REMEDIAL INVESTIGATION REPORT
AREA OF INTEREST 5

PHILADELPHIA ENERGY SOLUTIONS REFINING & MARKETING, LLC
PHILADELPHIA REFINING COMPLEX
PHILADELPHIA, PENNSYLVANIA

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January 16, 2017
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1.0 INTRODUCTION

This Remedial Investigation Report (RIR) has been prepared for Area of Interest (AOI) 5 at the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Refining Complex (Complex). Sunoco Inc. (R&M) (Sunoco) transferred the Complex to PES on September 8, 2012. Sunoco retained the remediation liability prior to this date. The remediation liability was transferred to Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) on December 30, 2013. The remediation program is currently being performed under a Buyer Seller Agreement signed by Sunoco, PES and the Pennsylvania Department of Environmental Protection (PADEP) in September 2012.

Site remediation at the Complex is ongoing as part of previously-established programs and the 2012 Buyer Seller Agreement as described below. The Complex has operated, and is planned to continue operating, as an oil refinery, marketing terminal and petrochemical complex.

Regulatory Overview

Sunoco and the PADEP entered into a Consent Order & Agreement (CO&A) in December 2003 with respect to the Complex. Sunoco's Phase I Remedial Plan (Phase I Plan), dated November 2003, was included as an attachment to the CO&A. In accordance with the CO&A and Phase I Plan, a Current Conditions Report and Comprehensive Remedial Plan (CCR) was prepared by Sunoco in June 2004. The Phase I Plan and the CCR divided the Complex into 11 AOIs, and presented a prioritization of the AOIs based on specific risk factors. The CCR also presented the Phase II remedial approach and schedule to characterize each of the 11 AOIs, and to conduct Phase I and II corrective action activities in accordance with the 2003 CO&A and the Phase I Plan. Since 2003, Sunoco has completed site characterization activities at all 11 AOIs in accordance with the 2003 CO&A. For each AOI that has been characterized, Sunoco prepared and submitted a corresponding Site Characterization Report (SCR) in accordance with the Revised Phase II Corrective Action Activities schedule that was included in the CCR.

In October 2006, Sunoco submitted a notice of intent to remediate (NIR) to the PADEP for the Complex entering the Complex into the Act 2 program. This NIR was later updated and submitted again to the PADEP in November 2014. In November 2011, the Complex was formally entered into the PA One Cleanup Program between the United States Environmental Protection Agency (EPA) – Region III and PADEP. In November 2011, Sunoco submitted a revised *Work Plan for Sitewide Approach Under the One Cleanup Program* (Work Plan for

Sitewide Approach) to document the Sitewide remedial approach extending beyond the requirements of the 2003 CO&A.

Sunoco submitted a Site Characterization Work Plan (Work Plan) for AOI 5 on June 15, 2007, to the PADEP and EPA. This Work Plan summarized proposed activities to be completed to characterize AOI 5 in accordance with the objectives of the CCR. The Work Plan was implemented between February and August 2007 and the results were summarized in a SCR submitted to PADEP and EPA on August 24, 2007. The PADEP responded to the submittal of the SCR with a combined AOI comment letter dated April 11, 2011 that included specific comments regarding the AOI 5 SCR.

Sunoco submitted a Site Characterization Report/Remedial Investigation Report/Cleanup Plan (SCR/RIR/CUP) for AOI 5 on December 13, 2011 to the PADEP and EPA. That report summarized additional site characterization work completed between 2007 and 2011, as well as proposed remedial and cleanup activities for AOI 5 based on the characterization. The PADEP responded to the submittal of the SCR/RIR/CUP with a comment letter dated March 15, 2012, stating the issues that need to be addressed in order for Sunoco to obtain a release of liability under Act 2.

On April 23, 2014, PADEP, Evergreen and Langan met to discuss proposed additional AOI 5 characterization activities. The PADEP provided meeting minutes dated April 25, 2014 summarizing the characterization issues that were presented and discussed by Evergreen and Langan.

In accordance with the Work Plan for Sitewide Approach, Evergreen is submitting this RIR for AOI 5 to formerly satisfy the requirements of Act 2. This report describes site characterization work included in the 2007 AOI 5 SCR and 2011 AOI 5 SCR/RIR/CUP, as well as additional site characterization work completed between 2011 and 2016 to supplement the previous work.

The supplemental work was completed to:

- Further characterize quality of surface (0-2 feet interval) and subsurface (2-15 feet interval) soil,
- Address regulated storage tank incidents for certain tanks in AOI 5,
- Delineate horizontal and vertical impacts in soils,
- Further characterize groundwater conditions in areas where constituents of concern (COCs) were previously above their respective screening criteria,

- Delineate light non-aqueous phase liquid (LNAPL),
- Investigate the potential vapor intrusion to indoor air pathway at occupied buildings,
- Further evaluate geology and hydrogeology, and
- Further evaluate contaminant fate and transport qualitatively.

The supplemental characterization work considered PADEP's and EPA's comments to previous work performed, addressed incidents related to Evergreen's operational history not addressed through the PADEP's Tank Program, and PADEP inspection issues that were identified after the 2007 SCR was prepared.

In accordance with Act 2, the required public and municipal notices for this report have been prepared and issued. Appendix A includes a copy of the original Complex NIR, the updated Complex NIR, as well as the report notices and their proof of receipt/publication. Also, included in Appendix A is correspondence from the PADEP with regard to AOI 5.

1.1 AOI 5 Area Description

The Complex is located in southwest Philadelphia. AOI 5 is located in the southern most portion of the Complex and is known as the Girard Point South Tank Field Area (Figure 1 and Figure 2). In 2014, PES built the Butane Rail Facility for loading/loading and storage of butane railcars. AOI 5 is bordered to the north and northwest by Penrose Avenue and the George Platt (formerly Penrose Avenue) Bridge, an industrial facility to the east, and the Schuylkill River to the south and southwest. AOI 5 encompasses approximately 114 acres. A sheet pile bulkhead, which is keyed into the Alluvium clay layer, extends along the entire western boundary of the AOI, between the AOI and the Schuylkill River. The extent of the wall is shown in Figure 2.

The area known as Girard Point Refinery (encompassing AOI 5 through AOI 7) was purchased by Sunoco, Inc. from Chevron USA, Inc. (Chevron) who acquired the facility from the Gulf Oil Company. The facility was purchased by Sunoco in 1994 and transferred to PES in 2012.

1.2 Complex and AOI 5 Operational History

The Complex has a long history of petroleum transportation, storage, and processing. The oldest portion of the Complex started petroleum-related activities in the 1860s when the Atlantic Refining Company established an oil distribution center. In the 1900s, crude oil processing began followed by full-scale gasoline production during World War II. In addition to refining crude oil, various chemicals, such as acids and ammonia, were also produced at the Complex for a time.

The primary historic operations at AOI 5 consisted of product storage in numerous above ground storage tanks (ASTs) containing fuel oil, waste oil, and lube oil. AOI 5 also housed packaging facilities. Other historic operations include transfer facilities for rail and trucking and a marine unloading/loading facility. AOI 5 is the oldest operating portion of the Girard Point Refinery, dating back to the 1920s (Dames & Moore, 1987).

Based on the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI), dated November 24, 1993, prepared by Dames and Moore, three solid waste management units (SWMUs) are located within AOI 5 and required further characterization. They include SWMU 93 (Storage Tank Areas: Buried Lead Sludge Area 7), SWMU 94 (Storage Tank Areas: Buried Lead Sludge Area 9) and SWMU 101 (Bulkhead Seepage Area).

1.3 AOI 5 Current Use

Currently, AOI 5 consists primarily of light and intermediate product tankage, old warehouses, a benzene rail unloading area, and docks that consist of three barge-loading areas. A loading rack and scale house are currently operating in the southeastern portion of AOI 5, as well as two pump houses. A stormwater separator and hazardous waste storage area are located in the southwestern portion of the AOI 5. Much of the area is open space due to the removal of several large ASTs. Two ship ballast tanks remain in use and, in 2014, PES redeveloped a portion of AOI 5 and constructed a butane rail loading/unloading area with an associated iso-butane storage vessel. A PECO substation is located in the northern most part of AOI 5. A sheet pile bulkhead, keyed into the Alluvium clay layer, extends along the entire southern boundary of AOI 5 along the Schuylkill River. The extent of the sheet pile wall/bulkhead is shown in Figure 2.

Approximately half of AOI 5 is covered by impervious surfaces. The current and historic use figure from the previous AOI 5 SCR was updated to reflect present day conditions/usage as part of the AOI 5 site characterization activities (see figure in Appendix B).

The existing monitoring well network in AOI 5 includes 84 monitoring wells, nine temporary well points, two piezometers, and three inactive recovery wells. Eighteen of the monitoring wells were installed in 2007 as part of the site characterization in AOI 5. Six monitoring wells were installed in 2012 to further investigate LNAPL occurrence and groundwater conditions. Six historical unconfined aquifer monitoring wells that were previously installed in AOI 5 (A-162, A-163, A-164, A-166, A-167, and A-168) were discovered by Aquaterra in 2012 and 2013. An additional seven monitoring wells were installed in 2014 to serve as fate and transport calibration wells and also to evaluate groundwater conditions. In 2014, 11 monitoring wells were abandoned due to the construction of the butane rail loading/unloading facility. Additionally in 2014, eleven historical monitoring wells were discovered and deemed A-174 through A-184. A-174 was subsequently destroyed several months after being discovered. In 2015, three monitoring wells were installed by Stantec Consulting Corporation (Stantec). The wells in AOI 5 are shown in Figure 3.

Groundwater gauging and sampling of select monitoring wells in AOI 5 occurs on an annual basis. This monitoring is completed by Stantec on behalf of Evergreen. Annual gauging activities and groundwater results are reported to the PADEP and EPA in semiannual Groundwater Remediation Status Reports. The reports also include the results of Evergreen's annual perimeter monitoring well sampling program.

1.4 Selection of Constituents of Concern and Screening Rationale

The COCs for soil and groundwater in AOI 5 are listed in Table 1 of this report. The COCs for the completed activities include all current constituents from the Pennsylvania Corrective Action Program CAP Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E of PADEP's Closure Requirements for Underground Storage Tank Systems, with the exception of the waste oil parameters since waste oil is only stored in small tanks within the facility maintenance garages. In May 2009, two additional COCs, 1,2,4-trimethylbenze (1,2,4-TMB) and 1,3,5-trimethylbenzene (1,3,5-TMB), were added to the list of COCs by Sunoco based on the PADEP's revisions to the petroleum short list of compounds and at the request of the PADEP. The COC listing for groundwater was also revised in 2012 to match the soil COC list. The additional compounds added to the groundwater COC list included anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, and benzo(b)fluoranthene.

The screening of the COCs was dependent upon the media of concern where all soil and groundwater screening levels were obtained from the PADEP Non-Residential medium specific concentrations (MSCs) for soils and groundwater last updated on August 27, 2016. These screening levels apply to all COCs except for surface soil lead values where a Complex-established site-specific standard (SSS) for lead has been approved by the PADEP.

Media of Concern

The media of concern for AOI 5 include soil and groundwater. The potential vapor intrusion into indoor air exposure pathway was evaluated by completing a site-specific indoor air evaluation. Surface water was evaluated as a receptor in relation to facility activities.

Surface Soil – 0 to 2 Feet Interval

Surface or shallow (0-2 feet) soil samples were collected at each soil boring/monitoring well location that represents a potentially complete direct contact exposure pathway to Complex workers. These surface soil results were screened against the PADEP non-residential soil direct contact MSCs and the Complex-established SSS for lead. The SSS for lead was submitted in the Human Health Risk Assessment (HHRA) by Langan in 2015 and was approved by the PADEP on May 6, 2015.

Subsurface Soil – 2 to 15 Feet Interval

Subsurface or deep (2-15 feet) soil samples were collected at several locations to either vertically characterize surface soil exceedances or to characterize subsurface soils where only a surface sample was previously collected. These subsurface soil results were screened against the PADEP non-residential soil direct contact MSCs.

Groundwater

Groundwater sample results were screened against the PADEP non-residential, used-aquifer (total dissolved solids (TDS<2,500) Statewide Health Standards (SHS) groundwater MSCs. This report includes a qualitative fate-and-transport analysis for groundwater. Evergreen is preparing a separate, quantitative site-wide fate-and-transport analysis for the Complex.

Surface Water

The Schuylkill River borders AOI 5 to the west and south. A sheet pile wall exists along the border with the river. Evergreen will be examining site-wide surface water compliance in future reporting.

Vapor Intrusion into Indoor Air

To evaluate the potential vapor intrusion into indoor air exposure pathway, indoor air sample results were screened against the current (January 2017) and one-tenth of the current PADEP Non-Residential Indoor Air SHS Vapor Intrusion Screening Values. The results were also compared to the OSHA Permissible Exposure Limits (PELs), the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs), and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). The EPA Industrial Regional Screening Levels (RSLs) were included in the comparison to identify COCs. Initially, the results were compared to the EPA Industrial RSLs established at a target cancer risk of 1E-05 and hazard quotient of 0.1. If vapor intrusion is the only potentially complete exposure pathway, these RSL-based screening levels are the prevailing risk-based screening levels for assessment of the indoor air inhalation pathway (PADEP 2015). The results were also conservatively compared to the EPA industrial RSLs established at a target cancer risk of 1E-06 and hazard quotient of 0.1.

1.5 Overview of Investigative Framework and Remedial Approach for AOI 5

The current remediation program for the Complex is described in the 2003 CO&A between PADEP and Sunoco, and the Work Plan for Sitewide Approach. Below is a general summary of the regulatory framework for the Complex:

- In April 2004, the PADEP and EPA signed an agreement entitled "One Cleanup Program Memorandum of Agreement (MOA or One-Cleanup Program)," which clarifies how sites remediated under Pennsylvania's Act 2 program may satisfy RCRA corrective action requirements through characterization and attainment of Act 2 remediation standards pursuant to Pennsylvania's Act 2.
- In 2005, PADEP, EPA, and Sunoco agreed that the One Cleanup Program would benefit the project by merging the remediation obligations under the various programs into one streamlined approach which would be conducted under the existing 2003 CO&A.
- In October 2006, Sunoco submitted a NIR to the PADEP for entering the

Complex into the Act 2 program, excluding the Belmont Terminal.

- In June 2007, Sunoco submitted a Work Plan for Site Characterization Activities for AOI 5 in accordance with the Phase II Corrective Action Schedule.
- On August 24, 2007, Sunoco submitted the AOI 5 SCR to the PADEP for review.
- In September 2007, Sunoco held a public involvement meeting in South Philadelphia, Pennsylvania.
- On April 11, 2011, PADEP provided their comments to the AOI 5 SCR. Comments were focused around the lack of an addendum submittal as suggested in the SCR. The PADEP suggested that a SCR/RIR be submitted that addressed the recommendations stated in the SCR. These recommendations included further delineation of leaded tank bottom materials, additional soil boring installations, resampling of monitoring well A-138 for cumene, and the evaluation of enhancements to the 9 Berth Recovery System.
- On November 8, 2011, the EPA provided an acknowledgment letter to Sunoco formerly accepting the Sunoco Complex into the One Cleanup Program.
- On November 30, 2011, Sunoco submitted a revised *Work Plan for Sitewide Approach Under the One Cleanup Program* (Work Plan for Sitewide Approach), to document the Sitewide remedial approach extending beyond the requirements of the 2003 CO&A. PADEP and EPA reviewed and provided input to this report. Sunoco submitted a letter of commitment stating the Complex will be remediated according to the Work Plan for Sitewide Approach.
- On December 13, 2011, Sunoco submitted a SCR/RIR/CUP to the PADEP for review.
- On March 15, 2012, PADEP provided their comments on the additional work required for AOI 5 based on deficiencies noted in the SCR/RIR/CUP submitted on December 13, 2011. PADEP concerns and proposed actions included the following issues:
    - LNAPL in wells located adjacent to the Schuylkill River potentially affecting the river.
    - LNAPL in wells A-155 and A-14 not being suitably delineated.
    - A lack of delineation of impacts in subsurface soils for benzene and lead.
    - Additional investigation of the 2-15 foot soil interval.
    - Further evaluation of the vapor intrusion pathway.
    - Additional soil investigation and delineation of SWMU-93, SWMU-94, and SWMU-101.
- On April 23, 2014, a meeting between PADEP, Evergreen and Langan personnel

was held to discuss Evergreen's Work Plans for AOI 5. Discussions included soil boring and well installations, groundwater sampling, indoor air evaluation, soil delineation sampling, LNAPL delineation, fate and transport modeling, SWMU soil sampling, and open storage tank incidents requiring action. David Brown of PADEP provided a summary of notes from the meeting and email summary on April 25, 2014; these items are included in Appendix A.

- In November 2014, Evergreen submitted an updated NIR to the PADEP for the Complex, excluding the Belmont Terminal which is not owned by PES.
- On February 24, 2015, Langan, on behalf of Evergreen, submitted an HHRA report for a SSS of lead in soil for the PES Refining Complex, the Sunoco Partners Marketing & Terminals, LP Belmont Terminal (Belmont Terminal) and the Sunoco Partners Marketing & Terminals, LP Marcus Hook Industrial Complex (MHIC) (Langan 2015). This HHRA was approved by the PADEP in a letter dated May 6, 2015.

2.0 SITE DESCRIPTION

2.1 Geology

The Complex occurs within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the "Fall Line," where crystalline bedrock of the Appalachian foothills intersects the ground surface (outcrops). The Atlantic Coastal Plain is a physiographic province that is defined as having relatively flat topography and as being underlain by a characteristic wedge of unconsolidated sediments that thicken in a southeasterly direction, away from sediment source areas in the Appalachian Mountains. These sediments were deposited atop a sloping bedrock surface in complex fluvial, estuarine, and marginal marine environments along the passive Atlantic margin. Overall, subsidence of the Piedmont land surface in conjunction with cyclical sea-level fluctuations have been the primary controlling mechanisms driving periods of deposition, non-deposition and erosion in the Atlantic Coastal Plain (Trapp and Meisler, 1992). In general, the resulting sedimentary record in the vicinity of the Complex is complex, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity. A summary of those deposits within AOI 5 is presented below.

Since 2007, 27 unconfined aquifer monitoring wells ranging between 5 to 18 feet below ground surface (bgs) and 291 soil borings were completed to further characterize geology in

AOI 5. Also, 36 composite and 36 grab soil samples were obtained by Stantec as part of the PES butane rail loading/unloading installation. Each monitoring well and soil boring location was continually logged by a field geologist. Monitoring well construction details for the AOI 5 monitoring wells are provided in Table 2 and boring/monitoring well construction logs for the existing monitoring wells are provided in Appendix C of this report.

Subsurface lithology from the numerous borings and monitoring wells completed in AOI 5 was used to characterize AOI 5 geologic conditions beneath AOI 5. A 3-dimensional (3D) geologic model of AOI 5 was generated with C Tech Development Corporation's Earth Volumetric Studio (EVS) software using historic and recently completed borings and monitoring well logs. One cross-section trending north to south and one trending east to west were created from the 3D geologic model. The plan view key for the cross sections is provided as Figure 4, and the geologic cross sections are provided as Figures 5a and 5b. The depiction of the Holocene Alluvium, as shown in Figures 5a and 5b, differs from that depicted in the 2007 SCR because of refinement of the geologic model based upon supplemental subsurface data obtained since 2007.

The following paragraphs describe the primary geologic units beneath AOI 5 beginning with the deepest units to the shallowest units.

BEDROCK

<u>Wissahickon Formation</u> – Bedrock beneath the Complex and AOI 5 is identified as the Wissahickon Schist. This formation is a metamorphosed greenish-gray micaceous schist and quartzite. The competent bedrock of the Wissahickon Formation is overlain by weathered bedrock consisting of micaceous clay, which becomes increasingly sandy as the degree of weathering lessens and competent bedrock is encountered. The weathered zone of the Wissahickon Schist was encountered approximately 87 feet bgs at monitoring well A-21D on the western side of AOI 5, as shown in the geologic cross-sections presented as Figures 5a and 5b. Two additional Lower Sand monitoring wells (A-13D and A-19D) did not encounter bedrock at their respective total depths of 69 feet and 60 feet bgs. However, based on geologic interpretation from USGS publications, weathered bedrock in the central and northern portions of AOI 5 is at approximately 90 feet bgs.

CRETACEOUS DEPOSITS

The Cretaceous deposits are configured in a southeasterly-thickening wedge, overlain by the much younger Quaternary deposits, and underlain by the Wissahickon Formation. The wedge is made up of a series of vertically alternating aquifers and confining units called the Potomac-Raritan-Magothy (PRM) aquifer system. Each of the geological units of the PRM progressively pinches-out to the northwest. The PRM aquifer system consists of six units:

- Upper Clay unit;
- Upper Sand unit;
- Middle Clay unit;
- Middle Sand unit;
- Lower Clay unit, and
- Lower Sand unit.

<u>Lower Sand Unit of the PRM</u> – Throughout the majority of the Complex, the Wissahickon Formation is overlain by the Lower Sand, which is the lowest member of the PRM aquifer system. As shown in Figures 5a and 5b, the Lower Sand overlies bedrock in AOI 5.

Boring logs for the three lower aquifer monitoring wells A-13D, A-19D, and A21D indicate the Lower Sand beneath AOI 5 is fine gravel and course sand that grades upward into medium-to-fine sands and may contain layers of silts and clay. The Lower Sand is located approximately 51 to 75 feet bgs. Based on available stratigraphic data, the Lower Sand is approximately 12 feet thick in the southwestern portion of AOI 5 and increases in thickness towards the eastern-northeastern portion of AOI 5 to approximately 40 feet. The interpreted extent of the Lower Sand beneath AOI 5 is consistent with the extent illustrated by USGS (USGS, 1961) and also with the generalized cross section prepared in 1992 by Dames and More presented in the CCR.

<u>Lower/Middle Clay</u> – The Lower Sand is overlain by the Lower/Middle Clay unit in AOI 5. The Lower/Middle Clay, is characterized by very low permeability reddish-brown, brown or gray clays, sandy clays, with trace amounts of organic matter.

As shown in Figures 5a and 5b, the Lower/Middle Clay ranges in thickness from 0 feet 23 feet throughout AOI 5. The Lower/Middle Clay appears to be fairly extensive throughout the western half of AOI 5 due to the significant thicknesses of 10 and 25 feet observed in A-19D and A-21D well logs, respectively. Based on the absence of the Lower/Middle Clay in the A-13D well log, the clay layer is believed to pinch out to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. Where present the Lower/Middle Clay functions as a confining bed to the Lower Sand aquifer.

QUATERNARY DEPOSITS

Trenton Gravel – Throughout most of the Complex, the Trenton Gravel typically overlies the Lower/Middle Clay and Lower Sand with thicknesses up to 30 feet. The Trenton Gravel is of Pleistocene Age (Ice Age; less than 2 million years) and is a heterogeneous unit comprised of a predominant brown to gray sand, gravel and minor amounts of clay (Owens and Minard, 1979). Along the Schuylkill River, most of the Pleistocene formations have been eroded away (Greenman et al., 1961). Based on available soil boring logs the Trenton Gravel is not present beneath AOI 5.

Recent (Holocene) Alluvium – Recent deposits of richly organic, dark gray mud, silt, and fine sand underlie the channels and tidal flats of the Delaware and Schuylkill Rivers. These sediments are most abundant in south Philadelphia near the confluence of the Delaware and Schuylkill Rivers, and can be up to 78 feet thick (Greenam et al., 1961). The alluvium ranges in thickness from approximately 20 feet (A-19D) in the northern portion of AOI 5 to up to 47 feet (A-13D abandoned in March of 2014) near the Schuylkill River. Based on the available stratigraphic data, the alluvium deposits in AOI 5 generally consist of two distinct stratigraphic layers;

- Silt layer: a soft, medium brown to dark gray silt, with organics and pieces of wood, trace to some clay, and interbedded thin sand and gravel lenses; overlain by
- Clay layer: a soft, dark gray clay, with trace to some silt, trace fine sand, and trace organics.

The silt and clay layers range in thickness from approximately 20 to 36 feet and 0 to 12 feet, respectively, across AOI 5. The alluvium sediments are less permeable than the Lower Sand unit and function as a leaky confining bed to the lower aquifer. Hydraulic conductivity estimates from aquifer tests of monitoring wells within AOI 5 which are screened across the Anthropogenic Fill and Holocene clay layer (A-22, A-24, A-140, A-147, A-151, and A-154) ranged from 0.35 to 56 feet per day (ft/day) (Dames & Moore, 1987, Langan, 2007). It is reasonable to assume the higher estimates are more representative of the fill material, and the lower range is a more appropriate value for the Holocene clay layer. Estimates from all aquifer tests in the unconfined aquifer in AOI 5 are significantly less than the published hydraulic conductivity estimates from the Lower Sand, which range between 123 to 153 ft/day (Paulachok, 1991).

The thick, low permeability, Holocene Alluvium deposits within AOI 5 tends to limit the free interchange of water between the Schuylkill River and the unconfined aquifer. The Holocene silt layer appears to thicken to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. The Holocene clay layer is believed to be fairly extensive across AOI 5 and eventually pinches out to the north (absent in A-19D well log), and may thin in the vicinity of historic tributaries to the Schuylkill River. The southern and western boundary of AOI 5 is bound by a sheet pile wall which is keyed into the Holocene clay layer as shown in Figures 5a and 5b.

Anthropogenic Fill

The Anthropogenic Fill varies in composition across AOI 5 and includes sands and gravels, brick, wood fragments and cinder ash up to 21 feet thick. Fill thickness tends to increase to the north as shown in Figures 5a and 5b.

2.2 Hydrogeology

The hydrogeologic frame work is defined by grouping geologic units that are laterally extensive and have similar hydrogeologic properties. The generalized hydrostratigraphy of the Complex consists of seven layers (Schreffler, 2001, Sloto 2012). Site-wide hydrostratigrapghy consist of:

- Layer 1: combined Anthropogenic Fill, Holocene Alluvium and Trenton Gravel (Trenton Gravel does not appear to be present in AOI 5)
- Layer 2: Upper Clay unit of the PRM (not present in AOI 5)
- Layer 3: Upper Sand unit of the PRM (not present in AOI5)
- Layer 4: Middle Clay unit of the PRM
- Layer 5: Middle Sand unit of the PRM (not present in AOI5)
- Layer 6: Lower Clay unit of the PRM, and
- Layer 7: Lower Sand unit of the PRM.

Within AOI 5, the hydrogeologic framework consists of the combined Anthropogenic Fill and Holocene Alluvium (which is referred to as the unconfined aquifer and makes up the water table aquifer). At depth and where less permeable, the Holocene Alluvium also acts as a leaky confining unit. Beneath the Holocene Alluvium is the Lower/Middle Clay confining unit (referred to as the clay aquitard). Beneath the clay aquitard is the Lower Sand which is a semi-confined to confined aquifer. The Lower Sand lies above the Wissahickon Schist bedrock.

2.2.1 Porosity

In July 2014, two Shelby Tube soil samples in the unconfined aquifer soils of AOI 5 were collected to determine soil properties (Appendix C). Soil sample A-170 8.5'-10.5' and A-186 8.5'-10.5' were both collected from a depth of 8.5 to 10.5 feet bgs. The soil sample from A-170, described as dark gray elastic silt with sand, trace roots, and organics, had a total porosity of 0.541 and an effective porosity of 0.182. The soil sample from A-186, described as dark gray elastic silt, with some organics, had a total porosity of 0.609 and an effective porosity of 0.205. The average total and effective porosities of the two samples are 0.575 and 0.194, respectively. In the calibrated groundwater flow model created by the USGS (Schreffler, 2001), a porosity of 0.3 was used for the unconfined aquifer.

2.2.2 Unconfined Aquifer Groundwater Occurrence and Flow

As defined above, the unconfined aquifer is the combined fill/alluvium which make up the water table aquifer. Groundwater gauging data collected by Aquaterra Technologies, Inc. (Aquaterra) in July and October of 2014 were used to generate groundwater flow figures for the unconfined aquifer (Figure 6 and Figure 7). The groundwater elevation data from these gauging events is provided in Table 3a and 3b and Appendix C. Monitoring well construction details for these monitoring wells are provided in Table 2 and all available logs for wells installed in AOI 5 are provided Appendix C of this report. Based on the groundwater elevations as shown in Figure 6 and Figure 7, the following observations can be made:

- Groundwater elevations recorded in AOI 5 during the July and October 2014 gauging events indicate unconfined groundwater flow is generally to the south towards the Schuylkill River under a typical hydraulic gradient of 0.005 feet/feet (ft/ft).
- Unconfined groundwater flow appears to be influenced by in-filled historic tributaries of the Schuylkill River as indicated by the valley-like gradient patterns in the vicinity of these features due to the contrast in hydraulic conductivity between natural and fill materials.

- Unconfined groundwater flow in AOI 5 is also influenced by the presence of the sheet pile bulkhead which extends along the AOI's boundary with the Schuylkill River and is keyed into the Holocene clay. Limited groundwater mounding behind portions of the sheet pile wall was observed in AOI 5 during both the July and October 2014 gauging events.
- Observations made from the 2014 data are consistent with flow observations made from previous gauging events.

2.2.3 Lower Aquifer Groundwater Occurrence and Flow

As defined above, within AOI 5 the lower aquifer is the Lower Sand unit of the PRM and is a semi-confined to confined aquifer. This lower aquifer is separated from the unconfined aquifer by subsequent confining, leaky confining, and confining units of the Holocene clay layer, Holocene silt layer, and the Lower/Middle Clay unit. Head potentials observed during the May 2011 gauging event in unconfined and lower aquifer monitoring well pairs confirm the two aquifers are hydraulically separated. The head differences measured in May 2011 between A-13 and A-13D, and A-21 and A-21D, were 4.59 and 11.3 feet, respectively. The observed head differences correspond to downward vertical hydraulic gradients of 0.082 and 0.16 ft/ft at the A-13 and A-21 monitoring well pairs, respectively.

As referenced above, published hydraulic conductivity estimates for the Lower Sand range between 123 to 152 ft/day with a mean of 135 feet/day (Paulachok, 1991). Based on limited lower aquifer monitoring wells within AOI 5, groundwater in the lower aquifer is assumed to flow southwest towards the Schuylkill River, under hydraulic gradient of 0.004 ft/ft. This assessment of lower aquifer groundwater conditions generally corresponds with the groundwater flow direction and gradients collected during the March 2013 site-wide gauging of the lower aquifer.

2.3 Surface Water

No surface water features are located in AOI 5. The nearest surface water body to AOI 5 is the Schuylkill River which comprises the southern boundary of AOI 5. A sheet pile wall that is keyed into the Alluvium clay layer exists between AOI 5 and the Schuylkill River as shown in Figure 2 and Figures 5a and 5b. Unconfined groundwater interaction with the Schuylkill River tends to be limited by the sheet pile wall. Evergreen will be examining site-wide surface water compliance in future reporting.

3.0 SITE CHARACTERIZATION ACTIVITIES

Initial site characterization activities in AOI 5 were performed between February and August 2007 and the results were summarized in the 2007 SCR. Additional site characterization activities were completed in April and July 2009 and the results were summarized in the 2011 SCR/RIR/CUP. Based on the findings of the SCR and the SCR/RIR/CUP, additional site characterization activities were completed between March 2013 and February 2016. Site characterization activities were completed by Aquaterra and Langan in coordination with Evergreen. These activities were executed in accordance with the Evergreen Quality Assurance/Quality Control (QA/QC) Plan and Field Procedures Manual provided in Appendix D. The following sections summarize the supplemental site characterization activities completed in AOI 5 since the submittal of the 2011 SCR/RIR/CUP.

3.1 Surface Soil Borings and Sampling

In 2007, five surface soil samples were collected for analysis of site COCs from areas within AOI 5. All five soil samples were collected during the advancement of monitoring wells.

After the submission of the SCR in October 2007, additional surface soil characterization work was performed in AOI 5 in 2009. A total of 17 soil samples were collected for analysis of site COCs from areas within AOI 5. Six of the soil samples were collected during the advancement of monitoring wells within AOI 5 and the remaining 11 soil samples were collected to delineate benzene and lead exceedances above the PADEP non-residential soil MSC.

Additional work was performed in AOI 5 after the submission of the SCR/RIR/CUP in December 2011. Four surface soil samples were collected during the advancement of six monitoring wells within AOI 5 in November 2012. Twelve soil samples were collected to delineate lead exceedances above the PADEP non-residential soil MSC in March 2013. Three additional samples were collected in October 2013 to delineate a former lead exceedance from March 2013.

Additional delineation activities were performed in March 2014, when four surface soil samples were collected to further delineate benzene, benzo(a)pyrene, cumene and lead detections above the PADEP non-residential soil direct contact MSCs and the SSS for lead within the eastern tank farm area of AOI 5.

In June of 2014, a total of seven surface soil samples were collected during the advancement of seven monitoring wells within AOI 5. Six of these monitoring wells were installed to serve as fate and transport calibration wells and the 7th well was installed as part of supplemental tank investigations discussed in Section 3.5.

Additional surface soil sampling occurred in June 2014 and February 2016, however, these soil borings were installed as part of supplemental tank investigations and are discussed in Section 3.5.

The locations of all soil borings are shown on Figure 3 and the boring logs are provided in Appendix C. All soil samples were collected using stainless steel hand augers. Soil borings were advanced to a maximum depth of two feet bgs at each location in accordance with the Work Plan documents. Due to shallow water table conditions in some areas of AOI 5 (less than 2 feet bgs), some surface samples were unable to be collected during the 2015 soil investigation; however, these areas were delineated with other surface soil samples.

Surface soil samples from 2007 were submitted to Pace Analytical (Pace) of Export, Pennsylvania for analysis of site COCs. The 2009 surface soil samples were analyzed by Lancaster Laboratories, Inc. (LLI) of Lancaster, Pennsylvania. In 2012, samples were submitted to LLI and Accutest Laboratories of Dayton, New Jersey (Accutest). The 2013 and 2014 soil samples were submitted to Accutest. All labs are Pennsylvania-certified labs. The soil samples collected in 2015 were submitted to Pace of Pittsburgh, Pennsylvania, for analysis of site COCs. A summary of the soil analytical results screened against the PADEP non-residential soil direct contact MSCs and the SSS for lead is provided as Table 4 and the results are discussed in Section 5.0. A summary of the PADEP non-residential soil direct contact MSC and SSS for lead exceedances are illustrated in Figure 8. The laboratory analytical reports are provided as Appendix E.

3.2 Subsurface Soil Borings and Sampling

Between August 2012 and March 2013, a total of 15 subsurface soil samples were collected to characterize subsurface soil and to vertically delineate previously identified benzene and lead exceedances in surface soil above the PADEP non-residential soil MSC. Seven subsurface samples were collected during the advancement of monitoring wells in June 2014.

Additional subsurface soil sampling occurred in June of 2014; however, these soil borings were installed as part of supplemental tank investigations and are discussed in Section 3.5.

The locations of all soil borings are shown on Figure 3 and the boring logs are provided in Appendix C. All soil samples were collected utilizing a stainless steel hand auger. Soil borings were advanced to between 2 feet below grade and the soil water interface in accordance with the Evergreen QA/QC Plan and Field Procedures Manual.

In 2012, samples were submitted to Accutest. The 2013 and 2014 soil samples were submitted to Accutest. A summary of the soil analytical results screened against the PADEP non-residential soil direct contact MSCs is provided as Table 5 and the results are discussed in Section 5.2. A summary of the PADEP non-residential soil direct contact MSC exceedances are illustrated in Figure 9. The laboratory analytical reports are provided as Appendix E.

3.3 Soil Borings at RCRA SWMU Areas

The 1993 RCRA RFI identified three SWMUs in AOI 5 that required further characterization. These SWMUs include SWMU 93 (Storage Tank Areas: Buried Lead Sludge Area 7), SWMU 94 (Storage Tank Areas: Buried Lead Sludge Area 8), and SWMU 101 (Bulkhead Seepage Area).

SWMUs 93 and 94 were investigated to characterize soil quality and to investigate for the presence of leaded tank bottom materials following the investigative approach outlined in

Section 1.2.2, 1.23 and 1.24 of the AOI 5 Work Plan. SWMU 101 was investigated for the presence of lead exceedances in soil and to characterize soil quality. The approach for identifying leaded tank bottom materials at that time is summarized below:

- If materials were encountered within the leaded tank bottom areas, matching the physical description of the leaded tank bottoms, then samples were collected for lead.
- If the lead results were above 450 parts per million (ppm) (PADEP's non-residential soil MSC for lead) then samples were analyzed for lead via Toxicity Characteristic Leaching Procedure (TCLP), EPA Test Method 1311.
- Delineated areas that have soils that physically resemble leaded tank bottoms, have concentrations of total lead exceeding 450 ppm, and are hazardous for lead based on TCLP analysis, will retain the leaded tank bottom designation. If soils did not meet all three of the above-mentioned criteria, then the area would no longer be classified as a leaded tank bottom area.

Soil borings were advanced at these specified SWMU areas and samples were collected to assist with the general site characterization activities described in this RIR and will ultimately allow for EPA preparation of Statement of Basis (SB) documentation for the SWMUs within AOI 5 and the completion of RCRA Corrective Action obligations by Evergreen. A SWMU closure request letter will be sent to the EPA under separate cover. These soil boring activities occurred between 2007 and 2014.

Designated boring locations within these SWMUs are displayed on Figure 3 and the boring logs are provided in Appendix C. Utilizing a stainless steel hand auger, soil borings were advanced to a minimum depth between 2 feet bgs and the soil water interface at each location in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. With regard to analysis, the soil samples collected in 2007 were submitted to Pace, the soil samples collected in 2009 were submitted to LLI, and the soil samples collected in 2012, 2013, and 2014 were submitted to Accutest. A summary of the surface and subsurface soil analytical results are provided in Table 4 and Table 5, respectively, and the results are discussed in Section 5.0. The laboratory analytical reports are provided as Appendix E. The site characterization activities for each SWMU are summarized below by SWMU.

3.3.1 Surface Soil Borings in SWMU 93

In November 2005, Sunoco installed a cover over the northern two-thirds of SWMU 93 which currently serves as a parking area. From bottom to top, this cover consists of approximately 18 inches of No. 4 stone placed atop the former grade, a layer of woven geo-textile fabric, and 6 to 10 inches of crushed concrete. This cover acts as a barrier which eliminates the potential direct contact exposure pathway to soil beneath the cover. Therefore, no soil borings or samples were collected beneath this cover as part of the 2007 and 2009 site characterization activities. However, soil samples were collected in this area as described in this sub-section, during the PES Butane Rail Line Development (see Section 3.4), as part of tank investigations (see Section 3.5) and well installation (see Section 3.6). The southern one-third of SWMU 93 is not covered by impervious surface and the investigation activities for this area are discussed below.

In 2007, 10 surface soil borings were advanced and five soil samples (BH-04-07, BH-05-07, BH-06-07, BH-07-07, and BH-08-07) were collected in SWMU 93 to investigate for leaded tank bottom materials. Five of the soil borings did not result in the collection of soil samples due to the shallow depth to the water table.

In 2009, the following sampling was completed to further delineate lead exceedances in soil and leaded tank bottom materials:

- Four surface soil borings (BH-05-09, BH-06-09, BH-07-09, and BH-08-09) were advanced and four soil samples were collected for lead analysis around soil boring location BH-07-07 completed in 2007.
- Four surface soil borings (BH-17-09, BH-18-09, BH-19-09, and BH-20-09) were advanced and four soil samples were collected for lead analysis around soil boring location BH-08-07 completed in 2007.
- One additional surface soil boring was advanced for site COCs (BH-25-09).

In March 2013, three additional soil borings were advanced for horizontal delineation of a lead exceedance at BH-25-09 and two soil samples were collected (BH-13-18 and BH-13-19). One soil boring (BH-13-20) did not result in the collection of a soil sample due to the shallow depth to the water table.

In June of 2014, some surface soil sampling occurred that was within the SWMU 93 area, however, these soil borings/monitoring wells were installed as part of supplemental tank investigations and are discussed in Section 3.5. No leaded tank bottom materials were observed during the June 2014 soil sampling event. Soil samples were analyzed for the entire site COC list.

3.3.2 Surface Soil Borings in SWMU 94

In 2007, 15 surface soil borings were advanced and six soil samples (BH-13-07, BH-18-07, BH-20-07, BH-21-07, BH-23-07, and BH-24-07) were collected in SWMU 94 to investigate for leaded tank bottom materials. Nine of the soil borings did not result in the collection of soil samples due to the shallow depth to the water table.

In 2009, the following site characterization activities were completed to further delineate lead exceedances of the MSC and leaded tank bottom materials:

- Four soil borings (BH-01-09, BH-02-09, BH-03-09, and BH-04-09) were advanced and four surface soil samples were collected for lead analysis around soil boring location BH-18-07 completed in 2007.
- Four soil borings (BH-21-09, BH-22-09, BH-23-09, and BH-24-09) were advanced and four surface soil samples were collected for lead analysis around soil boring location BH-23-07 completed in 2007.
- Two soil borings (BH-33-09 and BH-34-09) were advanced and two surface soil samples were collected for lead analysis south of soil boring location BH-02-09 completed in 2009.
- Two soil borings (BH-35-09 and BH-36-09) were advanced and two surface soil samples were collected for lead analysis north of soil boring location BH-04-09 completed in 2009.
- Two surface soil borings (BH-37-09 and BH-38-09) were advanced and two soil samples were collected for lead analysis south of soil boring location BH-22-09 completed in 2009.

Additional site characterization activities were completed to further delineate lead exceedances and possible leaded tank bottom material in SWMU 94 as follows:

- In August 2012, ten soil borings were advanced and eight surface soil samples were collected (BH-17-12, BH-19-12, BH-21-12, BH-23-12, BH-25-12, BH-28-12, BH-32-12, and BH-33-12). Two soil borings (BH-18-12 and BH-24-12) were attempted but had no soil samples collected due to shallow water table conditions.
- In March 2013, in response to PADEP comments, nine soil borings were attempted and of these nine soil borings, two were unsuccessful (BH-13-07 and BH-13-10) due to shallow water table conditions. Surface soil samples were collected from the other seven borings (BH-13-02, BH-13-03, BH-13-05, BH-13-06, BH-13-08, BH-13-11, and BH-13-13).
- In October 2013, in response to PADEP comments, eight soil borings were advanced. Eight shallow soil samples were collected (BH-13-116, BH-13-117, BH-13-121, BH-13-122, BH-13-123, BH-13-124, BH-13-125, and BH-13-126).
- In March 2014, five soil borings were advanced and five surface soil samples were collected (BH-14-01, BH-14-02, BH-14-06, BH-14-7, and BH-14-08).
- In June of 2014, additional surface soil sampling occurred that was within the SWMU 94 area, however, these soil borings/monitoring wells were installed as part of supplemental tank investigations and are discussed in Section 3.5. No leaded tank bottom materials were observed during this soil sampling event. Soil samples were analyzed for the entire site COC list.

3.3.3 Surface Soil Borings in SWMU 101

In 2007, four soil borings (BH-25-07, BH-26-07, BH-27-07 and A-142) were advanced and four surface soil samples were collected for total lead in SWMU 101.

In 2009, four additional soil borings were advanced and four surface soil samples were collected (BH-09-09, BH-10-09, BH-11-09, and BH-12-09) for total lead analysis around BH-27-07 due to lead detections above the PADEP soil MSC in the 2007 sampling event. Also in 2009, two additional soil borings (BH-39-09 and BH-40-09) were advanced and two surface soil samples were collected for lead analysis north of soil boring location BH-09-09 completed in 2009.

In August 2012, three surface soil samples were collected from three soil borings (BH-34-12, BH-36-12 and BH-40-12) to further investigate lead exceedances within SWMU 101.

In March 2013, a total of four surface soil samples (BH-13-38, BH-13-39, BH-13-42, and BH-13-43) were collected from five soil borings to delineate lead exceedances from prior sampling events. One soil sample (BH-13-41) was proposed but was not successfully sampled due to access issues.

In October 2013, a total of nine surface soil samples were collected from nine soil borings (BH-13-150 through BH-13-156, BH-13-158 and BH-13-159). These soil borings were advanced to delineate lead exceedances in previous soil boring locations BH-13-12, BH-13-38, and BH-13-39 completed in 2013. One soil sample (BH-13-157) was proposed but was not successfully sampled due to access issues.

In June of 2014, four soil borings/monitoring wells (A-171, A-172, A-185, and BH-14-38) were advanced for surface soil sampling purposes within SWMU 101. A total of four surface soil samples were collected from the four soil borings/monitoring wells (A-171, A-172, A-185, and BH-14-38). Soil boring BH-14-38 was originally proposed to be a monitoring well but a subsurface obstruction prevented the well installation. These soil borings/monitoring wells were advanced for future quantitative fate and transport modeling purposes.

3.3.4 Subsurface Soil Borings in SWMU 93

In August 2012, three soil borings were attempted to vertically delineate impacts in SWMU 93 from leaded tank bottoms. All three borings (BH-08-12, BH-09-12, and BH-11-12) were unsuccessful due to shallow water table conditions within AOI 5.

In March 2013, three additional soil borings were attempted to vertically delineate impacts in SWMU 93 from leaded tank bottoms. All three borings (BH-13-19, BH-13-20, and BH-13-21) were unsuccessful due to shallow standing water in the area.

Also in March and June of 2014, additional subsurface soil sampling occurred that was within the SWMU 93 area, however, these soil borings/monitoring wells were installed as part of supplemental tank investigations and are discussed in Section 3.5. No leaded tank bottom materials were observed during the June 2014 soil sampling. Soil samples were analyzed for the entire site COC list.

3.3.5 Subsurface Soil Borings in SWMU 94

In August 2012, vertical delineation activities occurred to delineate impacts in SWMU 94 for leaded tank bottom material with 15 subsurface soil borings advanced (BH-02-12, BH-07-12, BH-13-12, BH-20-12, BH-21-12, BH-22-12, BH-24-12, BH-25-12, BH-26-12, BH-27-12, BH-28-12, BH-29-12, BH-30-12, BH-31-12, and BH-32-12) and 5 subsurface soil samples collected (BH-02-12, BH-07-12, BH-20-12, BH-21-12, and BH-31-12). Ten of the soil borings were unsuccessful due to shallow water table conditions or standing water in the area.

In March 2013, 13 additional subsurface soil borings were attempted to delineate impacts from leaded tank bottom material and further delineate exceedances of the PADEP MSC for lead. Of these 13 soil borings, 12 were unsuccessful (BH-13-02, BH13-03, BH-13-04, BH13-05, BH-13-06, BH-13-07, BH13-09, BH-13-10, BH-13-11, BH-13-12, BH-13-13, and BH-13-14) due to shallow water table conditions and only one had a subsurface soil sample collected (BH-13-08).

Additional subsurface soil sampling occurred within SWMU 94 area during June of 2014, however, these soil borings were installed as part of tank closure investigations and are discussed in Section 3.5. No leaded tank bottom materials were observed during the June 2014 soil sampling event. Soil samples were analyzed for the entire site COC list.

3.3.6 Subsurface Soil Borings in SWMU 101

In August 2012, to characterize subsurface soil and further delineate exceedances of the PADEP MSC for lead, a total of nine subsurface soil samples were collected from nine soil borings (BH-03-12, BH-16-12, BH-34-12, BH-35-12,

BH-36-12, BH-37-12, BH-38-12, BH-39-12, and BH-40-12).

In March 2013, a total of six subsurface soil samples (BH-13-38, BH-13-39, BH-13-40, BH-13-41, BH-13-42, and BH-13-43) were collected from seven soil borings to characterize subsurface soil and further delineate exceedances of the PADEP MSC for lead from prior sampling events. One soil sample (BH-13-21) was proposed but was not successfully sampled due to a shallow water table.

In June of 2014, subsurface soil sampling occurred within the SWMU 101 area where a total of three subsurface soil samples were collected from four soil borings/monitoring wells (A-171, A-172, A-185, and BH-14-38). One subsurface soil sample from boring BH-14-38 was proposed but was not successfully sampled due to a subsurface obstruction. Soil boring BH-14-38 was originally proposed to be a monitoring well but as previously stated a subsurface obstruction prevented the well installation. These soil borings/monitoring wells were advanced for future quantitative fate and transport modeling purposes.

3.4 PES Butane Rail Loading/Unloading Facility Soil Borings

In March and August 2014, 156 soil borings were advanced by Stantec along the proposed footprint of the PES Butane Rail Loading/Unloading Facility within AOI 5 and on adjacent offsite Philadelphia Electric Company (PECO) offsite property. The limit of disturbance for the PES Butane Rail Facility development is shown in Figure 3. The purpose of obtaining soil samples was to characterize soil quality for potential soil re-use in conjunction with the Complex's Onsite Soil Reuse Plan or soil disposal requirements. The sampling protocols for the PES Butane Rail Facility soil borings followed Section 3.0 of the approved Onsite Soil Reuse Plan.

In March 2014, Stantec advanced 120 borings based upon the sampling protocols from the Onsite Soil Reuse Plan (refer to Table 6 for the PES Butane Rail Facility sample summary listing). Thirty subsurface composite samples and 30 discrete subsurface soil samples were collected from these 120 borings and submitted for laboratory analysis. The composite samples were analyzed for metals and SVOCs, and the discrete samples were analyzed for VOCs only.

In August 2014, Stantec advanced 36 additional borings based upon the sampling protocols from the Onsite Soil Reuse Plan (refer to Table 6 for the PES Butane Rail Facility sample summary listing). Twelve of these soil borings were advanced on PECO property and 24 were advanced within AOI 5. Three surface composite samples and three discrete surface soil samples were collected from the 24 soil borings. Three subsurface composite samples and three discrete subsurface soil samples were also collected from these 36 borings and submitted for laboratory analysis. The composite samples were analyzed for metals and SVOCs, and the discrete samples were analyzed for VOCs only.

Thirty-six of the March 2014 and 24 of the August 2014 boring locations are depicted on Figure 3. The 36 boring locations displayed on Figure 3 represent mostly the VOC grab samples that were obtained in the March sampling event. All of the 24 PES boring locations from the August sampling event are displayed on Figure 3. A summary of the soil analytical results are provided in Table 4 and Table 5. A summary of the PES Rail Line soil nomenclature is provided in Table 6. The laboratory analytical reports are provided in Appendix E.

3.5 Storage Tank Closure and Release Incident Investigation Soil Borings

Numerous ASTs were removed from AOI 5 prior to August 5, 1989. Conditions in tank areas where tanks were removed prior to August 5, 1989, are being characterized under the PA One Cleanup Program investigation and are discussed in this AOI 5 RIR.

Tanks in AOI 5 that have been closed or have exhibited a documented release after August 5, 1989 are being addressed under the Tank Program in a Site Characterization Report/Remedial Action Completion Report (SCR/RACR) that will be submitted separately, but in conjunction with this RIR. These regulated storage tank closure or release events are summarized in the following table.

Summary of Regulated Storage Tanks in AOI 5
With Documented Releases or Closed-In-Place Since August 5, 1989
PES Refining Complex, Philadelphia, PA

Tank No.	Closure Type	Documented Release (Yes or No)	Additional Comments
GP-1208	Closed in Place	Yes	September 2007 Closure Report Issued
GP-1209	Closed in Place	No	April 2012 Closure Report Issued
GP-1210	Closed in Place	No	April 2012 Closure Report Issued
GP-1212	Closed in Place	No	April 2012 Closure Report Issued
GP-1214	In Service	Yes	Surface and subsurface soil characterization performed.
Tank 207	Removed	Yes	No closure report issued. Surface and subsurface soil characterization performed. Groundwater monitoring well installed.
Tank 223	Removed	Yes	No closure report issued. Surface and subsurface soil characterization performed.
Tank 225	In Service	Yes	No closure report issued. Surface and subsurface soil characterization performed.
Tank 226	Removed	Yes	No closure report issued. Surface and subsurface soil characterization performed.
UST 355	Closed in Place	No	No closure report issued. Surface and subsurface soil characterization performed.

Based on the summary table above, five tanks in AOI 5 have been closed-in-place. Closure and corrective action documentation for four of these tanks (GP-1208, GP-1209, GP-1210 and GP-1212), consistent with requirements of 25 Pa Code §245.561, was prepared by others and previously submitted to the PADEP. Closure and corrective action documentation for GP 1208 was prepared by Secor International Incorporated (SECOR) in September 2007 and closure and corrective action documentation for GP-1209, GP-1210 and GP-1212 was prepared by Stantec in April 2012. Closure and corrective action documentation for UST T-355 was not prepared or submitted to the PADEP. Corrective action documentation was not submitted for the open release incidents associated with tanks GP-1214, 207, 223, 225, and 226. The reported release documentation is provided under separate cover in the AOI 5 SCR/RACR. It is anticipated that PES will reactivate tanks GP-1208, GP-1209, and GP-1212 in 2017.

Soil borings were advanced at these specified tank or tank dike areas and samples were collected to assist with the general site characterization activities described in this RIR. Soil analytical results from these borings are presented in this RIR for informational purposes only and will be used in a separately prepared tank SCR/RACR for closed-in-place tanks and open releases associated with tanks GP-1214, 207, 223, 225, 226, and UST T-355. This SCR/RACR will be submitted under separate cover to the PADEP in accordance with 25 Pa Code §245 regulations. Thirty-five supplemental borings were completed for tanks GP-1208, GP-1209, GP-1210 and GP-1212 with collection of surface and/or subsurface soil samples. One of the supplemental borings was a shared soil boring (BH-14-28) between tanks GP-1208 and GP-1214. Twenty-five soil borings were completed for tanks GP-1214, 207, 223, 225, 226, and UST T-355 with collection of surface and/or subsurface soil samples. One monitoring well/soil boring was installed (A-186) in conjunction with the other soil borings for Tank 207.

<u>Tank GP-1208</u>

The soil characterization activities for AST GP-1208 included advancement of five soil borings in the former tank area and collection of five shallow soil samples for laboratory analysis. Boring BH-13-36 was advanced in March 2013 and borings BH-14-26, BH-14-27, and BH-14-29 were advanced in 2014 to vertically delineate previous exceedances of benzene reported in numerous previously-installed borings. Subsurface soil samples were also obtained from BH-14-28 in 2014. Soil boring BH-14-28 was a shared soil boring location with the investigation of AST GP-1214 open release incident.

<u>Tank GP-1209</u>

The soil characterization activities for AST GP-1209 included the advancement of five soil borings in the former tank area and collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to delineate previous exceedances of lead, benzene, and cumene reported in previously-installed borings. The borings BH-13-34 and BH-13-35 were advanced in 2013 where surface and subsurface soil samples were obtained. Borings BH-13-145, BH-13-146, and BH-13-147 were advanced in 2014 and surface soil samples were collected.

Tank GP-1210

The soil characterization activities for AST GP-1210 included advancement of ten soil borings in the former tank area and collection of a surface soil samples for laboratory analysis. These borings were installed to delineate previous exceedances of lead, benzene, and cumene. In March 2013, two soil borings (BH-13-31 and BH-13-32) were advanced and two surface soil samples were collected to delineate the exceedance observed at GP1210-NE. Soil sample BH-13-32 was further delineated by three soil borings where three surface soil samples were collected in October 2013 (BH-13-142, BH-13-143, and BH-13-144). Two additional borings were advanced in October 2013, BH-13-148 and BH-13-149. In March 2014, three additional soil borings (BH-14-03, BH-14-04, and BH-14-11) were advanced and three surface soil samples were collected.

Tank GP-1212

The soil characterization activities for AST GP-1212 consisted of 15 surface soil samples. The supplemental soil characterization activities for AST GP-1212 consisted of the advancement of two soil borings (BH-13-29 and BH-13-44) in 2013, in the former tank area, and collection of two surface soil samples for laboratory analysis. Additional horizontal delineation soil borings for soil exceedances of lead and cumene were advanced as follows:

- In October 2013:
    - Three soil borings (BH-13-130, BH-13-131, and BH-13-132) were advanced to delineate former exceedances observed in GP1212-NW. Surface soil samples were collected from all three borings.
    - Three soil borings (BH-13-133, BH-13-134, and BH-13-135) were advanced to delineate former exceedances observed in GP1212-NE. Surface soil samples were collected from all three borings.
    - Three soil borings (BH-13-136, BH-13-137, and BH-13-138) were advanced to delineate exceedances observed in GP1212-SE. Surface soil samples were collected from all three borings.
    - Three soil borings (BH-13-139, BH-13-140, and BH-13-141) were advanced to delineate exceedances observed in GP1212-SW. Surface soil samples were collected from all three borings.
- In March 2014, one soil boring (BH-14-13) was advanced to delineate exceedances observed in BH-13-29. One surface soil sample was collected.

Tank GP-1214

The soil characterization activities for AST GP-1214 consisted of the advancement of three soil borings in the former tank area and collection of surface and subsurface soil samples for laboratory analysis in June 2014. Borings BH-14-28, BH-14-30, and BH-14-31 were advanced in 2014 to horizontally and vertically delineate a previous open release incident of benzene associated with AST GP-1214. The 2014 borings were focused around Pump #2 of the tank and BH-14-28 was a shared soil boring for the supplemental soil characterization for AST GP-1208. Surface and subsurface soil samples were obtained from the 2014 soil borings.

Tank 207

The soil characterization activities for AST 207 consisted of the advancement of four soil borings (BH-14-14, BH-14-15, BH-14-17, and BH-14-18) in June of 2014 in the tank area and the collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to horizontally and vertically delineate a previous open release incident of unleaded gasoline associated with AST 207. One groundwater monitoring well was also installed near AST 207 and surface and subsurface soil samples were obtained.

Tank 223

The soil characterization activities for AST 223 consisted of the advancement of four soil borings (BH-14-21, BH-14-22, BH-14-24, and BH-14-25), in June of 2014, in the former tank area and the collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to horizontally and vertically delineate a previous open release incident of number 6 fuel oil associated with AST 223.

Tank 225

The soil characterization activities for AST 225 consisted of the advancement of four soil borings (BH-14-19, BH-14-20, BH-14-36 and BH-14-37), in June of 2014, in the tank area and the collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to horizontally and vertically delineate a previous open release incident of number 6 fuel oil associated with AST 225.

Tank 226

The soil characterization activities for AST 226 consisted of the advancement of one soil boring (BH-04-07) in 2007 and the collection of one surface soil sample for laboratory analysis. Characterization activities continued in March 2014 with the advancement of three soil borings (GPBT_03102014_7_4, GPBT_03102014_7_8, and GPBT_03102014_7_12) in the tank area and the collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to investigate soil conditions of SWMU 93 and to characterize soil prior to the development of the Butane Rail Line in AOI 5.

Tank T-355

The soil characterization activities for UST 355 consisted of the advancement of four soil borings (BH-14-32, BH-14-33, BH-14-34 and BH-14-35), in June of 2014, in the tank area and the collection of surface and subsurface soil samples for laboratory analysis. These borings were installed to horizontally and vertically delineate soils around the tank in support of the closure of UST T-355. An additional soil boring (BH-16-1) was advanced in February 2016 to delineate a previous exceedance of benzo(a)pyrene from 2014.

Designated boring locations for these incidents are displayed on Figure 3 and the boring logs are provided in Appendix C. Utilizing a stainless steel hand auger, soil borings were advanced to a minimum depth between 2 feet bgs and the soil water interface at each location in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. The soil samples were submitted to Accutest for analysis. A summary of the surface and subsurface soil analytical results are provided in Table 4 and Table 5, respectively, and the results are discussed in Section 5.5. The laboratory analytical reports are provided as Appendix E.

3.6 Installation of Groundwater Monitoring Wells

As part of the 2007 AOI 5 characterization activities, groundwater monitoring well installation activities were performed February through August, 2007 by Total Quality Drilling, L.L.C. (Total Quality Drilling) of Mullica Hills, New Jersey under direct supervision of Aquaterra and Langan, and in coordination with Sunoco. Eighteen unconfined aquifer monitoring wells were installed to characterize shallow groundwater in AOI 5.

There were no new wells installed during the 2009 site characterization activities.

In November 2012, six unconfined aquifer monitoring wells were installed by Total Quality Drilling under direct supervision of Aquaterra. These wells were installed in response to

PADEP comments and to further delineate LNAPL in the areas of monitoring wells A-14 and A-155.

In addition, six historical unconfined aquifer monitoring wells that were previously installed in AOI 5, were discovered by Aquaterra in 2012 and 2013. These unconfined aquifer monitoring wells were named A-162, A-163, A-164, A-166, A-167, and A-168. These wells were surveyed but no boring or well construction data exists for these wells.

From June to July 2014, additional groundwater monitoring well installation activities were performed by Total Quality Drilling under direct supervision of Aquaterra under direct supervision of Aquaterra. Six of these monitoring wells (A-169, A-170, A-171, A-172, A-173 and A-185) were installed to serve as fate and transport calibration wells. The 7th well (A-186) was installed as part of supplemental tank investigations.

In 2014, one monitoring well was discovered near A-186 and was deemed A-174. There are no boring or well construction logs for A-174 and it was subsequently destroyed several months after being discovered. Additionally in 2014, ten historical monitoring wells were discovered and deemed A-175 through A-184. These wells were surveyed but no boring or well construction data exists for these wells. The locations of all monitoring wells are shown on Figure 3.

Shelby Tube samples were obtained during the well installation of A-170 and A-186 on June 24 and July 3, 2014, respectively. The Shelby Tubes were collected to obtain soil parameters including bulk density, dry density, effective porosity, total porosity, and fraction of organic carbon. The laboratory results for these Shelby Tube samples are provided in Appendix C.

Twelve unconfined aquifer monitoring wells and one lower aquifer monitoring well within AOI 5 were abandoned due to the PES Butane Rail Line development discussed in Section 3.6 of this report. The wells were abandoned by Parrat Wolff, Inc. (Parrat Wolff) of Syracuse, New York, a qualified Pennsylvania Licensed well driller, under the supervision of Aquaterra personnel. The wells that were abandoned include A-13, A-13D (part of AOI 11), A-14, A-43, A-91, A-120, A-121, A-138, A-144, A-145, A-159, and A-160. Recent construction activities have caused monitoring wells A-161 and A-185 to be destroyed. The locations of all abandoned or destroyed monitoring wells are shown on Figure 3.

Prior to the installation of monitoring wells, each well location was cleared for subsurface utilities to 8 feet bgs with a back hoe. During clearing of each location, soil samples were collected directly from the backhoe bucket. Samples were then screened with a photoionization detector (PID) and were collected in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. Unconfined aquifer monitoring wells advanced by the drilling subcontractors utilized split spoon samplers to record lithology. Monitoring wells were constructed with a stickup steel protective casing. Following construction, the monitoring wells were developed in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. Well construction details are provided in Table 2. Boring logs depicting monitoring well construction details and soil descriptions are provided as Appendix C.

3.7 Groundwater Monitoring

Monitoring well gauging activities to collect liquid levels from unconfined aquifer monitoring wells within AOI 5 were performed in May 2007 by Aquaterra. In May 2011, July 2014, and October 2014 either Stantec or Aquaterra performed monitoring well gauging activities to collect liquid levels from all accessible monitoring points within AOI 5. Also in July 2015, Stantec gauged monitoring wells A-15, A-22 and A-166 to identify previous LNAPL detections. These wells did not display LNAPL during this gauging event except for an LNAPL sheen identified in A-166. All well gauging readings from July 2014 and October 2014 are summarized in Table 3a and Table 3b.

The groundwater monitoring data from Table 3a and Table 3b were used to generate unconfined groundwater elevation contours provided as Figure 6 and Figure 7, respectively. Unconfined groundwater flow in both July 2014 and October 2014 appears to be influenced by historic tributaries of the Schuylkill River and the unconfined groundwater flow is generally to the southwest towards the sheet pile wall.

A recent online well radius search was conducted for the entire site using the Pennsylvania Groundwater Information System (PAGWIS) in November 2016 in order to evaluate potential potable well receptors. The results of this search are included in Appendix C.

3.8 Groundwater Sampling

As part of the 2007 site characterization activities, Aquaterra performed a complete round of groundwater sampling from all accessible monitoring wells in AOI 5 in May 2007. Additional sampling events of select wells were conducted by Stantec as part of annual sampling events. In July and October of 2014, Aquaterra performed two more comprehensive rounds of groundwater sampling in AOI 5. Also in July 2015, Aquaterra sampled monitoring wells A-15, A-22 and A-166 which had previous identified LNAPL thicknesses in July 2014. During the July 2015 sampling event, these wells did not display LNAPL and were sampled for site COCs. All groundwater sampling activities were completed in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. Lower aquifer groundwater monitoring well samples were obtained in the 2007 sampling event but not obtained as part of the 2014 through 2016 sampling events. The monitoring well sampling summary data sheets are provided as Appendix C. All groundwater analytical results are provided in Table 7. The laboratory analytical reports are included as Appendix E.

3.8.1 Sampling Beneath LNAPL

During the AOI 5 comprehensive July 2014 groundwater sampling event, groundwater was obtained from the water column beneath LNAPL in six monitoring wells (A-5, A-136, A-155, A-161, A-178, and WP-A) to respond to a PADEP request in 2014. In a separate event for below-LNAPL groundwater sampling in January 2016, groundwater was obtained from the water column beneath LNAPL in four monitoring wells (A-5, A-136, A-155, and WP-A). As noted above, monitoring well A-161 was recently destroyed due to construction activity.

The below-LNAPL groundwater sampling was conducted to obtain dissolved COC data in groundwater in wells with LNAPL and to use this data for the future fate and transport site-wide quantitative modeling. All sub-LNAPL sampling activities were completed in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. The monitoring well sampling summary data sheets are provided in Appendix C. The results of the groundwater sampling beneath LNAPL are displayed on Figure 10 and provided in Table 7. The groundwater analytical results are presented in Table 7 and Figure 10 and discussed in Section 5.7. The laboratory analytical reports are included in Appendix E.

3.9 Indoor and Ambient Air Sampling

Stantec collected one indoor air sample and one ambient air sample in 2012 as part of the Sunoco, Inc. (R&M) Philadelphia Refinery Remediation Program indoor air sampling report (Stantec, 2013). A copy of the Stantec 2013 indoor air sampling report is provided in Appendix F. The indoor air sample was collected from the Blending and Shipping (B&S)

Office. This building is shown in Figure 12. The one ambient air sample was collected from outside the B&S Office.

The samples were submitted to Columbia Analytical Services of Simi Valley, California (Columbia) for analysis of VOCs by EPA TO-15 method for Evergreen's short list of VOCs plus naphthalene. The results of the samples are provided in Table 8 and are discussed in Section 5.7. The laboratory analytical report for the samples is provided in Appendix E.

GHD conducted a second round of indoor air sampling in March 2016 where GHD collected six indoor air samples and one ambient air sample within AOI 5. A sample was collected from each of the occupied buildings in the AOI. The indoor air samples were collected as follows:

- One sample from the Control Room (Building 625);
- Two samples from the Wharf Dock Office (Building 526);
- One sample from the Wharf Dock Office (Building 501);
- One sample from the GP Dock 2; and
- One sample from the B&S Double Trailer Office (Building 34A/34B).

An indoor air sample was not collected from the PECO substation as the minimal proximity distances for petroleum substances have been met for soil, groundwater, and LNAPL. An ambient air sample was collected from the wharf dock area. The building locations and ambient air sample location are shown in Figure 11 and the results are displayed on Table 8.

The 2016 samples were submitted to LLI for analysis of VOCs by EPA TO-15 method for Evergreen's short list of VOCs plus naphthalene. The results of the samples are provided in Table 8 and are discussed in Section 5.8. The laboratory analytical report for the samples is provided in Appendix E.

3.10 Outdoor Worker Air Sampling

Aquaterra collected five outdoor worker ambient air samples within AOI 5. The outdoor air samples were collected from locations based upon PADEP vapor intrusion guidance documents related to vertical separation distance from the ground surface to a LNAPL source or dissolved groundwater plumes. The locations for the outdoor worker air samples are depicted on Figure 11.

The samples were submitted to Pace for analysis of VOCs by EPA TO-15 method for Evergreen's short list of VOCs plus naphthalene. The results of the samples are provided in Table 9 and are discussed in Section 5.9. The laboratory analytical report for the samples is provided in Appendix E.

3.11 LNAPL Sampling

LNAPL samples for select wells in AOI 5 were previously characterized as described in the CCR. During the 2007 gauging events for AOI 5, Aquaterra collected LNAPL samples from 10 monitoring wells (A-4, A-5, A-7, A-20, A-24, A-48, SW-1, SW-4, A-144 and A-155). An additional LNAPL sample from monitoring well WP-9-8 was collected for characterization purposes in July of 2014 by Aquaterra.

LNAPL was detected in monitoring wells A-15, A-22, A-150, and A-166 during the July 2014 sampling event. A LNAPL sample was planned to be obtained from wells A-15 and A-150 during the October 2014 groundwater sampling event; however, LNAPL was not detected in the wells in October 2014. A LNAPL sample was not obtained for A-22 due to the small amount of LNAPL detected. Lastly, a LNAPL sample was not collected for characterization from A-166 due to proximity of the well to defined plumes.

In July 2015, Stantec gauged monitoring wells A-15, A-22, and A-166 to investigate the previous July 2014 LNAPL detections. These wells did not display LNAPL during this gauging event except for an LNAPL sheen identified in A-166.

LNAPL has historically and sporadically been detected in the 9 Berth Area recovery wells RWBH-1 and RWBH-2. The historical LNAPL thicknesses have varied from not detected, to a maximum thickness in RWBH-1 of 0.27 feet in June 1998, and a maximum thickness in RWBH-2 of 0.71 feet in July 1999. No LNAPL detections were reported in either recovery well from November 2003 until March 2009 when a sheen detection was reported in RWBH-2. However, due to recent LNAPL detections between 2013 and 2016 in these recovery wells, Stantec collected a LNAPL sample from RWBH-2 in November 2015. Maximum LNAPL thickness since 2013 in RWBH-1 was 0.01 feet in August 2016 and 1.94 feet in RWBH-2 in November 2016.

LNAPL samples were collected using a direct sampling or swabbing method in accordance with in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. The LNAPL samples were sent to Torkelson Laboratories (Torkelson) of Tulsa, Oklahoma for characterization. LNAPL characterization data included product types, density, proportions of product, degree of weathering, and similarities to other LNAPL samples collected at the Complex. The LNAPL sample for RWBH-2 was analyzed by the in-house PES laboratory at the Complex. LNAPL sampling results are provided in Appendix G and modeling results are discussed in Section 6.3.

Three soil samples were collected in 2009 above LNAPL plumes (A-144, A-150, and A-155) and one sample was collected in 2012 above an LNAPL plume (A-161). These results are discussed in Section 5.1. During separate July 2014 and January 2016 groundwater sampling events, groundwater samples were collected from beneath the LNAPL in monitoring wells where the results are discussed in Section 5.7.

3.12 Surveying Activities

Following completion of monitoring well installation and soil boring activities, the newly-installed monitoring wells and soil boring locations were surveyed by Langan. Monitoring wells were surveyed to establish the location and elevation of the inner and outer casing and ground surface at each point. All well elevations were determined to the nearest 0.01 foot relative to mean sea level. All survey activities were overseen by a Pennsylvania licensed surveyor and tied to the NAD 83 state plane horizontal datum and NAVD 88 vertical datum. The survey data for the monitoring wells is presented in Table 2. This survey data was used to update the Geographic Information System (GIS) and site wide database for the Complex and for calculations involving groundwater or LNAPL measurements.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Sample results for AOI 5 supplemental activities were summarized in 61 sample delivery groups provided by Accutest Laboratories and Pace Laboratories and the results were evaluated for usability. The laboratory performed quality assurance and quality control (QA/QC) analyses, including analysis of LCS/LCSDs, MS/MSDs, laboratory duplicates, surrogate spikes, initial and continuing calibrations, serial dilutions, instrument tunes, interference check samples, internal standard area counts and method blanks. Laboratory QA/QC summaries are provided in each data package, where available. The analytical data, data qualifiers, and QA/QC results provided in these reports were evaluated to determine whether AOI 5 groundwater, air and soil data met data quality objectives and could be used in the decision-making process.

Several trip blank samples were collected during the soil and groundwater sampling events, and were non-detect for target analytes. All samples were properly preserved and were extracted/prepared, and analyzed within sample hold times with the exceptions noted above. Target compounds were detected in the laboratory method blanks which resulted in potential high bias for the compounds listed above. Recoveries in LCS/LCSDs were within acceptable recovery control limits with the exceptions listed above. Multiple surrogates and MS/SDs recovered outside of the acceptable range as described in detail above.

Based on the QA/QC evaluation of the laboratory data, the groundwater, air and soil data collected during the site characterization activities are considered usable for characterizing the site, identifying compounds of concern, and delineating potential impacts. A more detailed summary of the data quality evaluation is included in Appendix H. For more information regarding data QA/QC, refer to the Evergreen QA/QC Plan and Field Procedures Manual in Appendix D.

5.0 SITE CHARACTERIZATION ANALYTICAL RESULTS

The following sections discuss the analytical results of the site characterization and supplemental site characterization activities performed in AOI 5.

5.1 Surface Soil Analytical Results

The results of the surface soil samples collected in AOI 5 as part of the 2007 characterization activities, as well as the supplemental characterization activities are provided in Table 4. All of the soil samples were collected between the ground surface and two feet bgs and no saturated soils were observed at these depths. The soil sample results were screened against the PADEP non-residential MSCs and the PADEP-approved SSS for lead of 2,240 milligrams per kilogram (mg/kg). Sample locations and exceedances of the MSCs or SSS for lead are shown in Figure 8.

Below is a general summary of the surface soil screening results for the soil sampling activities (outside of RCRA SWMU areas and tank investigation areas):

- COCs detected in surface soil exceeding their respective non-residential soil direct contact MSC or the SSS for lead included benzo(a)pyrene and lead. The SSS for lead was exceeded in two locations (BH-13-27 and A-140). Benzo(a)pyrene was detected above the PADEP non-residential soil direct contact MSC in two locations (BH-13-28 and BH-14-33).

- Site COCs 1,2-dichloroethane, 1,2,4- TMB, 1,3,5-TMB, benzene, ethylbenzene, ethylene dibromide (EDB), isopropylbenzene (cumene), methyl tertiary butyl ether (MTBE), toluene, xylenes (total), anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(b)fluoranthene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene were not detected in AOI 5 soil samples above their respective PADEP non-residential soil direct contact MSCs.
- All of the surface soil exceedances for benzo(a)pyrene and the SSS for lead in AOI 5 surface soil have been delineated (outside of RCRA SWMU areas and tank investigation areas).

5.2 Subsurface Soil Results

No subsurface soil samples were collected during the 2007 soil investigations. The results of the subsurface soil samples collected in AOI 5 since 2007 are provided in Table 5. All of the subsurface soil samples were collected between two feet bgs and the soil-to-groundwater interface. The soil sample results were screened against the PADEP non-residential soil direct contact MSCs. Sample locations are shown in Figure 9. No subsurface soil samples exhibited detections above the PADEP non-residential direct contact standard (2-15 feet) for any site COCs (outside of RCRA SWMU areas and tank investigation areas).

5.3 Surface Soil Results at RCRA SWMU Areas

The results of the surface soil samples collected within the RCRA SWMU areas of AOI 5 are included in Table 5. All of the soil samples were collected between the ground surface and two feet bgs and no saturated soils were observed at these depths. The soil sample results were screened against the PADEP non-residential MSCs. Sample locations and exceedances of the MSCs or SSS for lead are shown in Figure 9.

As stated in Section 3.3 above, if suspect materials were encountered in surface soil (0-2 feet) within SWMUs 93 and 94 (leaded tank bottom areas) during site characterization activities matching the physical description of the leaded tank bottom materials, then samples were collected for total lead. If the total lead results were above 450 ppm (the PADEP non-residential soil MSC for lead) then samples were analyzed for lead via TCLP, EPA Test Method 1311. This sampling methodology was performed to determine if leaded tank bottom materials were present in soil. TCLP results are presented in Table 10.

5.3.1 SWMU 93

Leaded Tank Bottom Delineation

In SWMU 93, during the 2007 sampling event, five soil samples (BH-04-07, BH-05-07, BH-06-07, BH-07-07, and BH-08-07) exhibited characteristics resembling the physical description of leaded tank bottoms and were sampled accordingly. Results of the samples are discussed below.

- Soil samples BH-04-07, BH-05-07, and BH-06-07 exhibited total lead concentrations below the PADEP non-residential MSC for lead and were not submitted for further analysis.
- Soil samples BH-07-07 and BH-08-07 (1,250 mg/kg and 506 mg/kg, respectively) were above the PADEP non-residential soil MSC for total lead used at the time of analysis and were submitted for analysis of TCLP lead using EPA Method 1311. The lead concentration in soil sample BH-07-07 of 9.42 milligrams per liter (mg/L) was above the EPA maximum concentration of lead for toxicity characteristic of 5 mg/L, while the lead concentration in soil sample BH-08-07 (0.653 mg/L) was below the EPA maximum concentration. Therefore, the area around BH-07-07 will retain the leaded tank bottom SWMU designation and the area around BH-08-07 will not.
- In June 2009, four surface soil borings, BH-05-09, BH-06-09, BH-07-09, and BH-08-09 were completed around BH-07-07 for delineation of leaded tank bottoms and total lead. The results of these delineation samples are discussed below.
    - Leaded tank bottoms were not observed at BH-05-09 and BH-06-09. Materials resembling leaded tank bottoms were observed in BH-07-09 and BH-08-09. Total lead concentrations in BH-07-09 and BH-08-09 were above the PADEP non-residential soil MSC for lead (748 mg/kg and 563 mg/kg, respectively). TCLP analysis was not conducted on these samples.
- Leaded Tank Bottom material has been delineated within the surface soils of SWMU 93 in AOI 5.

Site COC Delineation

- As a result of the previous lead exceedance observed in sample BH-08-07, four surface soil borings (BH-17-09, BH-18-09, BH-19-09, and BH-20-09) were completed for delineation and sampled for total lead in June of 2009. All of the soil samples did not exhibit total lead detections above the SSS.
- In addition, one soil boring was advanced in 2009 (BH-25-09) as a general soil quality boring and was not utilized for delineation of other soil exceedances. Soil sample BH-25-09 exhibited a total lead detection below the SSS for lead.
- Site COCs 1,2-dichloroethane, 1,2,4-TMB, 1,3,-5-TMB, benzene, cumene, ethylbenzene, EDB, MTBE, toluene, xylenes (total), anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(g,h,i)perylene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene were not detected in the AOI 5 SWMU 93 area surface soils at concentrations above their respective PADEP non-residential soil MSCs. Lead was not detected at concentrations above the SSS.
- All of the surface soil exceedances of the SSS for lead in SWMU 93 have been delineated.

5.3.2 SWMU 94

Leaded Tank Bottom Delineation

In SWMU 94 during the 2007 sampling event, six soil sample locations (BH-13-07, BH-18-07, BH-20-07, BH-21-07, BH-23-07, and BH-24-07) exhibited characteristics resembling the physical description of leaded tank bottoms and were sampled accordingly. The results of these samples are discussed below.

- The total lead concentrations from soil samples BH-13-07, BH-20-07, BH-21-07, and BH-24-07 were below the PADEP non-residential soil MSC for lead and were not submitted for further analysis.
- The sample collected from soil boring BH-18-07 exhibited a detection (3,190 mg/kg) above the SSS for lead. This sample was submitted for analysis of TCLP lead using EPA Method 1311. The TCLP lead concentration in BH-18-07 (21.8 mg/L) was above the EPA maximum concentration of lead for toxicity characteristic. Therefore, the area around BH-18-07 will retain the leaded tank bottom SWMU designation.

In 2009, four surface soil borings BH-01-09, BH-02-09, BH-03-09, and BH-04-09 were completed around BH-18-07 for delineation of leaded tank bottoms. The results of these delineation samples are discussed below.

  - At BH-01-09, BH-03-09, and BH-04-09 the total lead concentration was below the SSS for lead and did not exhibit evidence of leaded tank bottoms.
  - BH-02-09 exhibited possible leaded tank bottom materials and total lead concentrations above the SSS (17,900 mg/kg). A TCLP analysis for lead was run and the result (172 mg/L) also was above the USEPA maximum concentration of lead for toxicity characteristic. Therefore, the area around BH-02-09 will retain the leaded tank bottom SWMU designation.

- BH-23-07 contained material that resembled leaded tank bottom materials and the soil was sampled accordingly. The total lead concentration exhibited in the sample was above the PADEP non-residential soil MSC (1,920 mg/kg). This sample was submitted for analysis of TCLP lead using EPA Method 1311. The TCLP lead concentration in BH-23-07 (0.78 mg/L) was below the USEPA maximum concentration of lead for toxicity characteristic. Therefore, the area around BH-23-07 will not retain the leaded tank bottom SWMU designation.
- Leaded Tank Bottom material has been delineated within the surface soils of SWMU 94 in AOI 5.

Site COC Delineation

- For the BH-01-09 lead exceedance referenced above (prior to the approval of the SSS for lead), additional delineation was performed in August 2012 and October 2013 by advancing five soil borings (BH-28-12, BH-13-123, BH-13-124, BH-13-125 and BH-13-126).
  - Three soil samples exhibited no exceedance for lead or other site COCs.
  - Two of the samples (BH-13-125 and BH-13-126) exhibited lead exceedances above the SSS for lead at 2,980 mg/kg and 2,950 mg/kg, respectively.
  - The exceedance at BH-13-125 was delineated by sample BH-14-01 and the exceedance at BH-13-126 was delineated by sample

BH-14-02 in March 2014.

- For the lead exceedances in BH-02-09, BH-04-09 and BH-18-07 referenced above (prior to the approval of the SSS for lead), two additional soil borings (BH-33-09 and BH-34-09) were advanced to the south of BH-02-09 and another two additional soil borings (BH-35-09 and BH-36-09) were advanced to the north of BH-04-09 and BH-18-07.
    - All four soil samples exhibited total lead concentrations below the SSS for lead.
    - BH-33-09 was run for TCLP analysis and was below the EPA maximum concentration of lead for toxicity characteristics.
    - In August 2012, one additional sample was collected (BH-32-12) to further delineate lead in this area and exhibited no exceedances for site COCs.
- Four surface soil borings (BH-21-09, BH-22-09, BH-23-09, and BH-24-09) were completed around BH-23-07 for delineation of lead (prior to the approval of the SSS for lead). Additional delineation of BH-23-07 was conducted in March 2013 by advancing four borings (BH-13-08, BH-13-08, BH-13-11, and BH-13-13). Further delineation of BH-23-07 was performed in October 2013 with borings BH-13-116 and BH-13-117. Soil sample results from all borings exhibited no exceedances for all site COCs.
- Two additional soil borings (BH-37-09 and BH-38-09) were completed to delineate total lead to the south of BH-22-09. The total lead concentration in BH-37-09 of 1,310 mg/kg was above the formerly applied PADEP non-residential soil MSC. Additional delineation was completed in October 2013 with two additional soil borings collected to the south and east of BH-22-09 (BH-13-121 and BH-13-122). Soil sample results from all borings exhibited no exceedances for all site COCs.
- In August 2012, two additional samples (BH-23-12 and BH-33-12) were collected to further delineate the lead exceedance observed at BH-23-09. Both samples exceeded the non-residential soil MSC but were below the SSS for lead (905 mg/kg and 545 mg/kg, respectively). Soil sample results from all borings exhibited no exceedances for all site COCs.
- One soil boring (BH-26-09) was advanced in 2009 for general delineation purposes in the southwest portion of SWMU 94. BH-26-09 exhibited no lead detections above the soil MSC. Two additional soil borings for

general delineation purposes of the western portion of SWMU 94 were advanced at the request of PADEP in March 2013 (BH-13-02 and BH-13-06). The associated soil samples from borings BH-13-02 and BH-13-06 exhibited no COC exceedances.

- In March of 2014, five surface soil samples were collected to further delineate lead detections above the PADEP non-residential soil MSCs within SWMU 94 (BH-14-01, BH-14-02, BH-14-06, BH-14-7, and BH-14-08). All five soil samples exhibited lead detections below the SSS for lead.
- Lead exceedances above the SSS have been delineated within the surface soils of SWMU 94 within AOI 5.

5.3.3 SWMU 101

Surface soil samples were collected at four soil boring locations (BH-25-07, BH-26-07, BH-27-07, and A-142) within SWMU 101 and analyzed for total lead. These soil borings were advanced for general delineation purposes of SWMU 101. The samples collected from soil borings BH-25-07, BH-26-07, and A-142 exhibited total lead concentrations below the PADEP non-residential soil MSC. The sample collected from soil boring BH-27-07 exhibited a lead detection of 3,700 mg/kg which was above the soil MSC and the SSS for lead. Fourteen surface soil borings and soil samples were completed around BH-27-07 for lead delineation from 2009 to 2013. The results of these delineation samples are discussed below:

- Soil samples in 2007 were only analyzed for lead. All other soil samples were analyzed for site COCs.
- Lead was the only site COC detected above the respective PADEP non-residential soil direct contact MSC. Lead was detected above the SSS in one surface soil samples (BH-09-09).
- Lead exceedances were delineated in this area of SWMU 101 in AOI 5.

To address additional information requested by PADEP in the SWMU 101 area, in March 2013, sample BH-13-38 was collected. This sample exhibited a lead concentration (3,600 mg/kg) above the PADEP non-residential surface soil MSC (prior to the approval of the SSS for lead). As a result, nine additional soil borings were advanced in October 2013 to delineate this area. The results of these delineation samples are discussed below:

- All soil samples were analyzed for site COCs.
- Lead was detected above the SSS in one surface soil sample (BH-13-152).
- Lead exceedances were delineated in this area of SWMU 101 in AOI 5.

In June 2014, one surface soil sample (BH-14-38) was collected as part of a monitoring well installation which was not completed due to a subsurface concrete obstruction. This lead concentration exhibited in this soil sample was below the SSS.

Also in June 2014, three surface soil samples were collected as part of monitoring well installations. Lead concentrations in the three surface soil samples (A-171, A-172, and A-185) exhibited detections below the SSS.

5.4 Subsurface Soil Results at RCRA SWMU Areas

Based on its review of the 2011 AOI 5 SCR/RIR/CUP, the PADEP requested vertical delineation of the surface soil samples with lead exceedances within the SWMU areas. The results of the subsurface soil samples collected within the SWMUs are provided in Table 5. All of the subsurface soil samples were collected between two feet bgs and the soil-to-groundwater interface. The soil sample results were screened against the PADEP non-residential MSCs and the PADEP non-residential direct contact standards (2-15 feet). Sample locations and exceedances of the MSCs are shown in Figure 9.

As stated in Section 3.3 above, if materials were encountered in subsurface soil (2-15 feet) within SWMUs 93 and 94 (leaded tank bottom areas) during site characterization activities matching the physical description of the leaded tank bottom materials, then samples were collected for total lead. Samples were analyzed for lead via TCLP, EPA Test Method 1311, when the total lead results were above 450 ppm (the PADEP non-residential soil MSC for lead). This sampling methodology was performed to determine if leaded tank bottom materials were present in soil. TCLP results are presented in Table 10.

The site COCs 1,2-dichloroethane, 1,2,4-TMB, 1,3,-5-TMB, cumene, ethylbenzene, EDB, MTBE, toluene, xylene (total), anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(g,h,i)perylene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene were not detected in AOI 5 SWMU area subsurface soils at concentrations above their respective PADEP non-residential soil MSCs. Refer to Table 5 for analytical results.

5.4.1 SWMU 93

There are no subsurface soil analytical results for SWMU 93 from the August 2012 (BH-08-12, BH-09-12 and BH-11-12) boring installations. Also, during the installation of the March 2013 (BH-13-19, BH-13-20 and BH-13-21) borings associated with the supplemental tank investigations, shallow groundwater table was encountered; therefore, no subsurface samples were collected.

5.4.2 SWMU 94

In August 2012 and March 2013, horizontal and vertical delineation activities were completed in SWMU 94 by advancing six soil borings (BH-02-12, BH-07-12, BH-20-12, BH-21-12, BH-31-12 and BH-13-08) and collecting six subsurface soil samples. All six of the subsurface soil samples exhibited no exceedances of site COCs. Twenty-two other boring installations were unsuccessful due to a shallow groundwater table.

5.4.3 SWMU 101

Nine soil borings (BH-03-12, BH-16-12, BH-34-12, BH-35-12, BH-36-12, BH-37-12, BH-38-12, BH-39-12, and BH-40-12) were advanced in August 2012 and six soil borings (BH-13-38, BH-13-39, BH-13-40, BH-13-41, BH-13-42, and BH-13-43) were advanced in 2013 to further investigate or vertically delineate previous exceedances in SWMU 101. The results of these delineation samples are discussed below:

- All soil samples were analyzed for site COCs and exhibited no exceedance of the PADEP nonresidential soil direct contact MSCs.
- Sample locations and exceedances of the MSCs are shown in Table 5 and Figure 9.

In June 2014, one subsurface soil sample was collected as part of a monitoring well installation which was not completed due to a subsurface concrete obstruction. This subsurface soil sample (BH-14-38) exhibited no detections above the PADEP non-residential soil direct contact MSC or the SSS for lead.

Also in June 2014, three subsurface soil samples were collected as part of monitoring well installations. The surface soil samples (A-171, A-172, and A-185) exhibited no detections above the PADEP non-residential soil direct contact MSC or the SSS for lead.

5.5 Storage Tank Closure and Release Incident Investigation Soil Borings

The results of the surface and subsurface soil samples collected as part of the storage tank closure and release incidents in AOI 5 are provided in Table 5 and Table 6. Field work for the tank investigation activities was in accordance with the Evergreen QA/QC Plan and Field Procedures Manual. All of the surface soil samples were collected between the ground surface and two feet bgs and no saturated soils were observed at these depths. All of the subsurface soil samples were collected between two feet bgs and the soil-to-groundwater interface. The soil sample results were screened against the PADEP non-residential direct contact MSCs and the SSS for lead (surface soil samples only). Sample locations and exceedances of the PADEP non-residential direct contact MSCs or SSS for lead are shown in Figure 8 and Figure 9. Below are summaries of the supplemental soil sample results by tank area.

<u>Tank GP-1208</u>

The soil characterization sample results for AST GP-1208 included surface soil samples BH-13-36, BH-14-26, BH-14-27, BH-14-28, BH-14-29 and a subsurface soil sample from BH-14-28.

- An exceedance for benzene above the subsurface PADEP non-residential direct contact MSC was reported in the subsurface soil sample.
- There were no other reported site COC exceedances of PADEP non-residential MSCs within the supplemental soil characterization samples.

<u>Tank GP-1209</u>

The supplemental soil characterization sample results for AST GP-1209 included soil samples GP1209-PP, BH-13-34, BH-13-35, BH-13-145, BH-13-146, and BH-13-147.

- An exceedance for cumene above the PADEP non-residential soil direct contact MSCs was reported in one of the surface soil samples.

- There were no other reported site COC exceedances of PADEP non-residential soil direct contact MSCs within the supplemental soil characterization samples.

Tank GP-1210

The soil characterization sample results for AST GP-1210 included soil samples BH-13-31, BH-13-32, BH-13-142, BH-13-143, BH-13-144, BH-13-148, BH-13-149, BH-14-03, BH-14-04, and BH-14-11.

- An exceedance of the SSS for lead was exhibited in one surface soil sample.
- Individual exceedances above the PADEP non-residential soil direct contact MSCs for cumene and benzene were reported in two separate surface soil samples.
- There were no other reported site COC exceedances of PADEP non-residential soil direct contact MSCs within the supplemental soil characterization samples.

Tank GP-1212

The soil characterization sample results for AST GP-1212 included soil samples GP1212-PP, BH-13-29, BH-13-44, BH-13-130 through BH-13-141, and BH-14-13.

- An exceedance for cumene above the PADEP non-residential soil direct contact MSC was reported in one surface soil sample.
- There were no other reported site COC exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the supplemental soil characterization samples.

Tank GP-1214

The soil characterization sample results for AST GP-1214 included soil samples BH-14-28, BH-14-30, and BH-14-31.

- Exceedances for benzene above the PADEP non-residential soil direct contact MSCs were reported in two subsurface soil samples.
- There were no other reported site COC exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the supplemental soil characterization samples.

Tank 207

The soil characterization sample results for AST 207 included soil samples BH-14-14, BH-14-15, BH-14-17, and BH-14-18.

- There were no reported exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the supplemental soil characterization samples.

Tank 223

The soil characterization sample results for AST 223 included soil samples BH-14-21, BH-14-22, BH-14-24, and BH-14-25.

- There were no reported exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the supplemental soil characterization samples.

Tank 225

The soil characterization sample results for AST 225 included soil samples BH-14-19, BH-14-20, BH-14-36 and BH-14-37.

- There were no reported exceedances of PADEP non-residential soil direct contact MSCs or SSS for lead within the supplemental soil characterization samples.

Tank 226

The soil characterization sample results for AST 226 included soil samples BH-04-07, GPBT_03102014_7_4, GPBT_03102014_7_8, and GPBT_03102014_7_12.

- There were no reported exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the soil characterization samples.

Tank T-355

The soil characterization sample results for UST T-355 included soil samples BH-14-32, BH-14-33, BH-14-34, BH-14-35 and BH-16-1.

- An exceedance above the PADEP non-residential soil direct contact MSC was reported in one surface soil sample for benzo(a)pyrene. The benzo(a)pyrene exceedance was delineated.
- There were no other reported site COC exceedances of PADEP non-residential soil direct contact MSCs or the SSS for lead within the supplemental soil characterization samples.

As stated in Section 3.6 above, the analytical data for these borings is presented in this RIR for informational purposes only and will be used in a separately prepared SCR/RACR for tank closures or open releases associated with tanks GP-1208, GP-1209, GP-1210, GP-1212, GP-1214, 207, 223, 225, 226, and UST T-355. The SCR/RACR will be submitted under separate cover to the PADEP in accordance with 25 Pa Code §245 regulations.

5.6 PES Butane Rail Facility Soil Results

The results of the surface and subsurface soil samples collected from the PES Butane Rail Facility footprint are provided in Table 4 and Table 5. The soil sample results were screened against the PADEP non-residential MSCs and the SSS for lead. Individual grab soil boring sample locations and exceedances of the MSCs or SSS for lead are shown in Figure 8 and Figure 9. Composite samples will not appear on Figure 8 and Figure 9. Refer to Table 6 for the listing of borings associated with each of the above composite soil samples. A summary of the soil sample exceedances is provided below.

- Thirty composite subsurface samples and thirty grab subsurface samples were collected in March 2014. None of the samples exceeded the PADEP direct contact soil MSCs or the SSS for lead.
- Three composite surface samples, three composite subsurface samples, three grab surface samples, and three grab subsurface samples were collected in August 2014. None of the samples exceeded the PADEP soil direct contact MSCs or the SSS for lead.

5.7 Groundwater Results

The results of the unconfined and lower aquifer groundwater samples collected from monitoring wells from 2005 to present are provided in Table 7. The results were screened against the PADEP non-residential used aquifer (TDS<2,500) groundwater MSCs. Figure 10 illustrates the locations where concentrations of COCs were detected above the groundwater MSCs. A summary of the COC concentrations that were above their respective PADEP non-residential groundwater MSCs are presented below.

- In 2009, well A-138, located in the eastern portion of AOI 5, was re-sampled to further assess the elevated cumene concentration of 17,000 micrograms per liter (ug/L) detected during the July 2007 sampling event. Cumene was detected at a concentration of 420 ug/L during the 2009 sampling event, which is below the PADEP non-residential groundwater MSC of 2,300 ug/L.

- Historically, the following COCs have been detected in the unconfined groundwater within monitoring wells at concentrations exceeding their respective PADEP non-residential groundwater MSCs: lead, 1,2,4-TMB, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene and pyrene.
- Historically, EDB, 1,2-dichloroethane, 1,3,5-TMB, ethylbenzene, cumene, MTBE, toluene, xylenes (total), anthracene, fluorene, naphthalene, and phenanthrene have not been detected in AOI 5 unconfined groundwater above their respective PADEP non-residential groundwater MSCs.
- During the July and October 2014 and the July 2015 sampling events, the same COCs with historic exceedances listed above were detected with concentrations in unconfined groundwater exceeding their respective PADEP non-residential groundwater MSCs. No additional COCs were detected in AOI 5 groundwater above their respective PADEP non-residential groundwater MSCs.
- During the July 2014 sampling event and a separate January 2016 sampling event, groundwater was obtained from the water column beneath LNAPL in select AOI 5 monitoring wells. The same historical COCs were detected beneath the LNAPL and no additional COCs were detected in AOI 5 groundwater above their respective PADEP non-residential groundwater MSCs. These results are presented in Table 7 and Figure 10.
- Lower aquifer groundwater in monitoring well A-19D historically exhibited concentrations of MTBE exceeding the respective PADEP non-residential groundwater MSC. No other COCs have historically been detected in the lower aquifer within AOI 5 above their respective PADEP non-residential groundwater MSCs.
- During the March 2013 sampling event A-19D exhibited concentrations of MTBE similar to historic detections at this well. Additionally, lead was detected in both A-19D and A-21D at concentrations exceeding the respective PADEP non-residential groundwater MSC.
- A PAGWIS 1 mile radius search for registered wells was conducted for AOI 5 in November 2016. The well search results indicated that no public supply wells exist within the 1 mile radius of the Complex. A figure generated from the PAGWIS system is provided in Appendix C.

The groundwater data summarized above and presented in Table 7 and Figure 10 indicate dissolved COCs in unconfined groundwater are delineated within the AOI 5 downgradient boundaries and within the eastern boundary of the Complex in AOI 5.

5.8 Indoor and Ambient Air Sampling Results

Stantec collected one indoor air sample and one ambient air sample in 2012 and GHD collected six indoor air samples and one ambient air sample in 2016. The Stantec 2012 indoor air sampling report and the GHD Air Data Evaluation Letter are provided in Appendix F. To evaluate the potential vapor intrusion into indoor air exposure pathway, indoor air sample results were screened against the current (January 2017) and one-tenth of the current PADEP Non-Residential Indoor Air SHS Vapor Intrusion Screening Values. The results were also compared to the OSHA PELs, the NIOSH RELs, and the ACGIH TLVs. The EPA industrial RSLs were included in the comparison to identify COCs. Initially, the results were compared to the EPA industrial RSLs established at a target cancer risk of 1E-05 and hazard quotient of 0.1. If vapor intrusion is the only potentially complete exposure pathway, these RSL-based screening levels are the prevailing risk-based screening levels for assessment of the indoor air inhalation pathway (PADEP 2015). The results were also conservatively compared to the EPA industrial RSLs established at a target cancer risk of 1E-06 and hazard quotient of 0.1. In September 2016, the EPA established a revised reference concentration (RfC) for 1,2,4-TMB and 1,3,5-TMB based on effects on the nervous system (EPA 2016). The revised RfC (6E-02 mg/m^3) was used to derive non-cancer EPA RSLs applicable to both TMBs. The results of the air samples are presented below.

- None of the indoor air samples from 2012 and 2016 exhibited exceedances of the published PADEP, NIOSH, and ACGIH indoor air screening values.
- None of the indoor air samples from 2012 and 2016 exhibited exceedances of the EPA Industrial RSL established at a 1E-05 target cancer risk and hazard quotient of 0.1.
- Six of the eight indoor air samples from 2012 and 2016 exhibited exceedances for benzene of one-tenth of the PADEP indoor air SHS screening values and the EPA industrial RSLs at a target cancer risk of 1E-06 and a hazard quotient of 0.1 indoor air screening values. The Blending & Shipping Trailer indoor air sample (AOI5-AI-16-006) also exhibited exceedances for 1,2,4-TMB and 1,3,5-TMB compared to one-tenth of the PADEP indoor air SHS screening values.
- The 2016 Control Room indoor air sample (AOI5-AI-16-001) was the only air sample

that did not exhibit exceedances of any of the indoor air screening values.

- Similar to the indoor air samples, the ambient air samples from 2012 and 2016 did not exhibit exceedances of the published PADEP, NIOSH, and ACGIG indoor air screening values.
- Both of the ambient air samples from 2012 and 2016 exhibited exceedances for benzene of one-tenth of the PADEP indoor air SHS screening values and the EPA industrial RSLs at a target cancer risk of 1E-06 and a hazard quotient of 0.1 indoor air screening values.

It should be noted that some of the laboratory reporting limits were greater than the applicable PADEP screening values. The results of the air samples are provided in Table 8 and building sample locations are displayed in Figure 11.

5.9 Outdoor Worker Air Sampling Results

Aquaterra collected five outdoor worker ambient air samples in 2016 from select locations from within AOI 5 based upon PADEP vapor intrusion guidance documents. The air sample results are provided in Table 9 and outdoor worker ambient air sample locations are displayed in Figure 11.

5.10 LNAPL Characterization Results

As a part of the site characterization activities in 2007, LNAPL samples were collected from 10 monitoring wells (A-4, A-5, A-7, A-20, A-24, A-48, A-144, A-155, SW-1, and SW-4) in AOI 5. More recently, additional LNAPL samples were collected in July 2014 at WP-9-8 and in November 2015 at the 9 Berth Area recovery well RWBH-2. LNAPL characterization results are presented in Appendix G. Appendix G also includes previous LNAPL characterization data for AOI 5 which was obtained as part of the CCR. The extent of LNAPL in AOI 5 and the apparent thickness of LNAPL was measured during the October 2014 gauging event, and further clarified during the July 2015 gauging event, as illustrated in Figure 12.

The previous LNAPL characterization data for AOI 5 (obtained as part of the CCR and the 2007 site characterization activities), and the 2014 and 2015 LNAPL characterization data is provided in Appendix G. Based on the LNAPL characterization performed by Torkelson during the CCR and the site characterization activities and the recent PES laboratory results for RWBH-2, there are three LNAPL mixtures in AOI 5. These include previous designations of: lube oil, middle distillate and residual oil. As of July 2016, new LNAPL site-wide classifications were adopted with definitions as follows:

- Light Distillates - Light distillates include liquid petroleum gas (LPG), aviation gasoline, gasoline, and naphtha. The samples grouped into the light distillate category included samples that were characterized to be more than 90 percent gasoline, heavy virgin naphtha or reformed light naphtha. The light distillate samples have an average viscosity of 0.67 centipoise and an average density of 0.78 g/ml.
- Middle Distillates - Middle distillates include kerosene, jet fuel, diesel fuels, and light fuel oils. The samples grouped into the middle distillate category included samples that were characterized to be more have an average viscosity of 3.72 centipoise and an average density of 0.83 g/ml.
- Mixes of Light/Middle Distillates - The samples grouped into the light/middle distillate category included samples that were characterized to be intermediate mixes of light and middle distillate products. The light/middle distillate samples have an average viscosity of 0.85 centipoise and an average density of 0.80 g/ml.
- Heavy Distillates - Heavy distillates include fuel oil, residual oil, and heavy atmospheric gas oil. The heavy distillate samples have an average viscosity of 5.8 centipoise and an average density of 0.9 g/ml.
- Residuum - Includes waxes and asphalts.
- Crude oil.

Based on the new classifications, Middle Distillate and Heavy Distillate LNAPL plumes currently exist in AOI 5. LNAPL that has not been analyzed for type and does not have a well within close proximity to associate LNAPL type is identified as "Unknown." These new classifications are displayed on Figures 10 and 12.

LNAPL characterization results are presented in Table G.1 of Appendix G. The LNAPL product types summarized in Table G.1 were applied to the October 2014 gauging data (or November 2015 gauging data in the case of RWBH-2) to generate the LNAPL plumes illustrated in Figure 12.

Based on the LNAPL type, delineation of LNAPL bodies, groundwater flow/gradients, and the LNAPL modeling performed as part of the CCR, LNAPL within AOI 5 is assumed to be stable and immobile. Additionally, the low concentrations of dissolved COCs detected in groundwater samples collected beneath LNAPL indicate the LNAPL bodies within AOI 5 are a not a significant source for dissolved COCs in groundwater. Therefore, no additional LNAPL modeling was completed as part of this RIR.

6.0 FATE AND TRANSPORT EVALUATION

The following sections describe the qualitative fate and transport evaluation completed in AOI 5. This fate and transport evaluation is provided in more detail in Appendix I. A quantitative assessment utilizing the site-wide groundwater model will be presented in a future submittal.

6.1 Soil

No fate and transport modeling was completed for the soil analytical results since the soil-to-groundwater pathway is evaluated through groundwater data. Potential exposure pathways for AOI 5 are discussed in more detail in Section 9.

6.2 Groundwater

In September 2015, representatives from Evergreen's team, PADEP and EPA met to discuss the F&T approach for the Complex. It was agreed upon during the meeting that initial AOI RIRs would contain a summary of the groundwater characterization results and identify where the groundwater MSCs were exceeded throughout the Site, not only at the Point of Compliance. To achieve this, the RIR would include an evaluation of groundwater analytical data, groundwater flow direction and groundwater velocity to evaluate the potential for groundwater in exceedance of the MSC to migrate off-site. In addition, Evergreen, its consultants, and the PADEP agreed that the RIRs would include a qualitative assessment of F&T and that a site-wide quantitative assessment would be prepared under separate cover using a groundwater model to support attainment in the Final Report. A qualitative assessment of F&T of COCs in groundwater in AOI 5 is provided in Appendix I. The qualitative assessment includes information regarding the following conditions in AOI 5:

- Geologic framework;
- Hydrogeologic conditions;
- Hydrologic conditions;

- Anthropogenic features (such as the sheet pile wall along the Schuylkill River); and
- COC temporal trends and spatial distribution.

6.3 LNAPL

As part of the 2013 AOI 5 SCR/RIR/CUP (included in Appendix J), Evergreen evaluated LNAPL mobility across the site using the API LNAPL Model as a tool for assessing LNAPL volume, mobility, and recoverability across the Complex. Based on consistently detected LNAPL types, relatively stable LNAPL distribution, consistent historical groundwater flow conditions and previously completed API LNAPL Model evaluations, LNAPL in AOI 5 is considered to be stable and immobile. No new LNAPL modeling was completed as part of this report. Additionally, the low concentrations of dissolved COCs detected in groundwater samples collected beneath LNAPL indicate the LNAPL plumes within AOI 5 are a not a significant source for dissolved COCs in groundwater.

7.0 CONCEPTUAL SITE MODEL

A preliminary conceptual site model (CSM) for the Complex, including AOI 5, was presented in the CCR. The CSM for AOI 5 was later refined as part of the 2007 AOI 5 SCR and 2013 AOI 5 SCR/RIR/CUP. Data collected from site characterization activities completed since the submittal of the 2013 AOI 5 SCR/RIR/CUP were used to further refine the CSM. These historical reports are provided in Appendix J. The current CSM for AOI 5 is described in the following sections:

7.1 Description and Site Use

AOI 5 is comprised of a wedge-shaped section of land located in the southern most portion of the Complex that encompasses approximately 114 acres. AOI 5 is bordered to the north and northwest by Penrose Avenue and the George Platt Bridge, an industrial facility to the east, and the Schuylkill River to the south and southwest. Prior to August 1994, the area was owned by Chevron who acquired the Complex from a merger with Gulf Oil Company. Existing usage within AOI 5 consists primarily of product tankage, old warehouses, and docks, a loading rack and scale house, and two pump houses. PECO operates a separately fenced substation in the northern area and PES recently constructed a rail system for butane loading/unloading within AOI 5. A stormwater separator and hazardous waste storage area are located in the southwestern portion of AOI 5.

AOI 5 is located within a fenced and secured area to prevent unauthorized access. Prior to any work being completed within AOI 5, appropriate work permits, safety and security measures must be approved by PES Refining Complex personnel. AOI 5 is under the control of PES's health and safety administrative procedures and is regulated by OSHA. The current and future intended use of AOI 5 is non-residential.

7.2 Geology and Hydrogeology

The following describes geologic and hydrogeologic conditions in AOI 5:

- The depth to bedrock beneath AOI 5 is estimated to be approximately 90 ft bgs;
- The Lower Sand overlies bedrock throughout AOI 5;
- Fill varies in composition across AOI 5 and includes sands and gravels, brick, wood fragments and cinder ash up to 21 feet thick. Fill thickness tends to increase to the north;
- The Alluvium is present throughout AOI 5 and ranges in thickness from approximately 20 feet to up to 47 feet near the Schuylkill River. Based on the available lithologic data, the alluvium deposits in AOI 5 generally consist of two distinct stratigraphic layers, a clay layer and a silt layer;
- Based on available soil boring logs, the Trenton Gravel is not present beneath AOI 5;
- Lower/Middle Clay ranges in thickness from 0 feet 23 feet and appears to be fairly extensive throughout AOI 5. The Lower/Middle Clay is believed to pinch out to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. Where present the Lower/Middle Clay functions as a confining bed to the lower sand aquifer.
- The hydrogeologic framework for AOI 5 consists of three layers. Layer one is the combined anthropogenic fill and Holocene alluvium (which is referred to as the unconfined aquifer makes up the water table aquifer). At depth and where less permeable, the alluvium also acts as a leaky confining unit. Layer two is the Lower/Middle Clay confining unit (referred to as the clay aquitard). Layer three is the Lower Sand which is a semi-confined to confined aquifer;
- Groundwater flow in the unconfined aquifer is generally to the south towards the Schuylkill River;

- Unconfined groundwater flow appears to be influenced by historic in-filled tributaries of the Schuylkill River;
- Unconfined groundwater flow in AOI 5 is influenced by the presence of the sheet pile bulkhead which extends along the AOI's boundary with the Schuylkill River and is keyed into the alluvium clay. As a result, limited groundwater mounding behind the sheet pile wall has been observed in AOI 5.

7.3 Compounds of Concern

The following summarizes relevant information concerning COCs by media in AOI 5:

Soil

- Benzo(a)pyrene and lead are the only COCs in surface soil detected above the PADEP non-residential soil direct contact MSCs or the SSS for lead (outside of RCRA SWMU areas and tank investigation areas). Areas where these COCs exceeded either the PADEP non-residential surface soil direct contact MSCs or the SSS for lead have been delineated.
- Benzene, cumene and lead are the only COCs in surface soil detected above the PADEP non-residential soil direct contact MSCs or the SSS for lead in tank investigation areas. Areas where these COCs exceeded either the PADEP non-residential surface soil direct contact MSCs or the SSS for lead have been delineated.
- Lead is the only COC in surface soil detected above the SSS for lead in RCRA SWMU areas. Areas where this COC exceeded the SSS for lead have been delineated.
- No COCs in subsurface soil were detected above the PADEP subsurface soil direct contact MSCs outside of the tank investigation areas.
- Benzene and cumene are the only COCs in subsurface soil detected above the PADEP subsurface soil direct contact MSCs in the tank investigation areas.

Groundwater

- 1,2,4-TMB, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, lead, and pyrene are the COCs in unconfined groundwater that were detected above their respective PADEP non-residential groundwater MSCs.

- MTBE and lead are the COCs in the lower aquifer groundwater that were detected above their respective PADEP non-residential groundwater MSCs.

Indoor Air

- No COCs in indoor air were detected above the PADEP indoor air SHS screening values during the 2012 and 2016 indoor air sampling events.

7.4 LNAPL Distribution and LNAPL Mobility

The following summarizes relevant information concerning LNAPL distribution in AOI 5:

- There are two different identified types or mixtures of LNAPL identified in AOI 5; these consist middle distillates and heavy distillates. LNAPL that has not been analyzed for type is identified as "Unknown."
- Based on API modeling results and historic distribution, LNAPL in AOI 5 is contained within the boundary of the Complex and does not appear to have to the potential to migrate off-site due to its low mobility and the presence of the sheet pile bulkhead.

7.5 Fate and Transport of COCs

- No fate and transport modeling was completed for the soil. The soil-to-groundwater pathway is evaluated through groundwater attainment with a site-specific standard.
- A qualitative assessment was completed to assess the potential fate and transport of dissolved petroleum impacts and refine the current CSM for AOI 5.
- For the AOI 5 CSM plume stability assessment, benzene, the most mobile of the COCs, was the focus, but all COCs that exceeded their respective PADEP non-residential MSCs were included in the trend analysis. The plume stability assessments for these compounds indicate their plumes are either decreasing or stable (refer to Appendix I).
- Two areas in AOI 5 have been identified as potential source areas for groundwater petroleum impacts (east and west source areas). The east source area is related to a heavy distillate LNAPL plume located to the north of the former warehouse building. Based on the current plume stability assessment,

the east source area is stable, and has attenuated with respect to benzene. Also, due to the presence of an underlying clay aquitard (Holocene clay) and the sheet pile wall, the east plume is unlikely to migrate further or reach any potential receptors. The west source area is related to several isolated middle distillate LNAPL plumes. Concentration trends suggest this source area is stable. Due to the plume stability and the presence of an underlying clay aquitard (Holocene clay and lower/middle clay) and presence of a sheet pile wall, the west plume is unlikely to migrate further or discharge to the Schuylkill River.

- The MTBE and lead exceedances identified in the lower aquifer will be addressed in the separate site-wide fate and transport analysis.

7.6 Potential Migration Pathways and Site Receptors

The following summarizes potential migration pathways and site receptors for AOI 5.

- AOI 5 is situated within a fenced and secured area to prevent unauthorized access.
- The potential direct contact pathway to soil greater than two feet is deemed incomplete based on PES's on-site permit and PPE procedures which limit exposure to soil encountered in excavations.
- The potential direct contact pathway to groundwater is deemed incomplete based on PES's on-site permit and PPE procedures which limit exposure to groundwater that may be encountered in excavations.
- COC concentrations in potential indoor air receptors are not above the PADEP indoor air SHS screening values.
- LNAPL is contained within the boundaries of AOI 5. The potential direct contact pathway to LNAPL is deemed incomplete based on PES's on-site permit and PPE procedures which limit exposure to groundwater that may be encountered in excavations.
- Dissolved phase COCs in the unconfined aquifer above the groundwater MSCs are contained within the boundary of AOI 5 or the Complex. Evergreen will prepare a separate site-wide fate and transport analysis using the site-wide quantitative model to further assess the extent of dissolved phase COCs in groundwater and their potential impact to receptors.

- The areas with surface soil concentrations above COC direct contact MSCs and lead above the SSS will be remediated by Evergreen to eliminate the potential exposure pathway. The remediation activities will be discussed in a separate Complex-wide Cleanup Plan.
- A recent online well radius search was conducted for the entire site using the PAGWIS in November 2016 in order to evaluate potential potable well receptors. Based on the PAGWIS search completed in 2016, there are no existing public or private water supply wells within a 1 mile radius of the Complex boundary.

8.0 REMEDIAL SYSTEM UPDATE

The 9 Berth Total Fluids Recovery System is the only remediation system located in AOI-5. This system was shut-down in January 2009 as a result of freezing conditions and due to the lack of LNAPL in the vicinity of the system. The system has remained offline since January 2009. The LNAPL evaluation discussed in Section 6.3 confirmed that the LNAPL in the vicinity of the 9 Berth System was generally immobile.

The 9 Berth Total Fluids Recovery System consisted of total fluids (groundwater and LNAPL) recovery from two recovery wells (RW-BH1 and RW-BH2) using electric, submersible pumps. The recovery wells were gauged weekly as part of the recovery system maintenance and monitoring program to ensure the system was operating as designed. Operation and maintenance data for this system, as well as well gauging and sampling data for AOI 5, had previously been reported to the PADEP and EPA in the remediation status reports for the Complex.

The volume of LNAPL recovered from either well cannot be ascertained based on the system discharge configuration. Total fluids were pumped directly into a closed benzene NESHAP-compliant sewer, which discharged to the Girard Point Wastewater Treatment Plant. The total fluids recovery for the system was at least 4,265,862 gallons of groundwater and LNAPL as last reported in the first quarterly remediation status reports of 2009.

As mentioned in previous sections, recent site-wide groundwater gauging events have indicated an increase in LNAPL within the recovery wells of the 9 Berth Total Fluids Recovery System. Evergreen will monitor the conditions at the 9 Berth Total Fluids Recovery System as part of the Complex-wide Cleanup Plan.

9.0 EXPOSURE ASSESSMENT

9.1 Human Health

A human health risk assessment has been completed for lead in site soils, as summarized in Section 1.4. Soil results that exceed the SSS for lead, or the non-residential direct contact MSC for the other COCs, are to be addressed through pathway elimination under the SSS or through engineering controls, the details of which will be identified in the Complex-wide Cleanup Plan. Groundwater results that exceed the non-residential MSC at the point of compliance will be addressed through engineering controls or by pathway elimination under the SSS, and will also be identified in the Complex-wide Cleanup Plan.

9.2 Ecological

The majority of AOI 5 is covered with impervious surfaces. Some areas are covered by soil and gravel; however, they are not likely to serve as a breeding area, migratory stopover, or primary habitat for wildlife. In July 2013, a request was submitted to the Pennsylvania Natural Diversity Inventory (PNDI) database to identify potential endangered, threatened and special concern wildlife near the project area. The PNDI search from July 2013 identified one potential impact to the Eastern Red-bellied Turtle under the jurisdiction of PA Fish & Boat Commission (PAFBC). Coordination with PAFBC resulted in a "no impact" determination as long as no wetlands, open water areas, streams or ponds are to be disturbed. Within AOI 5, wetlands, open water areas, streams or ponds do not exist and therefore the project will not result in impacts to the Eastern Red-bellied Turtle. PAFBC's July 2013 response was valid for two years and was extended in April 2015, making it valid through April 2017. The agency notification and response letters are included in Appendix A.

A new PNDI search was conducted on May 7, 2015 in response to a public notice issued by U.S. Army Corps of Engineers on May 4, 2015, which requires updates to all PNDI receipts dated prior to May 4, 2015 due to listing of the northern long-eared bat as a threatened species under the Endangered Species Act. The May 7, 2015 PNDI search did not result in any additional potential impacts to threatened or endangered species. The updated PNDI search is included in Appendix A.

No surface water features are located in AOI 5. The nearest surface water body to AOI 5 is the Schuylkill River, which borders the western and southern boundary. A sheet pile wall is present between AOI 5 and the Schuylkill River as illustrated in Figure 2. Groundwater interaction with surface water/sediment is restricted by the sheet pile wall. Evergreen will be examining site-wide surface water compliance in future reporting.

10.0 COMMUNITY RELATION ACTIVITIES

A Community Relation Plan (CRP) that includes public involvement with local residents to inform them of the anticipated investigations and remediation activities was completed as part of the original NIR submittal in 2006. A revised NIR was submitted in 2014. The purpose of the CRP is to provide a mechanism for the community, government officials, and other interested or affected citizens to be informed of on-site activities related to the remediation program at the Site. This plan incorporates aspects of public involvement under both PADEP's Act 2 program and EPA's RCRA Corrective Action program. Sunoco held an initial public meeting to present the strategy and give a status update of the project. As part of the CRP, Sunoco has presented updates on the remediation program to the Community Action Plan (CAP) on an as requested basis. The CAP meets on a monthly basis and includes members of the community, local officials and PES employees.

This report and future Act 2 reports will include the appropriate municipal and public notices in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in a local newspaper. A copy of the original NIR, the 2014 NIR and the Act 2 report notifications for this RIR are included in Appendix A.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the completed activities, the following conclusions and recommendations have been developed for AOI 5:

SOIL

Soil in Non-SWMU Areas

- Eight non-SWMU surface soil locations (seven in the eastern tank farm area) exhibited exceedances above either the SSS for lead, or the non-residential soil direct contact MSCs for benzene, cumene, or benzo(a)pyrene. These areas have been delineated and will be addressed by Evergreen as part of the forthcoming Complex-wide Cleanup Plan.
- Eight non-SWMU subsurface soil locations (all in the eastern tank farm area) exhibited exceedances above the non-residential soil direct contact MSC for either benzene or cumene.
- PES Butane Rail Facility surface and subsurface soils did not exhibit exceedances of the non-residential soil direct contact MSC or SSS for lead.
- With regard to the potential direct-contact pathway to subsurface soil within AOI 5 (i.e., greater than 2 feet deep) the direct contact pathway is considered incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure. The soil-to-groundwater pathway is addressed through groundwater attainment with a site-specific standard.

Soil Within SWMUs

- SWMU 93 contained one soil sample result of documented leaded tank bottoms with a TCLP result that exceeded the EPA maximum concentration of lead for toxicity characteristic. This leaded tank bottom sample did not exceed the SSS for lead. No other samples exceed the current SSS for lead. The documented leaded tank bottoms have been delineated and will be addressed by Evergreen as part of the forthcoming Complex-wide Cleanup Plan.
- SWMU 94 contained four soil sample results exceeding the SSS for lead. Two of these soil sample results are classified as documented leaded tank bottoms based upon the TCLP result. The areas with lead above the SSS and documented leaded tank bottoms have been delineated and will be addressed by Evergreen as part of the forthcoming Complex-wide Cleanup Plan.

- SWMU 101 contained four soil sample results with exceedances of the SSS for lead. These areas have been delineated and will be addressed by Evergreen as part of the forthcoming Complex-wide Cleanup Plan.
- With regard to the potential direct-contact pathway to subsurface soil within SWMUs (i.e., greater than 2 feet deep) and the soil-to-groundwater pathway, the direct contact pathway is considered incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure. The soil-to-groundwater pathway is addressed through groundwater attainment with a site-specific standard.
- A SWMU Closure letter will be forwarded under separate cover to request EPA's concurrence that no further investigation is necessary for SWMUs 93, 94, and 101 based on the characterization work completed. The letter will also request EPA's concurrence that no further action will be necessary once the delineated impacted soils in SWMUs 93, 94, and 101 are remediated in accordance with the PADEP and EPA-approved Cleanup Plan.

GROUNDWATER

- Unconfined (water table) groundwater flow is generally to the south towards the Schuylkill River. Unconfined groundwater flow appears to be influenced by in-filled historic tributaries of the Schuylkill River as indicated by the valley-like gradient patterns in the vicinity of these features due to the contrast in hydraulic conductivity between natural and fill materials. Unconfined groundwater flow in AOI 5 is also influenced by the presence of the sheet pile bulkhead which extends along the AOI's boundary with the Schuylkill River and is keyed into the Holocene clay. Localized groundwater mounding is apparent behind portions of the wall.
- Nine COCs [lead, 1,2,4-TMB, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, and pyrene] were detected in unconfined groundwater during the July 2014 and October 2014 groundwater sampling events at concentrations above their respective used-aquifer, non-residential groundwater MSCs. These and other historic groundwater quality results will be used by Evergreen in a site-wide quantitative groundwater model and fate and transport analysis to further evaluate the extent of groundwater impacts and potential exposure to receptors.
- Based on qualitative groundwater trends, the presence of the sheet pile wall, and groundwater flow direction in the unconfined aquifer, concentrations of the above mentioned dissolved COCs are delineated within AOI 5 and are not expected to

exceed the groundwater MSCs at the site boundary or affect site receptors (Schuylkill River to the west and off-site industrial areas to the east).

- Unconfined groundwater samples collected from beneath LNAPL in select monitoring wells exhibited similar historical COCs concentrations compared to monitoring wells without LNAPL. These results, as well as other dissolved COC results above the MSCs will be used in the site-wide fate and transport analysis being prepared under separate cover.
- MTBE and lead were detected in lower aquifer groundwater during the March 2013 groundwater sampling event at concentrations above their respective used-aquifer, non-residential groundwater MSCs. These results, as well as other dissolved COC results above the MSCs will be used in the site-wide fate and transport analysis being prepared under separate cover.
- Excavations in AOI 5 are governed by PES's permitting procedures which limit potential exposures to groundwater that could be encountered in excavations.
- Groundwater results that exceed the non-residential MSC at the point of compliance will be addressed through use of engineering and institutional controls and/or by pathway elimination and will also be addressed in the Complex-wide Cleanup Plan.
- Based on the PAGWIS search completed in 2016, there are no existing public or private water supply wells within a 1 mile radius of the Complex boundary. Evergreen intends to implement an UECA that will prohibit the use of groundwater in the Complex for potable purposes.

INDOOR AIR

- Based on the results of the 2012 and March 2016 indoor air samples, none of the buildings within AOI 5 had indoor air samples that exhibited COC exceedances above the PADEP indoor air SHS screening values. However, some of the laboratory reporting limits were greater than the applicable PADEP screening values. These buildings will be further evaluated by Evergreen as part of the forthcoming Complex-wide Cleanup Plan.

LNAPL

- The horizontal extents of the LNAPL plumes within AOI 5, relative to the Complex boundaries, have been delineated. Based on the LNAPL types, LNAPL modeling results and historic groundwater gauging and sampling activities, LNAPL present in AOI 5 is stable and relatively immobile. LNAPL does not appear to have the potential to migrate off-site. LNAPL sheens have not been observed in the Schuylkill

River on the river side of the sheet pile bulkhead.

- There are no complete direct contact exposure pathways for LNAPL within AOI 5 because of on-site permitting procedures and required PPE which limit potential exposure.
- Evergreen will continue to monitor the LNAPL condition at the 9 Berth Total Fluids Recovery System as part of the Complex-wide Cleanup Plan.

12.0 LIST OF CONTACTS

Below is the list of contacts associated with the RIR:

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13.0 SIGNATURES

The following parties are participating in the remediation at this time and are seeking relief from liability under Act 2 of 1995:

Tiffani L. Doerr, PG
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

This Act 2 RIR has been prepared in accordance with the final provisions of Act 2 and the June 8, 2002 Land Recycling Program Technical Guidance Manual.

14.0 REFERENCES

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TABLES

Table 1
Constituents of Concern
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

METALS	CAS No.
Lead (Total)	7439-92-1

VOCs	CAS No.
1,2-Dichloroethane	107-06-2
1,2,4-Trimethylbenzene	95-63-6
1,3,5-Trimethylbenzene	108-67-8
Benzene	71-43-2
Cumene	98-82-8
Ethylbenzene	100-41-4
Ethylene Dibromide (EDB)	106-93-4
Methyl Tertiary Butyl Ether	1634-04-4
Toluene	108-88-3
Xylene (Total)	1330-20-7

SVOCs/ PAHs	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Notes:

1. Constituents are from Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E (pgs. 29-30) of PADEP Document, Closure Requirements for Underground Storage Tank Systems, effective April 1, 1998 and the March 18, 2008 revised PADEP Petroleum Short List. In May 2009, two additional COCs, 1,2,4-trimethylbenze (1,2,4-TMB) and 1,3,5-trimethylbenzene (1,3,5-TMB), were added to the list of COCs by Evergreen based on the PADEP's revisions to the petroleum short list of compounds and at the request of the PADEP. The COC listing for groundwater was also revised in 2012 to follow the soil COC listing.

Table 2
Existing Well Summary
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

AOI #	Well ID	Former Well ID[3]	Well Status/ Description	Disposition of Well	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[2]: Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation (ft. msl) (NAVD88)	Ground Surface Elevation (ft.) (NAVD88)	Top of Screen Elevation (ft) (NAVD88)	Bottom of Screen Elevation (ft) (NAVD88)	Depth to Screen (ft. bgs)	Screen Length (ft.)	References	Product Characterization[5]: Density (g/cc)	Source[6]	Percentage and Product Type(s)
AOI - 5 (Girard Point South Tank Field Area)																							
5	A	–			–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	A-1	–			215288.956	2683608.072	MW	Unconfined	Y	Y	2/24/1986	16	4	6.85	5.81	0.81	-9.19	5	10	Dames & Moore, 1990			
5	A-10	–			215427.902	2682406.215	MW	Unconfined	Y	Y	2/25/1986	15	4	8.28	8.67	3.67	-6.33	5	10	Dames & Moore, 1990			
5	A-11	–			215380.325	2682015.508	MW	Unconfined	Y	Y	2/25/1986	14	4	7.77	4.59	1.09	-8.91	4	10	Dames & Moore, 1990			
5	A-118	–			217109.272	2683070.537	RFI MW	Unconfined	–	–	–	17.5	4	8.3	5.79	–	–	–	–	Handex, 1996			
5	A-119	–	Destroyed		216989.269	2683357.325	RFI MW	Unconfined	–	–	–	12.5	4	10.68	7.09	–	–	–	–	Handex, 1996			
5	A-12	–			215378.884	2682182.748	MW	Unconfined	Y	Y	2/24/1986	14	4	7.57	4.88	1.88	-8.12	3	10	Dames & Moore, 1990			
5	A-120	–	Destroyed		216016.277	2683147.065	RFI MW	Unconfined	–	–	–	17.3	4	9.17	6.51	–	–	–	–	Handex, 1996			
5	A-121	–	Destroyed		215917.121	2682857.226	RFI MW	Unconfined	–	–	–	17.5	4	9.32	6	–	–	–	–	Handex, 1996			
5	A-122	–			215929.834	2682277.55	RFI MW	Unconfined	–	–	–	17.6	4	7.44	6.79	–	–	–	–	Handex, 1996			
5	A-13	–	Destroyed		215611.001	2682674.376	MW	Unconfined	Y	Y	2/27/1986	13	4	8.48	6.93	3.93	-6.07	3	10	Dames & Moore, 1990	0.9015	A-13	90% Lube Oil, 10% Middle Distillate
5	A-132	–	Destroyed		–	–	MW	Unconfined	Y	Y	8/19/1992	16	4	–	10.35	5.35	-4.65	5	10	Dames & Moore, 1992			
5	A-133	–			215804.497	2681282.286	MW	Unconfined	Y	Y	8/19/1992	15	4	13.0236	10.2586	5	-4.7414	5	10	Dames & Moore, 1992	0.9796	A-133	100% Residual Oil
5	A-134	–			215809.959	2681408.542	RFI MW	Unconfined	Y	Y	8/19/1992	15	4	9.14	7.21	2.21	-7.79	5	10	Dames & Moore, 1992			
5	A-135	–			215822.935	2681633.451	RFI MW	Unconfined	Y	Y	8/21/1992	16	4	10.76	8.36	3.36	-6.64	5	10	Dames & Moore, 1992			
5	A-136	–			215556.216	2681692.562	RFI MW	Unconfined	Y	Y	8/20/1992	16	2	8.7	7.52	1.52	-8.48	6	10	Dames & Moore, 1992	0.9796	A-136	75% Residual Oil, 25% Middle Distillate
5	A-137	–			215161.003	2683597.259	MW	Unconfined	Y	Y	8/19/1992	15	4	8.63	6.29	4.29	-7.71	2	12	Dames & Moore, 1992			
5	A-138	–	Destroyed		216258.29	2683534.1	MW	Unconfined *	Y	Y	12/31/1999	0	–	6.57	6.82	–	–	–	–	–			
5	A-139	–	Damaged	Casing/Monument damaged	215985.03	2683731.8	MW	Unconfined	Y	Y	3/1/2007	15	4	9.12	6.9	4.9	-8.1	2	13	AOI5 Site Characterization			
5,11	A-13D	–	Destroyed		215608.118	2682677.259	MW	Lower Aquifer	Y	Y	11/13/1986	69	4	9.39	7.07	-51.93	-61.93	59	10	Handex, 1996			
5	A-14	–	Destroyed		215554.774	2682948.303	MW	Unconfined	Y	Y	2/26/1986	13	4	10.49	8	5	-5	3	10	Dames & Moore, 1990	0.9143	A-14	90% Lube Oil, 6% Middle Distillate, 4% Aviation Gasoline
5	A-140	–	Damaged	Casing/Monument damaged	215636.991	2683699.414	MW	Unconfined	Y	Y	3/6/2007	17	4	9.887	7.32	5.32	-9.68	2	15	Aquaterra, 2007			
5	A-141	–	Destroyed		215375.014	2683659.534	MW	Unconfined	Y	Y	3/6/2007	17	4	10.218	7.63	5.63	-9.37	2	15	Aquaterra, 2007			
5	A-142	–			214931.26	2683675.641	MW	Unconfined	Y	Y	3/6/2007	15	4	8.555	6.144	4.144	-8.856	2	13	Aquaterra, 2007			
5	A-143	–			215553.453	2683339.643	MW	Unconfined	Y	Y	3/1/2007	10	4	9.502	7.08	5.08	-2.92	2	8	Aquaterra, 2007			
5	A-144	–	Destroyed		215735.556	2682907.264	MW	Unconfined	Y	Y	3/6/2007	17	4	9.435	7.2	5.2	-9.8	2	15	Aquaterra, 2007	0.8753	A-144	80% Middle Distillate, 10% Unk Lt Material, 10% Heavier Material (Crude/Residual)
5	A-145	–	Destroyed		216182.184	2683206.283	MW	Unconfined	Y	Y	3/1/2007	15	4	7.448	5.12	3.12	-9.88	2	13	Aquaterra, 2007			
5	A-146	–			216551.974	2682962.216	MW	Unconfined	Y	Y	3/1/2007	17	4	10.877	11.31	9.31	-5.69	2	15	Aquaterra, 2007			
5	A-147	–			216815.03	2682850.343	MW	Unconfined	Y	Y	3/1/2007	14	4	7.512	7.74	5.74	-6.26	2	12	Aquaterra, 2007			
5	A-148	–			216806.086	2682640.918	MW	Unconfined	Y	Y	3/1/2007	12	4	8.008	5.703	3.703	-6.297	2	10	Aquaterra, 2007			
5	A-149	–			216327.389	2682442.66	MW	Unconfined	Y	Y	3/1/2007	15	4	8.494	5.59	3.59	-8.41	2	12	Aquaterra, 2007			
5	A-15	–			216313.742	2682689.425	MW	Unconfined	Y	Y	2/25/1986	15	4	5.11	4.79	-0.21	-10.21	5	10	Dames & Moore, 1990	0.9356	A-22	Middle Distillate 80%, Heavier Material2 20%
5	A-150	–			215611.769	2682502.234	MW	Unconfined	Y	Y	3/6/2007	17	4	9.64	7.17	5.17	-9.83	2	15	Aquaterra, 2007	0.9015	A-13	Lube Oil 90%, Middle Distillate 10%
5	A-151	–			215824.421	2682128.585	MW	Unconfined	Y	Y	3/1/2007	15	4	7.489	5.1	3.1	-9.9	2	13	Aquaterra, 2007			
5	A-152	–			216072.848	2681986.798	MW	Unconfined	Y	Y	3/6/2007	17	4	4.847	2.43	0.43	-14.57	2	15	Aquaterra, 2007			
5	A-153	–	Unable to Locate		217566.468	2683573.476	MW	Unconfined	Y	Y	3/1/2007	17	4	9.219	9.56	7.56	-7.44	2	15	Aquaterra, 2007			
5	A-154	–	Unable to Locate		216409.62	2681447.71	MW	Unconfined	Y	Y	3/6/2007	17	4	–	–	–	–	2	15	Aquaterra, 2007			
5	A-155	–			216208.292	2681449.43	MW	Unconfined	Y	Y	3/1/2007	15	4	8.389	5.9	3.9	-9.1	2	13	Aquaterra, 2007	0.8777	A-155	75% Mid Distillate, 5% Stoddard Solvent, 10% Unk Lt, 10% Heavier Material
5	A-156	–			216058.146	2681354.572	MW	Unconfined	Y	Y	11/8/2012	5	2	8.882	6.1	5.1	1.1	1	4	Aquaterra, 2012			
5	A-157	–			216278.08	2681413.674	MW	Unconfined	Y	Y	11/6/2012	8	4	8.623	5.8	5.8	-2.2	0	8	Aquaterra, 2012			
5	A-158	–			216131.91	2681604.367	MW	Unconfined	Y	Y	11/7/2012	11.5	4	6.139	6.25	4.75	-5.25	2	10	Aquaterra, 2012			
5	A-159	–	Destroyed		215628.716	2682713.93	MW	Unconfined	Y	Y	11/6/2012	17	4	9.725	6.73	4.73	-10.27	2	15	Aquaterra, 2012			
5	A-16	–	Destroyed		216996.268	2682671.491	MW	Unconfined	Y	Y	2/25/1986	14	4	9.02	6.2	4.7	-5.3	2	10	Dames & Moore, 1990			
5	A-160	–	Destroyed		215622.35	2682922.428	MW	Unconfined	Y	Y	11/6/2012	17	4	9.38	6.36	4.36	-10.64	2	15	Aquaterra, 2012			
5	A-161	–	Destroyed		215940.93	2681309.438	MW	Unconfined *	N	N	11/8/2012	0	–	8.29	5.33	–	–	–	–	Langan 2013	0.8953	A-24	Middle Distillate 80%, Heavier Material2 20%
5	A-162	–			215828.703	2681275.126	MW	Unconfined	N	N	–	–	–	7.41	6.29	–	–	–	–	Langan 2013			
5	A-163	–			215985.24	2681069.787	MW	Unconfined	N	N	–	–	–	10.49	7.29	–	–	–	–	Langan 2013			
5	A-164	–			216038.682	2681178.212	MW	Unconfined	N	N	–	–	–	8.91	6.05	–	–	–	–	Langan 2013			
5	A-166	–			215789.991	2681273.49	MW	Unconfined	–	–	–	–	–	11.2749	9.6949	–	–	–	–	Langan 2014	0.925	A-136	Residual Oil 75%, Middle Distillate 25%
5	A-167	–			216200.322	2681257.275	MW	Unconfined	–	–	–	–	–	9.4552	7.5099	–	–	–	–	Langan 2015			
5	A-168	–			216443.844	2681699.054	MW	Unconfined	–	–	–	–	–	10.6865	7.6957	–	–	–	–	–			
5	A-169	–			215952.71	2681150.05	MW	Unconfined	–	–	6/23/2014	16	2	8.62	6.1	5.1	-9.9	1	–	ns/lm			
5	A-17	–	Destroyed		216877.402	2683572.924	MW	Unconfined	Y	Y	2/27/1986	14	4	8.4	8.37	6.37	-3.63	2	10	Dames & Moore, 1990			
5	A-170	–			215866.68	2681810.94	MW	Unconfined	–	–	6/25/2014	16	2	4.63	2.2	1.2	-13.8	1	–	ns/lm			
5	A-171	–			215555.36	2681590.31	MW	Unconfined	–	–	7/1/2014	16.5	2	7.64	5.2	3.7	-11.3	2	–	ns/lm	0.925	A-136	Residual Oil 75%, Middle Distillate 25%
5	A-172	–			215440.73	2681779.69	MW	Unconfined	–	–	6/24/2014	16	2	6.32	4.7	3.7	-11.3	1	–	ns/lm			
5	A-173	–			215236.856	2682857.336	MW	Unconfined	–	–	6/30/2014	16	2	–	–	–	–	1	–	ns/lm			
5	A-174	–	Damaged	Obstruction in Well	217149.64	2683052.08	MW	Unconfined	–	–	–	–	–	8.02	6.3	–	–	–	–	Aquaterra, 2014			
5	A-175	–			215245.31	2682663.47	MW	Unconfined	–	–	–	–	–	4.73	5	–	–	–	–	–			
	A-176	–			215259.851	2682693.871	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	–			
	A-177	–			215248.638	2682739.38	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	–			
5	A-178	–	Unable to locate		215228.32	2682769.95	MW	Unconfined	–	–	–	–	–	4.55	4.8	–	–	–	–	–	0.9124	A-5	Lube Oil 100%
	A-179	–			215289.455	2682824.02	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	–			
5	A-18	–	Destroyed		217223.174	2683607.501	MW	Unconfined	Y	Y	2/27/1986	12	4	8.47	8.61	6.61	-3.39	2	10	Dames & Moore, 1990			
	A-180	–			215315.67	2682845.926	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	–			
5	A-181	–			215193.2	2682443.66	MW	Unconfined	–	–	–	–	–	6.52	5.3	–	–	–	–	–			
5	A-182	–			215082.92	2682579.97	MW	Unconfined	–	–	–	–	–	6.9	5	–	–	–	–	–			
	A-183	–			215353.968	2682598.093	Mw	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	–			
5	A-184	–	Damaged	Casing/Monument damaged	215355.16	2682611.2	MW	Unconfined	–	–	–	–	–	–	8.2	–	–	–	–	–	0.9124	A-5	Lube Oil 100%
5	A-185	–	Damaged*	Casing/Monument Damaged	215506.55	2681565.83	MW	Unconfined	–	–	6/26/2014	16	2	–	7.7	4.7	-8.3	3	–	ns/lm			
5	A-186	–			217107.28	2682887.99	MW	Unconfined	–	–	7/3/2014	18	2	8.257	5.6	2.6	-12.4	3	–	ns/lm			
5	A-187	–	Reserved		215337.08	2682720.65	MW	Unconfined	–	–	–	–	–	9.4	7.9	–	–	–	–	Stantec, 2015			
5	A-188	–	Reserved		215334.92	2682745.33	MW	Unconfined	–	–	–	–	–	11.48	8.1	–	–	–	–	Stantec, 2015			
5	A-189	–			217438.151	2683359.64	MW	Unconfined	–	–	–	–	–	8.51	5.91	–	–	–	–	–			
5	A-19	–	Destroyed		217570.98	2683558.686	MW	Unconfined	Y	Y	2/27/1986	11.5	4	9.52	8.47	6.97	-3.03	2	10	Dames & Moore, 1990			
5,11	A-19D	–			217562.844	2683562.754	MW	Lower Aquifer	Y	Y	10/30/1986	60	4	10.64	–	–	–	50	10	Dames & Moore, 1990			
5	A-2	–	Destroyed		–	–	MW	Unconfined	Y	Y	2/27/1986	13	4	7.84	–	–	–	3	10	Dames & Moore, 1990			
5	A-20	–	Destroyed		215307.608	2681972.433	MW	Unconfined	Y	Y	2/24/1986	14	4	8.81	–	–	–	4	10	Dames & Moore, 1990	0.9222	A-20	75% Middle Distillate, 25%Heavier Material (Crude/Residual)
5	A-21	–			215629.744	2681388.358	MW	Unconfined	Y	Y	2/25/1986	13	4	8.16	7.77	4.77	-5.23	3	10	Dames & Moore, 1990	0.91	SW-4	70% Middle Distillate, 30% Heavier Material (Crude/Residual)
5,11	A-21D	–			215629.744	2681388.358	MW	Lower Aquifer	Y	Y	10/28/1986	85	4	11.25	7.94	-67.06	-77.06	75	10	Dames & Moore, 1990			
5	A-22	–			216031.531	2680996.159	MW	Unconfined	Y	Y	2/2/1986	15	4	7.95	7.76	2.76	-7.24	5	10	Dames & Moore, 1990	0.9356	A-22	80% Middle Distillate, 20% Heavier Material (Crude/Residual)
5	A-23	–			216384.931	2682142.8	MW	Unconfined	Y	Y	2/27/1986	13	4	6.31	3.79	0.79	-9.21	3	10	Dames & Moore, 1990			
5	A-24	–			215977.199	2681515.23	MW	Unconfined	Y	Y	2/24/1986	14.5	4	5.53	5.56	3.56	-6.44	2	10	Dames & Moore, 1990	0.8953	A-24	80% Middle Distillate, 20% Heavier Material (Crude/Residual)
5	A-25	–			216982.319	2682468.225	MW	Unconfined	Y	Y	2/27/1986	13	4	8.8	8.82	5.82	-4.18	3	10	Dames & Moore, 1990			
5	A-26	–			216793.002	2682167.311	MW	Unconfined	Y	Y	2/27/1986	15	4	8.65	9	5.5	-4.5	4	10	Dames & Moore, 1990			

Table 2
Existing Well Summary
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

AOI #	Well ID	Former Well ID[3]	Well Status/ Description	Disposition of Well	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[2]								References	Product Characterization[5]		
												Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation (ft. msl) (NAVD88)	Ground Surface Elevation (ft.) (NAVD88)	Top of Screen Elevation (ft) (NAVD88)	Bottom of Screen Elevation (ft) (NAVD88)	Depth to Screen (ft. bgs)	Screen Length (ft.)		Density (g/cc)	Source[6]	Percentage and Product Type(s)
AOI - 5 (Girard Point South Tank Field Area)																							
5	A-27	–			216591.729	2681846.47	MW	Unconfined	Y	Y	2/27/1986	15	4	10.005	9.5	4.5	-5.5	5	10	Dames & Moore, 1990			
5	A-28	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	A-29	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	A-3	–			215784.549	2683411.637	MW	Unconfined	Y	Y	2/24/1986	15	4	8.24	7.66	4.66	-5.34	3	10	Dames & Moore, 1990			
5	A-30	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	A-39	–			215042.061	2683669.345	MW	Unconfined	Y	Y	7/18/1988	13	4	7.68	5.96	2.96	-7.04	3	10	Dames & Moore, 1992			
5	A-4	–			215000.611	2683519.767	MW	Unconfined	Y	Y	2/24/1986	15	4	6.04	5.85	0.85	-9.15	5	10	Dames & Moore, 1990	0.91	A-4	90% Middle Distillate, 10% Heavier Material (Crude/Residual)
5	A-40	–			215200.651	2683591.853	MW	Unconfined	Y	Y	7/18/1988	13	4	8.63	6.02	3.02	-6.98	3	10	Dames & Moore, 1992			
5	A-41	–			215097.421	2683534.984	MW	Unconfined	Y	Y	7/18/1988	13	4	5.6269	5.5372	3	-7.4628	3	10	Dames & Moore, 1992			
5	A-42	–	Destroyed		–	–	MW	Unconfined	Y	Y	7/19/1988	13	4	8.58	7.53	4.53	-5.47	3	10	Dames & Moore, 1992			
5	A-43	–	Destroyed		215588.114	2683119.688	MW	Unconfined	Y	Y	7/19/1988	13	4	10.43	7.89	4.89	-5.11	3	10	Dames & Moore, 1992			
5	A-44	–			215461.963	2683121.49	MW	Unconfined	Y	Y	7/19/1988	13	4	10.01	7.61	4.61	-5.39	3	10	Dames & Moore, 1992			
5	A-45	A-177			215239.036	2682742.137	MW	Unconfined	Y	Y	7/19/1988	13	4	4.72	4.87	1.87	-8.13	3	10	Dames & Moore, 1992	0.9124	A-5	100% Lube Oil
5	A-46	–			215347.166	2682463.884	MW	Unconfined	Y	Y	7/19/1988	12	4	10.82	8.56	6.56	-3.44	2	10	Dames & Moore, 1992	0.8926	A-47	100% Lube Oil
5	A-47	–	Damaged	Casing/Monument damaged	215249.128	2682432.166	MW	Unconfined	Y	Y	7/19/1988	12	4	7.42	5.55	3.55	-6.45	2	10	Dames & Moore, 1992	0.8926	A-47	100% Lube Oil
5	A-48	–			215156.858	2682295.202	MW	Unconfined	Y	Y	7/20/1988	12.5	4	6.45	4.63	2.13	-7.87	3	10	Dames & Moore, 1992	0.91	A-48	70% Middle Distillate, 30% Heavier Material (Crude/Residual)
5	A-49	–			215647.044	2682249.067	MW	Unconfined	Y	Y	7/20/1988	13	4	7.2	6.8	3.8	-6.2	3	10	Dames & Moore, 1992			
5	A-5	–	Damaged	Casing/Monument damaged	215250.57	2682619.59	MW	Unconfined	Y	Y	2/25/1986	18	4	5.01	5.15	1.15	-11.85	4	13	Dames & Moore, 1990	0.9124	A-5	100% Lube Oil
5	A-50	–	Destroyed		–	–	MW	Unconfined	Y	Y	7/20/1988	13	4	9.72	–	–	–	3	10	Dames & Moore, 1992			
5	A-51	–	Destroyed		–	–	MW	Unconfined	Y	Y	7/20/1988	12.5	4	11.24	–	–	–	3	10	Dames & Moore, 1992			
5	A-6	–			215267.871	2682954.07	MW	Unconfined	Y	Y	2/24/1986	15	4	6.74	7.01	4.01	-7.99	3	12	Dames & Moore, 1990			
5	A-7	–			215287.154	2683087.249	MW	Unconfined	Y	Y	2/24/1986	15	4	6.911	6.87	3.87	-6.13	3	10	Dames & Moore, 1990	0.8905	A-7	100% Lube Oil
5	A-8	–	Destroyed		215079.005	2682870.45	MW	Unconfined	Y	Y	2/24/1986	15	4	6.29	5.24	0.24	-9.76	5	10	Dames & Moore, 1990			
5	A-9	–			215096.126	2683089.052	MW	Unconfined	Y	Y	2/24/1986	15	4	5.8	5.95	2.95	-7.05	3	10	Dames & Moore, 1990			
5	A-91	–	Destroyed		216549.935	2683363.427	MW	Unconfined	Y	Y	10/21/1986	13	4	9.88	7.4	4.4	-5.6	3	10	Dames & Moore, 1990			
5	B	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	C	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Dames & Moore, 1987			
5	PZ-1	–	Damaged	Obstruction in well; Blocked at ~2.5 ft bgs	215883.487	2681473.42	RFI Well Point Loc.	Unconfined *	–	–	–	–	–	7.764	4.84	–	–	–	–	Handex, 1996			
5	PZ-2	–			215938.273	2681495.046	RFI Well Point Loc.	Unconfined *	–	–	–	–	–	10.88	5.12	–	–	–	–	Handex, 1996			
5	PZ-3	–			215958.457	2681510.905	RFI Well Point Loc.	Unconfined *	–	–	–	–	–	10.53	5.74	–	–	–	–	Handex, 1996			
5	RW16-2	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	RW-6S	RW-6			215947.481	2681519.677	RW	Unconfined	–	–	–	14.6	4	8.22	5.22	5.22	5.22	0	–	–			
5	RWBH-1	–	Active		215219.405	2682069.647	RW - Active	Unconfined	Y	–	3/19/1996	11.5	4	5.33	5.36	3.86	-6.14	2	10	Handex, 1996			
5	RWBH-2	–	Active		215220.069	2682108.595	RW - Active	Unconfined	Y	–	3/22/1996	8	4	4.13	4.33	2.33	-3.67	2	6	Handex, 1996	0.91	A-48	70% Middle Distillate, 30% Heavier Material (Crude/Residual)
5	RWM-8	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	RWM-9	–	Destroyed		–	–	MW	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	SW-1	–			215437.008	2681673.285	RFI MW	Unconfined	–	–	–	20	4	9.76	7.19	7.19	7.19	0	–	Handex, 1996	0.91	SW-1	70% Middle Distillate, 30% Heavier Material (Crude/Residual)
5	SW-2	–			215458.201	2681632.848	RFI MW	Unconfined	–	–	–	18.6	4	9.94	7.71	–	–	–	–	Handex, 1996			
5	SW-3	–			215491.872	2681564.953	MW	Unconfined	–	–	–	18	4	9.97	7.85	–	–	–	–	Handex, 1996			
5	SW-4	–			215533.919	2681486.195	RFI MW	Unconfined	–	–	–	15.6	4	7.15	7.22	7.22	7.22	0	–	Handex, 1996	0.91	SW-4	70% Middle Distillate, 30% Heavier Material (Crude/Residual)
5	SW-5	–			215654.599	2681321.8	RFI MW	Unconfined	–	–	–	14.6	4	10.49	7.84	7.84	7.84	0	–	Handex, 1996	0.9356	A-22	80% Middle Distillate, 20% Heavier Material (Crude/Residual)
5	SWR-1	–	Inactive		215697.37	2681283.47	RW - Inactive	Unconfined *	–	–	–	–	–	8.28	–	–	–	–	–	–			
5	SWR-2	–	Inactive		215397.239	2681737.115	RW - Inactive	Unconfined	–	–	–	15	4	10.06	8.41	–	–	–	–	Handex, 1996			
5	SWR-3	–	Inactive		215359.059	2681810.735	RW - Inactive	Unconfined	–	–	–	11.6	4	10.61	–	–	–	–	–	Handex, 1996			
5	unknown well	–			–	–	MW	Unconfined *	–	–	–	–	–	–	0	–	–	–	–	–			
5	WP-1	–	Destroyed		215265.302	2682064.502	Temporary Well Point	Unconfined	Y	Y	5/25/1993	6.95	1	–	4.61	0.66	-2.34	4	3	ENSR, 1993, Handex, 1996			
5	WP-10	–	Destroyed		222347.971	2681973.48	MW POINT	Unconfined	Y	Y	6/9/1992	15	2	7.292	4.6012	5	-10.3988	0	10	Dames & Moore, 1993			
5	WP1-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/4/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-10	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/26/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-11	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/26/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-12	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/3/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-13	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/15/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-14	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/15/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-15	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/24/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/4/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/4/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-4	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/3/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-14	–			215243.362	2682198.607	Temporary Well Point	Unconfined	–	–	–	9	2	9.12	4.24	–	–	–	–	Handex, 1996			
5	WP1-5	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/3/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-6	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/8/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP16-1	–	Destroyed		216966.376	2682416.412	Temporary Well Point	Unconfined	–	–	–	–	–	–	13.19	–	–	–	–	Handex, 1996			
5	WP16-3	–			216898.621	2682402.462	Temporary Well Point	Unconfined	–	–	–	14.5	2	11.07	7.34	–	–	–	–	Handex, 1996			
5	WP16-4	–	Destroyed		216970.362	2682549.93	Temporary Well Point	Unconfined	–	–	–	–	–	–	9.27	–	–	–	–	Handex, 1996			
5	WP1-7	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/26/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-8	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/26/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP1-9	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/3/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-1a	–	Destroyed		–	–	Temporary Well Point	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	WP-2	–	Destroyed		215256.247	2682083.943	Temporary Well Point	Unconfined	Y	Y	6/2/1993	6.66	1	–	4.82	1.16	-1.84	4	3	ENSR, 1993, Handex, 1996			
5	WP2-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-10	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-11	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-12	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-13	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-14	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-4	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-5	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-6	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-7	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-8	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP2-9	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-2a	–	Destroyed		–	–	Temporary Well Point	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	WP-3	–	Destroyed		215256.45	2682128.553	Temporary Well Point	Unconfined	Y	Y	6/2/1993	8	1	–	5.12	0.12	-2.88	5	3	ENSR, 1993, Handex, 1996			

Table 2
Existing Well Summary
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

AOI #	Well ID	Former Well ID[3]	Well Status/ Description	Disposition of Well	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[2]								References	Product Characterization[5]		
												Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation (ft. msl) (NAVD88)	Ground Surface Elevation (ft.) (NAVD88)	Top of Screen Elevation (ft) (NAVD88)	Bottom of Screen Elevation (ft) (NAVD88)	Depth to Screen (ft. bgs)	Screen Length (ft.)		Density (g/cc)	Source[6]	Percentage and Product Type(s)
AOI - 5 (Girard Point South Tank Field Area)																							
5	WP3-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-10	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-11	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-12	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-4	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-5	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-6	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-7	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-8	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP3-9	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/28/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-3a	–	Destroyed		–	–	Temporary Well Point	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	WP-4	–	Destroyed		215009.622	2683231.422	Temporary Well Point	Unconfined	Y	Y	6/2/1993	8.77	1	–	10.73	4.96	1.96	6	3	ENSR, 1993, Handex, 1996			
5	WP4-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/1/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP4-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/1/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP4-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/1/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP4-4	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/1/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP4-5	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/1/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-4A	–	Destroyed		215009.622	2683231.422	Temporary Well Point	Unconfined	–	–	–	9.5	2	6.7	–	–	–	–	–	Handex, 1996			
5	WP-5	–	Destroyed		215244.767	2682167.862	Temporary Well Point	Unconfined	Y	Y	6/2/1993	7.88	1	–	7.6	2.72	-0.28	5	3	ENSR, 1993, Handex, 1996			
5	WP5-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/11/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP5-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/11/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP5-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/11/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-5a	–	Destroyed		–	–	Temporary Well Point	Unconfined *	–	–	–	–	–	–	–	–	–	–	–	Handex, 1996			
5	WP-6	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	6/2/1993	6.86	1	–	–	–	–	4	3	ENSR, 1993, Handex, 1996			
5	WP6-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP6-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP6-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP6-4	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-7	–	Destroyed		215126.582	2682631.124	Temporary Well Point	Unconfined	Y	Y	6/2/1993	7.88	1	–	8.84	3.96	0.96	5	3	ENSR, 1993, Handex, 1996			
5	WP7-1	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP7-2	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP7-3	–	Destroyed		–	–	Temporary Well Point	Unconfined	Y	Y	5/25/1993	10.5	–	–	–	–	–	1	10	Dames & Moore, 1993			
5	WP-8	–			215136.674	2682440.816	Temporary Well Point	Unconfined	Y	Y	6/9/1992	15	2	6.99	3.98	-1.02	-11.02	5	10	Dames & Moore, 1993			
5	WP-9	–	Damaged	Casing/Monument Damaged	215223.177	2682225.999	Temporary Well Point	Unconfined	Y	Y	6/3/1992	15	2	8.57	5.75	0.75	-9.25	5	10	Dames & Moore, 1993			
5	WP9-7	–	Destroyed		216462.196	2681507.693	Temporary Well Point	Unconfined	–	–	–	–	–	–	8.25	–	–	–	–	Handex, 1996			
5	WP9-8	–			216376.53	2681391.26	Temporary Well Point	Unconfined *	–	–	–	–	–	8.87	6.17	–	–	–	–	Handex, 1996	0.8114	WP9-2	Aviation Gasoline 80% , Middle Distillate 20%
5	WP-A	–			215593.701	2681386.916	Temporary Well Point	Unconfined	–	–	–	13	2	9.6	7.35	–	–	–	–	Handex, 1996	0.91	SW-4	Middle Distillate 70% , Heavier Material (Crude/Residual) 30%
5	WP-B	–			215667.228	2681310.505	Temporary Well Point	Unconfined	–	–	–	12	2	10.08	7.12	–	–	–	–	Handex, 1996	0.9356	A-22	80% Middle Distillate, 20% Heavier Material (Crude/Residual)
5	WP-C	–	Damaged	Casing Broken off at grade	215681.178	2681378.371	Temporary Well Point	Unconfined	–	–	–	12.6	2	6.5253	7.0735	–	–	–	–	Handex, 1996			
5	WP-D	–			215913.763	2681483.512	Temporary Well Point	Unconfined	–	–	–	11.6	2	8.26	5.36	–	–	–	–	Handex, 1996			
5	WP-E	–			215985.849	2681621.917	Temporary Well Point	Unconfined	–	–	–	10.5	2	7.35	5.08	–	–	–	–	Handex, 1996			

NOTES:
1. Elevation datum for wells within AOI 5 were suryved to NAVD 88 as a part of this report. Survey completed by Langan as part of Work Plan and Site Characterization Activities.
2. Well construction details were taken directly from well boring logs provided by Handex, Stantec (formerly Secor), Aquaterra or collected from available historic reports. Where no well boring logs exist, no well construction data is listed.
3. Former well IDs were derived from handwritten notes on the logs themselves or the referenced report.
4. Hydrostratigraphic Unit based on the formation in which the well was screened in.
* - Hydrostratigraphic Unit was assumed based on available data.
Stanport lists disposition of well A-185 as "Casing/Monument Damaged". Well was gauged during July 2014 and October 2014 events.
AOI - Area of Interest
ft. - feet
bgs - below ground surface
in. - inches
msl - elevation relative to mean sea level
g/cc - grams per cubic centimeter
NA - Data not available
Destroyed or abandoned wells
– Data could not be located or determined based on available reports

Table 3a
Summary of AOI 5 Groundwater and LNAPL Elevations July 2014
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft msl)	Groundwater Elevation (ft msl)	Corrected GW Elevation (ft msl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-169	215952.842	2681149.425	Monitoring Well	Unconfined			--	4.96	--	--	3.66	3.66	8.62	
A-170	215866.761	2681810.857	Monitoring Well	Unconfined			--	2.85	--	--	1.70	1.70	4.55	
A-171	215555.327	2681590.443	Monitoring Well	Unconfined			--	5.68	--	--	1.91	1.91	7.59	
A-172	215440.922	2681779.717	Monitoring Well	Unconfined			--	4.52	--	--	1.81	1.81	6.33	
A-173	215220.763	2682837.220	Monitoring Well	Unconfined			--	2.78	--	--	1.78	1.78	4.56	
A-174	217149.006	2683052.551	Monitoring Well	Unconfined			--	5.92	--	--	5.02	5.02	10.94	A-174 designation was given to an existing well that was located during the sampling activities and surveyed by Langan personnel.
A-175	215245.157	2682663.584	Monitoring Well	Unconfined			--	4.23	--	--	0.52	0.52	4.75	
A-176	215259.851	2682693.871	Monitoring Well	Unconfined	0.9124	A-5	4.00	4.20	0.20	0.56	0.36	0.54	4.56	
A-177	215248.638	2682739.380	Monitoring Well	Unconfined			--	3.67	--	--	0.91	0.91	4.58	
A-178	215228.364	2682769.779	Monitoring Well	Unconfined	0.9124	A-5	3.36	4.00	0.64	1.23	0.59	1.17	4.59	
A-179	215289.455	2682824.020	Monitoring Well	Unconfined	0.9124	A-5	2.77	4.80	2.03	5.64	3.61	5.46	8.41	
A-180	215315.670	2682845.926	Monitoring Well	Unconfined	0.9124	A-5	3.10	3.15	0.05	3.61	3.56	3.60	6.71	
A-181	215193.272	2682443.584	Monitoring Well	Unconfined			--	2.10	--	--	4.50	4.50	6.60	
A-182	215082.884	2682579.928	Monitoring Well	Unconfined			--	5.23	--	--	1.69	1.69	6.92	
A-183	215353.968	2682598.093	Monitoring Well	Unconfined			--	7.18	--	--	4.61	4.61	11.79	
A-184	215355.106	2682611.410	Monitoring Well	Unconfined			--	5.36	--	--	4.98	4.98	10.34	
A-185	215506.571	2681565.569	Monitoring Well	Unconfined			--	8.90	--	--	1.18	1.18	10.08	
A-186	217107.287	2682887.932	Monitoring Well	Unconfined			--	5.05	--	--	5.49	5.49	10.54	
SW-3	215491.872	2681564.953	Monitoring Well	Unconfined			--	7.95	--	--	2.02	2.02	9.97	
A-45	215239.036	2682742.137	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	4.72	Same well as A-177 (one well in field is labeled with both designations on pvc pipe - map shows as two different wells, but only one actually present in field)
SWR-3	215359.059	2681810.735	Recovery Well - Inactive	Unconfined			--	7.44	--	--	3.17	3.17	10.61	
A-158	216131.910	2681604.367	Monitoring Well	Unconfined			--	3.22	--	--	2.92	2.92	6.14	
A-163	215985.240	2681069.787	Monitoring Well	Unconfined			--	6.72	--	--	3.77	3.77	10.49	
A-1	215288.956	2683608.072	Monitoring Well	Unconfined			--	4.46	--	--	2.39	2.39	6.85	
A-10	215427.902	2682406.215	Monitoring Well	Unconfined			--	3.45	--	--	4.83	4.83	8.28	
A-11	215380.325	2682015.508	Monitoring Well	Unconfined			--	5.03	--	--	2.74	2.74	7.77	
A-118	217109.272	2683070.537	RFI Monitoring Well	Unconfined			--	2.62	--	--	5.68	5.68	8.30	
A-12	215378.884	2682182.748	Monitoring Well	Unconfined			--	5.25	--	--	2.32	2.32	7.57	
A-122	215929.834	2682277.550	RFI Monitoring Well	Unconfined			--	4.62	--	--	2.82	2.82	7.44	
A-13	215611.001	2682674.376	Monitoring Well	Unconfined			--	--	--	--	NM	NM	8.48	Abandoned
A-133	215804.497	2681282.286	VI Monitoring Well	Unconfined			--	9.89	--	--	3.13	3.13	13.02	
A-134	215809.959	2681408.542	RFI Monitoring Well	Unconfined			--	7.94	--	--	1.20	1.20	9.14	
A-135	215822.935	2681633.451	RFI Monitoring Well	Unconfined			--	7.75	--	--	3.01	3.01	10.76	
A-136	215556.216	2681692.562	RFI Monitoring Well	Unconfined	0.9767	Characterization Results	7.05	7.37	0.32	1.65	1.33	1.64	8.70	
A-137	215161.003	2683597.259	VI Monitoring Well	Unconfined			--	6.65	--	--	1.98	1.98	8.63	
A-139	215985.030	2683731.800	Monitoring Well	Unconfined			--	4.43	--	--	4.69	4.69	9.12	
A-140	215636.991	2683699.414	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	9.89	
A-142	214931.260	2683675.641	Monitoring Well	Unconfined			--	5.80	--	--	2.76	2.76	8.56	
A-143	215553.453	2683339.643	Monitoring Well	Unconfined			--	5.79	--	--	3.71	3.71	9.50	

NOTES:

1. Elevation datum for wells within AOI 5 were surveyed to NAVD 88 as a part of this report. Survey completed by Langan as part of Work Plan and Site Characterization Activities.
2. Specific gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.
3. For wells with no direct LNAPL density values, the density value in the nearest well with LNAPL data was used.
4. Hydrostratigraphic Unit based on the formation in which the well was screened in.
5. Depth to water and depth to LNAPL provided by Stantec/Aquaterra.

0.01 foot Apparent LNAPL Thickness = Sheen or Film of Product on Groundwater.
AOI - Area of Interest
LNAPL - Light Non-Aqueous Phase Liquid
GW - Groundwater
ft - Feet
btic - BelowTop of Inner Casing
in - Inches
msl - Elevation Relative to Mean Sea Level
g/cc - Grams Per cubic centimeter
NM - Not Measured
VI - Vapor Intrusion

Table 3a
Summary of AOI 5 Groundwater and LNAPL Elevations July 2014
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft msl)	Groundwater Elevation (ft msl)	Corrected GW Elevation (ft msl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-146	216551.974	2682962.216	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	10.88	Unable to Locate
A-147	216815.030	2682850.343	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	7.51	Unable to Locate
A-148	216806.086	2682640.918	Monitoring Well	Unconfined			--	2.80	--	--	5.21	5.21	8.01	
A-149	216327.389	2682442.660	Monitoring Well	Unconfined			--	3.18	--	--	5.31	5.31	8.49	
A-15	216313.742	2682689.425	Monitoring Well	Unconfined	0.9	S.G is an estimate. Fingerprinting should be completed to characterize LNAPL	0.92	0.99	0.07	4.19	4.12	4.18	5.11	
A-150	215611.769	2682502.234	Monitoring Well	Unconfined	0.9124	A-5	5.45	5.55	0.10	4.19	4.09	4.18	9.64	
A-151	215824.421	2682128.585	Monitoring Well	Unconfined			--	4.32	--	--	3.17	3.17	7.49	
A-152	216072.848	2681986.798	Monitoring Well	Unconfined			--	3.03	--	--	1.82	1.82	4.85	
A-153	217566.468	2683573.476	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	9.22	Unable to Locate
A-154	--	--	Monitoring Well	Unconfined			--	2.45	--	--	No TIC Elevation	No TIC Elevation	--	
A-155	216208.292	2681449.430	Monitoring Well	Unconfined			5.85	6.65	0.80	2.54	1.74	1.74	8.39	
A-156	216058.146	2681354.572	Monitoring Well	Unconfined	0.877	A-155	--	5.03	--	--	3.85	3.85	8.88	
A-157	216278.080	2681413.674	Monitoring Well	Unconfined			--	3.10	--	--	5.52	5.52	8.62	
A-161	215940.930	2681309.438	Monitoring Well	Unconfined	0.877	A-155	4.90	5.00	0.10	3.39	3.29	3.38	8.29	
A-162	215828.703	2681275.126	Monitoring Well	Unconfined			--	4.40	--	--	3.01	3.01	7.41	
A-164	216038.682	2681178.212	Monitoring Well	Unconfined			--	5.45	--	--	3.46	3.46	8.91	
A-166	215789.991	2681273.490	Monitoring Well	Unconfined	0.925	A-136, Environment Canda Database (Residual Fuel Oil #4)	8.00	8.15	0.15	3.31	3.16	3.30	11.31	
A-167	216200.322	2681257.275	Monitoring Well	Unconfined			--	4.68	--	--	4.78	4.78	9.46	
A-168	216443.844	2681699.054	Monitoring Well	Unconfined			--	8.04	--	--	2.65	2.65	10.69	
A-16	216996.268	2682671.491	Monitoring Well	Unconfined			--	3.52	--	--	5.50	5.50	9.02	
A-17	216877.402	2683572.924	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	8.40	Unable to Locate
A-21	215629.744	2681388.358	Monitoring Well	Unconfined	0.9356	A-22	2.75	NM	--	5.41	NM	NM	8.16	
A-22	216031.531	2680996.159	Monitoring Well	Unconfined	0.9356	Characterization Results	6.18	6.25	0.07	1.77	1.70	1.77	7.95	
A-23	216384.931	2682142.800	Monitoring Well	Unconfined			--	3.55	--	--	2.76	2.76	6.31	
A-24	215977.199	2681515.230	Monitoring Well	Unconfined			--	2.96	--	--	2.57	2.57	5.53	
A-25	216982.319	2682468.225	Monitoring Well	Unconfined			--	4.65	--	--	4.15	4.15	8.80	
A-26	216793.002	2682167.311	Monitoring Well	Unconfined			--	5.45	--	--	3.20	3.20	8.65	
A-27	216591.729	2681846.470	Monitoring Well	Unconfined			--	6.94	--	--	3.07	3.07	10.01	
A-3	215784.549	2683411.637	Monitoring Well	Unconfined			--	4.65	--	--	3.59	3.59	8.24	
A-39	215042.061	2683669.345	Monitoring Well	Unconfined			--	2.43	--	--	5.25	5.25	7.68	
A-4	215000.611	2683519.767	Monitoring Well	Unconfined			--	3.18	--	--	2.86	2.86	6.04	
A-40	215200.651	2683591.853	Monitoring Well	Unconfined			--	6.61	--	--	2.02	2.02	8.63	
A-41	215097.421	2683534.984	Monitoring Well	Unconfined			--	3.72	--	--	1.91	1.91	5.63	
A-44	215461.963	2683121.490	Monitoring Well	Unconfined			--	6.37	--	--	3.64	3.64	10.01	
A-46	215347.166	2682463.884	Monitoring Well	Unconfined	0.9124	A-5	7.50	10.31	2.81	3.32	0.51	3.07	10.82	
A-47	215249.128	2682432.166	Monitoring Well	Unconfined			--	4.58	--	--	2.84	2.84	7.42	
A-48	215156.858	2682295.202	Monitoring Well	Unconfined			--	4.25	--	--	2.20	2.20	6.45	
A-49	215647.044	2682249.067	Monitoring Well	Unconfined			--	3.50	--	--	3.70	3.70	7.20	

NOTES:

1. Elevation datum for wells within AOI 5 were surveyed to NAVD 88 as a part of this report. Survey completed by Langan as part of Work Plan and Site Characterization Activities.
2. Specific gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.
3. For wells with no direct LNAPL density values, the density value in the nearest well with LNAPL data was used.
4. Hydrostratigraphic Unit based on the formation in which the well was screened in.
5. Depth to water and depth to LNAPL provided by Stantec/Aquaterra.

0.01 foot Apparent LNAPL Thickness = Sheen or Film of Product on Groundwater.
AOI - Area of Interest
LNAPL - Light Non-Aqueous Phase Liquid
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btic - BelowTop of Inner Casing
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NM - Not Measured

Table 3a
Summary of AOI 5 Groundwater and LNAPL Elevations July 2014
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft msl)	Groundwater Elevation (ft msl)	Corrected GW Elevation (ft msl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-5	215250.570	2682619.590	Monitoring Well	Unconfined	0.9124	Characterization Results	4.85	5.48	0.63	0.72	0.09	0.66	5.57	
A-6	215267.871	2682954.070	Monitoring Well	Unconfined			--	2.61	--	--	4.13	4.13	6.74	
A-7	215287.154	2683087.249	Monitoring Well	Unconfined			--	2.97	--	--	3.94	3.94	6.91	
A-9	215096.126	2683089.052	Monitoring Well	Unconfined			--	2.74	--	--	3.06	3.06	5.80	
SW-1	215437.008	2681673.285	RFI Monitoring Well	Unconfined	0.91	SW-1	7.75	8.65	0.90	2.01	1.11	1.93	9.76	
SW-2	215458.201	2681632.848	RFI Monitoring Well	Unconfined			--	6.39	--	--	3.55	3.55	9.94	
SW-4	215533.919	2681486.195	RFI Monitoring Well	Unconfined	0.91	SW-4	5.40	5.46	0.06	1.75	1.69	1.74	7.15	
SW-5	215654.599	2681321.800	RFI Monitoring Well	Unconfined	0.9356	A-22	5.85	9.90	4.05	4.64	0.59	4.38	10.49	
SWR-1	215697.370	2681283.470	Recovery Well - Inactive	Unconfined			--	6.66	--	--	1.62	1.62	8.28	
SWR-2	215397.239	2681737.115	Recovery Well - Inactive	Unconfined			--	7.79	--	--	2.27	2.27	10.06	
WP-14	215243.362	2682198.607	Temporary Well Point	Unconfined			--	6.55	--	--	2.57	2.57	9.12	
WP16-3	216898.621	2682402.462	Temporary Well Point	Unconfined			--	8.10	--	--	2.97	2.97	11.07	
WP-8	215136.674	2682440.816	Monitoring Well Point	Unconfined			--	4.11	--	--	2.88	2.88	6.99	
WP-9	215223.177	2682225.999	Monitoring Well Point	Unconfined			--	4.45	--	--	4.31	4.31	8.76	
WP9-8	216376.530	2681391.260	Temporary Well Point	--	0.9072	WP9-8	5.67	7.31	1.64	3.20	1.56	3.05	8.87	
WP-A	215593.701	2681386.916	Temporary Well Point	Unconfined	0.9356	A-22	5.35	9.15	3.80	4.25	0.45	4.01	9.60	
WP-B	215667.228	2681310.505	Temporary Well Point	Unconfined	0.9356	A-22	7.51	7.65	0.14	2.57	2.43	2.56	10.08	
WP-C	215681.178	2681378.371	Temporary Well Point	Unconfined			--	NM	--	--	NM	NM	6.53	Unable to Locate
WP-D	215913.763	2681483.512	Temporary Well Point	Unconfined			--	5.81	--	--	2.45	2.45	8.26	
WP-E	215985.849	2681621.917	Temporary Well Point	Unconfined			--	4.90	--	--	2.45	2.45	7.35	

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5. Depth to water and depth to LNAPL provided by Stantec/Aquaterra.

0.01 foot Apparent LNAPL Thickness = Sheen or Film of Product on Groundwater.
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Table 3b
Summary of AOI 5 Groundwater and LNAPL Elevations October 2014
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation[6] (ft amsl)	Groundwater Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-169	215952.842	2681149.425	Monitoring Well	Unconfined			--	5.55	--	--	3.07	3.07	8.62	
A-170	215866.761	2681810.857	Monitoring Well	Unconfined			--	4.04	--	--	0.51	0.51	4.55	
A-171	215555.327	2681590.443	Monitoring Well	Unconfined			sheen	6.86	--	--	0.73	0.73	7.59	
A-172	215440.922	2681779.717	Monitoring Well	Unconfined			--	5.30	--	--	1.03	1.03	6.33	
A-173	215220.763	2682837.220	Monitoring Well	Unconfined			--	3.45	--	--	1.11	1.11	4.56	
A-174	217149.006	2683052.551	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	10.94	Damaged. Bulldozer backed into well causing obstruction at approximately 3 feet below ground surface.
A-175	215245.157	2682663.584	Monitoring Well	Unconfined			--	4.35	--	--	0.40	0.40	4.75	
A-176	215259.851	2682693.871	Monitoring Well	Unconfined	0.9124	A-5	4.16	4.31	0.15	0.40	0.25	0.39	4.56	
A-177	215248.638	2682739.380	Monitoring Well	Unconfined			--	3.85	--	--	0.73	0.73	4.58	
A-178	215228.364	2682769.779	Monitoring Well	Unconfined	0.9124	A-5	3.57	4.45	0.88	1.02	0.14	0.94	4.59	
A-179	215289.455	2682824.020	Monitoring Well	Unconfined	0.9124	A-5	3.78	6.00	2.22	4.63	2.41	4.44	8.41	
A-180	215315.670	2682845.926	Monitoring Well	Unconfined	0.9124	A-5	3.37	3.44	0.07	3.34	3.27	3.33	6.71	
A-181	215193.272	2682443.584	Monitoring Well	Unconfined			--	3.84	--	--	2.76	2.76	6.60	
A-182	215082.884	2682579.928	Monitoring Well	Unconfined			--	5.21	--	--	1.71	1.71	6.92	
A-183	215353.968	2682598.093	Monitoring Well	Unconfined	0.9124	A-5	5.95	9.32	3.37	5.84	2.47	5.54	11.79	
A-184	215355.106	2682611.410	Monitoring Well	Unconfined	0.9124	A-5	6.45	6.75	0.30	3.89	3.59	3.86	10.34	
A-185	215506.571	2681565.569	Monitoring Well	Unconfined			--	9.37	--	--	0.71	0.71	10.08	
A-186	217107.287	2682887.932	Monitoring Well	Unconfined			--	5.50	--	--	5.04	5.04	10.54	
SW-3	215491.872	2681564.953	Monitoring Well	Unconfined			--	9.05	--	--	0.92	0.92	9.97	
A-45	215239.036	2682742.137	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	4.72	Same well as A-177 (one well in field is labeled with both designations on pvc pipe - map shows as two different wells, but only one actually present in field)
SWR-3	215359.059	2681810.735	Recovery Well - Inactive	Unconfined			--	8.05	--	--	2.56	2.56	10.61	
A-158	216131.910	2681604.367	Monitoring Well	Unconfined			--	4.50	--	--	1.64	1.64	6.14	
A-163	215985.240	2681069.787	Monitoring Well	Unconfined			--	7.13	--	--	3.36	3.36	10.49	
A-1	215288.956	2683608.072	Monitoring Well	Unconfined			--	5.21	--	--	1.64	1.64	6.85	
A-10	215427.902	2682406.215	Monitoring Well	Unconfined			--	4.29	--	--	3.99	3.99	8.28	
A-11	215380.325	2682015.508	Monitoring Well	Unconfined			--	5.61	--	--	2.16	2.16	7.77	
A-118	217109.272	2683070.537	RFI Monitoring Well	Unconfined			--	2.60	--	--	5.70	5.70	8.30	
A-12	215378.884	2682182.748	Monitoring Well	Unconfined			--	5.83	--	--	1.74	1.74	7.57	
A-122	215929.834	2682277.550	RFI Monitoring Well	Unconfined			--	5.27	--	--	2.17	2.17	7.44	
A-13	215611.001	2682674.376	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	8.48	Abandoned
A-133	215804.497	2681282.286	VI Monitoring Well	Unconfined			--	9.85	--	--	3.17	3.17	13.02	
A-134	215809.959	2681408.542	RFI Monitoring Well	Unconfined			--	8.21	--	--	0.93	0.93	9.14	
A-135	215822.935	2681633.451	RFI Monitoring Well	Unconfined			--	8.57	--	--	2.19	2.19	10.76	
A-136	215556.216	2681692.562	RFI Monitoring Well	Unconfined			--	8.18	--	--	0.52	0.52	8.70	
A-137	215161.003	2683597.259	VI Monitoring Well	Unconfined			--	7.03	--	--	1.60	1.60	8.63	
A-139	215985.030	2683731.800	Monitoring Well	Unconfined			--	5.80	--	--	3.32	3.32	9.12	
A-140	215636.991	2683699.414	Monitoring Well	Unconfined			--	6.80	--	--	3.09	3.09	9.89	
A-142	214931.260	2683675.641	Monitoring Well	Unconfined			--	7.64	--	--	0.92	0.92	8.56	
A-143	215553.453	2683339.643	Monitoring Well	Unconfined			--	7.96	--	--	1.54	1.54	9.50	

NOTES:
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g/cc - Grams Per cubic centimeter
NM - Not Measured
VI - Vapor Intrusion

Table 3b
Summary of AOI 5 Groundwater and LNAPL Elevations October 2014
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation[6] (ft amsl)	Groundwater Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-146	216551.974	2682962.216	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	10.88	Unable to Locate
A-147	216815.030	2682850.343	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	7.51	Unable to Locate
A-148	216806.086	2682640.918	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	8.01	
A-149	216327.389	2682442.660	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	8.49	
A-15	216313.742	2682689.425	Monitoring Well	Unconfined			--	1.21	--	--	3.90	3.90	5.11	
A-150	215611.769	2682502.234	Monitoring Well	Unconfined			--	5.65	--	--	3.99	3.99	9.64	
A-151	215824.421	2682128.585	Monitoring Well	Unconfined			--	5.10	--	--	2.39	2.39	7.49	
A-152	216072.848	2681986.798	Monitoring Well	Unconfined			--	4.12	--	--	0.73	0.73	4.85	
A-153	217566.468	2683573.476	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	9.22	Unable to Locate
A-154	--	--	Monitoring Well	Unconfined			--	3.51	--	--	No TIC Elevation	No TIC Elevation	--	
A-155	216208.292	2681449.430	Monitoring Well	Unconfined			5.99	6.50	0.51	2.40	1.89	1.89	8.39	
A-156	216058.146	2681354.572	Monitoring Well	Unconfined			--	6.02	--	--	2.86	2.86	8.88	
A-157	216278.080	2681413.674	Monitoring Well	Unconfined			--	5.55	--	--	3.07	3.07	8.62	
A-161	215940.930	2681309.438	Monitoring Well	Unconfined	0.877	A-155	5.43	5.55	0.12	2.86	2.74	2.85	8.29	
A-162	215828.703	2681275.126	Monitoring Well	Unconfined			--	4.08	--	--	3.33	3.33	7.41	
A-164	216038.682	2681178.212	Monitoring Well	Unconfined			--	5.97	--	--	2.94	2.94	8.91	
A-166	215790.017	2681273.477	Monitoring Well	Unconfined	0.925	A-136, Environment Canda Database	7.87	8.10	0.23	3.44	3.21	3.43	11.31	
A-167	216200.322	2681257.275	Monitoring Well	Unconfined			--	5.61	--	--	3.85	3.85	9.46	
A-168	216443.844	2681699.054	Monitoring Well	Unconfined			--	7.40	--	--	3.29	3.29	10.69	
A-16	216996.268	2682671.491	Monitoring Well	Unconfined			--	3.95	--	--	5.07	5.07	9.02	
A-17	216877.402	2683572.924	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	8.40	Unable to Locate
A-21	215629.744	2681388.358	Monitoring Well	Unconfined	0.9356	A-22	2.45	2.50	0.05	5.71	5.66	5.71	8.16	
A-22	216031.531	2680996.159	Monitoring Well	Unconfined	0.9356	Characterization Results	6.44	6.45	0.01	1.51	1.50	1.51	7.95	
A-23	216384.931	2682142.800	Monitoring Well	Unconfined			--	4.21	--	--	2.10	2.10	6.31	
A-24	215977.199	2681515.230	Monitoring Well	Unconfined			--	3.20	--	--	2.33	2.33	5.53	
A-25	216982.319	2682468.225	Monitoring Well	Unconfined			--	5.20	--	--	3.60	3.60	8.80	
A-26	216793.002	2682167.311	Monitoring Well	Unconfined			--	5.70	--	--	2.95	2.95	8.65	
A-27	216591.729	2681846.470	Monitoring Well	Unconfined			--	4.27	--	--	5.74	5.74	10.01	
A-3	215784.549	2683411.637	Monitoring Well	Unconfined			--	6.95	--	--	1.29	1.29	8.24	
A-39	215042.061	2683669.345	Monitoring Well	Unconfined			--	3.21	--	--	4.47	4.47	7.68	
A-4	215000.611	2683519.767	Monitoring Well	Unconfined			--	4.21	--	--	1.83	1.83	6.04	
A-40	215200.651	2683591.853	Monitoring Well	Unconfined			--	6.98	--	--	1.65	1.65	8.63	
A-41	215097.421	2683534.984	Monitoring Well	Unconfined			--	4.10	--	--	1.53	1.53	5.63	
A-44	215461.963	2683121.490	Monitoring Well	Unconfined			--	8.36	--	--	1.65	1.65	10.01	
A-46	215347.166	2682463.884	Monitoring Well	Unconfined	0.9124	A-5	8.91	11.89	2.98	1.91	-1.07	1.65	10.82	
A-47	215249.128	2682432.166	Monitoring Well	Unconfined			--	6.12	--	--	1.30	1.30	7.42	
A-48	215156.858	2682295.202	Monitoring Well	Unconfined			--	4.40	--	--	2.05	2.05	6.45	
A-49	215647.044	2682249.067	Monitoring Well	Unconfined			--	NM	--	--	NM	NM	7.20	

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Monitoring Point ID	Northing	Easting	Well Type	Hydrostratigraphic Unit[4]	Specific Gravity (g/cc) Used for GW Correction		Depth to Product (ft btic)	Depth to GW[5] (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation[6] (ft amsl)	Groundwater Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft. msl)	Notes
					S.G.[2]	Source[3]								
A-5	215279.332	2682614.581	Monitoring Well	Unconfined	0.9124	Characterization Results	5.05	5.10	0.05	0.52	0.47	0.51	5.57	
A-6	215267.871	2682954.070	Monitoring Well	Unconfined			--	3.98	--	--	2.76	2.76	6.74	
A-7	215287.154	2683087.249	Monitoring Well	Unconfined			3.68	3.72	0.04	3.23	3.19	3.19	6.91	
A-9	215096.126	2683089.052	Monitoring Well	Unconfined			--	3.51	--	--	2.29	2.29	5.80	
SW-1	215437.008	2681673.285	RFI Monitoring Well	Unconfined	0.91	SW-1	8.07	9.18	1.11	1.69	0.58	1.59	9.76	
SW-2	215458.201	2681632.848	RFI Monitoring Well	Unconfined			--	8.25	--	--	1.69	1.69	9.94	
SW-4	215533.919	2681486.195	RFI Monitoring Well	Unconfined	0.91	SW-4	6.05	6.10	0.05	1.10	1.05	1.10	7.15	
SW-5	215654.599	2681321.800	RFI Monitoring Well	Unconfined	0.9356	A-22	5.66	5.85	0.19	4.83	4.64	4.82	10.49	
SWR-1	215697.370	2681283.470	Recovery Well - Inactive	Unconfined			--	5.45	--	--	2.83	2.83	8.28	
SWR-2	215397.239	2681737.115	Recovery Well - Inactive	Unconfined			--	8.15	--	--	1.91	1.91	10.06	
WP-14	215243.362	2682198.607	Temporary Well Point	Unconfined			--	7.64	--	--	1.48	1.48	9.12	
WP16-3	216898.621	2682402.462	Temporary Well Point	Unconfined			--	8.69	--	--	2.38	2.38	11.07	
WP-8	215136.674	2682440.816	Monitoring Well Point	Unconfined			--	5.20	--	--	1.79	1.79	6.99	
WP-9	215236.361	2682346.451	Monitoring Well Point	Unconfined			--	5.59	--	--	3.17	3.17	8.76	
WP9-8	216376.530	2681391.260	Temporary Well Point	--	0.9072	WP9-8	5.30	7.10	1.80	3.57	1.77	3.40	8.87	
WP-A	215593.701	2681386.916	Temporary Well Point	Unconfined	0.9356	A-22	5.16	6.55	1.39	4.44	3.05	4.35	9.60	
WP-B	215667.228	2681310.505	Temporary Well Point	Unconfined	0.9356	A-22	7.31	7.54	0.23	2.77	2.54	2.76	10.08	
WP-C	215681.178	2681378.371	Temporary Well Point	Unconfined			--	NM	--	--	NM	NM	6.53	Unable to Locate
WP-D	215913.763	2681483.512	Temporary Well Point	Unconfined			--	6.10	--	--	2.16	2.16	8.26	
WP-E	215985.849	2681621.917	Temporary Well Point	Unconfined			--	5.00	--	--	2.35	2.35	7.35	

NOTES:

1. Elevation datum for wells within AOI 5 were surveyed to NAVD 88 as a part of this report. Survey completed by Langan as part of Work Plan and Site Characterization Activities.
2. Specific gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantec as part of CCR and/or SCR/RIR.
3. For wells with no direct LNAPL density values, the density value in the nearest well with LNAPL data was used.
4. Hydrostratigraphic Unit based on the formation in which the well was screened in.
5. Depth to water and depth to LNAPL provided by Stantec/Aquaterra.

0.01 foot Apparent LNAPL Thickness = Sheen or Film of Product on Groundwater.
AOI - Area of Interest
LNAPL - Light Non-Aqueous Phase Liquid
GW - Groundwater
ft - Feet
btic - BelowTop of Inner Casing
in - Inches
msl - Elevation Relative to Mean Sea Level
g/cc - Grams Per cubic centimeter
NM - Not Measured

Table 4
Summary of Surface Soil Sample Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	A-139				A-140				A-142				A-143				A-151				A_152			
			Sample ID	A-139_071207_1.5-2.0				A-140_071207_1.5-2.0				A-142_1.5-2.0				A-143_0712_1.5-2.0				A-151_071207_1.5-2.0				A-152_071207_1.5-2.0			
			Sample Date	7/12/2007				7/12/2007				7/12/2007				7/12/2007				7/12/2007				7/12/2007			
			Sample Depth (ft bgs)	1.5-2				1.5-2				1.5-2				1.5-2				1.5-2				1.5-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																											
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		0.036		0.0035		ND	U	0.0031	
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		0.0056		0.0035		ND	U	0.0031	
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.011		ND	U	0.0075		NA				ND	U	0.0071		0.0086		0.007		ND	U	0.0063	
Semi-Volatile Organic Compounds																											
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	ND	U	0.85		5.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(A)Pyrene	50-32-8	12	mg/kg	ND	U	0.85		6.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.93		0.85		6.1		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	ND	U	0.85		ND	U	2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Chrysene	218-01-9	760	mg/kg	ND	U	0.85		5.2		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.85		ND	U	2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.0053		ND	U	0.0038		NA				ND	U	0.0035		ND	U	0.0035		ND	U	0.0031	
Phenanthrene	85-01-8	190,000	mg/kg	ND	U	0.85		7.2		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Pyrene	129-00-0	96,000	mg/kg	0.92		0.85		11		2		NA				ND	U	0.38		ND	U	1.9		ND	U	1.9	
Metals																											
Lead*	7439-92-1	2,240	mg/kg	191		0.61		**2460**		0.64		377		0.57		446		0.58		112		0.65		110		0.57	

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	A-140				A-141				A-144				A-150				A-153			
			Sample ID	A-140				A-141				A-144				A-150				A-153			
			Sample Date	4/6/2009				4/6/2009				4/6/2009				4/7/2009				4/8/2009			
			Sample Depth (ft bgs)	0.5-2				0.5-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	ND	U	0.33	54.23	ND	U	0.38	64.43
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	ND	U	0.33	54.23	ND	U	0.38	64.43
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	4.9		0.33	54.23	ND	U	0.38	64.43
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	3.3		0.33	54.23	ND	U	0.38	64.43
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	1.2		0.33	54.23	ND	U	0.38	64.43
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	ND	U	0.33	54.23	ND	U	0.38	64.43
Toluene	108-88-3	10,000	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	6.9		0.33	54.23	ND	U	0.38	64.43
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.24	42.81	ND	U	0.28	46.82	ND	U	0.27	40.72	12		0.33	54.23	0.43		0.38	64.43
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.87		0.19	1	0.38		0.2	1	ND	U	0.22	1	0.28		0.2	1	0.28		0.2	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	2.3		0.19	1	1		0.2	1	0.43		0.22	1	ND	U	0.2	1	0.75		0.2	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	1.9		0.19	1	0.95		0.2	1	0.56		0.22	1	ND	U	0.2	1	0.65		0.2	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	2.6		0.19	1	1.2		0.2	1	0.75		0.22	1	ND	U	0.2	1	0.99		0.2	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.1		0.19	1	0.66		0.2	1	0.45		0.22	1	ND	U	0.2	1	0.43		0.2	1
Chrysene	218-01-9	760	mg/kg	2.2		0.19	1	1.1		0.2	1	0.49		0.22	1	ND	U	0.2	1	0.77		0.2	1
Fluorene	86-73-7	130,000	mg/kg	0.42		0.19	1	ND	U	0.2	1	ND	U	0.22	1	0.34		0.2	1	ND	U	0.2	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.19	1	ND	U	0.2	1	ND	U	0.22	1	ND	U	0.2	1	0.28		0.2	1
Phenanthrene	85-01-8	190,000	mg/kg	3.8		0.19	1	1.5		0.2	1	0.53		0.22	1	0.33		0.2	1	1.3		0.2	1
Pyrene	129-00-0	96,000	mg/kg	3.9		0.19	1	1.8		0.2	1	0.52		0.22	1	0.33		0.2	1	1.1		0.2	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	316		1.14	10	660		2.4	20	156		1.28	10	190		1.19	10	37.4		1.14	10

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	A-155				A-156				A-159				A-160				A-161			
			Sample ID	A-155				A-156-2'				A-159_2'				A-160_2'				A-161-0-1'			
			Sample Date	4/7/2009				11/9/2012				11/1/2012				11/2/2012				11/9/2012			
			Sample Depth (ft bgs)	0-2				1-2				1-2				1-2				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				ND	U	0.58	1	1.9		0.89	1	0.466	J	0.74	1	0.001	J	0.0068	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.26	43.71	ND	U	0.12	1	ND	U	0.36	1	ND	U	0.29	1	ND	U	0.0014	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.26	43.71	ND	U	0.12	1	ND	U	0.36	1	ND	U	0.29	1	ND	U	0.0014	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				ND	U	0.58	1	2.74		0.89	1	ND	U	0.74	1	0.00053	J	0.0068	1
Benzene	71-43-2	290	mg/kg	0.52		0.26	43.71	0.228		0.12	1	0.266		0.089	1	0.273		0.074	1	0.00034	J	0.0014	1
Ethylbenzene	100-41-4	890	mg/kg	0.71		0.26	43.71	ND	U	0.12	1	0.538		0.36	1	0.464		0.29	1	ND	U	0.0014	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	7.2		0.26	43.71	6.63		0.58	1	1.27		0.89	1	2.84		0.74	1	0.0008	J	0.0068	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.26	43.71	ND	U	0.12	1	ND	U	0.36	1	ND	U	0.29	1	ND	U	0.0014	1
Toluene	108-88-3	10,000	mg/kg	1		0.26	43.71	0.267		0.12	1	0.951		0.89	1	0.46	J	0.74	1	0.00041	J	0.0014	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	2.3		0.26	43.71	0.662		0.12	1	2.35		0.36	1	1.3		0.29	1	0.00092	J	0.0014	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	5.7		2	10	0.279		0.033	1	ND	U	0.69	5	0.134		0.12	1	0.603		0.21	5
Benzo(A)Anthracene	56-55-3	130	mg/kg	3.5		2	10	0.589		0.033	1	0.618	J	0.69	5	0.1	J	0.12	1	0.627		0.21	5
Benzo(A)Pyrene	50-32-8	12	mg/kg	3.1		2	10	0.559		0.033	1	0.376	J	0.69	5	0.0764	J	0.12	1	2.39		0.21	5
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	3.2		2	10	0.53		0.033	1	0.783		0.69	5	0.118	J	0.12	1	1.82		0.21	5
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	ND	U	2	10	0.389		0.033	1	0.275	J	0.69	5	0.0597	J	0.12	1	1.95		0.21	5
Chrysene	218-01-9	760	mg/kg	4.8		2	10	0.69		0.033	1	0.871		0.69	5	0.108	J	0.12	1	3.85		0.21	5
Fluorene	86-73-7	130,000	mg/kg	19		2	10	0.365		0.033	1	ND	U	0.69	5	0.334		0.12	1	0.259		0.21	5
Naphthalene**	91-20-3	760	mg/kg	ND	U	2	10	NA				1.69		0.69	5	0.105	J	0.12	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	31		2	10	1.13		0.033	1	0.836		0.69	5	0.783		0.12	1	0.554		0.21	5
Pyrene	129-00-0	96,000	mg/kg	6.5		2	10	0.909		0.033	1	3.16		0.69	5	0.24		0.12	1	5.02		0.21	5
Metals																							
Lead*	7439-92-1	2,240	mg/kg	446		1.19	10	204		2.4	1	158		1.3	1	163		1.1	1	1380		2.7	1

Notes:
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	A-169				A-170				A-171				A-172				A-173			
			Sample ID	PH-AOI5_A-169_0-2_06172014				A-170_0-2'				A-171_0-2'				PH-AOI5_A-172_0-2_06172014				A-173_0-2'			
			Sample Date	6/17/2014				6/24/2014				6/25/2014				6/17/2014				6/25/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.002	1	ND	U	0.0019	1	ND	U	0.0021	1	0.647		0.29	1	0.00078	J	0.0026	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0029	1	ND	U	0.0027	1	ND	U	0.0033	1	ND	U	0.0036	1	ND	U	0.0032	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00099	1	ND	U	0.00096	1	ND	U	0.0011	1	ND	U	0.14	1	ND	U	0.0013	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.002	1	ND	U	0.0019	1	ND	U	0.0021	1	0.189	J	0.29	1	0.00042	J	0.0026	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0005	1	ND	U	0.00048	1	ND	U	0.00053	1	0.237		0.072	1	ND	U	0.00065	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.00099	1	ND	U	0.00096	1	ND	U	0.0011	1	0.11	J	0.14	1	ND	U	0.0013	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.005	1	ND	U	0.0048	1	ND	U	0.0053	1	0.175	J	0.72	1	ND	U	0.0065	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00099	1	ND	U	0.00096	1	ND	U	0.0011	1	ND	U	0.14	1	ND	U	0.0013	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00099	1	ND	U	0.00096	1	ND	U	0.0011	1	1.04		0.14	1	ND	U	0.0013	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.00099	1	ND	U	0.00096	1	ND	U	0.0011	1	0.673		0.14	1	0.0008	J	0.0013	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0682		0.036	1	0.0875		0.035	1	0.412		0.042	1	0.0205	J	0.048	1	0.0346	J	0.041	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.129		0.036	1	0.59		0.035	1	0.476		0.042	1	0.0296	J	0.048	1	0.0552		0.041	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.164		0.036	1	0.653		0.035	1	0.46		0.042	1	0.0352	J	0.048	1	0.059		0.041	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.188		0.036	1	0.783		0.035	1	0.537		0.042	1	0.0408	J	0.048	1	0.0631		0.041	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.276		0.036	1	0.55		0.035	1	0.733		0.042	1	0.0383	J	0.048	1	0.0459		0.041	1
Chrysene	218-01-9	760	mg/kg	0.161		0.036	1	0.697		0.035	1	0.474		0.042	1	0.0738		0.048	1	0.0697		0.041	1
Fluorene	86-73-7	130,000	mg/kg	0.0223	J	0.036	1	0.0183	J	0.035	1	0.0338	J	0.042	1	0.06		0.048	1	0.055		0.041	1
Naphthalene**	91-20-3	760	mg/kg	0.0173	J	0.036	1	0.0178	J	0.035	1	0.125		0.042	1	0.0536		0.048	1	ND	U	0.041	1
Phenanthrene	85-01-8	190,000	mg/kg	0.179		0.036	1	0.337		0.035	1	0.271		0.042	1	0.0665		0.048	1	0.177		0.041	1
Pyrene	129-00-0	96,000	mg/kg	0.227		0.036	1	1.04		0.035	1	0.514		0.042	1	0.0473	J	0.048	1	0.0958		0.041	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	402		2	1	97.2		2.1	1	229		2.4	1	86		2	1	196		2.3	1

Notes:
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PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	A-185				A-186				BH-04-07				BH-05-07				BH-06-07				BH-07-07			
			Sample ID	A-185_0-2'				A-186_0-2'				BH-04-07_1-2				BH-05-07_1-2				BH-06-07_0.5-1.0				BH-07-07_1-2			
			Sample Date	6/24/2014				6/27/2014				7/13/2007				7/12/2007				4/4/2007				7/13/2007			
			Sample Depth (ft bgs)	0-2				0-2				1-2				1-2				0.5-1				1-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																											
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0021	1	0.0014	J	0.003	1	NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0028	1	ND	U	0.0041	1	NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0021	1	0.00081	J	0.003	1	NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	ND	U	0.00052	1	ND	U	0.00075	1	NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0052	1	ND	U	0.0075	1	NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	NA				NA				NA				NA			
Semi-Volatile Organic Compounds																											
Anthracene	120-12-7	190,000	mg/kg	0.0739		0.037	1	0.505		0.055	1	NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.203		0.037	1	0.974		0.055	1	NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.266		0.037	1	1.03		0.055	1	NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.386		0.037	1	1.14		0.055	1	NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.25		0.037	1	0.756		0.055	1	NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	0.224		0.037	1	0.914		0.055	1	NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.037	1	0.205		0.055	1	NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.037	1	0.221		0.055	1	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.0651		0.037	1	1.49		0.055	1	NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	0.285		0.037	1	1.97		0.055	1	NA				NA				NA				NA			
Metals																											
Lead*	7439-92-1	2,240	mg/kg	92.2		2	1	37.1		3.3	1	203		0.58		316		0.78		373		0.63		1250		0.71	

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
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10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-08-07				BH-13-07				BH-18-07				BH-20-07				BH-21-07				BH-23-07			
			Sample ID	BH-08-07_.75-2				BH-13-07_0.5-1.0				BH-18-07_1.0-2.0				BH-20-07_0.75-2.0				BH-21-07_1.75-2				BH-23-07_0-0.5			
			Sample Date	7/13/2007				4/4/2007				4/4/2007				7/11/2007				4/4/2007				7/11/2007			
			Sample Depth (ft bgs)	0.75-2				0.5-1				1-2				0.75-2				1.75-2				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																											
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																											
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA				NA			
Metals																											
Lead*	7439-92-1	2,240	mg/kg	506		0.64		310		0.62		**3190**		0.99		21.7		0.58		26.7		0.59		1920		0.69	

Notes:
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Q - Qualifier
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-24-07				BH-25-07				BH-26-07				BH-27-07				BH-01-09				BH-02-09			
			Sample ID	BH-24-07_1.5-2				BH-25-07_1-2				BH-26-07_1-2				BH-27-07_1.5-2.0				BH-01-09				BH-02-09			
			Sample Date	4/4/2004				7/11/2007				7/11/2007				7/12/2007				4/7/2009				4/7/2009			
			Sample Depth (ft bgs)	1.5-2				1-2				1-2				1.5-2				0-2				0-1.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																											
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																											
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA				NA			
Metals																											
Lead*	7439-92-1	2,240	mg/kg	152		0.64		103		0.6		41.7		0.56		**3700**		0.59		494		1.58	10	**17900**		68.7	500

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
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Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-03-09				BH-04-09				BH-05-09				BH-06-09				BH-07-09			
			Sample ID	BH-03-09				BH-04-09				BH-05-09				BH-06-09				BH-07-09			
			Sample Date	4/7/2009				4/7/2009				4/8/2009				4/8/2009				4/7/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	316		1.79	10	1810		8.17	50	449		1.38	10	407		1.32	10	748		2.43	20

Notes:
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[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-08-09_AOI5				BH-09-09				BH-10-09				BH-11-09				BH-12-09			
			Sample ID	BH-08-09_AOI5				BH-09-09				BH-10-09				BH-11-09				BH-12-09			
			Sample Date	4/7/2009				4/7/2009				4/6/2009				4/7/2009				4/6/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	563		1.23	10	**2430**		13.7	100	441		1.16	10	613		2.36	20	806		2.46	20

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-13-09				BH-14-09				BH-15-09				BH-16-09				BH-17-09			
			Sample ID	BH-13-09				BH-14-09				BH-15-09				BH-16-09				BH-17-09			
			Sample Date	4/6/2009				4/6/2009				4/6/2009				4/6/2009				4/8/2009			
			Sample Depth (ft bgs)	1-2				1-2				0.5-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	298		1.11	10	285		1.2	10	323		1.13	10	2030		6.13	50	790		2.45	20

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-18-09				BH-19-09				BH-20-09				BH-21-09				BH-22-09			
			Sample ID	BH-18-09				BH-19-09				BH-20-09				BH-21-09				BH-22-09			
			Sample Date	4/8/2009				4/8/2009				4/8/2009				6/8/2009				6/8/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	327		1.46	10	228		1.28	10	453		1.35	10	1210		6.57	50	1780		13	100

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-23-09				BH-24-09				BH-25-09				BH-26-09				BH-33-09			
			Sample ID	BH-23-09				BH-24-09				BH-25-09				BH-26-09				BH-33-09			
			Sample Date	6/8/2009				6/8/2009				4/7/2009				4/7/2009				7/9/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				ND	U	0.36	51.23	ND	U	0.29	47.35	NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				0.42		0.23	1	ND	U	0.2	1	NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				0.79		0.23	1	ND	U	0.2	1	NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				0.81		0.23	1	ND	U	0.2	1	NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				1		0.23	1	ND	U	0.2	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				0.53		0.23	1	ND	U	0.2	1	NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				0.85		0.23	1	0.25		0.2	1	NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				0.34		0.23	1	ND	U	0.2	1	NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				0.25		0.23	1	ND	U	0.2	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				1.1		0.23	1	0.44		0.2	1	NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				1.3		0.23	1	0.27		0.2	1	NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1220		7.5	50	1100		6.17	50	1100		2.76	20	102		1.17	10	790		2.75	20

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-34-09				BH-35-09				BH-36-09				BH-37-09				BH-38-09			
			Sample ID	BH-34-09				BH-35-09				BH-36-09				BH-37-09				BH-38-09			
			Sample Date	7/9/2009				7/9/2009				7/9/2009				7/9/2009				7/9/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				NA			
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	485		1.4	10	772		2.62	20	374		1.46	10	1310		2.97	25	36.8		2.35	20

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-39-09				BH-40-09				BH-41-09				BH-42-09				BH-43-09			
			Sample ID	BH-39-09				BH-40-09				BH-41-09				BH-42-09				BH-43-09			
			Sample Date	7/9/2009				7/9/2009				7/9/2009				7/9/2009				7/9/2009			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	NA				NA				NA				NA				ND	U	0.006	0.99
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA				NA			
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1050		2.29	20	219		1.06	10	387		1.08	10	183		1.1	10	NA			

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH-44-09				BH-45-09				BH-46-09				AOI5 BH-14-12				AOI5 BH-17-12			
			Sample ID	BH-44-09				BH-45-09				BH-46-09				AOI5_BH-14-12				BH-17-12_.5-1			
			Sample Date	7/9/2009				7/9/2009				7/9/2009				3/18/2014				8/6/2012			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0.5-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				ND	U	0.0047	1	ND	U	0.001	0.95
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				ND	U	0.0027	1	ND	U	0.001	0.95
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				ND	U	0.00094	1	ND	U	0.001	0.95
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				ND	U	0.0047	1	ND	U	0.001	0.95
Benzene	71-43-2	290	mg/kg	ND	U	0.29	51.55	ND	U	0.3	51.65	ND	U	0.006	0.96	ND	U	0.00094	1	0.002	J	0.0006	0.95
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				ND	U	0.00094	1	ND	U	0.001	0.95
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				ND	U	0.0047	1	0.001	J	0.001	0.95
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				ND	U	0.00094	1	ND	U	0.0006	0.95
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				ND	U	0.00094	1	0.002	J	0.001	0.95
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				ND	U	0.00094	1	ND	U	0.001	0.95
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				0.0485	J	0.062	2	0.026	J	0.012	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				0.175		0.062	2	0.17		0.012	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				0.181		0.062	2	0.19		0.012	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				0.235		0.062	2	0.29		0.012	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				0.143		0.062	2	0.14		0.012	1
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				0.221		0.062	2	0.23		0.012	1
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				ND	U	0.062	2	ND	U	0.012	1
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				ND	U	0.062	2	0.027	J	0.012	1
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				0.129		0.062	2	0.15		0.012	1
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				0.355		0.062	2	0.33		0.012	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	NA				NA				NA				99.9		2.2	1	158		0.0252	5

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-19-12				AOI5 BH-21-12				AOI5 BH-23-12				AOI5 BH-25-12				AOI5 BH-28-12			
			Sample ID	BH-19-12_.5-1				BH-21-12_.5-1				BH-23-12_.5-1				BH-25-12_.5-1				BH-28-12_0-.5			
			Sample Date	8/6/2012				8/6/2012				8/9/2012				8/8/2012				8/8/2012			
			Sample Depth (ft bgs)	0.5-1				0.5-1				0.5-1				0.5-1				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
Benzene	71-43-2	290	mg/kg	0.007		0.0006	0.86	0.002	J	0.0007	1.05	0.005	J	0.0006	0.91	ND	U	0.005	0.72	0.006	J	0.0008	0.95
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	ND	U	0.002	0.95
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0006	0.86	ND	U	0.0007	1.05	ND	U	0.0006	0.91	ND	U	0.005	0.72	ND	U	0.0008	0.95
Toluene	108-88-3	10,000	mg/kg	0.005	J	0.001	0.86	0.003	J	0.001	1.05	0.004	J	0.001	0.91	ND	U	0.005	0.72	0.016		0.002	0.95
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.001	0.86	ND	U	0.001	1.05	ND	U	0.001	0.91	ND	U	0.005	0.72	0.002	J	0.002	0.95
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.48		0.047	10	0.75		0.042	10	0.14		0.021	5	ND	U	0.38	5	0.14	J	0.08	5
Benzo(A)Anthracene	56-55-3	130	mg/kg	2		0.047	10	1.5		0.042	10	0.36		0.021	5	ND	U	0.38	5	0.32	J	0.08	5
Benzo(A)Pyrene	50-32-8	12	mg/kg	2.3		0.047	10	1.5		0.042	10	0.4		0.021	5	ND	U	0.38	5	0.43		0.08	5
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	2.6		0.047	10	1.6		0.042	10	0.53		0.021	5	ND	U	0.38	5	0.61		0.08	5
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.8		0.047	10	1.3		0.042	10	0.35		0.021	5	0.4		0.38	5	0.51		0.08	5
Chrysene	218-01-9	760	mg/kg	2.1		0.047	10	1.6		0.042	10	0.38		0.021	5	ND	U	0.38	5	0.4	J	0.08	5
Fluorene	86-73-7	130,000	mg/kg	0.16	J	0.047	10	0.25		0.042	10	0.045	J	0.021	5	ND	U	0.38	5	ND	U	0.08	5
Naphthalene**	91-20-3	760	mg/kg	1		0.047	10	3.3		0.042	10	0.53		0.021	5	0.57		0.38	5	0.47		0.08	5
Phenanthrene	85-01-8	190,000	mg/kg	2		0.047	10	1.6		0.042	10	0.44		0.021	5	ND	U	0.38	5	0.48		0.08	5
Pyrene	129-00-0	96,000	mg/kg	3.5		0.047	10	1.6		0.042	10	0.57		0.021	5	ND	U	0.38	5	0.49		0.08	5
Metals																							
Lead*	7439-92-1	2,240	mg/kg	876		0.119	20	121		0.0272	5	905		0.105	20	186		0.728	5	1760		0.349	50

Notes:
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mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10	DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-32-12				AOI5 BH-33-12				AOI5 BH-34-12				AOI5 BH-36-12				AOI5 BH-40-12			
			Sample ID	BH-32-12_.5-1				BH-33-12_.5-1				BH-34-12_.5-1				BH-36-12_.5-1				BH-40-12_.5-1			
			Sample Date	8/8/2012				8/8/2012				8/7/2012				8/7/2012				8/7/2012			
			Sample Depth (ft bgs)	0.5-1				0.5-1				0.5-1				0.5-1				0.5-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	0.4	J	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.001	0.9
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.001	0.9
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.001	0.9
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.27	J	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.001	0.9
Benzene	71-43-2	290	mg/kg	ND	U	0.048	71.49	ND	U	0.0009	0.99	ND	U	0.005	0.86	0.015		0.005	0.75	0.011		0.0006	0.9
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.001	0.9
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.22	J	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	0.002	J	0.001	0.9
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.048	71.49	ND	U	0.0009	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	ND	U	0.0006	0.9
Toluene	108-88-3	10,000	mg/kg	ND	U	0.095	71.49	0.002	J	0.002	0.99	ND	U	0.005	0.86	0.005		0.005	0.75	0.005	J	0.001	0.9
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.095	71.49	ND	U	0.002	0.99	ND	U	0.005	0.86	ND	U	0.005	0.75	0.002	J	0.001	0.9
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	2.1		0.044	5	2.5		0.029	5	0.18		0.018	1	ND	U	0.21	10	0.25		0.042	10
Benzo(A)Anthracene	56-55-3	130	mg/kg	1.6		0.044	5	1.7		0.029	5	0.34		0.018	1	ND	U	0.21	10	0.78		0.042	10
Benzo(A)Pyrene	50-32-8	12	mg/kg	1.4		0.044	5	3.5		0.029	5	0.27		0.018	1	ND	U	0.21	10	0.79		0.042	10
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	1.3		0.044	5	3.8		0.029	5	0.31		0.018	1	0.22		0.21	10	1.1		0.042	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1		0.044	5	4.9		0.029	5	0.22		0.018	1	0.23		0.21	10	0.72		0.042	10
Chrysene	218-01-9	760	mg/kg	3.1		0.044	5	2.4		0.029	5	0.31		0.018	1	ND	U	0.21	10	0.89		0.042	10
Fluorene	86-73-7	130,000	mg/kg	3.5		0.044	5	1.1		0.029	5	0.026		0.018	1	ND	U	0.21	10	0.09	J	0.042	10
Naphthalene**	91-20-3	760	mg/kg	3		0.044	5	19		0.029	5	0.056		0.018	1	ND	U	0.21	10	0.47		0.042	10
Phenanthrene	85-01-8	190,000	mg/kg	9.3		0.044	5	3.8		0.029	5	0.69		0.018	1	ND	U	0.21	10	0.85		0.042	10
Pyrene	129-00-0	96,000	mg/kg	3.5		0.044	5	1.9		0.029	5	0.52		0.018	1	0.26		0.21	10	1.2		0.042	10
Metals																							
Lead*	7439-92-1	2,240	mg/kg	232		0.0293	5	545		0.0746	10	77.8		0.207	2	493		2.44	20	1360		0.276	50

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-01				AOI5-BH-13-02				AOI5-BH-13-03				AOI5-BH-13-05				AOI5-BH-13-06			
			Sample ID	AOI5_BH-13-01_1.5-2_031213				A015-BH-13-02_0-.5				A015-BH-13-03_0-.5				A015-BH-13-05_0-.5				A015-BH-13-06_0-.25			
			Sample Date	3/12/2013				3/1/2013				3/1/2013				3/1/2013				3/1/2013			
			Sample Depth (ft bgs)	1.5-2				0-0.5				0-0.5				0-0.5				0-0.25			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0039	1	ND	U	0.0048	1	ND	U	0.0045	1	ND	U	0.0063	1	ND	U	0.0046	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0039	1	ND	U	0.0048	1	ND	U	0.0045	1	ND	U	0.0063	1	ND	U	0.0046	1
Benzene	71-43-2	290	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0039	1	ND	U	0.0048	1	ND	U	0.0045	1	ND	U	0.0063	1	ND	U	0.0046	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.00078	1	ND	U	0.00096	1	ND	U	0.0009	1	ND	U	0.0013	1	ND	U	0.00091	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0813		0.033	1	0.0282	J	0.043	1	0.0539		0.04	1	0.195		0.046	1	0.0298	J	0.039	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.2		0.033	1	0.182		0.043	1	0.0683		0.04	1	0.247		0.046	1	0.121		0.039	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.213		0.033	1	0.207		0.043	1	0.0791		0.04	1	0.303		0.046	1	0.143		0.039	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.273		0.033	1	0.264		0.043	1	0.168		0.04	1	0.363		0.046	1	0.179		0.039	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.191		0.033	1	0.26		0.043	1	0.112		0.04	1	0.391		0.046	1	0.127		0.039	1
Chrysene	218-01-9	760	mg/kg	0.216		0.033	1	0.184		0.043	1	0.114		0.04	1	0.308		0.046	1	0.139		0.039	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.033	1	ND	U	0.043	1	ND	U	0.04	1	ND	U	0.046	1	ND	U	0.039	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.033	1	ND	U	0.043	1	ND	U	0.04	1	0.0607		0.046	1	0.0187	J	0.039	1
Phenanthrene	85-01-8	190,000	mg/kg	0.192		0.033	1	0.0377	J	0.043	1	0.045		0.04	1	0.166		0.046	1	0.0862		0.039	1
Pyrene	129-00-0	96,000	mg/kg	0.264		0.033	1	0.188		0.043	1	0.124		0.04	1	0.309		0.046	1	0.171		0.039	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	331		2.4	1	137		2.6	1	168		2.4	1	1020		2.9	1	485		7.4	3

Notes:
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DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-08				AOI5-BH-13-11				AOI5-BH-13-13				AOI5_BH-13-15				AOI5_BH-13-16			
			Sample ID	AOI5_BH-13-08_1.5-2_031113				A015-BH-13-11_0-.25				A015-BH-13-13_0-.25				AOI5_BH-13-15_1.5-2_031113				AOI5_BH-13-16_1.5-2_031113			
			Sample Date	3/11/2013				3/1/2013				3/1/2013				3/11/2013				3/11/2013			
			Sample Depth (ft bgs)	1.5-2				0-0.25				0-0.25				1.5-2				1.5-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0044	1	ND	U	0.0051	1	ND	U	0.0045	1	ND	U	0.0045	1	ND	U	0.56	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	ND	U	0.11	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	ND	U	0.11	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0044	1	ND	U	0.0051	1	ND	U	0.0045	1	ND	U	0.0045	1	ND	U	0.56	1
Benzene	71-43-2	290	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	0.183		0.11	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	ND	U	0.11	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0044	1	ND	U	0.0051	1	ND	U	0.0045	1	ND	U	0.0045	1	ND	U	0.56	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	ND	U	0.11	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	0.366		0.11	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.00087	1	ND	U	0.001	1	ND	U	0.0009	1	ND	U	0.0009	1	0.294		0.11	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	ND	U	0.032	1	0.895		0.04	1	0.07		0.04	1	0.108		0.031	1	0.691		0.035	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	ND	U	0.032	1	3.47		0.04	1	0.377		0.04	1	0.242		0.031	1	2.15		0.035	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	ND	U	0.032	1	4.13		0.2	5	0.453		0.04	1	0.236		0.031	1	2.38		0.035	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	ND	U	0.032	1	4.63		0.2	5	0.537		0.04	1	0.272		0.031	1	2.51		0.035	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	ND	U	0.032	1	3.53		0.04	1	0.358		0.04	1	0.173		0.031	1	1.49		0.035	1
Chrysene	218-01-9	760	mg/kg	ND	U	0.032	1	3.41		0.04	1	0.443		0.04	1	0.236		0.031	1	2.12		0.035	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.032	1	0.178		0.04	1	0.0162	J	0.04	1	0.0418		0.031	1	0.224		0.035	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.032	1	0.0841		0.04	1	0.0212	J	0.04	1	ND	U	0.031	1	0.338		0.035	1
Phenanthrene	85-01-8	190,000	mg/kg	ND	U	0.032	1	3.4		0.04	1	0.282		0.04	1	0.367		0.031	1	1.49		0.035	1
Pyrene	129-00-0	96,000	mg/kg	ND	U	0.032	1	7.7		0.2	5	0.691		0.04	1	0.45		0.031	1	2.21		0.035	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	15.7		2.4	1	239		5.3	2	1310		2.4	1	28.6		2.3	1	349		2	1

Notes:
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[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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E - Compound was over the calibration range
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-17				AOI5-BH-13-18				AOI5-BH-13-19				AOI5_BH-13-22				AOI5_BH-13-25			
			Sample ID	AOI5_BH-13-17_1.5-2_031113				A015-BH-13-18_0-.25				A015-BH-13-19_.5-1				AOI5_BH-13-22_1.5-2_030813				AOI5_BH-13-25_1.5-2_030813			
			Sample Date	3/11/2013				3/1/2013				3/1/2013				3/8/2013				3/8/2013			
			Sample Depth (ft bgs)	1.5-2				0-0.25				0.5-1				1.5-2				1-1.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0058	1	ND	U	0.0056	1	ND	U	0.0051	1	ND	U	0.0056	1	ND	U	0.54	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	ND	U	0.0011	1	ND	U	0.11	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	ND	U	0.0011	1	ND	U	0.11	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0058	1	ND	U	0.0056	1	ND	U	0.0051	1	ND	U	0.0056	1	ND	U	0.54	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	0.0012		0.0011	1	0.906		0.11	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	ND	U	0.0011	1	0.964		0.11	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0058	1	ND	U	0.0056	1	ND	U	0.0051	1	ND	U	0.0056	1	3.15		0.54	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	ND	U	0.0011	1	ND	U	0.11	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	0.0016		0.0011	1	0.953		0.11	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.001	1	ND	U	0.0011	1	2.02		0.11	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.127		0.034	1	0.0834		0.044	1	0.232		0.041	1	3.23		0.19	5	2.5		0.19	5
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.354		0.034	1	0.359		0.044	1	0.92		0.041	1	1.54		0.19	5	1.12		0.19	5
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.354		0.034	1	0.452		0.044	1	1.08		0.041	1	1.41		0.19	5	1.05		0.19	5
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.431		0.034	1	0.49		0.044	1	1.22		0.041	1	2.39		0.19	5	1.22		0.19	5
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.298		0.034	1	0.325		0.044	1	0.678		0.041	1	1.03		0.19	5	0.685		0.19	5
Chrysene	218-01-9	760	mg/kg	0.443		0.034	1	0.387		0.044	1	0.924		0.041	1	2.11		0.19	5	1.47		0.19	5
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.034	1	ND	U	0.044	1	ND	U	0.041	1	5.99		0.19	5	6.13		0.19	5
Naphthalene**	91-20-3	760	mg/kg	0.0656		0.034	1	0.0546		0.044	1	0.0809		0.041	1	ND	U	0.19	5	ND	U	0.19	5
Phenanthrene	85-01-8	190,000	mg/kg	0.363		0.034	1	0.16		0.044	1	0.235		0.041	1	10.1		0.19	5	12.1		0.19	5
Pyrene	129-00-0	96,000	mg/kg	0.492		0.034	1	0.389		0.044	1	ND	U	0.041	1	6.64		0.19	5	3.52		0.19	5
Metals																							
Lead*	7439-92-1	2,240	mg/kg	783		2.3	1	420		2.7	1	333		2.4	1	128		2.5	1	79.5		2.6	1

Notes:

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10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-26				AOI5-BH-13-27				AOI5_BH-13-28				AOI5_BH-13-29				AOI5_BH-13-30			
			Sample ID	AOI5_BH-13-26_1.5-2_030813				AOI5_BH-13-27_1.5-2_30713				AOI5_BH-13-28_1.5-2_30713				AOI5_BH-13-29_1-1.5_30613				AOI5_BH-13-30_1.5-2_30713			
			Sample Date	3/8/2013				3/7/2013				3/7/2013				3/6/2013				3/7/2013			
			Sample Depth (ft bgs)	1.5-2				1.5-2				1.5-2				1-1.5				1.5-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0048	1	ND	U	0.8	1	ND	U	0.006	1	ND	U	46	1	0.0107		0.0045	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	***9.3***	1	ND	U	0.0009	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	9.3	1	ND	U	0.0009	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0048	1	ND	U	0.8	1	ND	U	0.006	1	ND	U	46	1	0.006		0.0045	1
Benzene	71-43-2	290	mg/kg	ND	U	0.00097	1	12.4		0.16	1	0.0012		0.0012	1	ND	U	9.3	1	ND	U	0.0009	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	9.3	1	ND	U	0.0009	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0048	1	62.4		4	1	ND	U	0.006	1	**15500**		460	5	ND	U	0.0045	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	9.3	1	ND	U	0.0009	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	9.3	1	ND	U	0.0009	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.00097	1	ND	U	0.16	1	ND	U	0.0012	1	ND	U	9.3	1	0.0073		0.0009	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	1.13		0.042	1	0.318		0.045	1	12.6	E	0.041	1	0.199		0.052	1	0.403		0.074	2
Benzo(A)Anthracene	56-55-3	130	mg/kg	3.2		0.042	1	1.4		0.045	1	21.9	E	0.041	1	0.538		0.052	1	0.772		0.074	2
Benzo(A)Pyrene	50-32-8	12	mg/kg	3.05		0.042	1	1.48		0.045	1	**19.4**	E	0.041	1	0.426		0.052	1	0.708		0.074	2
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	3.85		0.042	1	1.29		0.045	1	26.9	E	0.041	1	0.597		0.052	1	0.563		0.074	2
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	2.02		0.042	1	1.53		0.045	1	12.7	E	0.041	1	0.293		0.052	1	0.622		0.074	2
Chrysene	218-01-9	760	mg/kg	3.31		0.042	1	1.54		0.045	1	20.6	E	0.041	1	0.548		0.052	1	0.776		0.074	2
Fluorene	86-73-7	130,000	mg/kg	0.48		0.042	1	0.107		0.045	1	6.4	E	0.041	1	0.168		0.052	1	0.235		0.074	2
Naphthalene**	91-20-3	760	mg/kg	0.426		0.042	1	0.125		0.045	1	0.96		0.041	1	ND	U	0.052	1	0.329		0.074	2
Phenanthrene	85-01-8	190,000	mg/kg	6.5		0.084	2	1.12		0.045	1	53.7	E	0.041	1	0.998		0.052	1	1.39		0.074	2
Pyrene	129-00-0	96,000	mg/kg	6.5		0.084	2	2.15		0.045	1	35.5	E	0.041	1	0.989		0.052	1	1.21		0.074	2
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1190		2.7	1	**2730**		4	2	1590		2	1	195		2	1	446		1.8	1

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-31				AOI5_BH-13-32				AOI5_BH-13-33				AOI5_BH-13-34				AOI5_BH-13-35			
			Sample ID	AOI5_BH-13-31_1.5-2_30613				AOI5_BH-13-32_1.5-2_30613				AOI5_BH-13-33_1.5-2_30713				AOI5_BH-13-34_1.5-2_30613				AOI5_BH-13-35_1.5-2_30613			
			Sample Date	3/6/2013				3/6/2013				3/7/2013				3/6/2013				3/6/2013			
			Sample Depth (ft bgs)	1.5-2				1.5-2				1.5-2				1.5-2				1.5-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.005	1	ND	U	110	2.5	ND	U	0.37	1	ND	U	0.68	1	ND	U	0.006	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.001	1	ND	U	***21***	2.5	ND	U	0.073	1	ND	U	0.14	1	ND	U	0.0012	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.001	1	ND	U	21	2.5	ND	U	0.073	1	ND	U	0.14	1	ND	U	0.0012	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.005	1	ND	U	110	2.5	ND	U	0.37	1	ND	U	0.68	1	ND	U	0.006	1
Benzene	71-43-2	290	mg/kg	0.0161		0.001	1	**1070**		21	2.5	ND	U	0.073	1	13.6		0.14	1	0.0512		0.0012	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.001	1	ND	U	21	2.5	ND	U	0.073	1	0.701		0.14	1	ND	U	0.0012	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.0093		0.005	1	9330		1100	25	ND	U	0.37	1	1650		170	2.5	ND	U	0.006	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.001	1	ND	U	21	2.5	ND	U	0.073	1	ND	U	0.14	1	ND	U	0.0012	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.001	1	ND	U	21	2.5	ND	U	0.073	1	ND	U	0.14	1	ND	U	0.0012	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.001	1	ND	U	21	2.5	0.0879		0.073	1	ND	U	0.14	1	ND	U	0.0012	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0522		0.043	1	0.653		0.044	1	0.281		0.039	1	0.309		0.04	1	0.358		0.039	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.137		0.043	1	1.99		0.044	1	0.858		0.039	1	1.24		0.04	1	0.851		0.039	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.127		0.043	1	1.88		0.044	1	0.876		0.039	1	1.4		0.04	1	0.198		0.039	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.16		0.043	1	2.45		0.044	1	0.993		0.039	1	1.33		0.04	1	0.823		0.039	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.129		0.043	1	1.29		0.044	1	0.783		0.039	1	0.933		0.04	1	0.287		0.039	1
Chrysene	218-01-9	760	mg/kg	0.159		0.043	1	2.13		0.044	1	0.925		0.039	1	1.32		0.04	1	1.17		0.039	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.043	1	0.451		0.044	1	0.526		0.039	1	0.209		0.04	1	0.504		0.039	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.043	1	1.64		0.044	1	0.14		0.039	1	0.186		0.04	1	0.212		0.039	1
Phenanthrene	85-01-8	190,000	mg/kg	0.145		0.043	1	3.33		0.044	1	1.43		0.039	1	1.37		0.04	1	6.19		0.19	5
Pyrene	129-00-0	96,000	mg/kg	0.221		0.043	1	3		0.044	1	1.45		0.039	1	1.53		0.04	1	2.32		0.039	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	365		1.9	1	2020		6	3	1090		2	1	851		2.1	1	1500		2	1

Notes:
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Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-36				AOI5_BH-13-37				AOI5_BH-13-38				AOI5_BH-13-39				AOI-5_BH-13-42			
			Sample ID	AOI5_BH-13-36_1.5-2_30613				AOI5_BH-13-37_1.5-2_030513				AOI5_BH-13-38_1.5-2_030513				AOI5_BH-13-39_1.5-2_030513				BH-13-42-1.5-2_030413			
			Sample Date	3/6/2013				3/5/2013				3/5/2013				3/5/2013				3/4/2013			
			Sample Depth (ft bgs)	1.5-2				1.5-2				1.5-2				1.5-2				1.5-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.51	1	ND	U	0.0041	1	ND	U	0.0069	1	ND	U	0.0052	1	ND	U	0.0042	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.51	1	ND	U	0.0041	1	ND	U	0.0069	1	ND	U	0.0052	1	ND	U	0.0042	1
Benzene	71-43-2	290	mg/kg	2.62		0.1	1	0.0021		0.00081	1	ND	U	0.0014	1	0.00025	J	0.001	1	ND	U	0.00084	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	881		25	1	ND	U	0.0041	1	ND	U	0.0069	1	ND	U	0.0052	1	ND	U	0.0042	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.1	1	ND	U	0.00081	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.00084	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.161		0.076	2	0.0396		0.035	1	0.036	J	0.045	1	0.209		0.044	1	0.075		0.038	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.468		0.076	2	0.182		0.035	1	0.233		0.045	1	0.685		0.044	1	0.247		0.038	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.438		0.076	2	0.192		0.035	1	0.224		0.045	1	0.756		0.044	1	0.315		0.038	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.484		0.076	2	0.205		0.035	1	0.263		0.045	1	0.71		0.044	1	0.294		0.038	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.327		0.076	2	0.12		0.035	1	0.137		0.045	1	0.556		0.044	1	0.225		0.038	1
Chrysene	218-01-9	760	mg/kg	0.526		0.076	2	0.194		0.035	1	0.245		0.045	1	0.713		0.044	1	0.27		0.038	1
Fluorene	86-73-7	130,000	mg/kg	0.0949		0.076	2	0.0158	J	0.035	1	ND	U	0.045	1	0.0439	J	0.044	1	0.0164	J	0.038	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.076	2	0.0191	J	0.035	1	0.014	J	0.045	1	0.0511		0.044	1	0.0446		0.038	1
Phenanthrene	85-01-8	190,000	mg/kg	0.691		0.076	2	0.158		0.035	1	0.141		0.045	1	0.611		0.044	1	0.147		0.038	1
Pyrene	129-00-0	96,000	mg/kg	0.772		0.076	2	0.27		0.035	1	0.289		0.045	1	0.925		0.044	1	0.276		0.038	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	201		2	1	284		2.4	1	**3600**		7.9	3	1120		2.8	1	496		2.5	1

Notes:
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DF - Dilution Factor
ND - Not Detected
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-43				AOI5_BH-13-44				AOI5_BH-13-116				AOI5_BH-13-117				AOI5_BH-13-121			
			Sample ID	BH-13-43-1.5-2_030513				AOI5_BH-13-44_1.5-2_030813				AOI-5_BH-13-116_0-.5_102913				AOI-5_BH-13-117_0-.5_102913				AOI-5_BH-13-121_102913_0-0.5			
			Sample Date	3/5/2013				3/8/2013				10/29/2013				10/29/2013				10/29/2013			
			Sample Depth (ft bgs)	1.5-2				1.5-2				0-0.5				0-0.5				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0048	1	ND	U	0.0044	1	ND	U	0.0074	1	ND	U	0.0066	1	ND	U	0.0054	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.004	1	ND	U	0.0037	1	ND	U	0.0034	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0048	1	ND	U	0.0044	1	ND	U	0.0074	1	ND	U	0.0066	1	ND	U	0.0054	1
Benzene	71-43-2	290	mg/kg	0.0004	J	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0048	1	0.0044		0.0044	1	ND	U	0.0074	1	ND	U	0.0066	1	ND	U	0.0054	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.00097	1	ND	U	0.00087	1	ND	U	0.0015	1	ND	U	0.0013	1	ND	U	0.0011	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.137		0.042	1	0.155		0.033	1	0.0795		0.054	1	0.195		0.049	1	0.111		0.044	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.617		0.042	1	0.592		0.033	1	0.392		0.054	1	1.01		0.049	1	0.544		0.044	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.799		0.042	1	0.696		0.033	1	0.534		0.054	1	0.991		0.049	1	0.631		0.044	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.91		0.042	1	0.937		0.033	1	0.684		0.054	1	1.16		0.049	1	0.822		0.044	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.719		0.042	1	0.66		0.033	1	0.433		0.054	1	0.641		0.049	1	0.436		0.044	1
Chrysene	218-01-9	760	mg/kg	0.695		0.042	1	0.599		0.033	1	0.608		0.054	1	1.35		0.049	1	0.717		0.044	1
Fluorene	86-73-7	130,000	mg/kg	0.0517		0.042	1	0.0341		0.033	1	ND	U	0.054	1	0.036	J	0.049	1	0.0413	J	0.044	1
Naphthalene**	91-20-3	760	mg/kg	0.109		0.042	1	0.0669		0.033	1	0.027	J	0.054	1	0.0232	J	0.049	1	0.0357	J	0.044	1
Phenanthrene	85-01-8	190,000	mg/kg	0.356		0.042	1	0.304		0.033	1	0.388		0.054	1	1.03		0.049	1	0.514		0.044	1
Pyrene	129-00-0	96,000	mg/kg	0.698		0.042	1	0.687		0.033	1	0.88		0.054	1	2.64		0.049	1	1		0.044	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1080		2.6	1	950		2.1	1	724		1.2	1	704		1.1	1	1160		1	1

Notes:
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PADEP - Pennsylvania Department of Environmental Protection Agency
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mg/kg - milligram per kilogram
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ND - Not Detected
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-122				AOI5_BH-13-123				AOI5_BH-13-124				AOI5_BH-13-125				AOI5_BH-13-126			
			Sample ID	AOI-5_BH-13-122_0-.5_102913				AOI-5_BH-13-123_0-.5_102913				AOI-5_BH-13-124_0-.5_102913				AOI-5_BH-13-125_0-.5_102913				AOI-5_BH-13-126_0-0.5_102913			
			Sample Date	10/29/2013				10/29/2013				10/29/2013				10/29/2013				10/29/2013			
			Sample Depth (ft bgs)	0-0.5				0-0.5				0-0.5				0-0.5				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.012	1	ND	U	0.011	1	ND	U	0.013	1	ND	U	0.0074	1	ND	U	0.0041	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0053	1	ND	U	0.0043	1	ND	U	0.0043	1	ND	U	0.004	1	ND	U	0.0039	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.012	1	ND	U	0.011	1	ND	U	0.013	1	ND	U	0.0074	1	ND	U	0.0041	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.012	1	ND	U	0.011	1	ND	U	0.013	1	ND	U	0.0074	1	ND	U	0.0041	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0025	1	ND	U	0.0023	1	ND	U	0.0027	1	ND	U	0.0015	1	ND	U	0.00083	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.132		0.067	1	0.685		0.053	1	0.126		0.053	1	0.327		0.052	1	0.106		0.05	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.67		0.067	1	2.57		0.053	1	0.198		0.053	1	0.349		0.052	1	0.141		0.05	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.8		0.067	1	2.27		0.053	1	0.303		0.053	1	0.512		0.052	1	0.195		0.05	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	1.02		0.067	1	2.66		0.053	1	0.312		0.053	1	0.656		0.052	1	0.219		0.05	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.542		0.067	1	1.49		0.053	1	0.522		0.053	1	1.37		0.052	1	0.323		0.05	1
Chrysene	218-01-9	760	mg/kg	0.96		0.067	1	2.67		0.053	1	0.354		0.053	1	0.808		0.052	1	0.193		0.05	1
Fluorene	86-73-7	130,000	mg/kg	0.0456	J	0.067	1	0.0877		0.053	1	ND	U	0.053	1	0.0767		0.052	1	ND	U	0.05	1
Naphthalene**	91-20-3	760	mg/kg	0.031	J	0.067	1	0.0404	J	0.053	1	0.0675		0.053	1	0.0462	J	0.052	1	0.0253	J	0.05	1
Phenanthrene	85-01-8	190,000	mg/kg	0.764		0.067	1	1.83		0.053	1	0.165		0.053	1	0.32		0.052	1	0.103		0.05	1
Pyrene	129-00-0	96,000	mg/kg	1.42		0.067	1	4.31		0.053	1	0.324		0.053	1	0.717		0.052	1	0.186		0.05	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1450		1.7	1	1780		5.7	5	1350		1.2	1	**2890**		12	10	**2950**		12	10

Notes:
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PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-127				AOI5_BH-13-128				AOI5_BH-13-129				AOI5_BH-13-130				AOI5_BH-13-131			
			Sample ID	AOI-5_BH-13-127-0-1_103013				AOI-5_BH-13-128-0-1_103013				AOI-5_BH-13-129-0-1_103013				AOI-5_BH-13-130_0-1_103013				AOI-5_BH-13-131_0-1_103013			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/30/2013				10/30/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-1				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0066	1	ND	U	0.0059	1	ND	U	0.0054	1	ND	U	0.0076	1	ND	U	0.0075	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0028	1	ND	U	0.0027	1	ND	U	0.0026	1	ND	U	0.0027	1	ND	U	0.0027	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0066	1	ND	U	0.0059	1	ND	U	0.0054	1	ND	U	0.0076	1	ND	U	0.0075	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0066	1	ND	U	0.0059	1	ND	U	0.0054	1	ND	U	0.0076	1	ND	U	0.0075	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0013	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0015	1	ND	U	0.0015	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0566		0.033	1	0.178		0.072	2	0.273		0.035	1	0.0788	J	0.16	5	0.0989		0.066	2
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.159		0.033	1	0.489		0.072	2	0.746		0.035	1	0.165		0.16	5	0.355		0.066	2
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.169		0.033	1	0.453		0.072	2	0.7		0.035	1	0.182		0.16	5	0.345		0.066	2
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.214		0.033	1	0.656		0.072	2	0.875		0.035	1	0.26		0.16	5	0.41		0.066	2
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.122		0.033	1	0.328		0.072	2	0.467		0.035	1	0.173		0.16	5	0.208		0.066	2
Chrysene	218-01-9	760	mg/kg	0.2		0.033	1	0.575		0.072	2	0.822		0.035	1	0.189		0.16	5	0.377		0.066	2
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.033	1	0.0609	J	0.072	2	0.0734		0.035	1	ND	U	0.16	5	ND	U	0.066	2
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.033	1	ND	U	0.072	2	0.0414		0.035	1	ND	U	0.16	5	ND	U	0.066	2
Phenanthrene	85-01-8	190,000	mg/kg	0.158		0.033	1	0.672		0.072	2	1.11		0.035	1	0.108	J	0.16	5	0.191		0.066	2
Pyrene	129-00-0	96,000	mg/kg	0.294		0.033	1	0.791		0.072	2	1.22		0.035	1	0.223		0.16	5	0.409		0.066	2
Metals																							
Lead*	7439-92-1	2,240	mg/kg	62.9		0.88	1	115		0.9	1	171		0.88	1	52.8		0.89	1	48.5		0.87	1

Notes:
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*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-132				AOI5_BH-13-133				AOI5_BH-13-134				AOI5_BH-13-135				AOI5_BH-13-136			
			Sample ID	AOI-5_BH-13-132_0-1_103013				AOI-5_BH-13-133_0-1_103013				AOI-5_BH-13-134_0-1_103013				AOI-5_BH-13-135-0-1_103013				AOI5-BH-13-136_103013_0-1			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/30/2013				10/30/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-1				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0061	1	ND	U	0.0055	1	ND	U	0.0062	1	ND	U	0.0061	1	ND	U	0.006	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0026	1	ND	U	0.0026	1	ND	U	0.0026	1	ND	U	0.0026	1	ND	U	0.0026	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0061	1	ND	U	0.0055	1	ND	U	0.0062	1	ND	U	0.0061	1	ND	U	0.006	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0061	1	ND	U	0.0055	1	ND	U	0.0062	1	ND	U	0.0061	1	ND	U	0.006	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0012	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	ND	U	0.16	5	0.0786		0.034	1	0.15		0.068	2	0.0862		0.034	1	0.0696	J	0.16	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.154	J	0.16	5	0.176		0.034	1	0.301		0.068	2	0.198		0.034	1	0.206		0.16	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.176		0.16	5	0.22		0.034	1	0.313		0.068	2	0.266		0.034	1	0.303		0.16	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.239		0.16	5	0.28		0.034	1	0.397		0.068	2	0.333		0.034	1	0.28		0.16	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.167		0.16	5	0.189		0.034	1	0.221		0.068	2	0.222		0.034	1	0.259		0.16	1
Chrysene	218-01-9	760	mg/kg	0.178		0.16	5	0.241		0.034	1	0.363		0.068	2	0.262		0.034	1	0.25		0.16	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.16	5	ND	U	0.034	1	ND	U	0.068	2	ND	U	0.034	1	ND	U	0.16	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.16	5	ND	U	0.034	1	0.0642	J	0.068	2	ND	U	0.034	1	ND	U	0.16	1
Phenanthrene	85-01-8	190,000	mg/kg	0.0959	J	0.16	5	0.129		0.034	1	0.508		0.068	2	0.242		0.034	1	0.101	J	0.16	1
Pyrene	129-00-0	96,000	mg/kg	0.197		0.16	5	0.273		0.034	1	0.49		0.068	2	0.343		0.034	1	0.401		0.16	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	47.6		0.86	1	74.8		0.84	1	55.2		0.9	1	60.9		0.83	1	53.4		0.9	1

Notes:
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[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-137				AOI5_BH-13-138				AOI5_BH-13-139				AOI5_BH-13-140				AOI5_BH-13-141			
			Sample ID	AOI5-BH-13-137_103013_0-1				AOI5-BH-13-138_103013_0-1				AOI5-BH-13-139_103013_0-1				AOI5-BH-13-140_103013_0-1				AOI5-BH-13-141_103013_0-1			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/30/2013				10/30/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-1				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0057	1	ND	U	0.0071	1	ND	U	0.0061	1	ND	U	0.0067	1	ND	U	0.0061	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0027	1	ND	U	0.0029	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0026	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0057	1	ND	U	0.0071	1	ND	U	0.0061	1	ND	U	0.0067	1	ND	U	0.0061	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0057	1	ND	U	0.0071	1	ND	U	0.0061	1	ND	U	0.0067	1	ND	U	0.0061	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0011	1	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0012	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.113	J	0.16	1	0.0873	J	0.19	1	0.214		0.16	1	ND	U	0.17	1	0.121	J	0.17	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.271		0.16	1	0.206		0.19	1	0.455		0.16	1	0.205		0.17	1	0.227		0.17	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.29		0.16	1	0.22		0.19	1	0.462		0.16	1	0.25		0.17	1	0.302		0.17	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.456		0.16	1	0.341		0.19	1	0.523		0.16	1	0.296		0.17	1	0.381		0.17	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.314		0.16	1	0.301		0.19	1	0.397		0.16	1	0.212		0.17	1	0.257		0.17	1
Chrysene	218-01-9	760	mg/kg	0.278		0.16	1	0.243		0.19	1	0.476		0.16	1	0.25		0.17	1	0.263		0.17	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.16	1	ND	U	0.19	1	0.145	J	0.16	1	ND	U	0.17	1	0.111	J	0.17	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.16	1	ND	U	0.19	1	ND	U	0.16	1	ND	U	0.17	1	ND	U	0.17	1
Phenanthrene	85-01-8	190,000	mg/kg	0.244		0.16	1	0.106	J	0.19	1	0.623		0.16	1	0.105	J	0.17	1	0.127	J	0.17	1
Pyrene	129-00-0	96,000	mg/kg	0.516		0.16	1	0.403		0.19	1	0.874		0.16	1	0.295		0.17	1	0.393		0.17	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	39.1		0.91	1	35.1		0.97	1	69.2		0.86	1	57.2		0.92	1	76.8		0.9	1

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-142				AOI5_BH-13-143				AOI5_BH-13-144				AOI5_BH-13-145				AOI5_BH-13-146			
			Sample ID	AOI5-BH-13-142_103013_0-1				AOI5-BH-13-143_103013_0-1				AOI5-BH-13-144_103013_0-1				AOI5-BH-13-145_103013_0-1				AOI5-BH-13-146_103013_0-1			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/30/2013				10/30/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-1				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0074	1	ND	U	0.006	1	ND	U	0.0056	1	ND	U	0.0059	1	ND	U	0.0074	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0028	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0026	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0074	1	ND	U	0.006	1	ND	U	0.0056	1	ND	U	0.0059	1	ND	U	0.0074	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0074	1	ND	U	0.006	1	ND	U	0.0056	1	ND	U	0.0059	1	ND	U	0.0074	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0015	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0841	J	0.18	1	0.109	J	0.17	1	0.071		0.035	1	0.133	J	0.18	1	0.256		0.17	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.271		0.18	1	0.269		0.17	1	0.209		0.035	1	0.317		0.18	1	0.585		0.17	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.414		0.18	1	0.347		0.17	1	0.256		0.035	1	0.402		0.18	1	0.725		0.17	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.348		0.18	1	0.439		0.17	1	0.324		0.035	1	0.509		0.18	1	0.765		0.17	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.337		0.18	1	0.269		0.17	1	0.293		0.035	1	0.405		0.18	1	0.607		0.17	1
Chrysene	218-01-9	760	mg/kg	0.264		0.18	1	0.31		0.17	1	0.252		0.035	1	0.417		0.18	1	0.719		0.17	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.18	1	ND	U	0.17	1	ND	U	0.035	1	ND	U	0.18	1	ND	U	0.17	1
Naphthalene**	91-20-3	760	mg/kg	0.0822	J	0.18	1	ND	U	0.17	1	0.0481		0.035	1	ND	U	0.18	1	ND	U	0.17	1
Phenanthrene	85-01-8	190,000	mg/kg	0.161	J	0.18	1	0.342		0.17	1	0.185		0.035	1	0.296		0.18	1	0.539		0.17	1
Pyrene	129-00-0	96,000	mg/kg	0.44		0.18	1	0.532		0.17	1	0.425		0.035	1	0.642		0.18	1	1.29		0.17	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	37.9		0.93	1	40.1		0.88	1	**4060**		8.9	10	80.4		0.92	1	49.4		0.84	1

Notes:
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PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-147				AOI5_BH-13-148				AOI5_BH-13-149				AOI5_BH-13-149				AOI5_BH-13-150			
			Sample ID	AOI5-BH-13-147_103013_0-1				AOI5-BH-13-148_103013_0-1				AOI5-BH-13-149_103013_0-1				AOI5-BH-13-DUP-103013_0-1				AOI5-BH-13-150_103013_0-1			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/30/2013				10/30/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-1				0-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0057	1	ND	U	0.0061	1	ND	U	0.0063	1	ND	U	0.0056	1	ND	U	0.0082	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0029	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0057	1	ND	U	0.0061	1	ND	U	0.0063	1	ND	U	0.0056	1	ND	U	0.0082	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0057	1	ND	U	0.0061	1	ND	U	0.0063	1	ND	U	0.0056	1	ND	U	0.0082	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0011	1	ND	U	0.0012	1	ND	U	0.0013	1	ND	U	0.0011	1	ND	U	0.0016	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.112	J	0.17	1	0.0753	J	0.17	1	0.0401		0.034	1	0.041		0.035	1	0.293		0.038	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.25		0.17	1	0.203		0.17	1	0.117		0.034	1	0.122		0.035	1	1.08		0.038	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.323		0.17	1	0.288		0.17	1	0.144		0.034	1	0.147		0.035	1	1.14		0.038	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.376		0.17	1	0.313		0.17	1	0.168		0.034	1	0.169		0.035	1	1.39		0.038	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.232		0.17	1	0.233		0.17	1	0.13		0.034	1	0.151		0.035	1	0.762		0.038	1
Chrysene	218-01-9	760	mg/kg	0.302		0.17	1	0.231		0.17	1	0.147		0.034	1	0.159		0.035	1	1.23		0.038	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.17	1	ND	U	0.17	1	ND	U	0.034	1	ND	U	0.035	1	0.0827		0.038	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.17	1	ND	U	0.17	1	ND	U	0.034	1	ND	U	0.035	1	0.0517		0.038	1
Phenanthrene	85-01-8	190,000	mg/kg	0.151	J	0.17	1	0.137	J	0.17	1	0.104		0.034	1	0.0864		0.035	1	1.41		0.038	1
Pyrene	129-00-0	96,000	mg/kg	0.444		0.17	1	0.372		0.17	1	0.267		0.034	1	0.246		0.035	1	2.35		0.038	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	43.5		0.89	1	44.9		0.89	1	42.5		0.88	1	39.4		0.9	1	1750		4.8	5

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-151				AOI5_BH-13-152				AOI5_BH-13-153				AOI5_BH-13-154				AOI5_BH-13-155			
			Sample ID	AOI5-BH-13-151_103013_0-1				AOI5-BH-13-152_103013_0-1				AOI5-BH-13-153_103013_0-1				AOI-5_BH-13-154_0-0.5_102913				AOI-5_BH-13-155_0-.5_102913			
			Sample Date	10/30/2013				10/30/2013				10/30/2013				10/29/2013				10/29/2013			
			Sample Depth (ft bgs)	0-1				0-1				0-1				0-0.5				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.007	1	ND	U	0.0062	1	ND	U	0.006	1	ND	U	0.0075	1	ND	U	0.0062	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.003	1	ND	U	0.0031	1	ND	U	0.003	1	ND	U	0.0033	1	ND	U	0.003	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.007	1	ND	U	0.0062	1	ND	U	0.006	1	ND	U	0.0075	1	ND	U	0.0062	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.007	1	ND	U	0.0062	1	ND	U	0.006	1	ND	U	0.0075	1	ND	U	0.0062	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0014	1	ND	U	0.0012	1	ND	U	0.0012	1	ND	U	0.0015	1	ND	U	0.0012	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.161		0.076	2	0.393		0.039	1	0.352		0.038	1	0.128		0.043	1	0.19		0.039	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.81		0.076	2	1.25		0.039	1	1.8		0.038	1	0.497		0.043	1	0.68		0.039	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	1.03		0.076	2	1.25		0.039	1	1.74		0.038	1	0.574		0.043	1	0.781		0.039	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	1.31		0.076	2	1.52		0.039	1	2.27		0.038	1	0.768		0.043	1	1.02		0.039	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.68		0.076	2	0.838		0.039	1	1.08		0.038	1	0.477		0.043	1	0.664		0.039	1
Chrysene	218-01-9	760	mg/kg	1		0.076	2	1.29		0.039	1	2.2		0.038	1	0.617		0.043	1	0.833		0.039	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.076	2	0.112		0.039	1	0.0977		0.038	1	ND	U	0.043	1	0.0364	J	0.039	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.076	2	0.0368	J	0.039	1	0.0468		0.038	1	0.038	J	0.043	1	0.0585		0.039	1
Phenanthrene	85-01-8	190,000	mg/kg	0.565		0.076	2	1.45		0.039	1	1.48		0.038	1	0.406		0.043	1	0.52		0.039	1
Pyrene	129-00-0	96,000	mg/kg	1.5		0.076	2	2.58		0.039	1	3.45		0.038	1	0.784		0.043	1	1.04		0.039	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1020		1	1	**2290**		5	5	1270		0.99	1	1840		11	10	1690		9.7	10

Notes:
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-156				AOI5_BH-13-158				AOI5_BH-13-159				AOI5_BH-14-01				AOI5_BH-14-02			
			Sample ID	AOI-5_BH-13-156_0-.5_102913				AOI-5_BH-13-158_0-1_102913				AOI-5_BH-13-159_0-1_102913				AOI5_BH-14-01				AOI5_BH-14-02			
			Sample Date	10/29/2013				10/29/2013				10/29/2013				3/17/2014				3/17/2014			
			Sample Depth (ft bgs)	0-0.5				0-1				0-1				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0076	1	ND	U	0.0072	1	ND	U	0.0052	1	ND	U	0.007	1	0.0013	J	0.0095	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0031	1	ND	U	0.0031	1	ND	U	0.003	1	ND	U	0.0036	1	ND	U	0.0035	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.0014	1	ND	U	0.0019	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0076	1	ND	U	0.0072	1	ND	U	0.0052	1	ND	U	0.007	1	ND	U	0.0095	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.0014	1	ND	U	0.0019	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.0014	1	ND	U	0.0019	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0076	1	ND	U	0.0072	1	ND	U	0.0052	1	ND	U	0.007	1	ND	U	0.0095	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.0014	1	ND	U	0.0019	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	0.00066	J	0.0014	1	ND	U	0.0019	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.001	1	ND	U	0.0014	1	ND	U	0.0019	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.134		0.041	1	0.583		0.037	1	0.0202	J	0.037	1	0.0623		0.047	1	0.0482		0.045	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.391		0.041	1	1.34		0.037	1	0.035	J	0.037	1	0.0408	J	0.047	1	0.198		0.045	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.467		0.041	1	1.33		0.037	1	0.0647		0.037	1	0.0621		0.047	1	0.24		0.045	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.633		0.041	1	1.68		0.037	1	0.0787		0.037	1	0.0608		0.047	1	0.287		0.045	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.424		0.041	1	0.989		0.037	1	0.0814		0.037	1	0.132		0.047	1	0.183		0.045	1
Chrysene	218-01-9	760	mg/kg	0.43		0.041	1	1.48		0.037	1	0.0427		0.037	1	0.0394	J	0.047	1	0.212		0.045	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.041	1	0.321		0.037	1	ND	U	0.037	1	ND	U	0.047	1	ND	U	0.045	1
Naphthalene**	91-20-3	760	mg/kg	0.0485		0.041	1	0.412		0.037	1	ND	U	0.037	1	0.025	J	0.047	1	ND	U	0.045	1
Phenanthrene	85-01-8	190,000	mg/kg	0.289		0.041	1	2.27		0.037	1	0.0198	J	0.037	1	0.0304	J	0.047	1	0.164		0.045	1
Pyrene	129-00-0	96,000	mg/kg	0.536		0.041	1	2.14		0.037	1	0.0377		0.037	1	ND	U	0.047	1	ND	U	0.045	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1350		0.98	1	1190		1	1	158		0.9	1	175		2	1	2130		5.8	3

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-14-03				AOI5_BH-14-04				AOI5_BH-14-05				AOI5_BH-14-06				AOI5_BH-14-06			
			Sample ID	AOI5_BH-14-03				AOI5_BH-14-04				AOI5_BH-14-05				A015_BH-14-06				A015_BH-14-DUP1			
			Sample Date	3/17/2014				3/17/2014				3/18/2014				3/14/2014				3/14/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	35	1	ND	U	0.46	1	ND	U	0.0057	1	NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0029	1	ND	U	0.0034	1	ND	U	0.0028	1	NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	7	1	ND	U	0.092	1	ND	U	0.0011	1	NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	35	1	ND	U	0.46	1	ND	U	0.0057	1	NA				NA			
Benzene	71-43-2	290	mg/kg	ND	U	7	1	56.7		0.92	1	ND	U	0.0011	1	ND	U	0.0017	1	ND	U	0.0017	1
Ethylbenzene	100-41-4	890	mg/kg	44.2		7	1	ND	U	0.092	1	ND	U	0.0011	1	ND	U	0.0017	1	ND	U	0.0017	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	**21100**		3500	100	15.1		0.46	1	ND	U	0.0057	1	NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	7	1	ND	U	0.092	1	ND	U	0.0011	1	NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	7	1	0.0199	J	0.092	1	ND	U	0.0011	1	ND	U	0.0017	1	ND	U	0.0017	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	7	1	ND	U	0.092	1	ND	U	0.0011	1	ND	U	0.0017	1	ND	U	0.0017	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0301	J	0.035	1	0.0475		0.042	1	0.0575		0.033	1	NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.13		0.035	1	0.166		0.042	1	0.214		0.033	1	NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.136		0.035	1	0.163		0.042	1	0.227		0.033	1	0.2		0.045	1	ND	U	0.23	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.168		0.035	1	0.21		0.042	1	0.289		0.033	1	NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.103		0.035	1	0.122		0.042	1	0.2		0.033	1	NA				NA			
Chrysene	218-01-9	760	mg/kg	0.153		0.035	1	0.206		0.042	1	0.271		0.033	1	NA				NA			
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.035	1	0.0168	J	0.042	1	ND	U	0.033	1	NA				NA			
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.035	1	0.0414	J	0.042	1	ND	U	0.033	1	0.0259	J	0.045	1	ND	U	0.23	1
Phenanthrene	85-01-8	190,000	mg/kg	0.0849		0.035	1	0.155		0.042	1	0.151		0.033	1	0.119		0.045	1	ND	U	0.23	1
Pyrene	129-00-0	96,000	mg/kg	ND	U	0.035	1	ND	U	0.042	1	0.426		0.033	1	NA				NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	47.1		2.3	1	40.6		2	1	45.7		2.2	1	1570		6.1	3	1390		2	1

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-14-07				AOI5_BH-14-08				AOI5_BH-14-09				AOI5_BH-14-10				AOI5_BH-14-11			
			Sample ID	A015_BH-14-07				A015_BH-14-08				AOI5_BH-14-09				AOI5_BH-14-10				AOI5_BH-14-11			
			Sample Date	3/14/2014				3/14/2014				3/18/2014				3/18/2014				3/18/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				ND	U	0.0058	1	ND	U	0.0068	1	ND	U	0.0064	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				ND	U	0.0028	1	ND	U	0.0028	1	ND	U	0.0029	1
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				ND	U	0.0012	1	ND	U	0.0014	1	ND	U	0.0013	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				ND	U	0.0058	1	ND	U	0.0068	1	ND	U	0.0064	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0019	1	ND	U	0.0019	1	ND	U	0.0012	1	ND	U	0.0014	1	0.00038	J	0.0013	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0019	1	ND	U	0.0019	1	ND	U	0.0012	1	ND	U	0.0014	1	ND	U	0.0013	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				ND	U	0.0058	1	ND	U	0.0068	1	ND	U	0.0064	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				ND	U	0.0012	1	ND	U	0.0014	1	ND	U	0.0013	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0019	1	ND	U	0.0019	1	ND	U	0.0012	1	ND	U	0.0014	1	ND	U	0.0013	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	0.0039		0.0019	1	ND	U	0.0019	1	ND	U	0.0012	1	ND	U	0.0014	1	ND	U	0.0013	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	NA				NA				0.0479	J	0.066	2	0.079		0.035	1	0.105		0.07	2
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				0.18		0.066	2	0.264		0.035	1	0.323		0.07	2
Benzo(A)Pyrene	50-32-8	12	mg/kg	ND	U	0.049	1	0.337		0.047	1	0.217		0.066	2	0.29		0.035	1	0.316		0.07	2
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				0.267		0.066	2	0.388		0.035	1	0.376		0.07	2
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				0.203		0.066	2	0.23		0.035	1	0.227		0.07	2
Chrysene	218-01-9	760	mg/kg	NA				NA				0.212		0.066	2	0.356		0.035	1	0.396		0.07	2
Fluorene	86-73-7	130,000	mg/kg	NA				NA				ND	U	0.066	2	0.0231	J	0.035	1	0.0316	J	0.07	2
Naphthalene**	91-20-3	760	mg/kg	0.0363	J	0.049	1	0.0628		0.047	1	ND	U	0.066	2	0.0162	J	0.035	1	ND	U	0.07	2
Phenanthrene	85-01-8	190,000	mg/kg	ND	U	0.049	1	0.183		0.047	1	0.1		0.066	2	0.283		0.035	1	0.444		0.07	2
Pyrene	129-00-0	96,000	mg/kg	NA				NA				0.327		0.066	2	0.538		0.035	1	0.712		0.07	2
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1800		6.1	3	1670		2	1	37.9		2.3	1	27.5		2.2	1	38.3		2.4	1

Notes:
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DF - Dilution Factor
ND - Not Detected
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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D- Indicates a dilution

Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10	DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
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AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-14-13				AOI5-BH-14-14				AOI5-BH-14-15				AOI5-BH-14-17				AOI5-BH-14-18			
			Sample ID	AOI5_BH-14-13				AOI-5_14-14_0-2'				AOI-5_14-15_0-2'				AOI-5_14-17_0-2'				AOI-5_14-18_0-2'			
			Sample Date	3/18/2014				6/16/2014				6/16/2014				6/16/2014				6/16/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0053	1	0.0019	J	0.002	1	0.0007	J	0.002	1	0.0003	J	0.0027	1	ND		0.0028	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0028	1	ND		0.0027	1	ND		0.003	1	ND		0.0029	1	ND		0.0029	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0011	1	ND		0.001	1	ND		0.001	1	ND		0.0013	1	ND		0.0014	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0053	1	0.0014	JJ	0.002	1	0.00035	J	0.002	1	0.00034	J	0.0027	1	ND		0.0028	1
Benzene	71-43-2	290	mg/kg	ND	U	0.0011	1	0.00043	J	0.00051	1	0.00043	J	0.0005	1	ND		0.00067	1	ND		0.0007	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0011	1	ND		0.001	1	0.00033	J	0.001	1	ND		0.0013	1	ND		0.0014	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0053	1	0.00023	J	0.0051	1	0.00059	J	0.005	1	ND		0.0067	1	ND		0.007	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0011	1	ND		0.001	1	0.00041	J	0.001	1	NDJ		0.0013	1	ND		0.0014	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0011	1	0.0006	J	0.001	1	0.0006	JJ	0.001	1	ND		0.0013	1	ND		0.0014	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0011	1	0.0012		0.001	1	0.0022		0.001	1	0.00037	J	0.0013	1	ND		0.0014	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0466		0.035	1	0.387		0.035	1	0.0659		0.038	1	0.26		0.034	1	0.0393		0.037	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.158		0.035	1	1.08		0.035	1	0.182		0.038	1	0.783		0.034	1	0.148		0.037	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.154		0.035	1	1.17		0.035	1	0.244		0.038	1	0.951		0.034	1	0.176		0.037	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.202		0.035	1	1.38		0.035	1	0.319		0.038	1	1.04		0.034	1	0.207		0.037	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.141		0.035	1	0.865		0.035	1	0.2		0.038	1	0.673		0.034	1	0.135		0.037	1
Chrysene	218-01-9	760	mg/kg	0.204		0.035	1	1.22		0.035	1	0.212		0.038	1	0.803		0.034	1	0.159		0.037	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.035	1	0.106		0.035	1	0.0233	JJ	0.038	1	0.0849		0.034	1	ND		0.037	1
Naphthalene**	91-20-3	760	mg/kg	ND	U	0.035	1	0.0909		0.035	1	0.0422		0.038	1	0.0673		0.034	1	ND		0.037	1
Phenanthrene	85-01-8	190,000	mg/kg	0.102		0.035	1	1.19		0.035	1	0.137		0.038	1	0.774		0.034	1	0.146		0.037	1
Pyrene	129-00-0	96,000	mg/kg	0.327		0.035	1	1.98		0.035	1	0.244		0.038	1	1.29		0.034	1	0.239		0.037	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	29.5		2.3	1	120		2.1	1	336		2	1	87.7		2	1	31		2	1

Notes:
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[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH_14-19				BH_14-20				BH_14-21				BH_14-22				BH_14-24			
			Sample ID	AOI-5_BH_14-19_0-2'				AOI-5_BH_14-20				AOI-5_BH_14-21_0-2'				AOI-5_BH_14-22_0-2'				AOI-5_BH_14-24_0-2'			
			Sample Date	6/18/2014				6/20/2014				6/18/2014				6/18/2014				6/20/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	0.0011	J	0.0019	1	ND	U	0.0021	1	ND	U	0.0022	1	ND	U	0.0018	1	ND	U	0.003	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0051	1	ND	U	0.003	1	ND	U	0.0031	1	ND	U	0.003	1	ND	U	0.0032	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.00093	1	ND	U	0.0011	1	ND	U	0.0011	1	ND	U	0.0009	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.00075	J	0.0019	1	ND	U	0.0021	1	ND	U	0.0022	1	ND	U	0.0018	1	ND	U	0.003	1
Benzene	71-43-2	290	mg/kg	0.0044		0.00047	1	ND	U	0.00054	1	0.0034		0.00055	1	0.00061		0.00045	1	0.00062	J	0.00075	1
Ethylbenzene	100-41-4	890	mg/kg	0.00054	J	0.00093	1	ND	U	0.0011	1	ND	U	0.0011	1	ND	U	0.0009	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0047	1	ND	U	0.0054	1	ND	U	0.0055	1	ND	U	0.0045	1	ND	U	0.0075	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.00093	1	ND	U	0.0011	1	ND	U	0.0011	1	ND	U	0.0009	1	ND	U	0.0015	1
Toluene	108-88-3	10,000	mg/kg	0.00053	J	0.00093	1	ND	U	0.0011	1	ND	U	0.0011	1	ND	U	0.0009	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	0.0082		0.00093	1	ND	U	0.0011	1	ND	U	0.0011	1	0.00023	J	0.0009	1	ND	U	0.0015	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.0334		0.033	1	0.142		0.039	1	0.671		0.039	1	0.163		0.037	1	0.0179	J	0.043	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.0933		0.033	1	0.422		0.039	1	0.914		0.039	1	0.352		0.037	1	0.0983		0.043	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.102		0.033	1	0.578		0.039	1	0.932		0.039	1	0.303		0.037	1	0.122		0.043	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.0952		0.033	1	0.644		0.039	1	1		0.039	1	0.301		0.037	1	0.167		0.043	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.096		0.033	1	0.449		0.039	1	0.513		0.039	1	0.272		0.037	1	0.113		0.043	1
Chrysene	218-01-9	760	mg/kg	0.118		0.033	1	0.438		0.039	1	1.98		0.039	1	0.449		0.037	1	0.106		0.043	1
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.033	1	0.023	J	0.039	1	0.903		0.039	1	0.0904		0.037	1	ND	U	0.043	1
Naphthalene**	91-20-3	760	mg/kg	0.0208	J	0.033	1	0.161		0.039	1	0.145		0.039	1	0.0347	J	0.037	1	ND	U	0.043	1
Phenanthrene	85-01-8	190,000	mg/kg	0.0492		0.033	1	0.187		0.039	1	2.34		0.039	1	0.319		0.037	1	0.0447		0.043	1
Pyrene	129-00-0	96,000	mg/kg	0.11		0.033	1	0.443		0.039	1	2.65		0.039	1	0.527		0.037	1	0.0956		0.043	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	70		1.9	1	168		2.1	1	394		1.9	1	441		1.9	1	641		4	2

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH_14-25				BH_14-26				BH_14-27				BH_14-28				BH_14-29			
			Sample ID	AOI-5_BH_14-25_0-2'				AOI-5_BH_14-26_0-2'				AOI-5_BH_14-27_0-2'				AOI-5_BH_14-28_0-2'				AOI-5_BH_14-29_0-2'			
			Sample Date	6/18/2014				6/19/2014				6/19/2014				6/19/2014				6/19/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	0.0036		0.0034	1	ND	U	0.0031	1	ND	U	0.0023	1	ND	U	0.0017	1	ND	U	0.0031	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0042	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.0027	1	ND	U	0.003	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0017	1	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.00086	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.00069	J	0.0034	1	ND	U	0.0031	1	ND	U	0.0023	1	ND	U	0.0017	1	ND	U	0.0031	1
Benzene	71-43-2	290	mg/kg	0.006		0.00084	1	ND	U	0.00077	1	ND	U	0.00059	1	1.76		0.057	1	0.0337		0.00077	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0017	1	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.00086	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.00058	J	0.0084	1	ND	U	0.0077	1	ND	U	0.0059	1	ND	U	0.0043	1	0.0008	J	0.0077	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0017	1	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.00086	1	ND	U	0.0015	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0017	1	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.00086	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0017	1	ND	U	0.0015	1	ND	U	0.0012	1	ND	U	0.00086	1	ND	U	0.0015	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.659		0.053	1	0.0562	J	0.071	2	0.0481	J	0.073	2	0.0565		0.036	1	0.424		0.04	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	1.47		0.053	1	0.176		0.071	2	0.145		0.073	2	0.227		0.036	1	1.54		0.04	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	1.29		0.053	1	0.207		0.071	2	0.173		0.073	2	0.241		0.036	1	1.71		0.04	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	1.28		0.053	1	0.268		0.071	2	0.229		0.073	2	0.319		0.036	1	2.13		0.04	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.983		0.053	1	0.176		0.071	2	0.151		0.073	2	0.183		0.036	1	1.34		0.04	1
Chrysene	218-01-9	760	mg/kg	2.16		0.053	1	0.205		0.071	2	0.207		0.073	2	0.275		0.036	1	1.71		0.04	1
Fluorene	86-73-7	130,000	mg/kg	0.519		0.053	1	ND	U	0.071	2	ND	U	0.073	2	ND	U	0.036	1	0.117		0.04	1
Naphthalene**	91-20-3	760	mg/kg	0.149		0.053	1	ND	U	0.071	2	ND	U	0.073	2	ND	U	0.036	1	0.0902		0.04	1
Phenanthrene	85-01-8	190,000	mg/kg	3.67		0.053	1	0.109		0.071	2	0.121		0.073	2	0.178		0.036	1	1.72		0.04	1
Pyrene	129-00-0	96,000	mg/kg	3.02		0.053	1	0.289		0.071	2	0.236		0.073	2	0.388		0.036	1	2.54		0.04	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	1200		4.1	2	51.2		1.9	1	60.7		1.9	1	153		1.9	1	1330		2.4	1

Notes:
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MSC - Medium Specific Concentration
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Q - Qualifier
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH_14-30				BH_14-31				BH_14-32				BH_14-33				BH_14-34			
			Sample ID	AOI-5_BH_14-30_0-2'				AOI-5_BH_14-31_0-2'				AOI-5-BH_14-32_0-2'				AOI-5-BH_14-33_0-2'				AOI-5-BH_14-34_0-2'			
			Sample Date	6/19/2014				6/19/2014				6/17/2014				6/17/2014				6/17/2014			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0021	1	ND	U	0.003	1	ND	U	0.0028	1	0.133	J	0.32	1	0.262		0.2	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0029	1	ND	U	0.007	1	ND	U	0.0029	1	ND	U	0.003	1	ND	U	0.003	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.16	1	ND	U	0.1	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0021	1	ND	U	0.003	1	ND	U	0.0028	1	0.0497	J	0.32	1	0.0746	J	0.2	1
Benzene	71-43-2	290	mg/kg	3.13		0.068	1	0.125		0.00076	1	ND	U	0.00071	1	0.127		0.08	1	0.348		0.05	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	ND	U	0.0014	1	0.0978	J	0.16	1	0.267		0.1	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.00027	J	0.0052	1	ND	U	0.0076	1	ND	U	0.0071	1	59.5		4	1	39.2		2.5	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	ND	U	0.0014	1	ND	U	0.16	1	ND	U	0.1	1
Toluene	108-88-3	10,000	mg/kg	0.0019		0.001	1	ND	U	0.0015	1	ND	U	0.0014	1	0.128	J	0.16	1	0.396		0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.001	1	ND	U	0.0015	1	ND	U	0.0014	1	0.389		0.16	1	0.837		0.1	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.1		0.076	2	0.483		0.047	1	0.104		0.038	1	3.04		0.037	1	4.6		0.39	1
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.294		0.076	2	2.24		0.047	1	0.343		0.038	1	13.3		0.37	10	8.32		0.39	1
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.281		0.076	2	2.38		0.047	1	0.481		0.038	1	**12.5**		0.37	10	7.66		0.39	1
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.373		0.076	2	2.95		0.047	1	0.544		0.038	1	16.2		0.37	10	9.66		0.39	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.227		0.076	2	1.62		0.047	1	0.317		0.038	1	3.57		0.037	1	3.83		0.39	1
Chrysene	218-01-9	760	mg/kg	0.374		0.076	2	2.23		0.047	1	0.362		0.038	1	14.5		0.37	10	8.93		0.39	1
Fluorene	86-73-7	130,000	mg/kg	0.0403	J	0.076	2	0.145		0.047	1	0.0359	J	0.038	1	2.67		0.037	1	5.09		0.39	1
Naphthalene**	91-20-3	760	mg/kg	0.06	J	0.076	2	0.0775		0.047	1	0.0849		0.038	1	0.555		0.037	1	2.18		0.39	1
Phenanthrene	85-01-8	190,000	mg/kg	0.337		0.076	2	2.1		0.047	1	0.489		0.038	1	31		0.37	10	28.3		0.39	1
Pyrene	129-00-0	96,000	mg/kg	0.597		0.076	2	3.31		0.047	1	0.453		0.038	1	25.6		0.37	10	17.3		0.39	1
Metals																							
Lead*	7439-92-1	2,240	mg/kg	350		2	1	1980		1.9	1	344		1.9	1	1520		2.1	1	1140		4.1	2

Notes:
CAS No - Chemical Abstracts Service Registry Number
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ND - Not Detected
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ft bgs - feet below ground surface
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[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:

10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.

10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	BH_14-35				BH_14-36				BH_14-37				BH-14-38				GP1209-PP			
			Sample ID	AOI-5-BH_14-35_0-2'				AOI-5_BH_14-36_0-2'				AOI-5_BH_14-37_0-2'				BH-14-38_0-2'				GP1209-PP-0.5			
			Sample Date	6/17/2014				6/18/2014				6/19/2014				6/26/2014				1/23/2012			
			Sample Depth (ft bgs)	0-2				0-2				0-2				0-2				0.5-1			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0029	1	ND	U	0.0018	1	ND	U	0.0021	1	ND	U	0.002	1	ND	U	0.073	55.03
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.003	1	ND	U	0.0054	1	ND	U	0.0029	1	ND	U	0.0029	1	ND	U	0.073	55.03
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0014	1	ND	U	0.00088	1	ND	U	0.001	1	ND	U	0.001	1	ND	U	0.073	55.03
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0029	1	ND	U	0.0018	1	ND	U	0.0021	1	ND	U	0.002	1	ND	U	0.073	55.03
Benzene	71-43-2	290	mg/kg	ND	U	0.00071	1	0.0032		0.00044	1	0.0727		0.00052	1	ND	U	0.0005	1	2.2		0.036	55.03
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0014	1	ND	U	0.00088	1	ND	U	0.001	1	ND	U	0.001	1	ND	U	0.073	55.03
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0071	1	ND	U	0.0044	1	ND	U	0.0052	1	ND	U	0.005	1	4.1		0.073	55.03
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0014	1	ND	U	0.00088	1	ND	U	0.001	1	ND	U	0.001	1	ND	U	0.036	55.03
Toluene	108-88-3	10,000	mg/kg	0.00053	J	0.0014	1	ND	U	0.00088	1	ND	U	0.001	1	ND	U	0.001	1	ND	U	0.073	55.03
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0014	1	ND	U	0.00088	1	ND	U	0.001	1	ND	U	0.001	1	ND	U	0.073	55.03
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.592		0.037	1	0.227		0.032	1	0.503		0.038	1	0.0209	J	0.038	1	ND	U	0.0088	10
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.945		0.037	1	1.24		0.032	1	1.99		0.038	1	0.0298	J	0.038	1	0.016	J	0.0044	10
Benzo(A)Pyrene	50-32-8	12	mg/kg	1.31		0.037	1	1.13		0.032	1	2.94		0.038	1	0.0319	J	0.038	1	0.02		0.0044	10
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	1.58		0.037	1	1.25		0.032	1	3.11		0.038	1	0.0386		0.038	1	0.017		0.0035	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.854		0.037	1	0.591		0.032	1	1.7		0.038	1	0.0411		0.038	1	0.033	J	0.026	10
Chrysene	218-01-9	760	mg/kg	1.14		0.037	1	1.02		0.032	1	2.21		0.038	1	0.0316	J	0.038	1	ND	U	0.04	10
Fluorene	86-73-7	130,000	mg/kg	0.429		0.037	1	0.0171	J	0.032	1	0.129		0.038	1	ND	U	0.038	1	ND	U	0.044	10
Naphthalene**	91-20-3	760	mg/kg	1.2		0.037	1	0.0765		0.032	1	0.461		0.038	1	ND	U	0.038	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	1.52		0.037	1	0.19		0.032	1	0.84		0.038	1	0.0321	J	0.038	1	0.028	J	0.026	10
Pyrene	129-00-0	96,000	mg/kg	1.64		0.037	1	1.43		0.032	1	2.8		0.038	1	0.0447		0.038	1	0.049	J	0.044	10
Metals																							
Lead*	7439-92-1	2,240	mg/kg	376		2.1	1	37.9		1.9	1	181		2.3	1	222		4.1	1	22.2		0.29	1

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	GP1212-PP				GPBR_08212014_B17C				GPBR_08212014_B18C				GPBR_08212014_B19C				GPBR_08212014_B3			
			Sample ID	GP1212-PP-0.5				GPBR_017C_08-21-2014(PH3B)				GPBR_018C_08-21-2014(PH3B)				GPBR_019C_08-21-2014(PH3B)				GPBR_014G_08-21-2014(PH3B-3)			
			Sample Date	1/23/2012				8/21/2014				8/21/2014				8/21/2014				8/21/2014			
			Sample Depth (ft bgs)	0.5-1				1-2				1-2				1-2				1-2			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.005	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.0031	1
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.0025	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.005	1
Benzene	71-43-2	290	mg/kg	0.034		0.001	1.62	NA				NA				NA				ND	U	0.0012	1
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.0025	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.033		0.002	1.62	NA				NA				NA				ND	U	0.012	1
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.001	1.62	NA				NA				NA				ND	U	0.0025	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.0025	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.002	1.62	NA				NA				NA				ND	U	0.0025	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	190,000	mg/kg	0.042		0.0084	10	0.172		0.036	1	0.324		0.039	1	0.135		0.037	1	NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	0.16		0.0042	10	0.408		0.036	1	1.24		0.039	1	0.488		0.037	1	NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	0.17		0.0042	10	0.478		0.036	1	1.12		0.039	1	0.571		0.037	1	NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	0.14		0.0034	10	0.569		0.036	1	1.67		0.039	1	0.779		0.037	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.24		0.025	10	0.303		0.036	1	0.777		0.039	1	0.393		0.037	1	NA			
Chrysene	218-01-9	760	mg/kg	0.23		0.038	10	0.55		0.036	1	1.44		0.039	1	0.715		0.037	1	NA			
Fluorene	86-73-7	130,000	mg/kg	ND	U	0.042	10	0.063		0.036	1	0.0789		0.039	1	0.0308	J	0.037	1	NA			
Naphthalene**	91-20-3	760	mg/kg	NA				0.179		0.036	1	0.277		0.039	1	0.0607		0.037	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.16		0.025	10	0.357		0.036	1	1.26		0.039	1	0.485		0.037	1	NA			
Pyrene	129-00-0	96,000	mg/kg	0.26		0.042	10	0.835		0.036	1	2.07		0.039	1	1		0.037	1	NA			
Metals																							
Lead*	7439-92-1	2,240	mg/kg	110		0.267	1	380		2.3	1	1020		2.4	1	816		2.3	1	NA			

Notes:
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ND - Not Detected
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ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	GPBR_08212014_B5				GPBR_08212014_B8				AOI5-16-1-0-2-021016				GP-1208-LINE-1				GP-1208-LINE-2				GP-1208-LINE-3			
			Sample ID	GPBR_015G_08-21-2014(PH3B-5)				GPBR_016G_08-21-2014(PH3B-8)				AOI5-16-1-0-2-021016				GP-1208-LINE-1				GP-1208-LINE-2				GP-1208-LINE-3			
			Sample Date	8/21/2014				8/21/2014				2/10/2016				5/30/2007				5/30/2007				5/30/2007			
			Sample Depth (ft bgs)	1-2				1-2				0-2				0-0.5				0-0.5				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																											
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	ND	U	0.0025	1	ND	U	0.0052	1	NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	ND	U	0.0029	1	ND	U	0.0029	1	NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	ND	U	0.0012	1	ND	U	0.0026	1	NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0025	1	ND	U	0.0052	1	NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	ND	U	0.00062	1	ND	U	0.0013	1	NA				2.4	D	0.21	50	1	D	0.19	50	0.75	D	0.17	50
Ethylbenzene	100-41-4	890	mg/kg	ND	U	0.0012	1	ND	U	0.0026	1	NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0062	1	ND	U	0.013	1	NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	ND	U	0.0012	1	ND	U	0.0026	1	NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0012	1	ND	U	0.0026	1	NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	ND	U	0.0012	1	ND	U	0.0026	1	NA				NA				NA				NA			
Semi-Volatile Organic Compounds																											
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				0.3		0.0073	1	NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA				NA				NA			
Metals																											
Lead*	7439-92-1	2,240	mg/kg	NA				NA				121		0.31	1	NA				NA				NA			

Notes:
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DF - Dilution Factor
ND - Not Detected
NA - Not Analyzed
ft bgs - feet below ground surface
*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

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J - Estimated value. Result between method detection and reporting limits
E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10 DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 4
Summary of Surface Soil Sample Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Surface Soil Direct Contact MSC[1]	Location ID	GP-1208-LINE-4				GP-1208-LINE-5				GP-1208-LINE-6				GP-1208-LINE-7			
			Sample ID	GP-1208-LINE-4				GP-1208-LINE-5				GP-1208-LINE-6				GP-1208-LINE-7			
			Sample Date	5/30/2007				5/30/2007				5/30/2007				5/30/2007			
			Sample Depth (ft bgs)	0-0.5				0-0.5				0-0.5				0-0.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds																			
1,2,4-Trimethylbenzene	95-63-6	560	mg/kg	NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	3.7	mg/kg	NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	86	mg/kg	NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA			
Benzene	71-43-2	290	mg/kg	0.93	D	0.23	50	ND	U,D	0.26	50	0.2	J,D	0.22	50	1.9	D	0.25	50
Ethylbenzene	100-41-4	890	mg/kg	NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	8,600	mg/kg	NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	8,000	mg/kg	NA				NA				NA				NA			
Semi-Volatile Organic Compounds																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	130	mg/kg	NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	12	mg/kg	NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	76	mg/kg	NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA			
Chrysene	218-01-9	760	mg/kg	NA				NA				NA				NA			
Fluorene	86-73-7	130,000	mg/kg	NA				NA				NA				NA			
Naphthalene**	91-20-3	760	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA			
Pyrene	129-00-0	96,000	mg/kg	NA				NA				NA				NA			
Metals																			
Lead*	7439-92-1	2,240	mg/kg	NA				NA				NA				NA			

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
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*Site Specific Standard for lead is 2,240 mg/kg

[1]PADEP Non-Residential Direct Contact MSC for surface soils (0-2 feet below ground surface) (last updated August 27, 2016).

**Naphthalene was analyzed either as a semi volatile organic compound (analytical method SW8270C SIM) or volatile organic compound (analytical method SW8260B or SW8021B). Naphthalene results are presented on this table as semi-volatile organic compounds. In the event that both methods were used for one sample, the lower of the two detection limits was used.

Qualifiers:
U - The compound was analyzed but not detected
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E - Compound was over the calibration range
D- Indicates a dilution

Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC or the site-specific standard for lead.
10	DL exceeds the PADEP Non-Residential Surface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	A-169				A-170				A-171				A-172			
			Sample ID	PH-AOI5_A-169_2-4_06172014				A-170_4-6'				A-171_4-6'				PH-AOI5_A-172_2-3_06172014			
			Sample Date	6/17/14				6/24/14				6/25/14				6/17/14			
			Sample Depth (ft bgs)	2-4				4-6				4-6				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.086	J	0.23	1	0.00054	J	0.0016	1	ND	U	0.0018	1	0.00079	J	0.0034	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0062	1	ND	U	0.0029	1	ND	U	0.003	1	ND	U	0.004	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.12	1	ND	U	0.00082	1	ND	U	0.00089	1	ND	U	0.0017	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.23	1	ND	U	0.0016	1	ND	U	0.0018	1	ND	U	0.0034	1
Benzene	71-43-2	330	mg/kg	0.0949		0.058	1	ND	U	0.00041	1	ND	U	0.00045	1	0.00052	J	0.00086	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.0864	J	0.12	1	0.00062	J	0.00082	1	ND	U	0.00089	1	0.00075	J	0.0017	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	17.3		0.58	1	0.0185		0.0041	1	ND	U	0.0045	1	0.0034	J	0.0086	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.12	1	ND	U	0.00082	1	ND	U	0.00089	1	ND	U	0.0017	1
Toluene	108-88-3	10,000	mg/kg	0.134		0.12	1	ND	U	0.00082	1	ND	U	0.00089	1	0.0012	J	0.0017	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.282		0.12	1	0.0014		0.00082	1	ND	U	0.00089	1	0.0033		0.0017	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.261		0.041	1	0.153		0.037	1	0.45		0.04	1	0.157		0.053	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.132		0.041	1	0.363		0.037	1	1.31		0.04	1	0.317		0.053	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.104		0.041	1	0.375		0.037	1	1.48		0.04	1	0.409		0.053	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.151		0.041	1	0.437		0.037	1	1.64		0.04	1	0.497		0.053	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.0456		0.041	1	0.497		0.037	1	0.905		0.04	1	0.306		0.053	1
Chrysene	218-01-9	190,000	mg/kg	0.357		0.041	1	0.388		0.037	1	1.25		0.04	1	0.367		0.053	1
Fluorene	86-73-7	190,000	mg/kg	5.41		0.16	4	0.108		0.037	1	ND	U	0.04	1	0.174		0.053	1
Naphthalene	91-20-3	190,000	mg/kg	ND	U	0.041	1	ND	U	0.037	1	0.187		0.04	1	0.253		0.053	1
Phenanthrene	85-01-8	190,000	mg/kg	2.72		0.041	1	0.491		0.037	1	0.874		0.04	1	0.457		0.053	1
Pyrene	129-00-0	190,000	mg/kg	0.359		0.041	1	0.696		0.037	1	1.94		0.04	1	0.318		0.053	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	148		2.4	1	61.8		2	1	37.3		2.2	1	170		2	1

Notes:
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DF - Dilution Factor
ND - Not Detected
NA- Not Analyzed
ft bgs - feet below ground surface
[1] PADEP Act 2 Non-Residental Subsurface Soil Direct Contact MSCs (last updated August 27, 2016).

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
D - Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	A-173				A-185				A-186				AOI5 BH-01-12			
			Sample ID	A-173_4-6'				A-185_6-8'				A-186_4-6'				BH-01-12_2-2.5			
			Sample Date	6/25/14				6/24/14				6/27/14				8/8/12			
			Sample Depth (ft bgs)	4-6				6-8				4-6				2-2.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.0006	J	0.0025	1	ND	U	0.0028	1	ND	U	0.0021	1	0.75		0.06	49.09
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0034	1	ND	U	0.0033	1	ND	U	0.0031	1	ND	U	0.06	49.09
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0013	1	ND	U	0.0014	1	ND	U	0.0011	1	ND	U	0.06	49.09
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0025	1	ND	U	0.0028	1	ND	U	0.0021	1	0.34		0.06	49.09
Benzene	71-43-2	330	mg/kg	ND	U	0.00063	1	0.0017		0.00069	1	ND	U	0.00053	1	0.34		0.03	49.09
Ethylbenzene	100-41-4	1,000	mg/kg	0.00033	J	0.0013	1	0.00033	J	0.0014	1	ND	U	0.0011	1	0.29	J	0.06	49.09
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0063	1	ND	U	0.0069	1	ND	U	0.0053	1	6.2		0.06	49.09
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0013	1	0.0011	J	0.0014	1	ND	U	0.0011	1	ND	U	0.03	49.09
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0013	1	0.0006	J	0.0014	1	ND	U	0.0011	1	0.47		0.06	49.09
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.001	J	0.0013	1	0.0022		0.0014	1	ND	U	0.0011	1	1.6		0.06	49.09
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	ND	U	0.046	1	0.718		0.21	1	ND	U	0.037	1	14		0.2	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.95		0.046	1	0.933		0.21	1	ND	U	0.037	1	7.9		0.2	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	2.27		0.046	1	0.926		0.21	1	ND	U	0.037	1	4.8		0.2	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.27		0.046	1	1.07		0.21	1	ND	U	0.037	1	5.1		0.2	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.42		0.046	1	0.54		0.21	1	ND	U	0.037	1	2.6		0.2	10
Chrysene	218-01-9	190,000	mg/kg	1.8		0.046	1	2.28		0.21	1	ND	U	0.037	1	9.7		0.2	10
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.046	1	1.06		0.21	1	ND	U	0.037	1	54		0.2	10
Naphthalene	91-20-3	190,000	mg/kg	0.387		0.046	1	ND	U	0.21	1	ND	U	0.037	1	15		0.2	10
Phenanthrene	85-01-8	190,000	mg/kg	ND	U	0.046	1	1.71		0.21	1	ND	U	0.037	1	86		0.2	10
Pyrene	129-00-0	190,000	mg/kg	2.16		0.046	1	3.8		0.21	1	ND	U	0.037	1	17		0.2	10
Metals																			
Lead	7439-92-1	190,000	mg/kg	140		2.6	1	330		2.2	1	99.3		2.2	1	358		0.0529	10

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA- Not Analyzed
ft bgs - feet below ground surface
[1] PADEP Act 2 Non-Residental Subsurface Soil Direct Contact MSCs (last updated August 27, 2016).

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
D - Indicates a dilution

Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-02-12				AOI5 BH-03-12				AOI5 BH-04-12				AOI5 BH-07-12			
			Sample ID	BH-02-12_2.5-3				BH-03-12_2.5-3				BH-04-12_2-2.5				BH-07-12_3-3.5			
			Sample Date	8/8/12				8/7/12				8/7/12				8/6/12			
			Sample Depth (ft bgs)	2.5-3				2.5-3				2-2.5				3-3.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.002	1.19	0.067		0.005	0.83	1.6	J	0.48	375.17	0.33		0.062	44.25
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.002	1.19	ND	U	0.005	0.83	ND	U	0.48	375.17	ND	U	0.062	44.25
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.002	1.19	ND	U	0.005	0.83	ND	U	0.48	375.17	ND	U	0.062	44.25
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.002	1.19	0.16		0.005	0.83	0.51	J	0.48	375.17	0.16	J	0.062	44.25
Benzene	71-43-2	330	mg/kg	ND	U	0.0008	1.19	ND	U	0.005	0.83	0.86	J	0.24	375.17	ND	U	0.031	44.25
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.002	1.19	0.007		0.005	0.83	1.5	J	0.48	375.17	ND	U	0.062	44.25
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.002	1.19	0.86		0.28	46.61	ND	U	0.48	375.17	0.27	J	0.062	44.25
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0008	1.19	ND	U	0.005	0.83	ND	U	0.24	375.17	ND	U	0.031	44.25
Toluene	108-88-3	10,000	mg/kg	ND	U	0.002	1.19	0.007		0.005	0.83	3.3		0.48	375.17	ND	U	0.062	44.25
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.002	1.19	0.025		0.005	0.83	10		0.48	375.17	ND	U	0.062	44.25
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	2.1		0.024	5	ND	U	1	10	12		0.21	10	0.83		0.14	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.8		0.024	5	ND	U	1	10	3.3		0.21	10	0.93		0.14	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.8		0.024	5	ND	U	1	10	1.6		0.21	10	0.48	J	0.14	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.2		0.024	5	ND	U	1	10	2.7		0.21	10	0.53	J	0.14	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.3		0.024	5	ND	U	1	10	1	J	0.21	10	0.46	J	0.14	1
Chrysene	218-01-9	190,000	mg/kg	1.8		0.024	5	1.4		1	10	4.1		0.21	10	1.8		0.14	1
Fluorene	86-73-7	190,000	mg/kg	1.3		0.024	5	ND	U	1	10	37		0.21	10	0.87		0.14	1
Naphthalene	91-20-3	190,000	mg/kg	9.1		0.024	5	ND	U	1	10	8.6		0.21	10	0.43	J	0.14	1
Phenanthrene	85-01-8	190,000	mg/kg	5.4		0.024	5	2.5		1	10	84		0.21	10	2.4		0.14	1
Pyrene	129-00-0	190,000	mg/kg	2.4		0.024	5	1.6		1	10	11		0.21	10	4.7		0.14	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	179		0.0312	5	56.9		0.237	2	1610		0.276	50	111		0.0121	2

Notes:
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ft bgs - feet below ground surface
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-10-12				AOI5 BH-14-12				AOI5 BH-15-12				AOI5 BH-16-12			
			Sample ID	BH-10-12_4.5-5				BH-14-12_3.5-4				BH-15-12_4-4.5				BH-16-12_3.5-4			
			Sample Date	8/9/12				8/7/12				8/7/12				8/7/12			
			Sample Depth (ft bgs)	4.5-5				3.5-4				4-4.5				3.5-4			
			Unit	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.001	0.99	0.005	J	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.001	0.99	ND	U	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.001	0.99	ND	U	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.001	0.99	0.003	J	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
Benzene	71-43-2	330	mg/kg	0.025		0.0006	0.99	0.008		0.0006	0.95	ND	U	0.001	1.77	ND	U	0.005	0.81
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.001	0.99	0.003	J	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.001	0.99	0.004	J	0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0006	0.99	ND	U	0.0006	0.95	ND	U	0.001	1.77	ND	U	0.005	0.81
Toluene	108-88-3	10,000	mg/kg	ND	U	0.001	0.99	0.012		0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.001	0.99	0.012		0.001	0.95	ND	U	0.002	1.77	ND	U	0.005	0.81
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.42		0.02	5	0.48		0.044	10	0.098	J	0.041	10	0.36		0.019	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.2		0.02	5	1.2		0.044	10	0.36		0.041	10	1.3		0.019	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.1		0.02	5	1.4		0.044	10	0.28		0.041	10	1.2		0.019	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.6		0.02	5	1.7		0.044	10	0.43		0.041	10	1.4		0.019	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.95		0.02	5	1.4		0.044	10	0.2	J	0.041	10	0.75		0.019	1
Chrysene	218-01-9	190,000	mg/kg	1.4		0.02	5	1.3		0.044	10	0.66		0.041	10	1.2		0.019	1
Fluorene	86-73-7	190,000	mg/kg	0.077	J	0.02	5	0.14	J	0.044	10	ND	U	0.041	10	0.13		0.019	1
Naphthalene	91-20-3	190,000	mg/kg	0.87		0.02	5	1.6		0.044	10	0.32		0.041	10	0.044		0.019	1
Phenanthrene	85-01-8	190,000	mg/kg	1.6		0.02	5	1.1		0.044	10	0.58		0.041	10	1.3		0.019	1
Pyrene	129-00-0	190,000	mg/kg	1.8		0.02	5	1.4		0.044	10	0.51		0.041	10	2		0.019	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	1730		0.269	50	164		0.0286	5	120		0.0259	5	160		0.557	5

Notes:
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ft bgs - feet below ground surface
[1] PADEP Act 2 Non-Residental Subsurface Soil Direct Contact MSCs (last updated August 27, 2016).

Qualifiers:
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-20-12				AOI5 BH-21-12				AOI5 BH-31-12				AOI5 BH-34-12			
			Sample ID	BH-20-12_3.5-4				BH-21-12_5.5-6				BH-31-12_3-3.5				BH-34-12_4-4.5			
			Sample Date	8/6/12				8/6/12				8/8/12				8/7/12			
			Sample Depth (ft bgs)	3.5-4				5.5-6				3-3.5				4-4.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.003	J	0.001	0.96	0.005	J	0.002	0.94	0.001	J	0.001	0.92	ND	U	0.001	1.09
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.001	0.96	ND	U	0.002	0.94	ND	U	0.001	0.92	ND	U	0.001	1.09
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.001	0.96	ND	U	0.002	0.94	ND	U	0.001	0.92	ND	U	0.001	1.09
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.002	J	0.001	0.96	0.002	J	0.002	0.94	ND	U	0.001	0.92	ND	U	0.001	1.09
Benzene	71-43-2	330	mg/kg	ND	U	0.0007	0.96	0.002	J	0.0008	0.94	0.001	J	0.0007	0.92	0.012		0.0007	1.09
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.001	0.96	ND	U	0.002	0.94	ND	U	0.001	0.92	ND	U	0.001	1.09
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.003	J	0.001	0.96	0.056		0.002	0.94	0.002	J	0.001	0.92	ND	U	0.001	1.09
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0007	0.96	ND	U	0.0008	0.94	ND	U	0.0007	0.92	ND	U	0.0007	1.09
Toluene	108-88-3	10,000	mg/kg	ND	U	0.001	0.96	0.002	J	0.002	0.94	0.002	J	0.001	0.92	0.002	J	0.001	1.09
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.004	J	0.001	0.96	0.013		0.002	0.94	0.001	J	0.001	0.92	0.021		0.001	1.09
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	1.5		0.049	10	3.3		0.057	10	1.3		0.026	5	0.65		0.044	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	2.1		0.049	10	4.1		0.057	10	0.98		0.026	5	2.4		0.044	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	2.6		0.049	10	4.1		0.057	10	0.95		0.026	5	2.5		0.044	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.7		0.049	10	3.8		0.057	10	1		0.026	5	2.8		0.044	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	2.1		0.049	10	2.6		0.057	10	0.78		0.026	5	1.7		0.044	10
Chrysene	218-01-9	190,000	mg/kg	2.7		0.049	10	5.5		0.057	10	1.3		0.026	5	2.3		0.044	10
Fluorene	86-73-7	190,000	mg/kg	1.3		0.049	10	1.8		0.057	10	1.4		0.026	5	0.21	J	0.044	10
Naphthalene	91-20-3	190,000	mg/kg	10		0.049	10	14		0.057	10	5.9		0.026	5	0.2	J	0.044	10
Phenanthrene	85-01-8	190,000	mg/kg	4.1		0.049	10	5.7		0.057	10	4.5		0.026	5	2.3		0.044	10
Pyrene	129-00-0	190,000	mg/kg	2.3		0.049	10	6.5		0.057	10	1.6		0.026	5	3.4		0.044	10
Metals																			
Lead	7439-92-1	190,000	mg/kg	377		0.063	10	314		0.037	5	152		0.0332	5	1340		0.282	50

Notes:
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Qualifiers:
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-35-12				AOI5 BH-36-12				AOI5 BH-37-12				AOI5 BH-38-12			
			Sample ID	BH-35-12_2.5-3				BH-36-12_3.5-4				BH-37-12_2-2.5				BH-38-12_3-3.5			
			Sample Date	8/8/12				8/7/12				8/8/12				8/7/12			
			Sample Depth (ft bgs)	2.5-3				3.5-4				2-2.5				3-3.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.005	0.84	0.003	J	0.001	0.92	0.29	J	0.094	67.4	0.003	J	0.002	1.36
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.005	0.84	ND	U	0.001	0.92	ND	U	0.094	67.4	0.002	J	0.002	1.36
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.005	0.84	ND	U	0.001	0.92	ND	U	0.094	67.4	ND	U	0.002	1.36
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.005	0.84	0.002	J	0.001	0.92	ND	U	0.094	67.4	0.002	J	0.002	1.36
Benzene	71-43-2	330	mg/kg	ND	U	0.005	0.84	0.039		0.0006	0.92	ND	U	0.047	67.4	0.005	J	0.0009	1.36
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.005	0.84	ND	U	0.001	0.92	ND	U	0.094	67.4	ND	U	0.002	1.36
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.005	0.84	ND	U	0.001	0.92	ND	U	0.094	67.4	ND	U	0.002	1.36
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.005	0.84	ND	U	0.0006	0.92	ND	U	0.047	67.4	ND	U	0.0009	1.36
Toluene	108-88-3	10,000	mg/kg	ND	U	0.005	0.84	0.014		0.001	0.92	ND	U	0.094	67.4	0.004	J	0.002	1.36
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.018		0.005	0.84	0.009		0.001	0.92	0.11	J	0.094	67.4	0.002	J	0.002	1.36
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.15		0.11	5	0.18	J	0.043	10	0.21		0.023	5	0.13	J	0.046	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.68		0.11	5	0.29		0.043	10	0.63		0.023	5	0.53		0.046	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.69		0.11	5	0.42		0.043	10	0.6		0.023	5	0.55		0.046	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.95		0.11	5	0.46		0.043	10	0.87		0.023	5	0.64		0.046	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.53		0.11	5	1		0.043	10	0.54		0.023	5	0.43		0.046	10
Chrysene	218-01-9	190,000	mg/kg	0.78		0.11	5	0.44		0.043	10	0.67		0.023	5	0.52		0.046	10
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.11	5	0.056	J	0.043	10	0.21		0.023	5	0.096	J	0.046	10
Naphthalene	91-20-3	190,000	mg/kg	0.78		0.11	5	0.28		0.043	10	1.2		0.023	5	0.83		0.046	10
Phenanthrene	85-01-8	190,000	mg/kg	0.86		0.11	5	0.28		0.043	10	0.96		0.023	5	0.49		0.046	10
Pyrene	129-00-0	190,000	mg/kg	1.2		0.11	5	0.34		0.043	10	0.92		0.023	5	0.55		0.046	10
Metals																			
Lead	7439-92-1	190,000	mg/kg	660		2.4	20	254		0.0283	5	2230		0.305	50	2890		0.299	50

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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5 BH-39-12				AOI5 BH-40-12				AOI5_BH-13-08				AOI5_BH-13-15			
			Sample ID	BH-39-12_2-2.5				BH-40-12_3-3.5				AOI5_BH-13-08_3.5-4_031113				AOI5_BH-13-15_4.5-5_031113			
			Sample Date	8/7/12				8/7/12				3/11/13				3/11/13			
			Sample Depth (ft bgs)	2-2.5				3-3.5				3.5-4				4.5-5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.002	J	0.001	0.93	ND	U	0.001	0.94	ND	U	0.0047	1	ND	U	0.005	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.001	0.93	ND	U	0.001	0.94	ND	U	0.00094	1	ND	U	0.00099	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.001	0.93	ND	U	0.001	0.94	ND	U	0.00094	1	ND	U	0.00099	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.001	J	0.001	0.93	ND	U	0.001	0.94	ND	U	0.0047	1	ND	U	0.005	1
Benzene	71-43-2	330	mg/kg	0.021		0.0006	0.93	0.021		0.0006	0.94	ND	U	0.00094	1	ND	U	0.00099	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.001	J	0.001	0.93	0.002	J	0.001	0.94	ND	U	0.00094	1	ND	U	0.00099	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.001	0.93	ND	U	0.001	0.94	ND	U	0.0047	1	ND	U	0.005	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0006	0.93	ND	U	0.0006	0.94	ND	U	0.00094	1	ND	U	0.00099	1
Toluene	108-88-3	10,000	mg/kg	0.013		0.001	0.93	0.014		0.001	0.94	ND	U	0.00094	1	ND	U	0.00099	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.008		0.001	0.93	0.009		0.001	0.94	ND	U	0.00094	1	ND	U	0.00099	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.2	J	0.04	10	0.41		0.046	10	ND	U	0.036	1	0.0631		0.038	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.57		0.04	10	1.5		0.046	10	ND	U	0.036	1	0.0985		0.038	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.78		0.04	10	1.6		0.046	10	ND	U	0.036	1	0.0824		0.038	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.99		0.04	10	2		0.046	10	ND	U	0.036	1	0.112		0.038	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.94		0.04	10	1.3		0.046	10	ND	U	0.036	1	0.0524		0.038	1
Chrysene	218-01-9	190,000	mg/kg	0.68		0.04	10	1.8		0.046	10	ND	U	0.036	1	0.1		0.038	1
Fluorene	86-73-7	190,000	mg/kg	0.084	J	0.04	10	0.39		0.046	10	ND	U	0.036	1	ND	U	0.038	1
Naphthalene	91-20-3	190,000	mg/kg	0.48		0.04	10	0.98		0.046	10	ND	U	0.036	1	ND	U	0.038	1
Phenanthrene	85-01-8	190,000	mg/kg	0.36		0.04	10	1		0.046	10	ND	U	0.036	1	0.263		0.038	1
Pyrene	129-00-0	190,000	mg/kg	0.72		0.04	10	2.5		0.046	10	ND	U	0.036	1	0.202		0.038	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	3470		0.524	100	1140		0.298	50	34.5		2.1	1	15.6		2	1

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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-16				AOI5_BH-13-17				AOI5_BH-13-22				AOI5_BH-13-24			
			Sample ID	AOI5_BH-13-16_3.5-4_031113				AOI5_BH-13-17_5-5.5_031113				AOI5_BH-13-22_2-2.5_030813				AOI5_BH-13-24_2-2.5_030813			
			Sample Date	3/11/13				3/11/13				3/8/13				3/8/13			
			Sample Depth (ft bgs)	3.5-4				5-5.5				2-2.5				2-2.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.686		0.6	1	ND	U	0.0062	1	ND	U	0.64	1	ND	U	6.4	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.12	1	ND	U	0.0012	1	ND	U	0.13	1	ND	U	1.3	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.12	1	ND	U	0.0012	1	ND	U	0.13	1	ND	U	1.3	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.6	1	ND	U	0.0062	1	ND	U	0.64	1	ND	U	6.4	1
Benzene	71-43-2	330	mg/kg	0.736		0.12	1	ND	U	0.0012	1	0.336		0.13	1	2.31		1.3	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.831		0.12	1	ND	U	0.0012	1	0.275		0.13	1	4.32		1.3	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.6	1	ND	U	0.0062	1	1.72		0.64	1	3160		320	50
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.12	1	ND	U	0.0012	1	ND	U	0.13	1	ND	U	1.3	1
Toluene	108-88-3	10,000	mg/kg	2.2		0.12	1	ND	U	0.0012	1	0.552		0.13	1	4.6		1.3	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	2.83		0.12	1	ND	U	0.0012	1	1.01		0.13	1	14.3		1.3	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.817		0.04	1	0.0931		0.038	1	6.45		0.21	5	3.02		0.19	5
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	3.45		0.04	1	0.19		0.038	1	2.78		0.21	5	1.38		0.19	5
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	3.56		0.04	1	0.17		0.038	1	1.99		0.21	5	0.863		0.19	5
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	3.19		0.08	2	0.256		0.038	1	2.53		0.21	5	1.63		0.19	5
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	2.06		0.04	1	0.155		0.038	1	1.06		0.21	5	0.609		0.19	5
Chrysene	218-01-9	190,000	mg/kg	3.33		0.04	1	0.307		0.038	1	2.95		0.21	5	1.9		0.19	5
Fluorene	86-73-7	190,000	mg/kg	0.322		0.04	1	ND	U	0.038	1	14.7		0.21	5	5.42		0.19	5
Naphthalene	91-20-3	190,000	mg/kg	0.507		0.04	1	0.0508		0.038	1	ND	U	0.21	5	1.37		0.19	5
Phenanthrene	85-01-8	190,000	mg/kg	1.25		0.04	1	0.316		0.038	1	29.3		0.83	20	11.8		0.19	5
Pyrene	129-00-0	190,000	mg/kg	3.81		0.04	1	0.297		0.038	1	9.1		0.21	5	3.88		0.19	5
Metals																			
Lead	7439-92-1	190,000	mg/kg	260		1.9	1	896		2.6	1	80.3		2.5	1	115		2.4	1

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Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-25				AOI5-BH-13-27				AOI5_BH-13-34				AOI5_BH-13-37			
			Sample ID	AOI5_BH-13-25_2.5-3_030813				AO15-BH-13-27-2.5-330713				AOI5_BH-13-34_2.5-3_30613				AOI5_BH-13-37-2.5-3_030513			
			Sample Date	3/8/13				3/7/13				3/6/13				3/5/13			
			Sample Depth (ft bgs)	2.5-3				2.5-3				2.5-3				2.5-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.72		0.55	1	ND	U	0.0056	1	ND	U	170	2.5	ND	U	0.0065	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.11	1	ND	U	0.0011	1	ND	U	***34***	2.5	ND	U	0.0013	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.11	1	ND	U	0.0011	1	ND	U	34	2.5	ND	U	0.0013	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.55	1	ND	U	0.0056	1	ND	U	170	2.5	ND	U	0.0065	1
Benzene	71-43-2	330	mg/kg	1.22		0.11	1	0.0336		0.0011	1	35.3		34	2.5	0.0011	J	0.0013	1
Ethylbenzene	100-41-4	1,000	mg/kg	1.56		0.11	1	ND	U	0.0011	1	ND	U	34	2.5	ND	U	0.0013	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	3.96		0.55	1	0.0445		0.0056	1	**23200**		1700	25	ND	U	0.0065	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.11	1	ND	U	0.0011	1	ND	U	34	2.5	ND	U	0.0013	1
Toluene	108-88-3	10,000	mg/kg	1.58		0.11	1	ND	U	0.0011	1	ND	U	34	2.5	ND	U	0.0013	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	3.66		0.11	1	ND	U	0.0011	1	ND	U	34	2.5	ND	U	0.0013	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	4.99		0.19	5	ND	U	0.042	1	0.218		0.046	1	0.328		0.042	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	5.98		0.19	5	ND	U	0.042	1	0.712		0.046	1	0.921		0.042	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	13.6		0.19	5	0.0689		0.042	1	0.642		0.046	1	0.747		0.042	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	14.1		0.19	5	0.0688		0.042	1	0.841		0.046	1	0.717		0.042	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	9.17		0.19	5	0.0535		0.042	1	0.48		0.046	1	0.451		0.042	1
Chrysene	218-01-9	190,000	mg/kg	7.02		0.19	5	0.107		0.042	1	0.769		0.046	1	0.899		0.042	1
Fluorene	86-73-7	190,000	mg/kg	7.46		0.19	5	ND	U	0.042	1	0.127		0.046	1	0.0746		0.042	1
Naphthalene	91-20-3	190,000	mg/kg	ND	U	0.19	5	ND	U	0.042	1	0.272		0.046	1	0.0579		0.042	1
Phenanthrene	85-01-8	190,000	mg/kg	15.3		0.19	5	0.123		0.042	1	0.979		0.046	1	1.05		0.042	1
Pyrene	129-00-0	190,000	mg/kg	4.53		0.19	5	0.0941		0.042	1	1.1		0.046	1	1.43		0.042	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	42.4		2.3	1	2120		2.8	1	677		2	1	1000		2.8	1

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10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
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AOI 5 Remedial Investigation Report
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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5_BH-13-38				AOI5_BH-13-39				AOI5_BH-13-39				AOI-5_BH-13-40			
			Sample ID	AOI5_BH-13-38_3.5-4_030513				AOI5_BH-13-39_2.5-3_030513				AOI5_BH-13-39_2-2.5_030513				BH-13-40-2-2.5_030413			
			Sample Date	3/5/13				3/5/13				3/5/13				3/4/13			
			Sample Depth (ft bgs)	3.5-4				2.5-3				2-2.5				2-2.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.007	1	0.00049	J	0.0049	1	0.173	J	0.49	1	ND	U	0.0059	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0014	1	ND	U	0.00099	1	ND	U	0.098	1	ND	U	0.0012	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0014	1	ND	U	0.00099	1	ND	U	0.098	1	ND	U	0.0012	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.007	1	ND	U	0.0049	1	0.0466	J	0.49	1	ND	U	0.0059	1
Benzene	71-43-2	330	mg/kg	ND	U	0.0014	1	0.00058	J	0.00099	1	0.21		0.098	1	0.00055	J	0.0012	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.0014	1	0.00041	J	0.00099	1	0.168		0.098	1	ND	U	0.0012	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.007	1	ND	U	0.0049	1	ND	U	0.49	1	ND	U	0.0059	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0014	1	ND	U	0.00099	1	ND	U	0.098	1	ND	U	0.0012	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0014	1	0.0014		0.00099	1	0.372		0.098	1	0.00035	J	0.0012	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.0014	1	0.0022		0.00099	1	0.835		0.098	1	ND	U	0.0012	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.897		0.053	1	0.083		0.045	1	0.335		0.045	1	0.475		0.036	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	2.38		0.053	1	0.146		0.045	1	0.884		0.045	1	1.24		0.036	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	2.1		0.053	1	0.275		0.045	1	0.855		0.045	1	0.948		0.036	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.32		0.053	1	0.307		0.045	1	1.02		0.045	1	0.898		0.036	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.19		0.053	1	0.288		0.045	1	0.605		0.045	1	0.474		0.036	1
Chrysene	218-01-9	190,000	mg/kg	2.4		0.053	1	0.19		0.045	1	0.991		0.045	1	1.29		0.036	1
Fluorene	86-73-7	190,000	mg/kg	0.395		0.053	1	0.0413	J	0.045	1	0.473		0.045	1	0.144		0.036	1
Naphthalene	91-20-3	190,000	mg/kg	0.208		0.053	1	0.111		0.045	1	0.132		0.045	1	0.0524		0.036	1
Phenanthrene	85-01-8	190,000	mg/kg	3.35		0.053	1	0.152		0.045	1	1.12		0.045	1	1.97		0.036	1
Pyrene	129-00-0	190,000	mg/kg	3.67		0.053	1	0.178		0.045	1	1.53		0.045	1	2.35		0.036	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	2950		3.2	1	1740		14	5	1440		2.9	1	269		2.4	1

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Exceedance Summary:

10	Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI-5_BH-13-41				AOI-5_BH-13-42				AOI5_BH-13-43			
			Sample ID	BH-13-41-2-2.5_030413				BH-13-42-2.5-3_030413				BH-13-43-2-2.5_030513			
			Sample Date	3/4/13				3/4/13				3/5/13			
			Sample Depth (ft bgs)	2-2.5				2.5-3				2-2.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)															
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.0046	1	ND	U	0.0037	1	ND	U	0.0054	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0046	1	ND	U	0.0037	1	ND	U	0.0054	1
Benzene	71-43-2	330	mg/kg	0.00058	J	0.00093	1	ND	U	0.00074	1	0.00022	J	0.0011	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0046	1	ND	U	0.0037	1	ND	U	0.0054	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
Toluene	108-88-3	10,000	mg/kg	0.00032	J	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.00093	1	ND	U	0.00074	1	ND	U	0.0011	1
Semi-volatile Organic Compounds (SVOCs)															
Anthracene	120-12-7	190,000	mg/kg	0.116		0.037	1	ND	U	0.039	1	0.0959		0.042	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.309		0.037	1	0.0334	J	0.039	1	0.224		0.042	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.334		0.037	1	0.0339	J	0.039	1	0.381		0.042	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.415		0.037	1	0.0335	J	0.039	1	0.339		0.042	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.298		0.037	1	0.0295	J	0.039	1	0.524		0.042	1
Chrysene	218-01-9	190,000	mg/kg	0.376		0.037	1	0.0338	J	0.039	1	0.312		0.042	1
Fluorene	86-73-7	190,000	mg/kg	0.0947		0.037	1	ND	U	0.039	1	0.0617		0.042	1
Naphthalene	91-20-3	190,000	mg/kg	0.113		0.037	1	ND	U	0.039	1	0.083		0.042	1
Phenanthrene	85-01-8	190,000	mg/kg	0.535		0.037	1	0.0199	J	0.039	1	0.159		0.042	1
Pyrene	129-00-0	190,000	mg/kg	0.532		0.037	1	0.0455		0.039	1	0.269		0.042	1
Metals															
Lead	7439-92-1	190,000	mg/kg	712		2.3	1	232		2.5	1	878		2.7	1

Notes:
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U - The compound was analyzed but not detected
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D - Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	AOI5-BH-14-14				AOI5-BH-14-15				AOI5-BH-14-17				AOI5-BH-14-18			
			Sample ID	AOI-5_14-14_8-9'				AOI-5_14-15_8.0'				AOI-5_14-17_8.0'				AOI-5_14-18_7.0'			
			Sample Date	6/16/14				6/16/14				6/16/14				6/16/14			
			Sample Depth (ft bgs)	8-9				8-8.5				8-8.7				7-7.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND		0.0026	1	0.305	J	0.41	1	0.499		0.37	1	0.156	J	0.39	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND		0.0034	1	ND		0.0042	1	ND		0.0079	1	ND		0.004	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND		0.0013	1	ND		0.21	1	ND		0.19	1	ND		0.19	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND		0.0026	1	0.112	J	0.41	1	0.279	J	0.37	1	0.0673	J	0.39	1
Benzene	71-43-2	330	mg/kg	ND		0.00065	1	3.21		0.1	1	0.537		0.093	1	0.395		0.096	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND		0.0013	1	0.628		0.21	1	0.275		0.19	1	0.144	J	0.19	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND		0.0065	1	3.11		1	1	1.67		0.93	1	0.878	J	0.96	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	0.0026		0.0013	1	ND		0.21	1	ND		0.19	1	0.049	J	0.19	1
Toluene	108-88-3	10,000	mg/kg	ND		0.0013	1	0.892		0.21	1	1.49		0.19	1	0.636		0.19	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.00071	J	0.0013	1	1.63		0.21	1	0.516		0.19	1	0.282		0.19	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	1.38		0.045	1	1.21		0.054	1	NA				ND		0.051	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	8.65		0.45	10	1.3		0.054	1	NA				0.0385	J	0.051	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	10.6		0.45	10	1.1		0.054	1	NA				0.0376	J	0.051	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	11.5		0.45	10	1.13		0.054	1	NA				0.0329	J	0.051	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	5.72		0.45	10	0.563		0.054	1	NA				0.0229	J	0.051	1
Chrysene	218-01-9	190,000	mg/kg	7.82		0.45	10	1.41		0.054	1	NA				0.0351	J	0.051	1
Fluorene	86-73-7	190,000	mg/kg	0.417		0.045	1	1.08		0.054	1	NA				0.0205	J	0.051	1
Naphthalene	91-20-3	190,000	mg/kg	0.891		0.045	1	0.335		0.054	1	NA				ND		0.051	1
Phenanthrene	85-01-8	190,000	mg/kg	2.15		0.045	1	4.13		0.054	1	NA				0.0356	J	0.051	1
Pyrene	129-00-0	190,000	mg/kg	8.85		0.45	10	2.91		0.054	1	NA				0.0718		0.051	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	144		2	1	203		2	1	336		1.9	1	14.5		1.9	1

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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	BH_14-19				BH_14-20				BH_14-21				BH_14-22			
			Sample ID	AOI-5_BH_14-19_6-8'				A0I-5_BH_14_20_6-8'				AOI-5_BH_14-21_4-6'				AOI-5_BH_14-22_4-6'			
			Sample Date	6/18/14				6/24/14				6/18/14				6/18/14			
			Sample Depth (ft bgs)	6-8				6-8				4-6				4-6			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.0032	1	ND	U	0.0033	1	ND	U	0.0031	1	0.00047	J	0.0029	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0061	1	ND	U	0.0081	1	ND	U	0.0079	1	ND	U	0.0036	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0032	1	ND	U	0.0033	1	ND	U	0.0031	1	ND	U	0.0029	1
Benzene	71-43-2	330	mg/kg	0.0031		0.0008	1	ND	U	0.00081	1	0.0021		0.00079	1	ND	U	0.00073	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.008	1	ND	U	0.0081	1	ND	U	0.0079	1	ND	U	0.0073	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0016	1	0.00041	J	0.0016	1	0.0011	J	0.0016	1	0.00076	J	0.0015	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.0016	1	ND	U	0.0016	1	ND	U	0.0016	1	0.00073	J	0.0015	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.0545		0.049	1	ND	U	0.054	1	7.23		0.51	10	0.587		0.048	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.147		0.049	1	ND	U	0.054	1	15		0.51	10	2.27		0.048	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.147		0.049	1	ND	U	0.054	1	14.3		0.51	10	2.57		0.048	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.146		0.049	1	ND	U	0.054	1	15.6		0.51	10	2.45		0.048	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.0825		0.049	1	ND	U	0.054	1	9.57		0.51	10	1.4		0.048	1
Chrysene	218-01-9	190,000	mg/kg	0.148		0.049	1	ND	U	0.054	1	15.9		0.51	10	2.2		0.048	1
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.049	1	ND	U	0.054	1	3.32		0.051	1	0.363		0.048	1
Naphthalene	91-20-3	190,000	mg/kg	0.0401	J	0.049	1	ND	U	0.054	1	1.3		0.051	1	0.513		0.048	1
Phenanthrene	85-01-8	190,000	mg/kg	0.101		0.049	1	ND	U	0.054	1	32.2		0.51	10	1.87		0.048	1
Pyrene	129-00-0	190,000	mg/kg	0.291		0.049	1	0.0302	J	0.054	1	34		0.51	10	3.1		0.048	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	20.7		2	1	17.1		3.1	1	473		2	1	87.6		1.9	1

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10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	BH_14-24				BH_14-25				BH_14-28				BH_14-30			
			Sample ID	AOI-5_BH_14_24_4-6'				AOI-5_BH_14-25_6-8'				AOI-5_BH_14-28_4-6'				AOI-5_BH_14-30_4-6'			
			Sample Date	6/24/14				6/18/14				6/19/14				6/19/14			
			Sample Depth (ft bgs)	4-6				6-8				4-6				4-6			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.198		0.18	1	ND	U	0.0026	1	ND	U	0.003	1	ND	U	0.0028	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0035	1	ND	U	0.0036	1	ND	U	0.0064	1	ND	U	0.0036	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.09	1	ND	U	0.0013	1	ND	U	0.0015	1	ND	U	0.0014	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.0527	J	0.18	1	ND	U	0.0026	1	ND	U	0.003	1	ND	U	0.0028	1
Benzene	71-43-2	330	mg/kg	ND	U	0.045	1	0.0052		0.00064	1	**664**		4.1	1	**984**		8.2	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.107		0.09	1	ND	U	0.0013	1	0.00039	J	0.0015	1	0.00046	J	0.0014	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.0425	J	0.45	1	ND	U	0.0064	1	0.0015	J	0.0075	1	0.0034	J	0.007	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.09	1	ND	U	0.0013	1	ND	U	0.0015	1	ND	U	0.0014	1
Toluene	108-88-3	10,000	mg/kg	0.1		0.09	1	ND	U	0.0013	1	0.003		0.0015	1	0.0111		0.0014	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.492		0.09	1	ND	U	0.0013	1	0.00093	J	0.0015	1	0.00044	J	0.0014	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.0946		0.042	1	0.0399	J	0.042	1	0.184		0.042	1	0.282		0.048	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.381		0.042	1	0.0902		0.042	1	0.478		0.042	1	0.585		0.048	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.309		0.042	1	0.0909		0.042	1	0.443		0.042	1	0.622		0.048	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.373		0.042	1	0.0725		0.042	1	0.632		0.042	1	0.971		0.048	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.226		0.042	1	0.0506		0.042	1	0.332		0.042	1	0.722		0.048	1
Chrysene	218-01-9	190,000	mg/kg	0.381		0.042	1	0.0885		0.042	1	0.582		0.042	1	0.731		0.048	1
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.042	1	0.0289	J	0.042	1	0.155		0.042	1	0.221		0.048	1
Naphthalene	91-20-3	190,000	mg/kg	ND	U	0.042	1	0.0182	J	0.042	1	0.323		0.042	1	0.889		0.048	1
Phenanthrene	85-01-8	190,000	mg/kg	0.332		0.042	1	0.126		0.042	1	1.01		0.042	1	1.3		0.048	1
Pyrene	129-00-0	190,000	mg/kg	0.745		0.042	1	0.186		0.042	1	0.93		0.042	1	1.16		0.048	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	134		2.4	1	13.7		2	1	196		2	1	320		2.1	1

Notes:
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ft bgs - feet below ground surface
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	BH_14-31				BH_14-32				BH_14-33				BH_14-34			
			Sample ID	AOI-5_BH_14-31_4-6'				AOI-5-BH_14-32_4-5'				AOI-5-BH_14-33_5-6'				AOI-5-BH_14-34_5-6'			
			Sample Date	6/19/14				6/17/14				6/17/14				6/17/14			
			Sample Depth (ft bgs)	4-6				4-5				5-6				5-6			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.0035	1	1.15		0.3	1	0.384		0.28	1	0.207	J	0.47	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.004	1	ND	U	0.0031	1	ND	U	0.0032	1	ND	U	0.0033	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0018	1	ND	U	0.15	1	ND	U	0.14	1	ND	U	0.23	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0035	1	0.247	J	0.3	1	0.11	J	0.28	1	ND	U	0.47	1
Benzene	71-43-2	330	mg/kg	0.0712		0.00088	1	0.638		0.076	1	0.265		0.071	1	0.177		0.12	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.0018	1	1.71		0.15	1	0.697		0.14	1	0.407		0.23	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0088	1	28.6		0.76	1	45.1		7.1	1	71.2		5.8	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0018	1	ND	U	0.15	1	ND	U	0.14	1	ND	U	0.23	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0018	1	1.12		0.15	1	0.344		0.14	1	0.238		0.23	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.0018	1	3.47		0.15	1	1.21		0.14	1	0.735		0.23	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.16		0.046	1	1		0.04	1	0.575		0.042	1	1.54		0.043	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.966		0.046	1	0.655		0.04	1	0.922		0.042	1	1.29		0.043	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.12		0.046	1	0.547		0.04	1	0.916		0.042	1	1.09		0.043	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.46		0.046	1	0.634		0.04	1	1.08		0.042	1	1.27		0.043	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.905		0.046	1	0.284		0.04	1	0.521		0.042	1	0.562		0.043	1
Chrysene	218-01-9	190,000	mg/kg	0.997		0.046	1	0.726		0.04	1	1.05		0.042	1	1.56		0.043	1
Fluorene	86-73-7	190,000	mg/kg	0.0633		0.046	1	2.77		0.04	1	0.859		0.042	1	3.23		0.043	1
Naphthalene	91-20-3	190,000	mg/kg	0.037	J	0.046	1	ND	U	0.04	1	ND	U	0.042	1	ND	U	0.043	1
Phenanthrene	85-01-8	190,000	mg/kg	0.607		0.046	1	6.14		0.2	5	3.01		0.042	1	10.4		0.21	5
Pyrene	129-00-0	190,000	mg/kg	1.28		0.046	1	1.43		0.04	1	1.88		0.042	1	2.8		0.043	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	843		4	2	215		2	1	204		1.9	1	135		2	1

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Exceedance Summary:

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10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	BH_14-35				BH_14-36				BH_14-37				BH-14-38			
			Sample ID	AOI-5-BH_14-35_5-6'				AOI-5_BH_14-36_4-6'				AOI-5_BH_14-37_6-8'				BH-14-38_4-6'			
			Sample Date	6/17/14				6/18/14				6/19/14				6/26/14			
			Sample Depth (ft bgs)	5-6				4-6				6-8				4-6			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.0449	J	0.26	1	ND	U	0.0023	1	ND	U	0.0033	1	ND	U	0.0022	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0032	1	ND	U	0.0034	1	ND	U	0.0047	1	ND	U	0.0031	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.13	1	ND	U	0.0012	1	ND	U	0.0017	1	ND	U	0.0011	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.26	1	ND	U	0.0023	1	ND	U	0.0033	1	0.00026	J	0.0022	1
Benzene	71-43-2	330	mg/kg	ND	U	0.066	1	0.0014		0.00058	1	0.166		0.00083	1	ND	U	0.00055	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.0685	J	0.13	1	ND	U	0.0012	1	ND	U	0.0017	1	ND	U	0.0011	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	33.1		6.6	1	ND	U	0.0058	1	ND	U	0.0083	1	0.0036	J	0.0055	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.13	1	ND	U	0.0012	1	ND	U	0.0017	1	ND	U	0.0011	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.13	1	0.00061	J	0.0012	1	0.00052	J	0.0017	1	ND	U	0.0011	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.13	1	ND	U	0.0012	1	ND	U	0.0017	1	0.0007	J	0.0011	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.0238	J	0.041	1	0.163		0.045	1	0.0684		0.061	1	1.1		0.039	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.0762		0.041	1	0.527		0.045	1	0.176		0.061	1	1.28		0.039	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.0563		0.041	1	0.472		0.045	1	0.2		0.061	1	0.788		0.039	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.061		0.041	1	0.444		0.045	1	0.221		0.061	1	1.04		0.039	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.0315	J	0.041	1	0.228		0.045	1	0.129		0.061	1	0.284		0.039	1
Chrysene	218-01-9	190,000	mg/kg	0.0827		0.041	1	0.463		0.045	1	0.181		0.061	1	0.953		0.039	1
Fluorene	86-73-7	190,000	mg/kg	0.0341	J	0.041	1	0.264		0.045	1	ND	U	0.061	1	0.411		0.039	1
Naphthalene	91-20-3	190,000	mg/kg	0.0193	J	0.041	1	0.0754		0.045	1	0.0652		0.061	1	ND	U	0.039	1
Phenanthrene	85-01-8	190,000	mg/kg	0.115		0.041	1	0.419		0.045	1	0.135		0.061	1	3.28		0.039	1
Pyrene	129-00-0	190,000	mg/kg	0.134		0.041	1	0.955		0.045	1	0.228		0.061	1	3.58		0.039	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	3.1		1.9	1	45		2.1	1	103		2	1	91.3		4.6	1

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10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GP-1208-PER-1				GP-1208-PER-2				GP-1208-PER-3				GP-1208-PER-4			
			Sample ID	GP-1208-PER-1				GP-1208-PER-2				GP-1208-PER-3				GP-1208-PER-4			
			Sample Date	5/30/07				5/30/07				5/30/07				5/30/07			
			Sample Depth (ft bgs)	3-3.5				3-3.5				3-3.5				3-3.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				NA			
Benzene	71-43-2	330	mg/kg	1	D	0.28	50	4.8	D	0.21	50	16	D	0.3	50	5.4	D	0.28	50
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				NA			
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA			
Chrysene	218-01-9	190,000	mg/kg	NA				NA				NA				NA			
Fluorene	86-73-7	190,000	mg/kg	NA				NA				NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA			
Pyrene	129-00-0	190,000	mg/kg	NA				NA				NA				NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				NA				NA				NA			

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10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GP-1208-PER-5				GP-1208-SUB-1				GP1209-1210				GP1209-E			
			Sample ID	GP-1208-PER-5				GP-1208-SUB-1				GP1209-1210-2.6-3.1				GP1209-E-2.8-3.3			
			Sample Date	5/30/07				5/30/07				1/23/12				1/23/12			
			Sample Depth (ft bgs)	3-3.5				5-5.5				2.6-3.1				2.8-3.3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
Benzene	71-43-2	330	mg/kg	8	D	0.19	50	0.76	D	0.29	50	230		1.8	2606.16	13		0.046	65.92
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				510		3.6	2606.16	0.23	J	0.092	65.92
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				ND	U	1.8	2606.16	ND	U	0.046	65.92
Toluene	108-88-3	10,000	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				ND	U	3.6	2606.16	ND	U	0.092	65.92
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				1.2		0.018	20	ND	U	0.038	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				NA				2		0.0092	20	0.24		0.0046	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				NA				1.8		0.0092	20	0.18		0.0046	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				NA				1.6		0.0074	20	0.36		0.0037	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				2.5		0.055	20	0.64		0.028	10
Chrysene	218-01-9	190,000	mg/kg	NA				NA				2.7		0.083	20	0.36		0.042	10
Fluorene	86-73-7	190,000	mg/kg	NA				NA				0.79		0.092	20	ND	U	0.046	10
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				5.2		0.055	20	0.64		0.028	10
Pyrene	129-00-0	190,000	mg/kg	NA				NA				5.1		0.092	20	0.33		0.046	10
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				NA				2800		1.5	5	1540		0.3	1

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10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GP1209-NW				GP1209-SW				GP1210-NE				GP1210-NW			
			Sample ID	GP1209-NW-2.8-3.3				GP1209-SW-3.0-3.5				GP1210-NE-2.8-3.3				GP1210-NW-2.9-3.4			
			Sample Date	1/23/12				1/23/12				1/23/12				1/23/12			
			Sample Depth (ft bgs)	2.8-3.3				3-3.5				2.8-3.3				2.9-3.4			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	ND	U	4	3003.5	ND	U	0.1	70.15
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.096	65.24	ND	U	***56***	11488	ND	U	4	3003.5	ND	U	0.1	70.15
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	ND	U	4	3003.5	ND	U	0.1	70.15
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	ND	U	4	3003.5	ND	U	0.1	70.15
Benzene	71-43-2	330	mg/kg	4		0.048	65.24	49	J	28	11488	**1500**		5	7508.75	1.4		0.051	70.15
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	ND	U	4	3003.5	ND	U	0.1	70.15
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	26		0.096	65.24	**13000**		56	11488	2000		10	7508.75	1.5		0.1	70.15
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.048	65.24	ND	U	28	11488	ND	U	2	3003.5	ND	U	0.051	70.15
Toluene	108-88-3	10,000	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	6.5	J	4	3003.5	ND	U	0.1	70.15
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.096	65.24	ND	U	56	11488	ND	U	4	3003.5	ND	U	0.1	70.15
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.044		0.0098	10	0.77		0.033	10	0.53		0.018	20	0.023	J	0.0097	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.28		0.0049	10	1.6		0.016	10	2.2		0.0089	20	0.16		0.0049	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.27		0.0049	10	1.4		0.016	10	2.5		0.0089	20	0.13		0.0049	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.46		0.0039	10	1.2		0.013	10	2.1		0.0071	20	0.15		0.0039	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.75		0.029	10	1.8		0.098	10	3.6		0.053	20	ND	U	0.29	10
Chrysene	218-01-9	190,000	mg/kg	0.53		0.044	10	2.2		0.15	10	3.2		0.08	20	0.24		0.044	10
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.049	10	0.59	J	0.16	10	0.42		0.089	20	ND	U	0.049	10
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.34		0.029	10	4.3		0.098	10	2.7		0.053	20	0.13		0.029	10
Pyrene	129-00-0	190,000	mg/kg	0.54		0.049	10	4.1		0.16	10	3.6		0.089	20	0.27		0.049	10
Metals																			
Lead	7439-92-1	190,000	mg/kg	2490		1.59	5	1460		1.07	1	2680		1.44	5	645		0.314	1

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ND - Not Detected
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ft bgs - feet below ground surface
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GP1210-SW				GP1212-NE				GP1212-NW				GP1212-SE			
			Sample ID	GP1210-SW-3.3-3.8				GP1212-NE-2.9-3.4				GP1212-NW-2.7-3.2				GP1212-SE-2.9-3.4			
			Sample Date	1/23/12				1/23/12				1/23/12				1/23/12			
			Sample Depth (ft bgs)	3.3-3.8				2.9-3.4				2.7-3.2				2.9-3.4			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	9.3	6462.38	ND	U	9.1	6282.61	ND	U	0.11	73.07	ND	U	10	7285.88
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	***9.3***	6462.38	ND	U	***9.1***	6282.61	ND	U	0.11	73.07	ND	U	***10***	7285.88
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	9.3	6462.38	ND	U	9.1	6282.61	ND	U	0.11	73.07	ND	U	10	7285.88
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	9.3	6462.38	ND	U	9.1	6282.61	ND	U	0.11	73.07	ND	U	10	7285.88
Benzene	71-43-2	330	mg/kg	**910**		4.6	6462.38	6.6	J	4.6	6282.61	0.18	J	0.054	73.07	ND	U	5.2	7285.88
Ethylbenzene	100-41-4	1,000	mg/kg	10	J	9.3	6462.38	ND	U	9.1	6282.61	ND	U	0.11	73.07	ND	U	10	7285.88
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	**33000**		370	258495	**28000**		360	251304	14		0.11	73.07	**30000**		420	291435
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	4.6	6462.38	ND	U	4.6	6282.61	ND	U	0.054	73.07	ND	U	5.2	7285.88
Toluene	108-88-3	10,000	mg/kg	ND	U	9.3	6462.38	ND	U	9.1	6282.61	ND	U	0.11	73.07	ND	U	10	7285.88
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	9.3	6462.38	17	J	9.1	6282.61	0.16	J	0.11	73.07	ND	U	10	7285.88
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.51		0.019	20	1.5		0.19	10	0.13		0.02	20	1.5		0.048	50
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.3		0.0096	20	3.9		0.097	10	0.98		0.0098	20	3.3		0.024	50
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.2		0.0096	20	4.3		0.097	10	1.3		0.0098	20	3.6		0.024	50
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.2		0.0076	20	3.8		0.077	10	1.1		0.0079	20	3.1		0.019	50
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	2.2		0.057	20	6.7		0.58	10	2.9		0.059	20	5.2		0.14	50
Chrysene	218-01-9	190,000	mg/kg	1.7		0.086	20	6.3		0.87	10	2.1		0.089	20	4.9		0.21	50
Fluorene	86-73-7	190,000	mg/kg	0.47		0.096	20	1.5	J	0.97	10	ND	U	0.098	20	1.3		0.24	50
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	3.4		0.057	20	6.8		0.58	10	0.68		0.059	20	6.8		0.14	50
Pyrene	129-00-0	190,000	mg/kg	3		0.096	20	8.6		0.97	10	1.9		0.098	20	7.9		0.24	50
Metals																			
Lead	7439-92-1	190,000	mg/kg	1370		0.309	1	2550		1.58	5	4440		1.61	5	2890		1.56	5

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10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GP1212-SW				GPBR_08212014_A11				GPBR_08212014_A11C				GPBR_08212014_A12C			
			Sample ID	GP1212-SW-2.7-3.2				GPBR_010G_08-21-2014(PH3A-11)				GPBR_011C_08-21-2014(PH3A)				GPBR_012C_08-21-2014(PH3A)			
			Sample Date	1/23/12				8/21/14				8/21/14				8/21/14			
			Sample Depth (ft bgs)	2.7-3.2				2.5-3.5				2.5-3.5				2.5-3.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.002	1.13	ND	U	0.0031	1	NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.002	1.13	ND	U	0.0092	1	NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.002	1.13	ND	U	0.0016	1	NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.002	1.13	ND	U	0.0031	1	NA				NA			
Benzene	71-43-2	330	mg/kg	0.003	J	0.0008	1.13	ND	U	0.00078	1	NA				NA			
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.002	1.13	ND	U	0.0016	1	NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.011		0.002	1.13	0.00042	J	0.0078	1	NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0008	1.13	ND	U	0.0016	1	NA				NA			
Toluene	108-88-3	10,000	mg/kg	0.002	J	0.002	1.13	ND	U	0.0016	1	NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.003	J	0.002	1.13	ND	U	0.0016	1	NA				NA			
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.56		0.019	20	NA				0.0977		0.039	1	0.116		0.037	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.6		0.0095	20	NA				0.282		0.039	1	0.296		0.037	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.7		0.0095	20	NA				0.314		0.039	1	0.366		0.037	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.5		0.0076	20	NA				0.402		0.039	1	0.407		0.037	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	2.3		0.057	20	NA				0.213		0.039	1	0.235		0.037	1
Chrysene	218-01-9	190,000	mg/kg	2.2		0.085	20	NA				0.451		0.039	1	0.437		0.037	1
Fluorene	86-73-7	190,000	mg/kg	0.36	J	0.095	20	NA				0.0259	J	0.039	1	0.0275	J	0.037	1
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				0.0621		0.039	1	0.119		0.037	1
Phenanthrene	85-01-8	190,000	mg/kg	2.4		0.057	20	NA				0.455		0.039	1	0.331		0.037	1
Pyrene	129-00-0	190,000	mg/kg	2.4		0.095	20	NA				0.609		0.039	1	0.476		0.037	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	1850		0.309	1	NA				1570		2.4	1	227		2.3	1

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Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBR_08212014_A13C				GPBR_08212014_A3				GPBR_08212014_A7			
			Sample ID	GPBR_013C_08-21-2014(PH3A)				GPBR_008G_08-21-2014(PH3A-3)				GPBR_009G_08-21-2014(PH3A-7)			
			Sample Date	8/21/14				8/21/14				8/21/14			
			Sample Depth (ft bgs)	2.5-3.5				2.5-3.5				2.5-3.5			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)															
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				ND	U	0.0025	1	ND	U	0.0031	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				ND	U	0.0087	1	ND	U	0.0082	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				ND	U	0.0013	1	ND	U	0.0015	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				ND	U	0.0025	1	ND	U	0.0031	1
Benzene	71-43-2	330	mg/kg	NA				ND	U	0.00063	1	ND	U	0.00077	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				ND	U	0.0013	1	ND	U	0.0015	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				ND	U	0.0063	1	ND	U	0.0077	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				ND	U	0.0013	1	ND	U	0.0015	1
Toluene	108-88-3	10,000	mg/kg	NA				ND	U	0.0013	1	ND	U	0.0015	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				ND	U	0.0013	1	ND	U	0.0015	1
Semi-volatile Organic Compounds (SVOCs)															
Anthracene	120-12-7	190,000	mg/kg	0.0317	J	0.036	1	NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.0479		0.036	1	NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.0475		0.036	1	NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.0956		0.036	1	NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.041		0.036	1	NA				NA			
Chrysene	218-01-9	190,000	mg/kg	0.113		0.036	1	NA				NA			
Fluorene	86-73-7	190,000	mg/kg	ND	U	0.036	1	NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	0.0375		0.036	1	NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.108		0.036	1	NA				NA			
Pyrene	129-00-0	190,000	mg/kg	0.0803		0.036	1	NA				NA			
Metals															
Lead	7439-92-1	190,000	mg/kg	160		2.3	1	NA				NA			

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10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03062014_2_12				GPBT_03062014_2_1C				GPBT_03062014_2_2C			
			Sample ID	GPBT_003G_03-06-2014(STF2-12)				GPBT_001C_03-06-2014(STF2)				GPBT_002C_03-06-2014(STF2)			
			Sample Date	3/6/14				3/6/14				3/6/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)															
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.423	J	0.53	1	NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0027	1	NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.11	1	NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.147	J	0.53	1	NA				NA			
Benzene	71-43-2	330	mg/kg	0.0214	J	0.11	1	NA				NA			
Ethylbenzene	100-41-4	1,000	mg/kg	0.124		0.11	1	NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.636		0.53	1	NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.11	1	NA				NA			
Toluene	108-88-3	10,000	mg/kg	0.0716	J	0.11	1	NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.461		0.11	1	NA				NA			
Semi-volatile Organic Compounds (SVOCs)															
Anthracene	120-12-7	190,000	mg/kg	NA				1.34		0.04	1	0.649		0.037	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				0.398		0.04	1	1.04		0.037	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				0.237		0.04	1	1.07		0.037	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				0.475		0.04	1	1.49		0.037	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				0.251		0.04	1	0.921		0.037	1
Chrysene	218-01-9	190,000	mg/kg	NA				1.27		0.04	1	1.35		0.037	1
Fluorene	86-73-7	190,000	mg/kg	NA				20.2		0.4	10	0.532		0.037	1
Naphthalene	91-20-3	190,000	mg/kg	NA				0.547		0.04	1	0.245		0.037	1
Phenanthrene	85-01-8	190,000	mg/kg	NA				14.3		0.4	10	1.19		0.037	1
Pyrene	129-00-0	190,000	mg/kg	NA				1.45		0.04	1	2.59		0.037	1
Metals															
Lead	7439-92-1	190,000	mg/kg	NA				163		2.6	1	179		2.5	1

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03062014_2_3				GPBT_03062014_2_3C				GPBT_03062014_2_7			
			Sample ID	GPBT_001G_03-06-2014(STF2-3)				GPBT_003C_03-06-2014(STF2)				GPBT_002G_03-06-2014(STF2-7)			
			Sample Date	3/6/14				3/6/14				3/6/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)															
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.851	J	1.1	1	NA				0.0671	J	0.52	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0033	1	NA				ND	U	0.003	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.21	1	NA				ND	U	0.1	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.295	J	1.1	1	NA				0.0386	J	0.52	1
Benzene	71-43-2	330	mg/kg	0.14	J	0.21	1	NA				0.0261	J	0.1	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.367		0.21	1	NA				0.0523	J	0.1	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	7.71		1.1	1	NA				0.173	J	0.52	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.21	1	NA				ND	U	0.1	1
Toluene	108-88-3	10,000	mg/kg	0.801		0.21	1	NA				0.104		0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	2.52		0.21	1	NA				0.172		0.1	1
Semi-volatile Organic Compounds (SVOCs)															
Anthracene	120-12-7	190,000	mg/kg	NA				0.383		0.041	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				1.23		0.041	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				1.04		0.041	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				1.86		0.041	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				0.685		0.041	1	NA			
Chrysene	218-01-9	190,000	mg/kg	NA				1.41		0.041	1	NA			
Fluorene	86-73-7	190,000	mg/kg	NA				0.314		0.041	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	NA				0.256		0.041	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				0.702		0.041	1	NA			
Pyrene	129-00-0	190,000	mg/kg	NA				3.75		0.041	1	NA			
Metals															
Lead	7439-92-1	190,000	mg/kg	NA				299		2.8	1	NA			

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ft bgs - feet below ground surface
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03062014_3_4				GPBT_03062014_3_4C			
			Sample ID	GPBT_004G_03-06-2014(STF3-4)				GPBT_004C_03-06-2014(STF3)			
			Sample Date	3/6/14				3/6/14			
			Sample Depth (ft bgs)	2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)											
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	3.71		0.78	1	NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0034	1	NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.16	1	NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.567	J	0.78	1	NA			
Benzene	71-43-2	330	mg/kg	0.567		0.16	1	NA			
Ethylbenzene	100-41-4	1,000	mg/kg	0.487		0.16	1	NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	8.74		0.78	1	NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.16	1	NA			
Toluene	108-88-3	10,000	mg/kg	0.982		0.16	1	NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	1.64		0.16	1	NA			
Semi-volatile Organic Compounds (SVOCs)											
Anthracene	120-12-7	190,000	mg/kg	NA				1.76		0.39	10
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				1.15		0.39	10
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				1.11		0.39	10
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				1.36		0.39	10
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				1.09		0.39	10
Chrysene	218-01-9	190,000	mg/kg	NA				1.41		0.39	10
Fluorene	86-73-7	190,000	mg/kg	NA				4		0.39	10
Naphthalene	91-20-3	190,000	mg/kg	NA				ND	U	0.39	10
Phenanthrene	85-01-8	190,000	mg/kg	NA				8.49		0.39	10
Pyrene	129-00-0	190,000	mg/kg	NA				2.56		0.39	10
Metals											
Lead	7439-92-1	190,000	mg/kg	NA				511		2.3	1

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03062014_3_5C				GPBT_03062014_3_6				GPBT_03062014_3_6C				GPBT_03062014_3_8			
			Sample ID	GPBT_005C_03-06-2014(STF3)				GPBT_005G_03-06-2014(STF3-6)				GPBT_006C_03-06-2014(STF3)				GPBT_006G_03-06-2014(STF3-8)			
			Sample Date	3/6/14				3/6/14				3/6/14				3/6/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				0.868		0.74	1	NA				0.168	J	0.72	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				ND	U	0.0033	1	NA				ND	U	0.0033	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				ND	U	0.15	1	NA				ND	U	0.14	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				0.409	J	0.74	1	NA				0.0542	J	0.72	1
Benzene	71-43-2	330	mg/kg	NA				0.239		0.15	1	NA				0.101	J	0.14	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				0.38		0.15	1	NA				0.182		0.14	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				3.76		0.74	1	NA				1.55		0.72	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				ND	U	0.15	1	NA				ND	U	0.14	1
Toluene	108-88-3	10,000	mg/kg	NA				0.284		0.15	1	NA				0.18		0.14	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				1.56		0.15	1	NA				0.647		0.14	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.97		0.21	5	NA				0.33		0.036	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.61		0.21	5	NA				0.612		0.036	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.36		0.21	5	NA				0.795		0.036	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.78		0.21	5	NA				1.43		0.036	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.16		0.21	5	NA				0.794		0.036	1	NA			
Chrysene	218-01-9	190,000	mg/kg	1.69		0.21	5	NA				0.787		0.036	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.918		0.21	5	NA				0.0348	J	0.036	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	ND	U	0.21	5	NA				0.0838		0.036	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	3.2		0.21	5	NA				0.263		0.036	1	NA			
Pyrene	129-00-0	190,000	mg/kg	2.82		0.21	5	NA				0.783		0.036	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	531		2.6	1	NA				318		2.3	1	NA			

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Exceedance Summary:

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10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03072014_4_10				GPBT_03072014_4_3				GPBT_03072014_4_4				GPBT_03072014_4_7			
			Sample ID	GPBT_009G_03-07-2014(STF4-10)				GPBT_006G_03-06-2014(RW4-3)				GPBT_007G_03-07-2014(STF4-4)				GPBT_008G_03-07-2014(STF4-7)			
			Sample Date	3/7/14				3/6/14				3/7/14				3/7/14			
			Sample Depth (ft bgs)	2-3				3.5-4.5				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.63	1	0.405	J	0.95	1	0.0871	J	0.54	1	0.365	J	3.5	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0032	1	ND	U	0.0039	1	ND	U	0.003	1	ND	U	0.0032	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.13	1	ND	U	0.19	1	ND	U	0.11	1	ND	U	0.7	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.63	1	0.163	J	0.95	1	0.0375	J	0.54	1	ND	U	3.5	1
Benzene	71-43-2	330	mg/kg	ND	U	0.13	1	0.101	J	0.19	1	0.117		0.11	1	0.64	J	0.7	1
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.13	1	0.238		0.19	1	0.11		0.11	1	0.544	J	0.7	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	1.09		0.63	1	0.716	J	0.95	1	1.01		0.54	1	5.74		3.5	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.13	1	ND	U	0.19	1	ND	U	0.11	1	ND	U	0.7	1
Toluene	108-88-3	10,000	mg/kg	0.0444	J	0.13	1	0.377		0.19	1	0.0914	J	0.11	1	0.477	J	0.7	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.167		0.13	1	1.34		0.19	1	0.399		0.11	1	1.86		0.7	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				0.553		0.094	2	NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				0.663		0.094	2	NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				0.877		0.094	2	NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				0.933		0.094	2	NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				0.9		0.094	2	NA				NA			
Chrysene	218-01-9	190,000	mg/kg	NA				0.755		0.094	2	NA				NA			
Fluorene	86-73-7	190,000	mg/kg	NA				1.16		0.094	2	NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	NA				0.341		0.094	2	NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				1.61		0.094	2	NA				NA			
Pyrene	129-00-0	190,000	mg/kg	NA				1.56		0.094	2	NA				NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				207		3	1	NA				NA			

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03072014_4_7C				GPBT_03072014_4_8C				GPBT_03072014_4_9C				GPBT_03072014_5_1			
			Sample ID	GPBT_007C_03-07-2014(STF4)				GPBT_008C_03-07-2014(STF4)				GPBT_009C_03-07-2014(STF4)				GPBT_010G_03-07-2014(STF5-1)			
			Sample Date	3/7/14				3/7/14				3/7/14				3/7/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				0.0709	J	0.9	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				ND	U	0.0039	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				ND	U	0.18	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				ND	U	0.9	1
Benzene	71-43-2	330	mg/kg	NA				NA				NA				0.0721	J	0.18	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				ND	U	0.18	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				ND	U	0.9	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				ND	U	0.18	1
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				0.144	J	0.18	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				0.0692	J	0.18	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.578		0.041	1	0.673		0.037	1	0.189		0.039	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.815		0.041	1	1.07		0.037	1	0.247		0.039	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.957		0.041	1	1.25		0.037	1	0.322		0.039	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.952		0.041	1	1.36		0.037	1	0.41		0.039	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1		0.041	1	0.762		0.037	1	0.241		0.039	1	NA			
Chrysene	218-01-9	190,000	mg/kg	1.23		0.041	1	1.3		0.037	1	0.302		0.039	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.209		0.041	1	0.455		0.037	1	0.361		0.039	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	0.384		0.041	1	ND	U	0.037	1	ND	U	0.039	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	1.06		0.041	1	2.23		0.037	1	0.677		0.039	1	NA			
Pyrene	129-00-0	190,000	mg/kg	1.14		0.041	1	2.2		0.037	1	0.353		0.039	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	298		2	1	1860		2.5	1	106		2.6	1	NA			

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03072014_5_10C				GPBT_03072014_5_11C				GPBT_03072014_5_12C				GPBT_03072014_5_6			
			Sample ID	GPBT_010C_03-07-2014(STF5)				GPBT_011C_03-07-2014(STF5)				GPBT_012C_03-07-2014(STF5)				GPBT_011G_03-07-2014(STF5-6)			
			Sample Date	3/7/14				3/7/14				3/7/14				3/7/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				0.0652	J	0.44	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				ND	U	0.0028	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				ND	U	0.089	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				0.0267	J	0.44	1
Benzene	71-43-2	330	mg/kg	NA				NA				NA				0.153		0.089	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				0.0508	J	0.089	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				ND	U	0.44	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				ND	U	0.089	1
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				0.192		0.089	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				0.247		0.089	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.687		0.041	1	3.77		0.34	10	0.124		0.037	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.86		0.041	1	5.68		0.34	10	0.194		0.037	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.84		0.041	1	4.74		0.34	10	0.266		0.037	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.06		0.041	1	4.54		0.34	10	0.277		0.037	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.929		0.041	1	2.31		0.034	1	0.269		0.037	1	NA			
Chrysene	218-01-9	190,000	mg/kg	2		0.041	1	5.47		0.34	10	0.239		0.037	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.358		0.041	1	1.43		0.034	1	0.0275	J	0.037	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	0.101		0.041	1	0.102		0.034	1	0.0808		0.037	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.525		0.041	1	9.51		0.34	10	0.221		0.037	1	NA			
Pyrene	129-00-0	190,000	mg/kg	2.51		0.041	1	13.1		0.34	10	0.305		0.037	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	138		2	1	165		2.3	1	400		2.5	1	NA			

Notes:
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Q - Qualifier
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ND - Not Detected
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ft bgs - feet below ground surface
[1] PADEP Act 2 Non-Residental Subsurface Soil Direct Contact MSCs (last updated August 27, 2016).

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U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
D - Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03072014_5_8				GPBT_03102014_6_12				GPBT_03102014_6_13C				GPBT_03102014_6_14C			
			Sample ID	GPBT_012G_03-07-2014(STF5-8)				GPBT_015G_03-10-2014(STF6-12)				GPBT_013C_03-10-2014(STF6)				GPBT_014C_03-10-2014(STF6)			
			Sample Date	3/7/14				3/10/14				3/10/14				3/10/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.0046	1	ND	U	0.0056	1	NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0027	1	ND	U	0.0028	1	NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.00091	1	ND	U	0.0011	1	NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0046	1	ND	U	0.0056	1	NA				NA			
Benzene	71-43-2	330	mg/kg	ND	U	0.00091	1	ND	U	0.0011	1	NA				NA			
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.00091	1	ND	U	0.0011	1	NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0046	1	ND	U	0.0056	1	NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.00091	1	ND	U	0.0011	1	NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	0.00091	1	0.00025	J	0.0011	1	NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.00091	1	0.00035	J	0.0011	1	NA				NA			
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				0.114		0.038	1	0.121		0.036	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				NA				0.55		0.038	1	0.308		0.036	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				NA				0.605		0.038	1	0.471		0.036	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				NA				0.77		0.038	1	0.466		0.036	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				0.407		0.038	1	0.569		0.036	1
Chrysene	218-01-9	190,000	mg/kg	NA				NA				0.536		0.038	1	0.378		0.036	1
Fluorene	86-73-7	190,000	mg/kg	NA				NA				0.0484		0.038	1	0.0611		0.036	1
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				0.059		0.038	1	0.124		0.036	1
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				0.46		0.038	1	0.205		0.036	1
Pyrene	129-00-0	190,000	mg/kg	NA				NA				0.823		0.038	1	0.434		0.036	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				NA				153		2.3	1	269		2.6	1

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Exceedance Summary:
10	Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10	DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03102014_6_15C				GPBT_03102014_6_3				GPBT_03102014_6_9				GPBT_03102014_7_12			
			Sample ID	GPBT_015C_03-10-2014(STF6)				GPBT_013G_03-10-2014(STF6-3)				GPBT_014G_03-10-2014(STF6-9)				GPBT_018G_03-10-2014(STF7-12)			
			Sample Date	3/10/14				3/10/14				3/10/14				3/10/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				ND	U	0.0047	1	ND	U	0.0043	1	0.00027	J	0.0057	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				ND	U	0.003	1	ND	U	0.0028	1	ND	U	0.0032	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				ND	U	0.00094	1	ND	U	0.00087	1	ND	U	0.0011	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				ND	U	0.0047	1	ND	U	0.0043	1	ND	U	0.0057	1
Benzene	71-43-2	330	mg/kg	NA				ND	U	0.00094	1	ND	U	0.00087	1	ND	U	0.0011	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				0.00039	J	0.00094	1	ND	U	0.00087	1	0.00027	J	0.0011	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				ND	U	0.0047	1	ND	U	0.0043	1	ND	U	0.0057	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				ND	U	0.00094	1	ND	U	0.00087	1	ND	U	0.0011	1
Toluene	108-88-3	10,000	mg/kg	NA				ND	U	0.00094	1	ND	U	0.00087	1	ND	U	0.0011	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				0.00043	J	0.00094	1	ND	U	0.00087	1	0.00078	J	0.0011	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.114		0.036	1	NA				NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.446		0.036	1	NA				NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.554		0.036	1	NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.725		0.036	1	NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.51		0.036	1	NA				NA				NA			
Chrysene	218-01-9	190,000	mg/kg	0.585		0.036	1	NA				NA				NA			
Fluorene	86-73-7	190,000	mg/kg	0.0464		0.036	1	NA				NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	0.082		0.036	1	NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.286		0.036	1	NA				NA				NA			
Pyrene	129-00-0	190,000	mg/kg	0.776		0.036	1	NA				NA				NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	70.1		2.3	1	NA				NA				NA			

Notes:
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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03102014_7_16C				GPBT_03102014_7_17C				GPBT_03102014_7_18C				GPBT_03102014_7_4			
			Sample ID	GPBT_016C_03-10-2014(STF7)				GPBT_017C_03-10-2014(STF7)				GPBT_018C_03-10-2014(STF7)				GPBT_016G_03-10-2014(STF7-4)			
			Sample Date	3/10/14				3/10/14				3/10/14				3/10/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				ND	U	0.004	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				ND	U	0.0028	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				ND	U	0.0008	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				ND	U	0.004	1
Benzene	71-43-2	330	mg/kg	NA				NA				NA				0.00018	J	0.0008	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				ND	U	0.0008	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				ND	U	0.004	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				ND	U	0.0008	1
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				0.00023	J	0.0008	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				0.00016	J	0.0008	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.361		0.041	1	0.731		0.034	1	0.288		0.037	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	1.03		0.041	1	2.02		0.034	1	0.837		0.037	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	1.58		0.041	1	2.13		0.034	1	1.14		0.037	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	2.18		0.041	1	2.57		0.034	1	1.43		0.037	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	1.63		0.041	1	1.37		0.034	1	1.2		0.037	1	NA			
Chrysene	218-01-9	190,000	mg/kg	1.15		0.041	1	1.8		0.034	1	0.885		0.037	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.155		0.041	1	0.292		0.034	1	0.235		0.037	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	0.217		0.041	1	0.411		0.034	1	0.26		0.037	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.384		0.041	1	2.2		0.034	1	0.438		0.037	1	NA			
Pyrene	129-00-0	190,000	mg/kg	1.23		0.041	1	3.22		0.034	1	1.11		0.037	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	323		2.6	1	163		2.3	1	370		2.4	1	NA			

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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03102014_7_8				GPBT_03112014_8_28C				GPBT_03112014_8_29C				GPBT_03112014_8_30C			
			Sample ID	GPBT_017G_03-10-2014(STF7-8)				GPBT_028C_03-11-2014(STF 8)				GPBT_029C_03-11-2014(STF 8)				GPBT_030C_03-11-2014(STF 8)			
			Sample Date	3/10/14				3/11/14				3/11/14				3/11/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.0056	1	NA				NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.003	1	NA				NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0011	1	NA				NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0056	1	NA				NA				NA			
Benzene	71-43-2	330	mg/kg	0.00074	J	0.0011	1	NA				NA				NA			
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.0011	1	NA				NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.0056	1	NA				NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0011	1	NA				NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0011	1	NA				NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.0011	1	NA				NA				NA			
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				0.775		0.04	1	1.36		0.047	1	2.7		0.22	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				0.98		0.04	1	0.694		0.047	1	1.36		0.22	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				1.4		0.04	1	1.19		0.047	1	1.55		0.22	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				1.54		0.04	1	1.23		0.047	1	1.29		0.22	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				1.03		0.04	1	1.21		0.047	1	1.29		0.22	1
Chrysene	218-01-9	190,000	mg/kg	NA				1.01		0.04	1	0.767		0.047	1	2.22		0.22	1
Fluorene	86-73-7	190,000	mg/kg	NA				0.916		0.04	1	3.31		0.047	1	5.45		0.22	1
Naphthalene	91-20-3	190,000	mg/kg	NA				ND	U	0.04	1	ND	U	0.047	1	ND	U	0.22	1
Phenanthrene	85-01-8	190,000	mg/kg	NA				1.34		0.04	1	9.15		0.19	4	10.7		0.22	1
Pyrene	129-00-0	190,000	mg/kg	NA				1.18		0.04	1	1.24		0.047	1	4.03		0.22	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				235		2.6	1	208		3.2	1	141		2.8	1

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03112014_8_4				GPBT_03112014_8_5				GPBT_03112014_8_8				GPBT_03112014_9_1			
			Sample ID	GPBT_025G_03-11-2014(STF 8-4)				GPBT_026G_03-11-2014(STF 8-5)				GPBT_027G_03-11-2014(STF 8-8)				GPBT_019G_03-11-2014(STF 9-1)			
			Sample Date	3/11/14				3/11/14				3/11/14				3/11/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.13	J	0.79	1	0.104	J	1.1	1	0.078	J	0.8	1	0.0019	J	0.0079	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0038	1	ND	U	0.0043	1	ND	U	0.0039	1	ND	U	0.0039	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.16	1	ND	U	0.23	1	ND	U	0.16	1	ND	U	0.0016	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	0.0432	J	0.79	1	ND	U	1.1	1	ND	U	0.8	1	ND	U	0.0079	1
Benzene	71-43-2	330	mg/kg	ND	U	0.16	1	ND	U	0.23	1	ND	U	0.16	1	ND	U	0.0016	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.0632	J	0.16	1	0.0751	J	0.23	1	0.06	J	0.16	1	0.002		0.0016	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.0925	J	0.79	1	ND	U	1.1	1	0.465	J	0.8	1	0.13		0.0079	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.16	1	ND	U	0.23	1	ND	U	0.16	1	ND	U	0.0016	1
Toluene	108-88-3	10,000	mg/kg	0.139	J	0.16	1	0.0699	J	0.23	1	0.0512	J	0.16	1	0.0017		0.0016	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.313		0.16	1	0.143	J	0.23	1	0.0961	J	0.16	1	0.0069		0.0016	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA			
Chrysene	218-01-9	190,000	mg/kg	NA				NA				NA				NA			
Fluorene	86-73-7	190,000	mg/kg	NA				NA				NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA			
Pyrene	129-00-0	190,000	mg/kg	NA				NA				NA				NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				NA				NA				NA			

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Q - Qualifier
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Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 5
Summary of Subsurface Soil Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03112014_9_22C				GPBT_03112014_9_23C				GPBT_03112014_9_24C				GPBT_03112014_9_4			
			Sample ID	GPBT_022C_03-11-2014(STF 9)				GPBT_023C_03-11-2014(STF 9)				GPBT_024C_03-11-2014(STF 9)				GPBT_020G_03-11-2014(STF 9-4)			
			Sample Date	3/11/14				3/11/14				3/11/14				3/11/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**	**Result**	**Q**	**DL**	**DF**
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				0.427	J	0.62	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				ND	U	0.003	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				ND	U	0.12	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				0.0636	J	0.62	1
Benzene	71-43-2	330	mg/kg	NA				NA				NA				ND	U	0.12	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				0.162		0.12	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				1.11		0.62	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				ND	U	0.12	1
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				0.0375	J	0.12	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				0.617		0.12	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.779		0.25	5	0.634		0.052	1	0.584		0.045	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.621		0.25	5	0.851		0.052	1	0.775		0.045	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.697		0.25	5	0.786		0.052	1	0.963		0.045	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.841		0.25	5	0.886		0.052	1	0.981		0.045	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.523		0.25	5	0.615		0.052	1	0.785		0.045	1	NA			
Chrysene	218-01-9	190,000	mg/kg	0.801		0.25	5	0.86		0.052	1	0.871		0.045	1	NA			
Fluorene	86-73-7	190,000	mg/kg	1.37		0.25	5	0.716		0.052	1	0.76		0.045	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	ND	U	0.25	5	ND	U	0.052	1	0.431		0.045	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	3.62		0.25	5	1.6		0.052	1	2.48		0.045	1	NA			
Pyrene	129-00-0	190,000	mg/kg	1.43		0.25	5	1.39		0.052	1	1.2		0.045	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	222		2.8	1	336		3.1	1	485		3.1	1	NA			

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03112014_9_8				GPBT_03122014_1_1				GPBT_03122014_1_12				GPBT_03122014_1_3			
			Sample ID	GPBT_021G_03-11-2014(STF 9-8)				GPBT_031G_03-12-2014 (STF1-1)				GPBT_033G_03-12-2014 (STF1-12)				GPBT_032G_03-12-2014 (STF1-3)			
			Sample Date	3/11/14				3/12/14				3/12/14				3/12/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	0.0018	J	0.0091	1	0.0508	J	0.61	1	ND	U	1.1	1	ND	U	0.01	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0043	1	ND	U	0.0027	1	ND	U	0.0029	1	ND	U	0.0033	1
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0018	1	ND	U	0.12	1	ND	U	0.22	1	ND	U	0.002	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.0091	1	ND	U	0.61	1	ND	U	1.1	1	ND	U	0.01	1
Benzene	71-43-2	330	mg/kg	ND	U	0.0018	1	0.0248	J	0.12	1	ND	U	0.22	1	ND	U	0.002	1
Ethylbenzene	100-41-4	1,000	mg/kg	0.00085	J	0.0018	1	ND	U	0.12	1	ND	U	0.22	1	ND	U	0.002	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	0.0128		0.0091	1	0.0272	J	0.61	1	ND	U	1.1	1	ND	U	0.01	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0018	1	ND	U	0.12	1	ND	U	0.22	1	ND	U	0.002	1
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0018	1	ND	U	0.12	1	ND	U	0.22	1	ND	U	0.002	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	0.004		0.0018	1	0.0367	J	0.12	1	0.0872	J	0.22	1	ND	U	0.002	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	NA				NA				NA				NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	NA				NA				NA				NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	NA				NA				NA				NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	NA				NA				NA				NA			
Chrysene	218-01-9	190,000	mg/kg	NA				NA				NA				NA			
Fluorene	86-73-7	190,000	mg/kg	NA				NA				NA				NA			
Naphthalene	91-20-3	190,000	mg/kg	NA				NA				NA				NA			
Phenanthrene	85-01-8	190,000	mg/kg	NA				NA				NA				NA			
Pyrene	129-00-0	190,000	mg/kg	NA				NA				NA				NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	NA				NA				NA				NA			

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Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03122014_1_31C				GPBT_03122014_1_32C				GPBT_03122014_1_33C				GPBT_03122014_10_1			
			Sample ID	GPBT_031C_03-12-2014 (STF1)				GPBT_032C_03-12-2014 (STF1)				GPBT_033C_03-12-2014 (STF1)				GPBT_034G_03-12-2014 (STF10-1)			
			Sample Date	3/12/14				3/12/14				3/12/14				3/12/14			
			Sample Depth (ft bgs)	2-3				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				NA				NA				1.19		0.93	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				NA				NA				ND	U	0.003	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				NA				NA				ND	U	0.19	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				NA				NA				0.221	J	0.93	1
Benzene	71-43-2	330	mg/kg	NA				NA				NA				0.817		0.19	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				NA				NA				1.12		0.19	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				NA				NA				1.14		0.93	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				NA				NA				ND	U	0.19	1
Toluene	108-88-3	10,000	mg/kg	NA				NA				NA				0.442		0.19	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				NA				NA				2.6		0.19	1
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.128		0.038	1	0.117	J	0.2	1	2.18		0.2	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.402		0.038	1	0.723		0.2	1	4.79		0.2	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.446		0.038	1	0.777		0.2	1	3.46		0.2	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.5		0.038	1	0.864		0.2	1	3.7		0.2	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.223		0.038	1	0.293		0.2	1	1.44		0.2	1	NA			
Chrysene	218-01-9	190,000	mg/kg	0.408		0.038	1	0.82		0.2	1	4.76		0.2	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.0629		0.038	1	0.1	J	0.2	1	0.877		0.2	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	0.0299	J	0.038	1	ND	U	0.2	1	0.17	J	0.2	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.323		0.038	1	0.466		0.2	1	9.21		0.2	1	NA			
Pyrene	129-00-0	190,000	mg/kg	0.631		0.038	1	0.748		0.2	1	7.8		0.2	1	NA			
Metals																			
Lead	7439-92-1	190,000	mg/kg	285		2.4	1	370		2.4	1	518		2.6	1	NA			

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Table 5
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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03122014_10_10				GPBT_03122014_10_3				GPBT_03122014_10_34C				GPBT_03122014_10_35C			
			Sample ID	GPBT_011G_03-12-2014(RW10-10)				GPBT_035G_03-12-2014 (STF10-3)				GPBT_034C_03-12-2014 (STF10)				GPBT_035C_03-12-2014 (STF10)			
			Sample Date	3/12/14				3/12/14				3/12/14				3/12/14			
			Sample Depth (ft bgs)	3.7-4.7				2-3				2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF	Result	Q	DL	DF
Volatile Organic Compounds (VOCs)																			
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	ND	U	0.006	1	0.149	J	0.84	1	NA				NA			
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	ND	U	0.0036	1	ND	U	0.0029	1	NA				NA			
1,2-Dichloroethane	107-06-2	98	mg/kg	ND	U	0.0012	1	ND	U	0.17	1	NA				NA			
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	ND	U	0.006	1	0.047	J	0.84	1	NA				NA			
Benzene	71-43-2	330	mg/kg	ND	U	0.0012	1	0.362		0.17	1	NA				NA			
Ethylbenzene	100-41-4	1,000	mg/kg	ND	U	0.0012	1	0.359		0.17	1	NA				NA			
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	ND	U	0.006	1	2.09		0.84	1	NA				NA			
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	ND	U	0.0012	1	ND	U	0.17	1	NA				NA			
Toluene	108-88-3	10,000	mg/kg	ND	U	0.0012	1	0.13	J	0.17	1	NA				NA			
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	ND	U	0.0012	1	0.619		0.17	1	NA				NA			
Semi-volatile Organic Compounds (SVOCs)																			
Anthracene	120-12-7	190,000	mg/kg	0.182		0.073	1	NA				0.732		0.036	1	1.12		0.041	1
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.482		0.073	1	NA				0.289		0.036	1	1.65		0.041	1
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.602		0.073	1	NA				0.214		0.036	1	1.66		0.041	1
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	0.629		0.073	1	NA				0.337		0.036	1	2.03		0.041	1
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.473		0.073	1	NA				0.144		0.036	1	1.01		0.041	1
Chrysene	218-01-9	190,000	mg/kg	0.529		0.073	1	NA				0.34		0.036	1	1.68		0.041	1
Fluorene	86-73-7	190,000	mg/kg	0.0569	J	0.073	1	NA				3.26		0.036	1	2.04		0.041	1
Naphthalene	91-20-3	190,000	mg/kg	0.263		0.073	1	NA				ND	U	0.036	1	ND	U	0.041	1
Phenanthrene	85-01-8	190,000	mg/kg	0.393		0.073	1	NA				7.96		0.18	5	5.68		0.16	4
Pyrene	129-00-0	190,000	mg/kg	0.788		0.073	1	NA				0.829		0.036	1	3.97		0.041	1
Metals																			
Lead	7439-92-1	190,000	mg/kg	308		3	1	NA				178		2.2	1	1560		2.5	1

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Chemical Name	CAS No	PADEP Non-Residential Subsurface Soil Direct Contact MSC[1]	Location ID	GPBT_03122014_10_36C				GPBT_03122014_10_6			
			Sample ID	GPBT_036C_03-12-2014 (STF10)				GPBT_036G_03-12-2014 (STF10-6)			
			Sample Date	3/12/14				3/12/14			
			Sample Depth (ft bgs)	2-3				2-3			
			Unit	Result	Q	DL	DF	Result	Q	RL	DF
Volatile Organic Compounds (VOCs)											
1,2,4-Trimethylbenzene	95-63-6	640	mg/kg	NA				0.169	J	1.2	1
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	4.3	mg/kg	NA				ND	U	0.003	1
1,2-Dichloroethane	107-06-2	98	mg/kg	NA				ND	U	0.25	1
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	10,000	mg/kg	NA				ND	U	1.2	1
Benzene	71-43-2	330	mg/kg	NA				ND	U	0.25	1
Ethylbenzene	100-41-4	1,000	mg/kg	NA				0.125	J	0.25	1
Isopropylbenzene (Cumene)	98-82-8	10,000	mg/kg	NA				2.42		1.2	1
Methyl Tert-Butyl Ether	1634-04-4	9,900	mg/kg	NA				ND	U	0.25	1
Toluene	108-88-3	10,000	mg/kg	NA				0.0554	J	0.25	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	9,100	mg/kg	NA				0.318		0.25	1
Semi-volatile Organic Compounds (SVOCs)											
Anthracene	120-12-7	190,000	mg/kg	0.193		0.041	1	NA			
Benzo(A)Anthracene	56-55-3	190,000	mg/kg	0.931		0.041	1	NA			
Benzo(A)Pyrene	50-32-8	190,000	mg/kg	0.906		0.041	1	NA			
Benzo(B)Fluoranthene	205-99-2	190,000	mg/kg	1.07		0.041	1	NA			
Benzo(G,H,I)Perylene	191-24-2	190,000	mg/kg	0.582		0.041	1	NA			
Chrysene	218-01-9	190,000	mg/kg	1.01		0.041	1	NA			
Fluorene	86-73-7	190,000	mg/kg	0.0427		0.041	1	NA			
Naphthalene	91-20-3	190,000	mg/kg	0.0425		0.041	1	NA			
Phenanthrene	85-01-8	190,000	mg/kg	0.618		0.041	1	NA			
Pyrene	129-00-0	190,000	mg/kg	1.13		0.041	1	NA			
Metals											
Lead	7439-92-1	190,000	mg/kg	789		2.5	1	NA			

Notes:
CAS No - Chemical Abstracts Service Registry Number
PADEP - Pennsylvania Department of Environmental Protection Agency
MSC - Medium Specific Concentration
mg/kg - milligram per kilogram
Q - Qualifier
DL - May be reporting limit or method detection limit
DF - Dilution Factor
ND - Not Detected
NA- Not Analyzed
ft bgs - feet below ground surface
[1] PADEP Act 2 Non-Residental Subsurface Soil Direct Contact MSCs (last updated August 27, 2016).

Qualifiers:
U - The compound was analyzed but not detected
J - Estimated value. Result between method detection and reporting limits
D - Indicates a dilution

Exceedance Summary:
10 Reported result exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC.
10 DL exceeds the PADEP Non-Residential Subsurface Soil Direct Contact MSC

Table 6
PES Butane Rail Line Soil Sample Summary
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Section Name and Size	Composite Sample ID	Boring Location ID	Grab Sample PID Reading (ppm)	Grab Sample ID for VOC analysis
1	GPBT_031C_03-12-2014 (STF1)	1-1	17	GPBT_031G_03-12-2014 (STF1-1)
		1-2	0	NA
		1-3	4	GPBT_032G_03-12-2014 (STF1-3)
		1-4	0	NA
	GPBT_032C_03-12-2014 (STF1)	1-5	0	NA
		1-6	0	NA
		1-7	0	NA
		1-8	0	NA
	GPBT_033C_03-12-2014 (STF1)	1-9	0	NA
		1-10	0	NA
		1-11	0	NA
		1-12	6	GPBT_033G_03-12-2014 (STF1-12)
2	GPBT_001C_03-06-2014(STF2)	2-1	0	NA
		2-2	44	NA
		2-3	67	GPBT_001G_03-06-2014(STF2-3)
		2-4	58	NA
	GPBT_002C_03-06-2014(STF2)	2-5	20	NA
		2-6	60	NA
		2-7	82	GPBT_002G_03-06-2014(STF2-7)
		2-8	20	NA
	GPBT_003C_03-06-2014(STF2)	2-9	22	NA
		2-10	4	NA
		2-11	40	NA
		2-12	125	GPBT_003G_03-06-2014(STF2-12)
3	GPBT_004C_03-06-2014(STF3)	3-1	8	NA
		3-2	4	NA
		3-3	7	NA
		3-4	299	GPBT_004G_03-06-2014(STF3-4)
	GPBT_005C_03-06-2014(STF3)	3-5	35	NA
		3-6	298	GPBT_005G_03-06-2014(STF3-6)
		3-7	13	NA
		3-8	134	GPBT_006G_03-06-2014(ST3-8)
	GPBT_006C_03-06-2014(STF3)	3-9	2	NA
		3-10	53	NA
		3-11	38	NA
		3-12	0	NA
4	GPBT_007C_03-07-2014(STF4)	4-1	0	NA
		4-2	70	NA
		4-3	0	NA
		4-5	166	NA
	GPBT_008C_03-07-2014(STF4)	4-4	272	GPBT_007G_03-07-2014(STF4-4)
		4-6	142	NA
		4-7	341	GPBT_008G_03-07-2014(STF4-7)
		4-8	7	NA
	GPBT_009C_03-07-2014(STF4)	4-9	5	NA
		4-10	174	GPBT_009G_03-07-2014(STF4-10)
		4-11	9	NA
		4-12	1	NA
5	GPBT_010C_03-07-2014(STF5)	5-1	1	GPBT_010G_03-07-2014(STF5-1)
		5-2	0	NA
		5-3	0	NA
		5-4	0	NA
	GPBT_011C_03-07-2014(STF5)	5-5	0	NA
		5-6	2	GPBT_011G_03-07-2014(STF5-6)
		5-7	0	NA
		5-8	1	GPBT_012G_03-07-2014(STF5-8)
	GPBT_012C_03-07-2014(STF5)	5-9	0	NA
		5-10	0	NA
		5-11	0	NA
		5-12	0	NA

Notes:
Gray highlighting indicates boring location identification and associated PID measurement for each of the three highest PID concentrations per section and the grab sample identification for laboratory VOC analysis.
PID: Photo Ionization Detector
ppm: parts per million
VOC: Volatile Organic Compounds
NA: not applicable
Sources: "Composite Sample and Field Data Summary", Stantec, March 2014
"Composite Sample and Field Data Summary", Stantec, August 2014

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PES Butane Rail Line Soil Sample Summary
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Philadelphia, Pennsylvania

Section Name and Size	Composite Sample ID	Boring Location ID	Grab Sample PID Reading (ppm)	Grab Sample ID for VOC analysis
6	GPBT_013C_03-10-2014(STF6)	6-1	0	NA
		6-2	0	NA
		6-7	0	NA
		6-12	3	GPBT_015G_03-10-2014(STF6-12)
	GPBT_014C_03-10-2014(STF6)	6-3	0	GPBT_013G_03-10-2014(STF6-3)
		6-4	0	NA
		6-5	0	NA
		6-6	0	NA
	GPBT_015C_03-10-2014(STF6)	6-8	0	NA
		6-9	1	GPBT_014G_03-10-2014(STF6-9)
		6-10	0	NA
		6-11	0	NA
7	GPBT_016C_03-10-2014(STF7)	7-1	0	NA
		7-2	0	NA
		7-3	0	NA
		7-12	2	GPBT_018G_03-10-2014(STF7-12)
	GPBT_017C_03-10-2014(STF7)	7-4	0	GPBT_016G_03-10-2014(STF7-4)
		7-5	0	NA
		7-6	0	NA
		7-7	0	NA
	GPBT_018C_03-10-2014(STF7)	7-8	0	GPBT_017G_03-10-2014(STF7-8)
		7-9	0	NA
		7-10	0	NA
		7-11	0	NA
8	GPBT_028C_03-11-2014(STF 8)	8-1	2	NA
		8-2	1	NA
		8-3	8	NA
		8-4	38	GPBT_025G_03-11-2014(STF 8-4)
	GPBT_029C_03-11-2014(STF 8)	8-5	55	GPBT_026G_03-11-2014(STF 8-5)
		8-6	23	NA
		8-7	5	NA
		8-8	69	GPBT_027G_03-11-2014(STF 8-8)
	GPBT_030C_03-11-2014(STF 8)	8-9	34	NA
		8-10	27	NA
		8-11	27	NA
		8-12	16	NA
9	GPBT_022C_03-11-2014(STF 9)	9-1	28	GPBT_019G_03-11-2014(STF 9-1)
		9-2	8	NA
		9-3	1	NA
		9-4	12	GPBT_020G_03-11-2014(STF 9-4)
	GPBT_023C_03-11-2014(STF 9)	9-5	2	NA
		9-6	1	NA
		9-7	3	NA
		9-8	9	GPBT_021G_03-11-2014(STF 9-8)
	GPBT_024C_03-11-2014(STF 9)	9-9	2	NA
		9-10	2	NA
		9-11	1	NA
		9-12	7	NA
10	GPBT_034C_03-12-2014 (STF10)	10-1	103	GPBT_034G_03-12-2014 (STF10-1)
		10-2	65	NA
		10-3	72	GPBT_035G_03-12-2014 (STF10-3)
		10-5	57	NA
	GPBT_035C_03-12-2014 (STF10)	10-4	17	NA
		10-6	73	GPBT_036G_03-12-2014 (STF10-6)
		10-7	18	NA
		10-8	6	NA
	GPBT_036C_03-12-2014 (STF10)	10-9	6	NA
		10-10	3	NA
		10-11	0	NA
		10-12	0	NA

Notes:
Gray highlighting indicates boring location identification and associated PID measurement for each of the three highest PID concentrations per section and the grab sample identification for laboratory VOC analysis.
PID: Photo Ionization Detector
ppm: parts per million
VOC: Volatile Organic Compounds
NA: not applicable
Sources: "Composite Sample and Field Data Summary", Stantec, March 2014
"Composite Sample and Field Data Summary", Stantec, August 2014

Table 6
PES Butane Rail Line Soil Sample Summary
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Section Name and Size	Composite Sample ID	Boring Location ID	Grab Sample PID Reading (ppm)	Grab Sample ID for VOC analysis
PECO 1000 cubic yards	GPBR_003C_08-20-2014(PECO)	PECO 1	0.0	NA
		PECO 2	0.0	NA
		PECO 3	0.0	NA
		PECO 4	0.0	NA
	GPBR_004C_08-20-2014(PECO)	PECO 5	0.0	NA
		PECO 6	2.0	GPBR_001G_08-20-2014 (PECO6)
		PECO 7	0.0	NA
		PECO 8	1.0	GPBR_002G_08-20-2014 (PECO8) GPBR_006G_08-20-2014 (PECO8)[1]
	GPBR_005C_08-20-2014(PECO)2	PECO 92	0.0	NA
		PECO 10[2]	0.0	NA
		PECO 11[2]	0.0	NA
		PECO 12[2]	0.0	NA
A 3000 cubic yards	GPBR_011C_08-21-2014(PH3A)	A-1	0.0	NA
		A-2	0.0	NA
		A-3	0.0	GPBR_008G_08-21-2014 (PH3A-3)
		A-4	0.0	NA
	GPBR_012C_08-21-2014(PH3A)	A-5	0.0	NA
		A-6	0.0	NA
		A-7	0.0	GPBR_009G_08-21-2014 (PH3A-7)
		A-8	0.0	NA
	GPBR_013C_08-21-2014(PH3A)	A-9	0.0	NA
		A-10	0.0	NA
		A-11	0.0	GPBR_010G_08-21-2014 (PH3A-11)
		A-12	0.0	NA
B 3000 cubic yards	GPBR_017C_08-21-2014(PH3B)	B-1	1.0	NA
		B-2	0.0	NA
		B-3	1.0	GPBR_014G_08-21-2014 (PH3B-3)
		B-4	0.0	NA
	GPBR_018C_08-21-2014(PH3B)	B-5	1.0	GPBR_015G_08-21-2014 (PH3B-5)
		B-6	0.0	NA
		B-7	0.0	NA
		B-8	3.0	GPBR_016G_08-21-2014 (PH3B-8)
	GPBR_019C_08-21-2014(PH3B)	B-9	0.0	NA
		B-10	0.0	NA
		B-11	0.0	NA
		B-12	0.0	NA

Notes:
Gray highlighting indicates boring location identification and associated PID measurement for each of the three highest PID concentrations per section and the grab sample identification for laboratory VOC analysis.
PID: Photo Ionization Detector
ppm: parts per million
VOC: Volatile Organic Compounds
NA: not applicable
Sources: "Composite Sample and Field Data Summary", Stantec, March 2014
"Composite Sample and Field Data Summary", Stantec, August 2014

1. Grab sample GPBR_006G_08-20-2014 (PECO8) was collected from boring PECO 8 for analysis for VOC waste characterization parameters. A five point composite sample, GPBR_007C_08-20-2014 (PECO) was collected from borings PECO 2, PECO 4, PECO 6, PECO 9, and PECO 12 for additional waste characterization analyses.
2. Boring locations PECO 9, PECO 10, PECO 11, and PECO 12 were completed at the request of PECO for characterization of soils in the roadway footprint. A composite sample, GPBR_005C_08-20-2014(PECO), was collected from soil from these borings, as requested.

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-1_1242006					A-1_050707					A-1_071814					A-1_102214					A-10_1252006					A-10_050807				
			Sample Date	12/4/2006					5/7/2007					7/18/2014					10/22/2014					12/5/2006					5/8/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					NA					ND	U	0.19	2	1	ND	U	0.012	0.1	1	NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.26***	1	1	NA					ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					NA					ND	U	0.17	2	1	ND	U	0.26	1	1	NA					NA				
Benzene	71-43-2	5	ug/L	ND	U	0.5	1	1	ND	U	0.5	5	1	0.42	J	0.21	0.5	1	ND	U	0.01	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	2.5		0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.012	0.1	1	0.98	J	0.5	1	1	0.7	J	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.016	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.02	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	14		0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.015	0.1	1	0.69	J	0.5	3	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					0.468		0.02	0.1	1	ND	U	0.012	0.1	1	NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					2.23		0.012	0.1	1	ND	U	0.4	1	1	NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					**2.55**		0.012	0.1	1	ND	U	0.0081	0.02	1	NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					**3.39**		0.01	0.1	1	ND	U	0.036	0.1	1	NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					**1.77**		0.016	0.1	1	ND	U	0.017	0.1	1	NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.5	1	1	ND	U	0.00052	1	1	**2.34**		0.012	0.1	1	ND	U	1.3	3	1	ND	U	0.5	1	1	ND	U	0.0005	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.5	1	1	ND	U	0.00052	1	1	0.154		0.017	0.1	1	ND	U	0.17	2	1	0.8	J	0.5	1	1	ND	U	0.0005	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.5	1	1	ND	U	0.00052	1	1	0.2		0.036	0.1	1	ND	U	0.22	1	1	1.5		0.5	1	1	ND	U	0.0005	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.5	1	1	ND	U	0.00052	1	1	1.64		0.021	0.1	1	ND	U	0.3	1	1	1.1		0.5	1	1	ND	U	0.0005	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.5	1	1	ND	U	0.00052	1	1	3.21		0.015	0.1	1	ND	U	0.021	0.1	1	1		0.5	1	1	ND	U	0.0005	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	**7.1**		1.3	3	1	**9.8**		0.012	0.1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-10_072414					A-10_101314					A-11_050707					A-11-072214					A-11_100914					A-118_1262006				
			Sample Date	7/24/2014					10/13/2014					5/7/2007					7/22/2014					10/9/2014					12/6/2006				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.19	2	1	NA					ND	U	0.19	2	1	ND	U	0.016	0.1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	***0.4***	1	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.2***	1	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.17	2	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.22	1	1	NA					ND	U	0.17	2	1	ND	U	0.19	2	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.015	0.1	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.3	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.26	1	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	0.93	J	0.26	1	1	0.5	J	0.18	0.5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.01	0.1	1	6.3		0.5	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.26	1	1	3.3	J	0.5	5	1	0.71	J	0.26	1	1	0.87	J	0.0081	0.02	1	ND	U	0.5	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.2	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.26	1	1	ND	U	0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.45	J	0.2	1	1	0.3	J	0.085	0.5	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.02	0.1	1	ND	U	0.5	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	10.3		0.1	0.5	5	0.221		0.22	1	1	NA					ND	U	0.02	0.1	1	ND	U	0.012	0.1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	**16.6**		0.058	0.5	5	ND	U	0.01	0.1	1	NA					ND	U	0.012	0.1	1	0.17		0.011	0.02	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**14**		0.062	0.5	5	ND	U	0.016	0.1	1	NA					ND	U	0.012	0.1	1	0.124		1.3	3	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**16.4**		0.051	0.5	5	ND	U	0.02	0.1	1	NA					ND	U	0.01	0.1	1	0.138		0.018	0.1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**9.47**		0.078	0.5	5	ND	U	0.26	1	1	NA					ND	U	0.016	0.1	1	ND	U	0.012	0.1	1	NA				
Chrysene	218-01-9	1.9	ug/L	**15.3**		0.059	0.5	5	ND	U	0.015	0.1	1	ND	U	0.00049	1	1	0.124		0.012	0.1	1	0.192		0.037	0.1	1	ND	U	0.5	1	1
Fluorene	86-73-7	1900	ug/L	14.3		0.085	0.5	5	0.685		0.21	0.5	1	ND	U	0.00049	1	1	0.266		0.017	0.1	1	0.196		0.4	1	1	0.72	J	0.5	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.18	0.5	5	ND	U	0.012	0.1	1	ND	U	0.00049	1	1	ND	U	0.036	0.1	1	0.12		0.3	1	1	ND	U	0.5	1	1
Phenanthrene	85-01-8	1100	ug/L	20.3		0.1	0.5	5	0.818		0.26	1	1	ND	U	0.00049	1	1	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	ND	U	0.5	1	1
Pyrene	129-00-0	130	ug/L	39.5		0.075	5	5	0.265		0.2	1	1	ND	U	0.00049	1	1	0.204		0.015	0.1	1	0.326		0.022	0.1	1	ND	U	0.5	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	3.5		1.3	3	1	ND	U	0.0081	0.02	1	0.81	B	0.8	2	1	ND	U	1.3	3	1	ND	U	0.22	1	1	1.2	B	0.8	2	1

Note:
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ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-118_050907					A-118_072414					A-118_102014					A-119_050907					A-12_1252006					A-12_050707				
			Sample Date	5/9/2007					7/24/2014					10/20/2014					5/9/2007					12/5/2006					5/7/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.012	0.1	1	NA					NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.21***	0.5	1	ND	U	0.005	0.05	1	NA					ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.02	1	1	NA					NA					NA				
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.012	0.1	1	**15**		0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.19	2	1	3.8	J	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	0.61	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.012	0.1	1	160		0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.01	0.1	1	3	J	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.015	0.1	1	4.2	J	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.016	0.1	1	8.2		0.5	5	1	ND	U	0.5	3	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	ND	U	0.021	0.1	1	NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					0.105		0.012	0.1	1	ND	U	0.4	1	1	NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	0.011	0.02	1	NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	ND	U	***1.3***	3	1	NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	ND	U	0.036	0.1	1	NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.0016	3.2	1	0.12		0.012	0.1	1	ND	U	1.3	3	1	ND	U	0.0015	3	1	ND	U	0.5	1	1	ND	U	0.0005	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.0016	3.2	1	0.287		0.017	0.1	1	0.185		0.012	0.1	1	5.4		0.0015	3	1	16		0.5	1	1	24		0.005	9.9	10
Naphthalene	91-20-3	100	ug/L	ND	U	0.0016	3.2	1	ND	U	0.036	0.1	1	ND	U	0.17	2	1	ND	U	0.0015	3	1	ND	U	0.5	1	1	ND	U	0.0005	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.0016	3.2	1	0.106		0.021	0.1	1	ND	U	0.3	1	1	6.7		0.0015	3	1	1.7		0.5	1	1	4.2		0.0005	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.0016	3.2	1	0.199		0.015	0.1	1	ND	U	0.017	1	1	ND	U	0.0015	3	1	2.4		0.5	1	1	2.6		0.0005	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	1.6	B	1.3	3	1	ND	U	0.26	1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-12_073014					A-12_101014					A-120_1252006					A-121_1262006					A-121_050907				
			Sample Date	7/30/2014					10/10/2014					12/5/2006					12/6/2006					5/9/2007				
			Sample Matrix	WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																												
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.19	2	1	NA					NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	***0.4***	1	1	NA					NA					ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.17	2	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.22	1	1	NA					NA					NA				
Benzene	71-43-2	5	ug/L	0.25	J	0.21	0.5	1	0.27	J	0.3	1	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.3	1	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.26	1	1	14		0.5	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.2	1	1	ND	U	0.5	1	1	ND	U	0.5	1	1	0.6	J	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.26	1	1	ND	U	0.5	3	1	ND	U	0.5	3	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																												
Anthracene	120-12-7	66	ug/L	4.42		0.02	0.1	1	4.83		0.017	0.1	1	NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.39		0.012	0.1	1	0.199		0.0081	0.02	1	NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1	NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.01	0.1	1	ND	U	0.015	0.1	1	NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	0.02	0.1	1	NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	0.173		0.012	0.1	1	0.119		1.3	3	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.0015	3	1
Fluorene	86-73-7	1900	ug/L	27.6		0.017	1	1	29.6		0.3	1	1	4.6		0.5	1	1	ND	U	0.5	1	1	ND	U	0.0015	3	1
Naphthalene	91-20-3	100	ug/L	0.144		0.036	0.1	1	0.152		0.17	2	1	ND	U	0.5	1	1	ND	U	0.5	1	1	ND	U	0.0015	3	1
Phenanthrene	85-01-8	1100	ug/L	1.88		0.021	0.1	1	2.01		0.4	1	1	3		0.5	1	1	ND	U	0.5	1	1	ND	U	0.0015	3	1
Pyrene	129-00-0	130	ug/L	2.63		0.015	0.1	1	2.93		0.036	0.1	1	0.53	J	0.5	1	1	ND	U	0.5	1	1	ND	U	0.0015	3	1
Metals Dissolved																												
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	NA					ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-122_050807					A-122_072914					A-122_102014					A-133_050307					A-133_040813					A-133~JB68336				
			Sample Date	5/8/2007					7/29/2014					10/20/2014					5/3/2007					4/8/2013					6/2/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.22	1	1	NA					ND	U	0.19	2	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					-	-			-
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	0.021	0.1	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.036	0.1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	1.3	3	1	NA					ND	U	0.36	2	1	ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.17	2	1	1.2	J	0.5	5	1	ND	U	0.24	1	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.017	0.1	1	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.2	1	1	12		0.5	5	1	ND	U	0.45	2	1	0.39	J	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.5	5	1	ND	U	0.16	1	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.011	0.02	1	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.4	1	1	ND	U	0.5	5	1	ND	U	0.24	1	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	1.27		0.22	1	1	NA					ND	U	0.02	0.1	1	2.58	-	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	0.206		0.19	2	1	NA					0.173		0.012	0.1	1	**7.36**	-	0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	***0.21***	0.5	1	NA					**0.269**		0.012	0.1	1	**11.1**	-	0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	0.132		0.26	1	1	NA					ND	U	0.01	0.1	1	**4.4**	-	0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	ND	U	0.26	1	1	NA					ND	U	0.016	0.1	1	**6.58**	-	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00049	1	1	ND	U	0.012	0.1	1	0.182		0.21	0.5	1	**130**		0.005	10	10	0.574		0.012	0.1	1	**23.6**	-	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00049	1	1	ND	U	0.017	0.1	1	10.3		0.02	0.1	1	170		0.005	10	10	ND	U	0.017	0.1	1	8.11	-	0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00049	1	1	ND	U	0.036	0.1	1	ND	U	0.19	2	1	ND	U	0.005	10	10	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00049	1	1	ND	U	0.021	0.1	1	4.2		0.26	1	1	200		0.005	10	10	ND	U	0.021	0.1	1	9.18	-	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00049	1	1	0.113		0.015	0.1	1	0.95		0.2	1	1	110		0.005	10	10	0.959		0.015	0.1	1	24.1	-	0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.012	0.1	1	ND	U	0.8	0.8	1	ND	U	1.7	3	1	3.4	-	1.3	3	1

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DF - Dilution factor
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NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
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J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-133_072414					A-133_102114					A-133_20150521_1563168					A-134_1252006					A-134_050307					A-134_072414				
			Sample Date	7/24/2014					10/21/2014					5/21/2015					12/5/2006					5/3/2007					7/24/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1	NA					NA					1.8	J	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	***0.19***	2	1	ND	U	0.01	0.0095	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.02	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.015	0.1	1	ND	U	0.5	0.5	1	NA					NA					1.1	J	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	0.38	J	0.2	1	1	ND	U	0.5	0.5	1	**24**		0.5	1	1	**50**		0.5	5	1	**7**		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.26	1	1	ND	U	0.5	0.5	1	0.85	J	0.5	1	1	1.5	J	0.5	5	1	0.62	J	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	0.6	J	0.26	1	1	0.49	J	0.26	1	1	ND	U	0.5	0.5	1	63		0.5	1	1	83		0.5	5	1	71.6		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.01	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	0.86	J	0.22	1	1	ND	U	0.5	0.5	1	9.9		0.5	1	1	13		0.5	5	1	6.8		0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.016	0.1	1	ND	U	0.5	0.5	1	18		0.5	3	1	28		0.5	5	1	15.9		0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.02	0.1	1	0.621		0.02	0.1	1	0.5		0.1	0.1	1	NA					NA					2.91		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.21		0.012	0.1	1	1.35		0.012	0.1	1	0.8		0.1	0.1	1	NA					NA					0.196		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	0.192		0.012	0.1	1	**1.18**		0.012	0.1	1	**1**		0.1	0.1	1	NA					NA					0.127		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.111		0.01	0.1	1	**1.43**		0.01	0.1	1	0.5	J	0.1	0.1	1	NA					NA					0.147		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	**0.877**		0.016	0.1	1	**0.7**		0.1	0.1	1	NA					NA					ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	0.644		0.012	0.1	1	1.19		0.012	0.1	1	**3**		0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.152		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	0.351		0.017	0.1	1	0.321		0.017	0.1	1	2		0.1	0.1	1	6.8		0.5	1	1	9		0.0005	1	1	16.7		0.017	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	0.125		0.036	0.1	1	0.1	J	0.1	0.1	1	0.69	J	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.021	0.1	1	0.195		0.021	0.1	1	0.6		0.1	0.1	1	3		0.5	1	1	3.7		0.0005	1	1	14.8		0.021	1	1
Pyrene	129-00-0	130	ug/L	1.09		0.015	0.1	1	2.09		0.015	0.1	1	3		0.1	0.1	1	8.1		0.5	1	1	ND	U	0.0005	1	1	1.42		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.21	0.5	1	0.1	J	0.082	0.082	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-134_101314					A-135_1252006					A-135_050307					A-135_072414					A-135_101714					A-136_110308				
			Sample Date	10/13/2014					12/5/2006					5/3/2007					7/24/2014					10/17/2014					11/3/2008				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	2.4		0.021	0.1	1	NA					NA					0.86	J	0.19	2	1	1.8	J	0.016	0.1	1	ND	U	1	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.017	0.1	1	ND	U	0.01	0.0098	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.99	2.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.036	0.1	1	ND	U	1	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	2		0.01	1	1	NA					NA					ND	U	0.17	2	1	ND	U	1.3	3	1	ND	U	1	0.5	1
Benzene	71-43-2	5	ug/L	**64.6**		0.012	0.1	1	**22**		0.5	1	1	**18**		0.5	5	1	**7.1**		0.21	0.5	1	**17**		0.012	1	1	ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	3.7		0.016	0.1	1	3.1		0.5	1	1	3.1	J	0.5	5	1	1.2		0.4	1	1	2.2	J	0.015	0.1	1	ND	U	0.8	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	49.6		0.017	1	1	47		0.5	1	1	47		0.5	5	1	43.4		0.26	1	1	68.9		0.021	1	1	7		1	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.75	2.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.0081	0.02	1	ND	U	0.5	0.5	1
Toluene	108-88-3	1000	ug/L	73.5		0.012	0.1	1	21		0.5	1	1	20		0.5	5	1	6.3		0.22	1	1	17.9		0.012	1	1	ND	U	0.7	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	26.1		0.012	0.1	1	14		0.5	3	1	14		0.5	5	1	5.9		0.2	1	1	12.2		0.012	1	1	0.6	J	0.8	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	4.68		0.036	0.1	1	NA					NA					ND	U	0.02	0.1	1	0.177		0.017	1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.27		0.22	1	1	NA					NA					ND	U	0.012	0.1	1	0.128		0.011	0.02	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**0.66**		0.17	2	1	NA					NA					ND	U	0.012	0.1	1	ND	U	0.17	2	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.747		0.4	1	1	NA					NA					ND	U	0.01	0.1	1	ND	U	0.3	1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	0.225		0.0081	0.02	1	NA					NA					ND	U	0.016	0.1	1	ND	U	***0.4***	1	1	NA				
Chrysene	218-01-9	1.9	ug/L	0.731		0.3	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.012	0.1	1	0.123		1.3	3	1	**6**		1	1	1
Fluorene	86-73-7	1900	ug/L	19.6		0.26	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.389		0.017	0.1	1	0.707		0.3	1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.44	5	1	1.8		0.5	1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	0.139		0.17	2	1	NA				
Phenanthrene	85-01-8	1100	ug/L	22.5		0.2	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.122		0.021	0.1	1	0.119		0.4	1	1	7		1	1	1
Pyrene	129-00-0	130	ug/L	4.05		1.3	3	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.015	0.1	1	0.32		0.036	0.1	1	15		1	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**5.3**		0.015	1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.021	0.1	1	0.41	J	0.047	0.05	1

Note:
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TDS - Total Dissolved Solids
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Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-136_080114					A-136_101714					AOI5_A-136_012116~JC13091					A-137_11_9_2005					A-137_050707					A-137_110308				
			Sample Date	8/1/2014					10/17/2014					1/21/2016					11/9/2005					5/7/2007					11/3/2008				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	0.48	J	0.19	2	1	ND	U	0.037	0.11	1	ND	U	0.22	2	1	NA					NA					ND	U	1	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	0.016	0.11	1	ND	U	0.0083	0.019	1	ND	U	0.02	0.02	1	ND	U	0.005	0.05	1	ND	U	0.01	0.0099	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.012	0.11	1	ND	U	0.18	1	1	ND	U	1	1	1	ND	U	0.5	5	1	ND	U	1	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.013	0.11	1	ND	U	0.29	2	1	NA					NA					ND	U	1	0.5	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.018	0.11	1	ND	U	0.24	0.5	1	ND	U	1	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.011	0.11	1	ND	U	0.27	1	1	ND	U	1	1	1	ND	U	0.5	5	1	ND	U	0.8	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	19.5		0.26	1	1	8.4		0.012	0.1	1	12.6		0.23	1	1	NA					ND	U	0.5	5	1	ND	U	1	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.022	0.11	1	ND	U	0.24	1	1	4		1	1	1	0.6	J	0.5	5	1	2		0.5	0.5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.012	0.11	1	ND	U	0.16	1	1	ND	U	1	1	1	ND	U	0.5	5	1	ND	U	0.7	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	1.1		0.2	1	1	0.76	J	0.012	0.1	1	1		0.17	1	1	ND	U	1	1	1	ND	U	0.5	5	1	ND	U	0.8	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	1.28		0.021	0.11	1	1.41		0.021	1	1	0.817		0.013	0.1	1	NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.39		0.012	0.11	1	1.65		0.3	1	1	0.452		0.019	0.05	1	ND	U	0.014	0.1	1	NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**1.07**		0.013	0.11	1	**0.651**		0.4	1	1	**0.227**		0.03	0.05	1	ND	U	0.029	0.1	1	NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**1.52**		0.011	0.11	1	**1.23**		1.3	3	1	0.4		0.021	0.1	1	ND	U	0.022	0.1	1	NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**0.9**		0.016	0.11	1	**0.459**		0.036	0.1	1	0.168		0.026	0.1	1	ND	U	0.034	0.1	1	NA					NA				
Chrysene	218-01-9	1.9	ug/L	1.53		0.012	0.11	1	**2.01**		0.0081	0.02	1	0.441		0.015	0.1	1	ND	U	0.014	0.1	1	ND	U	0.00049	1	1	ND	U	1	1	1
Fluorene	86-73-7	1900	ug/L	2.79		0.018	0.11	1	3.22		0.22	1	1	2.09		0.027	0.1	1	ND	U	0.024	0.1	1	ND	U	0.00049	1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.037	0.11	1	ND	U	1.3	3	1	ND	U	0.013	0.1	1	NA					ND	U	0.00049	1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	1.24		0.022	0.11	1	2.23		0.17	2	1	0.592		0.016	0.1	1	0.2		0.03	0.1	1	ND	U	0.00049	1	1	ND	U	1	1	1
Pyrene	129-00-0	130	ug/L	7		0.016	1.1	1	4.22		0.017	1	1	1.52		0.013	0.1	1	0.2		0.021	0.1	1	ND	U	0.00049	1	1	ND	U	1	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	1.4	B	1.3	3	1	3.4		0.012	0.1	1	ND	U	2.3	3	1	ND	U	3	10	1	ND	U	0.8	0.8	1	0.17	J	0.047	0.05	1

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-137_040813					A-137~JB68336					A-137_071714					A-137_101514					A-137_20150521_1563168					AOI-5 A-138				
			Sample Date	4/8/2013					6/2/2014					7/17/2014					10/15/2014					5/21/2015					7/12/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.2	1	1	ND	U	0.5	0.5	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					-	-			-	NA					NA					NA									
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1	ND	U	0.01	0.0095	1	ND	U		50	
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.011	0.02	1	ND	U	0.5	0.5	1	ND	U		50	
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.36	2	1	ND	U	0.17	2	1	ND	U	0.17	2	1	ND	U	0.4	1	1	ND	U	0.5	0.5	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.24	1	1	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.22	1	1	ND	U	0.5	0.5	1	ND	U		50	
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.23	1	1	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	1.3	3	1	ND	U	0.5	0.5	1	62			50	
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.45	2	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.5	0.5	1	**17000**			1000	
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.84	J	0.16	1	1	0.43	J	0.26	1	1	0.8	J	0.26	1	1	0.89	J	0.012	0.1	1	0.7	J	0.5	0.5	1	ND	U		50	
Toluene	108-88-3	1000	ug/L	ND	U	0.23	1	1	ND	U	0.22	1	1	ND	U	0.22	1	1	ND	U	0.3	1	1	ND	U	0.5	0.5	1	ND	U		50	
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.24	1	1	ND	U	0.2	1	1	ND	U	0.2	1	1	ND	U	0.17	2	1	ND	U	0.5	0.5	1	280			100	
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.022	0.11	1	ND	U	0.02	0.1	1	ND	U	0.02	0.1	1	ND	U	0.21	0.5	1	ND	U	0.1	0.1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1	ND	U	0.1	0.1	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.013	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.015	0.1	1	ND	U	0.1	0.1	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.011	0.11	1	ND	U	0.01	0.1	1	ND	U	0.01	0.1	1	ND	U	0.26	1	1	ND	U	0.1	0.1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.017	0.11	1	ND	U	0.016	0.1	1	ND	U	0.016	0.1	1	ND	U	0.19	2	1	ND	U	0.1	0.1	1	NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.013	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.02	0.1	1	ND	U	0.1	0.1	1	NA				
Fluorene	86-73-7	1900	ug/L	ND	U	0.018	0.11	1	ND	U	0.017	0.1	1	ND	U	0.017	0.1	1	ND	U	0.01	0.1	1	0.1	J	0.1	0.1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.038	0.11	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	ND	U	0.012	0.1	1	ND	U	0.1	0.1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.022	0.11	1	0.245	-	0.021	0.1	1	0.31		0.021	0.1	1	0.215		0.19	2	1	0.3	J	0.1	0.1	1	NA				
Pyrene	129-00-0	130	ug/L	ND	U	0.016	0.11	1	0.138	-	0.015	0.1	1	0.153		0.015	0.1	1	0.137		0.21	0.5	1	0.3	J	0.1	0.1	1	NA				
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.7	3	1	1.9	J	1.3	3	1	ND	U	1.3	3	1	ND	U	0.017	0.1	1	0.3	J	0.082	0.082	1	NA				

Note:

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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:

U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

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Summary of Groundwater Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	AOI-5 A-138					A-138					A-138_040813					A-139_050707					A-139~JB68336					A-139_071814				
			Sample Date	7/16/2007					4/24/2009					4/8/2013					5/7/2007					6/2/2014					7/18/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					NA					ND	U	0.19	2	1	NA					ND	U	0.19	2	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L						NA					NA					NA					-	-			-	NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	NA					NA					ND	U	0.011	0.02	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	NA					NA					ND	U	0.26	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					NA					ND	U	0.36	2	1	NA					ND	U	0.17	2	1	ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	NA					NA					0.76	J	0.24	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	NA					NA					ND	U	0.23	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	NA					420		1	20	10	104		0.45	2	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	NA					NA					1.1		0.16	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	NA					NA					ND	U	0.23	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	NA					NA					0.33	J	0.24	1	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					ND	U	0.021	0.1	1	NA					ND	U	0.02	0.1	1	ND	U	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					0.151		0.012	0.1	1	NA					ND	U	0.012	0.1	1	ND	U	0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					ND	U	0.013	0.1	1	NA					ND	U	0.012	0.1	1	ND	U	0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					0.166		0.01	0.1	1	NA					ND	U	0.01	0.1	1	ND	U	0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					ND	U	0.016	0.1	1	NA					ND	U	0.016	0.1	1	ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U		0.2		NA					0.152		0.012	0.1	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U		0.62		NA					ND	U	0.017	0.1	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U		3		NA					ND	U	0.036	0.1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U		0.4		NA					0.235		0.021	0.1	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	ND	U	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U		0.2		NA					0.174		0.015	0.1	1	ND	U	0.00051	1	1	ND	U	0.015	0.1	1	ND	U	0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	NA					NA					ND	U	1.7	3	1	ND	U	0.8	0.8	1	2.6	J	1.3	3	1	**5.4**		1.3	3	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-139_102114					A-139_20150521_1563168					A-13D_1252006					A-13D_050307					A-13D_04112011					A-13D_04112011 FILTERED				
			Sample Date	10/21/2014					5/21/2015					12/5/2006					5/3/2007					4/11/2011					4/11/2011				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.4	1	1	ND	U	0.5	0.5	1	NA					NA					ND	U	0.5	0.5	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.012	0.1	1	ND	U	0.01	0.0095	1	NA					ND	U	0.005	0.05	1	ND	U	0.01	0.0096	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.021	0.1	1	ND	U	0.5	0.5	1	NA					NA					ND	U	0.5	0.5	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.011	0.02	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.3	1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	1.3	3	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	4		0.5	0.5	1	NA				
Toluene	108-88-3	1000	ug/L	ND	U	0.017	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.036	0.1	1	ND	U	0.5	0.5	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA				
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.17	2	1	ND	U	0.1	0.1	1	NA					NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.26	1	1	ND	U	0.1	0.1	1	NA					NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.19	2	1	ND	U	0.1	0.1	1	NA					NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.26	1	1	ND	U	0.1	0.1	1	NA					NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.2	1	1	ND	U	0.1	0.1	1	NA					NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.21	0.5	1	ND	U	0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	1	1	1	NA				
Fluorene	86-73-7	1900	ug/L	ND	U	0.015	0.1	1	ND	U	0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	1	1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.016	0.1	1	ND	U	0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	1	1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.02	0.1	1	ND	U	0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	1	1	1	NA				
Pyrene	129-00-0	130	ug/L	ND	U	0.22	1	1	ND	U	0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	1	1	1	NA				
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**25.7**		0.02	0.1	1	**94.6**		0.082	0.082	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	2.6		0.052	0.052	1	ND	U	0.052	1	1

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Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-13D_07012011					A-13D_07012011 FILTERED					A-13D_53012					A-13D_082112					A-13D_11112					A-13D_32713				
			Sample Date	7/1/2011					7/1/2011					5/30/2012					8/21/2012					11/1/2012					3/27/2013				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.35	5	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					ND	U	0.012	0.014	1	NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.01	0.0097	1	NA					ND	U	0.01	0.0096	1	ND	U	0.01	0.0097	1	ND	U	*0.5*	2	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.63	1	1	ND	U	0.26	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.47	5	1	ND	U	0.36	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.24	0.5	1	ND	U	0.24	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.51	1	1	ND	U	0.23	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.5	5	1	ND	U	0.45	2	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	4		0.5	0.5	1	NA					2		0.5	0.5	1	2		0.5	0.5	1	ND	U	0.41	1	1	0.57	J	0.16	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.51	1	1	ND	U	0.23	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.58	1	1	ND	U	0.24	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					NA					0.1	J	0.1	0.1	1	ND	U	0.018	0.1	1	ND	U	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					NA					ND	U	0.1	0.1	1	ND	U	0.03	0.05	1	ND	U	0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					NA					ND	U	0.1	0.1	1	ND	U	0.017	0.1	1	ND	U	0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					NA					ND	U	0.1	0.1	1	ND	U	0.024	0.05	1	ND	U	0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					NA					ND	U	0.1	0.1	1	ND	U	0.038	0.1	1	ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	1	1	1	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.073	0.1	1	ND	U	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	1	1	1	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.046	0.1	1	ND	U	0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	1	1	1	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	1	1	1	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.013	0.05	1	ND	U	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	1	1	1	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.036	0.1	1	ND	U	0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	0.33	J	0.08	0.08	1	ND	U	0.08	1	1	ND	U	0.08	1	1	ND	U	0.034	1	1	ND	U	2.1	5	1	ND	U	1.7	3	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-140_050707					A-140_040813					A-140~JB68336					A-140_071814					A-140_102114					A-140_20150521_1563168				
			Sample Date	5/7/2007					4/8/2013					6/2/2014					7/18/2014					10/21/2014					5/21/2015				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					0.39	J	0.19	2	1	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.011	0.02	1	ND	U	0.5	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					-	-			-	NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1	ND	U	0.01	0.1	1	ND	U	0.01	0.0097	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.36	2	1	ND	U	0.17	2	1	ND	U	0.17	2	1	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.24	1	1	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	1.3	3	1	ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	0.5	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.45	2	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.4	1	1	ND	U	0.5	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	0.24	J	0.16	1	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.036	0.1	1	ND	U	0.5	0.5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	0.22	1	1	ND	U	0.22	1	1	ND	U	0.021	0.1	1	ND	U	0.5	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	0.73	J	0.24	1	1	ND	U	0.2	1	1	ND	U	0.2	1	1	ND	U	0.017	0.1	1	ND	U	0.5	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.021	0.11	1	ND	U	0.02	0.1	1	ND	U	0.02	0.1	1	ND	U	0.3	1	1	ND	U	0.1	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.19	2	1	ND	U	0.1	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.013	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	***0.21***	0.5	1	ND	U	0.1	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.011	0.11	1	ND	U	0.01	0.1	1	ND	U	0.01	0.1	1	ND	U	0.2	1	1	ND	U	0.1	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.11	1	ND	U	0.016	0.1	1	ND	U	0.016	0.1	1	ND	U	0.22	1	1	ND	U	0.1	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00049	1	1	ND	U	0.012	0.11	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.26	1	1	ND	U	0.1	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00049	1	1	ND	U	0.018	0.11	1	ND	U	0.017	0.1	1	ND	U	0.017	0.1	1	ND	U	0.02	0.1	1	ND	U	0.1	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00049	1	1	ND	U	0.037	0.11	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	ND	U	0.015	0.1	1	ND	U	0.1	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00049	1	1	ND	U	0.022	0.11	1	ND	U	0.021	0.1	1	ND	U	0.021	0.1	1	ND	U	0.26	1	1	ND	U	0.1	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00049	1	1	ND	U	0.016	0.11	1	ND	U	0.015	0.1	1	ND	U	0.015	0.1	1	ND	U	0.17	2	1	ND	U	0.1	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	1.7	3	1	ND	U	1.3	3	1	2.6	B	1.3	3	1	ND	U	0.016	0.1	1	ND	U	0.082	0.082	1

Note:
CAS No. - Chemical Abstract Number
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TDS - Total Dissolved Solids
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Q - Qualifier
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-141_050707					A-142_071714					A-142_101514					A-143_050307					A-143_071814					A-143_101414				
			Sample Date	5/7/2007					7/17/2014					10/15/2014					5/3/2007					7/18/2014					10/14/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.26	1	1	NA					ND	U	0.19	2	1	ND	U	0.17	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.4***	1	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.012	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.17	2	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.017	0.1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.22	1	1	NA					ND	U	0.17	2	1	ND	U	0.036	0.1	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.19	2	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.3	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.3	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.021	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.022	0.11	1	26		0.5	5	1	23		0.26	1	1	ND	U	0.22	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	0.27	J	0.26	1	1	ND	U	0.21	0.5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.4	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.2	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	1.3	3	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.26	1	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.0081	0.02	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					1.42		0.02	0.1	1	ND	U	0.016	0.11	1	NA					ND	U	0.02	0.1	1	ND	U	0.2	1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					**7.42**		0.012	1	1	0.116		0.22	1	1	NA					ND	U	0.012	0.1	1	ND	U	0.015	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					**9.31**		0.012	1	1	ND	U	0.011	0.11	1	NA					ND	U	0.012	0.1	1	ND	U	0.02	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					**10.6**		0.01	1	1	0.136		0.3	1	1	NA					ND	U	0.01	0.1	1	ND	U	0.19	2	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					**3.76**		0.016	0.1	1	ND	U	0.017	0.11	1	NA					ND	U	0.016	0.1	1	ND	U	0.21	0.5	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00051	1	1	**6.94**		0.012	1	1	0.106		0.17	2	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.26	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00051	1	1	0.369		0.017	0.1	1	ND	U	0.013	0.11	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	0.132		0.19	2	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00051	1	1	0.448		0.036	0.1	1	ND	U	0.012	0.11	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.016	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00051	1	1	3.79		0.021	1	1	ND	U	0.013	0.11	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	0.22		0.21	0.5	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00051	1	1	11.8		0.015	1	1	0.169		0.4	1	1	ND	U	0.00051	1	1	ND	U	0.015	0.1	1	ND	U	0.26	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	**8.7**		1.3	3	1	ND	U	0.0081	0.02	1	ND	U	0.8	0.8	1	4.1		1.3	3	1	ND	U	0.012	1	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-145_050307					A-146_050907					A-147_050907					A-148_050807					A-148_072914					A-148_102214				
			Sample Date	5/3/2007					5/9/2007					5/9/2007					5/8/2007					7/29/2014					10/22/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					NA					NA					NA					ND	U	0.19	2	1	ND	U	1.3	3	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	0.016	0.1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					NA					NA					NA					ND	U	0.17	2	1	ND	U	0.012	0.1	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.036	0.1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.01	0.1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	3.2	J	0.5	5	1	1.3	J	0.5	5	1	0.98	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.0081	0.02	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	1.8	J	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.017	0.1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	0.7	J	0.5	5	1	2.3	J	0.5	5	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.012	0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.021	0.1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					NA					NA					ND	U	0.02	0.1	1	ND	U	0.4	1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					NA					NA					ND	U	0.012	0.1	1	ND	U	0.21	0.5	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					NA					NA					ND	U	0.012	0.1	1	ND	U	***0.26***	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					NA					NA					ND	U	0.01	0.1	1	ND	U	0.22	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					NA					NA					ND	U	0.016	0.1	1	ND	U	0.17	2	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00051	1	1	ND	U	0.0015	3	1	ND	U	0.0015	3	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.2	1	1
Fluorene	86-73-7	1900	ug/L	1.4		0.00051	1	1	9.7		0.0015	3	1	21		0.0015	3	1	2.2		0.00051	1	1	0.362		0.017	0.1	1	0.136		0.015	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00051	1	1	ND	U	0.0015	3	1	ND	U	0.0015	3	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.26	1	1
Phenanthrene	85-01-8	1100	ug/L	1.4		0.00051	1	1	5		0.0015	3	1	19		0.0015	3	1	4.2		0.00051	1	1	ND	U	0.021	0.1	1	ND	U	0.19	2	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00051	1	1	ND	U	0.0015	3	1	7.4		0.0015	3	1	2.2		0.00051	1	1	0.143		0.015	0.1	1	ND	U	0.3	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	4.5		0.8	2	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.015	0.1	1

Note:
CAS No. - Chemical Abstract Number
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TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-149_050807					A-149_072914					A-149_102214					A-15_1262006					A-15_050807					A-15_102014				
			Sample Date	5/8/2007					7/29/2014					10/22/2014					12/6/2006					5/8/2007					10/20/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.021	0.1	1	NA					NA					ND	U	0.012	0.1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.0095	0.023	1	ND	U	***0.26***	1	1	NA					ND	U	0.005	0.05	1	ND	U	***0.26***	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.015	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.19	2	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.016	0.1	1	NA					NA					ND	U	0.26	1	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.012	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.01	0.1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.02	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	18		0.5	5	1	ND	U	0.26	1	1	0.76	J	0.017	0.1	1	4.7		0.5	1	1	4.1	J	0.5	5	1	0.99	J	0.012	0.1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.012	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.016	0.1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.01	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.02	0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.012	0.1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.015	0.1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	0.141		0.012	0.1	1	NA					NA					1.8		0.037	0.11	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	ND	U	0.0081	0.02	1	NA					NA					0.128		0.0081	0.02	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	***1.3***	3	1	NA					NA					ND	U	0.017	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	ND	U	0.017	0.1	1	NA					NA					ND	U	0.012	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	0.172		0.012	0.1	1	NA					NA					ND	U	0.012	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND		0.036	0.1	1	ND	U	1	2	2	ND	U	0.0005	1	1	ND	U	0.021	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00051	1	1	0.649		0.017	0.1	1	1.68		0.017	0.1	1	21		1	2	2	18		0.0005	1	1	13		0.3	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.4	1	1	ND	U	1	2	2	ND	U	0.0005	1	1	0.217		0.17	2	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	0.199		0.021	0.1	1	13		1	2	2	8.1		0.0005	1	1	4.68		0.4	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00051	1	1	0.172		0.015	0.1	1	0.208		0.012	0.1	1	2	J	1	2	2	1.2		0.0005	1	1	0.959		1.3	3	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	0.96	B	0.8	2	1	ND	U	1.3	3	1	ND	U	0.19	2	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.2	1	1

Note:
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	AOI5_A-15_073115~JC522					AOI5_A-15_011916~JC12891					A-150_050807					A-150_102014					A-151_072314					A-151_102014				
			Sample Date	7/31/2015					1/19/2016					5/8/2007					10/20/2014					7/23/2014					10/20/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.22	2	1	ND	U	0.22	2	1	NA					ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.3	1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0078	0.018	1	ND	U	0.0082	0.019	1	ND	U	0.005	0.05	1	ND	U	***0.17***	2	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.18	1	1	ND	U	0.18	1	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.3	1	1	ND	U	0.021	0.1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.29	2	1	ND	U	0.29	2	1	NA					ND	U	0.26	1	1	ND	U	0.17	2	1	ND	U	0.017	0.1	1
Benzene	71-43-2	5	ug/L	ND	U	0.24	0.5	1	ND	U	0.24	0.5	1	**27**		0.5	5	1	2.9		1.3	3	1	ND	U	0.21	0.5	1	ND	U	0.4	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.27	1	1	ND	U	0.27	1	1	0.83	J	0.5	5	1	ND	U	0.22	1	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	1.5		0.23	1	1	ND	U	0.23	1	1	27		0.5	5	1	9.6		0.0081	0.02	1	ND	U	0.26	1	1	0.36	J	1.3	3	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.24	1	1	ND	U	0.24	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.26	1	1	ND	U	0.0081	0.02	1
Toluene	108-88-3	1000	ug/L	ND	U	0.16	1	1	ND	U	0.16	1	1	3.1	J	0.5	5	1	0.92	J	0.036	0.1	1	ND	U	0.22	1	1	ND	U	0.036	0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.21	J	0.17	1	1	ND	U	0.17	1	1	6.5		0.5	5	1	1.8		0.036	0.1	1	ND	U	0.2	1	1	ND	U	1.3	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	2.06		0.013	0.1	1	0.406		0.013	0.1	1	NA					ND	U	0.26	1	1	ND	U	0.02	0.1	1	ND	U	0.17	2	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.329		0.019	0.05	1	ND	U	0.019	0.05	1	NA					ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.26	1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**0.295**		0.03	0.05	1	ND	U	0.03	0.05	1	NA					ND	U	0.01	0.1	1	ND	U	0.012	0.1	1	ND	U	0.19	2	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.305		0.021	0.1	1	ND	U	0.021	0.1	1	NA					ND	U	0.015	0.1	1	ND	U	0.01	0.1	1	ND	U	0.26	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	0.209		0.026	0.1	1	ND	U	0.026	0.1	1	NA					ND	U	0.02	0.1	1	ND	U	0.016	0.1	1	ND	U	0.2	1	1
Chrysene	218-01-9	1.9	ug/L	0.313		0.015	0.1	1	ND	U	0.015	0.1	1	1.6		0.0005	1	1	ND	U	0.016	0.1	1	ND	U	0.012	0.1	1	ND	U	0.21	0.5	1
Fluorene	86-73-7	1900	ug/L	18		0.027	1	1	0.424		0.027	0.1	1	20		0.0005	1	1	0.165		0.17	2	1	0.533		0.017	0.1	1	0.243		0.26	1	1
Naphthalene	91-20-3	100	ug/L	0.308		0.013	0.1	1	ND	U	0.013	0.1	1	ND	U	0.0005	1	1	ND	U	0.012	0.1	1	ND	U	0.036	0.1	1	ND	U	0.015	0.1	1
Phenanthrene	85-01-8	1100	ug/L	3.28		0.016	0.1	1	0.132		0.016	0.1	1	16		0.0005	1	1	0.126		0.3	1	1	ND	U	0.021	0.1	1	ND	U	0.02	0.1	1
Pyrene	129-00-0	130	ug/L	1.54		0.013	0.1	1	0.434		0.013	0.1	1	3.8		0.0005	1	1	0.241		0.4	1	1	0.165		0.015	0.1	1	ND	U	0.22	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	2.3	3	1	ND	U	2.3	3	1	ND	U	0.8	0.8	1	ND	U	0.3	1	1	ND	U	1.3	3	1	ND	U	0.012	0.1	1

Note:
CAS No. - Chemical Abstract Number
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TDS - Total Dissolved Solids
mg/L - milligrams per liter
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
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Summary of Groundwater Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-152_050807					A-152_072314					A-152_102114					A-153_050907					A-154_050807					A-154-072214				
			Sample Date	5/8/2007					7/23/2014					10/21/2014					5/9/2007					5/8/2007					7/22/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.011	0.02	1	NA					NA					ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.01	0.1	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.012	0.1	1	NA					NA					ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	1.3	3	1	ND	U	0.5	5	1	9		0.5	5	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1	0.84	J	0.5	5	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.4	1	1	3.2	J	0.5	5	1	14		0.5	5	1	ND	U	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.036	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.021	0.1	1	ND	U	0.5	5	1	3.2	J	0.5	5	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.017	0.1	1	ND	U	0.5	5	1	9.6		0.5	5	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	ND	U	0.3	1	1	NA					NA					ND	U	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	ND	U	0.19	2	1	NA					NA					ND	U	0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	***0.21***	0.5	1	NA					NA					ND	U	0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	ND	U	0.2	1	1	NA					NA					ND	U	0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	ND	U	0.22	1	1	NA					NA					ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.26	1	1	ND	U	0.0015	3.1	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.02	0.1	1	ND	U	0.0015	3.1	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.015	0.1	1	ND	U	0.0015	3.1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	ND	U	0.26	1	1	ND	U	0.0015	3.1	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00051	1	1	ND	U	0.015	0.1	1	ND	U	0.17	2	1	ND	U	0.0015	3.1	1	ND	U	0.00051	1	1	ND	U	0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.016	0.1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1

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10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-154_102214					A-155_073014					AOI5_A-155_012016~JC12972					A-156_112112					A-156_072814					A-156_100614				
			Sample Date	10/22/2014					7/30/2014					1/20/2016					11/21/2012					7/28/2014					10/6/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.036	0.1	1	0.28	J	0.19	2	1	ND	U	0.22	2	1	ND	U	2	2	1	ND	U	0.19	2	1	0.43	J	0.26	1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.01	0.1	1	ND	U	0.0081	0.02	1	ND	U	0.0081	0.019	1	ND	U	0.02	0.02	1	ND	U	0.0081	0.02	1	ND	U	***0.4***	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.012	0.1	1	ND	U	0.3	1	1	ND	U	0.18	1	1	ND	U	1	1	1	ND	U	0.3	1	1	ND	U	0.17	2	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.012	0.1	1	0.24	J	0.17	2	1	ND	U	0.29	2	1	ND	U	2	2	1	ND	U	0.17	2	1	ND	U	0.22	1	1
Benzene	71-43-2	5	ug/L	1.5		0.21	0.5	1	0.56		0.21	0.5	1	ND	U	0.24	0.5	1	2.2		1	1	1	ND	U	0.21	0.5	1	2.7		0.12	10	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.012	0.1	1	ND	U	0.4	1	1	ND	U	0.27	1	1	ND	U	1	1	1	ND	U	0.4	1	1	ND	U	0.3	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	0.52	J	0.4	1	1	0.55	J	0.26	1	1	0.51	J	0.23	1	1	96.2		2	2	1	ND	U	0.26	1	1	2.3		0.12	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.017	0.1	1	ND	U	0.26	1	1	ND	U	0.24	1	1	ND	U	1	1	1	ND	U	0.26	1	1	ND	U	0.2	1	1
Toluene	108-88-3	1000	ug/L	0.23	J	0.011	0.02	1	1		0.22	1	1	0.2	J	0.16	1	1	1.5		1	1	1	ND	U	0.22	1	1	0.51	J	0.2	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.021	0.1	1	1.5		0.2	1	1	1.4		0.17	1	1	4.8		1	1	1	1.2		0.2	1	1	1.4		0.12	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	1.3	3	1	4.84		0.02	0.1	1	1.21		0.013	0.1	1	16		1	1	1	1.54		0.023	0.11	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.22	1	1	**11.8**		0.012	1	1	1.69		0.019	0.05	1	**33**		1	1	1	3.37		0.013	0.11	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.17	2	1	**8.8**		0.012	1	1	**1.17**		0.03	0.05	1	**15.7**		1	1	1	**1.87**		0.014	0.11	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.4	1	1	**8.97**		0.01	1	1	**1.39**		0.021	0.1	1	**8.02**		1	1	1	**1.62**		0.011	0.11	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.011	0.02	1	**3.74**		0.016	0.1	1	**0.711**		0.026	0.1	1	**5.65**		1	1	1	**1.08**		0.017	0.11	1	NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.3	1	1	**14.7**		0.012	1	1	**1.95**		0.015	0.1	1	**57.8**		1	1	1	**5.28**		0.013	1.1	1	NA				
Fluorene	86-73-7	1900	ug/L	0.128		0.023	0.11	1	16.1		0.017	1	1	2.88		0.027	0.1	1	41.5		1	1	1	4.92		0.019	1.1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.2	1	1	ND	U	0.036	0.1	1	ND	U	0.013	0.1	1	NA					ND	U	0.039	0.11	1	NA				
Phenanthrene	85-01-8	1100	ug/L	0.177		0.26	1	1	9.56		0.021	1	1	1.41		0.016	0.1	1	65.5		1	1	1	1.26		0.023	0.11	1	NA				
Pyrene	129-00-0	130	ug/L	0.137		0.19	2	1	28.2		0.015	1	1	3.98		0.013	0.1	1	61.1		1	1	1	5.46		0.017	0.11	1	NA				
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.016	0.1	1	4.3		1.3	3	1	ND	U	2.3	3	1	**12.2**		3	3	1	**6**		1.3	3	1	ND	U	0.0081	0.02	1

Note:
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PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-156_100714					A-157_112112					A-157_072914					A-157_101514					A-158_112112					A-158_072514				
			Sample Date	10/7/2014					11/21/2012					7/29/2014					10/15/2014					11/21/2012					7/25/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					7.8		2	2	1	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	2	2	1	1	J	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	NA					ND	U	0.02	0.02	1	ND	U	0.0081	0.02	1	ND	U	***0.3***	1	1	ND	U	0.02	0.02	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	NA					ND	U	1	1	1	ND	U	0.3	1	1	ND	U	0.22	1	1	ND	U	1	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	2	2	1	ND	U	0.17	2	1	ND	U	0.2	1	1	ND	U	2	2	1	0.29	J	0.17	2	1
Benzene	71-43-2	5	ug/L	NA					ND	U	1	1	1	ND	U	0.21	0.5	1	0.69		0.075	5	1	**27.1**		1	1	1	**13.4**		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	NA					2.5		1	1	1	ND	U	0.4	1	1	ND	U	0.17	2	1	2		1	1	1	1.1		0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	NA					4.4		2	2	1	ND	U	0.26	1	1	0.31	J	0.19	2	1	41		2	2	1	51.9		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	NA					ND	U	1	1	1	ND	U	0.26	1	1	ND	U	0.21	0.5	1	1.5		1	1	1	0.85	J	0.26	1	1
Toluene	108-88-3	1000	ug/L	NA					2.1		1	1	1	ND	U	0.22	1	1	ND	U	0.26	1	1	11		1	1	1	9.2		0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	NA					14		1	1	1	ND	U	0.2	1	1	0.21	J	0.21	0.5	1	15.8		1	1	1	14.4		0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	1.44		0.21	10	1	ND	U	0.1	0.1	1	ND	U	0.02	0.1	1	ND	U	0.26	1	1	20.4		1	1	1	3.14		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	3.9		0.3	1	1	ND	U	0.1	0.1	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	**11.1**		1	1	1	1.42		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**4.62**		0.4	1	1	ND	U	0.1	0.1	1	0.161		0.012	0.1	1	ND	U	0.012	0.1	1	**4.63**		0.1	0.1	1	**0.81**		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**2.81**		1.3	3	1	ND	U	0.1	0.1	1	0.2		0.01	0.1	1	ND	U	0.016	0.1	1	**4.65**		0.1	0.1	1	0.706		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**2.26**		0.36	1	1	ND	U	0.1	0.1	1	0.164		0.016	0.1	1	ND	U	0.015	0.1	1	**2.03**		0.1	0.1	1	**0.297**		0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	**9.79**		0.0081	0.02	1	ND	U	0.1	0.1	1	0.167		0.012	0.1	1	ND	U	0.01	0.1	1	**13.2**		1	1	1	1.6		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	1.41		0.22	1	1	ND	U	0.1	0.1	1	ND	U	0.017	0.1	1	ND	U	0.021	0.1	1	38.2		1	1	1	9.77		0.017	1	1
Naphthalene	91-20-3	100	ug/L	0.378		0.2	1	1	NA					ND	U	0.036	0.1	1	ND	U	0.017	0.1	1	NA					ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	0.802		0.17	2	1	ND	U	0.1	0.1	1	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	126		5	5	5	19.9		0.021	1	1
Pyrene	129-00-0	130	ug/L	5.76		0.17	1	1	0.194		0.1	0.1	1	0.205		0.015	0.1	1	ND	U	0.02	0.1	1	28.7		1	1	1	3.33		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	NA					ND	U	3	3	1	ND	U	1.3	3	1	ND	U	0.4	1	1	3		3	3	1	2.3	B	1.3	3	1

Note:
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-158_101514					A-159_112112					A-16_1252006					A-16_050807					A-16_072314					A-16_102214				
			Sample Date	10/15/2014					11/21/2012					12/5/2006					5/8/2007					7/23/2014					10/22/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	0.94	J	0.012	0.1	1	ND	U	10	10	5	NA					NA					ND	U	0.19	2	1	ND	U	0.4	1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.3***	1	1	ND	U	0.02	0.02	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.17	2	1	ND	U	5	5	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	0.25	J	0.016	0.1	1	ND	U	10	10	5	NA					NA					ND	U	0.17	2	1	ND	U	0.021	1	1
Benzene	71-43-2	5	ug/L	**15.1**		0.19	2	1	**30.8**		5	5	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.011	0.02	1
Ethylbenzene	100-41-4	700	ug/L	1		0.2	1	1	ND	U	5	5	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	52.4		0.26	1	1	525		10	10	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.3	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.89	J	0.01	0.1	1	ND	U	5	5	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	1.3	3	1
Toluene	108-88-3	1000	ug/L	8.6		0.26	1	1	6.6		5	5	5	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.017	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	13.5		0.21	0.5	1	14.6		5	5	5	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.036	0.1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	3.02		0.021	0.11	1	0.472		0.1	0.1	1	NA					NA					0.143		0.02	0.1	1	0.234		0.018	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1		0.012	0.11	1	ND	U	0.1	0.1	1	NA					NA					0.102		0.012	0.1	1	0.149		0.17	2	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**0.373**		0.013	0.11	1	ND	U	0.1	0.1	1	NA					NA					ND	U	0.012	0.1	1	0.131		0.3	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.391		0.011	0.11	1	ND	U	0.1	0.1	1	NA					NA					ND	U	0.01	0.1	1	0.138		0.0081	0.02	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	0.161		0.016	0.11	1	ND	U	0.1	0.1	1	NA					NA					ND	U	0.016	0.1	1	**0.279**		1.3	3	1
Chrysene	218-01-9	1.9	ug/L	1.07		0.012	0.11	1	0.125		0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.00055	1.1	1	0.107		0.012	0.1	1	0.13		0.4	1	1
Fluorene	86-73-7	1900	ug/L	7.91		0.018	0.11	1	2.6		0.1	0.1	1	1.1		0.5	1	1	ND	U	0.00055	1.1	1	1.34		0.017	0.1	1	1.54		0.2	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.22	1	1	NA					ND	U	0.5	1	1	ND	U	0.00055	1.1	1	0.147		0.036	0.1	1	ND	U	0.17	2	1
Phenanthrene	85-01-8	1100	ug/L	12.4		0.022	0.11	1	2.2		0.1	0.1	1	ND	U	0.5	1	1	ND	U	0.00055	1.1	1	0.335		0.021	0.1	1	0.453		0.22	1	1
Pyrene	129-00-0	130	ug/L	2.55		0.016	0.11	1	0.326		0.1	0.1	1	2		0.5	1	1	1.3		0.00055	1.1	1	0.911		0.015	0.1	1	0.502		0.037	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.4	1	1	ND	U	3	3	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.01	0.1	1

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-160_112112					A-161_073114					A-162_072414					A-162_101314					A-163_072314					A-163_100614				
			Sample Date	11/21/2012					7/31/2014					7/24/2014					10/13/2014					7/23/2014					10/6/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	2.8		2	2	1	**128**		0.19	2	1	ND	U	0.19	2	1	ND	U	0.4	1	1	ND	U	0.19	2	1	ND	U	0.21	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.02	0.02	1	ND	U	0.0081	0.02	1	ND	U	0.011	0.02	1	ND	U	0.012	1	1	ND	U	0.011	0.02	1	ND	U	***0.4***	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	1	1	1	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.012	1	1	ND	U	0.3	1	1	ND	U	0.17	2	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	2	2	1	17.9		0.17	2	1	ND	U	0.17	2	1	ND	U	0.021	1	1	ND	U	0.17	2	1	ND	U	0.22	1	1
Benzene	71-43-2	5	ug/L	ND	U	1	1	1	**30.3**		0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.0081	0.02	1	ND	U	0.21	0.5	1	ND	U	0.26	1	1
Ethylbenzene	100-41-4	700	ug/L	1.4		1	1	1	19		0.4	1	1	ND	U	0.4	1	1	ND	U	0.012	1	1	ND	U	0.4	1	1	ND	U	0.3	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	14.2		2	2	1	83.1		0.26	1	1	ND	U	0.26	1	1	0.48	J	0.012	0.1	1	6.6		0.26	1	1	5.1		1.3	3	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	1	1	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	1.3	3	1	ND	U	0.26	1	1	0.32	J	0.017	0.1	1
Toluene	108-88-3	1000	ug/L	2.4		1	1	1	11.7		0.22	1	1	ND	U	0.22	1	1	ND	U	0.017	1	1	ND	U	0.22	1	1	ND	U	0.2	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	8		1	1	1	40.6		0.2	1	1	ND	U	0.2	1	1	ND	U	0.036	0.1	1	ND	U	0.2	1	1	0.21	J	0.021	0.1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.611		0.1	0.1	1	0.841		0.02	0.1	1	1.16		0.025	0.13	1	0.734		1.9	20	1	0.389		0.02	0.1	1	0.529		0.0081	0.02	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.1	0.1	1	0.513		0.012	0.1	1	0.814		0.014	0.13	1	0.276		0.01	0.1	1	ND	U	0.012	0.1	1	0.139		0.22	1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.1	0.1	1	**0.507**		0.012	0.1	1	**0.47**		0.015	0.13	1	0.117		0.016	0.1	1	ND	U	0.012	0.1	1	ND	U	***0.26***	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.1	0.1	1	0.607		0.01	0.1	1	0.457		0.013	0.13	1	0.127		0.02	0.1	1	ND	U	0.01	0.1	1	0.108		0.3	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.1	0.1	1	**0.482**		0.016	0.1	1	0.225		0.02	0.13	1	ND	U	***0.3***	1	1	ND	U	0.016	0.1	1	ND	U	0.19	2	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.1	0.1	1	1.13		0.012	0.1	1	1		0.015	0.13	1	0.269		0.015	0.1	1	ND	U	0.012	0.1	1	0.146		0.17	2	1
Fluorene	86-73-7	1900	ug/L	3.34		0.1	0.1	1	13.7		0.017	1	1	0.824		0.021	0.13	1	1.77		0.012	0.1	1	4.31		0.017	1	1	4.39		0.2	1	1
Naphthalene	91-20-3	100	ug/L	NA					ND	U	0.036	0.1	1	ND	U	0.044	0.13	1	ND	U	0.22	1	1	ND	U	0.036	0.1	1	ND	U	0.021	0.14	1
Phenanthrene	85-01-8	1100	ug/L	3.6		0.1	0.1	1	7.23		0.021	1	1	ND	U	0.026	0.13	1	ND	U	0.17	2	1	0.172		0.021	0.1	1	ND	U	0.029	0.14	1
Pyrene	129-00-0	130	ug/L	0.55		0.1	0.1	1	1.85		0.015	0.1	1	1.62		0.019	0.13	1	0.696		2.6	10	1	0.24		0.015	0.1	1	0.377		0.4	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	3	3	1	2.8	B	1.3	3	1	1.7	B	1.3	3	1	3.8		2.1	5	1	ND	U	1.3	3	1	ND	U	0.0081	0.02	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-164_072314					A-164_100614					AOI5_A-166_073115~JC522					A-167_072914					A-167_102214					A-168-072214				
			Sample Date	7/23/2014					10/6/2014					7/31/2015					7/29/2014					10/22/2014					7/22/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.012	0.1	1	ND	U	0.22	2	1	ND	U	0.19	2	1	ND	U	0.015	0.1	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	***0.26***	1	1	ND	U	0.0077	0.018	1	ND	U	0.0081	0.02	1	ND	U	***0.17***	2	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.19	2	1	ND	U	0.18	1	1	ND	U	0.3	1	1	ND	U	0.2	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.26	1	1	ND	U	0.29	2	1	ND	U	0.17	2	1	ND	U	0.26	1	1	ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.01	0.1	1	ND	U	0.24	0.5	1	ND	U	0.21	0.5	1	ND	U	0.02	0.1	1	0.94		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.21	0.5	1	ND	U	0.27	1	1	ND	U	0.4	1	1	ND	U	0.22	1	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.012	0.1	1	0.47	J	0.23	1	1	ND	U	0.26	1	1	ND	U	0.016	0.1	1	3.8		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.016	0.1	1	ND	U	0.24	1	1	ND	U	0.26	1	1	ND	U	0.26	1	1	0.33	J	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.02	0.1	1	ND	U	0.16	1	1	ND	U	0.22	1	1	ND	U	0.21	0.5	1	0.83	J	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.015	0.1	1	ND	U	0.17	1	1	ND	U	0.2	1	1	ND	U	0.19	2	1	1.5		0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.231		0.02	0.1	1	ND	U	0.012	0.1	1	2.79		0.013	0.1	1	ND	U	0.02	0.1	1	ND	U	0.01	0.1	1	1		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.176		0.012	0.1	1	ND	U	0.0081	0.02	1	**6.99**		0.019	0.5	1	ND	U	0.012	0.1	1	ND	U	0.036	0.1	1	1.47		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	0.113		0.012	0.1	1	ND	U	***1.3***	3	1	**8.17**		0.03	0.5	1	ND	U	0.012	0.1	1	ND	U	0.017	1	1	**1.33**		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.105		0.01	0.1	1	ND	U	0.017	0.1	1	**3.31**		0.021	0.1	1	ND	U	0.01	0.1	1	ND	U	0.012	0.1	1	**1.9**		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	0.021	0.1	1	**3.34**		0.026	0.1	1	ND	U	0.016	0.1	1	ND	U	0.012	0.1	1	**0.961**		0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	0.368		0.012	0.1	1	ND	U	0.036	0.1	1	**15.7**		0.015	1	1	ND	U	0.012	0.1	1	ND	U	0.021	1	1	1.66		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	0.273		0.017	0.1	1	ND	U	0.4	1	1	4.82		0.027	0.1	1	ND	U	0.017	0.1	1	ND	U	0.0081	0.02	1	0.618		0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	0.183		0.012	0.1	1	0.56		0.013	0.1	1	ND	U	0.036	0.1	1	ND	U	0.4	1	1	0.299		0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.021	0.1	1	0.135		0.012	0.1	1	4.98		0.016	0.1	1	ND	U	0.021	0.1	1	ND	U	1.3	3	1	0.409		0.021	0.1	1
Pyrene	129-00-0	130	ug/L	0.575		0.015	0.1	1	0.158		0.01	0.1	1	23		0.013	1	1	ND	U	0.015	0.1	1	ND	U	0.012	0.1	1	3.82		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.2	1	1	ND	U	2.3	3	1	ND	U	1.3	3	1	ND	U	0.3	1	1	3.4		1.3	3	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-168_102214					A-169_072314					A-169_100614					A-17_11_9_2005					A-17_1262006					A-17_110308				
			Sample Date	10/22/2014					7/23/2014					10/6/2014					11/9/2005					12/6/2006					11/3/2008				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.012	0.1	1	0.27	J	0.19	2	1	0.29	J	0.2	1	1	NA					NA					ND	U	1	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.19***	2	1	ND	U	0.011	0.02	1	ND	U	0.01	0.1	1	ND	U	0.02	0.02	1	NA					ND	U	0.01	0.0097	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.02	0.1	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1	ND	U	1	1	1	ND	U	0.5	1	1	ND	U	1	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.015	0.1	1	ND	U	0.17	2	1	ND	U	0.012	0.1	1	NA					NA					ND	U	1	0.5	1
Benzene	71-43-2	5	ug/L	ND	U	0.01	0.1	1	0.53		0.21	0.5	1	0.53		0.4	1	1	ND	U	1	1	1	NA					ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.26	1	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	1	1	1	NA					ND	U	0.8	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	3.1		0.26	1	1	25.8		0.26	1	1	21.7		0.3	1	1	NA					ND	U	0.5	1	1	ND	U	1	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.71	J	0.4	1	1	ND	U	0.26	1	1	ND	U	0.021	0.1	1	ND	U	1	1	1	NA					0.7	J	0.5	0.5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.016	0.1	1	0.41	J	0.22	1	1	0.4	J	0.22	1	1	ND	U	1	1	1	NA					ND	U	0.7	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.36	J	0.011	0.02	1	1.3		0.2	1	1	1.4		0.0081	0.02	1	ND	U	1	1	1	NA					ND	U	0.8	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.012	0.1	1	1.5		0.02	0.1	1	2.16		0.17	2	1	NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.0081	0.02	1	0.383		0.012	0.1	1	0.529		0.19	2	1	ND	U	0.014	0.1	1	NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	***1.3***	3	1	0.155		0.012	0.1	1	0.198		0.21	0.5	1	ND	U	0.029	0.1	1	NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.017	1	1	0.239		0.01	0.1	1	0.276		0.2	1	1	0.2		0.022	0.1	1	NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.021	1	1	ND	U	0.016	0.1	1	ND	U	0.017	1	1	ND	U	0.034	0.1	1	NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.036	0.1	1	0.404		0.012	0.1	1	0.506		0.26	1	1	ND	U	0.014	0.1	1	ND	U	0.5	1	1	ND	U	1	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.3	1	1	9.55		0.017	1	1	8.56		0.021	0.1	1	ND	U	0.024	0.1	1	ND	U	0.5	1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.17	2	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	NA					ND	U	0.5	1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.4	1	1	6.29		0.021	1	1	8.38		0.26	1	1	ND	U	0.03	0.1	1	ND	U	0.5	1	1	ND	U	1	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.012	0.1	1	2.22		0.015	0.1	1	2.34		0.22	1	1	ND	U	0.021	0.1	1	ND	U	0.5	1	1	ND	U	1	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.21	0.5	1	ND	U	1.3	3	1	ND	U	0.016	0.1	1	ND	U	3	10	1	NA					ND	U	0.047	0.05	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-170_072314					A-170_102114					A-171_072914					A-172-072214					A-172_100914					A-173_072414				
			Sample Date	7/23/2014					10/21/2014					7/29/2014					7/22/2014					10/9/2014					7/24/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	0.27	J	0.19	2	1	ND	U	0.3	1	1	0.32	J	0.19	2	1	ND	U	0.19	2	1	ND	U	0.4	1	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	0.014	0.13	1	ND	U	0.0081	0.02	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.021	0.13	1	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.012	0.1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.044	0.13	1	ND	U	0.17	2	1	ND	U	0.17	2	1	ND	U	0.021	0.1	1	ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.4	1	1	0.33	J	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.0081	0.02	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.026	0.13	1	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	1.8		0.26	1	1	0.7	J	0.26	1	1	9.7		0.26	1	1	ND	U	0.26	1	1	ND	U	0.3	1	1	0.61	J	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.0081	0.02	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	1.3	3	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	1.3	3	1	0.41	J	0.22	1	1	ND	U	0.22	1	1	ND	U	0.017	1	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.71	J	0.2	1	1	0.51	J	0.19	2	1	2.4		0.2	1	1	ND	U	0.2	1	1	ND	U	0.036	0.1	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.473		0.02	0.1	1	0.247		0.062	0.53	1	2.05		0.02	0.1	1	ND	U	0.02	0.1	1	ND	U	0.17	2	1	ND	U	0.1	0.5	5
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.114		0.012	0.1	1	ND	U	0.21	0.5	1	1.16		0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.26	1	1	0.541		0.058	0.5	5
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.012	0.1	1	ND	U	***0.26***	1	1	**0.7**		0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.19	2	1	ND	U	0.062	0.5	5
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.118		0.01	0.1	1	ND	U	0.22	1	1	0.704		0.01	0.1	1	ND	U	0.01	0.1	1	ND	U	0.26	1	1	0.675		0.051	0.5	5
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	0.17	2	1	**0.365**		0.016	0.1	1	ND	U	0.016	0.1	1	ND	U	0.2	1	1	ND	U	0.078	0.5	5
Chrysene	218-01-9	1.9	ug/L	0.127		0.012	0.1	1	ND	U	0.2	1	1	1.9		0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.21	0.5	1	0.631		0.059	0.5	5
Fluorene	86-73-7	1900	ug/L	1		0.017	0.1	1	0.484		0.11	0.53	1	7.39		0.017	1	1	0.276		0.017	0.1	1	0.19		0.016	0.1	1	1.78		0.085	0.5	5
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.19	2	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	ND	U	0.02	0.1	1	ND	U	0.18	0.5	5
Phenanthrene	85-01-8	1100	ug/L	2.95		0.021	0.1	1	1.44		0.061	0.53	1	11.6		0.021	1	1	0.244		0.021	0.1	1	0.116		0.015	0.1	1	1.99		0.1	0.5	5
Pyrene	129-00-0	130	ug/L	0.642		0.015	0.1	1	0.281		0.065	0.53	1	2.57		0.015	0.1	1	0.111		0.015	0.1	1	ND	U	0.22	1	1	1.23		0.075	0.5	5
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.015	0.13	1	ND	U	1.3	3	1	ND	U	1.3	3	1	ND	U	0.01	0.1	1	ND	U	1.3	3	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
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mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-173_101414					A-174_072514					A-175_072414					A-175_101414					A-177_072414					A-177_101414				
			Sample Date	10/14/2014					7/25/2014					7/24/2014					10/14/2014					7/24/2014					10/14/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.01	0.1	1	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.01	0.1	1	ND	U	0.19	2	1	ND	U	0.01	0.1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.2***	1	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1	ND	U	***0.21***	0.5	1	ND	U	0.011	0.02	1	ND	U	***0.2***	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.21	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.19	2	1	ND	U	0.17	2	1	ND	U	0.17	2	1	ND	U	0.02	0.1	1	ND	U	0.17	2	1	ND	U	0.19	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.016	0.1	1	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.016	0.1	1	ND	U	0.21	0.5	1	ND	U	0.016	0.1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.26	1	1	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	0.19	2	1	ND	U	0.4	1	1	ND	U	0.26	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.012	0.1	1	ND	U	0.26	1	1	0.27	J	0.26	1	1	ND	U	0.012	0.1	1	0.68	J	0.26	1	1	0.7	J	0.036	0.1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.015	0.1	1	ND	U	0.26	1	1	0.34	J	0.26	1	1	0.7	J	0.021	0.1	1	ND	U	0.26	1	1	ND	U	0.015	0.1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.26	1	1	ND	U	0.22	1	1	ND	U	0.22	1	1	ND	U	0.015	0.1	1	ND	U	0.22	1	1	ND	U	0.26	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.02	0.1	1	ND	U	0.2	1	1	0.43	J	0.2	1	1	1.2		0.01	0.1	1	ND	U	0.2	1	1	ND	U	0.02	0.1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.228		0.036	0.1	1	ND	U	0.02	0.1	1	6.67		0.1	0.5	5	2.49		0.012	0.1	1	1.69		0.1	0.5	5	0.566		0.016	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.036	0.1	1	ND	U	0.012	0.1	1	**6.63**		0.058	0.5	5	1.07		1.3	3	1	3.92		0.058	0.5	5	0.407		0.017	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.017	0.1	1	ND	U	0.012	0.1	1	**5.19**		0.062	0.5	5	**0.574**		0.036	0.1	1	**4.25**		0.062	0.5	5	**0.286**		0.021	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.012	0.1	1	ND	U	0.01	0.1	1	**7.17**		0.051	0.5	5	0.699		0.021	0.1	1	**5.95**		0.051	0.5	5	0.379		0.012	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1	**3.8**		0.078	0.5	5	**0.275**		0.012	0.1	1	**3.41**		0.078	0.5	5	0.188		0.012	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	**6.79**		0.059	0.5	5	0.758		0.017	0.1	1	**4.65**		0.059	0.5	5	0.346		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	2.37		0.4	1	1	0.224		0.017	0.1	1	1.63		0.085	0.5	5	3.57		0.4	1	1	4.35		0.085	0.5	5	2.32		1.3	3	1
Naphthalene	91-20-3	100	ug/L	ND	U	1.3	3	1	ND	U	0.036	0.1	1	ND	U	0.18	0.5	5	ND	U	0.012	0.1	1	0.968		0.18	0.5	5	0.182		0.0081	0.02	1
Phenanthrene	85-01-8	1100	ug/L	1.03		0.0081	0.02	1	0.105		0.021	0.1	1	1.77		0.1	0.5	5	0.277		0.011	0.02	1	2.02		0.1	0.5	5	0.424		0.036	0.1	1
Pyrene	129-00-0	130	ug/L	0.462		1.3	3	1	ND	U	0.015	0.1	1	14.6		0.075	0.5	5	2.56		0.012	0.1	1	7.72		0.075	0.5	5	0.945		0.01	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.22	1	1	ND	U	1.3	3	1	1.4	B	1.3	3	1	ND	U	0.26	1	1	2.7	B	1.3	3	1	ND	U	0.22	1	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-178_080114					A-181_072514					A-181_101014					A-182-072214					A-182_101014					A-183_072814				
			Sample Date	8/1/2014					7/25/2014					10/10/2014					7/22/2014					10/10/2014					7/28/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.22	1	1	ND	U	0.19	2	1	ND	U	0.016	0.1	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	0.011	0.02	1	ND	U	0.021	0.1	1	ND	U	0.011	0.02	1	ND	U	***0.22***	1	1	ND	U	0.0081	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.036	0.1	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.17	2	1	ND	U	1.3	3	1	ND	U	0.17	2	1	ND	U	0.21	0.5	1	ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.17	2	1	ND	U	0.21	0.5	1	ND	U	0.015	0.1	1	0.95		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	0.017	0.1	1	ND	U	0.4	1	1	ND	U	0.2	1	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.2	1	1	0.4	J	0.26	1	1	0.52	J	0.0081	0.02	1	11.3		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.02	0.1	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.22	1	1	ND	U	0.0081	0.02	1	ND	U	0.22	1	1	ND	U	0.19	2	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.2	1	1	ND	U	0.4	1	1	ND	U	0.2	1	1	ND	U	0.26	1	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	2.24		0.02	0.1	1	0.61		0.031	0.15	1	0.27		0.036	0.1	1	ND	U	0.021	0.1	1	0.421		0.02	0.1	1	ND	U	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.33		0.012	0.1	1	1.38		0.018	0.15	1	0.585		0.22	1	1	ND	U	0.012	0.1	1	0.979		0.012	0.1	1	0.764		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**1.01**		0.012	0.1	1	**1.11**		0.019	0.15	1	**0.328**		0.17	2	1	ND	U	0.012	0.1	1	**0.463**		0.012	0.1	1	**0.616**		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.01	0.1	1	**1.65**		0.016	0.15	1	0.428		0.4	1	1	ND	U	0.01	0.1	1	0.6		0.01	0.1	1	0.761		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	**2.03**		0.024	0.15	1	0.225		0.0081	0.02	1	ND	U	0.016	0.1	1	**0.316**		0.016	0.1	1	**0.626**		0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	1.88		0.012	0.1	1	1.24		0.018	0.15	1	0.398		0.3	1	1	ND	U	0.012	0.1	1	0.699		0.012	0.1	1	1.53		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	3.47		0.017	0.1	1	1.38		0.026	0.15	1	0.942		0.26	1	1	0.107		0.017	0.1	1	1.94		0.017	0.1	1	0.394		0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	0.758		0.055	0.15	1	0.235		0.21	0.5	1	ND	U	0.036	0.1	1	ND	U	0.01	0.1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	5.07		0.021	1	1	2.27		0.032	0.15	1	1.36		0.2	1	1	ND	U	0.021	0.1	1	1.62		0.021	0.1	1	ND	U	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	4.45		0.015	0.1	1	2.62		0.023	0.15	1	1.14		1.3	3	1	0.114		0.015	0.1	1	2.31		0.015	0.1	1	1.69		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**64**		6.5	15	1	2.8	B	1.3	3	1	ND	U	0.012	0.1	1	ND	U	1.3	3	1	ND	U	0.17	2	1	ND	U	1.3	3	1

Note:

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-184_072814					A-185_072914					A-185_100814					A-186_072314					A-186_102014					A-19D_04112011				
			Sample Date	7/28/2014					7/29/2014					10/8/2014					7/23/2014					10/20/2014					4/11/2011				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	0.63	J	0.19	2	1	ND	U	0.19	2	1	ND	U	0.19	2	1	ND	U	0.26	1	1	ND	U	0.5	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	0.0081	0.02	1	ND	U	***0.3***	1	1	ND	U	0.011	0.02	1	ND	U	***0.3***	1	1	ND	U	0.01	0.0095	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.3	1	1	ND	U	0.22	1	1	ND	U	0.3	1	1	ND	U	0.22	1	1	ND	U	0.5	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	0.25	J	0.17	2	1	ND	U	0.2	1	1	ND	U	0.17	2	1	ND	U	0.2	1	1	ND	U	0.5	0.5	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	ND	U	0.21	0.5	1	0.34	J	0.21	0.5	1	0.25	J	0.19	2	1	ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.4	1	1	ND	U	0.17	2	1	ND	U	0.4	1	1	ND	U	0.17	2	1	ND	U	0.5	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	0.31	J	0.26	1	1	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.021	0.1	1	ND	U	0.5	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	0.7	J	0.26	1	1	1.4		0.2	1	1	ND	U	0.26	1	1	ND	U	0.19	2	1	**43**		0.5	0.5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.22	1	1	ND	U	0.26	1	1	ND	U	0.22	1	1	ND	U	0.26	1	1	ND	U	0.5	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	4.3		0.2	1	1	0.66	J	0.2	1	1	0.25	J	0.26	1	1	ND	U	0.2	1	1	ND	U	0.21	0.5	1	ND	U	0.5	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.368		0.02	0.1	1	1.4		0.02	0.1	1	1.01		0.26	1	1	0.211		0.02	0.1	1	ND	U	0.015	0.1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.684		0.012	0.1	1	0.834		0.012	0.1	1	0.427		0.016	0.1	1	0.147		0.012	0.1	1	ND	U	0.012	0.1	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**0.606**		0.012	0.1	1	**0.438**		0.012	0.1	1	0.198		0.015	0.1	1	ND	U	0.012	0.1	1	ND	U	0.013	0.1	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.774		0.01	0.1	1	0.436		0.01	0.1	1	0.27		0.26	1	1	0.125		0.01	0.1	1	ND	U	0.01	0.1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**0.6**		0.016	0.1	1	0.176		0.016	0.1	1	0.111		0.19	2	1	ND	U	0.016	0.1	1	ND	U	0.016	0.1	1	NA				
Chrysene	218-01-9	1.9	ug/L	1.68		0.012	0.1	1	0.894		0.012	0.1	1	0.508		0.02	0.1	1	0.196		0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	1	1	1
Fluorene	86-73-7	1900	ug/L	0.441		0.017	0.1	1	2.74		0.017	0.1	1	2.19		0.012	0.1	1	0.439		0.017	0.1	1	0.226		0.22	1	1	ND	U	1	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	ND	U	0.02	0.1	1	0.227		0.036	0.1	1	ND	U	0.021	0.1	1	ND	U	1	1	1
Phenanthrene	85-01-8	1100	ug/L	0.315		0.021	0.1	1	6.26		0.021	1	1	2.91		0.01	0.1	1	0.932		0.021	0.1	1	0.349		0.17	2	1	ND	U	1	1	1
Pyrene	129-00-0	130	ug/L	1.96		0.015	0.1	1	2.31		0.015	0.1	1	1.51		0.21	0.5	1	0.595		0.015	0.1	1	0.206		0.3	1	1	ND	U	1	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	1.9	B	1.3	3	1	ND	U	1.3	3	1	ND	U	0.4	1	1	1.9	B	1.3	3	1	ND	U	0.4	1	1	0.059	J	0.052	0.052	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-19D_04112011 FILTERED					A-19D_07012011					A-19D_07012011 FILTERED					A-19D_082012					A-19D_102612					A-19D_53112				
			Sample Date	4/11/2011					7/1/2011					7/1/2011					8/20/2012					10/26/2012					5/31/2012				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	2	2	1	ND	U	0.5	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	NA					ND	U	0.01	0.0097	1	NA					ND	U	0.01	0.0097	1	ND	U	0.02	0.02	1	ND	U	0.01	0.03	1
1,2-Dichloroethane	107-06-2	5	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	1	1	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	2	2	1	ND	U	0.5	2	1
Benzene	71-43-2	5	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	1	1	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	1	1	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	2	2	1	ND	U	0.5	2	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	NA					**40**		0.5	0.5	1	NA					**53**		0.5	0.5	1	**49.8**		1	1	1	**64**		0.5	1	1
Toluene	108-88-3	1000	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	1	1	1	ND	U	0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1	ND	U	1	1	1	ND	U	0.5	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					NA					ND	U	0.1	0.09	1	ND	U	2	2	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					NA					ND	U	0.1	0.09	1	ND	U	2	2	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					NA					ND	U	0.1	0.09	1	ND	U	***2***	2	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					NA					ND	U	0.1	0.09	1	ND	U	***2***	2	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					NA					ND	U	0.1	0.09	1	ND	U	***2***	2	1	NA				
Chrysene	218-01-9	1.9	ug/L	NA					ND	U	1	1	1	NA					ND	U	0.1	0.09	1	ND	U	***2***	2	1	ND	U	0.1	0.5	1
Fluorene	86-73-7	1900	ug/L	NA					ND	U	1	1	1	NA					ND	U	0.1	0.09	1	ND	U	2	2	1	ND	U	0.1	0.5	1
Naphthalene	91-20-3	100	ug/L	NA					ND	U	1	1	1	NA					ND	U	0.1	0.09	1	NA					ND	U	0.1	0.5	1
Phenanthrene	85-01-8	1100	ug/L	NA					ND	U	1	1	1	NA					ND	U	0.1	0.09	1	ND	U	2	2	1	ND	U	0.1	0.5	1
Pyrene	129-00-0	130	ug/L	NA					ND	U	1	1	1	NA					ND	U	0.1	0.09	1	ND	U	2	2	1	ND	U	0.1	0.5	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.052	1	1	ND	U	0.08	0.08	1	ND	U	0.08	1	1	ND	U	0.034	1	1	ND	U	3	3	1	ND	U	0.08	1	1

Note:
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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
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DF - Dilution factor
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
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B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-19D_032913					A-21D_1252006					A-21D_050707					A-21D_04112011					A-21D_04112011 FILTERED					A-21D_07012011				
			Sample Date	3/29/2013					12/5/2006					5/7/2007					4/11/2011					4/11/2011					7/1/2011				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	NA					NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	NA					ND	U	0.005	0.05	1	ND	U	0.01	0.0096	1	NA					ND	U	0.01	0.0096	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.26	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.36	2	1	NA					NA					ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Benzene	71-43-2	5	ug/L	ND	U	0.24	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.23	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.45	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	**56.7**		0.16	1	1	ND	U	0.5	1	1	0.57	J	0.5	5	1	2		0.5	0.5	1	NA					2		0.5	0.5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.23	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.24	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.5	0.5	1	NA					ND	U	0.5	0.5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.02	0.1	1	NA					NA					NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.1	1	NA					NA					NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.012	0.1	1	NA					NA					NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.01	0.1	1	NA					NA					NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	NA					NA					NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	1	1	1	NA					ND	U	1	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.017	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	1	1	1	NA					ND	U	1	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	1	1	1	NA					ND	U	1	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.021	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	1	1	1	NA					ND	U	1	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.015	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	1	1	1	NA					ND	U	1	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**7.2**		1.7	3	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.052	0.052	1	ND	U	0.052	1	1	0.16	J	0.08	0.08	1

Note:
CAS No. - Chemical Abstract Number
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TDS - Total Dissolved Solids
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-21D_07012011 FILTERED					A-21D_53012					A-21D_082112					A-21D_11112					A-21D_32913					AOI5_A-22_073115~JC522				
			Sample Date	7/1/2011					5/30/2012					8/21/2012					11/1/2012					3/29/2013					7/31/2015				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.35	5	1	ND	U	0.19	2	1	ND	U	0.22	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					ND	U	0.012	0.014	1	NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	NA					ND	U	0.01	0.0097	1	ND	U	0.01	0.0097	1	ND	U	***0.5***	2	1	ND	U	0.011	0.02	1	ND	U	0.0078	0.018	1
1,2-Dichloroethane	107-06-2	5	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.63	1	1	ND	U	0.26	1	1	ND	U	0.18	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.47	5	1	ND	U	0.36	2	1	ND	U	0.29	2	1
Benzene	71-43-2	5	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.24	0.5	1	ND	U	0.24	1	1	ND	U	0.24	0.5	1
Ethylbenzene	100-41-4	700	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.51	1	1	ND	U	0.23	1	1	ND	U	0.27	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.5	5	1	ND	U	0.45	2	1	1.4		0.23	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	NA					2		0.5	0.5	1	2		0.5	0.5	1	2.1		0.41	1	1	2.3		0.16	1	1	ND	U	0.24	1	1
Toluene	108-88-3	1000	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.51	1	1	ND	U	0.23	1	1	0.2	J	0.16	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	NA					ND	U	0.5	0.5	1	ND	U	0.5	0.5	1	ND	U	0.58	1	1	ND	U	0.24	1	1	ND	U	0.17	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					0.1	J	0.1	0.1	1	0.042	J	0.018	0.1	1	ND	U	0.02	0.1	1	1.21		0.013	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					ND	U	0.1	0.1	1	ND	U	0.03	0.05	1	ND	U	0.012	0.1	1	1.81		0.019	0.052	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					ND	U	0.1	0.1	1	ND	U	0.017	0.1	1	ND	U	0.012	0.1	1	**1.99**		0.031	0.052	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					ND	U	0.1	0.1	1	ND	U	0.024	0.05	1	ND	U	0.01	0.1	1	**2.3**		0.022	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					ND	U	0.1	0.1	1	ND	U	0.038	0.1	1	ND	U	0.016	0.1	1	**1.08**		0.027	0.1	1
Chrysene	218-01-9	1.9	ug/L	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.073	0.1	1	ND	U	0.012	0.1	1	**1.94**		0.016	0.1	1
Fluorene	86-73-7	1900	ug/L	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.046	0.1	1	ND	U	0.017	0.1	1	1.8		0.028	0.1	1
Naphthalene	91-20-3	100	ug/L	NA					ND	U	0.1	0.1	1	ND	U	0.1	0.1	1	ND	U	0.036	0.1	1	ND	U	0.036	0.1	1	ND	U	0.014	0.1	1
Phenanthrene	85-01-8	1100	ug/L	NA					0.1	J	0.1	0.1	1	0.2	J	0.1	0.1	1	0.13		0.013	0.05	1	0.173		0.021	0.1	1	ND	U	0.017	0.1	1
Pyrene	129-00-0	130	ug/L	NA					ND	U	0.1	0.1	1	0.1	J	0.1	0.1	1	0.041	J	0.036	0.1	1	ND	U	0.015	0.1	1	7.33		0.014	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.08	1	1	ND	U	0.08	1	1	ND	U	0.034	1	1	ND	U	2.1	5	1	**7.6**		1.7	3	1	2.5	B	2.3	3	1

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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
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MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	AOI5_A-22_012116~JC13091					A-23_1252006					A-23_050807					A-23_072314					A-23_102214					A-24_072114				
			Sample Date	1/21/2016					12/5/2006					5/8/2007					7/23/2014					10/22/2014					7/21/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.22	2	1	NA					NA					ND	U	0.19	2	1	ND	U	0.02	0.1	1	1.4	J	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0086	0.02	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.3***	1	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.18	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.22	1	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.29	2	1	NA					NA					ND	U	0.17	2	1	ND	U	0.2	1	1	0.53	J	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.24	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.26	1	1	**44.4**		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.27	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.17	2	1	1.5		0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	1.1		0.23	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.015	0.1	1	40.8		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.24	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.19	2	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.16	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.26	1	1	18.6		0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.17	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.21	0.5	1	18.9		0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	1.09		0.013	0.1	1	NA					NA					ND	U	0.02	0.1	1	ND	U	0.016	0.1	1	0.825		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.43		0.019	0.05	1	NA					NA					ND	U	0.012	0.1	1	ND	U	0.017	1	1	0.26		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**1.76**		0.03	0.05	1	NA					NA					ND	U	0.012	0.1	1	ND	U	0.021	1	1	0.13		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**2.06**		0.021	0.1	1	NA					NA					0.132		0.01	0.1	1	ND	U	0.012	0.1	1	0.143		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**1.18**		0.026	0.1	1	NA					NA					ND	U	0.016	0.1	1	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	1.29		0.015	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	2.01		0.027	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.017	0.1	1	ND	U	1.3	3	1	2.81		0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.013	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.016	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.162		0.021	0.1	1	ND	U	0.036	0.1	1	2.94		0.021	0.1	1
Pyrene	129-00-0	130	ug/L	6.54		0.013	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.177		0.015	0.1	1	ND	U	0.01	0.1	1	0.765		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	2.3	3	1	0.85	B	0.8	2	1	ND	U	0.8	0.8	1	1.3	B	1.3	3	1	ND	U	0.4	1	1	**5.8**		1.3	3	1

Note:
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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-24_100814					A-25_1262006					A-25_050307					A-25_072514					A-25_102014					A-26_1262006				
			Sample Date	10/8/2014					12/6/2006					5/4/2007					7/25/2014					10/20/2014					12/6/2006				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	0.49	J	0.01	0.1	1	NA					NA					ND	U	0.19	2	1	ND	U	0.038	0.11	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.21***	0.5	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.017	0.11	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.013	0.11	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.26	1	1	NA					NA					ND	U	0.17	2	1	ND	U	0.013	0.11	1	NA				
Benzene	71-43-2	5	ug/L	**18.2**		0.21	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.018	0.11	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	0.65	J	0.016	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.011	0.11	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	15.5		0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	1.3	3	1	ND	U	0.5	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.02	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	0.31	J	0.012	0.1	1	ND	U	0.5	1	1
Toluene	108-88-3	1000	ug/L	6.4		0.2	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.012	0.11	1	ND	U	0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	5.3		0.26	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.023	0.11	1	ND	U	0.5	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	1.28		0.26	1	1	NA					NA					ND	U	0.02	0.1	1	ND	U	0.011	0.02	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.05		0.26	1	1	NA					NA					ND	U	0.012	0.1	1	ND	U	0.22	1	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**1.29**		0.2	1	1	NA					NA					ND	U	0.012	0.1	1	ND	U	0.17	2	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**1.33**		0.17	2	1	NA					NA					ND	U	0.01	0.1	1	0.129		0.3	1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**0.775**		0.3	1	1	NA					NA					ND	U	0.016	0.1	1	ND	U	***0.4***	1	1	NA				
Chrysene	218-01-9	1.9	ug/L	0.808		0.22	1	1	ND	U	0.5	1.2	1	**3.1**		0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.3	1	1	ND	U	0.5	1	1
Fluorene	86-73-7	1900	ug/L	2.53		0.19	2	1	ND	U	0.5	1.2	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.2	1	1	ND	U	0.5	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.015	0.1	1	ND	U	0.5	1.2	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.26	1	1	ND	U	0.5	1	1
Phenanthrene	85-01-8	1100	ug/L	2.93		0.21	0.5	1	ND	U	0.5	1.2	1	2.4		0.00051	1	1	ND	U	0.021	0.1	1	0.109		0.17	2	1	ND	U	0.5	1	1
Pyrene	129-00-0	130	ug/L	2.34		0.4	1	1	ND	U	0.5	1.2	1	5.5		0.00051	1	1	0.163		0.015	0.1	1	0.18		0.4	1	1	ND	U	0.5	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	1.3	B	0.075	5	1	0.93	B	0.8	2	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.016	0.11	1	1.9	B	0.8	2	1

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-26_050407					A-26_072514					A-26_102014					A-27_1252006					A-27_050807					A-27-072214				
			Sample Date	5/4/2007					7/25/2014					10/20/2014					12/5/2006					5/8/2007					7/22/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.012	0.11	1	NA					NA					0.97	J	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.26***	1	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.26	1	1	NA					NA					0.52	J	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.011	0.11	1	1.5		0.5	1	1	1.7	J	0.5	5	1	1.3		0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1	0.51	J	0.5	5	1	0.67	J	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.013	0.11	1	20		0.5	1	1	26		0.5	5	1	31.8		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	1.1	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.016	0.11	1	1.9		0.5	1	1	1.7	J	0.5	5	1	0.34	J	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.021	0.11	1	4.4		0.5	1	1	5.8		0.5	5	1	4.6		0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.016	0.11	1	6.5		0.5	3	1	8.8		0.5	5	1	7.3		0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	0.269		0.26	1	1	NA					NA					0.216		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	1.13		0.17	2	1	NA					NA					0.145		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	**0.899**		0.3	1	1	NA					NA					0.122		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	**1.24**		0.26	1	1	NA					NA					0.177		0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	**0.62**		0.19	2	1	NA					NA					ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.0005	1	1	ND	U	0.012	0.1	1	1.01		0.4	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	0.203		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.0005	1	1	ND	U	0.017	0.1	1	ND	U	0.012	0.11	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	0.61		0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	0.102		0.2	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.0005	1	1	0.109		0.021	0.1	1	0.472		0.22	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	0.693		0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.0005	1	1	0.124		0.015	0.1	1	3.2		0.21	0.5	1	0.64	J	0.5	1	1	ND	U	0.00051	1	1	0.638		0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	2.6	6	2	ND	U	0.2	1	1	2		0.8	2	1	ND	U	0.8	0.8	1	**5.9**		1.3	3	1

Note:
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ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-27_102214					A-3_1242006					A-3_050307					A-3_072414					A-3_102014					A-39_1242006				
			Sample Date	10/22/2014					12/4/2006					5/3/2007					7/24/2014					10/20/2014					12/4/2006				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	1.3	J	0.4	1	1	NA					NA					0.34	J	0.19	2	1	ND	U	0.3	1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.4***	1	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.017	0.1	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	0.71	J	1.3	3	1	NA					NA					0.18	J	0.17	2	1	ND	U	0.036	0.1	1	NA				
Benzene	71-43-2	5	ug/L	1.5		0.17	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.4	1	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	0.8	J	0.036	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.021	0.1	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	40		0.22	1	1	4.3		0.5	1	1	6.8		0.5	5	1	170		0.26	1	1	30.5		0.17	2	1	ND	U	0.5	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.29	J	0.01	0.025	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.011	0.02	1	ND	U	0.5	1	1
Toluene	108-88-3	1000	ug/L	3.9		0.4	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	1.3	3	1	ND	U	0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	8.4		0.3	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	1.5		0.2	1	1	0.31	J	0.22	1	1	ND	U	0.5	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.142		0.2	1	1	NA					NA					0.189		0.02	0.1	1	0.357		0.22	1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.21	0.5	1	NA					NA					ND	U	0.012	0.1	1	0.247		0.19	2	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	***0.26***	1	1	NA					NA					ND	U	0.012	0.1	1	ND	U	***0.22***	1	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.22	1	1	NA					NA					ND	U	0.01	0.1	1	0.123		0.26	1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.17	2	1	NA					NA					ND	U	0.016	0.1	1	ND	U	0.17	2	1	NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.2	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	0.232		0.21	0.5	1	ND	U	0.5	1	1
Fluorene	86-73-7	1900	ug/L	0.753		0.19	2	1	0.97	J	0.5	1	1	1.5		0.00051	1	1	1.77		0.017	0.1	1	3.2		1.3	3	1	ND	U	0.5	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.2	1	1	ND	U	0.5	1	1
Phenanthrene	85-01-8	1100	ug/L	0.702		0.21	0.5	1	ND	U	0.5	1	1	1.3		0.00051	1	1	2.72		0.021	0.1	1	3.93		0.26	1	1	ND	U	0.5	1	1
Pyrene	129-00-0	130	ug/L	0.264		0.26	1	1	1.1		0.5	1	1	ND	U	0.00051	1	1	0.505		0.015	0.1	1	1.26		0.2	1	1	ND	U	0.5	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.011	0.02	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	2.6	B	1.3	3	1	ND	U	0.012	0.1	1	ND	U	0.8	0.8	1

Note:
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mg/L - milligrams per liter
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ug/L - micrograms per liter
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-39_050707					A-39_071714					A-39_100814					A-4_071714					A-4_101514					A-40_1242006				
			Sample Date	5/7/2007					7/17/2014					10/8/2014					7/17/2014					10/15/2014					12/4/2006				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.078	0.5	1	ND	U	0.19	2	1	ND	U	0.015	0.1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.22***	1	1	ND	U	0.011	0.02	1	ND	U	***0.26***	1	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.3	1	1	ND	U	0.19	2	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.21	0.5	1	ND	U	0.17	2	1	ND	U	0.26	1	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.075	0.5	1	ND	U	0.21	0.5	1	0.27	J	0.018	0.11	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.2	1	1	ND	U	0.4	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.051	0.5	1	0.77	J	0.26	1	1	4.6		0.03	2	1	ND	U	0.5	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.1	0.5	1	ND	U	0.26	1	1	ND	U	0.02	0.1	1	0.64	J	0.5	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.19	2	1	0.25	J	0.22	1	1	0.28	J	0.012	0.11	1	3.3		0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.26	1	1	ND	U	0.2	1	1	0.98	J	0.022	0.11	1	ND	U	0.5	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	ND	U	0.059	0.5	1	ND	U	0.2	1	1	15.3		0.031	0.2	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					0.1		0.012	0.1	1	ND	U	1.3	3	1	**33**		0.12	1	1	**19.6**		0.034	2	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					0.142		0.012	0.1	1	ND	U	0.18	0.5	1	**77.2**		0.12	10	1	**13**		0.042	2	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					0.21		0.01	0.1	1	ND	U	0.1	0.5	1	**84.8**		0.1	10	1	**19**		0.025	0.2	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					0.128		0.016	0.1	1	ND	U	0.058	0.5	1	**29.4**		0.16	1	1	**7.55**		0.024	2	1	NA				
Chrysene	218-01-9	1.9	ug/L	1.1		0.00052	1	1	0.168		0.012	0.1	1	ND	U	0.085	0.5	1	**45.5**		0.12	1	1	**18.9**		0.023	2	1	ND	U	0.5	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00052	1	1	ND	U	0.017	0.1	1	ND	U	0.4	1	1	28.9		0.17	1	1	19		1.3	3	1	ND	U	0.5	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00052	1	1	ND	U	0.036	0.1	1	ND	U	0.3	1	1	ND	U	0.36	1	1	ND	U	0.016	0.1	1	ND	U	0.5	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00052	1	1	ND	U	0.021	0.1	1	ND	U	0.0081	0.02	1	62.5		0.21	10	1	38.2		0.071	0.2	1	ND	U	0.5	1	1
Pyrene	129-00-0	130	ug/L	2.2		0.00052	1	1	0.186		0.015	0.1	1	ND	U	0.062	0.5	1	**215**		0.15	10	1	45.8		0.02	0.2	1	ND	U	0.5	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.17	2	1	**30.6**		1.3	3	1	**21.8**		0.041	2	1	ND	U	0.8	0.8	1

Note:
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-40_050707					A-40_071714					A-40_100814					A-41_050707					A-41_072914					A-41_100814				
			Sample Date	5/7/2007					7/17/2014					10/8/2014					5/7/2007					7/29/2014					10/8/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.01	0.1	1	NA					ND	U	0.19	2	1	ND	U	0.26	1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.26***	1	1	ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	***0.4***	1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.19	2	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.17	2	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.26	1	1	NA					ND	U	0.17	2	1	ND	U	0.22	1	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.016	0.1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.19	2	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.21	0.5	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.3	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.031	0.15	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.57	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.015	0.1	1	0.88	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.21	0.5	1
Toluene	108-88-3	1000	ug/L	0.59	J	0.5	5	1	ND	U	0.22	1	1	0.28	J	0.2	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.2	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.02	0.1	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.26	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	ND	U	0.012	0.1	1	NA					ND	U	0.02	0.1	1	ND	U	0.023	0.15	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	ND	U	***6.5***	15	1	NA					ND	U	0.012	0.1	1	ND	U	0.019	0.15	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	0.036	0.1	1	NA					ND	U	0.012	0.1	1	0.129		0.26	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	ND	U	0.021	0.1	1	NA					0.166		0.01	0.1	1	0.173		0.2	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	ND	U	0.012	0.1	1	NA					ND	U	0.016	0.1	1	ND	U	0.016	0.15	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.017	0.1	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.018	0.15	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.4	1	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.018	0.15	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.3	1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.032	0.15	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00051	1	1	0.245		0.021	0.1	1	ND	U	0.0081	0.02	1	ND	U	0.00051	1	1	0.134		0.021	0.1	1	0.116		0.21	0.5	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00051	1	1	ND	U	0.015	0.1	1	0.129		0.4	1	1	ND	U	0.00051	1	1	0.186		0.015	0.1	1	ND	U	0.024	0.15	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.2	1	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.011	0.02	1

Note:

CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:

U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-43_050307					A-44_1242006					A-44_050307					A-44_071814					A-44_101414					A-47_072114				
			Sample Date	5/3/2007					12/4/2006					5/3/2007					7/18/2014					10/14/2014					7/21/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					NA					NA					ND	U	0.19	2	1	ND	U	0.011	0.02	1	ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.011	0.11	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.014	0.11	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					NA					NA					ND	U	0.17	2	1	ND	U	0.013	0.11	1	0.23	J	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	1.3	3	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.013	0.11	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.4	1	1	1.3		0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.039	0.11	1	2.7		0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.023	0.11	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.019	0.11	1	0.27	J	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					NA					NA					ND	U	0.02	0.1	1	0.463		0.013	0.11	1	2.87		0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					NA					0.187		0.012	0.1	1	0.973		1.3	3	1	4.32		0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					NA					0.145		0.012	0.1	1	**0.562**		0.039	0.11	1	**4.01**		0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					NA					0.17		0.01	0.1	1	0.803		0.023	0.11	1	**3.8**		0.01	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					NA					ND	U	0.016	0.1	1	**0.353**		0.013	0.11	1	**2.68**		0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.00053	1.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	0.203		0.012	0.1	1	0.891		0.019	0.11	1	**3.65**		0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.00053	1.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1	0.612		0.4	1	1	9.45		0.017	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.00053	1.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.3	1	1	0.216		0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00053	1.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	0.429		0.0081	0.02	1	3.76		0.021	0.1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.00053	1.1	1	1.3		0.5	1	1	ND	U	0.00051	1	1	0.431		0.015	0.1	1	2		0.014	0.11	1	6.55		0.015	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	1.9	B	0.8	2	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	**7**		1.3	3	1	ND	U	0.017	0.11	1	**8.2**		1.3	3	1

Note:
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-47_102214					A-48_050807					A-48_072514					A-48_101314					A-49_1252006					A-49_050807				
			Sample Date	10/22/2014					5/8/2007					7/25/2014					10/13/2014					12/5/2006					5/8/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.012	0.1	1	NA					ND	U	0.19	2	1	ND	U	0.015	0.1	1	NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.26***	1	1	0.05	J	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	***0.21***	0.5	1	NA					ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.015	0.1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.26	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	0.24	J	0.19	2	1	NA					ND	U	0.17	2	1	ND	U	0.02	0.1	1	NA					NA				
Benzene	71-43-2	5	ug/L	ND	U	0.012	0.1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	0.37	J	0.016	0.11	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.021	0.1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.012	0.1	1	60		0.5	5	1	18.8		0.26	1	1	18.4		0.021	0.1	1	4		0.5	1	1	5.5		0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	1.8		0.012	0.1	1	2.3	J	0.5	5	1	0.46	J	0.26	1	1	0.32	J	0.016	0.11	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.016	0.1	1	0.68	J	0.5	5	1	ND	U	0.22	1	1	0.33	J	0.021	0.11	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.01	0.1	1	2.1	J	0.5	5	1	1.6		0.2	1	1	2.1		0.012	0.1	1	1.2	J	0.5	3	1	1.4	J	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	12		0.021	0.1	1	NA					2.66		0.02	0.1	1	3.45		0.017	0.1	1	NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	**15.5**		0.3	1	1	NA					1.08		0.012	0.1	1	1.44		0.17	2	1	NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**10.6**		0.4	1	1	NA					**0.517**		0.012	0.1	1	**0.622**		0.3	1	1	NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**11.8**		1.3	3	1	NA					0.786		0.01	0.1	1	0.803		0.0081	0.02	1	NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**4.53**		0.036	0.1	1	NA					**0.271**		0.016	0.1	1	**0.298**		1.3	3	1	NA					NA				
Chrysene	218-01-9	1.9	ug/L	**13.4**		0.011	0.02	1	ND	U	0.0005	1	1	1.18		0.012	0.1	1	1.27		0.4	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Fluorene	86-73-7	1900	ug/L	27.4		0.22	1	1	4		0.0005	1	1	8.73		0.017	1	1	8.02		0.2	1	1	3.5		0.5	1	1	1.4		0.00051	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.021	0.1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	ND	U	0.016	0.1	1	0.59	J	0.5	1	1	1.2		0.00051	1	1
Phenanthrene	85-01-8	1100	ug/L	10.6		0.17	2	1	2.3		0.0005	1	1	12.6		0.021	1	1	7.87		0.22	1	1	2		0.5	1	1	ND	U	0.00051	1	1
Pyrene	129-00-0	130	ug/L	42.4		0.017	0.1	1	2.1		0.0005	1	1	3.46		0.015	0.1	1	3.99		0.036	0.1	1	1.8		0.5	1	1	ND	U	0.00051	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**25.5**		0.012	0.1	1	1.3	B	0.8	2	1	ND	U	1.3	3	1	ND	U	0.26	1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1

Note:

CAS No. - Chemical Abstract Number

PADEP - Pennsylvania Department of Environmental Protection

TDS - Total Dissolved Solids

mg/L - milligrams per liter

MSC - Medium Specific Concentrations

ug/L - micrograms per liter

Q - Qualifier

MDL - Method detection limit

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-49_072414					A-49_102214					A-5_050407					A-5_080114					AOI5_A-5_012216~JC13164					A-6_050907				
			Sample Date	7/24/2014					10/22/2014					5/4/2007					8/1/2014					1/22/2016					5/9/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	0.45	J	0.19	2	1	ND	U	0.02	0.1	1	NA					0.42	J	0.19	2	1	ND	U	0.22	2	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	***0.17***	2	1	ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	0.0084	0.02	1	ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.2	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.18	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.26	1	1	NA					ND	U	0.17	2	1	ND	U	0.29	2	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.26	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.24	0.5	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.22	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	0.52	J	0.27	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	4.3		0.26	1	1	2.9		0.025	1.2	1	ND	U	0.5	5	1	1.5		0.26	1	1	1		0.23	1	1	0.73	J	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.19	2	1	17		0.5	5	1	ND	U	0.26	1	1	0.59	J	0.24	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.21	0.5	1	0.73	J	0.5	5	1	ND	U	0.22	1	1	0.38	J	0.16	1	1	0.82	J	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	1.2		0.2	1	1	1		0.014	0.12	1	1.1	J	0.5	5	1	0.62	J	0.2	1	1	3.5		0.17	1	1	0.9	J	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	0.686		0.02	0.1	1	0.409		0.02	1.2	1	NA					0.635		0.021	0.11	1	0.724		0.013	0.1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	0.192		0.012	0.1	1	ND	U	0.012	0.1	1	NA					1.05		0.012	0.11	1	1.33		0.019	0.05	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	0.121		0.012	0.1	1	ND	U	0.012	0.1	1	NA					**0.886**		0.013	0.11	1	**0.992**		0.03	0.05	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	0.144		0.01	0.1	1	ND	U	0.016	0.1	1	NA					1.14		0.011	0.11	1	1.13		0.021	0.1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	0.015	0.1	1	NA					**0.454**		0.016	0.11	1	**0.606**		0.026	0.1	1	NA				
Chrysene	218-01-9	1.9	ug/L	0.166		0.012	0.1	1	ND	U	0.01	0.1	1	**2.3**		0.00049	1	1	1.03		0.012	0.11	1	1.05		0.015	0.1	1	NA				
Fluorene	86-73-7	1900	ug/L	3.85		0.017	0.1	1	3.36		0.4	1	1	8.2		0.00049	1	1	1.29		0.018	0.11	1	1.18		0.027	0.1	1	NA				
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.012	0.1	1	ND	U	0.00049	1	1	ND	U	0.037	0.11	1	0.148		0.013	0.1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	1.32		0.021	0.1	1	0.815		0.014	0.035	1	5.1		0.00049	1	1	0.623		0.022	0.11	1	0.235		0.016	0.1	1	NA				
Pyrene	129-00-0	130	ug/L	0.665		0.015	0.1	1	0.388		0.043	0.12	1	9.8		0.00049	1	1	2.04		0.016	0.11	1	2.13		0.013	0.1	1	NA				
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.3	1	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	**16.1**		2.3	3	1	ND	U	0.8	0.8	1

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Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-6_073014					A-6_101714					A-8_1242006					A-8_050407					A-9_1242006					A-9_050407				
			Sample Date	7/30/2014					10/17/2014					12/4/2006					5/4/2007					12/4/2006					5/4/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.22	1	1	NA					NA					NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	0.021	1	1	NA					ND	U	0.005	0.05	1	NA					ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.036	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	1.3	3	1	NA					NA					NA					NA				
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.17	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.017	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	1.2		0.26	1	1	ND	U	0.2	1	1	0.66	J	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.3	1	1	0.96	J	0.5	1	1	1	J	0.5	5	1	16		0.5	1	1	5.1		0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.0081	0.02	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.4	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.5	3	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.021	0.11	1	ND	U	0.26	1	1	NA					NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.11	1	ND	U	0.016	0.1	1	NA					NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.013	0.11	1	ND	U	0.015	0.1	1	NA					NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.011	0.11	1	ND	U	0.26	1	1	NA					NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.11	1	ND	U	0.19	2	1	NA					NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.11	1	ND	U	0.02	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Fluorene	86-73-7	1900	ug/L	0.238		0.018	0.11	1	ND	U	0.012	0.1	1	1.3		0.5	1	1	ND	U	0.00051	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.037	0.11	1	ND	U	0.012	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Phenanthrene	85-01-8	1100	ug/L	0.128		0.022	0.11	1	ND	U	0.01	0.1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Pyrene	129-00-0	130	ug/L	0.13		0.016	0.11	1	ND	U	0.21	0.5	1	0.6	J	0.5	1	1	ND	U	0.00051	1	1	ND	U	0.5	1	1	ND	U	0.00051	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	4.9		1.3	3	1	1.9	B	0.051	0.5	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	A-9_072814					A-9_101314					A-91_050907					PZ-2_050307					PZ-3_050307					SW-2_050707				
			Sample Date	7/28/2014					10/13/2014					5/9/2007					5/3/2007					5/3/2007					5/7/2007				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.0081	0.02	1	NA					NA					NA					NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	0.012	0.1	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.021	0.1	1	NA					NA					NA					NA				
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	1.3	3	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.4	1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	1.4		0.26	1	1	2.3		0.017	0.1	1	1.2	J	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.017	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.036	0.1	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.02	0.1	1	0.117		0.036	0.1	1	NA					NA					NA					NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.1	1	0.134		0.4	1	1	NA					NA					NA					NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.012	0.1	1	ND	U	***0.22***	1	1	NA					NA					NA					NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.01	0.1	1	ND	U	0.17	2	1	NA					NA					NA					NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	***0.3***	1	1	NA					NA					NA					NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.1	1	0.146		0.0081	0.02	1	ND	U	0.0016	3.3	1	1.9		0.0005	1	1	ND	U	0.00054	1.1	1	ND	U	0.00049	1	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.017	0.1	1	0.235		0.17	2	1	ND	U	0.0016	3.3	1	ND	U	0.0005	1	1	ND	U	0.00054	1.1	1	ND	U	0.00049	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.2	1	1	ND	U	0.0016	3.3	1	ND	U	0.0005	1	1	ND	U	0.00054	1.1	1	ND	U	0.00049	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.021	0.1	1	0.298		0.3	1	1	ND	U	0.0016	3.3	1	1.5		0.0005	1	1	ND	U	0.00054	1.1	1	ND	U	0.00049	1	1
Pyrene	129-00-0	130	ug/L	0.21		0.015	0.1	1	0.448		1.3	3	1	ND	U	0.0016	3.3	1	1.9		0.0005	1	1	ND	U	0.00054	1.1	1	ND	U	0.00049	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	5		0.021	0.1	1	ND	U	0.8	0.8	1	**5.8**		0.8	2	1	2.7		0.8	2	1	1.5	B	0.8	2	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	SW-2_072914					SW-2_100714					SW-3_1252006					SW-3_050707					SW-3_072914					SW-3_100714				
			Sample Date	7/29/2014					10/7/2014					12/5/2006					5/7/2007					7/29/2014					10/7/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.016	0.1	1	NA					NA					ND	U	0.19	2	1	ND	U	0.014	0.11	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.0081	0.02	1	ND	U	***0.2***	1	1	NA					ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	***0.19***	2	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.023	0.11	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.19	2	1	NA					NA					ND	U	0.17	2	1	ND	U	0.017	0.11	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.015	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.013	0.11	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.26	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.26	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.01	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.013	0.11	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.02	0.1	1	2.3		0.5	1	1	1.6	J	0.5	5	1	0.33	J	0.26	1	1	0.46	J	0.3	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	0.32	J	0.0081	0.02	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.018	0.11	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.26	1	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.011	0.11	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	NA					NA					0.291		0.02	0.1	1	0.334		0.4	1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.1	1	**13.9**		0.015	0.1	1	NA					NA					0.694		0.012	0.1	1	0.856		0.21	0.5	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.013	0.1	1	**12.2**		0.02	0.1	1	NA					NA					**0.463**		0.012	0.1	1	**0.443**		0.26	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.011	0.1	1	**10.5**		0.19	2	1	NA					NA					0.522		0.01	0.1	1	0.509		0.22	1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	**8.49**		0.21	0.5	1	NA					NA					0.218		0.016	0.1	1	0.218		0.17	2	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.1	1	**20.2**		0.26	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	0.786		0.012	0.1	1	0.934		0.2	1	1
Fluorene	86-73-7	1900	ug/L	0.224		0.018	0.1	1	55.8		0.016	0.1	1	4.1		0.5	1	1	ND	U	0.0005	1	1	0.559		0.017	0.1	1	0.767		0.26	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.037	0.1	1	ND	U	0.012	0.1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	ND	U	0.024	0.11	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.022	0.1	1	ND	U	0.012	0.1	1	3.2		0.5	1	1	ND	U	0.0005	1	1	0.172		0.021	0.1	1	0.153		0.19	2	1
Pyrene	129-00-0	130	ug/L	0.118		0.016	0.1	1	24.8		0.26	1	1	ND	U	0.5	1	1	ND	U	0.0005	1	1	1.8		0.015	0.1	1	2.66		0.3	1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.22	1	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.21	0.5	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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U - Compound analyzed but not detected
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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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Table 7
Summary of Groundwater Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	SWR-1_072114					SWR-1_100714					SWR-2_050707					SWR2-072214					SWR-2_100714					SWR-3_1252006				
			Sample Date	7/21/2014					10/7/2014					5/7/2007					7/22/2014					10/7/2014					12/5/2006				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.26	1	1	NA					ND	U	0.19	2	1	ND	U	0.26	1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1	NA				
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.0081	0.02	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.011	0.02	1	ND	U	0.5	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.4	1	1	NA					ND	U	0.17	2	1	ND	U	0.4	1	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.2	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.2	1	1	ND	U	0.5	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	1.3	3	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	1.3	3	1	ND	U	0.5	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.21	0.5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.21	0.5	1	ND	U	0.5	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	0.22	1	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.22	1	1	ND	U	0.5	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.3	1	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.3	1	1	ND	U	0.5	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.17	2	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.17	2	1	ND	U	0.5	3	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.02	0.1	1	ND	U	0.19	2	1	NA					ND	U	0.02	0.1	1	ND	U	0.19	2	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	NA					ND	U	0.012	0.1	1	ND	U	0.012	0.1	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.012	0.1	1	ND	U	0.01	0.1	1	NA					ND	U	0.012	0.1	1	ND	U	0.01	0.1	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.01	0.1	1	ND	U	0.015	0.1	1	NA					ND	U	0.01	0.1	1	ND	U	0.015	0.1	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.016	0.1	1	ND	U	0.02	0.1	1	NA					0.131		0.016	0.1	1	ND	U	0.02	0.1	1	NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1	ND	U	0.016	0.1	1	**8.6**	J	5	10	10
Fluorene	86-73-7	1900	ug/L	ND	U	0.017	0.1	1	ND	U	0.012	0.1	1	0.58	J	0.00051	1	1	ND	U	0.017	0.1	1	ND	U	0.012	0.1	1	ND	U	5	10	10
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	ND	U	0.021	0.1	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1	ND	U	0.021	0.1	1	ND	U	5	10	10
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1	ND	U	0.012	0.1	1	ND	U	5	10	10
Pyrene	129-00-0	130	ug/L	ND	U	0.015	0.1	1	ND	U	0.26	1	1	ND	U	0.00051	1	1	ND	U	0.015	0.1	1	ND	U	0.26	1	1	39		5	10	10
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	1.3	3	1	ND	U	0.017	0.1	1	ND	U	0.8	0.8	1	ND	U	1.3	3	1	ND	U	0.017	0.1	1	1.5	B	0.8	2	1

Note:
CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
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MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10	- Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15	- MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	SWR-3_050707					SWR3-072214					SWR-3_100614				
			Sample Date	5/7/2007					7/22/2014					10/6/2014				
			Sample Matrix	WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																		
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.26	1	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.0081	0.02	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.4	1	1
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.2	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	1.3	3	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	0.55	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.21	0.5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.22	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.3	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.17	2	1
Semi-Volatile Organic Compounds																		
Anthracene	120-12-7	66	ug/L	NA					ND	U	0.02	0.1	1	ND	U	0.19	2	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					ND	U	0.012	0.1	1	0.265		0.051	0.5	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					ND	U	0.012	0.1	1	ND	U	0.02	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					ND	U	0.01	0.1	1	0.266		0.075	5	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					ND	U	0.016	0.1	1	ND	U	0.26	1	1
Chrysene	218-01-9	1.9	ug/L	**6.2**		0.0005	1	1	ND	U	0.012	0.1	1	0.491		0.078	0.5	1
Fluorene	86-73-7	1900	ug/L	ND	U	0.0005	1	1	ND	U	0.017	0.1	1	0.11		0.062	0.5	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	ND	U	0.015	0.1	1
Phenanthrene	85-01-8	1100	ug/L	2.3		0.0005	1	1	ND	U	0.021	0.1	1	0.219		0.059	0.5	1
Pyrene	129-00-0	130	ug/L	11		0.0005	1	1	ND	U	0.015	0.1	1	0.495		0.1	0.5	1
Metals Dissolved																		
Lead	7439-92-1	5	ug/L	2.5		0.8	2	1	ND	U	1.3	3	1	ND	U	0.017	0.1	1

Chemical Name	WP-14_050807					WP-14_040813					WP-14~JB68336				
	5/8/2007					4/8/2013					6/2/2014				
	WG					WG					WG				
	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds															
1,2,4-Trimethylbenzene	NA					ND	U	0.19	2	1	ND	U	1.9	20	10
1,2-Dibromo-3-Chloropropane	NA					NA					-	-			-
1,2-Dibromoethane (EDB)	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	3	10	10
1,3,5-Trimethylbenzene	NA					ND	U	0.36	2	1	ND	U	1.7	20	10
Benzene	ND	U	0.5	5	1	ND	U	0.24	1	1	ND	U	2.1	5	10
Ethylbenzene	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	4	10	10
Isopropylbenzene (Cumene)	ND	U	0.5	5	1	ND	U	0.45	2	1	ND	U	2.6	10	10
Methyl Tertiary Butyl Ether	0.69	J	0.5	5	1	0.26	J	0.16	1	1	ND	U	2.6	10	10
Toluene	ND	U	0.5	5	1	ND	U	0.23	1	1	ND	U	2.2	10	10
Xylenes, Total (Dimethylbenzene)	ND	U	0.5	5	1	ND	U	0.24	1	1	ND	U	2	10	10
Semi-Volatile Organic Compounds															
Anthracene	NA					0.249		0.021	0.11	1	0.631	-	0.021	0.1	1
Benzo(a)Anthracene	NA					0.586		0.012	0.11	1	ND	U	0.012	0.1	1
Benzo(a)Pyrene	NA					**0.463**		0.013	0.11	1	ND	U	0.013	0.1	1
Benzo(b)Fluoranthene	NA					0.432		0.011	0.11	1	ND	U	0.01	0.1	1
Benzo(g,h,i)Perylene	NA					**0.27**		0.016	0.11	1	ND	U	0.016	0.1	1
Chrysene	ND	U	0.0005	1	1	0.576		0.012	0.11	1	ND	U	0.012	0.1	1
Fluorene	ND	U	0.0005	1	1	0.228		0.018	0.11	1	4.94	-	0.017	0.1	1
Naphthalene	ND	U	0.0005	1	1	0.228		0.037	0.11	1	ND	U	0.036	0.1	1
Phenanthrene	ND	U	0.0005	1	1	0.54		0.022	0.11	1	1.65	-	0.021	0.1	1
Pyrene	ND	U	0.0005	1	1	1.17		0.016	0.11	1	1.34	-	0.015	0.1	1
Metals Dissolved															
Lead	2.3		0.8	2	1	ND	U	1.7	3	1	2	J	1.3	3	1

Note:
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mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
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ND - Not detected
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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 7
Summary of Groundwater Analytical Results
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP-14_072514					WP-14_100914					WP-14_20150521_1563168					WP16-3-052605					WP16-3_050407					WP-16-3_072514				
			Sample Date	7/25/2014					10/9/2014					5/21/2015					5/26/2005					5/4/2007					7/25/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.2	1	1	ND	U	0.5	0.5	1	NA					NA					ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	0.036	0.1	1	ND	U	0.01	0.0095	1	ND	U	0.0099	0.03	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.011	0.02	1	ND	U	0.5	0.5	1	ND	U	1	5	1	ND	U	0.5	5	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.4	1	1	ND	U	0.5	0.5	1	NA					NA					ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.21	0.5	1	ND	U	0.22	1	1	ND	U	0.5	0.5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	1.3	3	1	ND	U	0.5	0.5	1	ND	U	0.8	5	1	ND	U	0.5	5	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.26	1	1	ND	U	0.26	1	1	ND	U	0.5	0.5	1	ND	U	1	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	0.32	J	0.17	2	1	ND	U	0.5	0.5	1	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	ND	U	0.3	1	1	ND	U	0.5	0.5	1	ND	U	0.7	5	1	ND	U	0.5	5	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.2	1	1	ND	U	0.17	2	1	ND	U	0.5	0.5	1	ND	U	0.8	5	1	ND	U	0.5	5	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	1.12		0.023	0.11	1	0.264		0.21	0.5	1	0.2	J	0.1	0.1	1	NA					NA					ND	U	0.02	0.1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	3.47		0.013	0.11	1	0.398		0.016	0.1	1	0.6		0.1	0.1	1	NA					NA					ND	U	0.012	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**2.18**		0.014	0.11	1	0.167		0.015	0.1	1	**0.7**		0.1	0.1	1	NA					NA					ND	U	0.012	0.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**2.96**		0.011	0.11	1	0.21		0.26	1	1	0.7		0.1	0.1	1	NA					NA					ND	U	0.01	0.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**1.2**		0.017	0.11	1	ND	U	0.21	0.5	1	**0.5**		0.1	0.1	1	NA					NA					ND	U	0.016	0.1	1
Chrysene	218-01-9	1.9	ug/L	**2.78**		0.013	0.11	1	0.269		0.02	0.1	1	0.7		0.1	0.1	1	ND	U	1	10	1	ND	U	0.00051	1	1	ND	U	0.012	0.1	1
Fluorene	86-73-7	1900	ug/L	1.16		0.019	0.11	1	0.297		0.012	0.1	1	0.1	J	0.1	0.1	1	ND	U	1	10	1	ND	U	0.00051	1	1	ND	U	0.017	0.1	1
Naphthalene	91-20-3	100	ug/L	1.03		0.039	0.11	1	0.154		0.012	0.1	1	0.2	J	0.1	0.1	1	ND	U	1	10	1	ND	U	0.00051	1	1	ND	U	0.036	0.1	1
Phenanthrene	85-01-8	1100	ug/L	1.84		0.023	0.11	1	0.345		0.01	0.1	1	0.5	J	0.1	0.1	1	ND	U	1	10	1	ND	U	0.00051	1	1	ND	U	0.021	0.1	1
Pyrene	129-00-0	130	ug/L	6.16		0.017	1.1	1	1.15		0.19	2	1	0.8		0.1	0.1	1	ND	U	1	10	1	ND	U	0.00051	1	1	ND	U	0.015	0.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	**6.2**		1.3	3	1	ND	U	0.017	0.1	1	0.97	J	0.082	0.082	1	ND	U	0.18	1	1	**12**		0.8	2	1	**24.1**		1.3	3	1

Note:

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP16-3_102014					WP-4A_1242006					WP-4A_050707					WP-8_1252006					WP-8_050907					WP-8_072814				
			Sample Date	10/20/2014					12/4/2006					5/7/2007					12/5/2006					5/9/2007					7/28/2014				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.021	0.1	1	NA					NA					NA					NA					ND	U	0.19	2	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	***0.3***	1	1	NA					ND	U	0.005	0.05	1	NA					ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.22	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.3	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.2	1	1	NA					NA					NA					NA					ND	U	0.17	2	1
Benzene	71-43-2	5	ug/L	ND	U	0.26	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.17	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.4	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.015	0.1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	1.1		0.5	1	1	ND	U	0.5	5	1	0.6	J	0.26	1	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.19	2	1	ND	U	0.5	1	1	ND	U	0.5	5	1	5		0.5	1	1	3.3	J	0.5	5	1	ND	U	0.26	1	1
Toluene	108-88-3	1000	ug/L	ND	U	0.26	1	1	ND	U	0.5	1	1	ND	U	0.5	5	1	ND	U	0.5	1	1	0.79	J	0.5	5	1	ND	U	0.22	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.21	0.5	1	ND	U	0.5	3	1	ND	U	0.5	5	1	ND	U	0.5	3	1	0.91	J	0.5	5	1	ND	U	0.2	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	ND	U	0.016	0.1	1	NA					NA					NA					NA					2.86		0.024	0.12	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	ND	U	0.017	0.1	1	NA					NA					NA					NA					2.29		0.014	0.12	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	ND	U	0.021	0.1	1	NA					NA					NA					NA					**1.29**		0.015	0.12	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	ND	U	0.013	0.1	1	NA					NA					NA					NA					**1.46**		0.012	0.12	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	ND	U	0.012	0.1	1	NA					NA					NA					NA					**0.552**		0.019	0.12	1
Chrysene	218-01-9	1.9	ug/L	ND	U	0.012	0.1	1	**7.5**		2.5	6.3	5	ND	U	0.0005	1	1	**2.3**		0.5	1.2	1	NA					1.86		0.014	0.12	1
Fluorene	86-73-7	1900	ug/L	ND	U	1.3	3	1	6.9		2.5	6.3	5	ND	U	0.0005	1	1	9.5		0.5	1.2	1	NA					9.44		0.02	1.2	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.0081	0.02	1	ND	U	2.5	6.3	5	ND	U	0.0005	1	1	1.6		0.5	1.2	1	NA					ND	U	0.043	0.12	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.036	0.1	1	8.3		2.5	6.3	5	ND	U	0.0005	1	1	10		0.5	1.2	1	NA					18.4		0.025	1.2	1
Pyrene	129-00-0	130	ug/L	ND	U	0.01	0.1	1	36		2.5	6.3	5	1.9		0.0005	1	1	29		0.5	1.2	1	NA					4.61		0.018	0.12	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	ND	U	0.4	1	1	**12**		0.8	2	1	2.9		0.8	2	1	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	**34.1**		1.3	3	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:
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Exceedances:
10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
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AOI 5 Remedial Investigation Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP-8_100914					WP-8_101014					WP-9_050807					WP-9_072514					WP-9_100914					WP-A_11_9_2005				
			Sample Date	10/9/2014					10/10/2014					5/8/2007					7/25/2014					10/9/2014					11/9/2005				
			Sample Matrix	WG					WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																																	
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.3	1	1	NA					NA					ND	U	0.19	2	1	ND	U	0.3	1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.021	0.1	1	NA					ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1	ND	U	0.02	0.02	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.036	0.1	1	NA					ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.021	0.1	1	ND	U	1	1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	1.3	3	1	NA					NA					ND	U	0.17	2	1	ND	U	0.017	0.1	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.4	1	1	NA					ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.4	1	1	ND	U	1	1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.017	0.1	1	NA					ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	1	1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	2.6		0.26	1	1	NA					ND	U	0.5	5	1	ND	U	0.26	1	1	0.26	J	0.21	0.5	1	NA				
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.011	0.02	1	NA					ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.0081	0.02	1	**21**		1	1	1
Toluene	108-88-3	1000	ug/L	0.27	J	0.2	1	1	NA					ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.036	0.1	1	ND	U	1	1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.38	J	0.26	1	1	NA					ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	1.3	3	1	ND	U	1	1	1
Semi-Volatile Organic Compounds																																	
Anthracene	120-12-7	66	ug/L	NA					6.42		0.19	2	1	NA					0.619		0.02	0.1	1	0.162		0.26	1	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					**5.25**		0.012	0.1	1	NA					1.61		0.012	0.1	1	0.519		0.016	0.1	1	**14.7**		0.014	1.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					**3.1**		0.01	0.1	1	NA					**1.75**		0.012	0.1	1	**0.481**		0.015	1	1	**13.4**		0.029	1.1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					**3.93**		0.015	0.1	1	NA					**2.38**		0.01	0.1	1	0.754		0.26	1	1	**17.9**		0.022	1.1	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					**1.25**		0.02	0.1	1	NA					**1.29**		0.016	0.1	1	**0.401**		0.19	2	1	**18.1**		0.034	1.1	1
Chrysene	218-01-9	1.9	ug/L	NA					**4.83**		0.016	0.1	1	ND	U	0.00061	1.2	1	1.56		0.012	0.1	1	0.404		0.02	0.1	1	**9**		0.014	1.1	1
Fluorene	86-73-7	1900	ug/L	NA					20.3		0.012	0.1	1	ND	U	0.00061	1.2	1	0.74		0.017	0.1	1	0.277		0.012	1	1	38.2		0.024	1.1	1
Naphthalene	91-20-3	100	ug/L	NA					ND	U	0.17	2	1	ND	U	0.00061	1.2	1	0.966		0.036	0.1	1	0.118		0.012	1	1	NA				
Phenanthrene	85-01-8	1100	ug/L	NA					43.5		0.012	0.1	1	ND	U	0.00061	1.2	1	1.94		0.021	0.1	1	0.492		0.01	0.1	1	13.2		0.03	1.1	1
Pyrene	129-00-0	130	ug/L	NA					10.5		0.26	1	1	ND	U	0.00061	1.2	1	2.72		0.015	0.1	1	0.787		0.21	0.5	1	51.5		0.021	1.1	1
Metals Dissolved																																	
Lead	7439-92-1	5	ug/L	NA					**21.3**		0.21	0.5	1	ND	U	0.8	0.8	1	2.5	B	1.3	3	1	ND	U	0.012	0.1	1	ND	U	3	10	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Exceedances:
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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP-A_050707					WP-A-073114					AOI5_WPA_012116~JC13091					WP-B_050307				
			Sample Date	5/7/2007					7/31/2014					1/21/2016					5/3/2007				
			Sample Matrix	WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																							
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					ND	U	0.19	2	1	ND	U	0.22	2	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.0081	0.02	1	ND	U	0.0083	0.019	1	ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.18	1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					ND	U	0.17	2	1	ND	U	0.29	2	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.21	0.5	1	ND	U	0.24	0.5	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.27	1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.23	1	1	1.8	J	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	0.62	J	0.5	5	1	ND	U	0.26	1	1	ND	U	0.24	1	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.16	1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	0.17	1	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																							
Anthracene	120-12-7	66	ug/L	NA					6.75		0.1	0.5	1	0.72		0.014	0.11	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					**9.79**		0.058	0.5	1	1.62		0.02	0.054	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					**18.5**		0.062	0.5	1	**2.26**		0.032	0.054	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					**18.2**		0.051	0.5	1	**2.21**		0.023	0.11	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					**23.8**		0.078	0.5	1	**2.65**		0.028	0.11	1	NA				
Chrysene	218-01-9	1.9	ug/L	**3.6**		0.00049	1	1	**23.4**		0.059	0.5	1	**2.99**		0.016	0.11	1	**12**		0.005	9.9	10
Fluorene	86-73-7	1900	ug/L	ND	U	0.00049	1	1	2.34		0.085	0.5	1	0.133		0.029	0.11	1	ND	U	0.005	9.9	10
Naphthalene	91-20-3	100	ug/L	ND	U	0.00049	1	1	ND	U	0.18	0.5	1	ND	U	0.014	0.11	1	ND	U	0.005	9.9	10
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.00049	1	1	1.83		0.1	0.5	1	0.153		0.017	0.11	1	ND	U	0.005	9.9	10
Pyrene	129-00-0	130	ug/L	11		0.00049	1	1	65.2		0.075	5	1	8.73		0.014	1.1	1	23		0.005	9.9	10
Metals Dissolved																							
Lead	7439-92-1	5	ug/L	1.5	B	0.8	2	1	3.9		1.3	3	1	ND	U	2.3	3	1	1.7	B	0.8	2	1

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PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

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Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP-C_050307					WP-D_050307					WRD_072314					WP-D_100814					WP-E_050307				
			Sample Date	5/3/2007					5/3/2007					7/23/2014					10/8/2014					5/3/2007				
			Sample Matrix	WG					WG					WG					WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds																												
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	NA					NA					ND	U	0.19	2	1	ND	U	0.4	1	1	NA				
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA					NA					NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.005	0.05	1	ND	U	0.005	0.05	1	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1	ND	U	0.005	0.05	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.3	1	1	ND	U	0.021	0.1	1	ND	U	0.5	5	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	NA					NA					ND	U	0.17	2	1	ND	U	0.017	0.1	1	NA				
Benzene	71-43-2	5	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.21	0.5	1	0.22	J	0.19	2	1	ND	U	0.5	5	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.4	1	1	ND	U	0.012	0.1	1	ND	U	0.5	5	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	2	J	0.5	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.3	1	1	1.6	J	0.5	5	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.26	1	1	ND	U	0.011	0.02	1	ND	U	0.5	5	1
Toluene	108-88-3	1000	ug/L	ND	U	0.5	5	1	ND	U	0.5	5	1	ND	U	0.22	1	1	ND	U	0.036	0.1	1	ND	U	0.5	5	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.95	J	0.5	5	1	ND	U	0.5	5	1	ND	U	0.2	1	1	ND	U	1.3	3	1	ND	U	0.5	5	1
Semi-Volatile Organic Compounds																												
Anthracene	120-12-7	66	ug/L	NA					NA					ND	U	0.02	0.1	1	ND	U	0.17	2	1	NA				
Benzo(a)Anthracene	56-55-3	4.9	ug/L	NA					NA					0.211		0.012	0.1	1	0.291		0.02	0.1	1	NA				
Benzo(a)Pyrene	50-32-8	0.2	ug/L	NA					NA					**8**		0.012	0.1	1	**0.269**		0.26	1	1	NA				
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	NA					NA					0.323		0.01	0.1	1	0.302		0.21	0.5	1	NA				
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	NA					NA					0.252		0.016	0.1	1	0.168		0.26	1	1	NA				
Chrysene	218-01-9	1.9	ug/L	ND	U	0.0005	1	1	ND	U	0.0005	1	1	0.25		0.012	0.1	1	0.23		0.19	2	1	**3.4**		0.0005	1	1
Fluorene	86-73-7	1900	ug/L	1.1		0.0005	1	1	ND	U	0.0005	1	1	ND	U	0.017	0.1	1	ND	U	0.2	1	1	ND	U	0.0005	1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.0005	1	1	ND	U	0.0005	1	1	ND	U	0.036	0.1	1	ND	U	0.26	1	1	ND	U	0.0005	1	1
Phenanthrene	85-01-8	1100	ug/L	ND	U	0.0005	1	1	ND	U	0.0005	1	1	ND	U	0.021	0.1	1	ND	U	0.22	1	1	ND	U	0.0005	1	1
Pyrene	129-00-0	130	ug/L	ND	U	0.0005	1	1	ND	U	0.0005	1	1	0.419		0.015	0.1	1	0.575		0.2	1	1	7		0.0005	1	1
Metals Dissolved																												
Lead	7439-92-1	5	ug/L	ND	U	0.8	0.8	1	ND	U	0.8	0.8	1	2.2	B	1.3	3	1	ND	U	0.012	0.1	1	ND	U	0.8	0.8	1

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Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample ID	WP-E_072414					WP-E_101714				
			Sample Date	7/24/2014					10/17/2014				
			Sample Matrix	WG					WG				
			Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
Volatile Organic Compounds													
1,2,4-Trimethylbenzene	95-63-6	62	ug/L	ND	U	0.19	2	1	ND	U	0.0081	0.02	1
1,2-Dibromo-3-Chloropropane	96-12-8	0.2	ug/L	NA					NA				
1,2-Dibromoethane (EDB)	106-93-4	0.05	ug/L	ND	U	0.011	0.02	1	ND	U	0.012	0.1	1
1,2-Dichloroethane	107-06-2	5	ug/L	ND	U	0.3	1	1	ND	U	0.017	0.1	1
1,3,5-Trimethylbenzene	108-67-8	1200	ug/L	ND	U	0.17	2	1	ND	U	0.036	0.1	1
Benzene	71-43-2	5	ug/L	0.51		0.21	0.5	1	0.39	J	0.015	0.1	1
Ethylbenzene	100-41-4	700	ug/L	ND	U	0.4	1	1	ND	U	0.021	0.1	1
Isopropylbenzene (Cumene)	98-82-8	3500	ug/L	3.2		0.26	1	1	7.5		0.17	2	1
Methyl Tertiary Butyl Ether	1634-04-4	20	ug/L	ND	U	0.26	1	1	ND	U	1.3	3	1
Toluene	108-88-3	1000	ug/L	ND	U	0.22	1	1	0.3	J	0.02	0.1	1
Xylenes, Total (Dimethylbenzene)	1330-20-7	10000	ug/L	0.67	J	0.2	1	1	2		0.3	1	1
Semi-Volatile Organic Compounds													
Anthracene	120-12-7	66	ug/L	0.885		0.02	0.1	1	2.18		0.22	1	1
Benzo(a)Anthracene	56-55-3	4.9	ug/L	1.43		0.012	0.1	1	**5.8**		0.02	0.1	1
Benzo(a)Pyrene	50-32-8	0.2	ug/L	**1.38**		0.012	0.1	1	**6.96**		0.26	1	1
Benzo(b)Fluoranthene	205-99-2	1.2	ug/L	**1.33**		0.01	0.1	1	**3.04**		0.21	0.5	1
Benzo(g,h,i)Perylene	191-24-2	0.26	ug/L	**0.961**		0.016	0.1	1	**4.2**		0.26	1	1
Chrysene	218-01-9	1.9	ug/L	1.45		0.012	0.1	1	**17.4**		0.19	2	1
Fluorene	86-73-7	1900	ug/L	0.626		0.017	0.1	1	8.95		0.016	0.1	1
Naphthalene	91-20-3	100	ug/L	ND	U	0.036	0.1	1	0.477		0.01	0.1	1
Phenanthrene	85-01-8	1100	ug/L	0.471		0.021	0.1	1	8.07		0.015	0.1	1
Pyrene	129-00-0	130	ug/L	2.21		0.015	0.1	1	18.1		0.2	1	1
Metals Dissolved													
Lead	7439-92-1	5	ug/L	**12.9**		1.3	3	1	ND	U	0.012	0.1	1

Note:

CAS No. - Chemical Abstract Number
PADEP - Pennsylvania Department of Environmental Protection
TDS - Total Dissolved Solids
mg/L - milligrams per liter
MSC - Medium Specific Concentrations
ug/L - micrograms per liter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NA - Not analyzed

PADEP Act 2 Non-Residental Used Aquifer TDS <2500 ug/l (last updated August 27, 2016).

Qualifiers:

U - Compound analyzed but not detected
J - Compound detected between the RL and MDL. Result should be considered an estimate
B - Compound found in blank

Exceedances:

10 - Result exceeds PADEP Non-residential Used Aquifer TDS <2500 ug/l
15 - MDL exceeds either PADEP Non-residential Used Aquifer TDS <2500 ug/l

Table 8
Summary of Indoor Air Quality Analytical Results
AOI 5 Remedial Investigations Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Analyte	CAS Number	PADEP VI	1/10th PADEP VI	OSHA PEL TWA	EPA RSL Cancer Risk = 10^{-5} HQ = 0.1	EPA RSL Cancer Risk = 10^{-6} HQ = 0.1	NIOSH RELs	ACGIH TLVs	Location	B&S Office Building					B&S Office Building, Outside					Wharf on Building Dock, Outside					Control Room				
									Sample	Sample 1					Sample 2					AOI5-AA-16-001					AOI5-AI-16-001				
									Date	10/24/2012					10/24/2012					3/28/2016					3/28/2016				
									Collected By	Stantec					Stantec					GHD					GHD				
									Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	31	3.1	NS	26	26	125,000	123,000	ug/m3	1.5		0.85		1.69	1.3		1.1		2.27	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
1,2-Dibromoethane	106-93-4	0.2	0.02	153,700	0.2	0.02	346	NS	ug/m3	ND		***0.85***		1.69	ND		***1.1***		2.27	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1
1,2-Dichloroethane	107-06-2	4.7	0.47	202,400	4.7	0.47	4,000	40,500	ug/m3	ND	U	***0.85***		1.69	ND	U	***1.1***		2.27	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1
1,3,5-Trimethylbenzene	108-67-8	31	3.1	NS	26	26	125,000	123,000	ug/m3	ND	U	0.85		1.69	ND	U	1.1		2.27	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
Benzene	71-43-2	16	1.6	3,190	16	1.6	319	1,600	ug/m3	4.3		0.85		1.69	3.9		1.1		2.27	2.4	J	0.64	***3.2***	1	1.4	J	0.64	***3.2***	1
Ethylbenzene	100-41-4	49	4.9	435,000	49	4.9	435,000	86,800	ug/m3	1.3		0.85		1.69	ND	U	1.1		2.27	1.6	J	0.87	4.3	1	1.3	J	0.87	4.3	1
Isopropyl Benzene (Cumene)	98-82-8	1,800	180	245,000	180	180	245,000	246,000	ug/m3	2.1		0.85		1.69	2.0		1.1		2.27	2.5	J	0.98	4.9	1	9.8		0.98	4.9	1
Methyl Tert-Butyl Ether	1634-04-4	470	47	NS	470	47	NS	180,000	ug/m3	ND	U	0.85		1.69	ND	U	1.1		2.27	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1
Naphthalene	91-20-3	3.6	0.36	50,000	3.6	0.36	50,000	52,000	ug/m3	NA					NA					ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1
Toluene	108-88-3	22,000	2,200	754,000	2,200	2,200	375,000	75,400	ug/m3	7.4		0.85		1.69	6.5		1.1		2.27	1.7	J	0.75	3.8	1	3.1	J	0.75	3.8	1
Total Xylenes	1330-20-7	440	44	435,000	44	44	435,000	434,000	ug/m3	6.1		1.7		1.69	5.1		2.3		2.27	2.5	J	0.87	4.3	1	4.9	J	0.87	4.3	1

Note:
PADEP VI- Pennsylvania Department of Environmental Protection Vapor intrusion Screening Value. Indoor Air Statewide Health Standard Non-Residential Vapor Intrusion Screening Level (January 2017).
OSHA PEL TWA - Occupational Safety and Health Administration Time-Weighted Average Permissible Exposure Limit .
EPA RSL - United States Environmental Protection Agency Industrial Regional Screening Level.
HQ - Hazard Quotient
NIOSH RELs - National Institute for Occupational Safety and Health Recommended Exposure Limits.
ACGIH TLVs - American Conference of Governmental Industrial Hygienists Threshold Limit Value.
The RSL for 1,2,4 and 1,3,5- trimethylbenzene were calculated using the September 2016 final IRIS RfC.
OSHA PELs, NIOSH RELs, and ACGIH TLVs from GHD's Air Data Evaluation Letter (Reference No. 11109626), November 9, 2016.
CAS - Chemical Abstract Registry Number
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NS - No standard
NA - Not analyzed

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected below below the reporting limit (the value given is an estimate).

Exceedances:
10 - Result exceeds PA VI
10 - Result exceeds 1/10th PA VI
10 - Result exceeds OSHA PEL TWA
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-5)
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-6)
10 - Result exceeds NIOSH REL
10 - Result exceeds ACGIH TLVs
15 - MDL exceeds standard

Table 8
Summary of Indoor Air Quality Analytical Results
AOI 5 Remedial Investigations Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Analyte	CAS Number	PADEP VI	1/10th PADEP VI	OSHA PEL TWA	EPA RSL Cancer Risk = 10^{-5} HQ = 0.1	EPA RSL Cancer Risk = 10^{-6} HQ = 0.1	NIOSH RELs	ACGIH TLVs	Location	Dock Wharf Office, 2nd Floor					Dock Wharf Office, 1st Floor					Dock Office				
									Sample	AOI5-AI-16-002					AOI5-AI-16-003					AOI5-AI-16-004				
									Date	3/28/2016					3/28/2016					3/28/2016				
									Collected By	GHD					GHD					GHD				
									Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	31	3.1	NS	26	26	125,000	123,000	ug/m3	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
1,2-Dibromoethane	106-93-4	0.2	0.02	153,700	0.2	0.02	346	NS	ug/m3	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1
1,2-Dichloroethane	107-06-2	4.7	0.47	202,400	4.7	0.47	4,000	40,500	ug/m3	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1
1,3,5-Trimethylbenzene	108-67-8	31	3.1	NS	26	26	125,000	123,000	ug/m3	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1	ND	U	0.98	***4.9***	1
Benzene	71-43-2	16	1.6	3,190	16	1.6	319	1,600	ug/m3	4.3		0.64	***3.2***	1	2.6	J	0.64	***3.2***	1	4.4		0.64	***3.2***	1
Ethylbenzene	100-41-4	49	4.9	435,000	49	4.9	435,000	86,800	ug/m3	ND	U	0.87	4.3	1	1.2	J	0.87	4.3	1	1.1	J	0.87	4.3	1
Isopropyl Benzene (Cumene)	98-82-8	1,800	180	245,000	180	180	245,000	246,000	ug/m3	18		0.98	4.9	1	8.6		0.98	4.9	1	ND	U	0.98	4.9	1
Methyl Tert-Butyl Ether	1634-04-4	470	47	NS	470	47	NS	180,000	ug/m3	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1
Naphthalene	91-20-3	3.6	0.36	50,000	3.6	0.36	50,000	52,000	ug/m3	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1
Toluene	108-88-3	22,000	2,200	754,000	2,200	2,200	375,000	75,400	ug/m3	5		0.75	3.8	1	7.9		0.75	3.8	1	15		0.75	3.8	1
Total Xylenes	1330-20-7	440	44	435,000	44	44	435,000	434,000	ug/m3	1.7	J	0.87	4.3	1	4.1	J	0.87	4.3	1	3.8	J	0.87	4.3	1

Note:
PADEP VI- Pennsylvania Department of Environmental Protection Vapor intrusion Screening Value. Indoor Air Statewide Health Standard Non-Residential Vapor Intrusion Screening Level (January 2017).
OSHA PEL TWA - Occupational Safety and Health Administration Time-Weighted Average Permissible Exposure Limit .
EPA RSL - United States Environmental Protection Agency Industrial Regional Screening Level.
HQ - Hazard Quotient
NIOSH RELs - National Institute for Occupational Safety and Health Recommended Exposure Limits.
ACGIH TLVs - American Conference of Governmental Industrial Hygienists Threshold Limit Value.
The RSL for 1,2,4 and 1,3,5- trimethylbenzene were calculated using the September 2016 final IRIS RfC.
OSHA PELs, NIOSH RELs, and ACGIH TLVs from GHD's Air Data Evaluation Letter (Reference No. 11109626), November 9, 2016.
CAS - Chemical Abstract Registry Number
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NS - No standard
NA - Not analyzed

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected below below the reporting limit (the value given is an estimate).

Exceedances:
10 - Result exceeds PA VI
10 - Result exceeds 1/10th PA VI
10 - Result exceeds OSHA PEL TWA
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-5)
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-6)
10 - Result exceeds NIOSH REL
10 - Result exceeds ACGIH TLVs
15 - MDL exceeds standard

Table 8
Summary of Indoor Air Quality Analytical Results
AOI 5 Remedial Investigations Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Analyte	CAS Number	PADEP VI	1/10th PADEP VI	OSHA PEL TWA	EPA RSL Cancer Risk = 10^{-5} HQ = 0.1	EPA RSL Cancer Risk = 10^{-6} HQ = 0.1	NIOSH RELs	ACGIH TLVs	Location	GP2 Dock Building					Blending & Shipping Trailer					Field Blank				
									Sample	AOI5-AI-16-005					AOI5-AI-16-006					FIELD_BLANK				
									Date	3/28/2016					3/28/2016					3/29/2016				
									Collected By	GHD					GHD					GHD				
									Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	31	3.1	NS	26	26	125,000	123,000	ug/m3	1.1	J	0.98	***4.9***	1	12		0.98	***4.9***	1	ND	U		0.982	
1,2-Dibromoethane	106-93-4	0.2	0.02	153,700	0.2	0.02	346	NS	ug/m3	ND	U	***1.5***	***7.7***	1	ND	U	***1.5***	***7.7***	1	ND	U		***1.54***	
1,2-Dichloroethane	107-06-2	4.7	0.47	202,400	4.7	0.47	4,000	40,500	ug/m3	ND	U	***0.81***	***4***	1	ND	U	***0.81***	***4***	1	ND	U		***0.81***	
1,3,5-Trimethylbenzene	108-67-8	31	3.1	NS	26	26	125,000	123,000	ug/m3	ND	U	0.98	***4.9***	1	3.2	J	0.98	***4.9***	1	ND	U		0.982	
Benzene	71-43-2	16	1.6	3,190	16	1.6	319	1,600	ug/m3	1.8	J	0.64	***3.2***	1	1.8	J	0.64	***3.2***	1	ND	U		0.639	
Ethylbenzene	100-41-4	49	4.9	435,000	49	4.9	435,000	86,800	ug/m3	1.9	J	0.87	4.3	1	1.9	J	0.87	4.3	1	ND	U		0.867	
Isopropyl Benzene (Cumene)	98-82-8	1,800	180	245,000	180	180	245,000	246,000	ug/m3	ND	U	0.98	4.9	1	1.5	J	0.98	4.9	1	ND	U		0.983	
Methyl Tert-Butyl Ether	1634-04-4	470	47	NS	470	47	NS	180,000	ug/m3	ND	U	0.72	3.6	1	ND	U	0.72	3.6	1	ND	U		0.721	
Naphthalene	91-20-3	3.6	0.36	50,000	3.6	0.36	50,000	52,000	ug/m3	ND	U	***2.6***	***5.2***	1	ND	U	***2.6***	***5.2***	1	ND	U		***3.3***	
Toluene	108-88-3	22,000	2,200	754,000	2,200	2,200	375,000	75,400	ug/m3	3.1	J	0.75	3.8	1	4.6		0.75	3.8	1	ND	U		0.753	
Total Xylenes	1330-20-7	440	44	435,000	44	44	435,000	434,000	ug/m3	7.7	J	0.87	4.3	1	11		0.87	4.3	1	ND	U		1.73	

Note:
PADEP VI- Pennsylvania Department of Environmental Protection Vapor intrusion Screening Value. Indoor Air Statewide Health Standard Non-Residential Vapor Intrusion Screening Level (January 2017).
OSHA PEL TWA - Occupational Safety and Health Administration Time-Weighted Average Permissible Exposure Limit .
EPA RSL - United States Environmental Protection Agency Industrial Regional Screening Level.
HQ - Hazard Quotient
NIOSH RELs - National Institute for Occupational Safety and Health Recommended Exposure Limits.
ACGIH TLVs - American Conference of Governmental Industrial Hygienists Threshold Limit Value.
The RSL for 1,2,4 and 1,3,5- trimethylbenzene were calculated using the September 2016 final IRIS RfC.
OSHA PELs, NIOSH RELs, and ACGIH TLVs from GHD's Air Data Evaluation Letter (Reference No. 11109626), November 9, 2016.
CAS - Chemical Abstract Registry Number
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NS - No standard
NA - Not analyzed

Qualifiers:
U - Compound analyzed but not detected
J - Compound detected below below the reporting limit (the value given is an estimate).

Exceedances:
10 - Result exceeds PA VI
10 - Result exceeds 1/10th PA VI
10 - Result exceeds OSHA PEL TWA
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-5)
10 - Result exceeds EPA RSL (HQ = 0.1, Target Cancer Risk = 10-6)
10 - Result exceeds NIOSH REL
10 - Result exceeds ACGIH TLVs
15 - MDL exceeds standard

Table 9
Summary of Outdoor Worker Air Quality Analytical Results
AOI 5 Remedial Investigations Report
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Analyte	CAS Number	Location	Near BH-13-29					Near A-136					Near A-183					Near WP-A					Near A-134				
		Sample	AOI5-AA-16-002-20160503					AOI5-AA-16-003-20160503					AOI5-AA-16-004-20160503					AOI5-AA-16-005-20160503					AOI5-AA-16-006-20160503				
		Date	5/6/2016					5/6/2016					5/6/2016					5/6/2016					5/6/2016				
		Collected By	Aquaterra					Aquaterra					Aquaterra					Aquaterra					Aquaterra				
		Unit	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF	Result	Q	MDL	RL	DF
1,2,4-Trimethylbenzene	95-63-6	ug/m3	2.6	J	0.21	4.2	1.68	3.5	J	0.2	4.0	1.61	2.9	J	0.2	4.0	1.61	3.0	J	0.19	3.9	1.55	2.3	J	0.2	4.0	1.61
1,2-Dibromoethane	106-93-4	ug/m3	ND	U	1.3	2.6	1.68	ND	U	1.2	2.5	1.61	ND	U	1.2	2.5	1.61	ND	U	1.2	2.4	1.55	ND	U	1.2	2.5	1.61
1,2-Dichloroethane	107-06-2	ug/m3	ND	U	0.34	0.69	1.68	ND	U	0.33	0.66	1.61	ND	U	0.33	0.66	1.61	ND	U	0.32	0.64	1.55	ND	U	0.33	0.66	1.61
1,3,5-Trimethylbenzene	108-67-8	ug/m3	1.1	J	0.31	1.7	1.68	1.3	J	0.29	1.6	1.61	1	J	0.29	1.6	1.61	1.2	J	0.28	1.5	1.55	1.1	J	0.29	1.6	1.61
Benzene	71-43-2	ug/m3	0.45	J	0.2	1.1	1.68	1.9		0.2	1.0	1.61	0.63	J	0.2	1.0	1.61	1.9		0.19	1	1.55	2.3		0.2	1.0	1.61
Ethylbenzene	100-41-4	ug/m3	1.70	J	0.71	3.7	1.68	2.1	J	0.68	3.6	1.61	1.9	J	0.68	3.6	1.61	1.7	J	0.66	3.4	1.55	1.7	J	0.68	3.6	1.61
Isopropyl Benzene (Cumene)	98-82-8	ug/m3	482		4.6	84	33.6	ND	U	0.22	4.0	1.61	7.6		0.22	4.0	1.61	ND	U	0.21	3.9	1.55	ND	U	0.22	4.0	1.61
Methyl Tert-Butyl Ether	1634-04-4	ug/m3	ND	U	0.51	6.2	1.68	ND	U	0.49	5.9	1.61	ND		0.49	5.9	1.61	ND	U	0.47	5.7	1.55	ND	U	0.49	5.9	1.61
Naphthalene	91-20-3	ug/m3	2.9	J	0.51	9	1.68	2.9	J	0.49	8.6	1.61	4	J	0.49	8.6	1.61	N2.6	J	0.47	8.3	1.55	2.5	J	0.49	8.6	1.61
Toluene	108-88-3	ug/m3	1.5		0.26	1.3	1.68	3.4		0.25	1.2	1.61	3.3		0.25	1.2	1.61	2.2		0.24	1.2	1.55	1.6		0.25	1.2	1.61
Xylenes (Total)	1330-20-7	ug/m3	2.8	J	1.3	3	1.68	1.18	J	1.3	2.8	1.61	3.3		1.3	2.8	1.61	2.9		1.2	2.7	1.55	2.7	J	1.3	2.8	1.61

Note:
ug/m3 - Micrograms per cubic meter
Q - Qualifier
MDL - Method detection limit
RL - Reporting limit
DF - Dilution factor
ND - Not detected
NS - No standard

Qualifiers:
U - Compound analyzed but not detected
J- Estimated Value. Result between method detection and reporting limits

Table 10
Summary of TCLP Analytical Results
AOI 5 Site Characterization Report
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

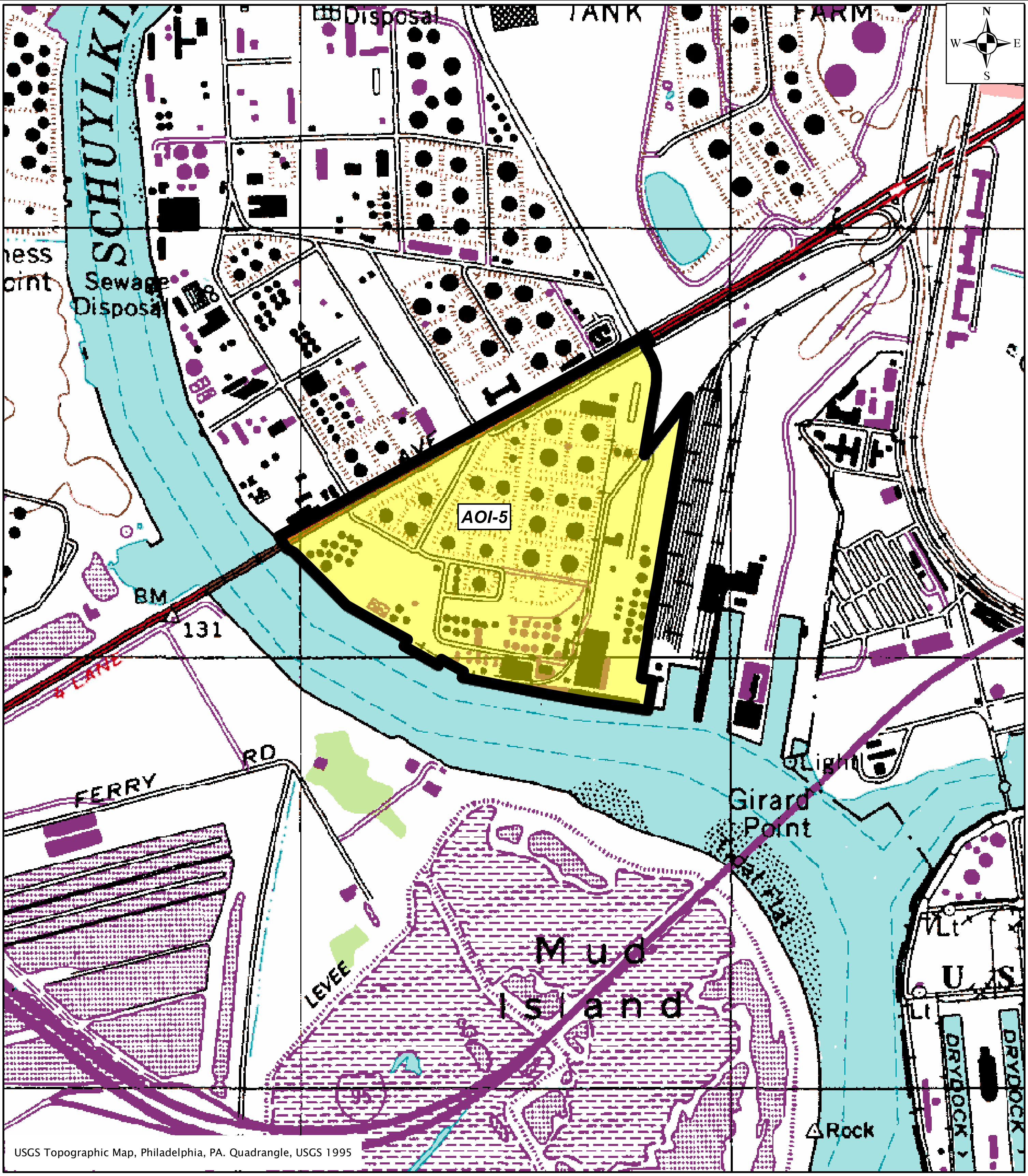
Chemical Name	Analytical Method	CAS No	EPA Maximum Concentration of Contaminants for Toxicity Concentration	Location ID	BH-07-07			BH-08-07			BH-18-07			BH-23-07			BH-02-09			BH-33-09		
				Sample ID	BH-07-07_1-2			BH-08-07_.75-2			BH-18-07_1.0-2.0			BH-23-07_0-0.5			BH-02-09 TCLP NVE			BH-33-09_0.0-2.0		
				Sample Matrix	Soil			Soil			Soil			Soil			Soil			Soil		
				Sample Date	7/13/2007			7/13/2007			4/4/2007			7/11/2007			4/7/2009			7/9/2009		
				Start Depth	1			0.75			1			0			0			0		
				End Depth	2			2			2			0.5			2			2		
TCLP Metals					**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Lead (Total)	SW846 1311	7439-92-1	5	mg/l	**9.42**		0.05	0.653		0.05	**21.8**		0.05	0.78		0.05	**172**		0.3	1.04		0.015

Notes:
mg/l - milligrams per liter
RL - Reporting Limit
(1) All soil samples collected and analyzed were unsaturated
Q - Qualifier

Exceedance Summary:

10	Reported result exceeds the EPA Maximum Concentration of Contaminants for Toxicity Concentration

FIGURES



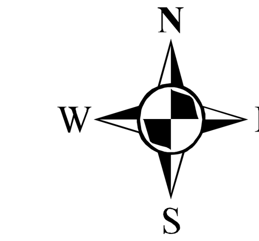
Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

Figure 1: Site Location Map
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery

Philadelphia, Pennsylvania

Job Number	Scale: 1" = 1,000'	Date
2574602	0 500 1,000 Feet	April 24, 2015

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Figure 1 - Site Location Map.mxd



Legend

- Penrose Avenue Sewer
- Sheet Pile Wall
- AOI Boundary

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).

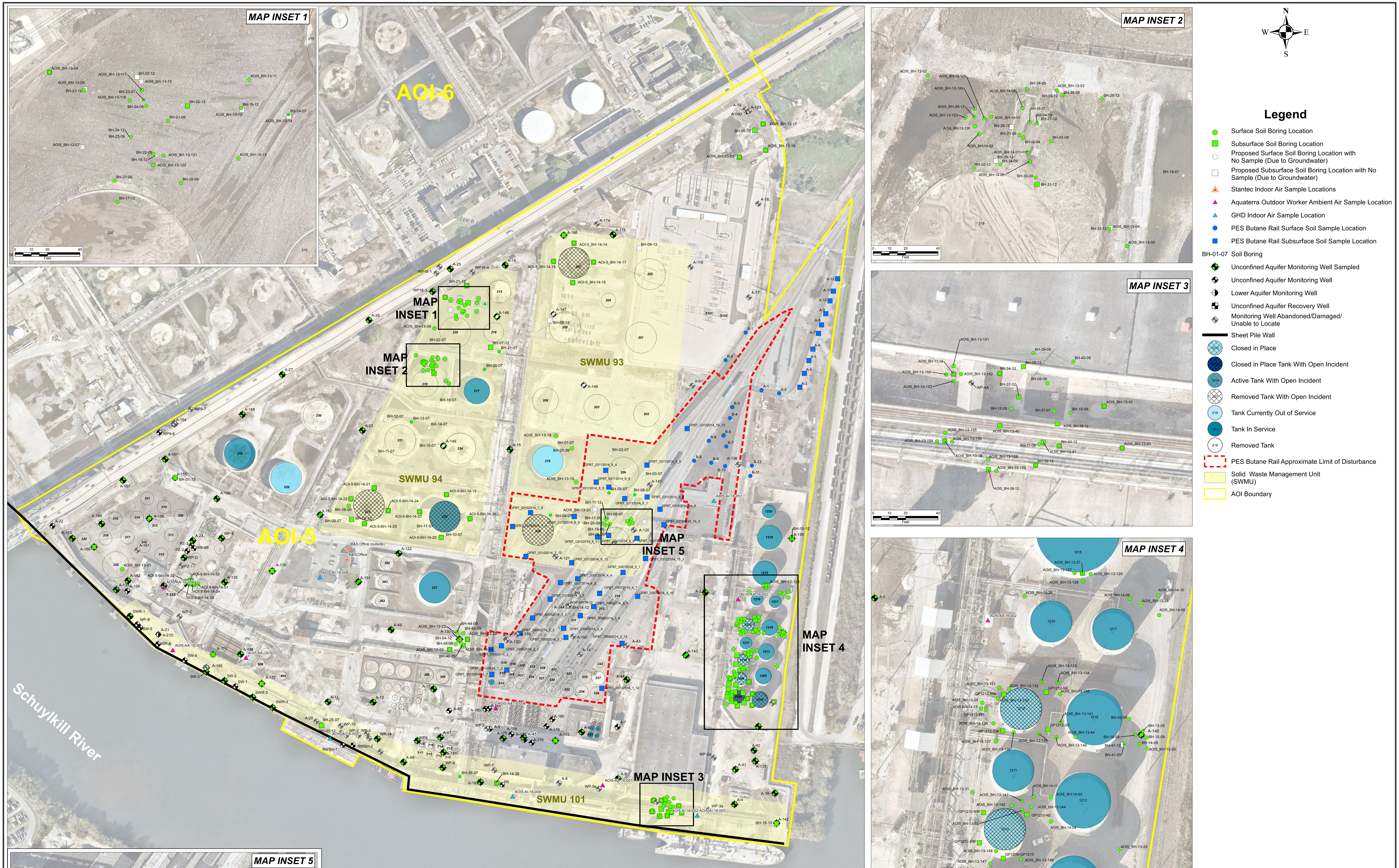
Figure 2: Site Plan
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: May 5, 2016
DRN. BY: MH
CKD. BY: PT
JOB#: 2574602

\\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Final\Figure 2 - Site Plan_052716.mxd



Notes:
1. Boundary of SWMUs and sheet pile wall referenced from RCRA Facility Investigation Chevron Refinery Vol 1, Dames and Moore, 11-24-93.
2. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
3. Historic soil sample locations referenced in the Aboveground Storage Tank Closure Assessment Report for GP 1209, 1210, and 1212 (Stantec, April 18, 2012), and the Aboveground Storage Tank GP-1208 Closure in Place Sampling Activities Report (Secor, Sept. 12, 2007).
4. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
5. Butane rail sample locations provided by Stantec.

Figure 3: Completed Activities
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 120 240 Feet

SCALE: See Map
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: KM
JOB#: 2574602

Document Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 3 - Completed Activities_112316.mxd

N
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Legend

- Monitoring Wells in A-A' Cross Section
- Monitoring Wells in B-B' Cross Section
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- A — A' AOI-5 Cross Section Location
- B — B' AOI-5 Cross Section Location
- Sheet Pile Wall
- AOI Boundary

Notes:
1. Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Source of aerial imagery is Microsoft, 3/19/2011 (Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community)
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).

Figure 4: Geologic Cross Section Location Plan
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: 12/6/2016
DRN. BY: AJC
CKD. BY: KM
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 4 - Cross Section Location Plan_112316.mxd

NOTES:

1. GEOLOGIC CROSS SECTION WAS CREATED FROM THE 3D GEOLOGIC MODEL OF AOI 5, WHICH WAS GENERATED IN EARTH VOLUMETRIC STUDIO (EVS) SOFTWARE.
2. THE WATER TABLE SURFACE WAS INTERPOLATED IN EVS USING THE GROUNDWATER ELEVATION DATA COLLECTED DURING THE OCTOBER 2014 GAUGING EVENT BY AQUATERRA TECHNOLOGIES, INC.

5 0 1 2 5
VERTICAL SCALE IN FEET

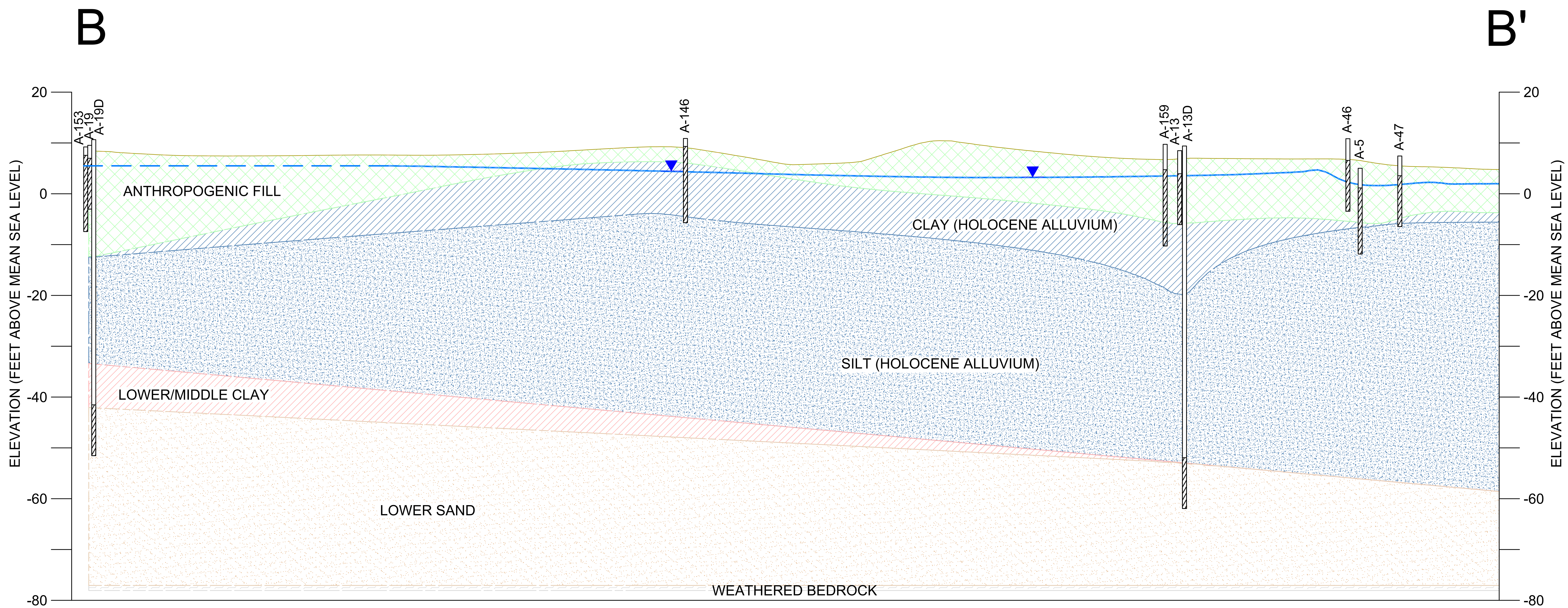
100 0 50 100
HORIZONTAL SCALE IN FEET

Philadelphia Refinery Operations A Series of Evergreen Resources Group, LLC. 2 Righter Parkway, Suite 200 Wilmington, DE 19803	Project AOI-5 REMEDIAL INVESTIGATION REPORT PES PHILADELPHIA REFINERY PHILADELPHIA COUNTY PENNSYLVANIA	Drawing Title GEOLOGIC CROSS SECTION A-A'	Project No. 2574602 Date 1 DECEMBER 2016 Scale 1"=100' HOR. 1"=5' VER. Drn. By MMK Last Revised 2 DECEMBER 2016	Drawing No. 5A

Filename: \\Langan.com\data\DYL\data6\2574601\Cadd Data - 2574601\Dwg\AOI 5 RIR 2016\RIR Geologic Cross-Sections_120616.dwg Date: 12/7/2016 Time: 10:26 User: acostello Style Table: Langan.stb Layout: A-A'

LEGEND:

- ANTHROPOGENIC FILL
- LOWER/MIDDLE CLAY
- CLAY (HOLOCENE ALLUVIUM)
- WATER TABLE
- SILT (HOLOCENE ALLUVIUM)
- LOWER SAND
- WEATHERED BEDROCK
- INFERRED WATER TABLE
- B-129 LOCATION ID
- WELL CASING
- WELL SCREEN



NOTES:

1. GEOLOGIC CROSS SECTION WAS CREATED FROM THE 3D GEOLOGIC MODEL OF AOI 5, WHICH WAS GENERATED IN EARTH VOLUMETRIC STUDIO (EVS) SOFTWARE.
2. THE WATER TABLE SURFACE WAS INTERPOLATED IN EVS USING THE GROUNDWATER ELEVATION DATA COLLECTED DURING THE OCTOBER 2014 GAUGING EVENT BY AQUATERRA TECHNOLOGIES, INC.
3. MONITORING WELL A-19 HAS BEEN DESTROYED, AND MONITORING WELL A-153 WAS UNABLE TO BE LOCATED DURING THE OCTOBER 2014 GAUGING EVENT. THEREFORE, THE WATER TABLE SURFACE IS INFERRED AT THESE WELLS.

VERTICAL SCALE IN FEET: 5 0 1 2 5

HORIZONTAL SCALE IN FEET: 100 0 50 100

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

Project	Drawing Title		Drawing No.
AOI-5 REMEDIAL INVESTIGATION REPORT PES PHILADELPHIA REFINERY	GEOLOGIC CROSS SECTION B-B′	Project No. 2574602	5B
PHILADELPHIA COUNTY PENNSYLVANIA		Date 1 DECEMBER 2016	
		Scale 1"=100' HOR. 1"=5' VER.	
		Drn. By MMK	
		Last Revised 2 DECEMBER 2016	

Filename: \\Langan.com\data\DYL\data6\2574601\Cadd Data - 2574601\Dwg\AOI 5 RIR 2016\RIR Geologic Cross-Sections_120616.dwg Date: 12/7/2016 Time: 10:27 User: acostello Style Table: Langan.stb Layout: B-B'

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Legend

- A-151 Unconfined Aquifer Monitoring Well and Groundwater Elevation (ft.)
- SWR-1 Unconfined Aquifer Recovery Well and Groundwater Elevation (ft.)
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- Groundwater Contour (ft - amsl)
- Inferred Groundwater Contour (ft - amsl)
- Sheet Pile Wall
- AOI Boundary
- ft - amsl Feet above mean sea level

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater gauging completed in July 2014 by Aquaterra.

Figure 6: Unconfined Aquifer Groundwater Elevation Contour Plan (July 2014)
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: KM
JOB#: 2574602

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 6 - Shallow GW Elevation Contour Plan (July 2014)_112316.mxd

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Legend

A-151 2.39	Unconfined Aquifer Monitoring Well and Groundwater Elevation (ft.)
SWR-1 2.83	Unconfined Aquifer Recovery Well and Groundwater Elevation (ft.)
	Lower Aquifer Monitoring Well
	Unconfined Aquifer Monitoring Well
	Unconfined Aquifer Piezometer
	Unconfined Aquifer Recovery Well
	Monitoring Well Abandoned/Damaged/ Unable to Locate
1	Groundwater Contour (ft - amsl)
	Inferred Groundwater Contour (ft - amsl)
	Sheet Pile Wall
	AOI Boundary
ft - amsl	Feet above mean sea level

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater gauging completed in October 2014 by Aquaterra.

Figure 7: Unconfined Aquifer Groundwater Elevation Contour Plan (October 2014)
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

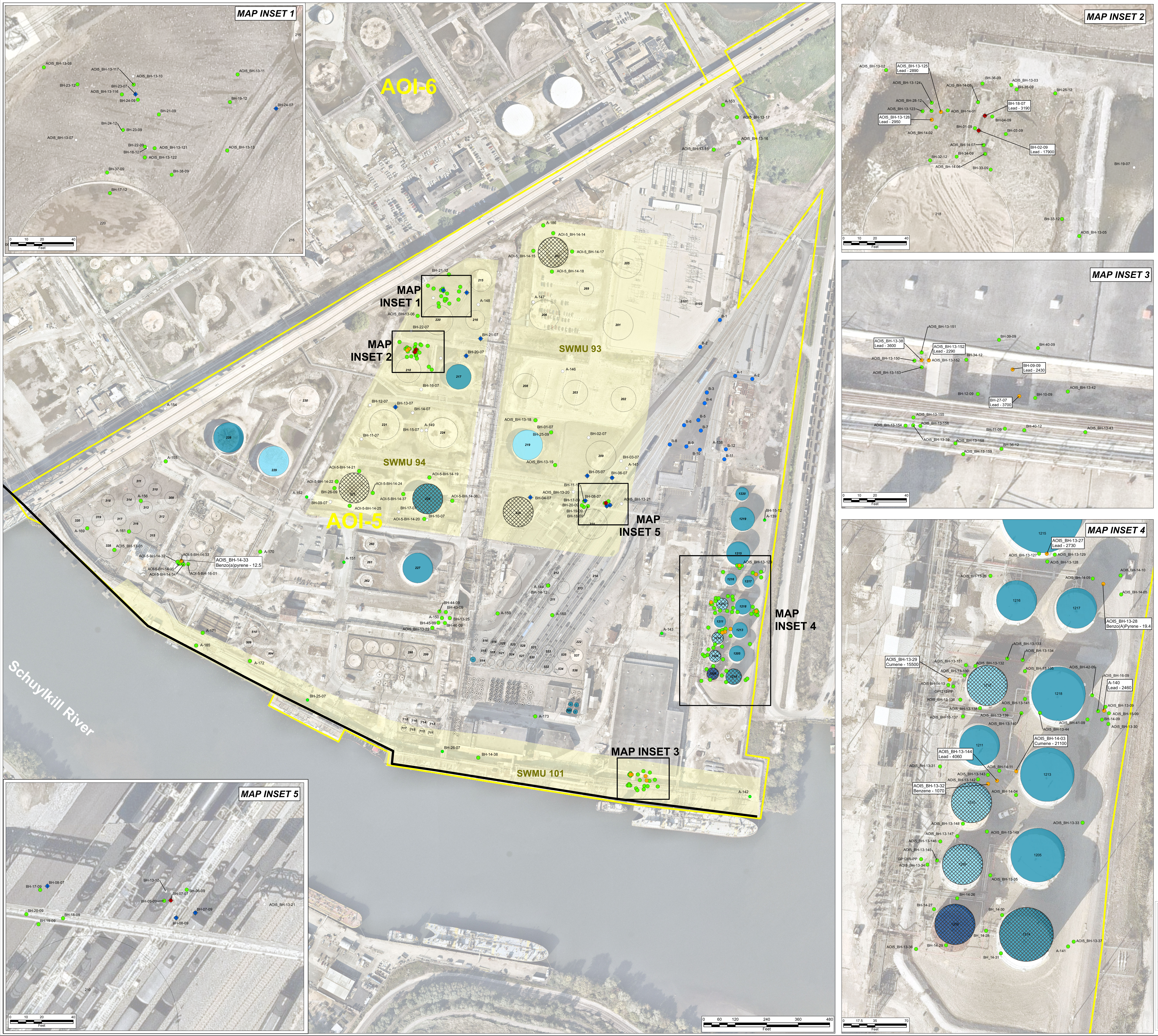
EVERGREEN

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: KM
JOB#: 2574602

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 7 - Shallow GW Elevation Contour Plan (October 2014)_112316.mxd



Legend

- Surface Soil Boring Location with No Exceedance of Direct Contact MSCs or SSS For Lead
- Surface Soil Boring Location with Exceedance of Direct Contact MSCs or SSS For Lead
- Proposed Surface Soil Boring Location with No Sample (Due to Groundwater)
- Soil Boring Location With Observed Leaded Tank Bottom Material
- Soil Boring Location With Documented Leaded Tank Bottom Material
- PES Butane Rail Surface Soil Sample Location
- BH-01-07 Soil Boring
- Sheet Pile Wall
- 1212 Closed in Place
- 1209 Closed in Place Tank With Open Incident
- 1214 Active Tank With Open Incident
- 207 Removed Tank With Open Incident
- 219 Tank Currently Out of Service
- 1215 Tank In Service
- 218 Removed Tank
- Solid Waste Management Unit (SWMU)
- AOI Boundary

Site-Specific Standard (SSS)

Lead - 2,240 mg/kg

Notes:

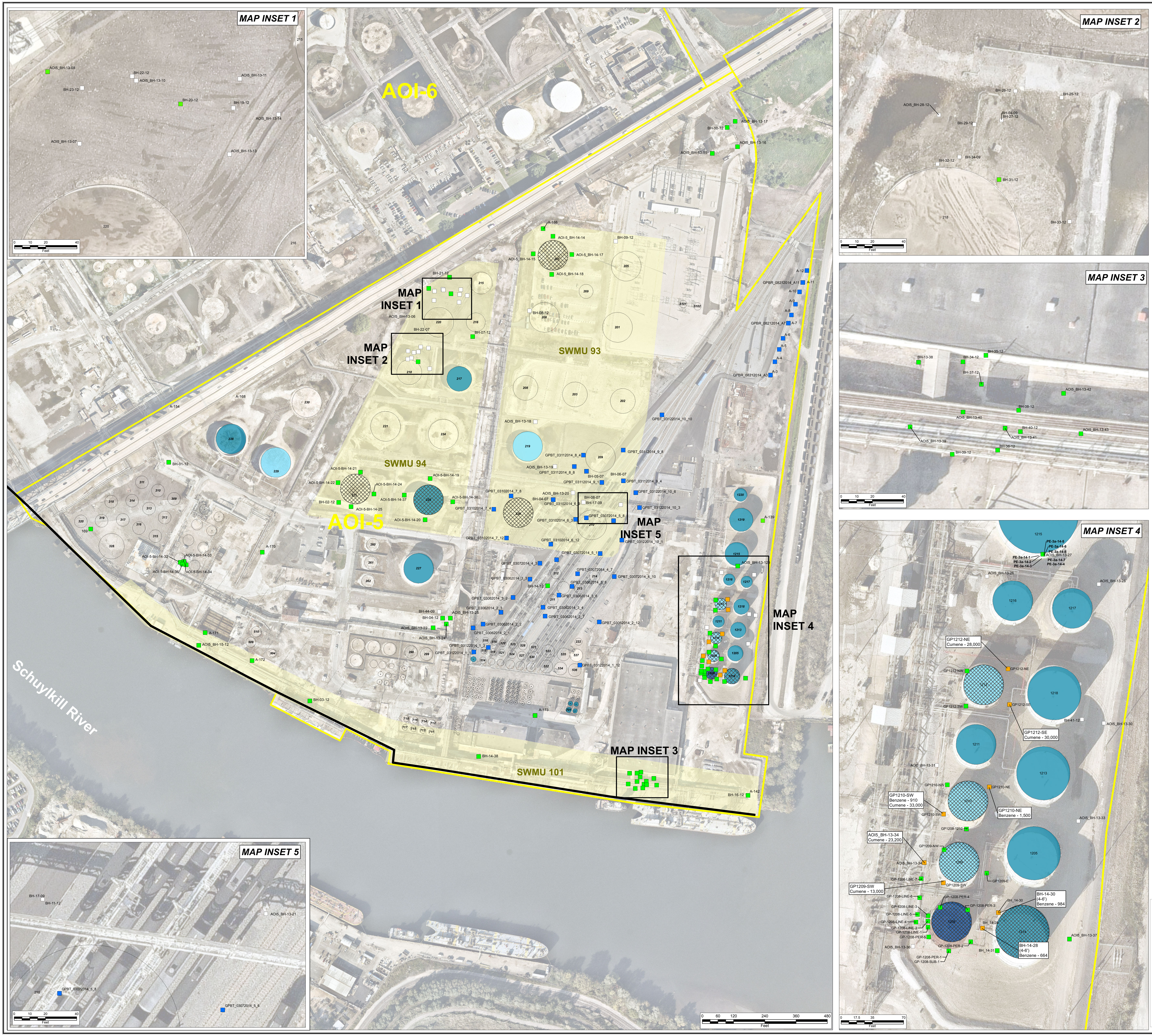
1. Boundary of SWMUs and sheet pile wall referenced from RCRA Facility Investigation Chevron Refinery Vol 1, Dames and Moore, 11-24-93.
2. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
3. Historic soil sample locations referenced in the Aboveground Storage Tank Closure Assessment Report for GP 1209, 1210, and 1212 (Stantec, April 18, 2012), and the Aboveground Storage Tank GP-1208 Closure in Place Sampling Activities Report (Secor, Sept. 12, 2007).
4. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
5. Butane rail sample locations provided by Stantec.
6. All results are displayed in milligrams per kilogram (mg/kg)

Figure 8: Summary of Surface Soil Sample Exceedances
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

SCALE: See Map
DATE: May 5, 2016
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Document Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 8 - Summary of Surface Soil Sample Exceedance_112316.mxd



Legend

- Subsurface Soil Boring Location with No Exceedance of Direct Contact MSCs
- Subsurface Soil Boring Location with Exceedance of the Direct Contact MSCs
- Proposed Subsurface Soil Boring Location with No Sample (Due to Groundwater)
- PES Butane Rail Sub-Surface Soil Sample Location
- BH-01-07 Soil Boring
- Sheet Pile Wall
- 1212 Closed in Place
- 1209 Closed in Place Tank With Open Incident
- 1214 Active Tank With Open Incident
- 207 Removed Tank With Open Incident
- 219 Tank Currently Out of Service
- 1215 Tank In Service
- 218 Removed Tank
- Solid Waste Management Unit (SWMU)
- AOI Boundary

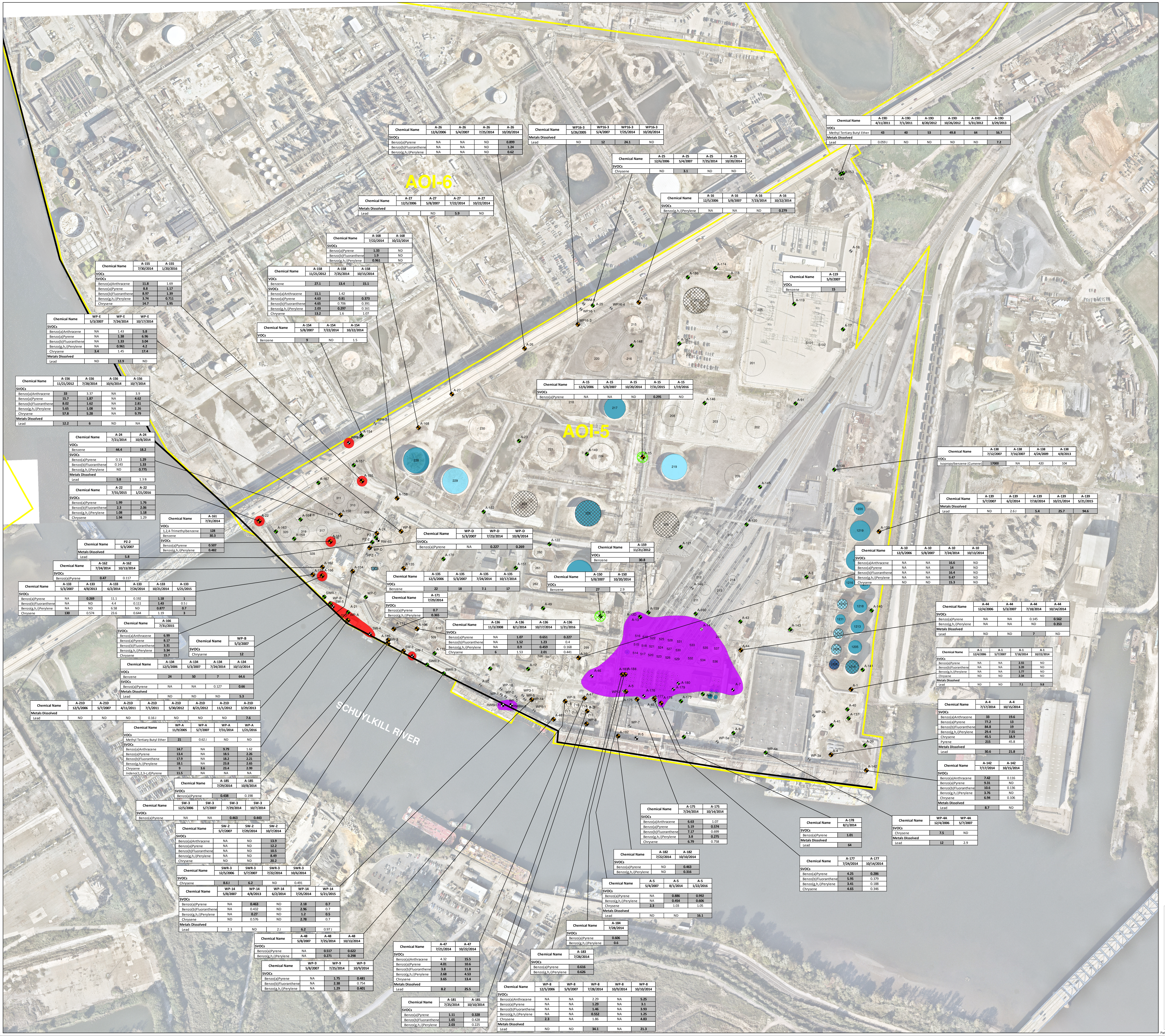
Notes:
1. Boundary of SWMUs and sheet pile wall referenced from RCRA Facility Investigation Chevron Refinery Vol 1, Dames and Moore, 11-24-93.
2. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
3. Historic soil sample locations referenced in the Aboveground Storage Tank Closure Assessment Report for GP 1209, 1210, and 1212 (Stantec, April 18, 2012), and the Aboveground Storage Tank GP-1208 Closure in Place Sampling Activities Report (Secor, Sept. 12, 2007).
4. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
5. Butane rail sample locations provided by Stantec.
6. All results are displayed in milligrams per kilogram (mg/kg)

Figure 9: Summary of Subsurface Soil Sample Exceedances
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

SCALE: See Map
DATE: May 5, 2016
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Document Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 9 - Summary of Subsurface Soil Sample Exceedance_112316.mxd



N
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Legend

- Groundwater Sample with an Exceedance between 2014 - 2016
- Groundwater Sample with No Exceedance between 2014 - 2016
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- Sheet Pile Wall
- Closed in Place
- Closed in Place Tank With Open Incident
- Active Tank With Open Incident
- Removed Tank With Open Incident
- Tank Currently Out of Service
- Tank In Service
- Removed Tank
- AOIs
- 10 Result Exceeds PADEP Non-Residential Used Aquifer MSC TDS<2500 mg/L

LNAPL Types

- Middle Distillate
- Heavy Distillate
- Unknown

Groundwater Screening Criteria

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs (ug/L)
Volatile Organic Compounds		
1,2,4-Trimethylbenzene	95-63-6	
Benzene	71-43-2	5
Isopropylbenzene (cumene)	98-82-8	3500
Methyl Tertiary Butyl Ether	1634-04-4	20
Semi-Volatile Organic Compounds		
Benzo(a)anthracene	56-55-3	4.9
Benzo(a)pyrene	50-32-8	0.2
Benzo(b)fluoranthene	205-99-2	1.2
Benzo(g,h,i)perylene	191-24-2	0.26
Chrysene	218-01-9	1.9
Indeno(1,2,3-c,d)pyrene	193-39-5	3.6
Pyrene	129-00-0	130
Metals Dissolved		
Lead	7439-92-1	5

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater exceedances or criteria displayed in micrograms per liter (ug/L)

Figure 10: Summary of Groundwater Sample Exceedances
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

EVERGREEN

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 140 280 Feet

SCALE: 1" = 140'
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: ED
JOB#: 2574602

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 10 - GW Exceedances 2014 to 2016_112316.mxd

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Legend

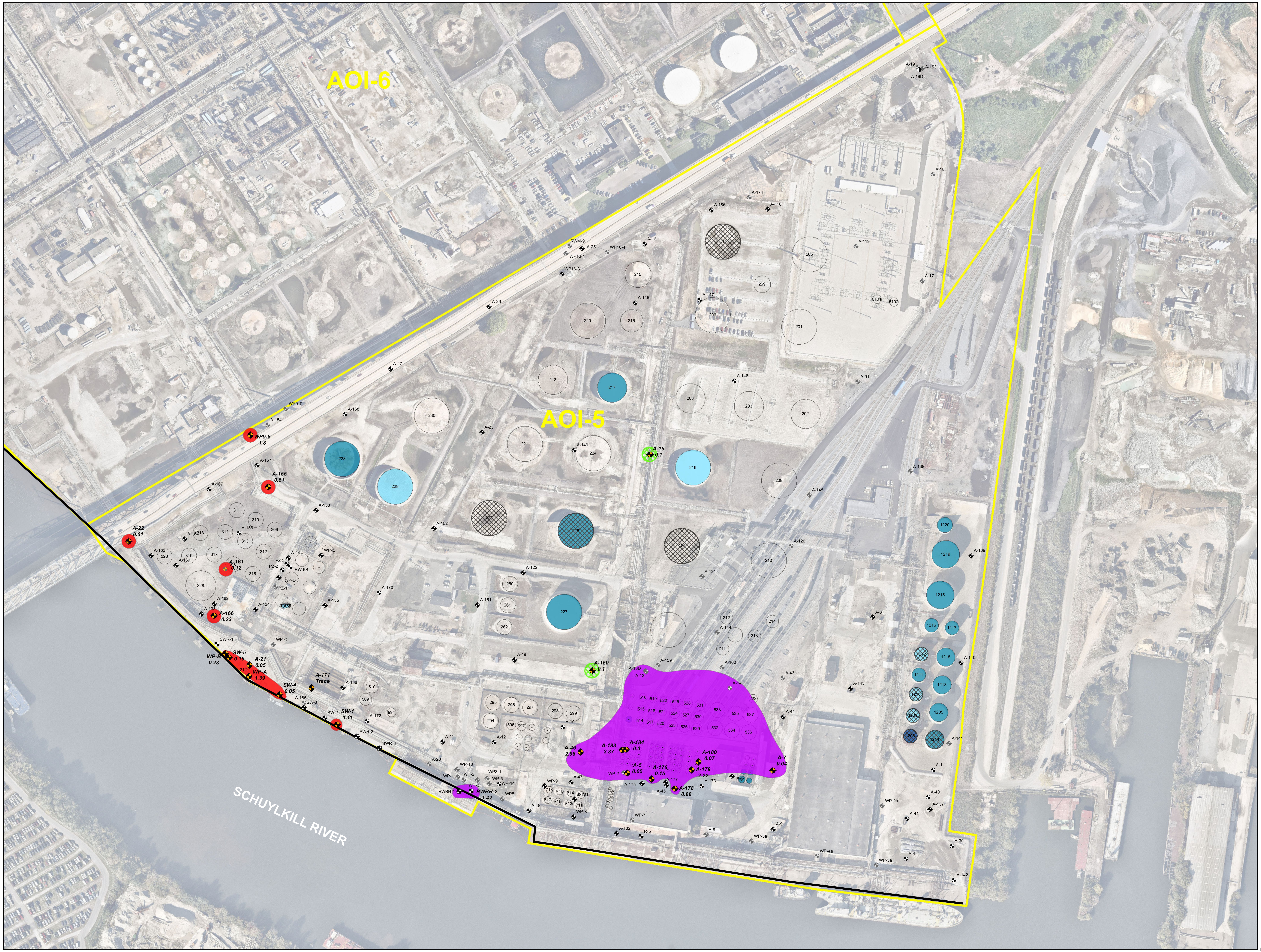
- Stantec Indoor Air Sample Locations
- Aquaterra Outdoor Worker Ambient Air Sample Location
- GHD Indoor Air Sample Location
- Sheet Pile Wall
- Occupied Buildings Not Under Positive Pressure
- Occupied Buildings Under Positive Pressure
- AOI Boundary

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Indoor air samples referenced from "Evaluation of Specific Volatile Organic Compounds in Occupied Buildings on the Philadelphia Refinery Properties" completed by Stantec, December 14, 2012.

Figure 11 - Summary of Indoor Air and Outdoor Worker Ambient Air Sample Locations
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 70 140 280
Feet



N
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Legend

- A-155 0.51 Unconfined Aquifer Monitoring Well with Apparent LNAPL Thickness (ft.)
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- Sheet Pile Wall
- 1212 Closed in Place
- Closed in Place Tank With Open Incident
- 1214 Active Tank With Open Incident
- 207 Removed Tank With Open Incident
- 219 Tank Currently Out of Service
- 1215 Tank In Service
- 218 Removed Tank
- AOIs
- 10 Result Exceeds PADEP Non-Residential Used Aquifer MSC TDS<2500 mg/L

LNAPL Types

- Middle Distillate
- Heavy Distillate
- Unknown

Notes:

1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater gauging completed in October, 2014, by Aquaterra.
4. LNAPL thicknesses shown for RWBH-1 and RWBH-2 are from the November 2015 gauging event.

Figure 12: Apparent LNAPL Thickness and Type
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: KM
JOB#: 2574602

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2016\Figure 12 - Apparent LNAPL Thickness_112316.mxd

APPENDIX A

NOTICES OF INTENT TO REMEDIATE, REPORT NOTIFICATIONS AND PADEP CORRESPONDENCE

LANGAN

NIR Documents

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

November 17, 2014

Mr. C. David Brown, Ph. D., PG
Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

**RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex
3144 West Passyunk Avenue, Philadelphia, Philadelphia County, Pennsylvania**

Dear Mr. Brown:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed is the revised Notice of Intent to Remediate (NIR) for the Philadelphia Refinery Complex (site). The original NIR for the site was submitted on October 12, 2006. The purpose of this revision is to update owner and remediator information for the facility. This revision also includes a site location map depicting a change to property boundaries, most notably the exclusion of Belmont Terminal, which was covered under a separate NIR submission on October 6, 2014. It should be noted that the Belmont Terminal was not included in the original October 12, 2006 NIR, therefore, its exclusion from the revised NIR is not a change.

On August 14, 2012, Sunoco, Inc. (R&M) (Sunoco) entered into a Consent Order and Agreement with Philadelphia Energy Solutions Refining & Marketing LLC (PES) and the Pennsylvania Department of Environmental Protection (PADEP) for the Philadelphia Refinery Complex. As part of this buyer-seller agreement, Sunoco retained responsibility of remediation activities for environmental conditions existing at the time of the transfer, and PES is responsible for environmental conditions following the purchase agreement. On September 8, 2012, Sunoco conveyed the Philadelphia Refinery to PES. Effective December 30, 2013, “Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC” (Evergreen) assumed Sunoco legacy remediation liabilities with respect to the Philadelphia Refinery Complex. Evergreen will continue to manage the remediation work at the facility under the One Cleanup Program with the PADEP and United States Environmental Protection Agency (USEPA) and in accordance with 2012 Consent Order & Agreement.

Please call me at (302) 477-0192 with any questions or comments.

Best Regards,

James Oppenheim, PE
Vice President

cc: Evergreen File
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

8000-FM-CRLG0010 Rev. 9/2010

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMUNITY REVITALIZATION AND LOCAL GOVERNMENT SUPPORT

For DEP Use Only
PF #________________
Rem ID #_____________

NOTICE OF INTENT TO REMEDIATE

Act 1995-2 requires four general information items to be included in the NIR: the general location, listing of contaminants, intended use of property, and proposed remediation measures. In addition, indicate the standard(s) to be obtained (if known) and attach a scaled site map (if available).

Property Name Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex

Former Name(s) / AKA Sunoco Inc. (R&M) Philadelphia Refinery

Address / Location 3144 Passyunk Avenue

City Philadelphia Zip Code 19145

Municipality(s) City of Philadelphia County(ies) Philadelphia

Latitude 39 º (deg). 55 ' (min) 13.976 " (sec) Longitude 75 º (deg). 11 ' (min) 52.429 " (sec)

Horizontal Collection Method Geographic Information Systems

Horizontal Reference Datum NAD 1983 Reference Point Visitor Entrance

☒ Wish to participate in the DEP/EPA MOA. Contact Troy Conrad at tconrad@state.pa.us for details.

EPA ID#, if known PAD049791098

DEP ID#(s), if known Multiple
(i.e., eFACTS site ID#, storage tank facility ID#, water quality permit #, watershed permit, air quality permit #, etc.)

Date Release Occurred (if known) ____________________

Provide a brief description of the site contamination in plain language (e.g. fuel oil spill, historical chemical industrial area contamination), the names of any know primary contaminants to be addressed, and the intended future use of the property.

The site contamination consists of impacts to soil and groundwater associated with historic petrochemical refining operations. The primary consistuents of concern in soil and groundwater are lead, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, cumene, ethylbenzene, methyl tertiary butyl ether, toluene, total xylenes, ethylene dibromide, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene. The future use of the facility is to remain industrial.

Provide a general description of proposed remediation measures.

Evergreen is submitting this Notice of Intent to Remediate (NIR) in order update an NIR previously submitted on October 6, 2006 which formally entered the property into the PA Act 2 Program. In November 2011, the facility was formally entered into the PA One Cleanup Program with the USEPA and PADEP. The purpose of this NIR revision is to update the facility ownership and remediator information. The facility has been divided into 11 Areas of Interest (AOIs). These areas consist of the Point Breeze Processing Area North Yard (AOI 8) and South Yards (AOI 1 through AOI 4); the Girard Point South Tank Field (AOI 5) and Processing Area (AOI 6 and AOI 7); the Schuylkill River Tank Farm (AOI 9); the West Yard (AOI 10); and the deep aquifer (AOI 11). Each AOI will be characterized in accordance with PA Act 2, and remedial measures will be developed to address the risk of exposure identified during the characterization activities.

Remediation Standard(s) planned (if known at this time):

☐ Unknown at this time ☐ Soil ☐ Groundwater

☐ Background ☐ Soil ☐ Groundwater
Contaminants:

☐ Statewide Health - Residential ☐ Soil ☐ Groundwater
Contaminants:

☐ Statewide Health – Non-Residential ☐ Soil ☐ Groundwater
Contaminants:

☒ Site Specific ☒ Soil ☒ Groundwater
Contaminants:

☐ Special Industrial Area* ☐ Soil ☐ Groundwater
Contaminants:

*NOTE: Specific standard or Special Industrial Area require a 30-day municipal comment period

Remediator / Property Owner / Consultant. Complete the form below for *each* recipient obtaining a release of liability upon approval of the final report. Attach additional sheets as necessary.

Remediator

Contact Person/Title Jim Oppenheim, PE/Vice President eFACTS Client ID* 314958

Relationship to Site Remediator Client Type* Limited Liability Company
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (302) 477-0192 Email Address JROPPENHEIM@evergreenresmgt.com

Company Name Evergreen Resources Management Operations EIN or Federal ID # 46-4184955

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803

Property Owner

Contact Person/Title Charles Barksdale Jr./Site Environmental Director eFACTS Client ID* 298341

Relationship to Site Owner Client Type* Limited Liability Company
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number 215-339-2074 Email Address charles.barksdale@pes-companies.com

Company Name Philadelphia Energy Solutions Refining and Marketing, LLC EIN or Federal ID # 61-168974

Address (street, city, state, zip) 3144 Passyunk Ave, Philadelphia, PA 19145

Consultant

Contact Person/Title Jennifer Menges/Principal Consultant, LRS eFACTS Client ID* N/A

Relationship to Site Consultant Client Type* N/A
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (610) 840-2540 Email Address Jennifer.Menges@stantec.com

Company Name Stantec EIN or Federal ID # N/A

Address (street, city, state, zip) 1060 Andrew Drive, Suite 140, West Chester, PA 19380

*Include eFACTS Client ID (if known) – "Client Types" below:

Association/Organization	Limited Liability company	Partnership-General
Authority	Limited Liability Partnership	Partnership-Limited
County	Municipality	School District
Estate/Trust	Non-Pennsylvania Government	Sole Proprietorship
Federal Agency	Other (Non-Government)	State Agency
Individual	Pennsylvania Corporation	

Preparer of Notice of Intent to Remediate

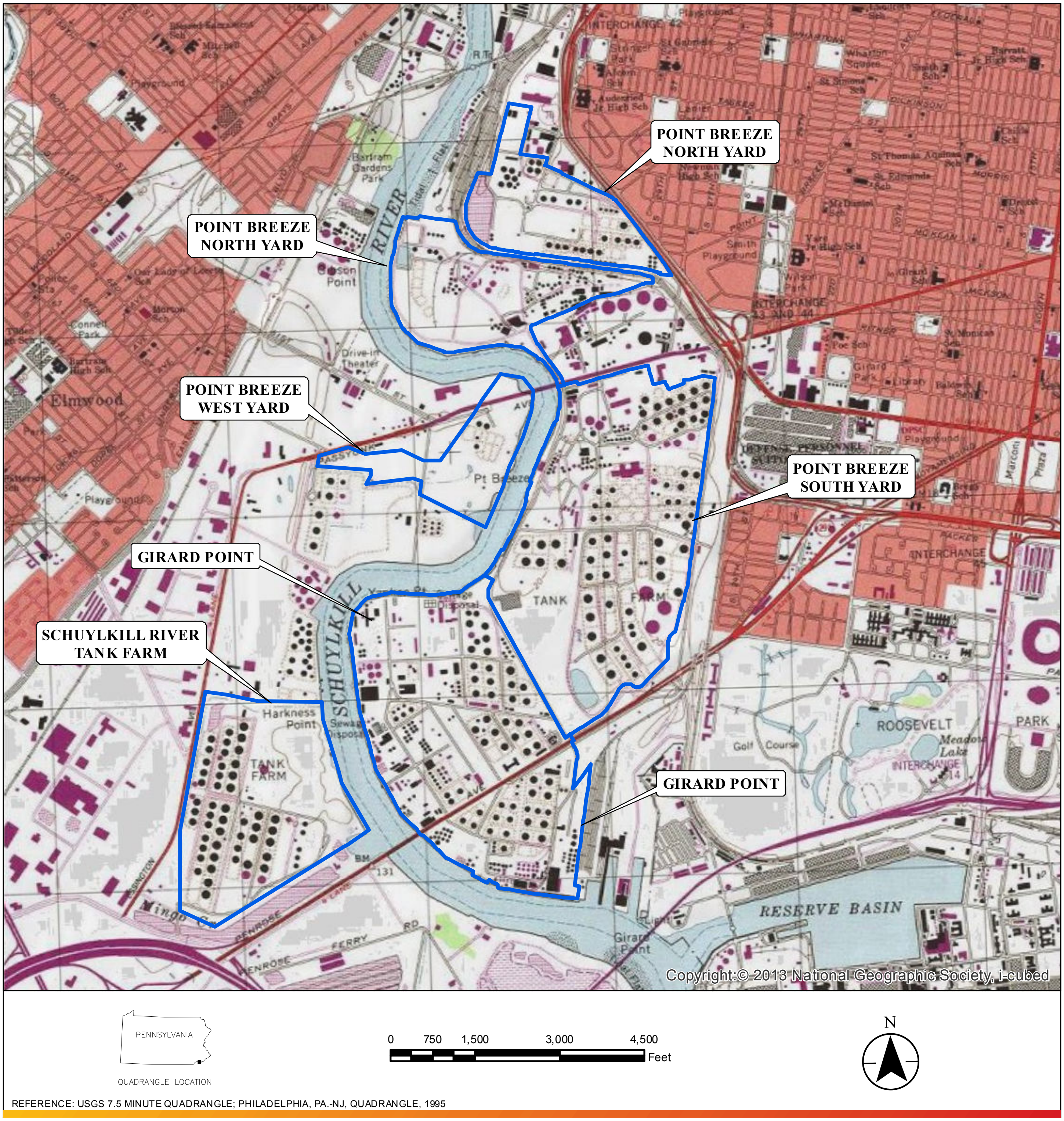
Name Jim Oppenheim, PE Title Vice President

Phone Number (302) 477-0192 Email Address JROPPENHEIM@evergreenresmgt.com

Company Name Evergreen Resources Management eFACTS Client ID

Operations

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803



REFERENCE: USGS 7.5 MINUTE QUADRANGLE; PHILADELPHIA, PA.-NJ, QUADRANGLE, 1995

Stantec

Stantec Consulting Services Inc.
1060 Andrew Drive, Suite 140
West Chester, Pennsylvania 19380
Tel. 610-840-2500
Fax. 610-840-2501
www.stantec.com

DRAWN BY: GWC
CHECKED BY: JKD
APPROVED BY: JLM
DATE: 11/11/2014

Prepared For:

EVERGREEN RESOURCES
MANAGEMENT OPERATIONS
PHILADELPHIA REFINERY COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA. 19145

Figure Title:

Philadelphia Refinery Complex
Site Location Map

Figure No.:

1

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

November 17, 2014

Leigh Anne Rainford, MPH
Sanitarian Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, PA 19104

RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex
3144 West Passyunk Avenue Philadelphia, Philadelphia County

Dear Ms. Rainford:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) a site be provided to the municipality in which the site is located. This notification is to inform the City of Philadelphia of the submission of an update to the original October 12, 2006 NIR. The purpose of the revised NIR is to update the facility owner and remediator information. On September 8, 2012, Sunoco Inc., (R&M) (Sunoco) conveyed the Philadelphia Refinery to Philadelphia Energy Solutions Refining & Marketing LLC (PES). As part of the transaction, Sunoco retained responsibility for remediation activities for environmental conditions existing at the time of the transfer. Effective December 30, 2013, “Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC” (Evergreen) assumed Sunoco legacy remediation liabilities with respect to the Philadelphia Refinery Complex. A copy of the revised NIR is enclosed for your reference.

Please call me at (302) 477-0192 if you have any questions concerning the proposed remediation.

Best Regards,

James Oppenheim, PE
Vice President

cc: Evergreen File
C. David Brown, PADEP
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

Philadelphia Refinery

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Manager
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue
Philadelphia, PA 19104

Re: Sunoco, Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Sir/Madam:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) be provided to the municipality in which the site is located when a site is being remediated to a site-specific Standard. The municipality is afforded a 30-day comment period. In accordance with this provision of the Act, Sunoco, Inc. (R&M) is formally notifying you of its intent to remediate the subject site under Act 2. A copy of the NIR, which will be sent to the Pennsylvania Department of Environmental Protection (PaDEP), is enclosed. This notice will also be published in the Pennsylvania Bulletin, and a summary of the notice appeared in the Philadelphia Daily News on October 16, 2006.

Publication of this notice in the Philadelphia Daily News initiates the 30-day public and municipal comment period. During the next thirty days, your municipality may request to become involved in the development of the remediation plans for the site. If the municipality wishes to become involved in this project, please send your comments to Sunoco to my attention.

Please call me at (610) 859-1881 if you have any questions concerning the proposed remediation.

Best Regards,

James R. Oppenheim, P.E.
Senior Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
Steve O'Neil, PaDEP
Colleen Costello, Langan

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.
Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
Contact Person: James R. Oppenheim
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
Phone Number: (610) 859-1881
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim

Title: Project Manager

Address: 100 Green Street
Marcus Hook, PA 19061

Telephone: (610) 859-1881

Email Address: jroppenheim@sunocoinc.com

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Mr. Robert Day-Lewis
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Mr. Steve O'Neil
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Re: Sunoco Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Mr. Day-Lewis and Mr. O'Neil:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed are two copies of a Notice of Intent to Remediate (NIR) for the Sunoco Inc. (R&M) Philadelphia Refinery. This NIR covers remediation being done as part of the 2003 Consent Order and Agreement (CO&A) at Point Breeze, Girard Point and Schuylkill River Tank Farm. Remediation at Belmont Terminal, which is part of the CO&A, is not part of this NIR since this site is not subject to RCRA Corrective Action. Sunoco is considering submitting a separate NIR for this area under the Act 2 program only.

This NIR is being submitted with the intent to enter the Sunoco Philadelphia Refinery into the One Cleanup Program with PaDEP and the USEPA. All remediation work at the Philadelphia refinery will be completed under the 2003 Consent Order & Agreement (CO&A), however, RCRA Corrective Action measures will be addressed concurrently with work performed under the CO&A and within the Act 2 program.

Please call me at 610-859-1881 or email me at jroppenheim@sunocoinc.com with any questions or comments.

Best Regards,

James Oppenheim, PE
Sr. Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
David Burke, PADEP
Walter Payne, PADEP
Hon Lee, USEPA Region III
Colleen Costello, Langan

2530-FM-BWM0019 Rev. 4/2004

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.

Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
Contact Person: James R. Oppenheim
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
Phone Number: (610) 859-1881
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim

Address: 100 Green Street
Marcus Hook, PA 19061

Email Address: jroppenheim@sunocoinc.com

Title: Project Manager

Telephone: (610) 859-1881

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Proof of Publication in The Philadelphia Daily News
Under Act. No 587, Approved May 16, 1929

STATE OF PENNSYLVANIA
COUNTY OF PHILADELPHIA

Anna Dickerson being duly sworn, deposes and says that **The Philadelphia Daily News** is a newspaper published daily, except Sunday, at Philadelphia, Pennsylvania, and was established in said city in 1925, since which date said newspaper has been regularly issued in said County, and that a copy of the printed notice of publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said newspaper on the following dates:

October 16, 2006

Affiant further deposes and says that he is an employee of the publisher of said newspaper and has been authorized to verify the foregoing statement and that he is not interested in the subject matter of the aforesaid notice of publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

Anna Dickerson

Sworn to and subscribed before me this 16th day of October, 2006

Mary Anne Logan
Notary Public

My Commission Expires:

NOTARIAL SEAL
Mary Anne Logan, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 30, 2009

Copy of Notice of Publication

Newspaper Notice of Intent to Remediate to an Environmental Standard. (Sections 302(e)(1)(ii), 303(h)(1)(ii), 304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act (Act), the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Sunoco Inc.(R&M) has submitted to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 Passyunk Ave., Philadelphia, Philadelphia County, Pennsylvania. This Notice of Intent to Remediate states that the site is a petroleum refinery. It has been determined that petroleum compounds have impacted soil and groundwater at the site. Sunoco Inc. (R&M) has indicated that proposed remediation measures will include source reduction and engineered boundary controls. The proposed future use of the property is industrial for continued operation as a petroleum refinery.

Sunoco Inc. (R&M) plans to use the site-specific remediation standard at the site. The Act provides for a 30-day public comment period for site-specific standard remediation. The 30-day comment period is initiated with the publication of this notice. Until November 16, 2006, the City of Philadelphia may submit a request to Sunoco Inc. (R&M) to be involved in the development of the remediation and reuse plans for the site. The City of Philadelphia may also submit a request to Sunoco Inc. (R&M) during this 30-day comment period to develop and implement a public involvement plan. Copies of these requests and of any comments should also be submitted to the Department of Environmental Protection at 2 East Main Street, Norristown, PA 19401 to the attention of Mr. Walter Payne. All correspondence with Sunoco Inc. (R&M) should be addressed to the Public Relations Dept., Sunoco Inc. (R&M) at 3144 Passyunk Ave, Philadelphia, PA, 19145.

LEGAL NOTICES

Newspaper Notice of Intent to Remediate
to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act (Act), the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Sunoco Inc.(R&M) has submitted to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 Passyunk Ave., Philadelphia, Philadelphia County, Pennsylvania. This Notice of Intent to Remediate states that the site is a petroleum refinery. It has been determined that petroleum compounds have impacted soil and groundwater at the site. Sunoco Inc. (R&M) has indicated that proposed remediation measures will include source reduction and engineered boundary controls. The proposed future use of the property is industrial for continued operation as a petroleum refinery.

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Appeared in: ***Philadelphia Inquirer & Philadelphia Daily News*** on Monday, 10/16/2006

Back

PNDI Documents

March 12, 2015

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane
Bellefonte, PA 16823-7437

Re: *UPDATE* SIR # 41012
PNDI Search ID: 20150312489658
Philadelphia Energy Solutions Refining and Marketing LLC
Philadelphia Refinery, AOI-5
City of Philadelphia, Philadelphia County, Pennsylvania
Langan Project No.: 002574601

Dear Sir/Madam:

As environmental and regulatory compliance agent for Evergreen Resources Management Operations (applicant), Langan Engineering & Environmental Services (Langan) submits this request for potential conflicts associated with a search of the Pennsylvania Natural Diversity Inventory (PNDI) database. According to the PNDI search (PNDI 201503212489658), potential impacts may exist within the project site under the jurisdiction of the Pennsylvania Fish and Boat Commission. A SIR is enclosed for your reference.

AOI 5 is located in the southern most portion of the Philadelphia Energy Solutions (PES) Refining and Marketing, LLC Philadelphia Refinery in Philadelphia, Pennsylvania and is known as the Girard Point South Tank Field Area (Figure 1). AOI 5 is bordered to the North and Northwest by Penrose Avenue and the George Platt (formerly Penrose Avenue) Bridge, an industrial facility to the East, and the Schuylkill River to the South and Southwest. AOI 5 encompasses approximately 100 acres. No surface water features are located in AOI 5. The nearest surface water body to AOI 5 is the Schuylkill River which comprises the southern boundary of AOI 5. A sheet pile bulkhead, keyed into the Middle Clay Unit, extends along the entire southern boundary of the AOI 5 along the Schuylkill River. The extent of the sheet pile wall/bulkhead is shown in Figure 2. Groundwater interaction with surface water/sediment is limited by the sheet pile wall.

The project is currently in the Act 2 reporting process and information related to threatened/endangered species or their habitats is required. A previous response was obtained from your office in July 2013 (enclosed). We request updated information as to whether the project is determined to affect species of special concern under your jurisdiction, specifically addressing Act 2 reporting. If you have any questions on the enclosed materials or require any additional materials to make your determination, please feel free to contact me at (215) 491-6553.

Sincerely,
Langan Engineering and Environmental Services, Inc.

Jason Gilmore, PWS
Project Scientist

Enclosure(s): As discussed

\\langan.com\data\DT\data6\2574601\Engineering Data\Natural Resources\2015 PNDIs\AOI 5\2015-3-12 PFBC Update Letter.docx

PFBC-NESU-1 (5/2/03)

COMMONWEALTH OF PENNSYLVANIA
FISH AND BOAT COMMISSION
NATURAL DIVERSITY SECTION

SPECIES IMPACT REVIEW (SIR) REQUEST FORM

A. This form provides the site information necessary to perform a computer database search for species of special concern listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, the Pennsylvania Fish and Boat Code or the Wildlife Code.

B. Use only ***one form*** for each proposed project or location. Complete the information below and **mail** form to:

Natural Diversity Section
PA Fish and Boat Commission
450 Robinson Lane
Bellefonte, PA 16823
Fax: (814) 359-5153

C. This form, a cover letter including a project narrative, and accompanying maps should be sent to the above address for environmental reviews that ***only*** concern ***reptiles, amphibians, fishes and aquatic invertebrates***. Reviews for other natural resources must be submitted to other appropriate agencies.

D. The absence of recorded information from our databases and files does not necessarily imply actual conditions on site. Future field investigations could alter this determination. The information contained in our files is routinely updated. A review is valid for one year.

E. ***Please send us only one (1) copy of your request*** – either by fax or by mail – not both. Mail is preferred to improve legibility of maps. Facsimile submission will not improve our response turn-around time.

F. ***Allow 30 days for completion of the review from the date of PFBC-NESU receipt.*** Large projects and workload may extend this review timeframe.

G. ***In any future correspondence with us following your receipt of the SIR response, please refer to the assigned SIR number at the top left of our cover letter.***

H. **FORMS THAT ARE NOT COMPLETED IN FULL WILL NOT BE REVIEWED.**

PLEASE PRINT OR TYPE: If available, provide the potential conflict **PNDI Search Number**: 20150312489658

PFBC response should be sent to:

Company/Agency: Langan Form Preparer: Jason Gilmore

Address: 2700 Kelly Rd, Suite 200, Doylestown, PA 18976

Phone: (8:00 AM – 4:00 PM): 215-491-6553

Project Description: The project consists of approximately 100 acres. The project is currently in the Act 2 reporting process and information related to threatened/endangered species or their habitats is required.

Indicate if the project is: Transportation ☐ or Non-transportation ☒ (check one)

Will the proposed project encroach directly or indirectly (e.g., runoff) upon wetlands or waterways? Circle one for each:

Wetlands: Yes **No** Unknown Waterways: **Yes** No Unknown

County: Philadelphia Township/Municipality: City of Philadelphia

Name of the United States Geological Survey (U.S.G.S.) 7.5 Minute Quadrangle Map where project is located:

Philadelphia, PA Project size (in acres): 100

Attach an 8.5" by 11" photocopy (**DO NOT REDUCE**) of the section of the U.S.G.S. Quadrangle Map which identifies the project location. On this map, indicate the location of the project center (if linear, depict both ends) and outline the appropriate boundaries of the project area.

Specify latitude/longitude of the project center. **Latitude**: 39° / 53' / 53.6" **N**

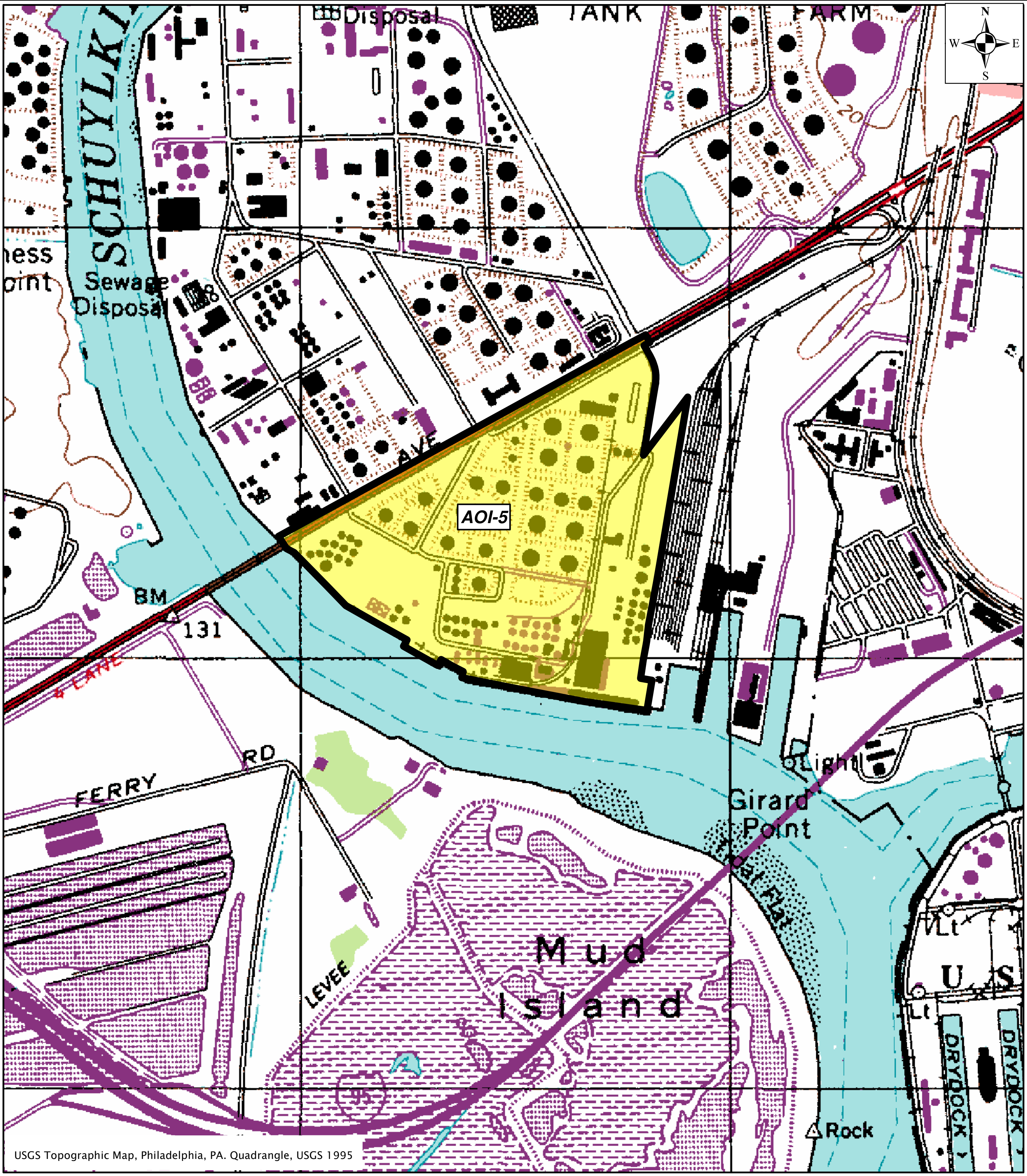
Indicate latitude/longitude in degrees-minutes-seconds format only. **Longitude**: 75° / 12' / 11.4" **W**

Three steps are needed to convert from decimal to degrees-minutes-seconds: (1) Degrees will be the whole number. (2) To get minutes, multiply the decimal degree portion by 60. (3) Multiply the decimal minute portion by 60 to get seconds.

Example: (Latitude) 40.93748 = **40°** ; 0.93748 x 60 = 56.2488' = **56'** ; 0.2488 x 60 = 14.928 = **15"** = **40°56'15"N**
(Longitude) 75.94740 = **75°** ; 0.94740 x 60 = 56.844' = **56'** ; 0.844 x 60 = 50.64 = **51'** = **75°56'51"W**

FOR PFBC USE ONLY

SIR#	Quad Name	Data Source	Search Results-Potential Species Conflict	Action



Evergreen Resources Management Operations

2 Righter Parkway, Suite 200
Wilmington, DE 19803

Figure 1: Site Location Map
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery

Philadelphia | Pennsylvania

Job Number	Scale: 1" = 1,000'	Date
2574601	0 500 1,000 Feet	March 12, 2015

Path: \\langan.com\data\DT\data6\2574601\ArcGIS\MapDocuments\Natural Resources\AOI5\Figure 1- Site Location Map_3-12-15.mxd

Notes:
1. Aerial basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Source of aerial imagery is Microsoft, 3/19/2011.

Figure 2: Site Plan
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: March 12, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 2574601

Q:\\Data6\2574601\ArcGIS\MapDocuments\AOI 6 Site Characterization\Figure 8 Summary of Non SWMUs Soil Sample Exceedances.mxd

1. PROJECT INFORMATION

Project Name: **Evergreen/PES AOI 5**
Date of review: **3/12/2015 11:22:09 AM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation,Other**
Project Area: **101.6** acres
County: **Philadelphia** Township/Municipality: **Philadelphia**
Quadrangle Name: **PHILADELPHIA** ~ ZIP Code: **19145**
Decimal Degrees: **39.897916 N, -75.205106 W**
Degrees Minutes Seconds: **39° 53' 52.5" N, -75° 12' 18.4" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened

Scientific Name: Sensitive Species**
Common Name:
Current Status: Endangered

U.S. Fish and Wildlife Service

RESPONSE: No impacts to federally listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. For cases where a "Potential Impact" to threatened and endangered species has been identified before the application has been submitted to DEP, the application should not be submitted until the impact has been resolved. For cases where "Potential Impact" to special concern species and resources has been identified before the application has been submitted, the application should be submitted to DEP along with the PNDI receipt. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. DEP and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at http://www.naturalheritage.state.pa.us.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Pennsylvania Field Office
110 Radnor Rd; Suite 101, State College, PA 16801
NO Faxes Please.

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name: Jason Gilmore, PWS
Company/Business Name: Langan
Address: 2700 Kelly Road, Suite 200
City, State, Zip: Warrington, PA 18976
Phone:(215) 491-6553 Fax:( )
Email: jgilmore@langan.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

[signature] 3/12/2015
applicant/project proponent signature date

Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823-9620
(814) 359-5237 Fax: (814) 359-5175

July 15, 2013

IN REPLY REFER TO
SIR# 41012

LINDA KENNEY
LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES
PO BOX 1569
DOYLESTOWN, PA 18901-0219

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 20130115386609
PHILADELPHIA AO1-5
UPDATE TO SIR #37591
PHILADELPHIA Township, PHILADELPHIA County, Pennsylvania

Dear Ms. KENNEY:

I have examined the map accompanying your recent correspondence which shows the location for the above referenced project. Based on records maintained in the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files, the state threatened eastern redbelly turtle (*Pseudemys rubriventris*) is known from the vicinity of the project site.

The eastern redbelly turtle is one of Pennsylvania's largest native aquatic turtles. This turtle species is known to inhabit relatively large, deep streams, rivers, ponds, lakes and marshes with permanent water and ample basking sites. Redbelly turtles are restricted to the southcentral and southeastern regions of the Commonwealth. The existence of this turtle species is threatened by habitat destruction, poor water quality, and competition with aggressive non-native turtle species that share its range and habitat (e.g., red-eared slider, *Trachemys scripta elegans*).

Redbelly turtles are known from near the project area. It is possible that they could also occur in any wetlands and water bodies on-site. **Therefore, if wetlands with open water areas, streams, or ponds are to be disturbed from the project activity**, we will need to conduct a more thorough evaluation of the potential adverse impacts to the redbelly turtle. Items **such as:** basic project plans, project narrative, general habitat descriptions, and color photographs keyed to a site map or diagram of the project area, wetlands identification and delineation, stream characterization (flow velocity, width, depth, substrate type, pools and riffles, identification of basking areas, logs, woody debris, presence of aquatic vegetation) would expedite our review process. Pending the review of information, a survey for targeting the presence of the species of concern may be warranted.

However, if wetlands or water bodies are not to be disturbed in any way by the proposed activity, and provided that best management practices are employed and strict erosion and sedimentation measures are maintained, I do not foresee any adverse impacts to eastern redbelly turtle or any other rare or protected species under Pennsylvania Fish and Boat Commission jurisdiction.

Note that this office performed no field inspection of the project area. Consequently, comments in this letter are not meant to address other issues or concerns that might arise concerning matters under Pennsylvania Fish and Boat Commission jurisdiction or that of other authorities. If you have any questions regarding this response, please contact Kathy Gipe at 814-359-5186 **and refer to the SIR number at the top of this letter**. Thank you for your cooperation and attention to this matter of endangered species conservation and habitat protection.

Sincerely,

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/kn

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823
814-359-5237

April 2, 2015

IN REPLY REFER TO
SIR# 44011

Langan Engineering & Environmental Services, Inc.
Jason Gilmore
2700 Kelly Road
Warrington, Pennsylvania 18976

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 20150312489658
Evergreen/PES AOI 5
PHILADELPHIA County: Philadelphia City

Dear Jason Gilmore:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search "potential conflict" or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

According to this submission and our records there have been no changes in the project or on-site biological information; therefore, the Commission's comments regarding potential impacts to rare, candidate, threatened, or endangered species under our jurisdiction, as detailed in our letter of July 15, 2013 for SIR# 41012, remain unchanged.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

If you have any questions regarding this review, please contact Kathy Gipe at 814-359-5186 and refer to the SIR # 44011. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

Christopher A. Urban

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/dn

1. PROJECT INFORMATION

Project Name: **Evergreen/PES AOI 5**
Date of review: **5/7/2015 12:35:18 PM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation,Other**
Project Area: **100.2** acres
County: **Philadelphia** Township/Municipality: **Philadelphia**
Quadrangle Name: **PHILADELPHIA** ~ ZIP Code: **19145**
Decimal Degrees: **39.898574 N, -75.205556 W**
Degrees Minutes Seconds: **39° 53' 54.9" N, -75° 12' 20" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	No Known Impact	No Further Review Required
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources

RESPONSE: No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Fish and Boat Commission

RESPONSE: Further review of this project is necessary to resolve the potential impacts(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)
Scientific Name: Sensitive Species**
Common Name:
Current Status: Threatened

Scientific Name: Sensitive Species**
Common Name:
Current Status: Endangered

U.S. Fish and Wildlife Service

RESPONSE: No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.* is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictinal agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, send the following information to the agency(s) seeking this information (see AGENCY CONTACT INFORMATION).

Check-list of *Minimum* Materials to be submitted:

____**SIGNED** copy of this Project Environmental Review Receipt
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____Project location information (name of USGS Quadrangle, Township/Municipality, and County)
____USGS 7.5-minute Quadrangle with project boundary clearly indicated, and quad name on the map

The inclusion of the following information may expedite the review process.
____A basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams

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5. ADDITIONAL INFORMATION

The PNDI environmental review website is a **preliminary** screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources

Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552, Harrisburg, PA. 17105-8552
Fax:(717) 772-0271

U.S. Fish and Wildlife Service

Pennsylvania Field Office
110 Radnor Rd; Suite 101, State College, PA 16801
NO Faxes Please.

PA Fish and Boat Commission

Division of Environmental Services
450 Robinson Lane, Bellefonte, PA. 16823-7437
NO Faxes Please

PA Game Commission

Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA. 17110-9797
Fax:(717) 787-6957

7. PROJECT CONTACT INFORMATION

Name:____
Company/Business Name:_____________________________
Address:____
City, State, Zip:_____________________________________
Phone:(____)_________________Fax:(____)______________
Email:____

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

______________________________ ________________
applicant/project proponent signature date

RIR Documents

March 17, 2015

VIA EMAIL- ADS@PHILLYNEWS.COM

Legal Advertising Department – Daily News
P.O. Box 8263 – 4th Floor
Philadelphia, PA 19101
Attn: Mary Anne Logan
215-854-5834

Re: Remedial Investigation Report
Area of Interest (AOI) 5
Philadelphia Energy Solutions (PES) Facility
3144 West Passyunk Avenue
Philadelphia, Philadelphia County, Pennsylvania
Langan Project No.: 2574602

On behalf of Evergreen Resources Group LLC (Evergreen), Langan Engineering and Environmental Services, Inc. requests that the following Public Notice be published in the Philadelphia Daily News under the legal notices section.

Notification of Submittal of a Remedial Investigation Report

Notice is hereby given that Evergreen Resources Group LLC (*Remediator), is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection, Southeast Regional Office for Area of Interest 5 located at the Philadelphia Energy Solutions Refining and Marketing LLC Facility, Philadelphia County, Philadelphia, PA.*

The report is being submitted in accordance with the site-specific remediation standards established under the Land Recycling and Environmental Remediation Standards Act. This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Please publish the notice as soon as possible and fax the proof of publication to me at (215) 491-6501. Please also mail the hard copy of the proof of publication and your invoice to my attention at the following address:

Langan Engineering & Environmental Services
Attn: Donna Pilla
2700 Kelly Road
Warrington, Pa. 18976

Should you have any questions or comments regarding the request, please contact me at (215) 491-6518

Sincerely,
Langan Engineering and Environmental Services, Inc.

Kevin McKeever
Senior Project Manager

cc: Jim Oppenheim, Evergreen
Charles Barksdale, PES

\\langan.com\data\DT\data6\2574601\Office Data\Reports\Remedial Investigation Reports\AOI 5\Appendices\Appendix A -Report Notices - Public and Municipal\components\2015_0317_AOI 5_RIR Newspaper Notification.docx

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Lehigh Anne Rainford, MPH
Sanitation Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, Pennsylvania 19104

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SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Lehigh Anne Rainford, MPH
Sanitation Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, Pennsylvania 19104

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

MAR 20 2015
USPS

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☒ Return Receipt ~~for Merchandise~~
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from service label) 7012 2210 0000 1980 3954

PS Form 3811, February 2004 Domestic Return Receipt 102595-02-M-1540

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MAR 17 2015
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Sent To: Lehigh Anne Rainford, MPH
Sanitation Supervisor
Street, Apt. No.; or PO Box No.: Philadelphia Department of Public Health
Environmental Engineering Section
City, State, ZIP+4: 321 University Avenue
Philadelphia, Pennsylvania 19104

PS Form 3800, August 2006 See Reverse for Instructions

Proof of Publication in The Philadelphia Daily News
Under Act. No 587, Approved May 16, 1929

STATE OF PENNSYLVANIA
COUNTY OF PHILADELPHIA

Florence Devlin being duly sworn, deposes and says that **The Philadelphia Daily News** is a newspaper published daily, except Sunday, at Philadelphia, Pennsylvania, and was established in said city in 1925, since which date said newspaper has been regularly issued in said County, and that a copy of the printed notice of publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said newspaper on the following dates:

March 19, 2015

Affiant further deposes and says that she is an employee of the publisher of said newspaper and has been authorized to verify the foregoing statement and that she is not interested in the subject matter of the aforesaid notice of publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

Florence Devlin

Sworn to and subscribed before me this 19th day of March, 2015.

Mary Anne Logan
Notary Public

My Commission Expires:

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MARY ANNE LOGAN, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 30, 2017

Copy of Notice of Publication

Notification of Submittal of a Remedial Investigation Report
Notice is hereby given that Evergreen Resources Group LLC (Remediator), is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection, Southeast Regional Office for Area of Interest 5 located at the Philadelphia Energy Solutions Refining and Marketing LLC Facility, Philadelphia County, Philadelphia, PA. The report is being submitted in accordance with the site-specific remediation standards established under the Land Recycling and Environmental Remediation Standards Act. This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act the Act of May 19, 1995, P.L. #4, No. 2.

PADEP Correspondence

Pennsylvania Department of Environmental Protection

2 East Main Street
Norristown, PA 19401
October 20, 2006

Southeast Regional Office

Phone: 484-250-5970
Fax: 484-250-5971

Mr. James Oppenheim, P.E.
Senior Environmental Consultant
Sunoco, Inc.
3144 Passyunk Avenue
Philadelphia, PA 19145

Re: WQ-IW Correspondence
Sunoco, Inc., Philadelphia Refinery
Consent Order and Agreement
City of Philadelphia

Dear Mr. Oppenheim:

This is in reference to your October 16, 2006, letter requesting a revision to the prioritization of the area of interest (AOI) characterizations.

Your request to perform the AOI No. 5 characterization during the first and second quarters of 2007 and postpone the AOI No. 2 characterization until the first and second quarters of 2010 is hereby approved.

The Department will include the revised Phase 2 Corrective Action Activities Schedule attached to the above-referenced letter into the December 2003 Consent Order and Agreement by reference.

If you have any questions, please contact me at 484-250-5173.

Sincerely,

Steve O'Neil

Steve O'Neil
Chief, Operations Section
Water Management

cc: Ms. Costello – Langan Engineering & Environmental Services
Mr. Lee – EPA
Mr. Burke
Mr. Payne
Mr. Young
Mr. Sneath
Re 30 (joh06)293-18

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

12 October 2006

M. Logan
Philadelphia Daily News

Re: **Notification of Change of Address for Billing Purposes**
Langan Engineering and Environmental Services

To whomever it may concern:

For billing purposes, this letter is to serve as notification of our recent change of address. Our former office address was 500 Hyde Park, Doylestown, PA 18902. Or new office address is 2700 Kelly Road, Suite 200, Warrington, PA 18976.

Thank you,
Langan Engineering and Environmental Services, Inc.

Jason Hanna
Project Manager

P.O. Box 1569 Doylestown, PA 18901-0219 T: 215.491.6500 F: 215.491.6501 www.langan.com
Shipping Address: Stone Manor Corporate Center 2700 Kelly Road Suite 200 Warrington, PA 18976
Doylestown, PA • Elmwood Park, NJ • Miami, FL • New Haven, CT • New York, NY • Philadelphia, PA • Trenton, NJ

Commonwealth of Pennsylvania
Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

[date] /2011

To: Jim Oppenheim, Sunoco

cc: Walter Payne
Ayman Ghobrial
Steve O'Neil

From: David Burke (484-250-5822)

Re: Sunoco Philadelphia Refinery
Groundwater remediation program
Site Characterization Reports for AOIs 1 through 9

Technical comments have been provided to you previously for certain of the Areas of Interest (AOIs) as the Site Characterization Reports (SCRs) have been reviewed by DEP. However, for some of the SCRs, DEP has not provided any comments to date. At our meeting of March 23, 2011, you requested that DEP provide written confirmation of any and all comments on the SCRs that have been submitted by Sunoco to date. This memo is DEP's response to that request.

We note that Sunoco has informed DEP that they will revise and re-submit the SCRs for all nine of these AOIs. The new submissions will be called Remedial Investigation Reports (RIRs) to conform with the terminology used in the Land Recycling Act. In some cases, the re-submission represents an opportunity for Sunoco to provide additional information that was not available at the time the original SCR was submitted.

This memo will refer to past comments where appropriate. For the AOIs that have not been previously addressed in other comment documents, we will list issues that remain unresolved, as far as DEP can tell. We will go down the list of AOIs in chronological order according to when the SCR was submitted.

<u>AOI-1 (first SCR submitted 6/30/05, revised SCR submitted 10/4/07):</u>

- The most recent DEP comments on AOI-1 were provided in our memo dated 2/25/11. There were also several earlier documents that addressed various aspects of this AOI.
- In addition to the comments provided earlier, we wish to note that there is off-site contamination in one or more places adjacent to this AOI, so Sunoco's characterization and cleanup activities should continue to address these off-site areas.

<u>AOI-4 (SCR submitted August 2005):</u>

- The most recent DEP comments on AOI-4 were provided in our memo dated 2/25/11. Those comments include a concern about possible offsite contamination. We understand, based on recent conversation with you, that additional characterization and cleanup activities are ongoing at the southern boundary of AOI-4.

AOI-6 (SCR submitted September 2006):

- The SCR indicates that the LNAPL plume at the 27 Pump House appears to have a southern portion (that extends into AOI-5) and a northern portion (referred to as the "Tank 797 Area" or the "1700 Unit Tank Farm") that both need to be evaluated for potential additional recovery efforts. Follow-up information was to have been submitted with the quarterly reports. DEP requests that the re-submitted SCR/RIR contain an update on remedial activities as well as a summary of any evaluation that may have taken place since September 2006.

AOI-5 (SCR submitted August 2007):

- The SCR recommends further delineation of leaded tank bottom material and lead concentrations in soil in several areas and indicates that the results of these activities will be presented in an addendum to the SCR. DEP is unaware of any addendum having been provided to date.
- The SCR recommends additional soil borings at multiple locations, and indicates that the results of these activities will be presented in an addendum to the SCR. DEP is unaware of any addendum having been provided to date.
- The SCR recommends re-sampling well A-138 to assess the elevated concentration of cumene, and an evaluation of potential source areas. Results were to be presented in an addendum to the SCR. DEP is unaware of any addendum having been provided to date.
- The SCR recommends an evaluation of the need for enhancement of the recovery system at the sheet pile bulkhead ("9 berth"), and indicates that results of pump tests and recommendations will be presented in an addendum to the SCR. DEP is unaware of any addendum having been provided to date.
- Some of the above issues could legitimately be addressed in the Cleanup Plan for the AOI, instead of in an addendum to the SCR. Nevertheless, DEP requests that Sunoco use the re-submitted SCR/RIR to provide a summary of activities that may have been completed since August 2007, as well as a summary of the status of each of the issues described in the "Conclusions and Recommendations" section of the August 2007 SCR.

AOI-8 (SCR submitted September 2008):

- DEP provided comments on the SCR in a letter dated November 14, 2008. At a meeting in July 2009, Sunoco provided some information in response to DEP's comments. DEP suggests that the re-submitted SCR incorporate Sunoco's responses to DEP's November 2008 comments.

AOI-9 (SCR submitted October 2009):

- The Conclusions and Recommendations section of the SCR indicates that "activities requiring further work will be presented in a Site Characterization Report Addendum or Cleanup Plan for AOI-9." DEP suggests that certain of the recommended activities be reported on in the re-submitted SCR. These activities should include the following.
    - Further evaluation of the potential vapor intrusion into indoor air pathway for the blending area building.
    - Installation of additional monitoring wells and further evaluation of the dissolved organic compound plume at the western site boundary and, if necessary, beyond the boundary.
    - Re-sampling of lead in groundwater and additional evaluation of the mobility of this contaminant.

AOI-3 (SCR submitted September 2010):

- The SCRs for AOI-3 and AOI-2 both included evaluations of the flux of dissolved contaminants from groundwater to the tidal Schuylkill River, using a combination of modeling approaches. These evaluations have been reviewed by the Department's Water Quality Program staff, whose 4/1/2011 memo is attached to this one. As supported by the comments given in that memo, DEP requests that Sunoco provide a revised evaluation of this issue.
- The SCR indicates that Sunoco will perform additional delineation of surface soils at several locations, based on the possibility of exceedances of the site-specific standards for benzene and lead, and one actual exceedance for lead. Results of this additional delineation should be provided to DEP.
- The SCR indicates that Sunoco will investigate the source(s) of the elevated benzene concentration in groundwater at well S-280. The results of this investigation should be provided to DEP.
- The SCR reports that the LNAPL plume in the area of RW-2, S-59, S-60, and S-113 is "stable and immobile." However, the SCR does not provide significant data to support this conclusion. In addition, DEP suggests that just because a LNAPL plume is stable, it doesn't mean that the plume is not recoverable. The recovery well at RW-2 has been reasonably successful recovering LNAPL for a long time, until it was deactivated in 2009. Monitoring well S-59, located adjacent to RW-2, had an average LNAPL thickness of 2.6 feet before the recovery system was deactivated (six-year average of quarterly LNAPL thicknesses). To date, DEP has not accepted the idea that this recovery system should be turned off for good. If Sunoco intends to use the SCR to support an argument that the recovery system at RW-2 should remain inactive, we do not believe that the case has been made.

AOI-2 (SCR submitted September 2010):

- The SCRs for AOI-3 and AOI-2 both included evaluations of the flux of dissolved contaminants from groundwater to the tidal Schuylkill River, using a combination of modeling approaches. These evaluations have been reviewed by the Department's Water Quality Program staff, whose 4/1/2011 memo is attached to this one. As supported by the comments given in that memo, DEP requests that Sunoco provide a revised evaluation of this issue.
- The SCR indicates that Sunoco will perform additional delineation of surface soils at several locations, based on the possibility of exceedances of the site-specific standards for benzene and lead. Results of this additional delineation should be provided to DEP.
- The SCR indicates that Sunoco will collect soil gas samples to assess the vapor intrusion pathway for the Bio/BFW Unit building. The results of this additional sampling should be provided to DEP.
- The SCR indicates that several investigative tasks will be performed as part of a detailed evaluation of the LNAPL issue in the vicinity of the Pollock Street Sewer. DEP accepts that this issue can be addressed in the Cleanup Plan rather than in the SCR/RIR.

AOI-7 (SCR submitted September 2010):

- The SCR indicates that Sunoco will perform additional delineation of surface soils at several locations, based on the possibility of exceedances of the site-specific standards for organic compounds and lead . Results of this additional delineation should be provided to DEP.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOUTHEAST REGIONAL OFFICE

December 29, 2011

Ms. Colleen Costello
Langan Engineering and Environmental Services
30 South 17th Street, Suite 1500
Philadelphia, PA 19103

Re: ECP - Special Projects - Act 2
Receipt of Report/Plan/SSS
Sunoco Inc. Philadelphia Refinery Schuylkill River Tank Farm AO1-5
eFACTS No. 748141
3144 Passyunk Avenue
City of Philadelphia
Philadelphia County

Dear Ms. Costello:

This letter acknowledges receipt of your administratively complete Remedial Investigation Report and Cleanup Plan on December 1, 2011, pertaining to the subject site and submitted in accordance with the provisions of the Land Recycling and Environmental Remediation Standards Act (Act 2).

The Department of Environmental Protection (Department) has 90 days from receipt to review the Remedial Investigation Report and Cleanup Plan. If we do not respond with deficiencies within the 90-day time frame, the Remedial Investigation Report and Cleanup Plan shall be deemed approved. You will receive a letter advising you of the Department's action.

The procedures set forth in Act 2 must be followed in order for your site to qualify for liability protection provided by the Act. Please refer to Section V of the Act 2 Technical Guidance Manual for clarification of notification requirements. Approval of your submission and the liability protection provided by Act 2 are, in part, contingent upon compliance with applicable public and municipal notifications.

If you have any questions or need further clarifications of our procedures, please contact me at 484.250.5781.

Sincerely,

Ayman L. Ghobrial

Ayman L. Ghobrial, P.G.
Licensed Professional Geologist
Environmental Cleanup

cc: Mr. Oppenheim (Sunoco Inc. (R&M)
Mr. Baker (Sunoco Inc. (R&M)
Mr. Delaney (Philadelphia County Conservation District)
Mr. Payne
Ms. Fries
Ms. Bass
Re 30(cb11ecp) 364.5

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOUTHEAST REGIONAL OFFICE

March 15, 2012

Mr. James Oppenheim
Sunoco, Inc. (R&M)
100 Green Street
Marcus Hook, PA 19061

Re: ECB - Special Projects - Act 2
Remedial Investigation Report/Cleanup Plan Disapproval
Sunoco Philadelphia Refinery
Area of Interest No. 5 (AOI-5)
Sunoco, Inc. (R&M)
eFACTS No. 748141
3144 Passyunk Avenue
City of Philadelphia
Philadelphia County

Dear Mr. Oppenheim:

The Department of Environmental Protection (Department) has received and reviewed the December 13, 2011, document titled "Site Characterization/Remedial Investigation Report/Cleanup Plan" (RIR), for the AOI-5 for the property located at 3144 Passyunk Avenue, Philadelphia, PA. The report was prepared by Langan Engineering and Environmental Services, and submitted to the Department in accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2). The report constitutes a Remedial Investigation Report as defined in Chapter 3, Section 304 of the Act.

The Department notes the following deficiencies in the Remedial Investigation Report and disapproves it in accordance with the provisions of Act 2:

- Regarding the mobility and stability of Light Non Aqueous Phase Liquid (LNAPL) at AOI-5: The Department accepts Sunoco's conclusion that the material appears to be immobile and stable, subject to the following condition: The LNAPL in wells WP-B, WP-A, A-21, SW-4, and SW-1 is located immediately adjacent to the Schuylkill River, and may be prevented from discharging to the river only by virtue of the structural integrity of the sheet pile bulkhead. If new evidence should appear to indicate, or to suggest, that LNAPL has discharged or may be discharging to the Schuylkill River from these areas, Sunoco will be responsible to investigate the circumstances, and to remediate any environmental contamination that may have occurred due to the release of LNAPL from this area.

- The sheet pile bulkhead should be recognized as an engineering control; therefore, a Post Remediation Care Plan (PRCP) must be developed for the sheet pile bulkhead that will include periodic inspection for the structural integrity of the bulkhead. The UECA forAOI-5 will ultimately require compliance with the PRCP for the bulkhead and other areas with engineering controls.

- The LNAPL thickness at the newly installed monitoring wells (A-155 and A-14) is 1.15 ft and 1.6 ft, respectively. Further delineation in the vicinity of the locations of the aforementioned wells is required to determine the extent of the LNAPL. Results of the LNAPL delineation and proposed recovery must be documented in the RIR/Cleanup Plan.

- The depth to groundwater at the AOI-5 is less than five feet below the ground surface. The RIR proposes to further evaluate the vapor intrusion into indoor building pathway for the current occupied buildings via soil gas sampling. Results of additional evaluation and/or mitigation measures, if needed, should have been documented in the RIR/Cleanup Plan.

- Contaminants of concern (COC) found in soil are benzene and lead. Based on the current and future intended nonresidential use, site investigation was conducted for shallow soil only (0–2 ft). Exposure assessment was also conducted for the COC that were above the nonresidential direct contact MSCs found in shallow soil. The potential direct contact pathway for soil greater than two feet is described as incomplete based on Sunoco's existing permitting procedure (OSHA and personal protective equipment, PPE). The PRCP may need to incorporate this internal permit procedure. Please also note that a future termination of the existing Sunoco internal permit procedure may become a reopener of an Act 2 release. In order for site soil to be eligible for a release of liability under Act 2, additional soil investigation will be required for the 2–15 ft interval (or soil to groundwater interface for the current scenario). Please follow the TGM on how to select a Cleanup Standard for soil medium for the nonresidential scenario. Furthermore, the soil-to-groundwater pathway was not evaluated. The release of liability under Act 2 for soil will be granted only for those areas that has been investigated and remediated.

- The RIR proposes additional soil investigation and delineation for Areas 1 and 2 (SWMU-94) and Area 3 (SWMU-101). The proposed soil delineation should have been implemented, and results should have been documented in the RIR.

- Issues regarding investigation and closure of the three SWMUs, Nos. 93, 94 (leaded tank bottom disposal areas), and No. 101 (Bulkhead Seepage Area), must be coordinated with the USEPA.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717.787.3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800.654.5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717.787.3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD.

IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717.787.3483) FOR MORE INFORMATION.

We are willing to work with you toward developing an acceptable submission. If you have any questions or need further information regarding this matter, please contact Mr. Ayman Ghobrial, P.G., at 484.250.5781.

Sincerely,

Stephan Sinding
Regional Manager
Environmental Cleanup and Brownfields

cc: Mr. Payne
Mr. Ghobrial
Mr. Burke
Ms. Bass
Ms. Fries
Stan Sneath, Esq. - OCC
Ms. Costello, Langan Engineering and Environmental Services
Mr. Gotthold, USEPA
Mr. Bilash, USEPA
Mr. Lee, USEPA
City of Philadelphia Department of Public Health
Regional
(GJS12ECB)82-10

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION	**MEETING NOTES** C. David Brown 25 Apr 2014	**Commonwealth of Pennsylvania Department of Environmental Protection Southeast Regional Office Environmental Cleanup and Brownfields**

Site:		eFACTS Facility ID:	Tank Facility ID:
Philadelphia Energy Solutions Refinery 3144 Passyunk Avenue Philadelphia, PA 19145		*multiple*	*multiple*
		Incident ID: *multiple*	NIR Date: 16 Oct 2006
Municipality: City of Philadelphia	County: Philadelphia		Location: 39.9130°N, 75.1985°W
Owner: Philadelphia Energy Solutions Refining and Marketing LLC 3144 Passyunk Ave. Philadelphia, PA 19145	Remediator: Evergreen Resources Management Operations 2 Righter Parkway, Suite 200 Wilmington, DE 19803		Consultant: Langan Engineering & Environmental Services 30 S. 17th St., Suite 1300 Philadelphia, PA 19103
Contact: Chuck Barksdale (215-339-2074)	Contact: Jim Oppenheim (302-477-0192)		Contact: Jason Hanna (215-864-0640)

Attendees: **Date:** 23 Apr 2014

DEP	David Brown
Evergreen	Jim Oppenheim
Langan	Kevin McKeever

We met at DEP's office to review work being done in **AOI 5**. Sunoco submitted a remedial investigation report and cleanup plan dated 13 Dec 2011. DEP disapproved the report on 15 Mar 2012. PES will be constructing a butane rail loading terminal on the east side of the area, and Evergreen prepared a work plan for remedial excavations dated 11 Feb 2014. Work in the last two years as well as additional planned work will address the deficiencies with the 2011 RIR.

Evergreen has excavated lead-impacted soil in SWMUs 93 (#4) and 94 (#1A). They are performing additional delineation in the southeast tank field area (#3A and #3B). Stantec has collected numerous soil samples throughout the footprint of the rail project for PES. They include discrete grab samples and composite samples for soil reuse. Sampling has been done in the upper 2′, and much of this soil will be excavated. These results will be incorporated into the AOI 5 RIR addendum. Mr. Oppenheim was not aware of any exceedences. The excavated area will be covered with a couple feet of ballast and possibly other materials. Evergreen's monitoring wells in the project area have now been abandoned.

Mr. McKeever provided a map showing AST locations, groundwater contours (based on averaged elevations), soil boring and monitoring well locations, groundwater exceedences, LNAPL areas, the boundary of the rail project, excavation areas, and other information. He noted two preferential groundwater flow pathways to the Schuylkill River that appeared to follow historic infilled stream beds. They intend to install six new shallow wells in between contaminated areas and the river; these can also serve as calibration wells for fate-and-transport modeling. Langan provided a table of proposed new soil borings and monitoring wells.

There are seven open storage tank incidents in AOI 5 that require corrective action.

• Tank 207: This tank, in the north, has been dismantled. There was a release of 8400 gal of gasoline in 1992. Evergreen plans one central and four perimeter soil borings with shallow and deep samples. They could not find sampling data from the time of the incident. They had proposed a monitoring well to the northwest of the tank but asked if it was needed. Because the product was removed promptly (within ~24 hr) and there was no suspected groundwater impact, I said that the well would not be necessary if the soil results were favorable.

• Tank 226: This tank is within the rail project footprint, and it has been dismantled. About 3 Bbl of No. 6 fuel oil were released in 1991. The location of the release was not described in the notification. Evergreen believes that PES's recent sampling is adequate to characterize the area around this tank.

• Tank 225: This is an active tank. In 2002 ~50 gal of No. 6 fuel oil were released. Evergreen had proposed four borings around the tank with two to be constructed as wells. I suggested that because of the small quantity of product released a groundwater investigation was not necessary. I will check the file for better information on the source of the release. Soil sampling should be targeted there. If the location is unknown, then four perimeter samples biased toward areas of possible impact are acceptable.

• Tank 223: This tank has been dismantled. A ~2-Bbl release of No. 6 fuel oil occurred in 1994. Evergreen proposed one central and four perimeter soil borings. The notification identified the origin as a failed mixer seal. Soil sampling should be targeted there if the location of the mixer can be determined; if not, the perimeter samples are adequate.

• Tank 1208: This is closed-in-place tank in the southeast. A release was discovered in 2007 by exceedences in the closure samples. A layer of stone has subsequently been placed on the ground. Evergreen proposed three shallow samples to complement the deeper closure samples. I recommended that they examine the closure results and decide if the exceedences need to be delineated. If not, further sampling might not be necessary. There are several monitoring wells downgradient of the tank field toward the river; they have not had exceedences.

• Tank 1214: This is an active tank. About 1 Bbl of benzene was released from the P-2 pump in 1995. Soil sampling will be targeted there.

• Tank 355: This was an open-topped in-ground tank used for oil separation. It was located in the southwest of AOI 5, just north of well WP-C. Contamination was discovered in 1998 during closure. The separator had secondary containment consisting of a concrete box, which Mr. Oppenheim believed was still present. The floor of the box was at least 5′ below the ground surface, likely within the saturated zone. Langan provided portions of a Dec 1992 RCRA verification investigation final report (by Dames & Moore) and a Mar 1999 soil assessment report (by Handex). I indicated that I would check our file for the closure report and review the 1992 and 1999 materials. If the only impacts would have been to saturated soil then additional sampling might not be necessary and Evergreen could rely on the monitoring well data in the vicinity.

I pointed out that when only soil is impacted and the results attain the Statewide health standard we can close the incident. We generally require a minimum of two soil samples for small releases [§250.707(b)(1)(iii)(B)(VI)—surface release, ≤50 yd^3 excavated].

We discussed the plans for further fate-and-transport analyses. Mr. McKeever indicated that they would update the work done in 2011. I pointed out that modeling for chrysene transport to the Schuylkill River was not required because it has only a human health standard in Ch. 93 and the tidal portion of the river is excluded as a potable water supply.

We talked about a 2007 cumene exceedence at A-138, at the eastern property boundary. This well has been abandoned and a rail spur will be built in the area. I found that recent progress reports showed a decreasing trend for cumene in 2010–2013, and there was apparently no exceedence in the last couple years. There are some existing downgradient wells that do not exceed. I concluded that further groundwater investigation in the area was probably not necessary.

I asked how Langan intended to perform fate-and-transport modeling for LNAPL source areas, particularly those adjacent to the river. Mr. McKeever responded that this hadn't yet been decided. They were not in favor of using effective solubilities because the petroleum was highly weathered. We talked about some potential alternative methods for sampling groundwater in wells containing LNAPL, and we agreed to look into this possibility further. Some areas with LNAPL will have sufficient downgradient wells to characterize any potential surface water impacts.

Some wells had been installed since 2012 to delineate LNAPL around A-14 and A-155. I asked about LNAPL at A-144, as there had been no delineation to the west, toward the South Tank Field Block House. Mr. Oppenheim said he would check if this building is still occupied. If so, I recommended LNAPL delineation and/or a vapor intrusion evaluation. Mr. Oppenheim will also check with PES if the warehouses in the southeast of AOI 5 are in use or not.

The 9 Berth LNAPL recovery system operated until 2009 at RWBH-1 and 2, next to the bulkhead. This area remains free of LNAPL.

Mr. Oppenheim expected the soil sampling to be done in May, to be followed by the well installation. I reminded him that the new wells would need two sampling rounds for the RIR, and I preferred that the sampling interval be quarterly. We agreed that just the new wells would be sampled first followed by an AOI 5 synoptic round in the subsequent event. The RIR addendum could then be submitted later this year. Because the remedial work will have been completed, Evergreen can submit a combined RIR/CUP.

C. David Brown	4/25/14
C. David Brown P.G.	Date

Pennsylvania Registered Professional Geologist No. PG005002

APPENDIX B

CURRENT AND HISTORIC USE FIGURE

LANGAN

Legend

- PECO Substation
- Current Use Areas
- Butane Rail Limit of Disturbance
- Historic Use Areas
- AOIs

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco, Inc. (R&S).

Appendix B - Current and Historic Use
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 70 140 280 Feet

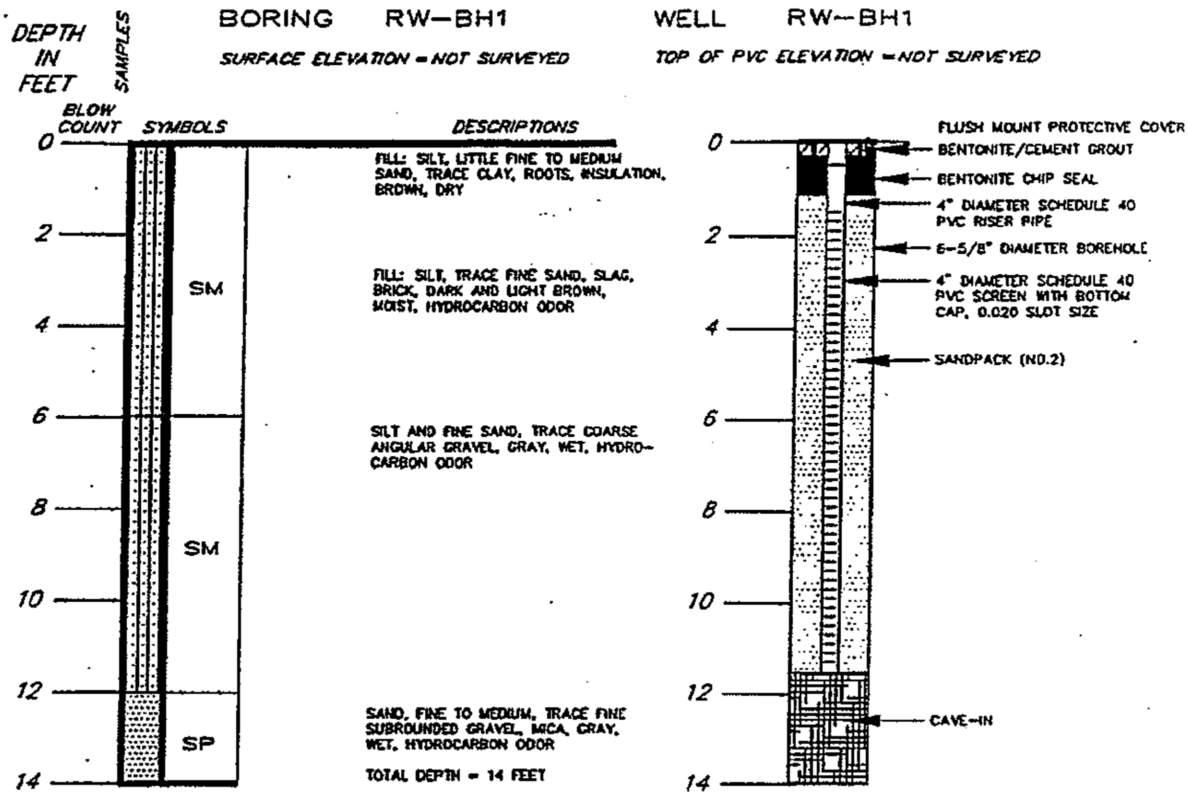
SCALE: 1" = 140'
DATE: April 21, 2016
DRN. BY: MM
CKD. BY:
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Appendix B - Historic Use Figure.mxd

APPENDIX C

SOIL BORING LOGS, MONITORING WELL CONSTRUCTION SUMMARIES, GROUNDWATER PARAMETER SHEETS, GEOTECHNICAL LABORATORY TESTING RESULTS AND 2016 ONE MILE RADIUS WELL SEARCH FIGURE

AOI 5



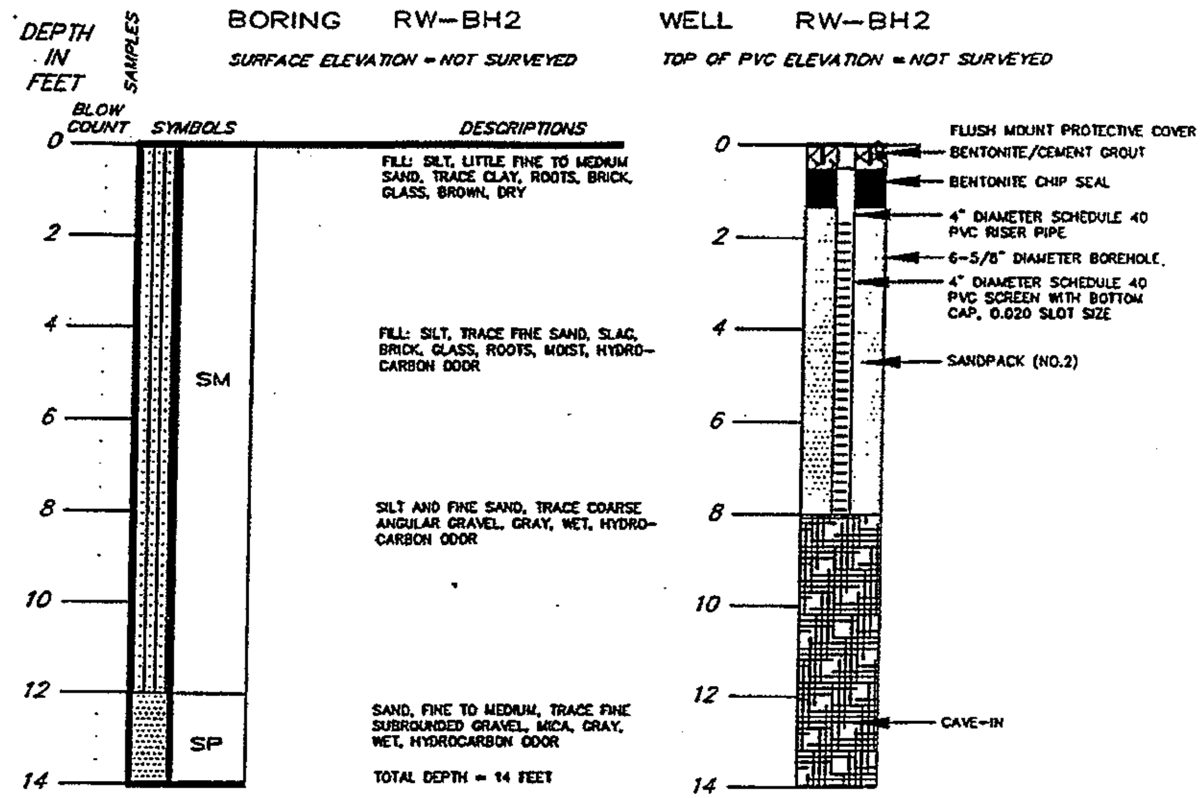
LOG OF SOIL BORING AND MONITORING WELL DETAIL SUN REFINERY PHILADELPHIA, PENNSYLVANIA

NOTES:

1. BORING COMPLETED TO A DEPTH OF 14 FEET BELOW GROUND SURFACE ON MARCH 19, 1996.
2. MONITORING WELL COMPLETED TO A DEPTH OF 11.5 FEET BELOW GROUND SURFACE ON MARCH 20, 1996.
3. MONITORING WELL INSTALLED AND COMPLETED BY DAMES & MOORE USING A TRIPOD RIG, 3" SPLIT-SPOON SAMPLER, 140 lb. HAMMER, AND 6" INSIDE DIAMETER CASING.
4. WELL DEVELOPED BY DAMES & MOORE ON APRIL 5, 1996. APPROXIMATE YIELD OF WELL MEASURED TO BE IN EXCESS OF 10 gpm.
5. DAMES & MOORE OBSERVED EVIDENCE OF TIDAL INFLUENCE IN RW-BH1 DUE TO HYDROCARBON STAINING ON INSIDE CASING. THE WATER LEVEL APPEARS TO FLUCTUATE APPROXIMATELY 3 FEET IN RW-BH1.

DAMES & MOORE

(3) G:\D... VRON\16000491\RW-BH1 05/03/96



LOG OF SOIL BORING AND MONITORING WELL DETAIL
SUN REFINERY
PHILADELPHIA, PENNSYLVANIA

NOTES:

1. BORING COMPLETED TO A DEPTH OF 14 FEET BELOW GROUND SURFACE ON MARCH 22, 1996.
2. MONITORING WELL COMPLETED TO A DEPTH OF 8 FEET BELOW GROUND SURFACE ON MARCH 23, 1996.
3. MONITORING WELL INSTALLED AND COMPLETED BY DAMES & MOORE USING A TRIPOD RIG, 3" SPLIT-SPOON SAMPLER, 140 lb. HAMMER, AND 6" INSIDE DIAMETER CASING.
4. WELL DEVELOPED BY DAMES & MOORE ON APRIL 5, 1996. APPROXIMATE YIELD OF WELL MEASURED TO BE 1.5 gpm.
5. DAMES & MOORE OBSERVED EVIDENCE OF TIDAL INFLUENCE IN RW-BH2 DUE TO HYDROCARBON STAINING ON INSIDE CASING. THE WATER LEVEL APPEARS TO FLUCTUATE APPROXIMATELY 3 FEET IN RW-BH2.

DAMES & MOORE

(3) C:\DWG\...\EVRON\16000491\RW-BH2 05/03/96

A01 5

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A1

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Andreu Ivansiu

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

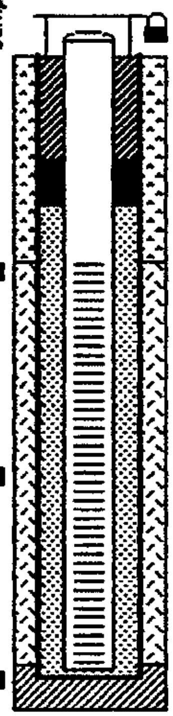
MEASUREMENTS (NGVD)

Top of Casing Elevation -	8.63'
Static Water Level Elevation -	3.08'
Date Measured -	1/9/87
Surface Elevation -	8.63'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) — Description



Depth (ft)	*blows/ft	samples		Description
0			GM	Sandy gravel, strong petroleum odor
5	3	■	SW	Fine to coarse sand and fine to medium gravel, dark-gray, dry; (fill)
10	2	■		trace silt, trace to little clay, wet
15	2	■	CL	Silty sandy clay, light gray, wet
20				

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

- Filter Pack
- Bentonite Seal
- Cement Grout

DAM

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A3

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Mark Robertson

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

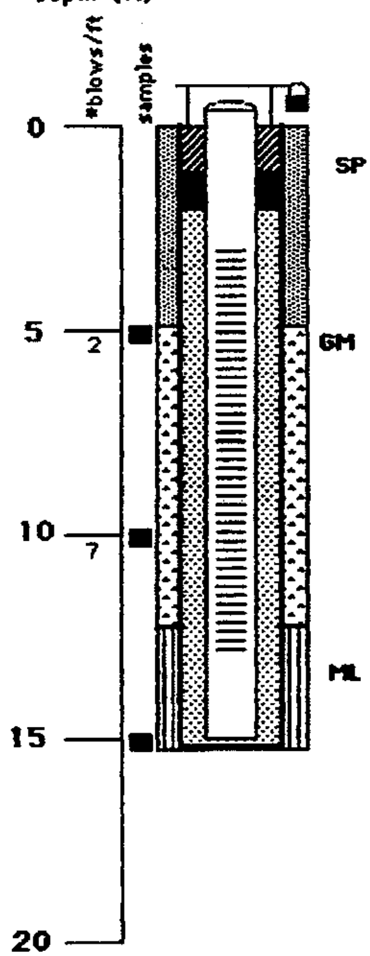
MEASUREMENTS (NGVD)

Top of Casing Elevation -	9.37'
Static Water Level Elevation -	5.26'
Date Measured -	1/9/87
Surface Elevation -	9.32'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Depth (ft)	Description
0	SP Sand with some gravel, trace silt, dark brown
5	GM Sandy gravel, product visible, strong petroleum odor, black
10	trace silt and clay, grey
	ML Clayey silt with trace sand, dark green

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project: Chevron/Philadelphia Refinery

Boring/Well No. - A4

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Andrew Ivansiu

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

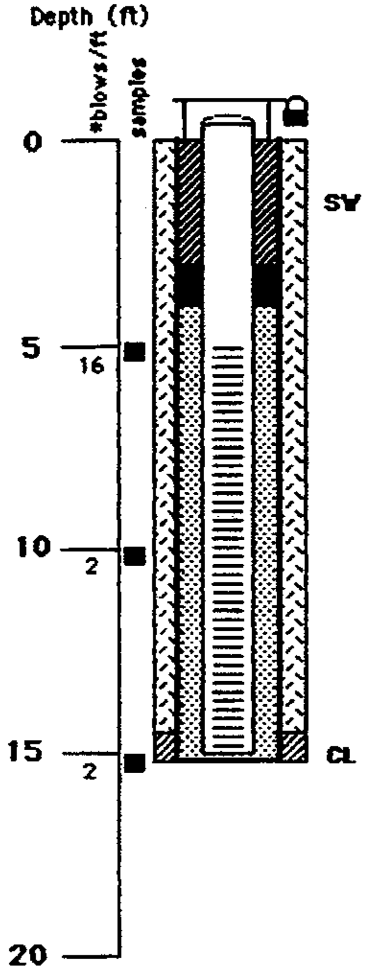
MEASUREMENTS (NGVD)

Top of Casing Elevation -	7.06'
Static Water Level Elevation -	1.58'
Date Measured -	1/9/87
Surface Elevation -	6.90'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Depth (ft)	Description
5	Fine to coarse sand with some fine gravel, petroleum odor
10	trace clay, wet
15	Silty clay, dark gray, moist

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

- Filter Pack
- Bentonite Seal
- Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A5

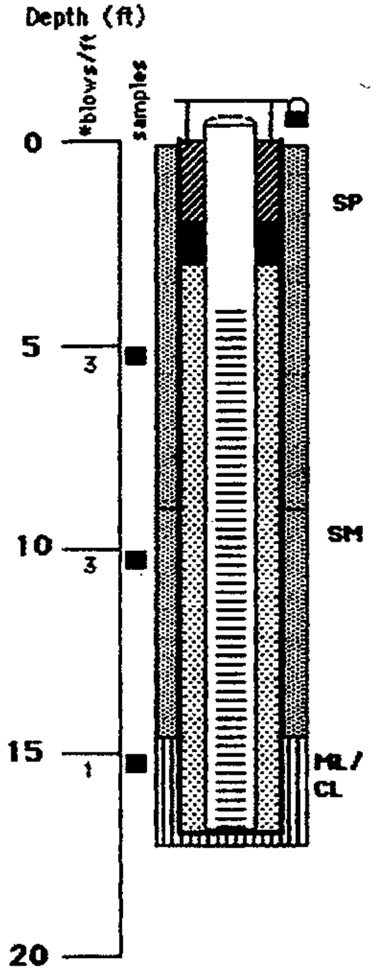
Project No. 113-909-032

Date M.W. completed 2/25/86

Supervising D & M Engineer /Geologist Andrei Ivansiu

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	18'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	17'
Screen Setting -	4' - 17'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	6.93'
Static Water Level Elevation -	Not Available
Date Measured -	1/9/87
Surface Elevation -	6.77'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Sandy gravel, dark grey, moist

Silty sand, dark grey, moist, soft

Silty clay, soft, moist, dark gray

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A6

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Andrew Ivansiu

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	3' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

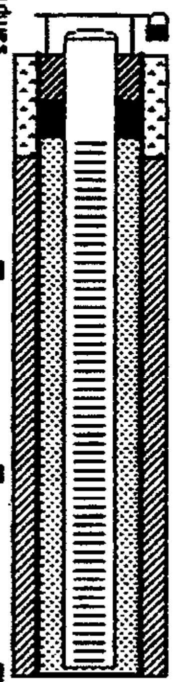
MEASUREMENTS (NGVD)

Top of Casing Elevation -	7.96'
Static Water Level Elevation -	3.25'
Date Measured -	1/9/87
Surface Elevation -	7.88'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft)	*blows/ft	samples		Description
0			SM	Sandy gravel, dark grey
5	2	■	CL	Silty clay, dark grey, moist, soft
10	4	■		Clayey silt to silty clay with plant remnants, dark gray, moist, soft
15	4	■		trace coarse gravel
20				



Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. - A7

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

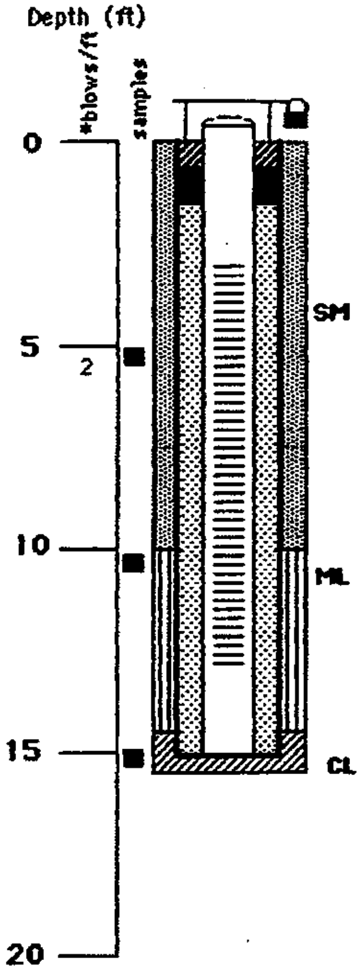
MEASUREMENTS (NGVD)

Top of Casing Elevation -	8.02'
Static Water Level Elevation -	4.95'
Date Measured -	1/9/87
Surface Elevation -	8.02'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Depth	USCS	Description
5	SM	Silty sand with gravel, dark grey-brown
10	ML	Silty sand with trace gravel, gray, soft
15	CL	Silty clay to clayey silt, gray

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

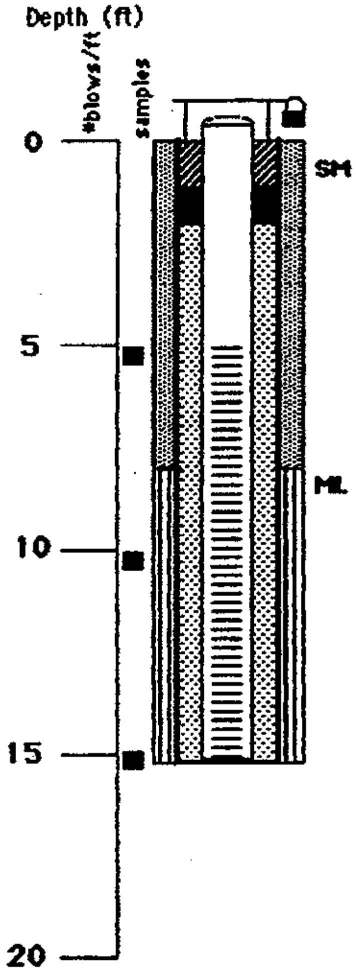
Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. - A8

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	6.29'
Static Water Level Elevation -	1.04'
Date Measured -	1/9/87
Surface Elevation -	6.13'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



Silty to clayey sand with trace gravel, brown

grades to dark gray-brown

Grades to clayey silt, greenish-brown, soft

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. - A9

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	3' -13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

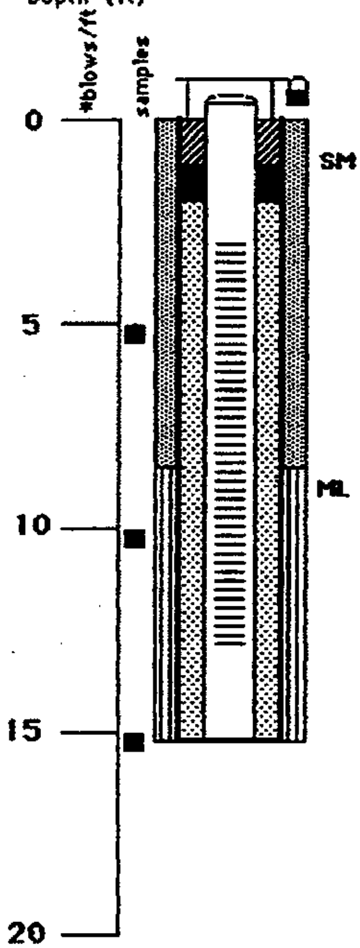
MEASUREMENTS (NGVD)

Top of Casing Elevation -	7.17'
Static Water Level Elevation -	3.23'
Date Measured -	1/9/87
Surface Elevation -	7.17'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Silty sand with some gravel, dark grey-brown

Changes to clayey silt with trace sand and gravel, greenish-brown, soft

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/25/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. - A10

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	*2 Sand
Type of Grout -	Cement/Bentonite

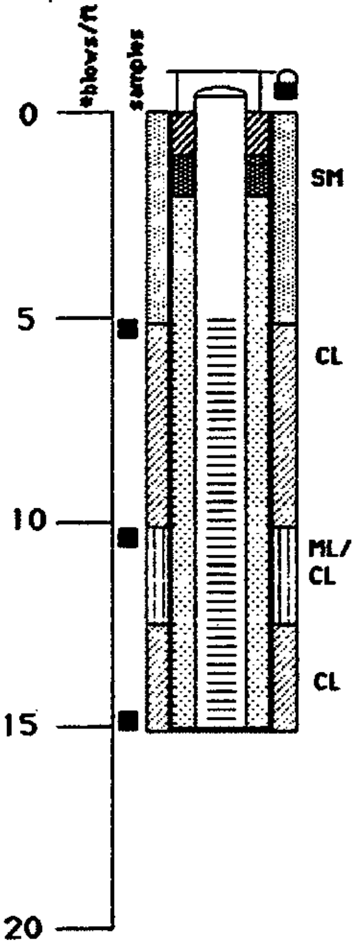
MEASUREMENTS (NGVD)

Top of Casing Elevation -	9.48'
Static Water Level Elevation -	6.04'
Date Measured -	1/13/87
Surface Elevation -	9.40'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Depth	Class	Description
0–5	SM	Silty sand with trace gravel, brown, very soft
5–10	CL	Silty clay with trace fine to med. sand, dark gray, visible product with sheen, strong chemical oder, very soft grades to greenish-grey
10	ML/CL	Silty clay to clayey silt
12–15	CL	Silty clay, light gray

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOO[RE]

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/25/86

Supervising D & M Engineer/Geologist Andrei Ivansiu

Boring/Well No. - A11

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	14'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13' 6"
Screen Setting -	3' 6" - 13' 6"
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

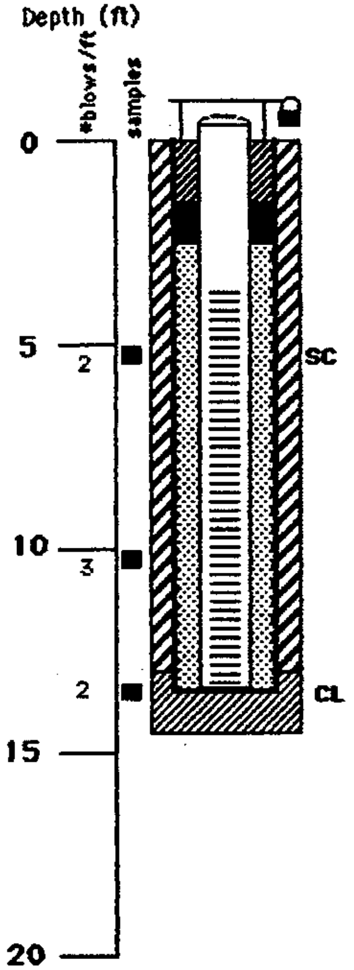
MEASUREMENTS (NGVD)

Top of Casing Elevation -	5.89'
Static Water Level Elevation -	4.04'
Date Measured -	1/13/87
Surface Elevation -	5.57'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



Depth (ft)	#blows/ft	Class	Description
5	2	SC	Silty sand with trace gravel, black; (fill)
10	3		Clayey sand with some pebbles, black, soft, loose
	2	CL	Silty clay, black, fine

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Andrei Ivansiu

Boring/Well No. - A12

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	14'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

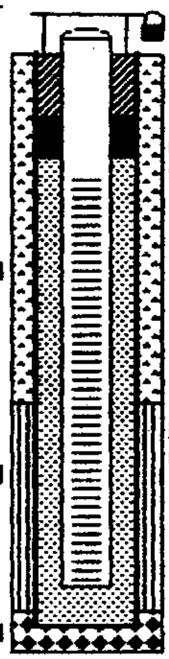
MEASUREMENTS (NGVD)

Top of Casing Elevation -	6.14'
Static Water Level Elevation -	3.53'
Date Measured -	1/13/87
Surface Elevation -	5.90'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft)	*blows/ft	samples	Description
0			
			GM/SP Sandy gravel, dark grey
5	11	■	wet, loose, strong petroleum odor
			ML/CL
10	5	■	Silty clay to clayey silt, dark grey, wet
		■	GP well washed
15	3		
20			



Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

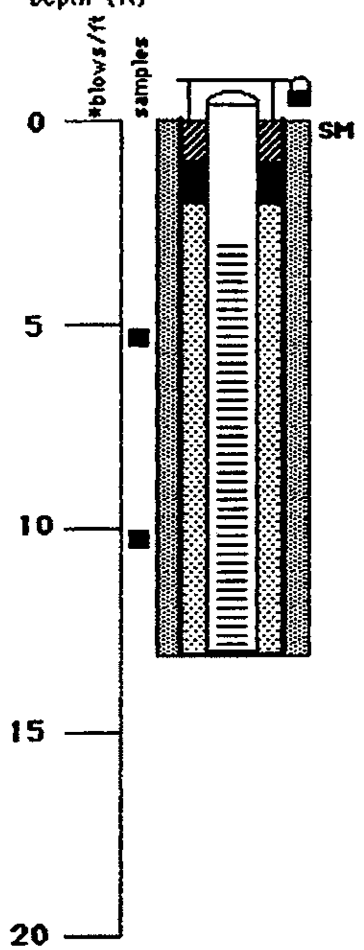
Date M.W. completed 2/27/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. -A13

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	13'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	7.91'
Static Water Level Elevation -	4.52'
Date Measured -	1/9/87
Surface Elevation -	7.83'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Silty sand with trace gravel, gray-brown

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A13D

Project No. 113-950-032

Date M.W. completed 11/13/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	11/13/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

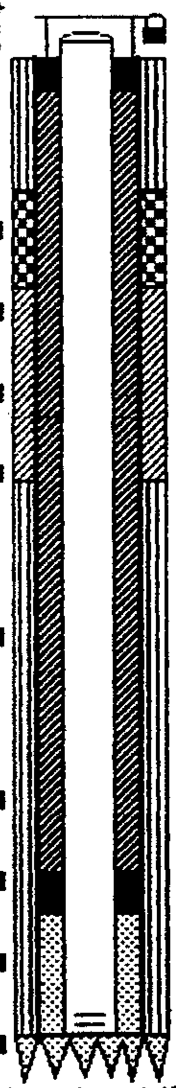
Borehole Diam. -	10"
Borehole Depth -	70'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	69'
Screen Setting -	59' - 69'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Bentonite

MEASUREMENTS(NGVD)

Top of Casing Elevation -	7.99'
Static Water Level Elevation -	-1.95'
Date Measured -	12/22/86
Surface Elevation -	8.10'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	--
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	



Depth (ft)	*blows/ft	samples		Description
0			ML	Silt with some fine to coarse sand, trace fine gravel, black, saturated; petroleum odor; petroleum residues present
10	7	■	GW	Fine gravel with some silt, little fine to coarse sand, black, loose, saturated; strong petroleum odor
	3	■	CL	Clay with little to some silt, dark gray, very soft, saturated; trace organics
20	2	■		Grading to dark brown
	3	■	ML	increasing silt; silt with some clay
30				
	3	■		Grading to medium brown
40				
	3	■		Grading to brownish-gray
50	4	■		Trace mica
	7	■		Silt with little to some clay, trace fine to medium sand, gray, medium stiff, saturated; trace organics; very micaceous
60	19	■		

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A13D (Cont.)

Project No. 113-950-032

Date M.W. completed 11/13/86

Supervising D & M Geologist David Wagner

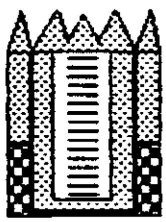
Location - Chevron Refinery

Driller - Lambert, Inc.

Drilling Completed - 11/13/86

Type of Rig - Hollow Stem Auger

Depth (ft) *blows/ft samples Description



Depth (ft)	*blows/ft		Description
60	19	SP	Fine sand with little to some medium sand, trace silt, reddish-brown, medium dense, saturated
	117	GW	Fine to coarse gravel with some fine to coarse sand, reddish-brown, very dense, saturated
70	50/1"		
80			
90			

WELL CONSTRUCTION KEY

FILTER PACK

BENTONITE SEAL

BENTONITE GROUT

CAVE IN MATERIAL

CONCRETE

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

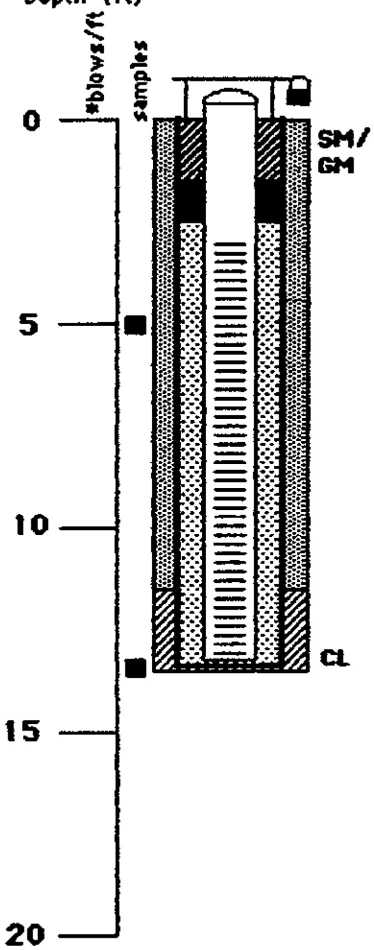
Date M.W. completed 2/26/86

Supervising D & M Engineer /Geologist: Mark Robertson

Boring/Well No. -A14

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/26/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	13'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	8.55'
Static Water Level Elevation -	4.95'
Date Measured -	1/13/87
Surface Elevation -	8.55'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) — Description



Silty sand and gravel, brown

grades dark grey

gravel decreasing

very loose

Silty clay with trace sand, light gray, wet

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

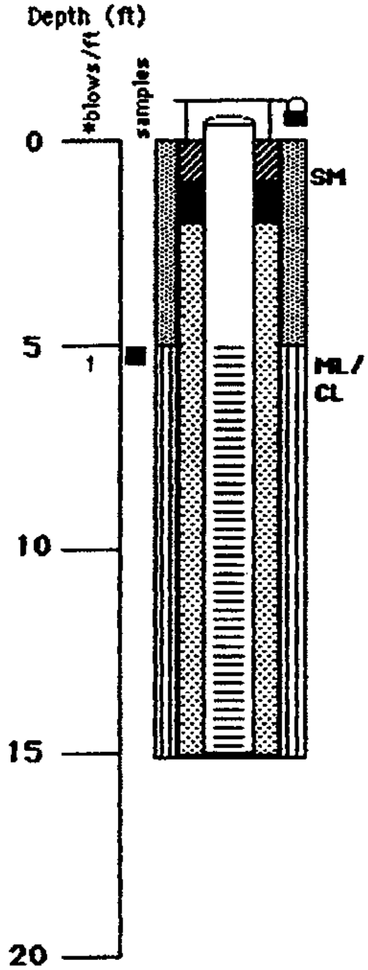
LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project: Chevron/Philadelphia Refinery

Boring/Well No. - A15

Project No.	113-909-032
Date M.W. completed	2/25/86
Supervising D & M Engineer/Geologist	Mark Robertson

Depth (ft)　　Description



Silty sand with gravel, brown

grades to black

Silty clay with trace sand, greenish-grey, very soft

trace peat

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	6.90'
Static Water Level Elevation -	6.48'
Date Measured -	1/13/87
Surface Elevation -	6.84'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOOI

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/25/86

Supervising D & M Engineer /Geologist Mark Robertson

Boring/Well No. - A16

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	14'
Screen Setting -	1'6" - 11'6"
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

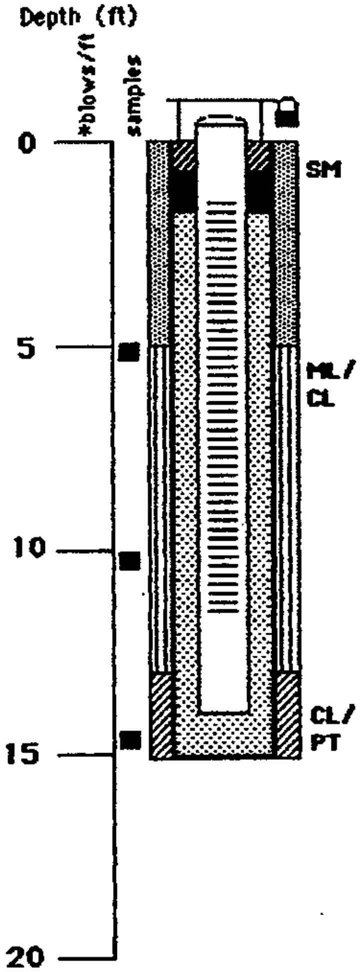
MEASUREMENTS (NGVD)

Top of Casing Elevation -	8.47'
Static Water Level Elevation -	6.33'
Date Measured -	1/13/87
Surface Elevation -	7.81'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



Depth	Class	Description
0	SM	Silty sand with some gravel and cobbles, dark-grey
		decreasing cobbles and gravel
5	ML/CL	Clayey silt, green
		grades to greenish-brown
14	CL/PT	grades to silty clay and peat

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. -A17

Project No.	113-909-032
Date M.W. completed	2/27/86
Supervising D & M Engineer/Geologist	Ralph T. Golia

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	14'
Screen Setting -	2' - 12'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	*2 Sand
Type of Grout - Cement/Bentonite	

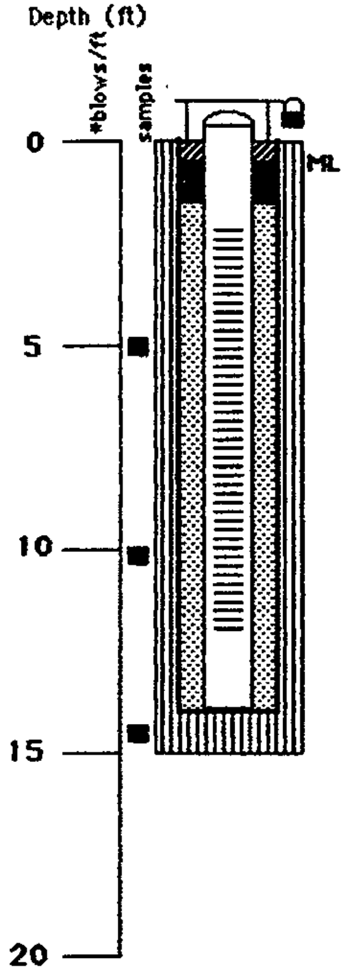
MEASUREMENTS (NGVD)

Top of Casing Elevation -	9.42'
Static Water Level Elevation -	6.02'
Date Measured -	1/13/87
Surface Elevation -	9.34'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



Clayey silt with some fine gravel and sand, blackish-brown, moist, soft; petroleum odor

very moist, some wood debris, petroleum odor

increased moisture

saturated

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. -A18

Project No.	113-909-032
Date M.W. completed	2/27/86
Supervising D & M Engineer/Geologist	Ralph T. Golia

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	12'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	12'
Screen Setting -	2' - 12'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

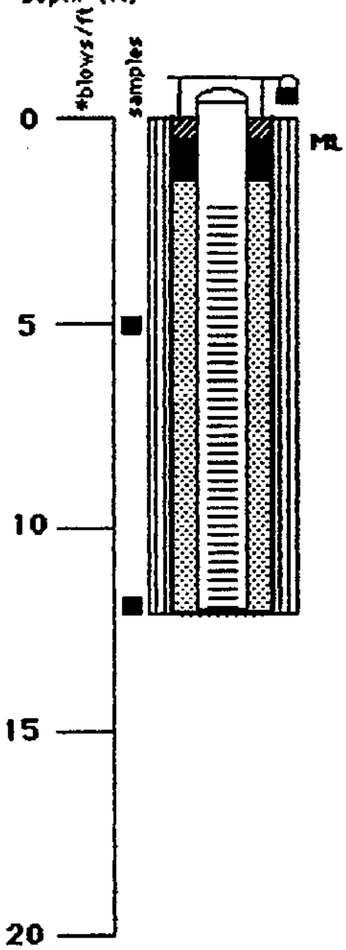
MEASUREMENTS (NGVD)

Top of Casing Elevation -	9.52'
Static Water Level Elevation -	7.27'
Date Measured -	1/13/87
Surface Elevation -	9.35'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



ML — Clayey silt with some fine gravel and sand, blackish-brown, moist, soft; petroleum odor

very moist to wet, some wood debris, petroleum odor

increased moisture; wet to saturated

sample not collected

resistance; wood at 10'

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

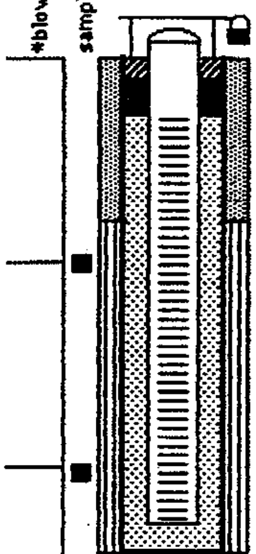
Date M.W. completed 2/27/86

Supervising D & M Engineer/Geologist Ralph T. Golia

Boring/Well No. -A19

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	12'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	11'6"
Screen Setting -	1'6" - 11'6"
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	9.52'
Static Water Level Elevation -	5.77'
Date Measured -	1/13/87
Surface Elevation -	9.28'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) *blows/ft samples Description



Depth (ft)		Description
0		Asphalt
	SM	Silty sand with some gravel and trace clay, medium brown, damp, medium dense,(fill)
		change to blackish-brown, slight petroleum odor
5	ML	Clayey silt with trace sand, blackish-brown, wet to saturated, soft; petroleum oder
10		wood debris; resistance
15		
20		

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project: Chevron/Philadelphia Refinery

Boring/Well No. - A19D

Project No. 113-950-032

Date M.W. completed 10/30/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	10/30/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	60'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	60'
Screen Setting -	50' - 60'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	*2 Sand
Type of Grout -	Bentonite

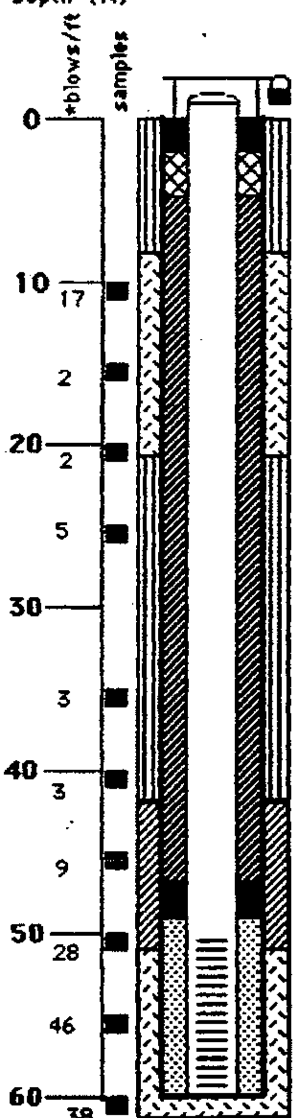
MEASUREMENTS(NGVD)

Top of Casing Elevation -	11.69'
Static Water Level Elevation -	-1.71'
Date Measured -	12/22/86
Surface Elevation -	8.69'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



ML Silt with some fine to coarse sand, trace clay, brown, soft, moist; petroleum odor
Grading to very dark gray, saturated

SW Fine to coarse sand with some fine gravel, little silt, blackish-gray, medium dense, saturated; resistance encountered - wood

ML Silt with some clay, dark gray, soft, moist; organics; micaceous; weak petroleum odor

SHELBY TUBE taken from 30' to 31.5'

Increasing clay; silt and clay

CL Clay with some silt and little fine sand, reddish-brown, soft, saturated, micaceous

SW Fine to coarse sand with some fine gravel, reddish-brown, medium dense, saturated
Grading to brownish-gray
Increasing density: dense
Increasing gravel: fine gravel and sand

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE GROUT
- CAVE IN MATERIAL
- CONCRETE

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project :Chevron/Philadelphia Refinery

Project No. 113-909-032

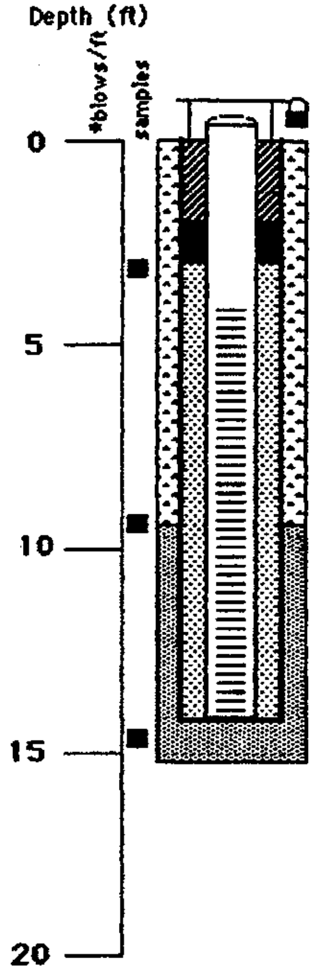
Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Andreu Ivansiu

Boring/Well No. - A20

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	14'
Screen Setting -	4'-14'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	8.81'
Static Water Level Elevation -	4.08'
Date Measured -	1/13/87
Surface Elevation -	8.73'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

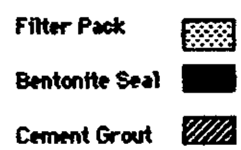
Depth (ft) | Description



GM Silty to clayey fine sand, black, moist, soft, petroleum odor

SP Sand with some pebbles, black, wet, petroleum oder

WELL CONSTRUCTION KEY



Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

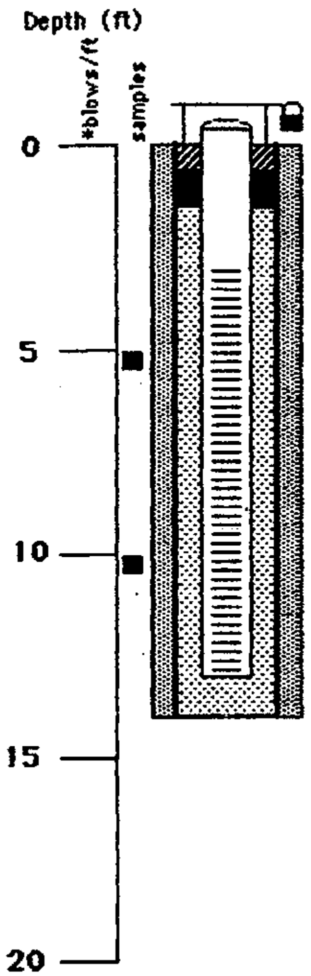
Project : Chevron/Philadelphia Refinery

Boring/Well No. - A21

Project No. 113-909-032

Date M.W. completed 2/25/86

Supervising D & M Engineer/Geologist: Mark Robertson



Description

SM Silty sand with some gravel and cobble

grades to black, strong petroleum odor

decreasing gravel and cobbles

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/25/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	13'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	9.84'
Static Water Level Elevation -	Not Available
Date Measured -	1/13/87
Surface Elevation -	9.02'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOO

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project: Chevron/Philadelphia Refinery

Boring/Well No. - A21D

Project No.	113-950-032
Date M.W. completed	10/28/86
Supervising D & M Geologist	David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	10/28/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	85'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	85'
Screen Setting -	75' - 85'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

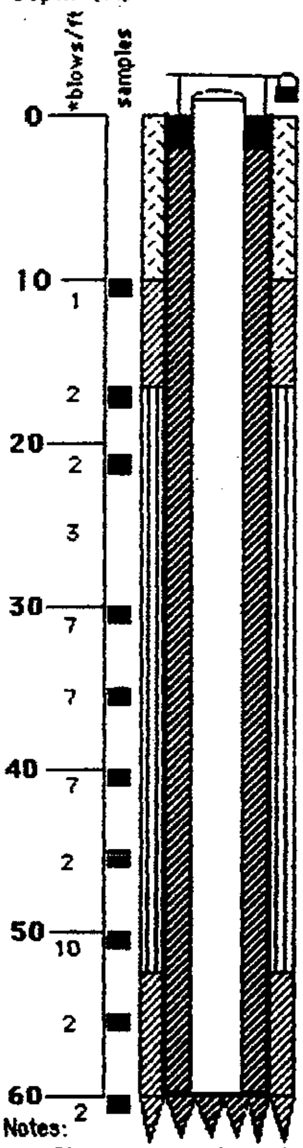
MEASUREMENTS(NGVD)

Top of Casing Elevation -	12.18'
Static Water Level Elevation -	-4.13'
Date Measured -	12/22/86
Surface Elevation -	8.48'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



SW Fine to coarse sand with some silt, little fine gravel, very dark brown, soft, very moist; wood debris, brick, wire, etc.; petroleum odor; oily

CL Clay with little silt, trace fine sand, very dark brown, soft, saturated; very strong petroleum odor; oily

ML Silt with some clay, trace fine sand, medium gray, soft, saturated; trace mica; trace organics; petroleum odor
Decreasing clay; little clay, weak petroleum odor
SHELBY TUBE taken from 19' to 21'
Decreasing clay and increasing fine sand; trace to little clay, little fine sand
2" sand lense at 36'; fine to medium sand with little clay, medium gray, trace mica
Silt with little to some clay, little fine sand, dark gray, soft, saturated; wood debris
Increasing clay and decreasing fine sand; some clay, trace fine sand
Decreasing clay: little clay
No petroleum odor

CL Clay with little silt, dark gray, soft, saturated; trace mica

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE/CEMENT
- CAVE IN MATERIAL
- CONCRETE

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE

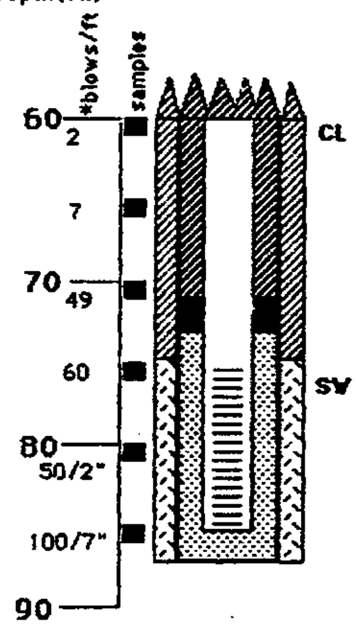
LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project: Chevron/Philadelphia Refinery

Boring/Well No. - A21D **(Cont.)**

Project No.	113-950-032	Location -	Chevron Refinery
Date M.W. completed	10/28/86	Driller -	Lambert, Inc.
Supervising D & M Geologist	David Wagner	Drilling Completed -	10/28/86
		Type of Rig -	Hollow Stem Auger

Depth(ft.) Description



CL — Increasing silt: some silt

6" lense of fine to medium sand with little coarse sand at 66', grayish-brown, saturated

Clay with some silt, trace to little fine sand, dark-gray, soft, saturated

Little to some fine gravel and little fine to coarse sand

SW — Fine to coarse sand with some fine gravel, brownish-gray, very dense, saturated

Fine to coarse sand with some fine gravel, trace clay(white), very light gray, very dense, saturated

Weathered bedrock: Wissahickon Schist

WELL CONSTRUCTION KEY

- FILTER PACK
- BENTONITE SEAL
- BENTONITE/CEMENT
- CAVE IN MATERIAL
- CONCRETE

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. -A22

Project No.	113-909-032
Date M.W. completed	2/26/86
Supervising D & M Engineer/Geologist	Mark Robertson

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/26/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5' - 15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

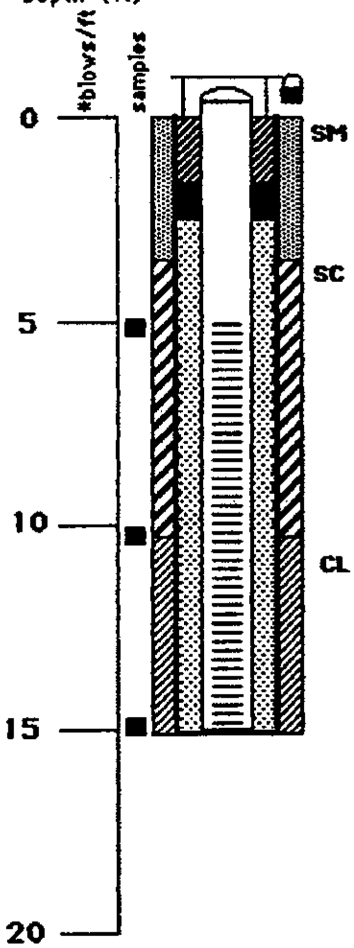
MEASUREMENTS (NGVD)

Top of Casing Elevation -	9.02'
Static Water Level Elevation -	1.71'
Date Measured -	1/13/87
Surface Elevation -	8.78'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) — Description



SM — Silty sand with trace gravel, discolored, strong petroleum odor

SC — Silty to clayey fine to coarse sand with trace fine gravel, petroleum odor

CL — Silty clay, gray, petroleum odor

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOOR

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

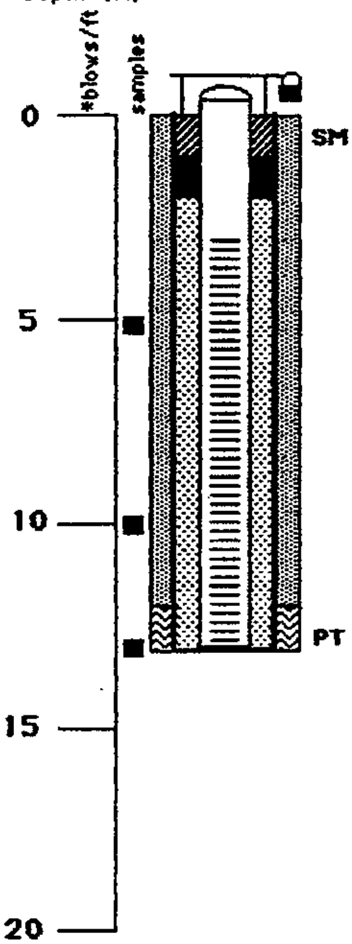
Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/27/86

Supervising D & M Engineer / Geologist Mark Robertson

Depth (ft) — Description



SM — Silty sand with some gravel and mica flakes, light brown

grades to dark brown with trace gravel, very soft

grades to grey-brown

PT — Fibrous peat

Boring/Well No. -A23

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	13'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	4.71'
Static Water Level Elevation -	4.31'
Date Measured -	1/13/87
Surface Elevation -	4.71'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

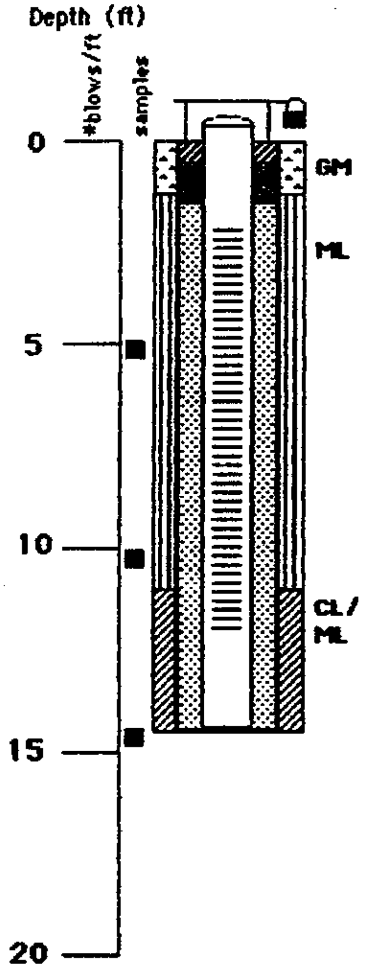
Date M.W. completed 2/24/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. - A24

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/24/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	14' 6"
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	14' 6"
Screen Setting -	2' - 12'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	6.54'
Static Water Level Elevation	3.78'
Date Measured -	1/9/87
Surface Elevation -	6.46'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) — Description



GM	Silty sand with gravel, brown
ML	Silt with some sand, black, discolored, strong odor
CL/ML	Silty clay with trace sand, green, medium stiff grades to brown with some peat fibers

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

Date M.W. completed 2/27/86

Supervising D & M Engineer/Geologist Mark Robertson

Boring/Well No. -A25

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	13'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3' - 13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

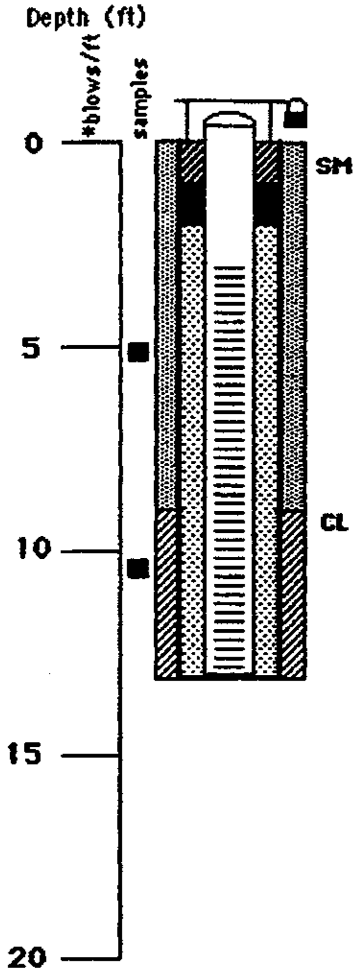
MEASUREMENTS (NGVD)

Top of Casing Elevation -	10.46'
Static Water Level Elevation -	5.16'
Date Measured -	1/13/87
Surface Elevation -	10.38'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	--
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) | Description



Depth	Description
0 (SM)	Silty sand with trace gravel, brown
	decreasing sand and gravel
	very moist
(CL)	Silty clay, grey

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. -A26

Project No.	113-909-032
Date M.W. completed	2/27/86
Supervising D & M Engineer/Geologist	Ralph T. Golia

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	3'6" - 13'6"
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite

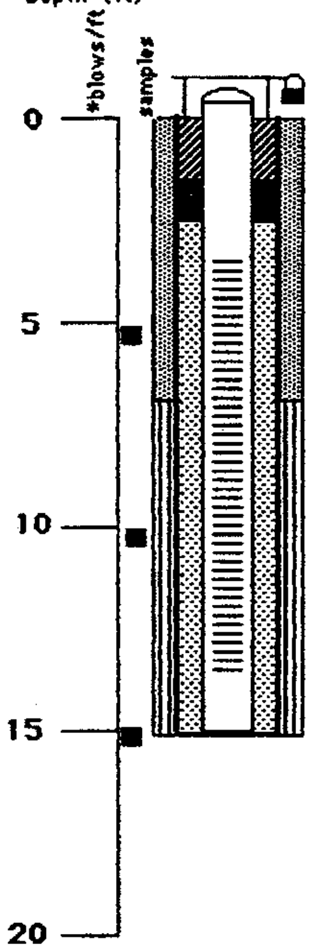
MEASUREMENTS (NGVD)

Top of Casing Elevation -	11.38'
Static Water Level Elevation -	4.23'
Date Measured -	1/13/87
Surface Elevation -	11.24'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) — Description



Asphalt

SP — Gravelly sand with trace silt and clay, reddish-brown, damp, medium dense; fill

change to dark brown

moist to very moist

ML/CL — Clayey silt to silty clay, blackish-brown, wet to saturated, soft; slight petroleum oder

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOORE

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Project No. 113-909-032

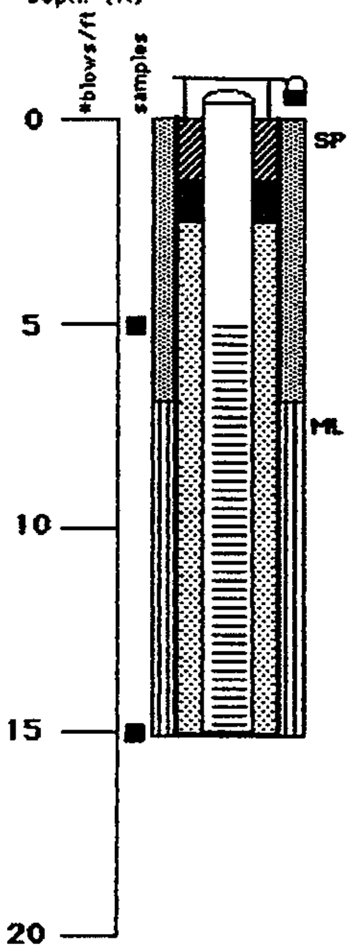
Date M.W. completed 2/27/86

Supervising D & M Engineer /Geologist Ralph T. Golia

Boring/Well No. -A27

Location -	Chevron Refinery
Driller -	Warren George
Drilling Completed -	2/27/86
Type of Rig -	Hollow Stem Auger
CONSTRUCTION DATA	
Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	15'
Screen Setting -	5'-15'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	Cement/Bentonite
MEASUREMENTS (NGVD)	
Top of Casing Elevation -	12.08'
Static Water Level Elevation -	3.84'
Date Measured -	1/13/87
Surface Elevation -	11.58'
TEST DATA	
Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



Gravelly sand with trace silt and clay, reddish-brown, damp, medium dense

change to dark brown

moist to very moist

Clayey silt to silty clay with trace wood, blackish-brown, wet to saturated, soft; slight petroleum odor, wood

Notes:

* Blows taken using a 140 lb hammer falling 30 inches.

** All soils classified by visual inspection.

WELL CONSTRUCTION KEY

Filter Pack

Bentonite Seal

Cement Grout

DAMES & MOOR

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-39
DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 13' WELL DIAMETER 4"
DATE(S) DRILLED 18 JULY 1988
ELEVATION 8.93 (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 24" PVC STICKUP, 30" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
				4-6-4-4	(0 - 2.0')
	1		Stone, silt, and brick fill		
	2				
				11-10-4-10	(2 - 4')
	3		Poorly sorted sand, some silt		PID = ND
			Clean, fine sand (lens)		EX = 0%
	4		Micaceous clayey silt, moist at 5'. Wet on spoon at 6'		
	5				
				3-2-3-1	(5 - 7')
	6				PID = 5ppm
					EX = 30%
	7		Clayey silt, slightly plastic, moist		
	8				PID = 4.5ppm
					EX = 5%
	9				
	10		Fine gravel, some coarse sand.HC staining and odors		
				11-11-6-3	(10 - 12')
	11		Very plastic clay, trace silt, HC staining		
	12		Coarse angular gravel, some sand, HC staining and odor		
					PID = Photoionization Device
	13				EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-40
DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 13' WELL DIAMETER 4"
DATE(S) DRILLED 18 JULY 1988
ELEVATION 10.06' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 39" PVC STICKUP, PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
	1			4-2-1-1	(0 - 2)
					PID = 12.5ppm
	2		Silt, stone, and brick fill, HC stained		
	3				
	4			14-17-19-8	(3 - 5)
					PID = 4ppm
	5		Fine, well-sorted sand (fill)		EX = 0%
	6				
	7			10-3-2-5	(5 - 7)
			Fill with brick, some silty sand. Wet on spoon at 5.5'		
	8				
	9				
	10				
	11		Black, HC stained medium sand, some medium gravel		
				3-2-2-4	(10 - 12)
	12		Slightly plastic clay, HC stained, fill		
	13		Fill		PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-41

DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 13' WELL DIAMETER 4"
DATE(S) DRILLED 18 JULY 1988
ELEVATION 9.94' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 39" PVC STICKUP, 42" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
				4-1-1-2	(0 - 2)
	1				
	2		Stone and brick fill		
	3			6-7-6-2	(2.5 - 4.5)
	4				
	5		Silty sand, trace of medium gravel. HC stained. Wet on spoon at 5.5'		
				11-12-6-4	(5 -7)
	6				
	7				
	8		Clayey silt, some medium sand and gravel		
	9				
	10		Tight plastic clay, HC stained, some fill	15-11-10-9	(10 - 12)
	11				
	12		Clayey silt.		
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-43

DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
WELL DEPTH 13' WELL DIAMETER 4"
ELEVATION 11.0' (PVC)

DRILL RIG MOBILE DRILL® B-57
DRILL METHOD HOLLOW STEM AUGER
DATE(S) DRILLED 19 JULY 1988
LOGGED BY C. CARLSON

ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 24" PVC STICKUP, 30" PROTECTIVE STEEL CASING

DEPTH	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
2	Silt fill, some gravel. Black, heavily stained, with strong HC odor		(2.5 - 4.5) PID = 45ppm EX = 0%
5	Same, but increase in clayey silt and moisture. Wet on spoon at 6'. Heavy HC residue on soil.	4-3-4-4	(5 - 7) PID = 10ppm Ex = 0%
10	Clayey sand, wet, slight odor	6-4-4-5	(10 - 12)

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

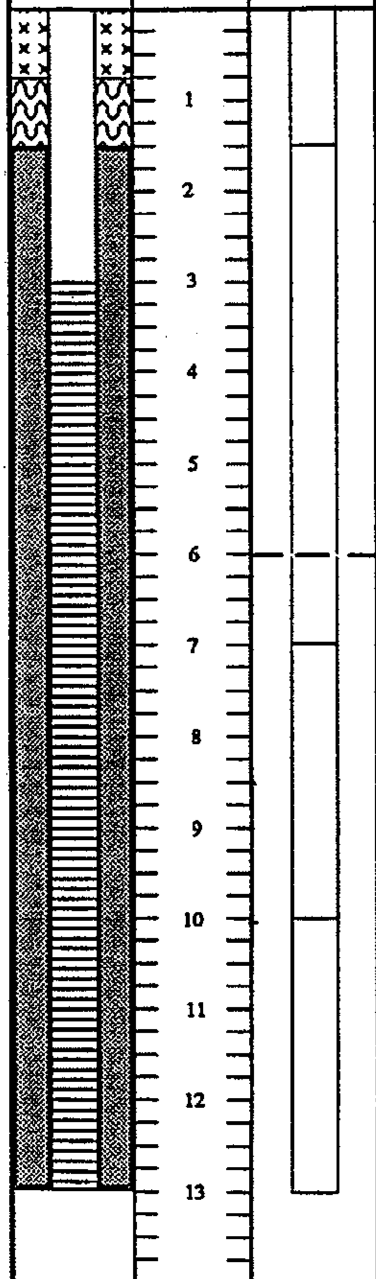
PID = Photoionization Device
EX = Explosimeter
HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-44
DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 13' WELL DIAMETER 4"
DATE(S) DRILLED 19 JULY 1988
ELEVATION 11.20' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 24" PVC STICKUP, 30" PROTECTIVE STEEL CASING



WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
	1		Asphalt, cobble and gravel fill		
	2				
	3		Medium, well sorted sand with some silt, cinders. wet on spoon at 6', strong HC odors		(2.5 - 4.5) PID = 15ppm EX = 0%
	4				
	5				
	6				
	7				
	8		Silty sand, strong HC odor. Visible residue on particles		PID = 10ppm
	9				
	10				
	11		Fine to medium gravel and sand, some wood.	2-1-1-1	(10 - 12)
	12				
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-45
DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 13' WELL DIAMETER 4"
DATE(S) DRILLED 19 JULY 1988
ELEVATION 6.02' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 12" MANHOLE, FLUSH WITH GRADE, LOCKING STEP-ON CAP

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
			Asphalt		Offset 2X - Encountered concrete
	1		Fill, silt, trace of gravel		
	2				
				3-3-2-3	(2.5 - 4.5)
	3		Silty, medium, poorly sorted sand, strong HC odor and staining		PID = 7ppm
	4				EX = 0%
	5		Silty clay, slighty plastic. Wet on spoon at 6'		
				7-2-5-4	(5 - 7)
	6		Silty sand, HC stain and odor		
	7				
	8		Wet, sandy clay, very plastic		PID = 3ppm
	9				EX = 0%
	10				
	11		Silty clay, very plastic, grading to slightly sandy, silty clay with depth.		
	12		Slightly running sand at 13'		
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-46
DRILLER: GT DRILLING

CASED FROM 0 TO 2' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 2' TO 12' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 12' WELL DIAMETER 4"
DATE(S) DRILLED 19 JULY 1988
ELEVATION 12.01' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 24" PVC STICKUP, 30" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
	1		Cobble and gravel fill		
	2				
	3			5-6-7-7	(2.5 - 4.5)
	4		Brick and cobble fill		
	5				
	6		Same, but with clayey silt and minor brick		
	7		Clayey medium sand, HC odor and stain	5-6-4-4	(5 - 7)
	8				PID = 4ppm
					EX = 0%
	9		Silt and gravel .brick fill		
	10				
	11		Clayey medium sand, Slight HC staining and odor	10-7-8-5	(10 - 12)
	12				
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-47
DRILLER: GT DRILLING

CASED FROM 0 TO 2' WITH THREADED PVC
DRILL RIG MOBILE DRILL® B-57
SCREENED FROM 2' TO 12' WITH 0.010" SLOT
DRILL METHOD HOLLOW STEM AUGER
WELL DEPTH 12' WELL DIAMETER 4"
DATE(S) DRILLED 19 JULY 1988
ELEVATION 8.58' (PVC)
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 24" PVC STICKUP, 30" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
	1			3-2-2-4	(2.5 - 4.5)
	2		Gravel and micaceous silt fill, some medium sand, some		
			HC odor		
	3				
	4				
	5				
			Medium sand and silt. Wet on spoon at 5'		
	6			1-1-1-1	(5 - 7)
	7				
	8		Slightly clayey silt, minor plasticity		
	9				
	10				
			Slightly silty clay, very plastic. HC staining and odors	1-3-2-2	(10 - 12)
	11				
	12				
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-48
DRILLER: GT DRILLING

CASED FROM 0 TO 2.5' WITH THREADED PVC
SCREENED FROM 2.5' TO 12.5' WITH 0.010" SLOT
WELL DEPTH 12.5' WELL DIAMETER 4"
ELEVATION 7.70' (PVC)
DRILL RIG MOBILE DRILL® B-57
DRILL METHOD HOLLOW STEM AUGER
DATE(S) DRILLED 20 JULY 1988
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 30" PVC STICKUP, 30" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
			Silt and gravel fill		
	1		Heavily oil-stained silt and medium gravel fill		
	2			3-2-2-1	(2.5 - 4.5)
	3				
	4				
	5		Same, free oil in split spoon		
	6			2-2-2--1	(5 - 7)
	7				
	8				
	9				
	10				
	11			2-1-3-1	(10 - 12)
	12		Slightly silty clay, slightly plastic. HC stained.		
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

GROUNDWATER TECHNOLOGY, INC.

CLIENT: CHEVRON USA, INC.
PROJECT NAME: CHEVRON REFINERY
PROJECT NUMBER: 300-175-3482
LOCATION: PHILADELPHIA, PA

DATE 30 AUGUST 1988 WELL NUMBER A-49

DRILLER: GT DRILLING

CASED FROM 0 TO 3' WITH THREADED PVC
SCREENED FROM 3' TO 13' WITH 0.010" SLOT
WELL DEPTH 13' WELL DIAMETER 4"
ELEVATION 8.44' (PVC)
DRILL RIG MOBILE DRILL® B-57
DRILL METHOD HOLLOW STEM AUGER
DATE(S) DRILLED 20 JULY 1988
LOGGED BY C. CARLSON
ANNULUS COMPLETION 2" ANNULUS PACKED WITH #1 MORIE SAND, BENTONITE SEALED, CONCRETE GROUTED.
OTHER 30" PVC STICKUP, 30" PROTECTIVE STEEL CASING

WELL DETAIL	DEPTH	GRAPHIC COLUMN	LITHOLOGICAL DESCRIPTION	SAMPLE	COMMENTS
			Gravel and silt fill		
	1			2-2-1-1	(2.5 - 4.5)
	2				
	3		Very clayey silt, HC odors, oil soaked to 4.5'		
	4				
			Wet at 5'	1-1-2-1	(5 - 7)
	5				
	6				
	7				
	8		Clayey silt, some minor amounts of medium sand present in sparse lenses.		
	9				
	10			2-3-4-4	(10 -12)
	11				
	12				
	13				PID = Photoionization Device
					EX = Explosimeter
					HC = Hydrocarbon

LOG of BORING and MONITORING WELL CONSTRUCTION DETAILS

Project : Chevron/Philadelphia Refinery

Boring/Well No. - A91

Project No. 113-950-032

Date M.W. completed 10/21/86

Supervising D & M Geologist David Wagner

Location -	Chevron Refinery
Driller -	Lambert, Inc.
Drilling Completed -	10/21/86
Type of Rig -	Hollow Stem Auger

CONSTRUCTION DATA

Borehole Diam. -	10"
Borehole Depth -	15'
Casing/Screen Type -	PVC
Casing Diam. -	4"
Casing Depth -	13'
Screen Setting -	3'-13'
Slot Width -	0.02"
Type of Seal -	Bentonite
Type of Filterpack -	#2 Sand
Type of Grout -	

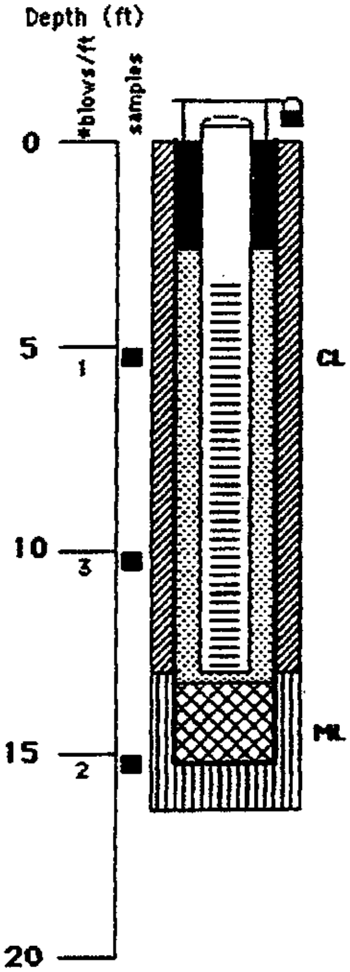
MEASUREMENTS(NGVD)

Top of Casing Elevation -	10.85'
Static Water Level Elevation -	5.93'
Date Measured -	1/14/87
Surface Elevation -	7.85'

TEST DATA

Pump Type -	
Depth to Intake (ft) -	
Satic Water Level (ft) -	
Pumping Water Level (ft) -	
Drawdown (ft) -	
Length of Test (Hrs) -	

Depth (ft) Description



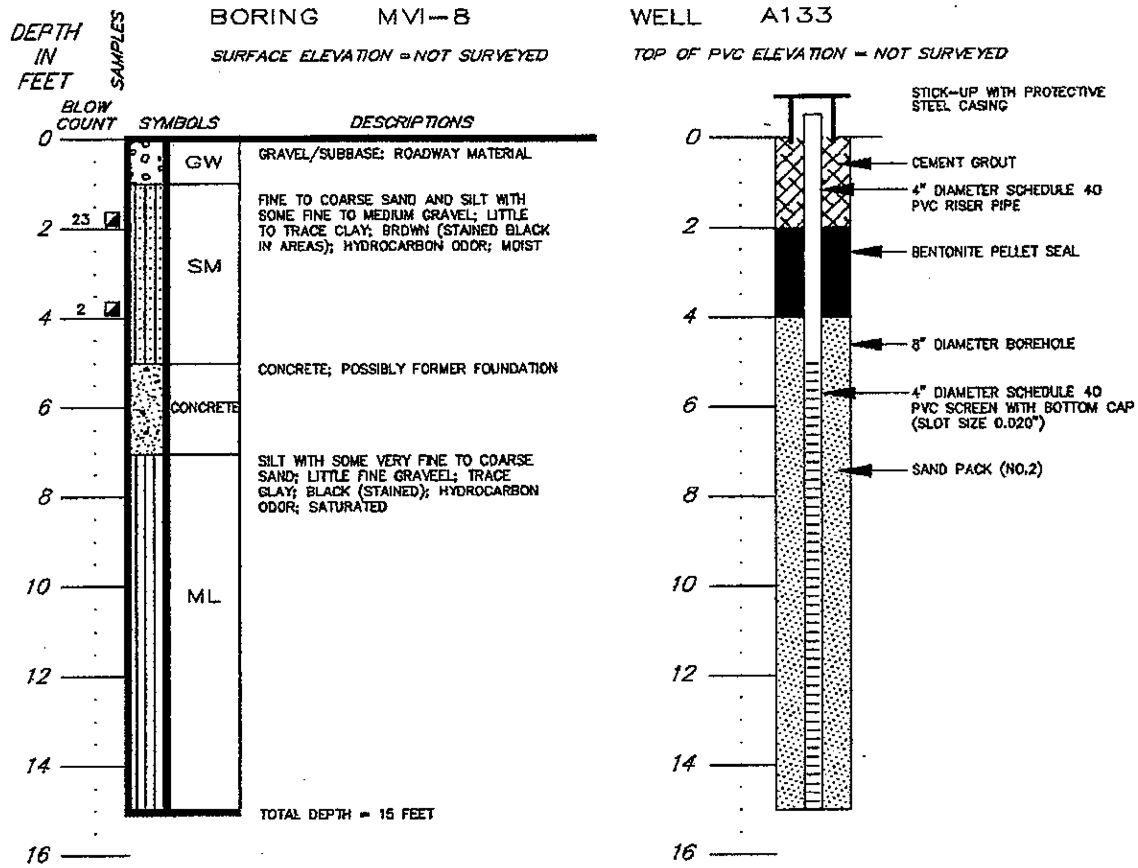
Depth (ft)	*blows/ft		Description
5	1	CL	Clay with some silt, blackish-brown, very soft, saturated; organics; petroleum odor
10	3		Decreased clay; silt and clay
15	2	ML	Inceased silt; silt with some clay; weak petroleum odor

WELL CONSTRUCTION KEY

FILTER PACK
BENTONITE SEAL
CONCRETE
CAVE IN MATERIAL

Notes:
* Blows taken using a 140 lb hammer falling 30 inches.
** All soils classified by visual inspection.

DAMES & MOORE



EXPLANATION:

2-FOOT SPLIT-SPOON SAMPLE COLLECTED FROM THIS INTERVAL

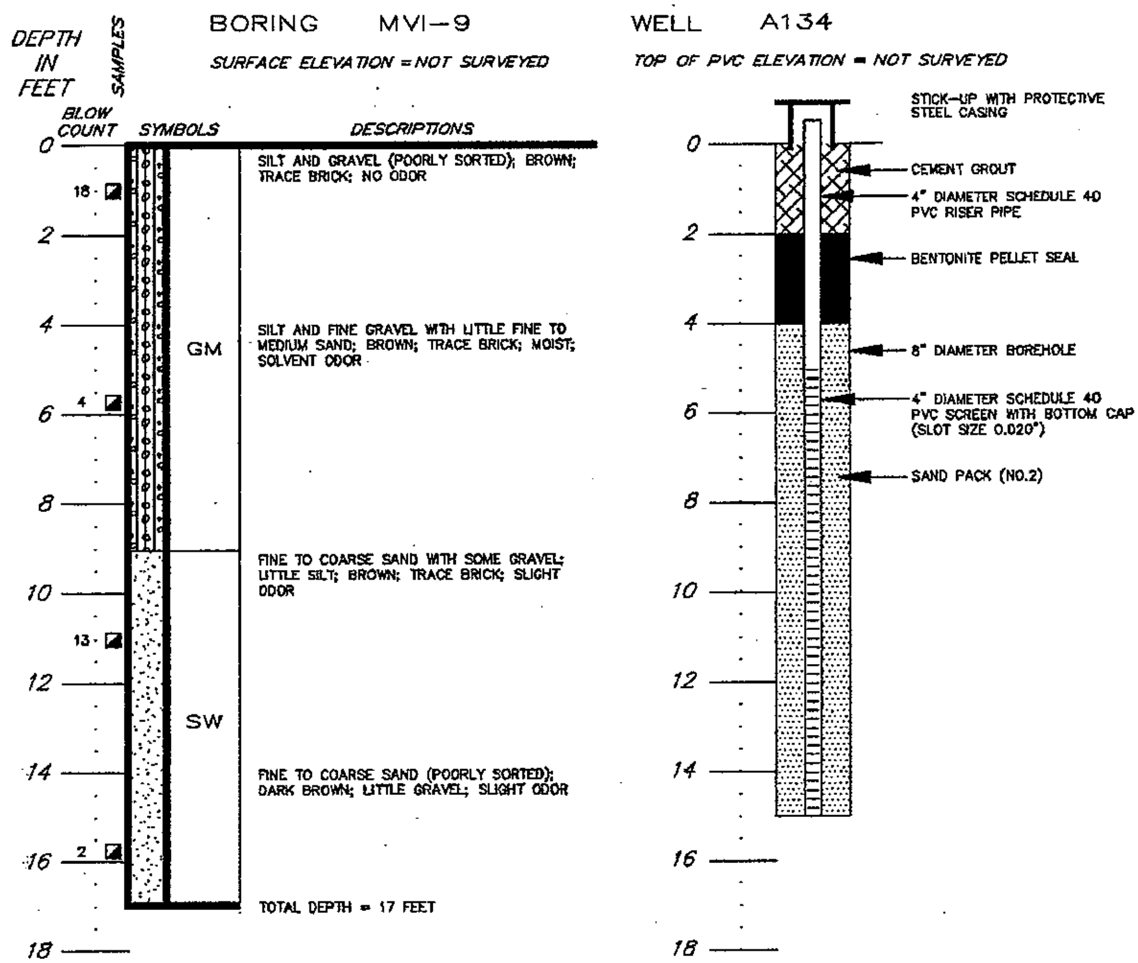
NOTES:

1. BORING ADVANCED WITH A DRILL RIG AND SPLIT-SPOON SAMPLER ON 8/4/92 & 8/6/92 BY MARCOR DRILLING OF EXTON, PENNSYLVANIA.
2. BORING TERMINATED AT 15 FEET ON 8/6/92.
3. MONITORING WELL A133 INSTALLED ON 8/6/92.
4. MONITORING WELL A133 DEVELOPED ON 8/19/92.
5. SAMPLES WERE COLLECTED AT THIS SOIL BORING LOCATION WITH A 3-INCH STAINLESS STEEL SPLIT-SPOON SAMPLER.
6. A "BLOW-COUNT" REFERS TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT-SPOON SAMPLER A DISTANCE OF ONE FOOT (UNLESS OTHERWISE NOTED) USING A 140 lb. HAMMER FALLING 30 INCHES.
7. DEPTH TO WATER MEASURED TO BE 10.19 FEET ON 9/2/92.
8. DEPTH TO FREE-PHASE HYDROCARBON MEASURED TO BE 9.95 FEET ON 9/2/92.
9. IN ORDER TO DRILL THROUGH THE CONCRETE AT 6 TO 7 FEET BELOW GROUND SURFACE (BGS) THE BOTTOM OF THE LEAD AUGER WAS "PLUGGED" WITH WOOD. THIS WOOD PLUG COULD NOT BE REMOVED, AND, THUS THIS BOREHOLE WAS LOGGED FROM DRILL CUTTINGS FROM 7 FEET TO 15 FEET BGS.

LOG OF SOIL BORING AND MONITORING WELL DETAIL
CHEVRON REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE

(2) CHEVRON\TG-MVI8 10/05/92 09:09



EXPLANATION:

2–FOOT SPLIT–SPOON SAMPLE COLLECTED FROM THIS INTERVAL

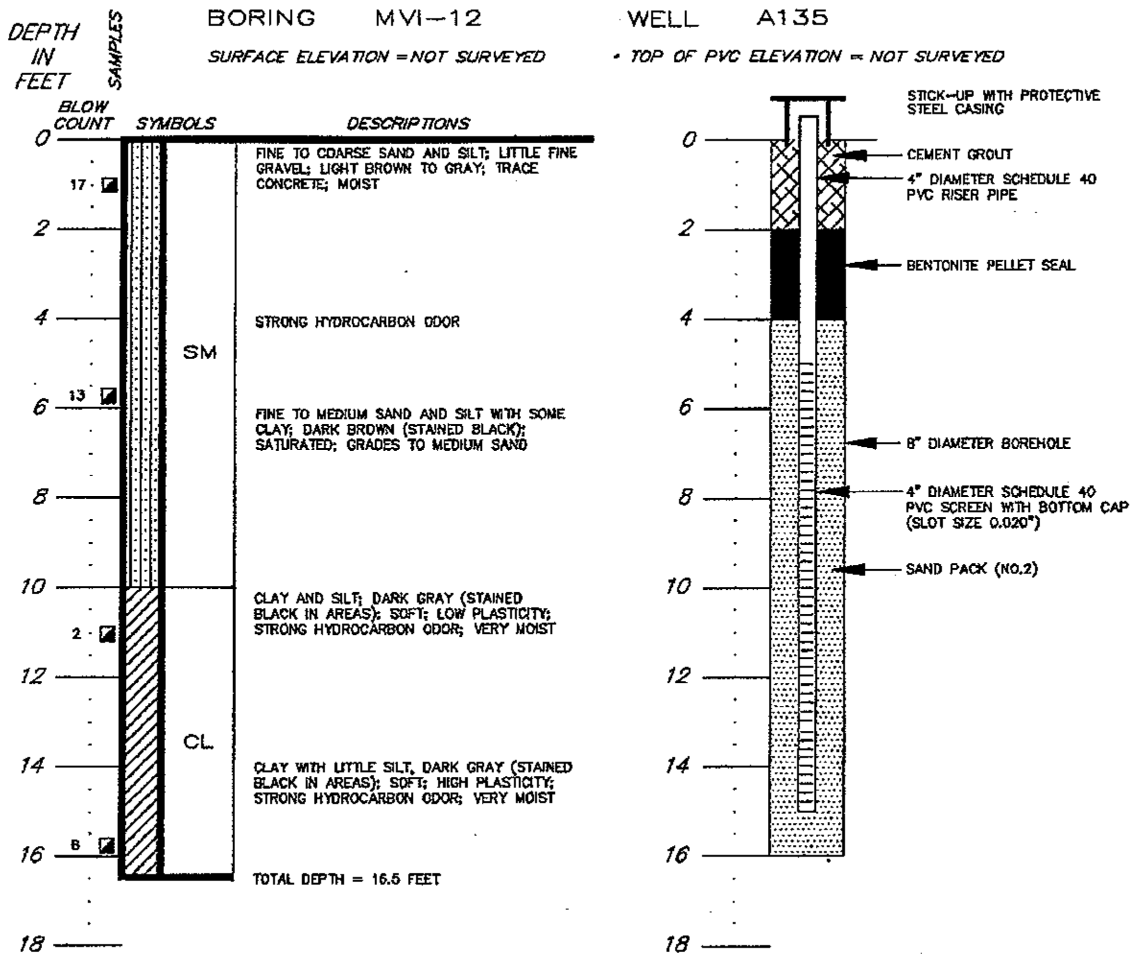
NOTES:

1. BORING ADVANCED WITH A DRILL RIG AND SPLIT–SPOON SAMPLER ON 8/6/92 BY MARCOR DRILLING OF EXTON, PENNSYLVANIA.
2. BORING TERMINATED AT 17 FEET ON 8/6/92.
3. MONITORING WELL A134 INSTALLED ON 8/6/92.
4. MONITORING WELL A134 DEVELOPED ON 8/19/92.
5. SAMPLES WERE COLLECTED AT THIS SOIL BORING LOCATION WITH A 3–INCH STAINLESS STEEL SPLIT–SPOON SAMPLER.
6. A "BLOW–COUNT" REFERS TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT–SPOON SAMPLER A DISTANCE OF ONE FOOT (UNLESS OTHERWISE NOTED) USING A 140 lb. HAMMER FALLING 30 INCHES.
7. DEPTH TO WATER MEASURED TO BE 7.78 FEET ON 9/3/92.

LOG OF SOIL BORING AND MONITORING WELL DETAIL CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE

(3) CHEVRON\TG-MV19 10/05/92 09:12



EXPLANATION:

■ 2-FOOT SPLIT-SPOON SAMPLE COLLECTED FROM THIS INTERVAL

NOTES:

1. BORING ADVANCED WITH A DRILL RIG AND SPLIT-SPOON SAMPLER ON 8/20/92 BY MARCOR DRILLING OF EXTON, PENNSYLVANIA.
2. BORING TERMINATED AT 16.5 FEET ON 8/20/92.
3. MONITORING WELL A135 INSTALLED ON 8/20/92.
4. MONITORING WELL A135 DEVELOPED ON 8/21/92.
5. SAMPLES WERE COLLECTED AT THIS SOIL BORING LOCATION WITH A 3-INCH STAINLESS STEEL SPLIT-SPOON SAMPLER.
6. A "BLOW-COUNT" REFERS TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT-SPOON SAMPLER A DISTANCE OF ONE FOOT (UNLESS OTHERWISE NOTED) USING A 140 lb. HAMMER FALLING 30 INCHES.
7. DEPTH TO WATER MEASURED TO BE 7.43 FEET ON 9/2/92.

LOG OF SOIL BORING AND MONITORING WELL DETAIL CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE

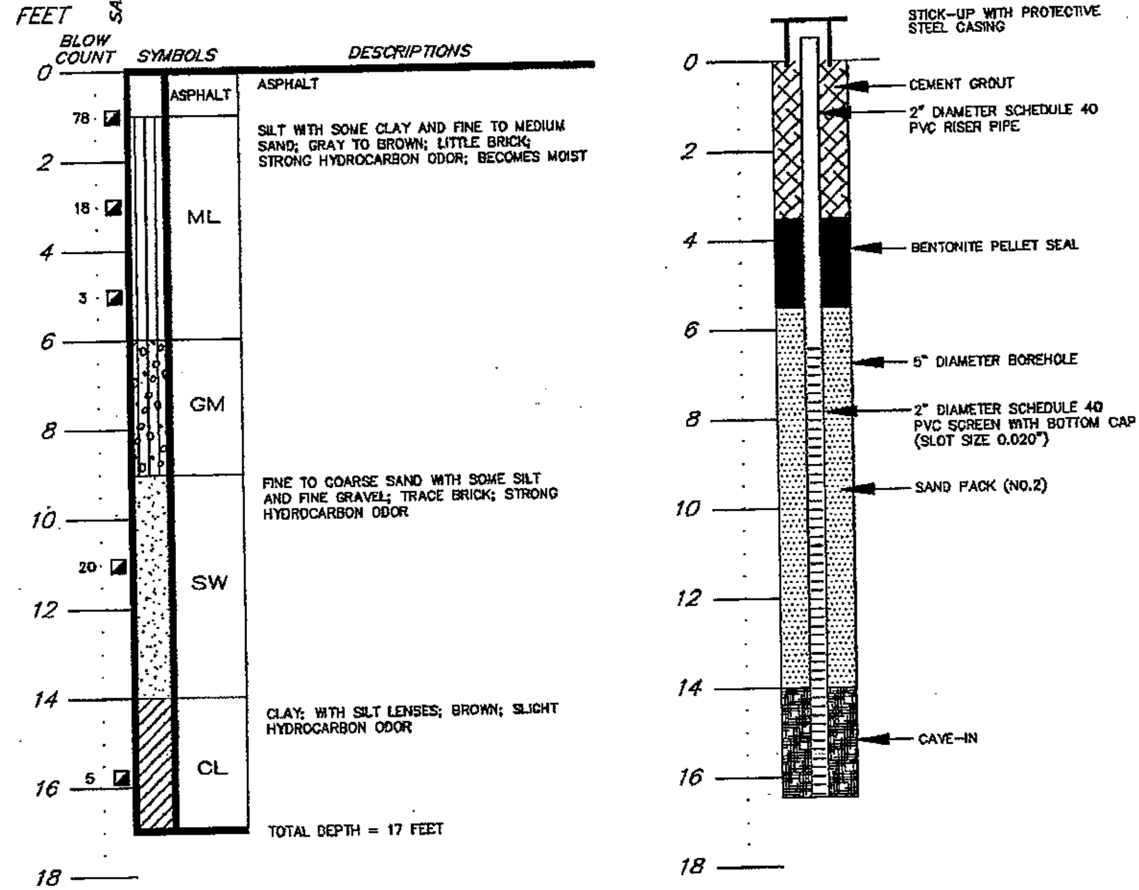
(2) CHEVRON\TG-MVI12 10/05/92 09:38

BORING MVI-10

SURFACE ELEVATION = NOT SURVEYED

WELL A136

TOP OF PVC ELEVATION = NOT SURVEYED



EXPLANATION:

2-FOOT SPLIT-SPOON SAMPLE COLLECTED FROM THIS INTERVAL

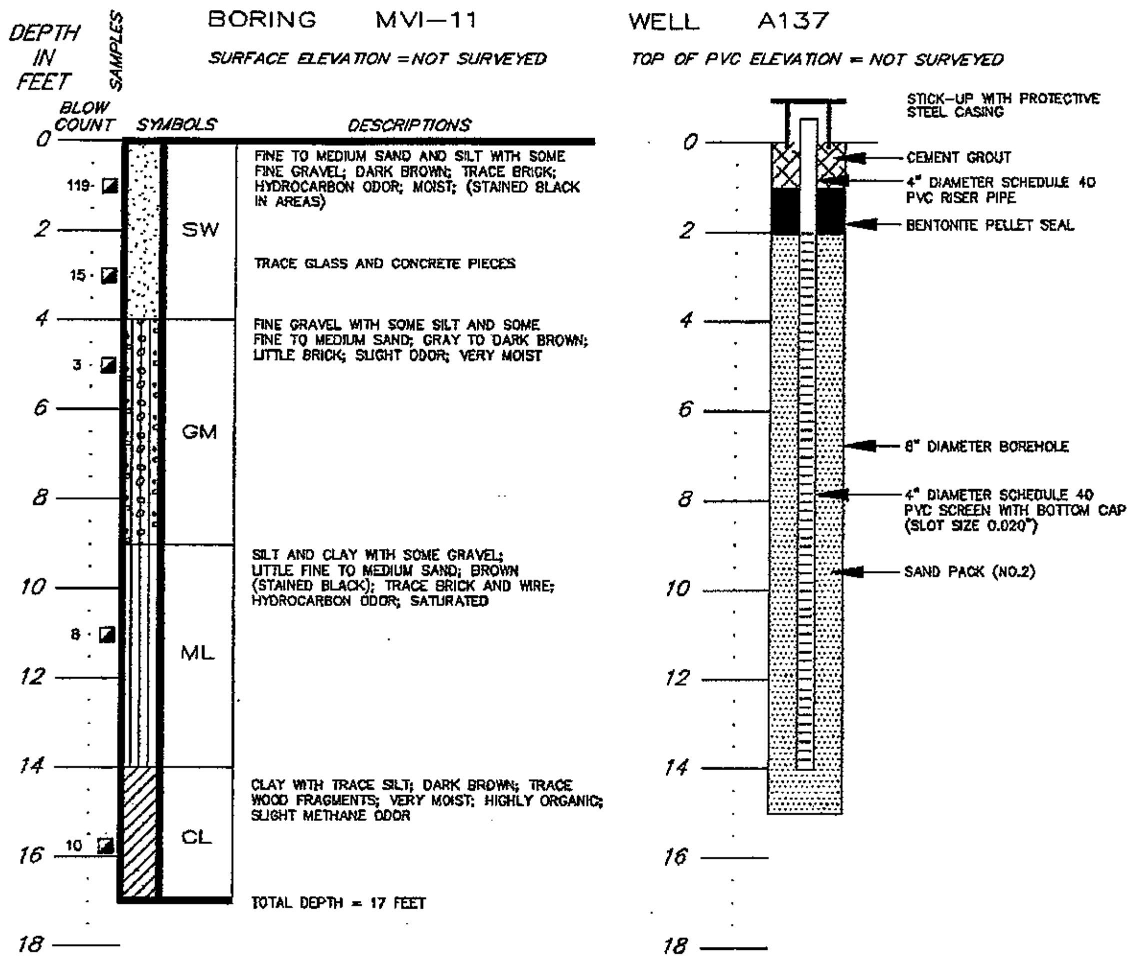
NOTES:

1. BORING ADVANCED WITH A TRIPOD RIG AND SPLIT-SPOON SAMPLER ON 8/6/92 & 8/6/92 BY MARCOR DRILLING OF EXTON, PENNSYLVANIA.
2. BORING TERMINATED AT 17 FEET ON 8/7/92.
3. MONITORING WELL A136 INSTALLED ON 8/10/92.
4. MONITORING WELL A136 DEVELOPED ON 8/20/92.
5. SAMPLES WERE COLLECTED AT THIS SOIL BORING LOCATION WITH A 3-INCH STAINLESS STEEL SPLIT-SPOON SAMPLER.
6. A "BLOW-COUNT" REFERS TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT-SPOON SAMPLER A DISTANCE OF ONE FOOT (UNLESS OTHERWISE NOTED) USING A 140 lb. HAMMER FALLING 30 INCHES.
7. DEPTH TO WATER MEASURED TO BE 6.91 FEET ON 9/3/92.

LOG OF SOIL BORING AND MONITORING WELL DETAIL CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE

(2) CHEVRON\TC-MVI10 10/05/92 08:32



EXPLANATION:

2–FOOT SPLIT–SPOON SAMPLE COLLECTED FROM THIS INTERVAL

NOTES:

1. BORING ADVANCED WITH A DRILL RIG AND SPLIT–SPOON SAMPLER ON 8/4/92 BY MARCOR DRILLING OF EXTON, PENNSYLVANIA.
2. BORING TERMINATED AT 17 FEET ON 8/4/92.
3. MONITORING WELL A137 INSTALLED ON 8/4/92.
4. MONITORING WELL A137 DEVELOPED ON 8/19/92.
5. SAMPLES WERE COLLECTED AT THIS SOIL BORING LOCATION WITH A 3–INCH STAINLESS STEEL SPLIT–SPOON SAMPLER.
6. A "BLOW–COUNT" REFERS TO THE NUMBER OF BLOWS REQUIRED TO DRIVE A STANDARD SPLIT–SPOON SAMPLER A DISTANCE OF ONE FOOT (UNLESS OTHERWISE NOTED) USING A 140 lb. HAMMER FALLING 30 INCHES.
7. DEPTH TO WATER MEASURED TO BE 7.91 FEET ON 9/2/92.

LOG OF SOIL BORING AND MONITORING WELL DETAIL CHEVRON REFINERY PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE

(2) CHEVRON\TG–MV11 10/05/92 09:31

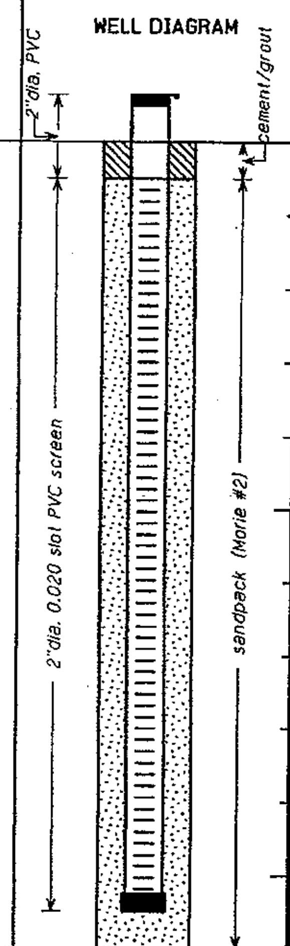
Dames & Moore, Inc.

Log of Monitoring Well WP1-1

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.84/13.04 TOC elevation*
DATE STARTED: *06/04/93*	INITIAL H2o LEVEL: *~9.50 ft. TOC*
DATE FINISHED: *06/04/93*	FINAL H2o LEVEL: *9.45 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: clay to sandy clay with some gravel after 7 feet; stiff to soft; medium dense; mottled brown and orange to medium brown after 7 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4.5	X	15	100				
~9.5	X	8	50				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP1-2

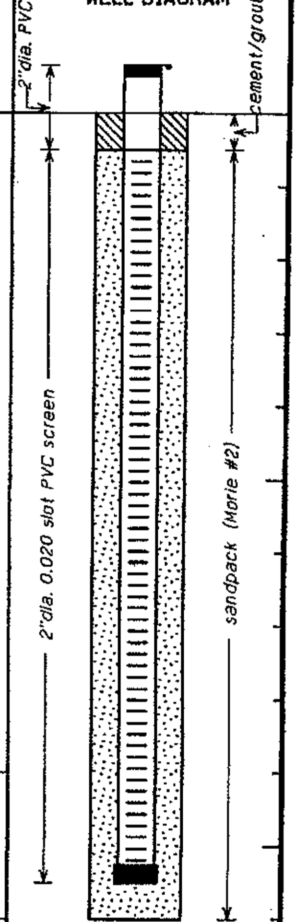
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.34/13.40 TOC elevation*
DATE STARTED: *06/04/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/04/93*	FINAL H2o LEVEL: *6.01 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	SOIL CLASS	GEOLOGIC DESCRIPTION
0					FM	Fill Material: fine to medium sand, clay, and gravel mix; medium dense; brown to brownish black; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick and metal present
4	X	67	400			
5						
9	X	6	400		CL	Clay: trace very fine sand and silt, soft to medium stiff, slightly mottled medium brown and black (stained), moist, hydrocarbon odor, no visible free-phase hydrocarbon
10						
11						End of Boring at 11.0 feet
15						

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



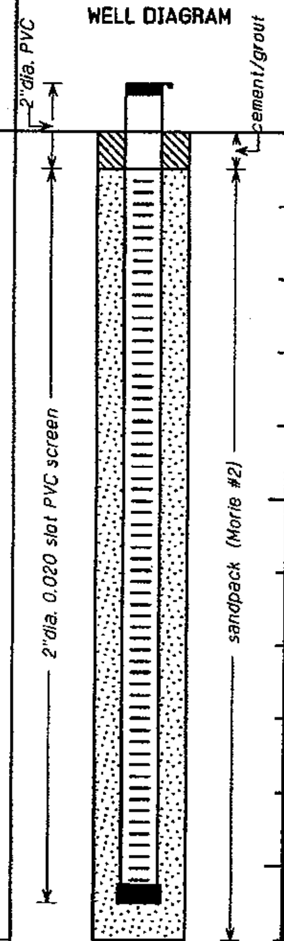
Dames & Moore, Inc.	**Log of Monitoring Well WP1-3**
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.04/12.79 TOC elevation*
DATE STARTED: *06/04/93*	INITIAL H2o LEVEL: *~6.50 ft. TOC*
DATE FINISHED: *06/04/93*	FINAL H2o LEVEL: *6.70 On 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: fine to coarse sand, silt, and clay mix with some gravel; medium dense; medium brown to blackish brown to gray; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick, wood, metal, and coal present
~4	X	16	200				
~9	X	22	100				
11							End of Boring at 11.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



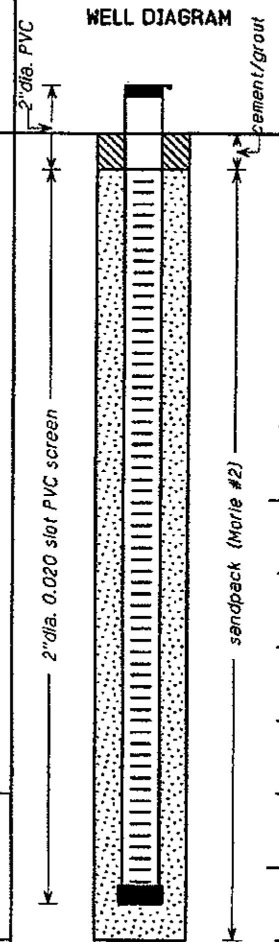
Dames & Moore, Inc.

Log of Monitoring Well WP1-4

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.49/8.87 TOC elevation*
DATE STARTED: *06/03/93*	INITIAL H2o LEVEL: *~8.00 ft. TOC*
DATE FINISHED: *06/03/93*	FINAL H2o LEVEL: *8.01 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9						FM	Fill Material: silty clay with some sand and gravel, very soft to soft, dark brown, moist to wet,hydrocarbon odor, no visible free-phase hydrocarbon, wood present
~4	X	-	5000				
5							
9–11	X	2	3000			CL	Clay: trace organic matter, soft, dark brown to black (stained) at 10 feet; wet, hydrocarbon odor, no visible free-phase hydrocarbon
10							
11							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP1-5

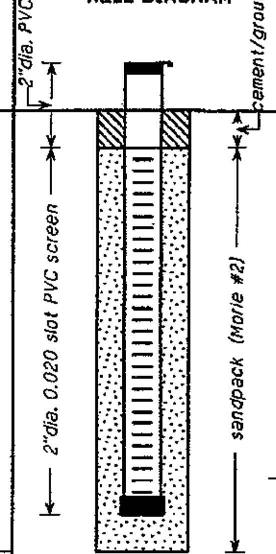
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.29/9.54 TOC elevation*
DATE STARTED: *06/03/93*	INITIAL H2o LEVEL: *~8.50 ft. TOC*
DATE FINISHED: *06/03/93*	FINAL H2o LEVEL: *8.50 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *5.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–6	X	-	600			FM	Fill Material: silt and sand with some gravel, loose, dark brown, moist to wet, hydrocarbon odor, no visible free-phase hydrocarbon, brick present
	X	-	250				
6							End of Boring at 6.0 feet

NOTES:

1. Samples were collected from the return cuttings at the intervals noted.
2. Free-phase hydrocarbon was not encountered.
3. Boring terminated at 6.0 feet due to auger refusal.

WELL DIAGRAM



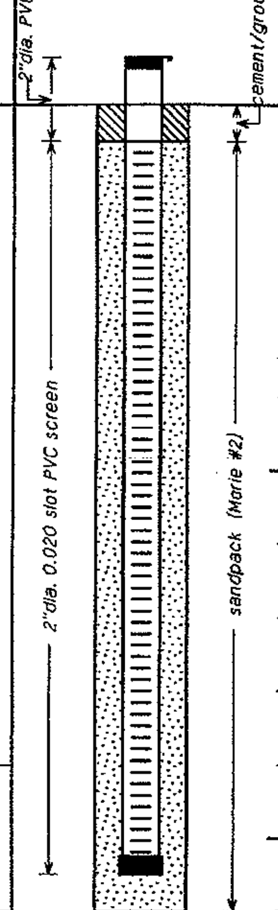
Dames & Moore, Inc.

Log of Monitoring Well WP1-6

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.49/11.35 TOC elevation*
DATE STARTED: *06/08/93*	INITIAL H2o LEVEL: *~9.00 ft. TOC*
DATE FINISHED: *06/08/93*	FINAL H2o LEVEL: *8.75 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material: silty clay with some sand and gravel, very soft to soft, gray brown to gray, moist to wet, hydrocarbon odor, no visible free-phase hydrocarbon, glass and wood present
	X	3	600				
5							
	X	2	500			CL	Clay: soft, gray, wet, hydrocarbon odor, no visible free-phase hydrocarbon
10							
							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

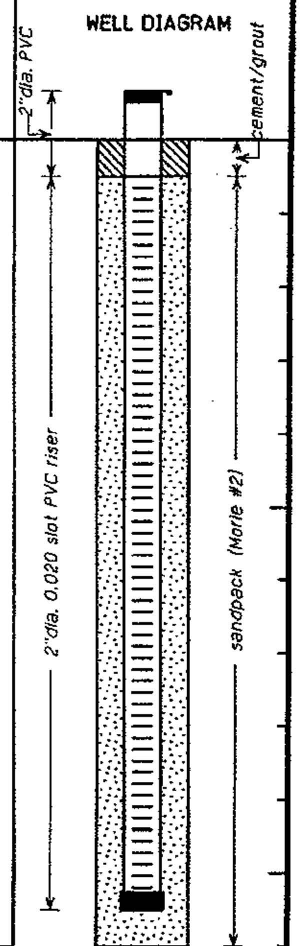
Dames & Moore, Inc.

Log of Monitoring Well WP1-7

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.69/8.88 TOC elevation*
DATE STARTED: *05/26/93*	INITIAL H2o LEVEL: *~5.50 ft. TOC*
DATE FINISHED: *05/26/93*	FINAL H2o LEVEL: *5.55 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: silt, fine to coarse sand, and gravel mix; loose to medium dense; brown to gray black (stained); staining visible at the 3 feet to 4 feet interval and after 9 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick and glass present
~4	x	39	128				
5							
~9	x	6	90.2				
10							
11							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

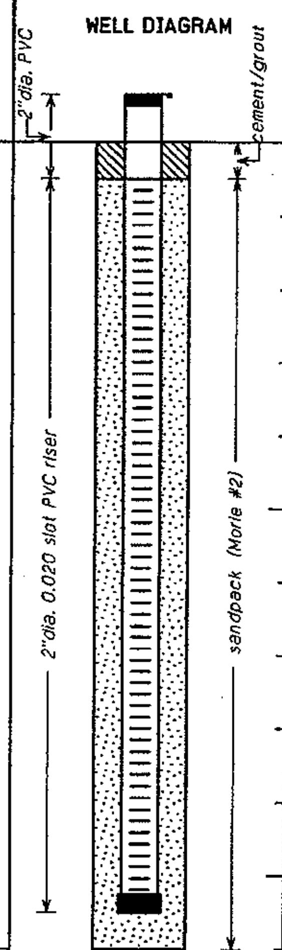
Dames & Moore, Inc.

Log of Monitoring Well WP1-8

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.59/8.84 TOC elevation*
DATE STARTED: *05/26/93*	INITIAL H2o LEVEL: *5.50 ft. TOC*
DATE FINISHED: *05/26/93*	FINAL H2o LEVEL: *5.37 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: fine to coarse sand, silt, and gravel mix; medium dense to dense; gray to dark brown; staining visible from approximately 2 to 4 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	x	35	24				
~9	x	26	62				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP1-9

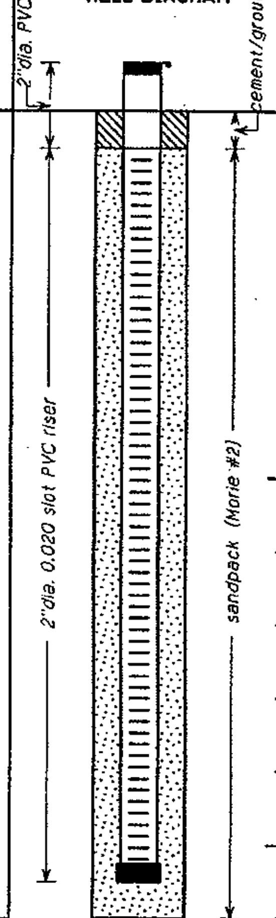
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.39/11.15 TOC elevation*
DATE STARTED: *06/03/93*	INITIAL H2o LEVEL: *6.50 ft. TOC*
DATE FINISHED: *06/03/93*	FINAL H2o LEVEL: *6.61 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: silt and clay mix with some gravel; loose to dense; light brown; wet; hydrocarbon odor detected after 9 feet; no visible free-phase hydrocarbon
~4	x	11	35				
~9	x	4	300				
11							End of Boring at 11.0 feet

NOTES:

1. Samples were collected at the 4.0 to6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

WELL DIAGRAM

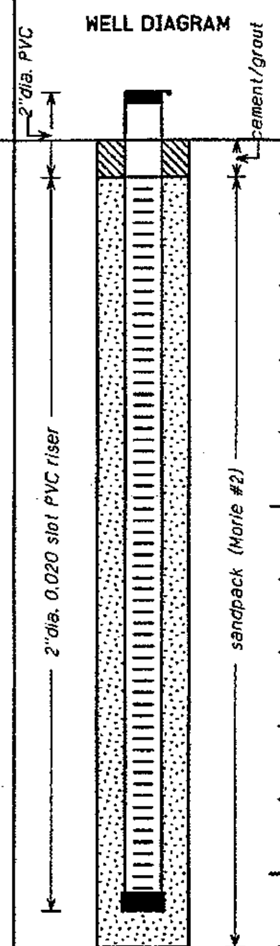


Dames & Moore, Inc.

Log of Monitoring Well WP1-10

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.59/8.60 TOC elevation*
DATE STARTED: *05/26/93*	INITIAL H2o LEVEL: *5.50 ft. TOC*
DATE FINISHED: *05/26/93*	FINAL H2o LEVEL: *5.70 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	SOIL CLASS	GEOLOGIC DESCRIPTION
0				FM	Fill Material: fine to medium sand, silt, clay and gravel mix; clay content increases with depth; medium dense to dense; dark brown to dark gray; moist to wet; hydrocarbon odor from 0 to 6 feet; no visible free-phase hydrocarbon
~4	x	40	28.5		
~9	x	12	.91		
11					End of Boring at 11.0 feet



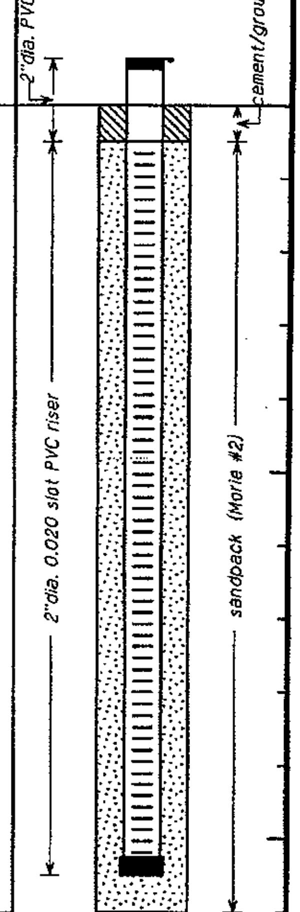
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

Dames & Moore, Inc.	**Log of Monitoring Well WP1-11**
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.49/8.62 TOC elevation*
DATE STARTED: *05/26/93*	INITIAL H2o LEVEL: *5.50 ft. TOC*
DATE FINISHED: *05/26/93*	FINAL H2o LEVEL: *5.53 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sand, silt, and gravel mix; dense to very dense; dark brown to grayish black; dry to wet; hydrocarbon odor at 4 to 6 foot interval; no visible free-phase hydrocarbon
4	x	27	172				
5							
9	x	62	0				
10							
11							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP1-12

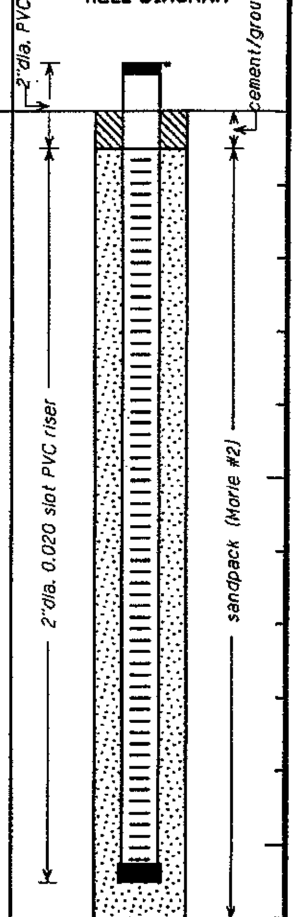
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.89/11.83 TOC elevation*
DATE STARTED: *06/03/93*	INITIAL H2o LEVEL: *5.50 ft. TOC*
DATE FINISHED: *06/03/93*	FINAL H2o LEVEL: *5.39 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: silt, clay, and gravel mix with some fine to medium sand micaceous; loose to medium dense; brown; moist to wet; no hydrocarbon odor or visible free-phase hydrocarbon; brick present
~4	x	13	200				
~9	x	06	300				
11							End of Boring at 11.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

WELL DIAGRAM



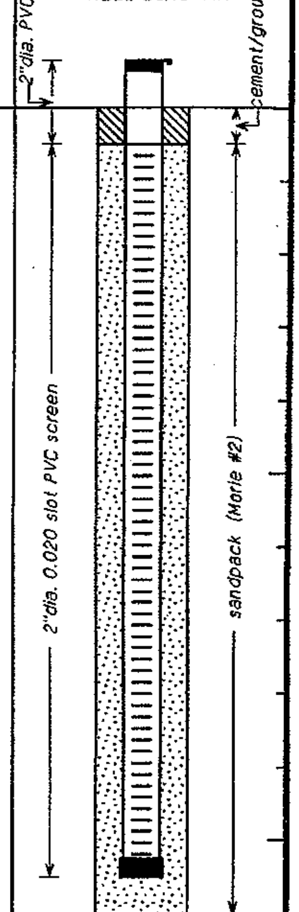
Dames & Moore, Inc.

Log of Monitoring Well WP1-13

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.39/11.41 TOC elevation*
DATE STARTED: *06/15/93*	INITIAL H2o LEVEL: *~6.50 ft. TOC*
DATE FINISHED: *06/15/93*	FINAL H2o LEVEL: *6.53 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: fine to coarse sand, silt, and gravel mix with trace clay; loose to medium dense; medium to dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	X	27	2000				
~9	X	1	2000				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

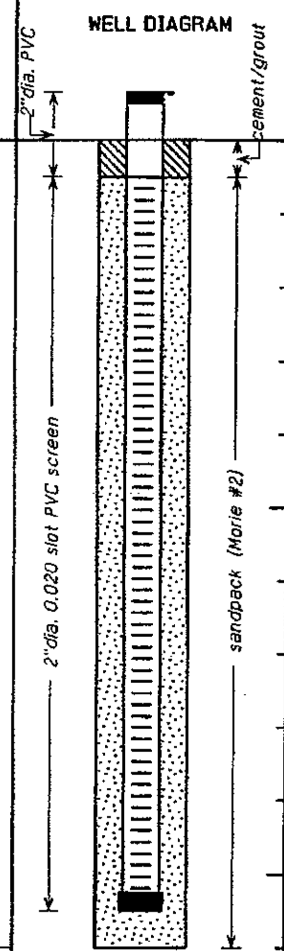
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	# Log of Monitoring Well WP1-14
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.29/11.08 TOC elevation*
DATE STARTED: *06/15/93*	INITIAL H2o LEVEL: *~5.00 ft. TOC*
DATE FINISHED: *06/15/93*	FINAL H2o LEVEL: *5.10 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: fine sand, silt, and gravel mix; very loose to loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	X	0	2000				
~9	X	8	2500				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP1-15

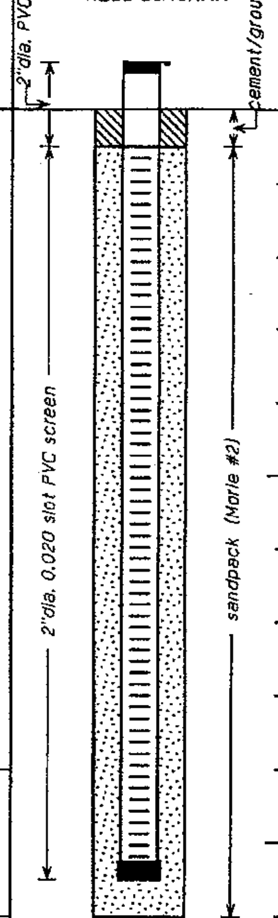
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *6.69/9.52 TOC elevation*
DATE STARTED: *06/24/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/24/93*	FINAL H2o LEVEL: *6.10 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9	X	3	600			FM	Fill Material: very fine to medium sand, clay, and gravel mix; micaceous; very loose; medium brown to dark brown after 5 feet; hydrocarbon odor; no visible free-phase hydrocarbon; wood and brick present
9–11	X	4	600			CL	Clay: abundant organic matter, soft, medium brown to gray, moist, no hydrocarbon odor or visible free-phase hydrocarbon
11							End of Boring at 11.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM

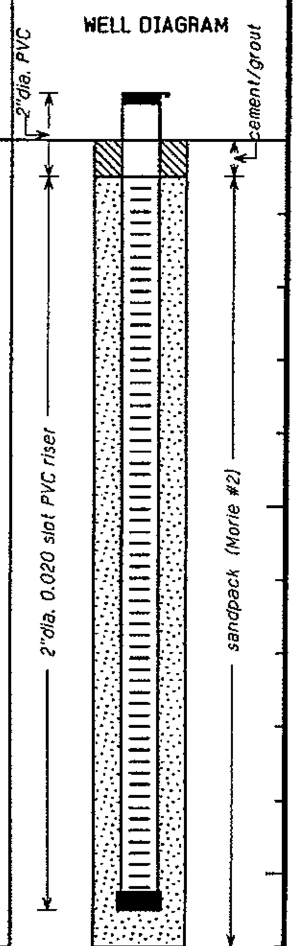


Dames & Moore, Inc.	**Log of Monitoring Well WP2-1**
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.98/13.26 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *6.50 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.62 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sand, clay, and gravel mix; brown to black (stained) after 2 feet; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon after 2 feet
~4	x	13	200				
~9	x	06	300				
11							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free phase hydrocarbon was encountered at approximately 2.0 to 11.0 feet.

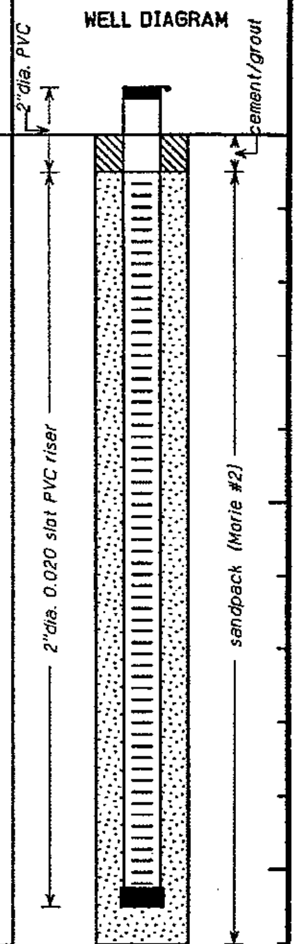
Dames & Moore, Inc.

Log of Monitoring Well WP2-2

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.58/9.89 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *6.50 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.60 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sand, clay, and gravel mix; medium dense; black to brownish gray; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon present after 4 feet
~4	x	11	NA				
~9	x	20	NA				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were not collected for the PID headspace analysis due to the presence of free-phase hydrocarbon.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free phase hydrocarbon was encountered at approximately 4.0 feet.

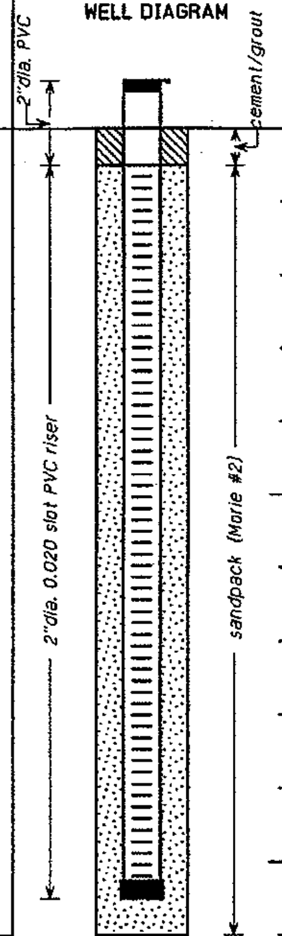
Dames & Moore, Inc.

Log of Monitoring Well WP2-3

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.88/10.05 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *8.50 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *8.51 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: silt and clay mix; dark brown; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon after 4 feet
	x	11	NA				
5							
	x	20	NA				
10							
							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were not collected for PID headspace analysis due to the presence of free-phase hydrocarbon.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was encountered at approximately 4.0 feet.

Dames & Moore, Inc.

Log of Monitoring Well WP2-4

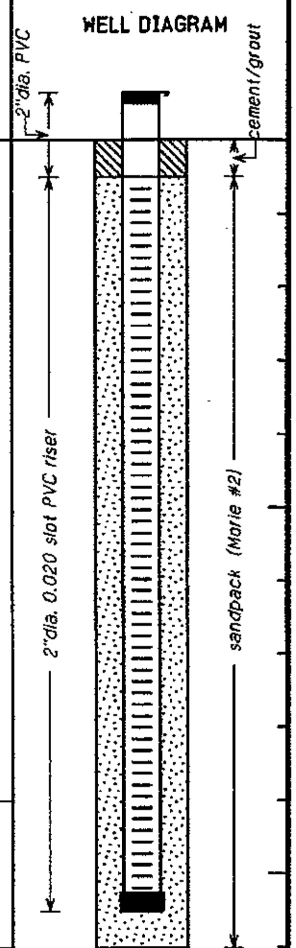
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.19/11.30 TOC elevation*
DATE STARTED: *06/08/93*	INITIAL H2o LEVEL: *4.00 ft. TOC*
DATE FINISHED: *06/08/93*	FINAL H2o LEVEL: *4.06 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material: fine to medium sand with trace gravel and clay; loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	9	200				
5							
9	x	3	250			CL	Clay: trace fine to coarse sand; soft; mottled dark brown and black (stained) at 10 feet; wet; hydrocarbon odor; no visible free-phase hydrocarbon
10							
11							End of Boring at 11.0 feet
15							

NOTES:

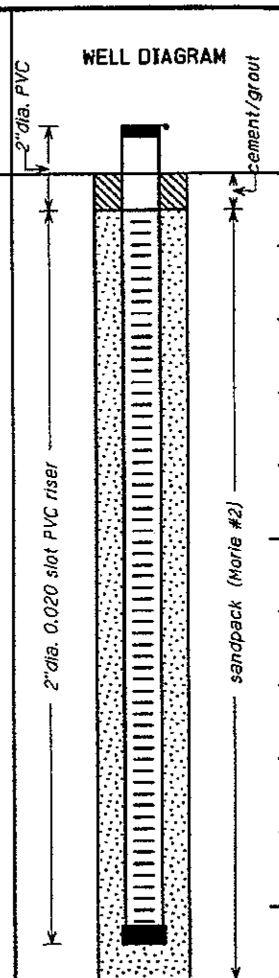
1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



Dames & Moore, Inc.	# Log of Monitoring Well WP2-5
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.09/7.84 TOC elevation*
DATE STARTED: *06/08/93*	INITIAL H2o LEVEL: *4.00 ft. TOC*
DATE FINISHED: *06/08/93*	FINAL H2o LEVEL: *3.87 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material; silt and coarse sand mix with trace gravel; fine to medium sand lens at 9 to 11 feet; loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	4	300				
5							
9	x	5	150				
10							
11							End of Boring at 11.0 feet
15							



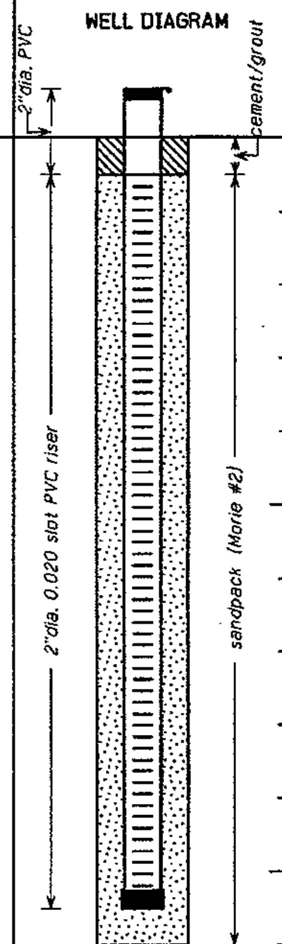
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	Log of Monitoring Well WP2-6
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.83/7.61 TOC elevation*
DATE STARTED: *06/09/93*	INITIAL H2o LEVEL: *3.00 ft. TOC*
DATE FINISHED: *06/09/93*	FINAL H2o LEVEL: *3.21 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–10.5						FM	Fill Material: sand, clay, and gravel mix; medium sand lens at 9 feet; loose; dark brown to black (stained) at 4 to 6 foot interval; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	6	180				
9	x	9	300				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

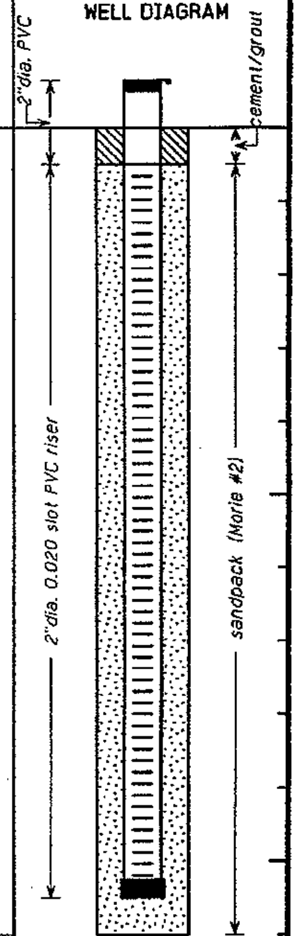
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	# Log of Monitoring Well WP2-7
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.94/7.64 TOC elevation*
DATE STARTED: *06/08/93*	INITIAL H2o LEVEL: *4.00 ft. TOC*
DATE FINISHED: *06/08/93*	FINAL H2o LEVEL: *3.98 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sand and gravel mix with some clay; medium sand lens at 9 to 11 feet; loose; medium to dark brown to black (stained) at 4 to 6 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	x	7	400				
~9	x	8	1200				
11							End of Boring at 11.0 feet

WELL DIAGRAM



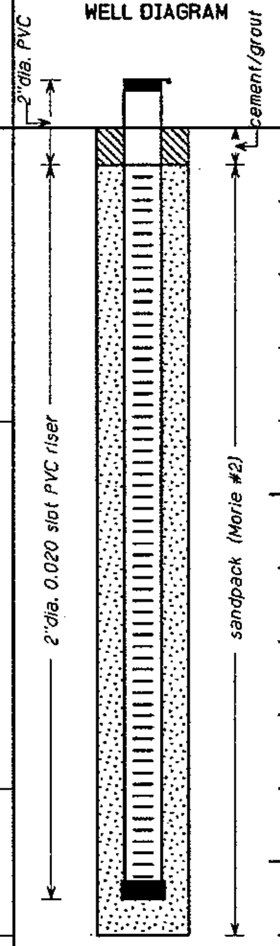
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	# Log of Monitoring Well WP2-8
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.61/7.37 TOC elevation*
DATE STARTED: *06/01/93*	INITIAL H2o LEVEL: *4.50 ft. TOC*
DATE FINISHED: *06/01/93*	FINAL H2o LEVEL: *4.51 on 7/7/93 ft. TOC*
DRILLING METHOD: *8in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	SOIL CLASS	GEOLOGIC DESCRIPTION
0					FM	Fill Material: sand and gravel mix with some clay; loose; gray to brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	2	64.7	■	SC	Sandy Clay: medium sand, silt, and clay; soft; gray to brown to black, (stained) at 6 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
9	x	8	0		CL	Clay: medium stiff; brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
11						End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

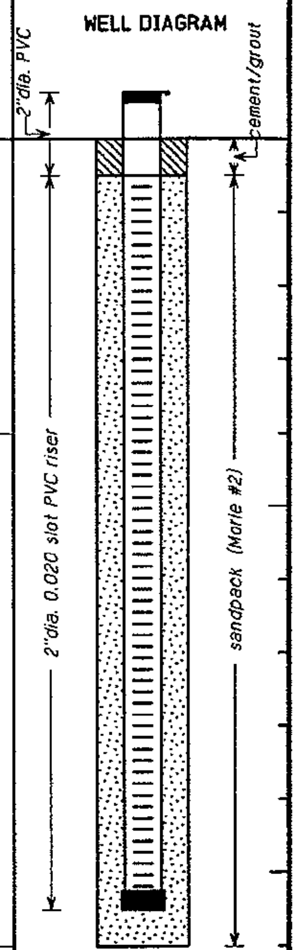
Dames & Moore, Inc.

Log of Monitoring Well WP2-9

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.87/7.65 TOC elevation*
DATE STARTED: *06/01/93*	INITIAL H2o LEVEL: *4.50 ft. TOC*
DATE FINISHED: *06/01/93*	FINAL H2o LEVEL: *4.54 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–4						FM	Fill Material: sand and gravel mix with some clay; loose; gray to brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	6	NR			SC	Sandy Clay: medium stiff; brown to black, (stained) after 4 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
5							
9	x	16	NR				
10							
11							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP2-10

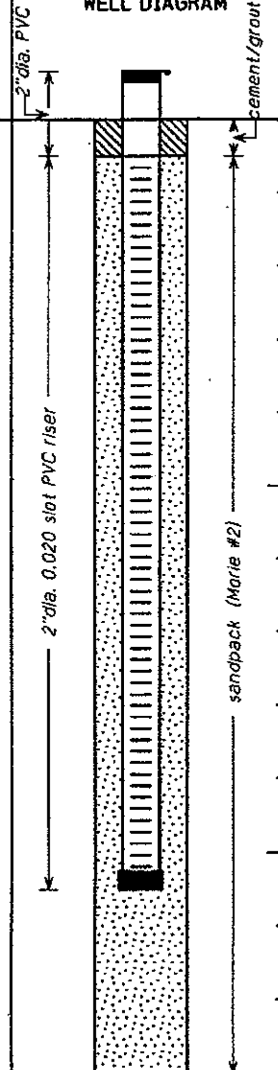
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.82/12.32 TOC elevation*
DATE STARTED: *06/22/93*	INITIAL H2o LEVEL: *7.50 ft. TOC*
DATE FINISHED: *06/22/93*	FINAL H2o LEVEL: *7.65 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–13						FM	Fill Material: sand and gravel mix; loose to medium dense; light to dark brown to black (stained) after 9 feet; dry to wet; hydrocarbon odor after 4 feet; visible sheen; no visible free-phase hydrocarbon; coal and brick present
~4	x	13	1400				
~8.9	x	10	100				
13							End of Boring at 13.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



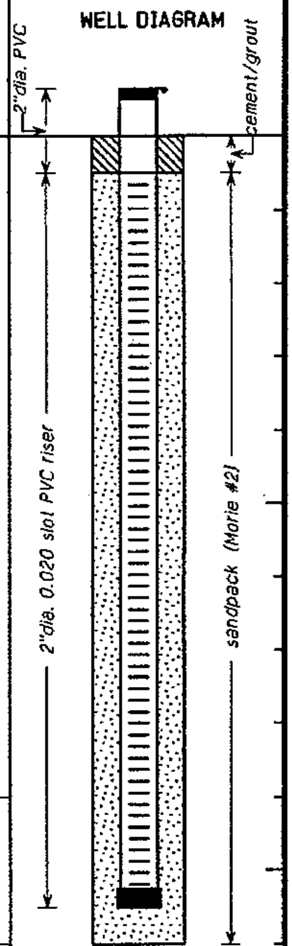
Dames & Moore, Inc.

Log of Monitoring Well WP2-11

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.04/12.83 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *6.00 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *6.22 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	SOIL CLASS	GEOLOGIC DESCRIPTION
0					FM	Fill Material: medium sand, silt, and gravel mix; loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	x	3	500			
5						
9	x	2	700		CL	Clay: soft; dark brown; moist; hydrocarbon odor; no visible free-phase hydrocarbon
10						
11						End of Boring at 11.0 feet
15						

WELL DIAGRAM



NOTES:

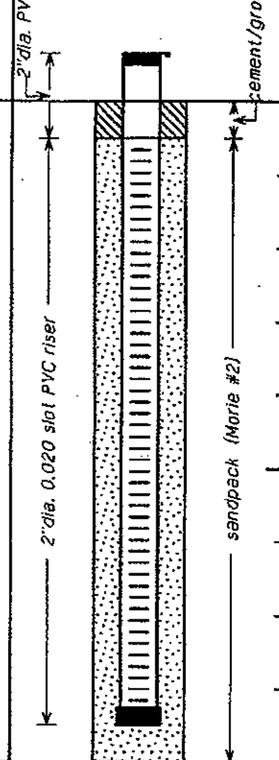
1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	Log of Monitoring Well WP2-12
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.89/12.98 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *8.00 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *8.08 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *8.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9						FM	Fill Material; sand, clay, and gravel mix; brown; moist to wet; no hydrocarbon odor or visible free-phase hydrocarbon; brick present
9							End of Boring at 9.0 feet

Depth scale: 5, 10, 15

WELL DIAGRAM



NOTES:

1. Split spoon samples could not be obtained using power hand auger.
2. Free-phase hydrocarbon was not encountered.

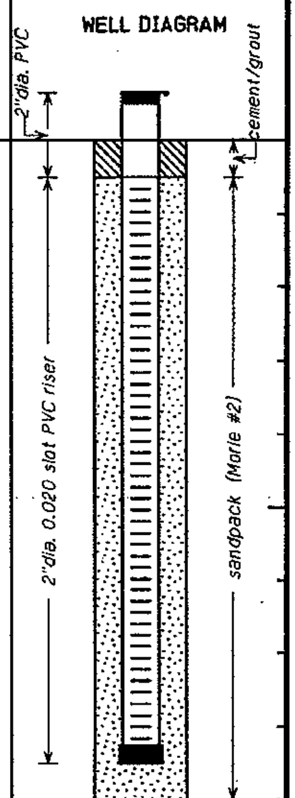
Dames & Moore, Inc.	Log of Monitoring Well WP2-13
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *11.09/13.68 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *7.50 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *7.31 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *8.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9						FM	Fill Material: sand, clay, and gravel mix; brown; moist to wet; no hydrocarbon odor or visible free-phase hydrocarbon
~7	x		60				
9							End of Boring at 9.0 feet

Depth scale: 5, 10, 15

NOTES:

1. Samples were collected from return cuttings at the interval noted.
2. Free-phase hydrocarbon was not encountered.



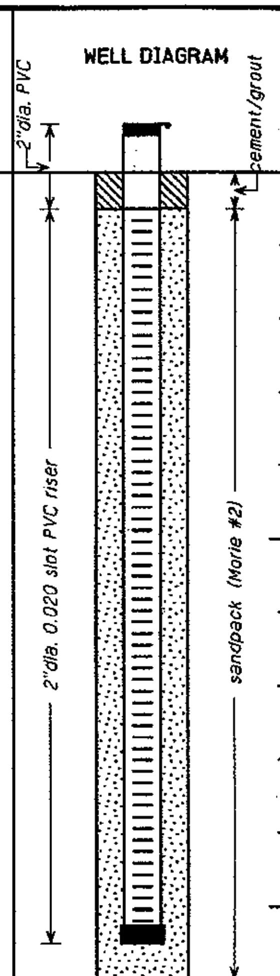
Log of Monitoring Well WP2-14

Dames & Moore, Inc.

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.84/13.08 TOC elevation*
DATE STARTED: *06/24/93*	INITIAL H2o LEVEL: *7.50 ft. TOC*
DATE FINISHED: *06/24/93*	FINAL H2o LEVEL: *7.31 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sand and gravel mix; loose; dark brown to black, (stained); dry to wet; hydrocarbon odor; visible free-phase hydrocarbon at 4 feet; brick, metal, and plastic present
~4	x	4	10000				
~8.5	x	3	1500				
11							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

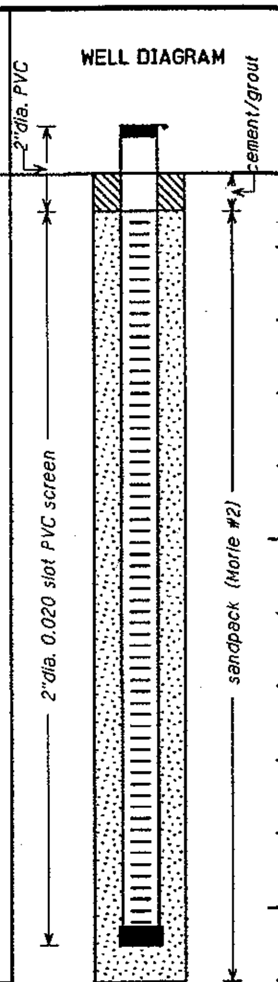


NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at 4.0 feet.

Dames & Moore, Inc.	# Log of Monitoring Well WP3-1
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.79/9.90 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.06 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11.0						FM	Fill Material: very fine to coarse sand, silt, and clay mix with some gravel; loose; gray brown and black (stained); moist to wet; strong hydrocarbon odor; visible free-phase hydrocarbon at 4 feet; brick and glass present
4	X	9	361				
5							
9	X	10	274				
10							
11.0							End of Boring at 11.0 feet
15							



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

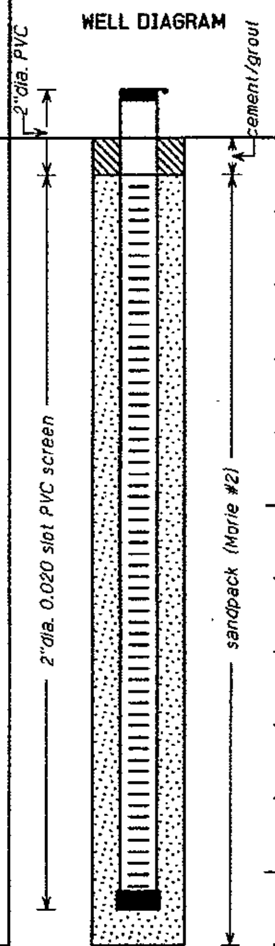
Dames & Moore, Inc.

Log of Monitoring Well WP3-2

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.99/10.89 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~7.00 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.97 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material; medium to coarse sand and silt mix with some to little gravel; loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	X	7	50				
~9	X	7	34				
11							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

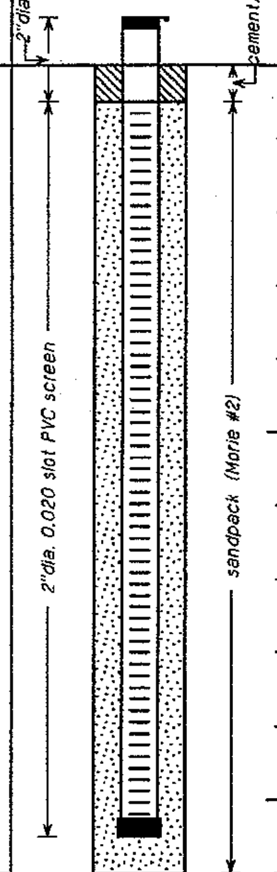
Dames & Moore, Inc.

Log of Monitoring Well WP3-3

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *11.29/11.62 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.03 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: very fine to fine sand, silt, and clay mix with some to trace gravel; micaceous; very loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick present
4	X	4	126				
9	X	3	120				
11							End of Boring at 11.0 feet

WELL DIAGRAM



Depth scale: 5, 10, 15

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

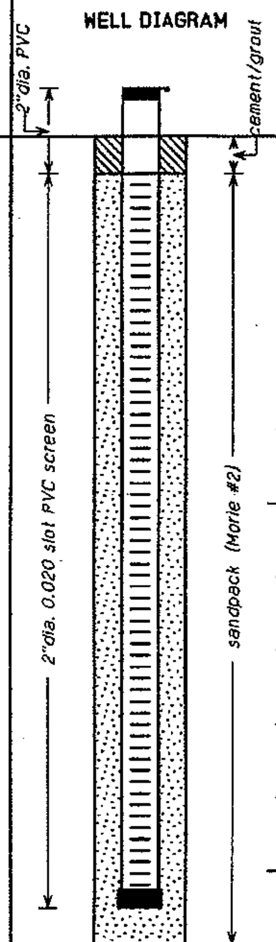
Dames & Moore, Inc.

Log of Monitoring Well WP3-4

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.59/9.63 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~5.50 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *5.52 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: medium to coarse sand, silt, clay, and gravel mix; medium dense; gray brown and black (stained); moist to wet; hydrocarbon odor; visible free-phase hydrocarbon at 4 feet; brick and plastic present
~4	X	22	252				
5							
~9	X	19	148				
10							
11							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

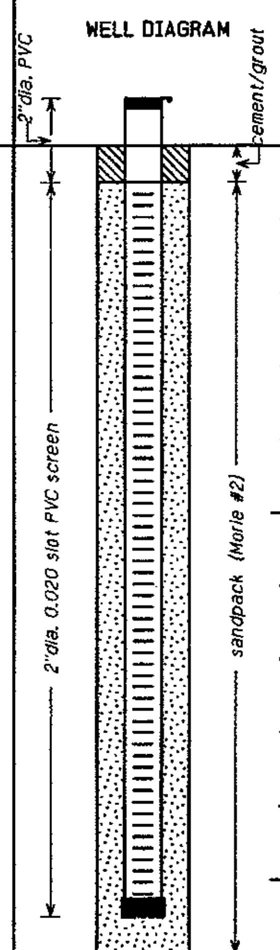
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

Dames & Moore, Inc.

Log of Monitoring Well WP3-5

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.97/11.13 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.08 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11.0						FM	Fill Material: fine to medium sand with some clay, silt, and gravel; micaceous; loose; dark brown; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon at approximately 9 feet
~4	X	7	0				
5							
~9	X	7	16				
10							
11.0							End of Boring at 11.0 feet
15							



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was encountered at approximately 9.0 feet.

Dames & Moore, Inc.	# Log of Monitoring Well WP3-6
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.99/11.16 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~7.00 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *6.93 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *11 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: silt and clay mix grading to fine to coarse sand and gravel mix after 6 feet; micaceous; medium dense; dark brown to gray after 6 feet; hydrocarbon odor; no visible free-phase hydrocarbon
4	X	12	85				
9	X	21	48				
11							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

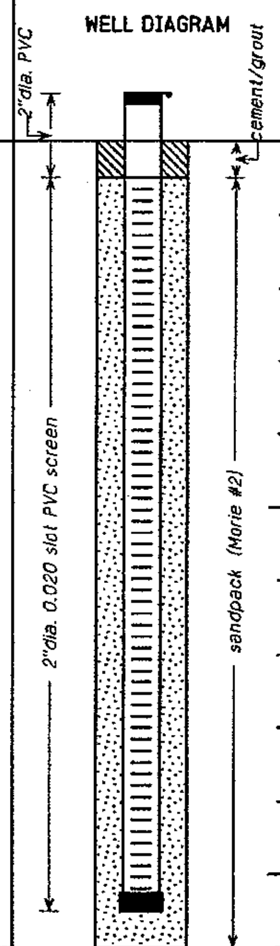
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



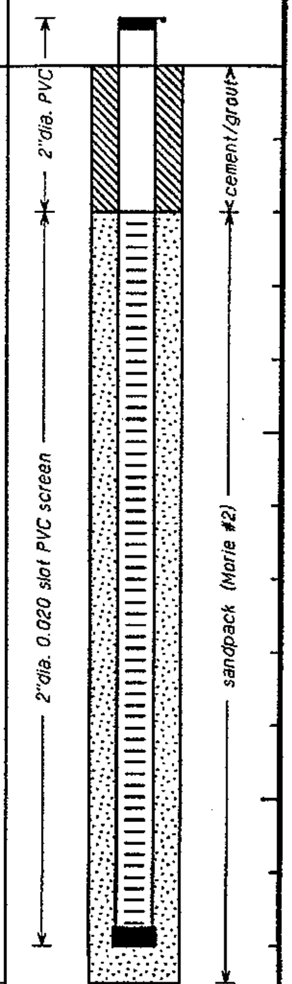
Dames & Moore, Inc.

Log of Monitoring Well WP3-7

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.19/10.26 TOC elevation*
DATE STARTED: *05/28/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *05/28/93*	FINAL H2o LEVEL: *7.27 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *12 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material: very fine to coarse sand, silt, and clay mix with some gravel; 6-inch clay layer at approximately 5.5 feet; coarse fraction increases after 6 feet; medium dense; gray brown to black (stained); moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick present
4	X	41	606				
9	X	28	145				
12.5							End of Boring at 12.5 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	# Log of Monitoring Well WP3-8
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.29/13.13 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *7.77 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

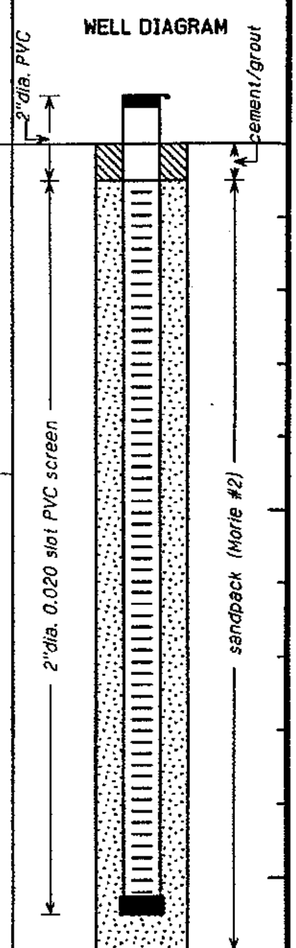
DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–4.5	X	3	1000			FM	Fill Material: fine to medium sand and silt mix with some gravel, very loose, dark brown, moist, hydrocarbon odor, no visible free-phase hydrocarbon
4.5–11.0	X	7	1000			CL	Clay: micaceous, soft to medium stiff, dark brown, moist to wet, hydrocarbon odor, no visible free-phase hydrocarbon
11.0							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



Dames & Moore, Inc.

Log of Monitoring Well WP3-9

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.59/9.65 TOC elevation*
DATE STARTED: *06/16/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/16/93*	FINAL H2o LEVEL: *6.01 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9	X	14	1400		FM	Fill Material: fine to medium sand and clay mix with some gravel from 0 to 2.5 feet, medium dense, medium brown to brownish black (stained), moist to wet, hydrocarbon odor, visible free-phase hydrocarbon at approximately 4 feet, brick present to 2.5 feet
9–11	X	4	1000		CL	Clay; some fine to medium sand; soft; brownish black; wet; hydrocarbon odor; visible free-phase hydrocarbon

End of Boring at 11.0 feet

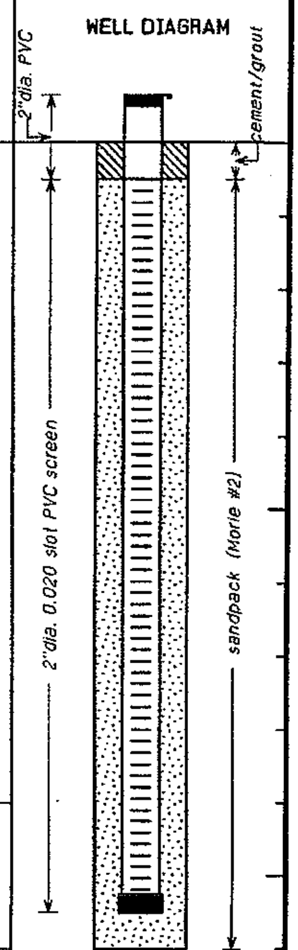
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

WELL DIAGRAM



Dames & Moore, Inc.	Log of Monitoring Well WP3-10
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.19/11.70 TOC elevation*
DATE STARTED: *06/16/93*	INITIAL H2o LEVEL: *~6.50 ft. TOC*
DATE FINISHED: *06/16/93*	FINAL H2o LEVEL: *6.76 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

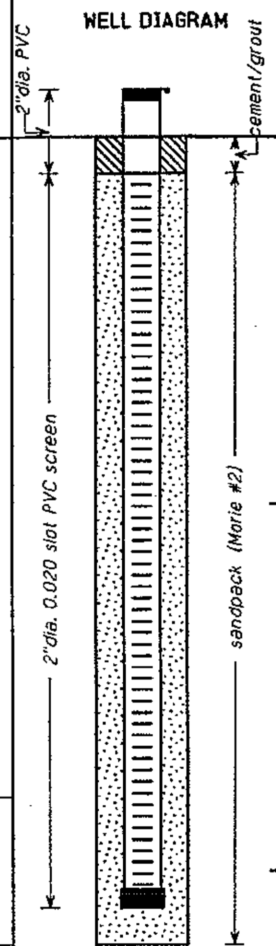
DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9						FM	Fill Material: medium to coarse sand with some gravel and trace clay and fine sand, medium dense, medium brown to brownish black (stained), moist to wet, hydrocarbon odor, visible free-phase hydrocarbon at approximately 4 feet
4	X	13	800				
9	X	2	600			CL	Clay: micaceous, trace organic material, soft, brownish black, wet, hydrocarbon odor, no visible free-phase hydrocarbon
11							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

WELL DIAGRAM



Dames & Moore, Inc.	**Log of Monitoring Well WP3-11**
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.65/12.60 TOC elevation*
DATE STARTED: *06/17/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/17/93*	FINAL H2o LEVEL: *7.68 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material: fine to coarse sand, silt, clay, and gravel mix, loose to medium dense, dark brown to brownish black (stained), moist to wet, hydrocarbon odor, visible free-phase hydrocarbon at approximately 4 feet
~4	X	4	500				
5							
~9	X	7	350				
10							
11							End of Boring at 11.0 feet
15							

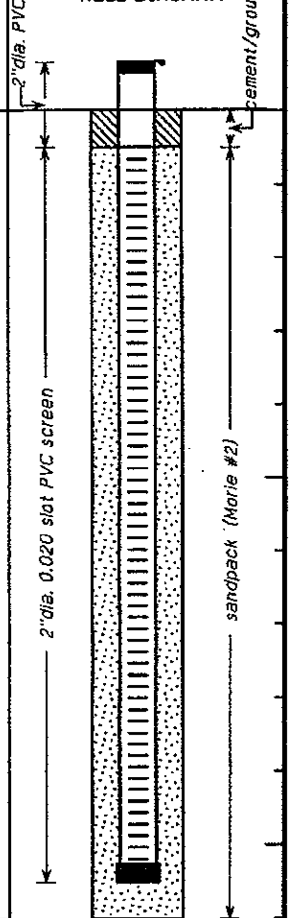
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

WELL DIAGRAM



Dames & Moore, Inc.	Log of Monitoring Well WP3-12
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.76/11.88 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *7.63 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

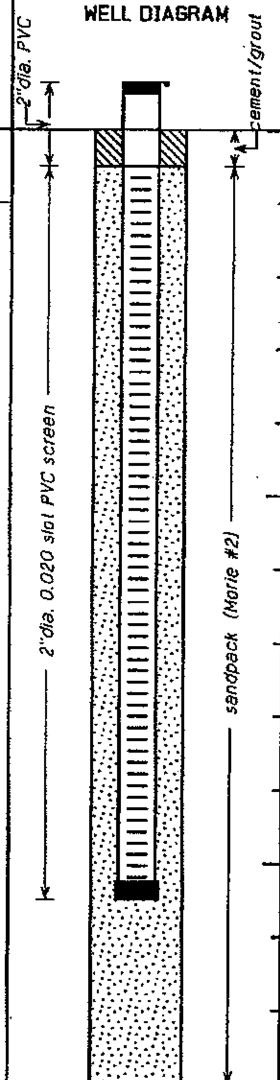
DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						FM	Fill Material: fine to coarse sand, silt, and gravel mix; loose; medium brown; dry to moist; no hydrocarbon odor or free-phase hydrocarbon
						CL	Clay: very soft to soft; trace sand; micaceous; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
	X	4	150				
5							
	X	1	500				
10							
15							

End of Boring at 13.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

WELL DIAGRAM



Dames & Moore, Inc.

Log of Monitoring Well WP4-1

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *12.09/15.02 TOC elevation*
DATE STARTED: *06/01/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/01/93*	FINAL H2o LEVEL: *7.34 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–1						FM	Fill Material: building foundation
1–10						SC	Sandy Clay: trace gravel; loose; brown to black (stained) after 4 feet; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	X	3	ND				
5							
9	X	3	ND				
10–11						CL	Clay: trace organic material; soft; brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
15							

End of Boring at 11.0 feet

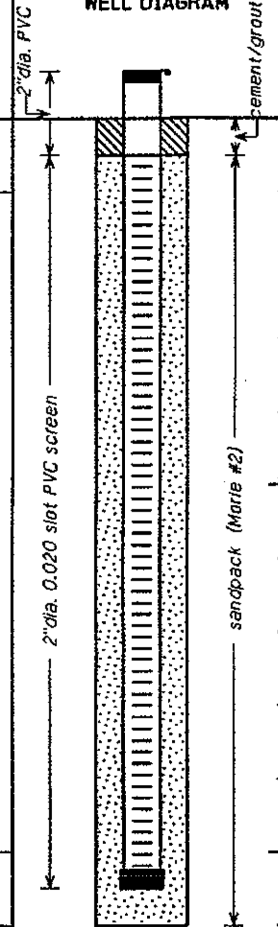
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



Dames & Moore, Inc.

Log of Monitoring Well WP4-2

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.99/11.83 TOC elevation*
DATE STARTED: *06/02/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/02/93*	FINAL H2o LEVEL: *6.21 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	SOIL CLASS	GEOLOGIC DESCRIPTION
0–1				FM	Fill Material: sand and gravel mix; loose; brown; dry; no hydrocarbon odor or visible free-phase hydrocarbon, wood present
1–10				SC	Sandy Clay: medium sand and clay mix with some gravel; brownish black; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon after 4 feet
~4	X	8	2500		
~9	X	7	373		
10–11				CL	Clay: organic material; soft; brown to black; hydrocarbon odor; visible sheen; no visible free-phase hydrocarbon

PID PROFILE scale: 0 – 1000

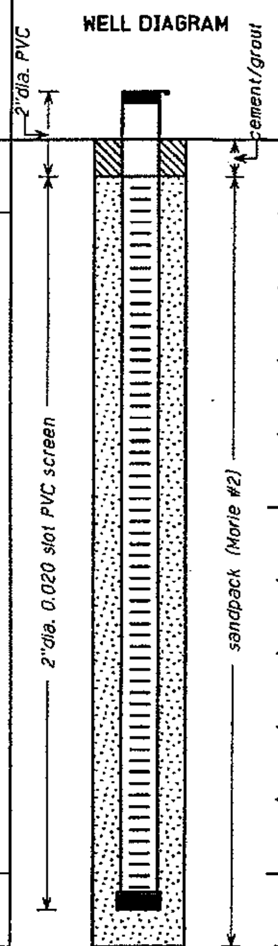
Depth scale: 5, 10, 15

End of Boring at 11.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered after 4.0 feet.

WELL DIAGRAM



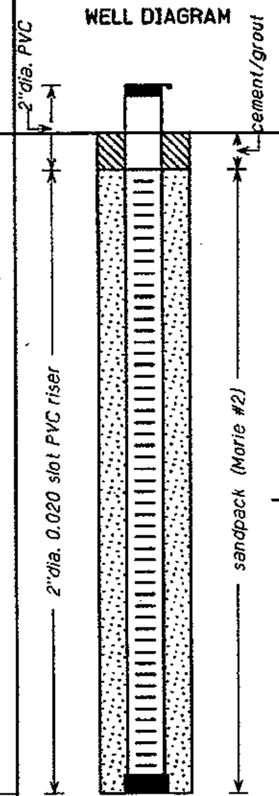
Dames & Moore, Inc.

Log of Monitoring Well WP4-3

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.99/7.76 TOC elevation*
DATE STARTED: *06/09/93*	INITIAL H2o LEVEL: *6.00 ft. TOC*
DATE FINISHED: *06/09/93*	FINAL H2o LEVEL: *5.95 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *9 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
						FM	Fill Material: sand and gravel mix; medium brown to dark brown and grayish black; moist to wet; hydrocarbon odor after 3 feet; no visible free-phase hydrocarbon
	x	-	100				
5							
	x	-	100				
							End of Boring at 9.0 feet
10							NOTES:
							1. Samples were collected from return cuttings at the intervals noted.
							2. Free-phase hydrocarbon was not encountered.
15							

WELL DIAGRAM



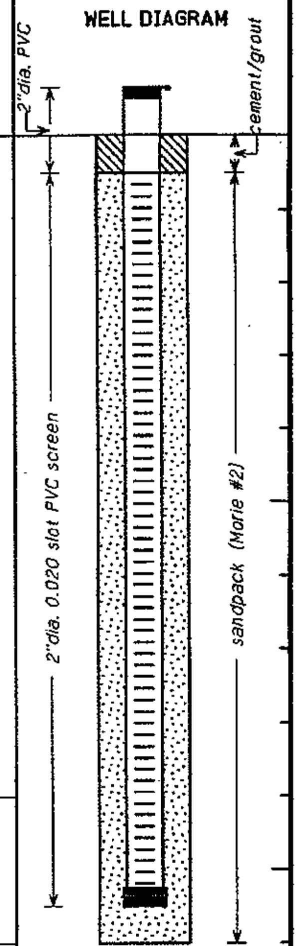
Dames & Moore, Inc.

Log of Monitoring Well WP4-4

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.29/8.45 TOC elevation*
DATE STARTED: *06/08/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/08/93*	FINAL H2o LEVEL: *6.57 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–9						FM	Fill Material: coarse sand, silt, and gravel mix; micaceous; loose; brown to gray; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
4	X	6	200				
9–11	X	3	300			CL	Clay: soft; 6-inch lens of coarse sand at 9.0 feet; loose; dark brown; moist; no hydrocarbon odor or visible free-phase hydrocarbon
11							End of Boring at 11.0 feet

WELL DIAGRAM

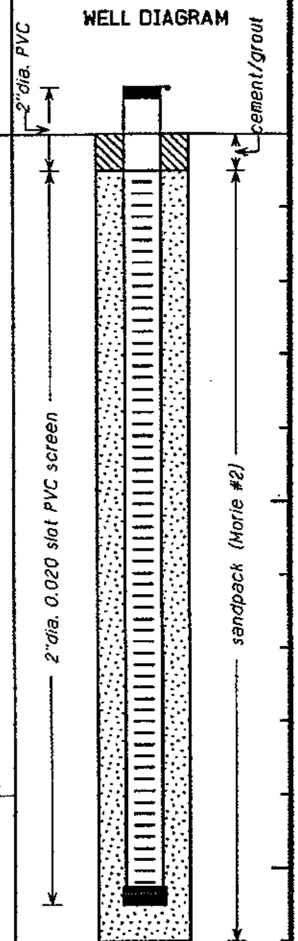


NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.	Log of Monitoring Well WP4-5
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *11.29/14.37 TOC elevation*
DATE STARTED: *06/18/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *06/18/93*	FINAL H2o LEVEL: *6.05 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0						FM	Fill Material: fine to medium sand, silt, and clay mix; loose; dark brown; moist to wet; no hydrocarbon odor or visible free-phase hydrocarbon
4	X	3	300				
5							
9	X	1	1000			CL	Clay: soft; dark brown; wet; hydrocarbon odor; free-phase hydrocarbon present
10							
11							End of Boring at 11.0 feet
15							



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered after 9.0 feet.

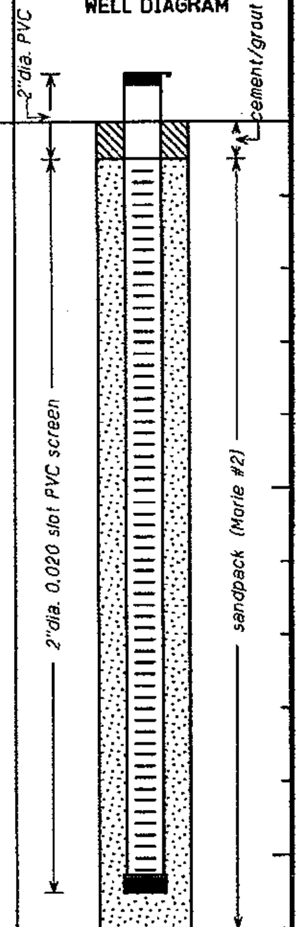
Dames & Moore, Inc.

Log of Monitoring Well WP5-1

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.09/11.00 TOC elevation*
DATE STARTED: *06/11/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/11/93*	FINAL H2o LEVEL: *7.36 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11.0						FM	Fill Material; sand and gravel mix with trace silt and clay; loose; brownish black; staining visible after 2 feet; moist to wet; hydrocarbon odor; trace amount of visible free-phase hydrocarbon
	X	2	3500				
5							
	X	3	2000				
10							
							End of Boring at 11.0 feet
15							

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

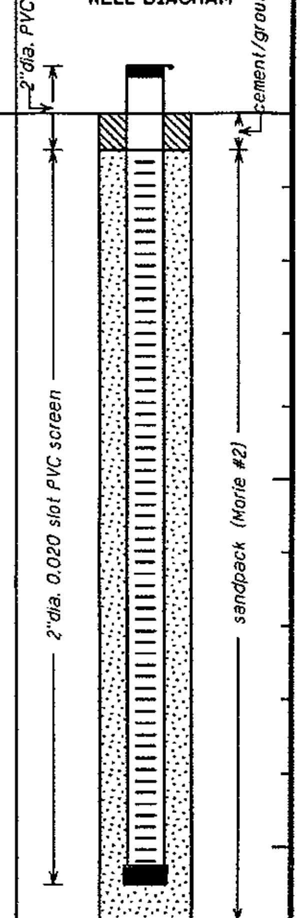
Dames & Moore, Inc.	Log of Monitoring Well WP5-2
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *7.99/10.09 TOC elevation*
DATE STARTED: *06/11/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/11/93*	FINAL H2o LEVEL: *7.60 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–10.5						FM	Fill Material: medium sand and gravel mix with trace silt and clay; loose; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	X	6	6000				
5							
~9	X	8	300				
10							
11							End of Boring at 11.0 feet
15							

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM

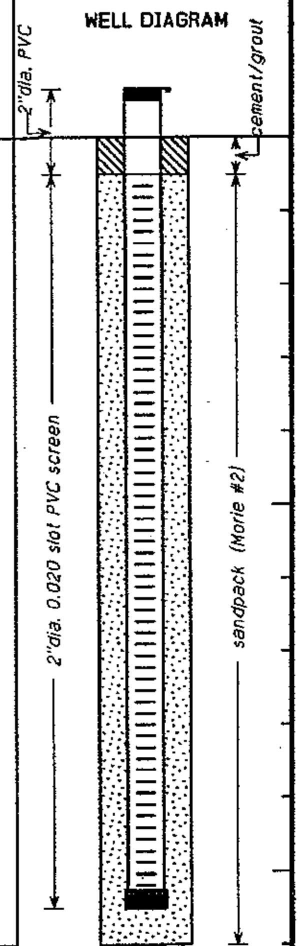


Dames & Moore, Inc.	Log of Monitoring Well WP5-3
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.59/11.10 TOC elevation*
DATE STARTED: *06/11/93*	INITIAL H2o LEVEL: *~6.50 ft. TOC*
DATE FINISHED: *06/11/93*	FINAL H2o LEVEL: *6.75 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11.0						FM	Fill Material: sand, silt, clay, and gravel mix; loose; dark brown to gray; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	X	4	10000				
~9	X	2	5000				
11.0							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

WELL DIAGRAM



NOTES:

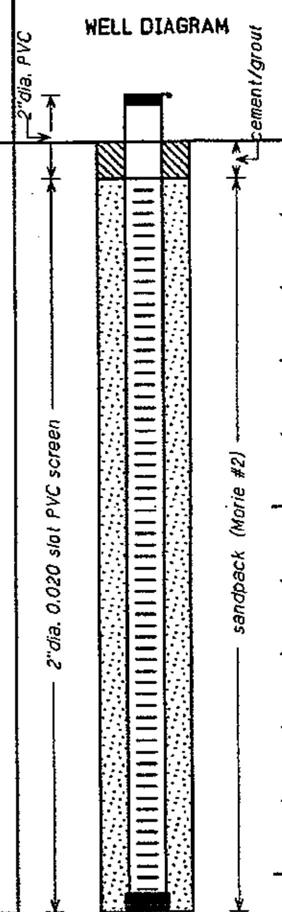
1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

Dames & Moore, Inc.

Log of Monitoring Well WP6-1

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *12.64/14.12 TOC elevation*
DATE STARTED: *05/25/93*	INITIAL H2o LEVEL: *~8.50 ft. TOC*
DATE FINISHED: *05/25/93*	FINAL H2o LEVEL: *8.27 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–10.5						FM	Fill Material: sandy/silty clay with some gravel grading to medium to coarse sand at 9 feet; medium dense; medium brown to grayish black (stained); moist; hydrocarbon odor and visible free-phase hydrocarbon at 4 feet; brick present
~4	X	21	1370				
~9	X	22	1078				
10.5							End of Boring at 10.5 feet



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

Dames & Moore, Inc.

Log of Monitoring Well WP6-2

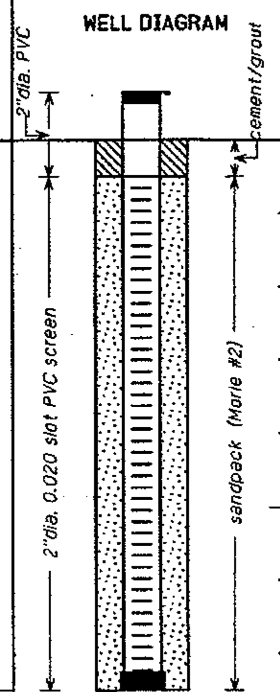
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *8.19/11.29 TOC elevation*
DATE STARTED: *06/11/93*	INITIAL H2o LEVEL: *~8.00 ft. TOC*
DATE FINISHED: *06/11/93*	FINAL H2o LEVEL: *7.90 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *7.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–7.5						FM	Fill Material: sandy clay with some gravel; black; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon at 4 feet; miscellaneous debris
~7	x		4500				
7.5							End of Boring at 7.5 feet

NOTES:

1. A sample was collected from the return cuttings at the interval noted.

2. Free-phase hydrocarbon was encountered at approximately 4.0 feet.



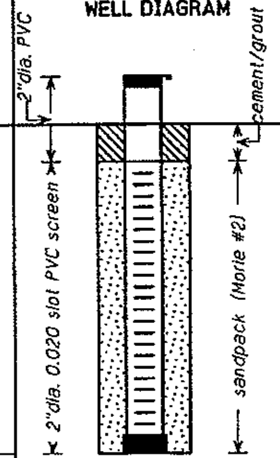
Dames & Moore, Inc.	Log of Monitoring Well WP6-3
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.29/10.61 TOC elevation*
DATE STARTED: *06/11/93*	INITIAL H2o LEVEL: *~7.50 ft. TOC*
DATE FINISHED: *06/11/93*	FINAL H2o LEVEL: *7.37 on 7/7/93 ft. TOC*
DRILLING METHOD: *Power Hand Auger*	TOTAL DEPTH: *4.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–4.5	x		3000			FM	Fill Material: sandy clay with some gravel; black; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick, metal, and coal present
5							End of Boring at 4.5 feet
10							
15							

NOTES:

1. A sample was collected from the return cuttings at the interval noted.
2. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM



Dames & Moore, Inc.

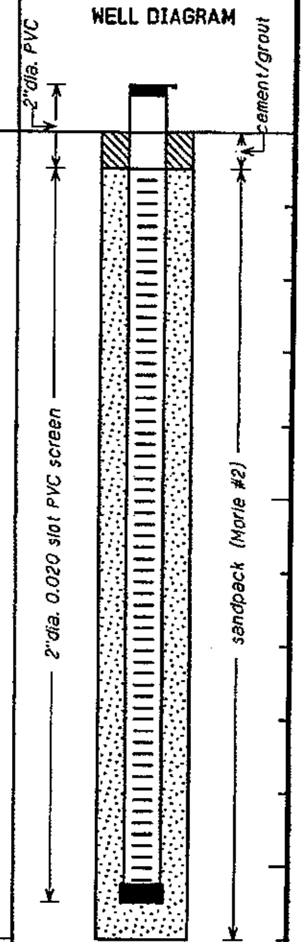
Log of Monitoring Well WP6-4

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *9.84/13.07 TOC elevation*
DATE STARTED: *06/22/93*	INITIAL H2o LEVEL: *~8.50 ft. TOC*
DATE FINISHED: *06/22/93*	FINAL H2o LEVEL: *8.74 on 7/7/93 ft. TOC*
DRILLING METHOD: *6" Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dana Brown*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: sandy clay with some gravel; loose; dark brown to black (stained) after 4 feet; moist to wet; hydrocarbon odor; visible free-phase hydrocarbon at 4 feet; brick and glass present
~4	x	3	600				
~9	x	8	400				
11							End of Boring at 11.0 feet

Depth scale: 5, 10, 15

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split spoon sampler.
2. A "blow count" refers to the number of blows required to drive a standard split spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was encountered at approximately 4.0 feet.

Dames & Moore, Inc.

Log of Monitoring Well WP7-1

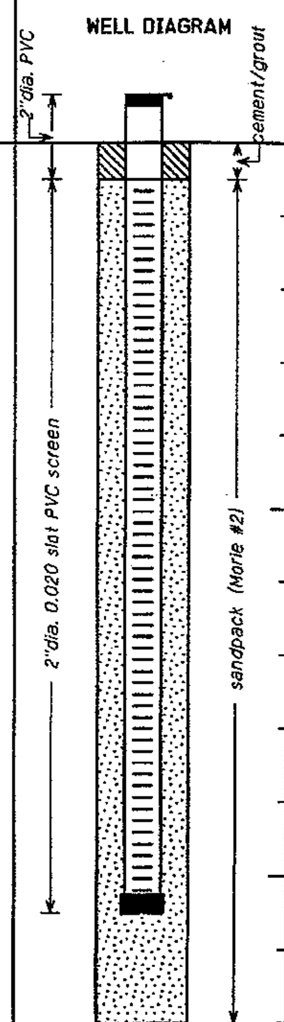
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.03/10.35 TOC elevation*
DATE STARTED: *05/25/93*	INITIAL H2o LEVEL: *~6.00 ft. TOC*
DATE FINISHED: *05/25/93*	FINAL H2o LEVEL: *6.04 on 7/7/93 ft. TOC*
DRILLING METHOD: *6" Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE 0–1000	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–12						FM	Fill Material: fine sand and silt mix with trace gravel; medium dense; dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon
~4	x	10	120				
~9	x	12	1770				
12							End of Boring at 12.0 feet

NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split spoon sampler.
2. A "blow count" refers to the number of blows required to drive a standard split spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free-phase hydrocarbon was not encountered.

WELL DIAGRAM

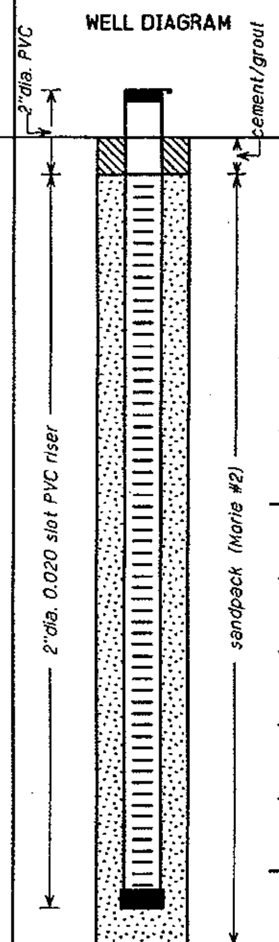


Dames & Moore, Inc.

Log of Monitoring Well WP7-2

PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.24/10.54 TOC elevation*
DATE STARTED: *05/25/93*	INITIAL H2o LEVEL: *4.5 ft. TOC*
DATE FINISHED: *05/25/93*	FINAL H2o LEVEL: *4.66 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11						FM	Fill Material: fine grain sand and silt with some gravel; micaceous; medium dense; orange brown to dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick present
~4	x	13	85				
~9	x	8	833				
11							End of Boring at 11.0 feet



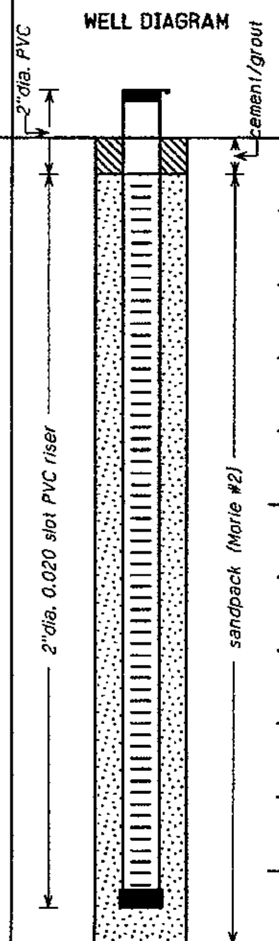
NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split spoon sampler.
2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.
3. Free phase hydrocarbon was not encountered.

Dames & Moore, Inc.	Log of Monitoring Well WP7-3
PROJECT: *Chevron USA, Incorporated*	LOCATION: *Philadelphia, Pennsylvania*
PROJECT NO.: *16000-443*	SURFACE ELEVATION: *10.65/11.13 TOC elevation*
DATE STARTED: *05/25/93*	INITIAL H2o LEVEL: *7.50 ft. TOC*
DATE FINISHED: *05/25/93*	FINAL H2o LEVEL: *7.28 on 7/7/93 ft. TOC*
DRILLING METHOD: *6in. Hollow Stem Auger*	TOTAL DEPTH: *10.5 Feet*
DRILLING COMPANY: *MARCOR of PA*	GEOLOGIST: *Dan Sirkis*

DEPTH feet	SAMPLE NO.	BLOWS/FT.	PID (ppm) VALUES	PID (ppm) PROFILE (0–1000)	GRAPHIC LOG	SOIL CLASS	GEOLOGIC DESCRIPTION
0–11.0						FM	Fill Material: fine grain sand and silt with some gravel; medium dense; orange brown to dark brown; moist to wet; hydrocarbon odor; no visible free-phase hydrocarbon; brick present
~4	x	50	391				
~9	x	6	2500				
11.0							End of Boring at 11.0 feet

WELL DIAGRAM



NOTES:

1. Samples were collected at the 4.0 to 6.0 and 9.0 to 11.0 foot intervals with a 2-inch split-spoon sampler.

2. A "blow count" refers to the number of blows required to drive standard split-spoon sampler a distance of one-foot using a 140 pound hammer falling 30 inches.

3. Free phase hydrocarbon was not encountered.

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-02-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **4 April 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-2'		Black silty sand with gravel and rock		
-1					No Sample Collected
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-03-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**11 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Brown sandy silt		
-1	1'-1.5'		Brown sandy silt and gravel		NO SAMPLE COLLECTED
	1.5'-2'		Black stained sandy silt and gravel		
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-04-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**13 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Brown sandy silt and gravel		
-1	1'-2'		Black sandy silt, stained, metallic-like appearance		Sample 1'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**12 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Brown sandy silt and gravel		
-1	1'-2'		Black stained sandy silt, highly plastic, strong petroleum odor, slight metallic-like appearance		Sample 1'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-06-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **4 April 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-1'		Rocks and silt		
-1	1'-2'		Gray metallic-like sand, silt and gravel		Sample 1'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-07-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **13 July 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.25'		Brown sandy silt and gravel		
	0.25'-1'		Black sandy silt		
-1	1'-2'		Gray sandy silt and gravel, wet, slight metallic-like appearance		Sample 1'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-08-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**13 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.75'		Brown sandy silt and gravel		
-1	0.75'-2'		Black stained sandy silt, petroleum odor, slight metallic-like appearance		Sample 0.75'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-07-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**13 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.25'		Brown sandy silt and gravel		
	0.25'-1'		Black sandy silt		
	1'-2'		Gray sandy silt and gravel, wet, slight "metallic" appearance		Sample 1'-2' collected for lead analysis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-10-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-2'		Black silt with gravel		
-1					No Sample Collected
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-11-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**3'**
DATES DRILLED:	**3 April**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0					
	0-1'		Crushed stone fill		
	1'-3'		Black sand and gravel with some black clay, wood and rocks		No Sample Collected

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-12-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **4 April 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD: **Hand Auger**
SAMPLING METHOD: **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Gravel and fill		
-1	1'-2'		Brown sandy silt clay and gravel		No Sample Collected
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-13-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-0.75'		Rusty brown-red sand		Sample 0.5'-0.75'
	0.75'-2'		Brown-tan sandy clay		
-1					
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-14-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-2'		Bricks and rock in sandy silt		
-1					No Sample Collected
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-15-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-2'		Black-green petroleum stained silty clay		
-1					No Sample Collected
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-17-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-2'		Black silty sand with gravel and rock		No Sample Collected

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-16-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **11 July 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Brown sandy silt and gravel fill		
-1	1'-2'				NO SAMPLE COLLECTED
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-18-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-1'		Brown sandy clay with gravel		
-1	1'-2'		Black dense clay with metallic-like appearance (may be from sheen)		Sample 1'-2' collected for lead anaylsis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-19-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **12 April 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **0.5'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Silty clay and gravel fill		Consistent refusal at 0.5' after several attempts in differnt locations No Sample Collected

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-20-07**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hand Auger
JOB NO.:		SAMPLING METHOD	Cuttings
LOGGED BY:	Brandee Blasi	TOTAL DEPTH:	2'
DATES DRILLED:	11 July 2007		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.75'		Brown/"rust" colored sandy silt, rust from actually metal in ground (localized)		
	0.75-2'		Black-silver metallic-like sandy silt		
-1					Sample 0.75'-2 for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-21-07**

Aquaterra Technologies, Inc.

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **4 April 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-1.75'		Brown sandy silt with gravel		
-1					Sample 1.75'-2' collected for lead anaylsis
	1.75'-2'		Orange-brown plastic clay "waxy" consistency		
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-22-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**12 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-2'		Brown sandy silt and gravel		
-1					NO SAMPLE COLLECTED
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-23-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **11 July 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Brown/"rust" colored sandy silt		Sample 0'-0.5' collected for lead anaylsis
	0.5'-1'		Black stained sandy silt and gravel		
-1	1'-2'		Gray-green silt with petroleum odor		
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-24-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**4 April 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-0.5'		Gravel and fill		
	0.5'-1.5'		Brown clay with gravel and sand		
-1					
	1.5'-2'		Black-green metallic-like gravel and sand		Sample 1.5'-2' collected for lead anaylsis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-25-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **11 July 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Fill		
-1	1'-2'		Black stained sandy, silt and gravel, wet		Sample 1'-2' collected for lead analysis
-2					

Aquaterra Technologies, Inc.

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-26-07**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Brandee Blasi**
DATES DRILLED: **11 July 2007**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1'		Fill		
-1	1'-2'		Black stained sandy, silt and gravel, wet		Sample 1'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-27-07**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Brandee Blasi**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**12 July 2007**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0-1.5'		Fill-sandy silt with brick and rock		
-1					
	1.5'-2'		Same as above, less brick content		Sample 1.5'-2' collected for lead analysis
-2					

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc.

BOREHOLE NO. **BH-01-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Dark gray silty clay, soft, wet, marshy smell, no tank bottom material observed		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-02-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-1.5'		Dark gray stained clay with some scaley/platey lenses.		
	1.5'-2'		Dark gray clay with organic materials		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-03-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD	Split Spoon
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	7 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Dark gray silty clay, soft, wet, marshy smell, no tank bottom material observed		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-04-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Dark gray silty clay, soft, wet, marshy smell, petroleum odor		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-05-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hand Auger
JOB NO.:		SAMPLING METHOD	Cuttings
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	8 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Black clay with no tank bottom materials		Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-06-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**8 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown sand and gravel fill with brick, glass and some black staining. No tank bottom material		Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-07-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hand Auger
JOB NO.:		SAMPLING METHOD	Cuttings
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	7 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown sand and gravel fill with brick, glass and some black staining. No tank bottom material		Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-08-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown sand and gravel fill with brick, glass and some black staining. No tank bottom material		Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-09-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hand Auger**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-10-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD	Split Spoon
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	6 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-11-09**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Tiffani Doerr**
DATES DRILLED: **7 April 2009**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hand Auger**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-12-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD	Split Spoon
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	6 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0			Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

Aquaterra Technologies, Inc.

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-13-09**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Tiffani Doerr**
DATES DRILLED: **6 April 2009**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hollow Stem Auger**
SAMPLING METHOD **Split Spoon**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-14-09**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Tiffani Doerr**
DATES DRILLED: **6 April 2009**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hollow Stem Auger**
SAMPLING METHOD **Split Spoon**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-15-09**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Tiffani Doerr**
DATES DRILLED: **6 April 2009**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Hollow Stem Auger**
SAMPLING METHOD **Split Spoon**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-16-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD	Split Spoon
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	6 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0			Brown clayey sand, fill with gravel, brick and glass		Sample 0'-2' collected for lead anaylsis

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-17-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Back Hoe
JOB NO.:		SAMPLING METHOD	Cuttings
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	8 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Dark brown and black sandy clay with fill material (glass, brick, ect.), odors		Debris pile on top of location. Backhoe to remove debris to grade and backhoe dug to 2' Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc.

BOREHOLE NO. **BH-18-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Back Hoe**
JOB NO.:		SAMPLING METHOD	**Cuttings**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**8 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Black clay with fill material (glass, brick, ect.), odors		Debris pile on top of location. Backhoe to remove debris to grade and backhoe dug to 2' Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-19-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Back Hoe
JOB NO.:		SAMPLING METHOD	Cuttings
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	8 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Dark brown and black sandy clay with fill material (glass, brick, ect.), odors		Debris pile on top of location. Backhoe to remove debris to grade and backhoe dug to 2' Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-20-09**

PROJECT: **Sunoco Refinery**
SITE LOCATION: **AOI-5**
JOB NO.:
LOGGED BY: **Tiffani Doerr**
DATES DRILLED: **8 April 2009**

DRILLING CO.: **Aquaterra**
DRILLING METHOD **Back Hoe**
SAMPLING METHOD **Cuttings**
TOTAL DEPTH: **2'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown sand and gravel fill with brick, glass and some black staining. No tank bottom material		Debris pile on top of location. Backhoe to remove debris to grade and backhoe dug to 2' Sample 0'-2' collected for total lead

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-25-09**

PROJECT:	Sunoco Refinery	DRILLING CO.:	Aquaterra
SITE LOCATION:	AOI-5	DRILLING METHOD	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD	Split Spoon
LOGGED BY:	Tiffani Doerr	TOTAL DEPTH:	2'
DATES DRILLED:	7 April 2009		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Brown clayey sand with gravel and glass		Sample 0'-2' collected for all parameters

SUBSURFACE BORING LOG

BOREHOLE NO. **BH-26-09**

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Aquaterra**
SITE LOCATION:	**AOI-5**	DRILLING METHOD	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	TOTAL DEPTH:	**2'**
DATES DRILLED:	**7 April 2009**		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	0'-2'		Light brown coarse sand with gravels, wet		Sample 0'-2' collected for lead anaylsis

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-21-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/8/09** COMPLETED: **6/8/09** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill (glass)						
					1130 BH-21-09				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-22-09** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **6/8/09** COMPLETED: **6/8/09** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill (glass)		1115 BH-22-09				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-23-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/8/09** COMPLETED: **6/8/09** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill (glass)		1120 BH-23-09				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-24-09** PAGE 1 OF 1

DRILLING / INSTALLATION: STARTED **6/8/09** COMPLETED: **6/8/09** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill (glass)		1140 BH-24-09				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-33-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Black; Oily, scaley material (tank bottom)		BH-33-09@ 0-2'				

Borehole terminated at 2 feet.

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PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-34-09** PAGE 1 OF 1 Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **2.0** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole BackfillBorehole BackfillBorehole Backfill
			CLAY ; brown and gray; mottled; Little mica, no evidence of leaded tank bottom.		BH-34-09@ 0-2'					

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-35-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **2.0** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole BackfillBorehole BackfillBorehole Backfill
			SANDY CLAY ; brown; Grass							
			CLAY ; dark gray; wet; Micaceous (difficult to tell difference between mica and scales)		BH-35-09@ 0-2'					

Borehole terminated at 2 feet.

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PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-36-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**
	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **2.0** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole BackfillBorehole BackfillBorehole Backfill
			SANDY CLAY ; brown; Grass							
			CLAY ; dark gray; wet; Micaceous (difficult to tell difference between mica and scales)		BH-36-09@ 0-2'					

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-37-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**
	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **2.0** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole BackfillBorehole BackfillBorehole Backfill
			GRAVEL AND CLAY WITH SAND ; brown							
					BH-37-09@ 0-2'					
			SANDY CLAY ; black; no odor; micaceous							

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-38-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVEL AND CLAY WITH SAND ; brown		BH-38-09@ 0-2'				
			SANDY CLAY ; black; no odor; micaceous						

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-39-09** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill		BH-39-09@ 0-2'				

Borehole terminated at 2 feet.

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PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-40-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill						
					BH-40-09@ 0-2'				

Borehole terminated at 2 feet.

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PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-41-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Fill, dirt		BH-41-09@ 0-2'				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-42-09** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVEL ; 8 inches of gravel						
			Fill		BH-42-09@ 0-2'				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-43-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Slight petroleum odor; Cinders, no tar-like material		BH-43-09@ 0-2'				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-44-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **4** LOGGED BY: **TD** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVEL ; 4 inches of gravel						
			Black; moderate petroleum odor; Soft mix of cindersand tar-like material		BH-44-09@ 0-2'				

Borehole terminated at 2 feet.

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-45-09** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **7/9/09** COMPLETED: **7/9/09** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **TD**
	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **4** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVEL ; 6 inches of gravel						
			CLAY ; black; moist; Fill (cinders, glass, brick)		BH-45-09@ 0-2'				

Borehole terminated at 2 feet.

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Log of Boring **AOI5_BH-01-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 2.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						
			0–0.5		HA	6			
			0.5–1		HA	6			
			1–1.5		HA	6			
			1.5–2		HA	6			
			2–2.5	1	HA	6		842	Collected sample BH-01-12_2-2.5 at 12:05.
			2.5						Ended boring at 2.5 ft bgs due to groundwater.
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-02-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 0; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1.5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0					
			1					No sample collected due to groundwater.
		▽	1.5					Ended boring at 1.5 ft bgs due to groundwater.
			2					
			3					
			4					
			5					

LANGAN

Log of Boring AOI5_BH-03-12 Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 8/7/12 / Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 3 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 3 / Completion ▼ / 24 HR. ▼
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			Collected sample BH-03-12_2-2.5 at 8:40.
				1	HA	6		192	Ended boring at 3 ft bgs due to product.
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-04-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ∇ 2.5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2	1	HA	6		250	Collected sample BH-04-12_2-2.5 at 8:15.
			2.5						Ended boring at 2.5 ft bgs due to product.
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-07-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3	1	HA	6		1.5	Collected sample BH-07-12_3-3.5 at 13:25.
			3.5						Ended boring at 3.5 ft bgs due to groundwater.
			4						
			5						

Project: Sunoco PES Facility			Project No.: 25746012		
Location: Philadelphia, Pa			Elevation and Datum: --		
Drilling Company: Langan			Date Started: 8/9/12	Date Finished: 8/9/12	
Drilling Equipment: Stainless Steel Hand Auger			Completion Depth: 1 ft	Rock Depth: NE	
Size and Type of Bit: 2"			Number of Samples	Disturbed: 0	Undisturbed: 0 / Core: 0
Casing Diameter (in): NA		Casing Depth (ft): NA	Water Level (ft.)	First: ▽ 1	Completion: ▼ / 24 HR.: ▼
Casing Hammer: NA	Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy		
Sampler: Hand Auger			Inspecting Engineer: Patrick Troy		
Sampler Hammer: NA	Weight (lbs): NA	Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL	0		HA	6			
					HA	6			No sample collected due to groundwater.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-10-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/9/12	Date Finished: 8/9/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Depth Scale (ft)	Sample Description	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
0	Gravel FILL		HA	6			
			HA	6			
1			HA	6			
			HA	6			
2	Sand FILL		HA	6			
			HA	6			
3			HA	6			
			HA	6			
4	Gravel FILL		HA	6			Collected sample BH-10-12_4.5-5 at 12:00.
		1	HA	6		0	Ended boring at 5 ft bgs due to groundwater.
5	▽						

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Log of Boring AOI5_BH-11-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 0; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			No sample collected due to groundwater.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

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Log of Boring AOI5_BH-14-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 4; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
				1	HA	6		9.1	Collected sample BH-14-12_3.5-4 at 7:30.
			4						Ended boring at 4 ft bgs due to groundwater.
			5						

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Log of Boring **AOI5_BH-15-12** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 8/7/12 / Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 4.5 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First 4.5 / Completion / 24 HR.
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
					HA	6			
			4	1	HA	6		0.0	Collected sample BH-15-12_4-4.5 at 10:45.
			4.5						Ended boring at 4.5 ft bgs due to groundwater.
			5						

LANGAN

Log of Boring **AOI5_BH-16-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 4; Completion; 24 HR.	
Casing Hammer: NA	Weight (lbs): NA; Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA	Weight (lbs): NA; Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
				1	HA	6		4.5	Collected sample BH-16-12_3.5-4 at 9:40.
			4						Ended boring at 4 ft bgs due to groundwater.
			5						

LANGAN

Log of Boring AOI5_BH-17-12 Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 8/6/12 / Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 2 / Completion ▼ / 24 HR. ▼
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6		0.0	
				1	HA	6		0.0	Collected sample BH-17-12_0.5-1 at 10:55.
			1		HA	6		0.0	
					HA	6		0.0	
		▽	2						Ended boring at 2 ft bgs due to groundwater.
			3						
			4						
			5						

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Log of Boring AOI5_BH-19-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 1; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6		2.5	Collected sample BH-19-12_0.5-1 at 11:05.
			1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-20-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0	Core 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 4; Completion	24 HR.
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
				1	HA	6		25.8	Collected sample BH-20-12_3.5-4 at 12:55.
			4						Ended boring at 4 ft bgs due to groundwater.
			5						

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Log of Boring AOI5_BH-21-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 6 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 6; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6		51.5	Collected sample BH-21-12_0.5-1 at 11:25.
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
					HA	6			
			4		HA	6			
					HA	6			
			5		HA	6			
				2	HA	6		4.0	Collected sample BH-21-12_5.5-6 at 12:15. Ended boring at 6 ft bgs due to groundwater.
			6						
			7						
			8						
			9						
			10						

LANGAN

Log of Boring AOI5_BH-22-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/6/12	Date Finished: 8/6/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 0; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			No sample collected due to groundwater.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-23-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/9/12	Date Finished: 8/9/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples	Disturbed: 1 / Undisturbed: 0 / Core: 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.)	First: NE / Completion: / 24 HR.:
Casing Hammer: NA / Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA / Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6		0.0	Collected sample BH-23-12_0.5-1 at 9:35.
			1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring **AOI5_BH-25-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6			Collected sample BH-25-12_0.5-1 at 10:10.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-28-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.8 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 0.8; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-28-12_0-0.5 at 10:30.
					HA	3.6			
			1						Ended boring at 0.8 ft bgs due to groundwater.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-31-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3	1	HA	6			Collected sample BH-31-12_3-3.5 at 9:30.
			3.5						Ended boring at 3.5 ft bgs due to groundwater.
			4						No PID readings due to malfunctioning PID.
			5						

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Log of Boring **AOI5_BH-32-12** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 8/8/12 / Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 1.5 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 1.5 / Completion ▼ / 24 HR. ▼
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6			Collected sample BH-32-12_0.5-1 at 8:45.
			1		HA	6			
		▽ (1.5)							Ended boring at 1.5 ft bgs due to groundwater.
			2						No PID readings due to malfunctioning PID.
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-33-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6			Collected sample BH-31-12_0.5-1 at 9:40.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-34-12** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 8/7/12 / Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 4.5 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 2 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 4.5 / Completion / 24 HR.
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6		13.6	Collected sample BH-34-12_0.5-1 at 12:00.
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3		HA	6			
					HA	6			
			4	2	HA	6		7.1	Collected sample BH-34-12_4-4.5 at 12:25.
		▽							Ended boring at 4.5 ft bgs due to groundwater.
			5						

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Log of Boring **AOI5_BH-35-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
				1	HA	6			Collected sample BH-35-12_2.5-3 at 8:05.
			3						Ended boring at 3 ft bgs due to groundwater.
									No PID readings due to malfunctioning PID.
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-36-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ∇ 4; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						
					HA	6			
				1	HA	6		7.5	Collected sample BH-36-12_0.5-1 at 11:40.
			1						
					HA	6			
					HA	6			
			2						
					HA	6			
					HA	6			
			3						
					HA	6			
				2	HA	6		0.0	Collected sample BH-36-12_3.5-4 at 11:55.
		∇	4						Ended boring at 4 ft bgs due to groundwater.
			5						

LANGAN

Log of Boring AOI5_BH-37-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/8/12	Date Finished: 8/8/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 2.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						
			0–0.5		HA	6			
			0.5–1		HA	6			
			1–1.5		HA	6			
			1.5–2		HA	6			
			2–2.5	1	HA	6			Collected sample BH-37-12_2-2.5 at 7:45.
			2.5						Ended boring at 2.5 ft bgs due to groundwater.
			3						No PID readings due to malfunctioning PID.
			4						
			5						

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Log of Boring **AOI5_BH-38-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3	1	HA	6		10.2	Collected sample BH-38-12_3-3.5 at 13:00.
									Ended boring at 3.5 ft bgs due to groundwater.
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-39-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ∇ 2.5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2	1	HA	6		9.7	Collected sample BH-39-12_2-2.5 at 13:30.
		∇	2.5						Ended boring at 2.5 ft bgs due to groundwater.
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-40-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
				1	HA	6		7.2	Collected sample BH-40-12_0.5-1 at 11:20.
			1		HA	6			
					HA	6			
			2		HA	6			
					HA	6			
			3	2	HA	6		7.1	Collected sample BH-40-12_3-3.5 at 11:30.
			4						
			5						Ended boring at 3.5 ft bgs due to groundwater.

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Log of Boring AOI5_BH-41-12 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 0; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Patrick Troy	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			No sample collected due to groundwater.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

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Log of Boring **AOI5_BH-13-01** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 3/11/13 / Date Finished: 3/11/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 2 / Completion ▼ / 24 HR. ▼
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample BH-13-01_1.5-2_102913 at 9:30.
		▽	2						Ended boring at 2 ft bgs due to groundwater.
			3						
			4						
			5						

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Log of Boring **AOI5_BH-13-02** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 0.5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
FILL (hatched)		Brown sand, trace silt FILL ▽	0 – 0.5	1	HA	6		0.0	Collected sample BH-13-02_0-0.5 at 9:00. Ended boring at 0.5 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-03 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples — Disturbed: 1; Undisturbed: 0; Core: 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.) — First: 0.5; Completion: ; 24 HR.:	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Brown sand, some gravel, and trace silt FILL	0	1	HA	6		0.0	Collected sample BH-13-02_0-0.5 at 9:10.
									Ended boring at 0.5 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-04** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 0; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 0.1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL ▽	0		HA	6		0.0	No sample collected due to groundwater.
									Ended boring at 0.5 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-05 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 0.5; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Sandy silt, trace clay FILL	0	1	HA	6		0.0	Collected sample BH-13-05_0-0.5 at 8:50.
									Ended boring at 0.5 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

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Log of Boring **AOI5_BH-13-06** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 0.3; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gray gravelly sand FILL ▽	0	1	HA	6			Collected sample BH-13-06_0-0.25 at 10:00. Ended boring at 0.3 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-08 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/11/13	Date Finished: 3/11/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 4; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample BH-13-08_1.5-2_102913 at 16:00.
			2		HA	6			
					HA	6			
			3		HA	6			
				2	HA	6			Collected sample BH-13-08_3.5-4 at 16:20.
			4						Ended boring at 4 ft bgs due to groundwater.
			5						

LANGAN

Log of Boring AOI5_BH-13-11 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 0.3; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gray gravelly sand FILL	0	1	HA	6		0.0	Collected sample BH-13-11_0-0.25 at 9:50. Ended boring at 0.3 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

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Log of Boring **AOI5_BH-13-12** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 8/7/12	Date Finished: 8/7/12
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 1; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			No sample collected due to groundwater.
		▽	1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-13** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 0.3; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Brown gravelly sand FILL ▽	0	1	HA	3.6		0.0	Collect sample BH-13-13_0-0.25 at 9:35. Ended boring at 0.3 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-15** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 3/11/13 — Date Finished: 3/11/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 5 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 2 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First ▽ 5 — Completion ▼ — 24 HR. ▼
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample BH-13-15_1.5-2_102913 at 13:30.
			2		HA	6			
					HA	6			
			3		HA	6			
					HA	6			
			4		HA	6			
		▽	5	2	HA	6			Collected sample BH-13-15_4.5-5 at 14:00. Ended boring at 5 ft bgs due to groundwater.

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Log of Boring AOI5_BH-13-16 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/11/13	Date Finished: 3/11/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 4 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 4; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample BH-13-16_1.5-2_102913 at 9:00.
			2		HA	6			
					HA	6			
			3		HA	6			
				2	HA	6			Collected sample BH-13-16_3.5-4 at 9:30.
			4						Ended boring at 4 ft bgs due to groundwater.
			5						

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Log of Boring **AOI5_BH-13-17** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/11/13	Date Finished: 3/11/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 5.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ 5.5; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample BH-13-17_1.5-2_102913 at 10:40.
			2		HA	6			
					HA	6			
			3		HA	6			
					HA	6			
			4		HA	6			
					HA	6			
			5	2	HA	6			Collected sample BH-13-17_5-5.5 at 11:00. Ended boring at 5.5 ft bgs due to groundwater.
			6						
			7						
			8						
			9						
			10						

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Log of Boring AOI5_BH-13-18 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 0.3; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravelly sand FILL	0	1	HA	6		0.0	Collected sample BH-13-18_0-0.25 at 10:45. Ended boring at 0.3 ft bgs due to groundwater.
			1						
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-19** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 3/1/13	Date Finished: 3/1/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 1; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravelly sand FILL	0		HA	6			
				1	HA	6		0.0	Collected sample BH-13-19_0.5-1 at 10:30.
			1						Ended boring at 1 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-22** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/8/13	Date Finished: 3/8/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck	
Sampler: NA		Inspecting Engineer: Eric Dieck	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
FILL		Brown silt and gravel FILL	0		HA	6			
					HA	6		0	
			1		HA	6		13	
				1	HA	6		54	Collected sample AOI5_BH-13-22_1.5-2_030813 at 12:30.
			2	2	HA	6		102	Collected sample AOI5_BH-13-22_2-2.5_030813 at 13:00.
			2.5					109	Ended boring at 2.5 ft bgs.
			3						
			4						
			5						

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Log of Boring **BH-13-24** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/12/13 — Date Finished: 3/12/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2.5 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples — Disturbed: 1 — Undisturbed: 0 — Core: 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.) — First: NE — Completion: — 24 HR.:
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Brown silt and gravel FILL	0		HA	6			
					HA	6			
			1		HA	6			
					HA	6			
			2	1	HA	6			Collected sample AOI5_BH-13-24_2-2.5_030813 at 15:30.
			2.5						Ended boring at 2.5 ft bgs.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-25** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/8/13 · Date Finished: 3/8/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 3 ft · Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 2 · Undisturbed 0 · Core 0
Casing Diameter (in): NA · Casing Depth (ft): NA	Water Level (ft.): First ▽ NE · Completion ▼ · 24 HR. ▼
Casing Hammer: NA · Weight (lbs): NA · Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA · Weight (lbs): NA · Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Brown silt with some gravel, FILL	0		HA	6			
					HA	6		0	
			1		HA	6		0	
				1	HA	6		291	Collected AOI5_BH-13-25_1.5-2_030813 at 14:00.
			2		HA	6		386	
				2	HA	6		388	Collected AOI5_BH-13-25_2.5-3_030813 at 14:15.
			3					392	Ended boring at 3 ft bgs.
			4						
			5						

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Log of Boring **BH-13-26** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/8/13	Date Finished: 3/8/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA	Inspecting Engineer: Eric Dieck	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample AOI5_BH-13-26_1.5-2_030813 at 10:00.
			2						Ended boring at 2 ft bgs.
			3						
			4						
			5						

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Log of Boring **BH-13-27** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/7/13	Date Finished: 3/7/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3; Completion; 24 HR.	
Casing Hammer: NA	Weight (lbs): NA; Drop (in): NA	Drilling Foreman: Eric Dieck	
Sampler: NA		Inspecting Engineer: Eric Dieck	
Sampler Hammer: NA	Weight (lbs): NA; Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL	0		HA	6		0	
		Yellow brown clay FILL			HA	6		0	
			1		HA	6		0	
				1	HA	6		3.7	Collected sample AOI5_BH-13-27_1.5-2_030713 at 13:15.
		Black brown silt, gravel, glass, and brick FILL	2		HA	6		0	
				2	HA	6		0.3	Collected sample AOI5_BH-13-27_2.5-3_030713 at 13:30.
			3						Ended boring at 3 ft bgs due to groundwater.
			4						
			5						

LANGAN

Log of Boring **BH-13-28** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/7/13	Date Finished: 3/7/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL	0		HA	6			
					HA	6			
		Yellow brown clay FILL	1		HA	6			
		Brown black silt and gravel FILL		1	HA	6			Collcected sample AOI5_BH-13-28_1.5-2_030713 at 12:40.
			2						Ended boring at 2 ft bgs.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-29** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012		
Location: Philadelphia, Pa		Elevation and Datum: --		
Drilling Company: Langan Engineering		Date Started: 3/6/13	Date Finished: 3/6/13	
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1.5 ft	Rock Depth: NE	
Size and Type of Bit: 2"		Number of Samples	Disturbed: 1	Undisturbed: 0 / Core: 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.)	First: 1.5	Completion: / 24 HR.:
Casing Hammer: NA / Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck		
Sampler: NA		Inspecting Engineer: Eric Dieck		
Sampler Hammer: NA / Weight (lbs): NA	Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel and silt FILL	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1	1	HA	6			Collected sample AOI5_BH-13-29_1-1.5_030613 at 14:00.
			1.5						Ended boring at 1.5 ft bgs due to groundwater.
			2						
			3						
			4						
			5						

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Log of Boring **BH-13-30** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/7/13	Date Finished: 3/7/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL with marble cobbles,	0		HA	6		0	
					HA	6		0	
		Brown silt and gravel FILL	1		HA	6		0	
				1	HA	6		0	Collected sample AOI5_BH-13-30_1.5-2_030713 at 11:30.
			2						Ended boring at 2 ft bgs.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-31** Sheet 1 of 1

Project: Sunoco PES Facility			Project No.: 25746012		
Location: Philadelphia, Pa			Elevation and Datum: --		
Drilling Company: Langan Engineering			Date Started: 3/6/13	Date Finished: 3/6/13	
Drilling Equipment: Stainless Steel Hand Auger			Completion Depth: 2 ft	Rock Depth: NE	
Size and Type of Bit: 2"			Number of Samples	Disturbed: 1	Undisturbed: 0 / Core: 0
Casing Diameter (in): NA		Casing Depth (ft): NA	Water Level (ft.)	First: ▽ 2	Completion: ▼ / 24 HR.: ▼
Casing Hammer: NA	Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck		
Sampler: NA			Inspecting Engineer: Eric Dieck		
Sampler Hammer: NA	Weight (lbs): NA	Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL with some silt	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1		HA	6			
		Red brown clay with gravel and slag, FILL		1	HA	6			Collected sample AOI5_BH-13-31_1.5-2_030613 at 13:15.
		▽	2						Ended boring at 2 ft bgs due to groundwater.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-32** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/6/13	Date Finished: 3/6/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 2; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA		Inspecting Engineer: Eric Dieck	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL with some silt	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1		HA	6			
		Red brown clay with some gravel and slag, FILL		1	HA	6			Collected sample AOI5_BH-13-32_1.5-2_030613 at 12:00.
			2						Ended boring at 2 ft bgs due to groundwater.
			3						
			4						
			5						

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Log of Boring **BH-13-33** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/7/13 — Date Finished: 3/7/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First NE — Completion — 24 HR.
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL	0		HA	6			
		Yellow brown clay FILL			HA	6			
		Grey gravel FILL	1		HA	6			
		Black gravel and silt FILL		1	HA	6			Collected sample AOI5_BH-13-33_1.5-2_030713 at 10:00.
			2					8.0	End boring at 2 ft bgs due to obstruction.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-34** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/6/13	Date Finished: 3/6/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First 3; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL with some silt	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1		HA	6			
		Red brown clay, some gravel, slag, and brick, FILL		1	HA	6			Collected sample AOI5_BH-13-34_1.5-2_030613 at 10:00.
			2		HA	6			
				2	HA	6			Collected sample AOI5_BH-13-34_2.5-3_030613 at 10:40.
			3						Ended boring at 3 ft bgs due to groundwater.
			4						
			5						

LANGAN

Log of Boring **BH-13-35** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/6/13	Date Finished: 3/6/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA		Inspecting Engineer: Eric Dieck	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL with some silt	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1		HA	6			
		Red brown clay, some gravel, brick, and slag, FILL		1	HA	6			Collected sample AOI5_BH-13-35_1.5-2_030613 at 9:40.
			2						Ended boring at 2 ft bgs.
			3						
			4						
			5						

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LANGAN

Log of Boring **BH-13-36** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/6/13 / Date Finished: 3/6/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First ▽ 2 / Completion ▼ / 24 HR. ▼
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel and silt FILL	0		HA	6			
		Yellowish brown clay FILL			HA	6			
			1		HA	6			
		Red brown clay with gravel and slag, FILL		1	HA	6			Collected sample AOI5_BH-13-36_1.5-2_030613 at 9:00.
		▽	2					282	Ended boring at 2 ft bgs due to groundwater.
			3						
			4						
			5						

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LANGAN

Log of Boring **BH-13-37** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/5/13	Date Finished: 3/5/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA	Inspecting Engineer: Eric Dieck	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel FILL	0		HA	6			
					HA	6			
		Silt with gravel and slag, FILL	1		HA	6			
		Silty clay with gravel, FILL		1	HA	6			Collected sample AOI5_BH-13-37_1.5-2_030513 at 13:00.
		Silt with gravel and slag, FILL	2		HA	6			
				2	HA	6			Collected sample AOI5_BH-13-37_2.5-3_030513 at 13:00.
			3						Ended boring at 3 ft bgs.
			4						
			5						

LANGAN

Log of Boring **BH-13-38** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/5/13 — Date Finished: 3/5/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 4 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 2 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First NE — Completion — 24 HR.
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravel with some silt, bricks, glass, and slag, FILL	0		HA	6			
					HA	6		0	
			1		HA	6		0	
		Black brown gravelly silt, slag, glass, and brick FILL		1	HA	6		0.2	Collected sample AOI5_BH-13-38_1.5-2_030513 at 10:00.
			2		HA	6		0	
					HA	6		0	
			3		HA	6		0	
				2	HA	6		0	Collected sample AOI5_BH-13-38_3.5-4_030513 at 10:30.
			4					0	Ended boring at 4 ft bgs.
			5						

LANGAN

Log of Boring BH-13-39 Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/5/13; Date Finished: 3/5/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 3 ft; Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 3; Undisturbed 0; Core 0
Casing Diameter (in): NA; Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Black brown gravelly silt, slag, brick, concrete, and glass FILL	0		HA	6			
					HA	6		0	
			1		HA	6		0	
				1	HA	6		0	Collected sample AOI5_BH-13-39_1.5-2_030513 at 11:00.
			2	2	HA	6		0	Collected sample AOI5_BH-13-39_2-2.5_030513 at 11:10.
				3	HA	6		42.8	Collected sample AOI5_BH-13-39_2.5-3_030513 at 11:15.
			3					8.0	Ended boring at 3 ft bgs.
			4						
			5						

LANGAN

Log of Boring **BH-13-40** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/4/13	Date Finished: 3/4/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
FILL		Black brown silt, gravel, brick, slag, and glass FILL	0		HA	6			
								0	
					HA	6			
			1					0	
					HA	6			
								0	
					HA	6			
			2					0	Collected sample AOI5_BH-13-40_2-2.5_030413 at 11:00.
				1	HA	6			
								0	Ended boring at 2.5 ft bgs.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-41** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/4/13	Date Finished: 3/4/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Black brown silt, gravel, slag, brick, and glass FILL	0	1	HA	6			
					HA	6			
			1					1.7	
					HA	6			
								0.5	
					HA	6			
			2					0.7	Collected sample AOI5_BH-13-41_2-2.5_030413 at 12:00.
				1	HA	6			
								1.8	Ended boring at 2.5 ft bgs.
			3						
			4						
			5						

LANGAN

Log of Boring **BH-13-42** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/4/13	Date Finished: 3/4/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 3 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 2; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Eric Dieck	
Sampler: NA			
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA		Inspecting Engineer: Eric Dieck	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Black brown silt, gravel, brick, slag, and glass FILL	0		HA	6			
					HA	6			
		Brown silt, some clay, slag, gravel, and brick FILL	1		HA	6			
				1	HA	6			Collected sample AOI5_BH-13-42_1.5-2_030413 at 12:30.
			2		HA	6			
				2	HA	6			Collected sample AOI5_BH-13-42_2.5-3_030413 at 13:00.
			3						Ended boring at 3 ft bgs.
			4						
			5						

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LANGAN

Log of Boring **BH-13-43** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan Engineering	Date Started: 3/5/13 — Date Finished: 3/5/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 2.5 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 2 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First NE — Completion — 24 HR.
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Eric Dieck
Sampler: NA	Inspecting Engineer: Eric Dieck
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	Black brown silt, gravel, slag, brick, and glass FILL	0		HA	6			
				HA	6		0	
	CONCRETE	1		HA	6		0	
			1	HA	6		0	Collected sample AOI5_BH-13-43_1.5-2_030513 at 8:45.
		2	2	HA	6		0	Collected sample AOI5_BH-13-43_2-2.5_030513 at 9:00.
		2.5					3.7	Ended boring at 2.5 ft bgs.
		3						
		4						
		5						

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LANGAN

Log of Boring **BH-13-44** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan Engineering		Date Started: 3/8/13	Date Finished: 3/8/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 2 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Eric Dieck	
Sampler: NA		Inspecting Engineer: Eric Dieck	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0		HA	6			
					HA	6			
			1		HA	6			
				1	HA	6			Collected sample AOI5_BH-13-44_1.5-2_030813 at 10:30.
			2						Ended boring at 2 ft bgs.
			3						
			4						
			5						

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LANGAN

Log of Boring AOI5_BH-13-116 Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/29/13 / Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 0.5 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First NE / Completion / 24 HR.
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravelly sand FILL	0	1	HA	6		0.0	Collected sample BH-13-116_0-0.5_102916 at 10:10.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-117** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		Gravelly sand FILL	0	1	HA	6			Collected sample BH-13-117_0-0.5_102916 at 10:10.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring **AOI5_BH-13-121** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/29/13 — Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 0.5 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First NE — Completion — 24 HR.
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-121_0-0.5_102916 at 9:30.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-122 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-122_0-0.5_102913 at 9:30.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-123** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-123_0-0.5_102913 at 11:10.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-124 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-124_0-0.5_102913 at 11:25.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-125** Sheet 1 of 1

Project: Sunoco PES Facility			Project No.: 25746012			
Location: Philadelphia, Pa			Elevation and Datum: --			
Drilling Company: Langan			Date Started: 10/29/13		Date Finished: 10/29/13	
Drilling Equipment: Stainless Steel Hand Auger			Completion Depth: 0.5 ft		Rock Depth: NE	
Size and Type of Bit: 2"			Number of Samples	Disturbed: 1	Undisturbed: 0	Core: 0
Casing Diameter (in): NA		Casing Depth (ft): NA	Water Level (ft.)	First: NE	Completion:	24 HR.:
Casing Hammer: NA	Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy			
Sampler: Hand Auger			Drilling Foreman: Patrick Troy			
Sampler Hammer: NA	Weight (lbs): NA	Drop (in): NA	Inspecting Engineer: Patrick Troy			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-125_0-0.5_102913 at 11:35.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-126** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-126_0-0.5_102913 at 11:35.
									Ended boring at 0.5 ft bgs.
			1						No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-127** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-127_0-1_103013 at 8:10.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-128 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1, Undisturbed 0, Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE, Completion, 24 HR.	
Casing Hammer: NA, Weight (lbs): NA, Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA, Weight (lbs): NA, Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-128_0-1_103013 at 8:00.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring AOI5_BH-13-129 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						
				1	HA	12			Collected sample BH-13-129_0-1_103013 at 7:50.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-130 Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/30/13 / Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 1 ft / Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0
Casing Diameter (in): NA / Casing Depth (ft): NA	Water Level (ft.): First NE / Completion / 24 HR.
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-130_0-1_103013 at 10:20.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-131 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0	Core 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion	24 HR.
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-131_0-1_103013 at 10:10.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-132** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0	Core 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion	24 HR.
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-132_0-1_103013 at 10:00.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-133** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-133_0-1_103013 at 9:50.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-134** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-134_0-1_103013 at 9:40.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-135 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0 – 1	1	HA	12			Collected sample BH-13-135_0-1_103013 at 9:30.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-136 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1, Undisturbed 0, Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE, Completion, 24 HR.	
Casing Hammer: NA, Weight (lbs): NA, Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA, Weight (lbs): NA, Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-136_0-1_103013 at 12:00.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-137** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-137_0-1_103013 at 12:15.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-138** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0					Collected sample BH-13-138_0-1_103013 at 12:00.
			1					Ended boring at 1 ft bgs.
								No PID readings due to malfunctioning PID.
			2					
			3					
			4					
			5					

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LANGAN

Log of Boring **AOI5_BH-13-139** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						Collected sample BH-13-139_0-1_103013 at 11:55.
				1	HA	12			
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-140** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-140_0-1_103013 at 11:45.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-141** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/30/13 — Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 1 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples — Disturbed: 1 — Undisturbed: 0 — Core: 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.) — First: NE — Completion: — 24 HR.:
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-141_0-1_103013 at 11:50.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring **AOI5_BH-13-142** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE / Completion / 24 HR.	
Casing Hammer: NA / Weight (lbs): NA / Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA / Weight (lbs): NA / Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-142_0-1_103013 at 12:30.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-143** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First ▽ NE; Completion ▼; 24 HR. ▼	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-143_0-1_103013 at 12:25.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-144** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1 / Undisturbed 0 / Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE / Completion / 24 HR.	
Casing Hammer: NA / Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA / Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						Collected sample BH-13-144_0-1_103013 at 12:20.
				1	HA	12			
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-145** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/30/13 — Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 1 ft — Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 — Undisturbed 0 — Core 0
Casing Diameter (in): NA — Casing Depth (ft): NA	Water Level (ft.): First NE — Completion — 24 HR.
Casing Hammer: NA — Weight (lbs): NA — Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA — Weight (lbs): NA — Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-145_0-1_103013 at 12:55.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-146** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-146_0-1_103013 at 12:55.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-147** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0						Collected sample BH-13-147_0-1_103013 at 12:50.
				1	HA	12			
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring **AOI5_BH-13-148** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1 / Undisturbed 0	Core 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE / Completion	24 HR.
Casing Hammer: NA / Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA / Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-148_0-1_103013 at 12:50.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-149 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-149_0-1_103013 at 12:35.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-150** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1, Undisturbed 0, Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE, Completion, 24 HR.	
Casing Hammer: NA, Weight (lbs): NA, Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA, Weight (lbs): NA, Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-150_0-1_103013 at 13:15.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-151 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1	Undisturbed 0; Core 0
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE	Completion; 24 HR.
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
FILL (hatched)		FILL	0	1	HA	12			Collected sample BH-13-151_0-1_103013 at 13:25.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring AOI5_BH-13-152 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-152_0-1_103013 at 13:25.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring **AOI5_BH-13-153** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	12			Collected sample BH-13-153_0-1_103013 at 13:15.
			1						Ended boring at 1 ft bgs.
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-154** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 1 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-154_0-0.5_102913 at 13:30.
									Ended boring at 0.5 ft bgs.
			1						
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-155** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-155_0-0.5_102913 at 13:35.
									Ended boring at 0.5 ft bgs.
			1						
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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LANGAN

Log of Boring AOI5_BH-13-156 Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/30/13	Date Finished: 10/30/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA; Drop (in): NA		Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA; Drop (in): NA			

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-156_0-0.5_102913 at 13:40.
									Ended boring at 0.5 ft bgs.
			1						
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-158** Sheet 1 of 1

Project: Sunoco PES Facility	Project No.: 25746012
Location: Philadelphia, Pa	Elevation and Datum: --
Drilling Company: Langan	Date Started: 10/29/13 · Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger	Completion Depth: 0.5 ft · Rock Depth: NE
Size and Type of Bit: 2"	Number of Samples: Disturbed 1 · Undisturbed 0 · Core 0
Casing Diameter (in): NA · Casing Depth (ft): NA	Water Level (ft.): First NE · Completion · 24 HR.
Casing Hammer: NA · Weight (lbs): NA · Drop (in): NA	Drilling Foreman: Patrick Troy
Sampler: Hand Auger	Inspecting Engineer: Patrick Troy
Sampler Hammer: NA · Weight (lbs): NA · Drop (in): NA	

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-158_0-0.5_102913 at 12:50.
									Ended boring at 0.5 ft bgs.
			1						
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

LANGAN

Log of Boring **AOI5_BH-13-159** Sheet 1 of 1

Project: Sunoco PES Facility		Project No.: 25746012	
Location: Philadelphia, Pa		Elevation and Datum: --	
Drilling Company: Langan		Date Started: 10/29/13	Date Finished: 10/29/13
Drilling Equipment: Stainless Steel Hand Auger		Completion Depth: 0.5 ft	Rock Depth: NE
Size and Type of Bit: 2"		Number of Samples: Disturbed 1; Undisturbed 0; Core 0	
Casing Diameter (in): NA	Casing Depth (ft): NA	Water Level (ft.): First NE; Completion; 24 HR.	
Casing Hammer: NA; Weight (lbs): NA	Drop (in): NA	Drilling Foreman: Patrick Troy	
Sampler: Hand Auger		Inspecting Engineer: Patrick Troy	
Sampler Hammer: NA; Weight (lbs): NA	Drop (in): NA		

MATERIAL SYMBOL	Elev. (ft)	Sample Description	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	PID Reading (ppm)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
		FILL	0	1	HA	6			Collected sample BH-13-159_0-0.5_102913 at 12:35.
									Ended boring at 0.5 ft bgs.
			1						
									No PID readings due to malfunctioning PID.
			2						
			3						
			4						
			5						

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PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH_14-14
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:	NORTHING (ft):
STARTED **6/15/14** COMPLETED: **6/15/14**	EASTING (ft):
DRILLING COMPANY: **Aquaterra**	LAT:
DRILLING EQUIPMENT:	LONG:
DRILLING METHOD:	GROUND ELEV (ft):
SAMPLING EQUIPMENT: **Hand Auger**	TOC ELEV (ft):
	INITIAL DTW (ft): **8.00**
	WELL DEPTH (ft): **---**
	STATIC DTW (ft): **Not Encountered**
	BOREHOLE DEPTH (ft): **9.0**
	WELL CASING DIA. (in): **---**
	BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM**
	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID Method	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0-2			**SANDY SILT WITH GRAVEL** ; gray and orange; Boring installed via Hand Auger.		BH_14-14_0-2 1530			0.5	
2-4			**GRAVELLY CLAY** ; dark grayish black		BH_14-14@ 2-4'			18.9	
4-6			**CLAY WITH GRAVEL** ; black and orange		BH_14-14@ 4-6'			21.3	
6-8			**CLAY** ; grayish black and dark red		BH_14-14@ 6-8'			25.1	
8-9			**CLAY** ; grayish black; wet; Metallic in color.		BH_14-14_8-9 1600			30.7	
9			Borehole terminated at 9 feet.						

Depth scale: 5, 10, 15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH_14-15
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/15/14** COMPLETED: **6/15/14**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT:
DRILLING METHOD:
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **6.00**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **8.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **2**
LOGGED BY: **LM**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH GRAVEL ; whiteish gray; Boring installed via Hand Auger.		1000 BH_14-15_0-2			0.1	
			CLAY ; black with orange		BH_14-15@ 2-4'			2.2	
5			**GRAVELLY CLAY** ; black and gray		BH_14-15@ 4-6'			3.1	5
			CLAY ; black; wet; Strong petroleum-like odor. Sheen present.		1200 BH_14-15_6-8			8.2	
			Borehole terminated at 8 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-17** PAGE 1 OF 1	Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/15/14** COMPLETED: **6/15/14**	NORTHING (ft):	EASTING (ft):
DRILLING COMPANY: **Aquaterra**	LAT:	LONG:
DRILLING EQUIPMENT:	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING METHOD:	INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **---**
SAMPLING EQUIPMENT: **Hand Auger**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **8.0**
	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM**	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
		SM	**SILTY SAND WITH GRAVEL** ; SM; white and orange; Boring installed via Hand Auger.		1400 BH_14-17_0-2			2.7	
			GRAVELLY CLAY ; orange and brown; Fill (bricks)		BH_14-17@ 2-4'			7.1	
5		CL	**CLAY** ; CL; black		BH_14-17@ 4-6'			8.8	5
		CL	**CLAY** ; CL; blackish gray and dark red		1500 BH_14-17_6-8			10.4	
			Borehole terminated at 8 feet.						
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-5**	**BH_14-18** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/15/14** COMPLETED: **6/15/14**	LAT:	LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT:	INITIAL DTW (ft): **7.00**	WELL DEPTH (ft): **---**
DRILLING METHOD:	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **8.0**
	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **2**
SAMPLING EQUIPMENT: **Hand Auger**	LOGGED BY: **LM**	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
		SM	**SILTY SAND WITH GRAVEL** ; SM; orange and brown; Boring installed via Hand Auger.		1200 BH_14-18_0-2			0.2	
			GRAVELLY CLAY ; dark grayish black		BH_14-18@ 2-4'			0.2	
5			**GRAVELLY CLAY** ; brown and black		BH_14-18@ 4-6'			0.1	5
			CLAY ; dark blackish gray and dark red; Metallic color. Wet at 7'bgs.		1330 BH_14-18_6-8			0.3	▽
			Borehole terminated at 8 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-5**	**BH_14-19** PAGE 1 OF 1
PROJECT NUMBER:	
DRILLING / INSTALLATION:	NORTHING (ft): / EASTING (ft):
STARTED **6/18/04** COMPLETED: **6/18/14**	LAT: / LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft): / TOC ELEV (ft):
DRILLING EQUIPMENT:	INITIAL DTW (ft): **6** / WELL DEPTH (ft): **---**
DRILLING METHOD:	STATIC DTW (ft): **Not Encountered** / BOREHOLE DEPTH (ft): **8.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---** / BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM** / CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY AND GRAVEL ; orange; Boring installed via Hand Auger.		1400 BH_14-10_0-2			0.0	
			CLAY ; black		BH_14-19@ 2-4'			0.3	
5			**CLAY** ; gray		BH_14-19@ 4-6'			0.0	5
			CLAY ; gray and black; wet; Cohesive.		1445 BH_14-19_6-8			0.0	▽
			Borehole terminated at 8 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-20** PAGE 1 OF 1	Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:	NORTHING (ft): EASTING (ft):
STARTED **6/20/14** COMPLETED: **6/20/14**	LAT: LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft): TOC ELEV (ft):
DRILLING EQUIPMENT:	INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---**
DRILLING METHOD:	STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **8.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–2			**SILTY CLAY WITH SAND** ; black and brown; Boring installed via Hand Auger.		0800 BH_14-20_0-2			0.3	
2–4			**SANDY SILT WITH GRAVEL** ; black		BH_14-20@ 2-4'			42.3	
4–6 (5)			**CLAY** ; black and gray		BH_14-20@ 4-6'				5
6–8			**CLAY** ; gray		1400 BH_14-20_6-8			50.8	
8			Borehole terminated at 8 feet.						
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-21** PAGE 1 OF 1

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/18/14** COMPLETED: **6/18/14**	LAT:	LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT:	INITIAL DTW (ft): **5.5**	WELL DEPTH (ft): **---**
DRILLING METHOD:	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **6.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM**	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVELLY CLAY ; black; Boring installed via Hand Auger.		1030 BH_14-21_0-2			7.3	
			SILTY CLAY WITH SAND ; black and tan		BH_14-21@ 2-4'			111.3	
5			**CLAY** ; red and gray; Wet at 5.5'bgs.		1130 BH_14-21_4-6				5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-22** PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION: STARTED **6/18/14** COMPLETED: **6/18/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **6.00** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **6.0** BOREHOLE DIA. (in): **2** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY SAND ; brown and tan; Boring installed via Hand Auger. Fill (concrete)		1145 BH_14-22_0-2			3.4	
			SILTY CLAY ; black and brown		BH_14-22@ 2-4'			2.0	
5			**CLAY** ; gray and black; Wet at 6'bgs.		1215 BH_14-22_4-6			8.7	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-24** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/20/14** COMPLETED: **6/20/12** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **4.00** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **8.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2** LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY WITH SAND ; dark orangeish brown; Boring installed via Hand Auger.		0900 BH_14-24_0-2			0.0	
5			**SANDY SILT** ; black; Wet at 4'bgs. Perch water suspected due to soil being dry at 5-6'bgs. SPH noted.		1300 BH_14-24_4-6			348.8	5
			CLAY ; dark grayish black; dry		12.2 BH_14-24@ 6-8'			12.2	
			Borehole terminated at 8 feet.						
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:

BH_14-25

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/18/14** COMPLETED: **6/18/14**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT:
DRILLING METHOD:
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft): EASTING (ft):
LAT: LONG:
GROUND ELEV (ft): TOC ELEV (ft):
INITIAL DTW (ft): **8.00** WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **8.0**
WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2**
LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			CLAY ; black and red; Boring installed via Hand Auger.		1230 BH_14-25_0-2			2.7	
			SANDY CLAY WITH SILT ; brown		BH_14-25@ 2-4'			2.8	
5			**CLAY** ; gray and black		BH_14-25@ 4-6'			2.1	5
			CLAY ; black; Wet at 8'bgs. SPH present.		1245 BH_14-25_6-8			2.9	
			Borehole terminated at 8 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-26** PAGE 1 OF 1

DRILLING / INSTALLATION: STARTED **6/19/14** COMPLETED: **6/19/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **2** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH GRAVEL ; dark brown; Boring installed via Hand Auger.		1430 BH_14-26_0-2			4.5	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-27** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/19/14** COMPLETED: **6/19/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2** LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH CLAY ; dark brown with orange; Boring installed via Hand Auger.		1500 BH_14-27_0-2			3.7	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH_14-28
PAGE 1 OF 1

DRILLING / INSTALLATION:
STARTED **6/18/14** COMPLETED: **6/18/14**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT:
DRILLING METHOD:
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **6.00**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **6.0**
BOREHOLE DIA. (in): **2**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH GRAVEL ; gray and black; Boring installed via Hand Auger.		0900 BH_14-28_0-2			5.4	
			CLAY ; orange		BH_14-28@ 2-4'			38.7	
5			**SILTY CLAY** ; black and brown; Wet at 6'bgs.		0830 BH_14-28_4-6			53.9	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-29** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/19/14** COMPLETED: **6/19/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2** LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH CLAY ; black with orange; Boring installed via Hand Auger.		1400 BH_14-29_0-2			5.2	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-5**	**BH_14-30** PAGE 1 OF 1
PROJECT NUMBER:	
DRILLING / INSTALLATION:	NORTHING (ft): / EASTING (ft):
STARTED **6/18/14** COMPLETED: **6/18/14**	LAT: / LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft): / TOC ELEV (ft):
DRILLING EQUIPMENT:	INITIAL DTW (ft): **5.50** / WELL DEPTH (ft): **---**
DRILLING METHOD:	STATIC DTW (ft): **Not Encountered** / BOREHOLE DEPTH (ft): **6.0**
	WELL CASING DIA. (in): **---** / BOREHOLE DIA. (in): **2**
SAMPLING EQUIPMENT: **Hand Auger**	LOGGED BY: **LM** / CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY CLAY WITH SILT ; brown and gray; Boring installed via Hand Auger.		1000 BH_14-30_0-2			8.3	
			CLAY ; orange		BH_14-30@ 2-4'			38.7	
5			**CLAY WITH GRAVEL** ; white and greenish gray; Wet at 5.5'bgs.		1030 BH_14-30_4-6			60.4	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-31** PAGE 1 OF 1

DRILLING / INSTALLATION: STARTED **6/18/14** COMPLETED: **6/18/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **5.5** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **6.0** BOREHOLE DIA. (in): **2** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH CLAY ; gray and tan; Boring installed vis Hand Auger.		1100 BH_14-31_0-2			26.4	
			SANDY CLAY ; white and gray		BH_14-31@ 2-4'			10.3	
5			**SANDY CLAY WITH SILT** ; black and greenish gray; Wet at 5.5'bgs.		1130 BH_14-31_4-6			23.7	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-32** PAGE 1 OF 1	Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/17/14** COMPLETED: **6/17/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **4.50** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **5.0** BOREHOLE DIA. (in): **2** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVELLY SAND ; orangeish brown; Boring installed via Hand Auger. Fill (debris)		1330 BH_14-32_0-2			596.3	
			CLAY ; dark brown and grayish tan		BH_14-32@ 2-4'			1468	
			SANDY GRAVEL WITH SILT ; black; Wet at 4.5'bgs. Srong petroleum-like odor.		1400 BH_14-32_4-5			4399	∇
5			Borehole terminated at 5 feet.						5
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-33** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **6/17/14** COMPLETED: **6/17/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **5.50** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **6.0** BOREHOLE DIA. (in): **2** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVELLY SILT ; dark brown; Boring installed via Hand Auger. Fill (debris).		1100 BH_14-33_0-2			599.1	
			CLAY ; brown and gray		BH_14-33@ 2-4'			700.2	
5			**CLAY** ; black; Wet at 5.5'bgs. Saturated with product.		1200 BH_14-33_4-6			1866	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH_14-34
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/17/14** COMPLETED: **6/17/14**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT:
DRILLING METHOD:
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **5.50**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **6.0**
BOREHOLE DIA. (in): **2**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVELLY SILT ; black and brown; Boring installed via Hand Auger. Fill (debris)		1100 BH_14-34_0-2			769	
			CLAY ; brown and gray		BH_14-34@ 2-4'			884	
5			**CLAY WITH SILT AND SAND** ; black and gray; Wet at 5.5'bgs. Saturated with product.		1230 BH_14-34_4-6			2105	5
			Borehole terminated at 6 feet.						
10									10
15									15

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH_14-35** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/17/14** COMPLETED: **6/17/14** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: DRILLING METHOD: SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **5.50** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **6.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2** LOGGED BY: **LM** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Boring installed via Hand Auger. Fill (slag)						
			SILTY GRAVEL ; dark brown		1430 BH_14-35_0-2			18.9	
			CLAY ; black		BH_14-35@ 2-4'			438	
			CLAY ; black		BH_14-35@ 4-5'			613	
5			**SAND** ; black and gray; fine-grained; Wet at 5.5'bgs.		1500 BH_14-35_5-6			887	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH_14-36

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/18/14** COMPLETED: **6/18/14**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT:
DRILLING METHOD:
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **6.00**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **6.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **2**
LOGGED BY: **LM**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			GRAVEL WITH CLAY ; white with reddish orange; Boring installed via Hand Auger.		1300 BH_14-36_0-2			0.2	
			SILTY CLAY WITH SAND ; black and brown		BH_14-36@ 2-4'			0.8	
5			**CLAY AND SILT WITH SAND** ; dark brown; Wet at 6'bgs.		1330 BH_14-36_4-6			3.1	5
			Borehole terminated at 6 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:	
LOCATION: **AOI-5**	**BH_14-37** PAGE 1 OF 1	
PROJECT NUMBER:		
DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/18/14** COMPLETED: **6/18/14**	LAT:	LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft):	TOC ELEV (ft):
	INITIAL DTW (ft): **8.00**	WELL DEPTH (ft): **---**
DRILLING EQUIPMENT:	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **8.0**
DRILLING METHOD:	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **2**
SAMPLING EQUIPMENT: **Hand Auger**	LOGGED BY: **LM**	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–2			**CLAY WITH GRAVEL** ; black; Boring installed via Hand Auger.		0800 BH_14-37_0-2			3.2	
2–4			**CLAY** ; green and gray		BH_14-37@ 2-4'			4.1	
4–6			**CLAY** ; gray and black		BH_14-37@ 4-6'			4.7	5
6–8			**CLAY** ; black; Wet at 8'bgs.		0830 BH_14-37_6-8			8.1	
8			Borehole terminated at 8 feet.						
10									10
15									15

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-14-38 PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/26/14** COMPLETED: **6/26/14**
DRILLING COMPANY: **Eisco**
DRILLING EQUIPMENT: **Hydrovac**
DRILLING METHOD: **Hydrovac**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **8.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY CLAY WITH SILT ; tan						
					0900 BH-14-38 _0-2			0.7	
			CLAY ; greenish gray						
5					1200 BH-14-38 _4-6			8.1	5

Borehole terminated at 8 feet.

GEO FORM 304 PHILLY AOI5 BH-14-38.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 5/24/16

PROJECT: **Philadelphia Energy Solutions**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-1 PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **2/10/16** COMPLETED: **2/10/16**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT: **Hand Auger**
DRILLING METHOD: **Hand Auger**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft): EASTING (ft):
LAT: LONG:
GROUND ELEV (ft): TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **2.0**
WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2**
LOGGED BY: **LM** CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH CLAY ; red and orangeish brown; Fill (bricks, slag, comcrete, rubble)		1300 BH-16-1 _0-2			0.0	
			Borehole terminated at 2 feet.						

MONITORING WELL LOGS

Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-138

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Kevin Martin**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**16 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Asphalt and fill		Completed as a flushmount with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0'-0.5')	
-5						
					Sand pack (0.5'-17')	
-10	0.4		Dark gray silty clay, moist		Screen interval (2'-17')	
	0.2		same as above			
	0.4		Dark gray silty clay with some sand	Borehole completed to 17'		
-15						

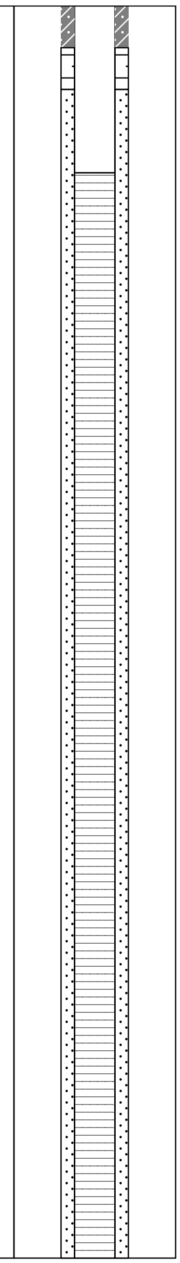
Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-139

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	7 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	15'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Brown silt and sand with gravel.		Completed as a stickup with locking cap
			No lithology available, hydro-vacuum extraction	Sample A-139_071207_1.5-2	Bentonite (0.5'-1')
				Utility clearance to 8'	
-5					
					Sand pack (1'-15')
-10	0.4		Dark brown wet, plastic clay	Water encountered	Screen interval (2'-15')
	0.2		Med brown moist plastic silty clay		
	0.0		Mottled light and dark med sand with some clay	Borehole completed to 15'	
-15					

WELL DIAGRAM



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-140

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Brandee Blasi**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Brown silt and gravel Brown silt/sand and gravel, moist	Utility clearance to 10'	Completed as a stickup with locking cap	
			No lithology available, hydro-vacuum extraction	Sample A-140_071207_1.5-2	Bentonite (0'-0.5')	
-5						
					Sand pack (0.5'-17')	
-10			Stained silty clay, highly plastic, saturated, odor	water encountered	Screen interval (2'-17')	
			sheen present			
				Borehole completed to 17'		
-15						

MONITORING WELL LOG: A-141

Aquaterra Technologies, Inc.

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Brandee Blasi	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	6 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	17'	ELEVATION:	NA

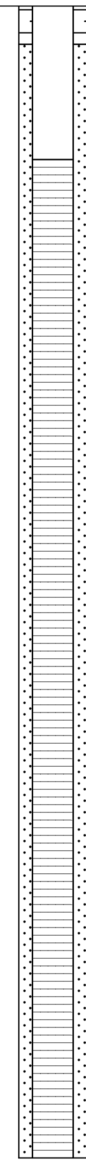
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Large stone gravel surface		Completed as a stickup with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 6'	Bentonite (0'-0.5')	
-5						
					Sand pack (0.5'-17')	
-10			Green-black silty clay, saturated, odor	water encountered	Screen interval (2'-17')	
				Borehole completed to 17'		
-15						

Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-142

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Brandee Blasi**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**15'**	ELEVATION:	**NA**

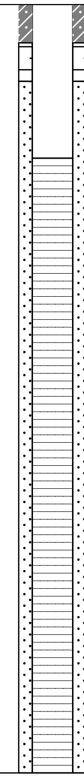
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Brown silt/sand and gravel		Completed as a stickup with locking cap	
			Brown sand with some gravel, moist	Sample A-142_071207_1.5-2		
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0'-0.5')	
-5						
					Sand pack (0.5'-15')	
-10			Black stained coarse grained sandy clay and silt, saturated, odor	water encountered	Screen interval (2'-15')	
			Coarse sand and gravel, saturated with sheen, odor			
-15				Borehole collapse to 15'		
				Borehole completed to 17'		



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-143

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hydro-vac
JOB NO.:	AOI-5	SAMPLING METHOD:	none
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	7 March 2007	WELLBORE DIAMETER:	10"
TOTAL DEPTH:	10'	ELEVATION:	NA

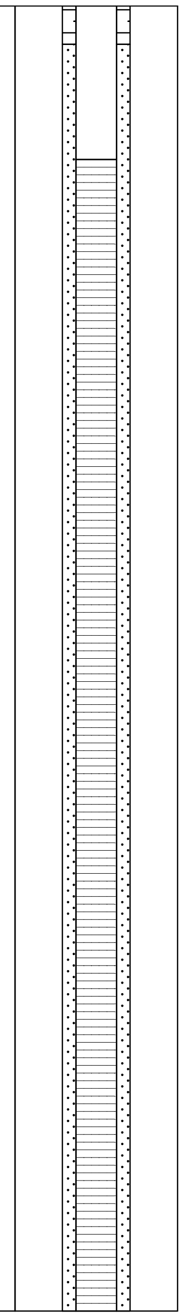
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Brown silt and fill material Soft dug only due to overhead utilities, no lithology available due to hydro-vacuum extraction	Sample A-143_071207_0.5-1 Utility clearance to 10'	Completed as a stickup with locking cap Bentonite (0.5'-1')	
-5					Sand pack (1'-10') Screen interval (2'-10')	
-10				Borehole completed to 10'		

Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-144

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Brandee Blasi**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Fill material		Completed as a stickup with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0'-0.5')	
-5					Sand pack (0.5'-17')	
-10			Green-gray clay with sheen, highly plastic, saturated, odor	water encountered	Screen interval (2'-17')	
-15				Borehole completed to 17'		



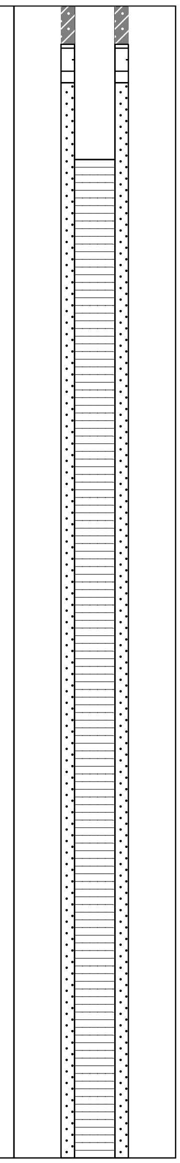
Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-145

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Kevin Martin**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**8 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**15'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Brown silt-sand and gravel		Completed as a stickup with locking cap
			Gray-green silt, plastic, slight petroleum odor		
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0.5'-1')
-5					
					Sand pack (1'-15')
-10	0.4		Med brown silty clay, moist		Screen interval (2'-15')
	0.0		Med brown plastic clay, wet	water encountered	
			Dark brown silty clay with some sand	Borehole completed to 15'	
-15					

WELL DIAGRAM



MONITORING WELL LOG: A-146

Aquaterra Technologies, Inc.

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	8 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	17'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Crushed stone fill		Completed as a flushmount with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 8'	Bentonite (0.5'-1')	
-5						
					Sand pack (1'-17')	
-10	0.2		Dark brown silty clay, wet, some sand	water encountered	Screen interval (2'-17')	
	0.1		Med brown sandy clay, moist			
	0.0		Med brown fine sand with some clay, moist			
-15				Borehole completed to 17'		

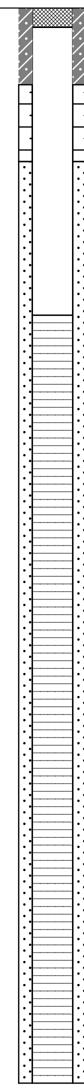
Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-147

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Kevin Martin**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**9 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**14'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Crushed stone fill		Completed as a flushmount with locking cap
			No lithology available, hydro-vacuum extraction	Utility clearance to 8'	Bentonite (1'-2')
-5					
					Sand pack (2'-14')
-10	0.7		Med brown plastic clay, moist		Screen interval (2'-14')
	0.6		Dark brown plastic silty clay, moist		
			Same as above	Well set at 14'	
-15					
				Borehole completed to 18'	

WELL DIAGRAM



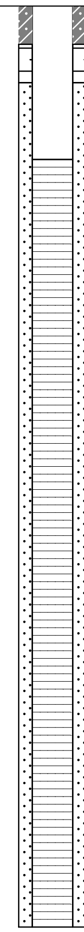
MONITORING WELL LOG: A-147

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM

MONITORING WELL LOG: A-148

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	9 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	12'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Dark brown sandy silt and gravel		Completed as a stickup with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 8'	Bentonite (0.5'-1')	
-5						
					Sand pack (1'-12')	
-10	0.9		Dark brown silty clay, moist		Screen interval (2'-12')	
	0.7		Dark brown silty clay with some sand, moist	Well set at 12'		
			Same as above			
-15				Borehole completed to 16'		



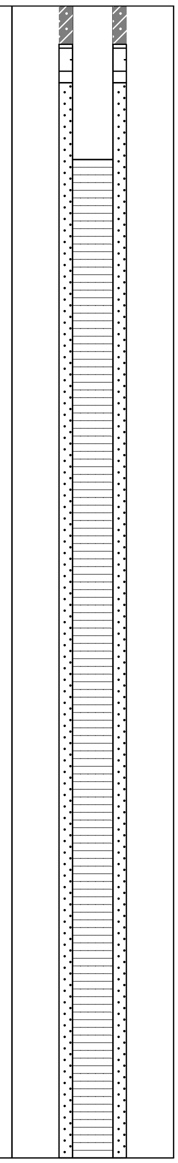
Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-149

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Kevin Martin**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**12 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**15'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Dark brown silt and gravel		Completed as a stickup with locking cap
			Black stained sandy silt, strong petroleum odor		
			No lithology available, hydro-vacuum extraction	Utility clearance to 8'	Bentonite (0.5'-1')
-5					
					Sand pack (1'-15')
-10	0.4		Dark brown plastic clay, moist		Screen interval (2'-15')
	0.5		Dark brown plastic silty clay, moist		
				water encountered at 14'	
	0.0		Dark brown plastic clay, wet	Borehole completed to 15'	
-15					

WELL DIAGRAM



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-150

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Brandee Blasi**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Large stone fill		Completed as a stickup with locking cap	
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0.5'-1')	
-5					Sand pack (1'-17')	
-10			Black stained silty clay, saturated, strong odor	water encountered	Screen interval (2'-17')	
-15			Black stained coarse sand and gravel, saturated, strong odor	Borehole completed to 17'		

Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-151

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	1 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	15'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Grass and topsoil		Completed as a stickup with locking cap	
			Dark brown silty clay with some rocks	Sample A-151_071207_1.5-2		
			No lithology available, hydro-vacuum extraction	Utility clearance to 5'	Bentonite (0.5'-1')	
-5						
					Sand pack (1'-15')	
-10	0.0		Dark gray silty clay		Screen interval (2'-15')	
	0.0					
	0.0			Borehole completed to 15'		
-15						

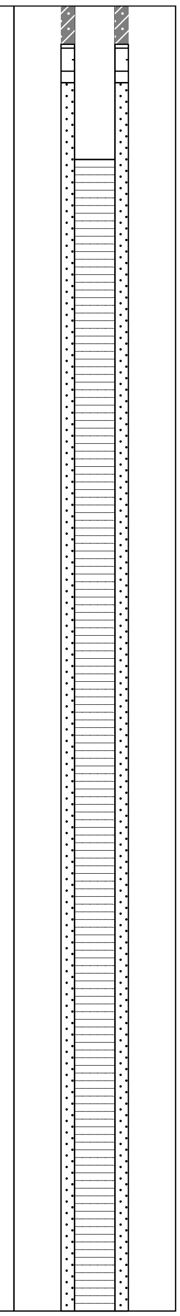
Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-152

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Brandee Blasi**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**6 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Light brown silty sand and gravel	Sample A-152_071207_1.5-2	Completed as a stickup with locking cap
			No lithology available, hydro-vacuum extraction	Utility clearance to 10'	Bentonite (0.5'-1')
-5					
					Sand pack (1'-17')
-10			Silty clay, highly plastic, saturated	water encountered	Screen interval (2'-17')
-15				Borehole completed to 17'	

WELL DIAGRAM

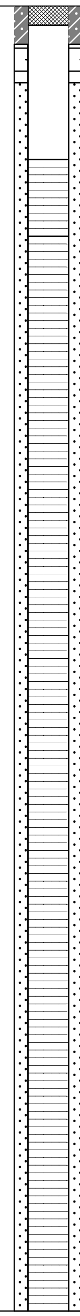


Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-153

PROJECT:	**Sunoco Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**Philadelphia**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**AOI-5**	SAMPLING METHOD:	**Cuttings**
LOGGED BY:	**Kevin Martin**	SCREEN/RISER DIAMETER:	**4-inch**
DATES DRILLED:	**15 March 2007**	WELLBORE DIAMETER:	**8.25"**
TOTAL DEPTH:	**17'**	ELEVATION:	**NA**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Crushed stone fill		Completed as a flushmount with locking cap	
			No lithology available, hydro-vacuum extraction			
				Utility clearance to 8'	Bentonite (0.5'-1')	
-5						
					Sand pack (1'-17')	
-10					Screen interval (2'-17')	
	1.0		Dark brown silty clay, wet	water encountered		
	1.0		Dark brown med sand with some clay, wet			
-15				Borehole completed to 17'		



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-154

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Brandee Blasi	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	6 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	17'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Asphalt and fill No lithology available, hydro-vacuum extraction		Completed as a flushmount with locking cap and manhole	
				Utility clearance to 10'	Bentonite (0.5'-1')	
-5						
					Sand pack (1'-17')	
-10			Sand and gravel, sheen present, odor	water encountered	Screen interval (2'-17')	
			Gray-green silty clay, wet with sheen, odor			
-15				Borehole completed to 17'		

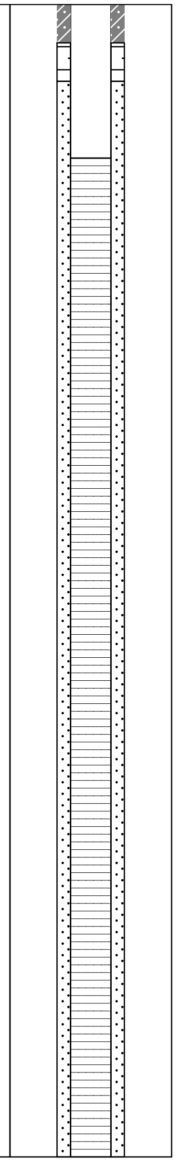
MONITORING WELL LOG: A-155

Aquaterra Technologies, Inc.

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Cuttings
LOGGED BY:	Kevin Martin	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	2 March 2007	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	15'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Large stone fill		Completed as a stickup with locking cap
			No lithology available		
				Utility clearance to 10'	Bentonite (0.5'-1')
-5					
					Sand pack (1'-15')
-10	0.0		Dark gray silty clay, moist		Screen interval (2'-15')
	0.2				
	0.0			Borehole completed to 15'	
-15					

WELL DIAGRAM

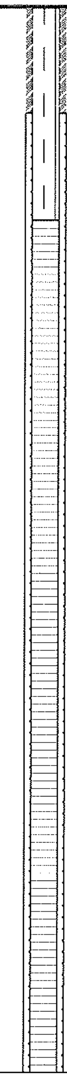


Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-156

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hand Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger
LOGGED BY:	Noelle Stroik	SCREEN/RISER DIAMETER:	2-inch
DATES DRILLED:	11/8/12	WELLBORE DIAMETER:	3"
TOTAL DEPTH:	5'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
					Completed as a stick-up with locking cap	
	46.8		0-2' bgs: FILL (gravel, brick, concrete, dark gray brown sandy silt)	Sample A-156_0-2' collected.	Concrete (0'-0.5')	
	39.7		2-3' bgs: Same as above.	Water/SPH encountered at 2' bgs.	Sand pack (0.5'-5')	
	47.1		3-4' bgs: Same as above.			
	52.3		4-5' bgs: Brown gray GRAVEL, some to little sandy silt, wet, petroleum-like odor.		Screen interval (1'-5')	
-5						



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-157

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hydroexcavation
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	11/6/12	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	8'	ELEVATION:	NA

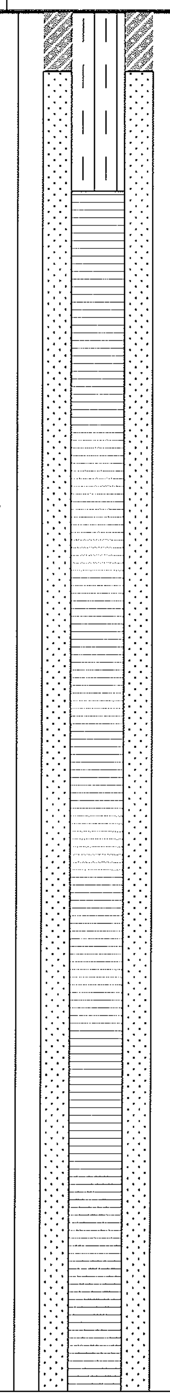
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0				A sample was not collected due to concrete/gravel.	Completed as a stick-up with locking cap	
			0-8' bgs: FILL (gravel, sand)	Water/SPH encountered at 1' bgs.	Concrete (0')	
					Sand pack (0'-8')	
-5				Utility clearance to 8'		
					Screen interval (0'-8')	
				Boring terminated at 8' bgs.		

Aquaterra Technologies, Inc

MONITORING WELL LOG: A-158

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger/Split Spoon
LOGGED BY:	Shaun Sykes/Noelle Stroik	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	11/7/12	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	11.5'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			0-1' bgs: FILL (gravel, brick, concrete, sand)		Completed as a flushmount with locking cap Concrete (0'-0.5')	
			1-10' bgs: FILL (large concrete blocks, gravel, wood, brick) dark gray/black silt & gravels.	Water encountered at 2' bgs. (Sheen)	Sand pack (0.5'-11.5')	
					Screen interval (1.5'-11.5')	
-5						
-10	22.9		10-11.5' bgs: (Spoon: Backfill material) Cuttings: Dark brown/gray brown fine to medium SAND, little gravel, little to trace silt, wet, petroleum-like odor.	Utility clearance to 5' bgs. Auger refusal at 11.5' bgs.		



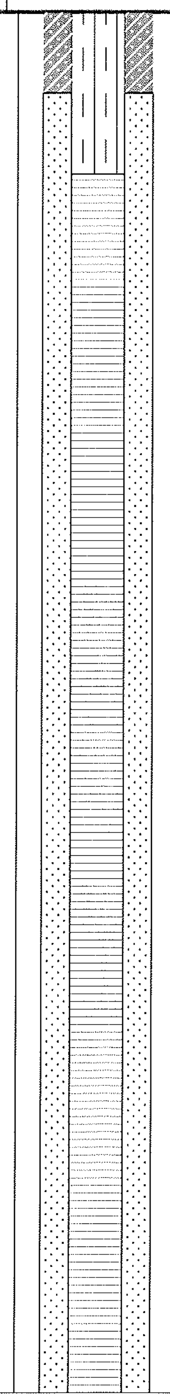
Aquaterra Technologies, Inc

MONITORING WELL LOG: A-159

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger/Split Spoon
LOGGED BY:	Shaun Sykes/Noelle Stroik	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	11/6/12	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	17'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			0-1' bgs: FILL (gravel, brick, asphalt, sand)	Sample A-159 @ 2' collected.	Completed as a stick-up with locking cap
				Water encountered at 2' bgs. (Sheen)	Concrete (0'-1')
-5			1-10' bgs: FILL (gravel, wood, railroad ties, dark brown/black silty sand)	Utility clearance to 10'	
					Sand pack (1'-17')
-10	39.7		10-12' bgs: (Recovery 2') Dark brown/gray brown fine to medium SAND, little to some gravel, little to trace silt, moist to wet, petroleum-like odor.		Screen interval (2'-17')
	45.6		12-14' bgs: (Recovery 1') Same as above, wet.		
	35.2		14-15.5' bgs: Same as above.		
-15	5.9		15.5-17' bgs: Brown gray silty CLAY, little to trace fine to medium sand, wet, petroleum-like odor.	Boring terminated at 17' bgs.	

WELL DIAGRAM



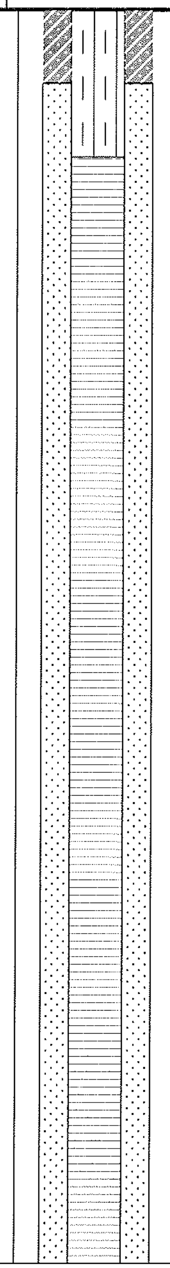
Aquaterra Technologies, Inc

MONITORING WELL LOG: A-160

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger/Split Spoon
LOGGED BY:	Shaun Sykes/Noelle Stroik	SCREEN/RISER DIAMETER:	4-inch
DATES DRILLED:	11/6/12	WELLBORE DIAMETER:	8.25"
TOTAL DEPTH:	17'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			0-1' bgs: FILL (gravel, glass, brick, wood)	Sample A-160_2' collected. Water encountered at 2' bgs.	Completed as a stick-up with locking cap. Concrete (0'-1')
-5			1-10' bgs: FILL (gravel, wood, brick, metal particles, dark brown/black silty sand)	Utility clearance to 10'	Sand pack (1'-17')
-10	5.9		10-12' bgs: (Recovery 2') (Backfill material) Brown/tan fine to medium SAND, little gravel, little to trace silt, wet, petroleum-like odor.		Screen interval (2'-17')
	9.1		12-14' bgs: (Recovery 0.5') Dark gray brown fine to medium SAND, little gravel, little to trace silt, wet, petroleum-like odor.		
	10.8		14-16' bgs: (Recovery 1.5') Same as above.		
-15	1.2		16-18' bgs: (Recovery 1.2') Gray brown silty CLAY, little to some organics (roots), wet, marsh-like odor.	Boring terminated at 17' bgs.	

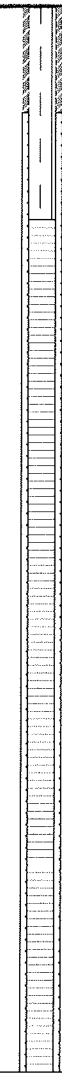
WELL DIAGRAM



Aquaterra Technologies, Inc.

MONITORING WELL LOG: A-161

PROJECT:	Sunoco Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	Philadelphia	DRILLING METHOD:	Hand Auger
JOB NO.:	AOI-5	SAMPLING METHOD:	Hand Auger
LOGGED BY:	Noelle Stroik	SCREEN/RISER DIAMETER:	2-inch
DATES DRILLED:	11/8/12	WELLBORE DIAMETER:	3"
TOTAL DEPTH:	5'	ELEVATION:	NA

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0	13.8		0-1' bgs: FILL (gravel, bricks, dark gray brown sandy silt)	Sample A-161_1' collected.	Completed as a stick-up with locking cap	
				Water/SPH encountered at 1' bgs.	Concrete (0'-0.5')	
	121		1-2' bgs: Same as above.		Sand pack (0.5'-5')	
	82.3		2-3' bgs: Same as above.			
	71.4		3-4' bgs: Same as above.		Screen interval (1'-5')	
-5	77.6		4-5' bgs: Same as above.			

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
A-169
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:	NORTHING (ft):
STARTED **6/17/14** COMPLETED: **6/23/14**	EASTING (ft):
DRILLING COMPANY: **Total Quality Drilling**	LAT:
DRILLING EQUIPMENT: **Track Rig**	LONG:
DRILLING METHOD: **HSA**	GROUND ELEV (ft):
SAMPLING EQUIPMENT: **Grab**	TOC ELEV (ft):
	INITIAL DTW (ft): **3.50**
	WELL DEPTH (ft): **16.0**
	STATIC DTW (ft): **Not Encountered**
	BOREHOLE DEPTH (ft): **16.0**
	WELL CASING DIA. (in): **2**
	BOREHOLE DIA. (in): **8**
	LOGGED BY: **NS**
	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
			GRAVELLY SAND ; grayish brown; fine to medium-grained; moist; angular; well graded; Utility clearing via HydraVac to a depth of 8'bgs.		1000 A-169_0-2			19		0-1 ft: Riser 0-1 ft: Bentonite
			SANDY GRAVEL ; grayish black; fine to medium-grained; moist to wet; angular; well graded; Groundwater encountered at 3.5 ft bgs during clearing.		0930 A-169_2-4			241		
5					A-169@ 4-6'			38.6	5	
			SANDY CLAY ; reddish brown; fine to medium-grained; wet; HydraVac refusal at 7.5 ft bgs due to rock.		A-169@ 6-8'			2.4		
			SILTY SAND ; brownish gray; fine to medium-grained; wet; Driller did not have split spoons. Samples collected from cuttings.							1-16 ft: Screen 1-16 ft: Sand
10			Same as above.						10	
			Same as above.							
15			Same as above.		A-169@ 14-16'			2.0	15	
			Borehole terminated at 16 feet.							

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **A-170** PAGE 1 OF 1 Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/24/14** COMPLETED: **6/25/14** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Track Rig** DRILLING METHOD: **HSA** SAMPLING EQUIPMENT: **Grab**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **4.50** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **2** LOGGED BY: **LM/NS**
	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **16.0** BOREHOLE DEPTH (ft): **16.0** BOREHOLE DIA. (in): **8** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
0–2			**SANDY GRAVEL WITH SILT** ; dark brown to black; Fill (concrete) Utility clearing via backhoe to a depth of 8'bgs.		1000 A-170_0-2			4.1		0-1 ft: Riser 0-1 ft: Bentonite
2–4			**GRAVELLY CLAY** ; reddish brown; fine to medium-grained; moist		A-170@ 2-4'			8.9		
4–6			**CLAY** ; gray with black; wet; Black staining.		1100 A-170_4-6			151.6	5	
6–8			**SILTY CLAY WITH FINE GRAVEL** ; reddish brown; rounded		A-170@ 6-8'			14.3		
8–10.5			Soil sample collected via Shelby Tube for geotechnical analysis.						10	1-16 ft: Screen 1-16 ft: Sand
10.5–16			**SANDY CLAY LITTLE ORGANICS** ; grayish brown; moist to wet; Organic content increase with depth.		A-170@ 10.5-11.5'			1.2		
					A-170@ 11.5-12.5'			0.6		
					A-170@ 12.5-13.5'			0.5		
					A-170@ 13.5-14.5'			1.1	15	
16			Borehole terminated at 16 feet.							

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
A-171 PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/25/14** COMPLETED: **7/1/14**
DRILLING COMPANY: **Total Quality Drilling**
DRILLING EQUIPMENT: **Tripod**
DRILLING METHOD: **Direct Push**
SAMPLING EQUIPMENT: **Grab**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **5.50**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **2**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **16.5**
BOREHOLE DEPTH (ft): **16.5**
BOREHOLE DIA. (in):
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
		SC	**SANDY CLAY WITH GRAVEL** ; SC; dark brown; Utiltity Clearing via HydraVac to a depth of 8'bgs.		0900 A-171_0-2			76.8		0-1.5 ft: Riser 0-1.5 ft: Bentonite
		CL	**CLAY** ; CL; tannish brown		A-171@ 2-4'			136.8		
5		CL-ML	**SILTY CLAY WITH GRAVEL** ; CL-ML; tannish brown		1200 A-171_4-6			224.9	5	
		CL-ML	**SILTY CLAY WITH GRAVEL** ; CL-ML; tannish brown		A-171@ 6-8'			200.1		
10			Well Installed via direct push. Soil samples could not be collected.						10	2-16.5 ft: Sand 1.5-16.5 ft: Screen
15									15	
			Borehole terminated at 16.5 feet.							

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-5** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **A-172** PAGE 1 OF 1 Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/17/14** COMPLETED: **6/24/14** DRILLING COMPANY: **Total Quality Drilling** DRILLING EQUIPMENT: **Track Rig** DRILLING METHOD: **HSA** SAMPLING EQUIPMENT: **Grab/Split spoon**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **3** WELL DEPTH (ft): **16.0** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16.0** WELL CASING DIA. (in): **2** BOREHOLE DIA. (in): **8** LOGGED BY: **NS** CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
0		SW	**GRAVELLY SAND LITTLE CLAY** ; SW; dark grayish brown; fine to medium-grained; moist to wet; Utility clearing via HydraVac to a depth of 8'bgs.		1030 A-172_0-2			25		0-1 ft: Riser 0-1 ft: Bentonite
2		CL	**GRAVELLY CLAY LITTLE FINE TO MEDIUM SAND** ; CL; dark grayish brown; fine to medium-grained; wet; Grounwater encountered at 3 ft bgs.		1100 A-173_2-4			63.3	∇	
5					A-172@ 4-6'			12.3	5	
					A-172@ 6-8'			11.8		
8		CL	**SANDY CLAY** ; CL; brownish gray; fine to medium-grained; wet; Driller did not have split spoons. Samples collected from cuttings.							1-16 ft: Screen 1-16 ft: Sand
10			Same as above.						10	
12			Same as above.							
14			Same as above		A-172@ 14-16'			0.2	15	
16			Borehole terminated at 16 feet.							

GEO FORM 304 PHILLY REFINERY AOI-5.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/15/14

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO: **A-173** PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/25/14** COMPLETED: **6/30/14**
DRILLING COMPANY: **Total Quality Drilling**
DRILLING EQUIPMENT: **Track Rig**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Grab/Split spoon**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **4.5**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **2**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **16.0**
BOREHOLE DEPTH (ft): **16.0**
BOREHOLE DIA. (in): **8**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
			Utility Clearing via HydraVac to a depth of 8'bgs.		1330 A-173_0-2			11.3		0-1 ft: Riser 0-1 ft: Bentonite
			Fill (bricks, asphalt, concrete)							
			WITH SILT AND SAND ; dark brown; Fill (bricks)		A-173@ 2-4'			25.8		
5			**WITH SILT AND SAND** ; dark brown; Fill (bricks) Wet at 4-5'bgs. SPH noted.		1500 A-173_4-6			48.1	5	
			WITH SAND AND GRAVEL ; brown and black; Fill (bricks, timber)		A-173@ 6-8'			36.7		
			Fill (backfill well sand)		A-173@ 8-10'			6.0		1-16 ft: Screen 1-16 ft: Sand
10		SP	**SAND** ; SP; black		A-173@ 10-12'			0.9	10	
		SP-SC	**CLAYEY SAND** ; SP-SC		A-173@ 12-14'			11.1		
15		SP-SC	**CLAYEY SAND WITH COARSE SAND** ; SP-SC; black with whiteish tan		A-173@ 14-16'			13.4	15	
			Borehole terminated at 16 feet.							

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-5**	**A-185** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/24/14** COMPLETED: **6/26/14**	LAT:	LONG:
DRILLING COMPANY: **Total Quality Drilling**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Track Rig**	INITIAL DTW (ft): **6.21**	WELL DEPTH (ft): **16.0**
DRILLING METHOD: **HSA**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **16.0**
SAMPLING EQUIPMENT: **Grab/Split spoon**	WELL CASING DIA. (in): **2**	BOREHOLE DIA. (in): **8**
	LOGGED BY: **LM/NS**	CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
			SILTY GRAVEL WITH SAND ; white and orange; coarse-grained; Utility clearing via backhoe to a depth of 8'bgs.		1130 A-185_0-2			11.3		0-2 ft: Bentonite 0-3 ft: Riser
			WITH SILT AND SAND ; reddish brown		A-185@ 2-4'			13.9		
5			**WITH SILT AND SAND** ; black		A-185@ 4-6'			20.3	5	
			SANDY SILT WITH FINE GRAVEL ; black; strong petroleum odor; Wet at 6'bgs. SPH observed.		1200 A-185_6-8			48.1		
			No Recovery.							2-16 ft: Sand 3-16 ft: Screen
10			**SANDY CLAY LITTLE FINE GRAVEL** ; grayish brown; wet						10	
15			**GRAVELLY CLAY LITTLE FINE TO MEDIUM SAND** ; grayish brown; wet						15	
			Borehole terminated at 16 feet.							

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-5**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO: **A-186** PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/27/14** COMPLETED: **7/3/14**
DRILLING COMPANY: **Total Quality Drilling**
DRILLING EQUIPMENT: **Track Rig**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Grab/Split spoon**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **4.5**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **2**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **18.0**
BOREHOLE DEPTH (ft): **18.0**
BOREHOLE DIA. (in): **8**
CHECKED BY:

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
			CLAY ; grayish black; Fill (bricks, glass) Utility Clearing via soft dig to a depth of 8'bgs.		1000 A-186_0-2			388.3		0-1.5 ft: Bentonite; 0-3 ft: Riser
			CLAY ; greenish gray		A-186@ 2-4'			404.3		
5			**CLAY** ; grayish black tan; Wet at 4.5-5'bgs.		1100 A-186_4-6			695.4	5	
			CLAY ; grayish black tan		A-186@ 6-8'			555.0		
			CLAY ; dark gray; Shelby tube collected from 8-10'bgs.		A-186@ 8-10'			221.0		
10					A-186@ 10-12'			187.1	10	1.5-18 ft: Sand; 3-18 ft: Screen
			CLAY ; dark gray to black		A-186@ 12-14'			132.0		
15					A-186@ 14-16'			121.0	15	
					A-186@ 16-18'			40.6		

Borehole terminated at 18 feet.

Well ID	Date Sampled	Depth to Water (feet)	Depth to Product (feet)	Total Depth (feet)	Water Column (feet)	Conversion Factor	Well Volume (gallons)	Purge Volume (gallons)
A-1	5/7/2007	4.27	NP	10	5.73	0.65	3.7	11.2
A-10	5/8/2007	3.30	NP	15	11.70	0.65	7.6	22.8
A-11	5/7/2007	4.75	NP	16	11.25	0.65	7.3	21.9
A-118	5/9/2007	2.75	NP	17.5	14.75	0.65	9.6	28.8
A-119	5/9/2007	4.41	NP	12.5	8.09	0.65	5.3	15.8
A-12	5/7/2007	4.12	NP	15.6	11.48	0.65	7.5	22.4
A-120	5/9/2007	4.80	NP	17.3	12.50	0.65	8.1	24.4
A-121	5/9/2007	6.04	NP	17.5	11.46	0.65	7.4	22.3
A-122	5/8/2007	3.72	NP	17.6	13.88	0.65	9.0	27.1
A-13	NS	5.21	4.72	NM	NM		NS	NS
A-133	5/3/2007	8.21	NP	16.6	8.39	0.65	5.5	16.4
A-134	5/3/2007	7.05	NP	17	9.95	0.65	6.5	19.4
A-135	5/3/2007	6.81	NP	17	10.19	0.65	6.6	19.9
A-137	5/7/2007	6.51	NP	14	7.49	0.65	4.9	14.6
A-139	5/7/2007	3.44	NP	18	14.56	0.65	9.5	28.4
A-13D	5/3/2007	11.43	NP	70	58.57	0.65	38.1	114.2
A-14	NS	6.78	6.45	NM	SPH	SPH	SPH	SPH
A-140	5/7/2007	4.24	NP	18	13.76	0.65	8.9	26.8
A-141	5/7/2007	4.40	NP	18.5	14.10	0.65	9.2	27.5
A-142	5/7/2007	7.88	NP	17.2	9.32	0.65	6.1	18.2
A-143	5/3/2007	5.49	NP	13.3	7.81	0.65	5.1	15.2
A-144	NS	19.87	5.24	NM	SPH	SPH	SPH	SPH
A-145	5/3/2007	2.94	NP	17	14.06	0.65	9.1	27.4
A-146	5/9/2007	5.48	NP	17	11.52	0.65	7.5	22.5
A-147	5/9/2007	1.35	NP	14	12.65	0.65	8.2	24.7
A-148	5/8/2007	2.97	NP	14.5	11.53	0.65	7.5	22.5
A-149	5/8/2007	3.40	NP	18	14.60	0.65	9.5	28.5
A-15	5/8/2007	1.04	NP	15	13.96	0.65	9.1	27.2
A-150	5/8/2007	5.02	NP	19	13.98	0.65	9.1	27.3
A-151	NS	4.13	4.12	NM	SPH	SPH	SPH	SPH
A-152	5/8/2007	2.60	NP	19.5	16.90	0.65	11.0	33.0
A-153	5/9/2007	4.00	NP	17	13.00	0.65	8.5	25.4
A-154	5/8/2007	2.02	NP	17	14.98	0.65	9.7	29.2
A-155	NS	5.84	4.81	NM	SPH	SPH	SPH	SPH
A-16	5/8/2007	3.69	NP	10	6.31	0.65	4.1	12.3
A-17	NS	2.15	NP	NM	Well Casing Damaged - Bailer or pump would not fit in well			
A-20	NS	6.50	4.72	7.2	SPH	SPH	SPH	SPH
A-21	NS	4.00	2.14	SPH to thick to determine	SPH	SPH	SPH	SPH
A-21D	5/7/2007	15.75	NP	100+	84.25	0.65	54.8	164.3
A-22	NS	5.49	5.48	15	SPH	SPH	SPH	SPH
A-23	5/8/2007	3.54	NP	16	12.46	0.65	8.1	24.3
A-24	NS	1.90	1.85	15	SPH	SPH	SPH	SPH
A-25	5/4/2007	4.81	NP	11.5	6.69	0.65	4.3	13.0
A-26	5/4/2007	5.02	NP	9	3.98	0.65	2.6	7.8
A-27	5/8/2007	6.05	NP	15	8.95	0.65	5.8	17.5
A-3	5/3/2007	4.38	NP	16	11.62	0.65	7.6	22.7
A-39	5/7/2007	2.21	NP	9	6.79	0.65	4.4	13.2
A-4	NS	SPH to thick to determine	3.84	16.5	SPH	SPH	SPH	SPH
A-40	5/7/2007	6.44	NP	17	10.56	0.65	6.9	20.6
A-41	5/7/2007	6.25	NP	15	8.75	0.65	5.7	17.1
A-43	5/3/2007	5.95	NP	11	5.05	0.65	3.3	9.8
A-44	5/3/2007	6.20	NP	14	7.80	0.65	5.1	15.2
A-45	NS	All SPH	3.61	8.5	SPH	SPH	SPH	SPH
A-46	NS	SPH to thick to determine	6.88	NM	SPH	SPH	SPH	SPH
A-47	NS	4.77	4.69	14.6	SPH	SPH	SPH	SPH
A-48	5/8/2007	4.91	NP	14.6	9.69	0.65	6.3	18.9
A-49	5/8/2007	2.99	NP	12.4	9.41	0.65	6.1	18.3
A-5	5/4/2007	4.18	NP	9.5	5.32	0.65	3.5	10.4
A-6	5/9/2007	3.40	NP	17.5	14.10	0.65	9.2	27.5
A-7	NS	3.77	2.99	NM	SPH	SPH	SPH	SPH
A-8	5/4/2007	3.39	NP	13	9.61	0.65	6.2	18.7
A-9	5/4/2007	3.17	NP	15.5	12.33	0.65	8.0	24.0

Well ID	Date Sampled	Depth to Water (feet)	Depth to Product (feet)	Total Depth (feet)	Water Column (feet)	Conversion Factor	Well Volume (gallons)	Purge Volume (gallons)
A-91	5/9/2007	4.28	NP	11.5	7.22	0.65	4.7	14.1
PZ-1	NS	DRY	DRY	3.4	DRY	DRY	DRY	DRY
PZ-2	5/3/2007	6.78	NP	9.6	2.82	0.16	0.5	1.4
PZ-3	5/3/2007	6.80	NP	10	3.20	0.16	0.5	1.5
RW-6	5/3/2007	3.88	NP	14.6	10.72	0.65	7.0	20.9
RWBH-1	NS	3.41	NP	PUMP	NS	NS	NS	NS
RWBH-2 **(A-33)**	NS	3.98	NP	8.6				
SW-1	NS	8.31	7.05	20	SPH	SPH	SPH	SPH
SW-2	5/7/2007	6.01	NP	18.6	12.59	0.65	8.2	16.0
SW-3	5/7/2007	7.11	NP	18	10.89	0.65	7.1	13.8
SW-4	NS	4.16	4.10	15.6	SPH	SPH	SPH	SPH
SW-5	NS	SPH to thick to determine	5.09	14.6	SPH	SPH	SPH	SPH
SWR-2	5/7/2007	7.85	NP	15	7.15	0.65	4.6	9.1
SWR-3	5/7/2007	7.75	NP	11.6	3.85	0.65	2.5	4.9
WP-1	5/8/2007	2.52	NP	4	DRY	DRY	DRY	DRY
WP-14	5/8/2007	6.16	NP	9	2.84	0.16	0.5	0.2
WP-16-1	NS	Could not be located			NS	NS	NS	NS
WP-16-3	5/4/2007	7.48	NP	14.5	7.02	0.16	1.1	3
WP-16-4	NS	Could not be located			NS	NS	NS	NS
WP-1A	NS	Could not be located			NS	NS	NS	NS
WP-2	NS	DRY	DRY	2	DRY	DRY	DRY	DRY
WP-2A	NS	Could not be located			NS	NS	NS	NS
WP-3	NS	DRY	DRY	4	DRY	DRY	DRY	DRY
WP-3A	NS	Could not be located			NS	NS	NS	NS
WP-4A	5/7/2007	7.00	NP	9.5	2.50	0.16	0.4	1.75
WP-5A	NS	Could not be located			NS	NS	NS	NS
WP-8	5/9/2007	3.33	NP	9	5.67	0.16	0.9	0.4
WP-9	5/8/2007	4.88	NP	13	8.12	0.16	1.3	0.6
WP-A	5/7/2007	3.24	NP	13	9.76	0.16	1.6	0.7
WP-B	5/3/2007	5.75	NP	12	6.25	0.16	1.0	0.5
WP-C	5/3/2007	6.35	NP	12.6	6.25	0.16	1.0	0.5
WP-D	5/3/2007	4.02	NP	11.6	7.58	0.16	1.2	0.6
WP-E	5/3/2007	3.74	NP	10.5	6.76	0.16	1.1	0.5

NS - Not sampled
DRY - Insufficient well volume to collect sample
SPH - Separate phase hydrocarbons
NP - No product (SPH) in well
NM - Not measured
Pump in well; total depth of well could not be determined
Note: All wells were gauged on 5/2/2007.

Appendix C
Summary of Groundwater Field Sample Reports - November 2012
Remedial Investigation Report
AOI 5
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)				
	Total Depth (below toc)	Well Diameter (in)				Temp. (˚C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (˚C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (˚C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)
A-156	8.5	2	4.85			13.2	4.34	-32.9	7.19	0.781	Hand Bailed - could not collect readings					12.84	8.5	-27.6	7.12	0.757
A-157	10.4	4	5.16			10.72	6.7	6.1	6.17	0.509	10.7	5.79	4.7	6.18	0.508	10.65	3.69	-26.8	6.69	0.506
A-158	11.5	4	4.12			18.12	7.89	-29.9	6.83	0.899	17.72	4.62	-47.1	6.9	0.887	17.82	5.18	-56.6	7.04	0.915
A-159	17	4	6.59			17.33	11.43	-27.2	6.63	1.198	17.34	9.55	-45.6	6.43	1.101	17.76	9.05	-56.9	6.43	1.055
A-160	17	4	6.5			16.89	7.8	-45.4	6.48	0.837	17.78	6.29	-65.4	6.73	0.842	17.8	6.12	-75.5	6.83	0.828
A-161		2	5.83	5.81	0.02															

Wells with product

Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
	Total Depth (below toc)	Well Diameter (in)				Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
A-169	17	2	4.96			16.00	0.27	-116.5	6.63	0.592	15.89	0.31	-128.2	6.77	0.585	15.84	0.33	-130.9	6.80	0.583	1110	1113	2	6	7/23/2014
A-170	18.3	2	2.85			16.44	0.10	-26.7	6.72	0.820	15.61	0.03	-63.8	6.65	0.843	16.42	0.07	-71.5	6.62	0.847	0945	1015	2	60	7/23/2014
A-171	19.3	2	5.68			13.87	0.45	-121.9	5.98	0.649	13.82	0.35	-147.9	6.07	0.650	13.77	0.32	-166.7	6.12	0.650	1031	1035	2	8	7/29/2014
A-172	12.8	2	4.52			14.42	0.88	-58.5	6.46	0.858	14.35	0.61	-60.6	6.43	0.858	14.08	0.25	-76.6	6.46	0.958	1344	1350	2	12	7/21/2014
A-173	14.4	2	2.78			15.53	2.18	-80.8	6.52	1.932	15.44	1.04	-83.7	6.45	1.929	15.32	0.97	-82.8	6.45	1.943	1035	1038	2	6	7/24/2014
A-174	13.3	4	5.92			18.26	0.27	-74.4	6.77	0.228	18.44	0.38	51.0	6.69	0.224	18.72	0.44	2.2	6.76	0.275	1100	1130	2	60	7/25/2014
A-175	10.3	2	4.23			18.62	0.51	-89.4	6.62	5.391	18.55	0.47	-99.2	6.56	5.280	18.45	0.47	-99.9	6.56	5.286	1042	1045	2	6	7/24/2014
A-176		2	4.20	4.00	0.20																				
A-177	12.3	4	3.67			16.02	0.68	-100.2	6.51	5.245	17.43	0.70	-104.8	6.58	5.524	17.52	0.72	-107.2	6.62	5.637	1221	1230	2	18	7/24/2014
A-178		2	4.00	3.36	0.64																				8/1/2014
A-179		2	4.80	2.77	2.03																				
A-180		2	3.15	3.1	0.05																				
A-181	7	2	2.10			22.28	0.29	-114.7	6.68	0.530	23.19	2.37	-113.6	6.71	0.479	23.60	1.82	-107.5	0.72	0.459	1433	1435	2	4	7/25/2014
A-182	10.1	2	5.23			22.48	2.70	-53.7	7.04	0.507	22.44	1.22	-56.0	7.04	0.508	22.47	0.76	-58.4	7.05	0.508	1415	1417	2	4	7/22/2014
A-183	13.6	2	7.18			21.64	0.55	-67.7	6.75	4.680	21.64	0.49	-69.8	6.73	0.469	21.58	0.47	-71.2	6.73	0.466	1155	1157	2	4	7/28/2014
A-184	9.5	2	5.36			21.02	1.33	-113.9	6.70	0.690	20.76	0.56	-121.4	6.65	0.684	22.17	0.44	-85.5	6.72	0.530	1040	1044	2	8	7/28/2014
A-185	18.6	2	8.90			14.60	0.26	-46.9	6.64	0.849	14.55	0.25	-50.6	6.69	0.838	14.50	0.26	-53.6	6.70	0.812	0957	1000	2	6	7/29/2014
A-186	21	2	5.05			14.88	0.56	143.7	6.38	2.428	15.72	0.36	-35.5	6.43	2.910	16.08	0.55	-36.4	6.46	3.132	1420	1450	2	60	7/23/2014
SW-3	18.1	4	7.95			15.78	0.76	11.4	6.64	0.669	15.50	0.41	-2.8	6.52	0.718	15.46	0.39	-5.7	6.50	0.731	1322	1332	2	20	7/29/2014
A-45	Same well as A-177 (one well in field is labeled with both designations on pvc pipe - map shows as two different wells, but only one actually present in field)																								
SWR-3	11.2	30	7.44			25.54	4.20	-37.8	7.20	0.382	25.65	2.88	11.8	7.05	0.391	25.78	2.78	11.3	6.91	0.403	1240	1340	2	120	7/22/2014
A-158	11	4	3.22			17.26	1.48	59.6	7.19	0.154	17.40	0.52	36.1	6.89	0.139	17.53	0.47	24.8	6.90	0.155	1430	1500	2	60	7/25/2014
A-163	15.7	2	6.72			15.99	0.61	-115.3	6.57	0.835	15.96	0.51	-119.3	6.70	0.828	15.91	0.45	-111.0	6.71	0.827	1200	1203	2	6	7/23/2014
A-1	7.7	4	4.46			19.30	0.45	75.8	7.94	0.704	19.06	0.42	64.6	7.95	0.708	18.26	0.35	57.8	7.87	0.662	0900	0930	2	60	7/18/2014
A-10	14.9	4	3.45			15.13	1.39	-99.6	6.54	0.525	15.17	0.30	-80.5	6.43	0.515	16.68	0.31	-84.3	6.58	0.627	1455	1506	2	22	7/24/2014
A-11	16.2	4	5.03			45.48	0.56	-124.0	6.73	0.822	14.79	0.19	-158.3	6.87	0.894	15.11	1.05	-100.6	6.76	0.791	1045	1056	2	22	7/22/2014
A-118	18	4	2.62			14.52	0.49	42.7	7.22	1.107	14.80	0.47	-48.1	6.80	1.080	14.81	0.31	-83.1	6.78	1.006	0930	1000	2	60	7/24/2014
A-12	15.6	4	5.25			16.69	0.55	29.4	6.47	1.283	21.33	0.57	-11.1	6.57	0.710	21.38	0.57	-12.7	6.57	0.700	1137	1147	2	20	7/30/2014
A-122	18	4	4.62			15.85	0.39	78.3	6.25	0.165	19.35	0.39	38.8	6.63	0.185	14.96	0.67	146.4	6.59	0.148	0945	1015	2	60	7/29/2014
A-13	Abandonded																								
A-133	16.8	4	9.89			15.51	0.29	-73.2	7.29	0.074	15.52	0.20	-86.3	7.29	0.072	15.38	0.15	-93.9	7.27	0.090	1500	1530	2	60	7/24/2014
A-134	17	4	7.94			18.71	0.18	52.4	6.54	0.826	16.85	0.13	-19.4	6.55	0.855	16.81	0.10	-116.9	6.76	0.833	1045	1115	2	60	7/24/2014
A-135	17.2	4	7.75			16.50	0.31	-3.7	7.01	0.659	16.39	0.33	-40.1	6.60	0.611	19.25	0.32	-61.8	6.74	0.596	1230	1300	2	60	7/24/2014
A-136		2	7.37	7.05	0.32																				8/1/2014
A-137	14.3	4	6.65			16.30	0.62	-80.6	6.12	0.672	15.37	0.14	-61.7	6.04	0.670	15.37	0.13	-48.1	6.08	0.668	1420	1439	2	38	7/17/2024
A-139	18.6	4	4.43			15.97	2.34	12.4	6.72	0.497	15.21	1.25	-3.0	6.70	0.512	15.14	0.86	-28.2	6.73	0.533	0730	0800	2	60	7/18/2014
A-140	No gauging data					14.85	0.11	-95.4	6.65	0.836	14.66	0.09	-98.7	6.65	0.828	14.61	0.24	-97.6	6.63	0.831	0815	0830	2	30	7/18/2014
A-142	18.3	4	5.80			23.90	1.44	55.6	7.14	0.467	24.25	0.36	54.6	7.15	0.468	23.19	0.69	132.7	6.93	0.007	1430	1450	2	40	7/17/2014
A-143	13.3	4	5.79			18.45	0.02	-98.4	6.71	0.662	16.42	0.07	-96.3	6.64	0.670	16.16	0.04	-97.0	6.57	0.617	0945	1000	2	30	7/18/2014
A-146	Unable to locate																								
A-147	Unable to Locate																								
A-148	18	4	2.80			14.23	0.69	90.5	7.14	0.124	14.36	2.18	69.8	6.85	0.125	14.20	1.12	69.5	6.69	0.124	1200	1230	2	60	7/21/2014

Appendix C
Summary of Groundwater Field Sample Reports - July 2014
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AOI 5
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
	Total Depth (below toc)	Well Diameter (in)				FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
A-149	20	4	3.18			15.12	1.38	180.3	7.25	0.122	14.76	0.61	115.7	7.02	0.121	14.65	0.58	103.1	6.88	0.121	1100	1130	2	60	7/29/2014
A-15		4	0.99	0.92	0.07																				
A-150		4	5.55	5.45	0.10																				
A-151	19	4	4.32			15.94	0.17	12.0	6.69	1.662	15.34	0.37	-21.5	6.40	1.746	15.25	0.35	-22.5	6.40	1.753	1300	1330	2	60	7/23/2014
A-152	19.7	4	3.03			13.88	0.07	-79.9	7.06	0.682	14.10	0.03	-136.3	7.20	0.683	14.09	0.04	-149.1	7.30	0.680	0845	0915	2	60	7/23/2014
A-153	Unable to locate																								
A-154	17	4	2.45			14.47	0.15	-0.9	7.43	4.948	18.88	0.12	-88.5	7.23	3.470	14.87	0.10	-80.3	6.69	7.017	1130	1200	2	60	7/22/2014
A-155		4	6.65	5.85	0.80																1426	1430	2	8	7/30/2014
A-156	8.55	2	5.03			22.14	0.95	-178.0	7.54	1.459	22.08	0.28	-166.6	7.55	1.460	23.15	1.26	-147.9	7.47	1.358	0930	0932	2	4	7/23/2014
A-157	10.4	4	3.10			25.38	-0.13	20.5	7.05	0.698	25.31	0.22	-15.0	7.00	0.640	25.17	0.30	-16.6	7.00	0.640	1501	1505	2	8	7/29/2014
A-161		2	5.00	4.9	0.10																				7/31/2014
A-162	7.2	2	4.40			20.69	0.36	129.7	7.18	0.427	20.67	0.42	-122.8	7.18	0.429	20.85	0.66	-123.5	7.16	0.424	0830	0833	2	6	7/23/2014
A-164	15.35	2	5.45			16.55	0.31	-176.7	7.17	0.612	16.51	0.31	-195.2	7.90	0.612	16.51	0.29	-197.2	7.40	0.612	1036	1039	2	6	7/23/2014
A-166		2	8.15	8.00	0.15																				
A-167	37	2	4.68			16.09	0.82	1.1	6.10	2.476	15.90	0.24	-21.6	6.14	2.457	15.98	0.21	-23.9	6.12		1412	1420	2	16	7/29/2014
A-168	12.99	2	8.04			24.22	1.23	37.0	7.53	0.749	20.76	0.01	-85.8	7.48	0.828	20.79	0.00	-99.3	7.47	0.822	1000	1030	2	60	7/22/2014
A-16	17	4	3.52			19.95	0.12	-24.0	6.51	1.047	22.47	0.33	-48.4	6.51	0.873	23.82	0.59	-63.9	6.71	0.656	1045	1115	2	60	7/23/2014
A-17	Unable to Locate																								
A-21		4	-	2.75																					
A-22	14.7	4	6.25	6.18	0.07																				
A-23	16	4	3.55			14.87	0.04	-75.1	6.78	1.059	18.77	0.05	-90.3	6.80	0.790	20.20	0.53	-73.5	6.90	0.450	0800	0830	2	60	7/23/2014
A-24	15.15	4	2.96			15.81	0.60	5.3	7.40	0.255	17.04	1.22	136.4	5.97	0.660	16.24	0.47	-103.6	6.91	0.666	1124	1148	2	48	7/21/2014
A-25	11.7	4	4.65			17.52	0.32	201.0	7.36	0.442	17.80	0.15	-10.9	7.13	0.416	17.10	0.10	-62.4	7.13	0.415	0915	0945	2	60	7/25/2014
A-26	14.6	-	5.45			17.83	0.94	118.1	7.16	0.167	17.58	0.65	100.6	6.97	0.209	17.34	0.62	58.3	6.79	0.375	0830	0900	2	60	7/25/2014
A-27		4	6.94	-		16.86	0.06	-138.1	6.86	1.874	16.86	0.06	-141.5	6.85	1.697	16.55	0.02	-134.3	6.87	0.980	0830	0900	2	60	7/22/2014
A-3	16.2	4	4.65			14.37	0.35	-148.8	6.83	1.409	14.35	1.32	-131.6	6.72	1.406	14.34	0.70	-123.6	6.68	1.405	0830	0842	2	24	7/24/2014
A-39	9	4	2.43			24.84	1.73	-21.5	7.91	0.268	24.56	1.64	-13.0	7.83	0.266	24.55	1.57	-11.3	7.62	0.266	1455	1505	2	20	7/17/2014
A-4	14.7	4	3.18			19.92	0.59	-71.3	7.11	0.229	16.77	0.27	-98.7	7.07	0.233	16.81	0.14	-102.0	7.03	0.239	1450	1510	2	40	7/17/2014
A-40	17	4	6.61			17.95	0.82	-19.4	6.45	0.504	17.92	0.66	-14.9	6.49	0.517	17.17	0.62	-26.5	6.54	0.525	1300	1330	2	60	7/17/2014
A-41	12	4	3.72			16.11	0.60	85.7	8.14	0.106	16.04	0.55	69.4	7.65	0.126	16.02	0.55	55.7	7.35	0.137	0830	0900	2	60	7/29/2014
A-44	14.3	4	6.37			17.44	0.04	-129.1	6.86	0.781	16.42	0.04	-145.2	6.91	0.838	16.38	0.16	-151.1	7.00	0.838	1030	1100	2	60	7/18/2014
A-46		4	10.31	7.5	2.81																				
A-47	14.5	4	4.58			15.79	0.10	-104.4	6.64	0.458	15.83	0.26	-102.8	6.61	0.457	16.74	1.52	-96.6	6.53	0.555	1532	1542	2	20	7/21/2014
A-48	14.5	4	4.25			14.49	0.49	-79.3	6.48	0.378	16.62	0.45	-80.0	6.52	0.388	16.05	2.53	-67.8	6.50	0.372	1135	1145	2	20	7/25/2014
A-49	12.4	4	3.50			16.52	1.13	69.4	6.51	0.813	16.22	0.32	-41.5	6.46	0.743	16.09	0.25	-57.7	6.49	0.721	0730	0800	2	60	7/24/2014
A-5		4	5.48	4.85	0.63																				8/1/2014
A-6	17.4	4	2.61			15.11	1.44	101.5	6.37	1.278	15.08	0.97	68.4	6.32	1.300	15.05	2.43	29.6	6.35	1.156	1244	1259	2	30	7/30/2014
A-7	12.2	4	2.97																						
A-9	15.3	4	2.74			15.21	0.90	-64.3	6.57	0.612	15.11	0.68	-69.6	6.56	0.632	15.21	0.85	-77.7	6.62	0.643	1344	1357	2	26	7/28/2014
SW-1		4	8.65	7.75	0.90																				
SW-2	18.75	4	6.39			14.66	0.84	0.8	6.06	0.320	19.79	1.55	-53.0	6.90	0.272	18.66	1.23	-46.5	6.88	0.278	1123	1135	2	24	7/29/2014
SW-4		4	5.46	5.4	0.06																				

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Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
	Total Depth (below toc)	Well Diameter (in)				FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
SW-5		4	9.90	5.85	4.05																				
SWR-1	15.2	30	6.66			16.20	0.35	-165.6	6.49	0.270	16.15	0.18	-112.5	7.84	0.268	16.14	0.16	-69.1	7.78	0.268	0950	1050	2	120	7/21/2014
SWR-2	14.75	30	7.79			22.62	0.19	-156.3	7.43	0.507	22.49	0.12	-138.7	7.52	0.542	22.38	0.07	-75.7	7.51	0.542	1130	1230	2	120	7/22/2014
WP-14	10.9	2	6.55			21.16	0.19	-149.9	7.21	0.601	21.06	0.17	-143.6	7.19	0.579	20.94	0.12	-143.3	7.19	0.583	1357	1400	2	6	7/25/2014
WP16-3	19.6	2	8.10			18.74	0.63	-6.7	7.18	0.329	18.42	0.26	-11.8	7.12	0.323	18.14	0.27	-13.2	7.13	0.338	1015	1045	2	60	7/25/2014
WP-8	9.6	2	4.11			19.31	0.70	-98.7	6.80	0.424	19.26	0.80	-101.8	6.87	0.424	19.77	1.10	-102.9	6.85	0.403	0958	1000	2	4	7/28/2014
WP-9	-	2	4.45	-		18.37	0.40	-69.3	6.17	0.819	18.75	0.34	-69.7	6.15	0.828	18.64	0.36	-70.9	6.16	0.832	1025	1030	2	10	7/25/2014
WP9-8		2	7.31	5.67	1.64	Product sample collected. Casing damaged - could not sample water beneath lnapl																			
WP-A	13.00	2	9.15	5.35	3.80																				7/31/2014
WP-B		2	7.65	7.51	0.14																				
WP-C	Unable to locate																								
WP-D	11.6	2	5.81			24.78	0.39	-15.1	7.87	0.234	20.65	0.45	1.0	7.64	0.254	20.29	0.13	36.1	7.32	0.246	0850	0852	2	4	7/23/2014
WP-E	10.6	2	4.90			18.81	0.16	25.7	7.26	0.253	19.10	0.11	-16.1	7.22	0.252	21.84	0.09	-40.5	7.08	0.224	1315	1345	2	60	7/24/2014

NR - not recorded
NS-i - not sampled due to insufficient water
NS-p - Not sampled due to product.
NS - not sampled

Wells with product

**SELECT WELLS WITH PRODUCT WERE SAMPLED USING THE DEVICE CREATED TO SAMPLE GW BENEATH LNAPL.
"A-174" designation was given to an existing well that was located during the sampling activities and surveyed by Langan personnel.

Appendix C
Summary of Groundwater Field Sample Reports - October 2014
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Philadelphia, Pennsylvania

Well ID	Well Construction Details[3] Total Depth (below toc)	Well Construction Details[3] Well Diameter (in)	Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	FIELD READINGS (pre-purge) Temp. (°C)	FIELD READINGS (pre-purge) DO (mg/L)	FIELD READINGS (pre-purge) ORP (mv)	FIELD READINGS (pre-purge) pH	FIELD READINGS (pre-purge) Conductivity (mS/cm)	FIELD READINGS (during purge) Temp. (°C)	FIELD READINGS (during purge) DO (mg/L)	FIELD READINGS (during purge) ORP (mv)	FIELD READINGS (during purge) pH	FIELD READINGS (during purge) Conductivity (mS/cm)	FIELD READINGS (post purge) Temp. (°C)	FIELD READINGS (post purge) DO (mg/L)	FIELD READINGS (post purge) ORP (mv)	FIELD READINGS (post purge) pH	FIELD READINGS (post purge) Conductivity (mS/cm)	FIELD READINGS (sampling) Purge Start	FIELD READINGS (sampling) Purge Complete (sample time)	FIELD READINGS (sampling) Approx. Purge Rate (gpm)	FIELD READINGS (sampling) Volume Purged (gal)	FIELD READINGS (sampling) Date Sampled
A-169	16.8	2	5.55			19.68	0.34	-187.9	6.58	0.820	20.32	0.31	-187.8	6.59	0.784	20.52	0.26	-188.7	6.56	0.714	1257	1300	2	6	10/6/2014
A-170	18	2	4.04			20.05	0.30	-100.4	7.22	0.865	20.04	0.35	-78.4	7.24	0.837	19.98	0.28	-81.5	7.24	0.836	1256	1300	2	8	10/21/2014
A-171	19.2	2	6.86		Trace product. Not sampled.																				
A-172	13	2	5.30			17.46	0.40	-113.3	6.40	0.574	17.54	1.34	-82.2	6.35	0.621	17.37	2.92	-52.7	6.35	0.719	0918	0920	2	16	10/9/2014
A-173	14.5	2	3.45			19.01	0.30	-57.2	6.59	1.084	19.03	0.22	-52.2	6.54	1.231	19.04	0.19	-59.3	6.55	1.363	1357	1200	2	6	10/14/2014
A-174		4	Damaged. Bulldozer backed into well causing obstruction at approximately 3 feet below ground surface																						
A-175	10.8	2	4.35			19.35	0.29	-90.2	6.60	5.409	19.30	0.31	-86.0	6.59	5.473	19.30	0.85	-62.9	6.59	5.469	0957	1000	2	6	10/14/2014
A-176		2	4.31	4.16	0.15																				
A-177	12.3	4	3.85			19.33	0.38	-79.9	6.64	2.438	19.94	0.68	-65.8	6.57	1.865	20.00	0.90	-66.2	6.57	1.862	1051	1100	2	18	10/14/2014
A-178		2	4.45	3.57	0.88																				
A-179		2	6.00	3.78	2.22																				
A-180		2	3.44	3.37	0.07																				
A-181	7	2	3.84			21.61	1.31	-91.6	6.57	0.313	21.60	0.44	-110.4	6.56	0.303	20.93	0.50	-110.0	6.65	0.339	0958	1000	2	4	10/10/2014
A-182	10.1	2	5.21			18.94	1.14	-66.9	6.81	0.344	18.88	0.02	-80.7	6.79	0.344	18.92	0.36	-84.2	6.76	0.382					10/10/2014
A-183		2	9.32	5.95	3.37																				
A-184		2	6.75	6.45	0.30																				
A-185	18.3	2	9.37			19.01	0.49	-133.7	7.55	0.696	18.87	0.43	-133.6	7.45	0.654	18.69	0.35	-132.7	7.30	0.633	1012	1015	2	6	10/8/2014
A-186	21	2	5.50			18.02	0.14	-100.5	8.16	5.443	19.95	0.13	-106.0	8.08	5.316	17.76	0.11	-104.6	8.03	5.003	1400	1405	2	10	10/20/2014
SW-3	18.1	4	9.05			20.46	0.28	-115.3	6.68	0.883	21.21	0.52	-118.4	6.68	0.898	20.48	0.42	-123.7	6.66	0.838	1245	1255	2	20	10/7/2014
A-45	Same well as A-177 (one well in field is labeled with both designations on pvc pipe - map shows as two different wells, but only one actually present in field																								
SWR-3	11.3	30	8.05			20.15	0.30	20.3	6.75	0.456	20.14	0.23	39.1	6.78	0.457	20.14	0.27	57.6	6.80	0.456	1350	1450	2	120	10/6/2014
A-158	11	4	4.50			19.07	0.56	-136.3	6.87	1.320	19.94	0.28	-143.1	6.86	1.306	20.33	0.23	-139.4	6.85	1.276	1353	1400	2	14	10/15/2014
A-163	15.7	2	7.13			20.59	0.52	-180.4	6.83	0.769	20.45	0.42	-193.8	6.63	0.789	20.43	0.38	-196.2	6.63	0.793	1233	1255	2	4	10/6/2014
A-1	8	4	5.21			19.85	2.32	-44.4	7.38	0.615	19.91	0.27	-46.4	7.46	0.626	18.96	0.79	-52.7	7.60	0.600	1300	1330	2	60	10/22/2014
A-10	15	4	4.29			18.25	0.48	-52.7	6.44	0.532	20.38	0.28	-96.2	6.51	0.582	20.39	0.52	-110.8	6.55	0.628	1224	1235	2	22	10/13/2014
A-11	16.2	4	5.61			18.55	1.07	-83.7	6.42	1.063	19.68	0.81	-90.5	6.41	0.959	18.11	0.96	-80.7	6.51	0.967					10/9/2014
A-118	18	4	2.60			16.41	1.41	-65.1	7.95	1.260	16.79	2.35	-47.7	8.14	0.600	16.77	0.86	48.6	8.24	0.400	1315	1345	2	60	10/20/2014
A-12	15.5	4	5.83			19.43	0.34	-66.4	6.49	1.127	19.97	0.65	-53.5	6.43	0.811	20.08	0.72	-48.8	6.38	0.655	1028	1040	2	24	10/10/2014
A-122	18	4	5.27			18.23	1.24	-49.4	7.33	0.825	18.60	1.29	-53.7	7.51	0.836	18.73	1.09	-68.4	7.55	0.835	1236	1250	2	28	10/20/2014
A-13	Abandoned																								
A-133	16.8	4	9.85			19.95	0.37	-51.5	7.26	0.346	19.98	0.39	-48.0	7.40	0.352	19.98	0.39	-49.3	7.40	0.550	1353	1400	2	14	10/21/2014
A-134	17	4	8.21			21.02	0.42	-99.8	6.59	1.157	21.90	0.21	-127.3	6.65	0.829	21.20	0.17	-138.8	6.65	0.720	1007	1015	2	22	10/13/2014
A-135	17.2	4	8.57			20.13	0.72	-19.4	6.67	0.869	20.98	0.27	-49.7	6.78	0.781	20.10	1.02	-41.5	6.73	0.843	1300	1309	2	18	10/17/2014
A-136	18.1	2	8.18			21.36	1.37	-27.4	6.58	1.135	21.25	0.70	-54.3	6.59	1.139	21.23	0.62	-56.0	6.59	1.135	1207	1210	2	6	10/17/2014
A-137	14	4	7.03			18.20	0.58	-40.2	6.55	0.738	18.99	0.27	-67.6	6.63	0.610	18.99	0.27	-69.3	6.62	0.609	0938	0945	2	14	10/15/2014
A-139	18.6	4	5.80			18.15	0.30	27.7	7.32	0.443	19.24	2.02	43.0	7.25	0.549	19.28	1.69	48.8	7.23	0.450	1032	1045	2	16	10/21/2014
A-140	16.99		6.80			18.42	1.69	39.4	7.33	0.787	19.27	1.12	-17.6	7.37	0.519	19.27	1.06	-26.2	7.37	0.484	0940	0950	2	20	10/21/2014
A-142	18.6	4	7.64			20.62	2.93	53.2	6.87	0.509	20.77	0.31	61.3	6.91	0.499	20.92	1.56	49.4	6.93	0.479	1034	1045	2	22	10/15/2014
A-143	13	4	7.96			20.52	0.57	-101.1	6.69	0.668	20.49	0.32	-106.5	6.68	0.670	20.44	0.30	-110.1	6.68	0.670	1355	1400	2	10	10/14/2014
A-146	Unable to locate																								
A-147	Unable to Locate																								
A-148		4				17.45	0.76	5.0	8.79	0.489	17.57	0.65	3.0	8.81	0.488	17.55	0.55	1.7	9.49	0.487	1210	1220	2	20	10/22/2014
A-149		4				17.82	0.92	20.8	13.96	0.389	17.87	0.76	30.4	14.24	0.389	17.84	0.62	-43.2	14.09	0.389	1315	1330	2	30	10/22/2014
A-15	17	4	1.21			16.20	0.86	-18.8	7.30	0.570	17.90	2.52	-39.0	7.25	0.554	17.48	0.53	-73.0	7.25	0.699	1329	1345	2	32	10/20/2014
A-150	19	4	5.65			20.06	0.55	-50.4	7.26	0.735	20.27	0.58	-72.9	7.23	0.760	20.26	0.33		7.22	0.758	1121	1135	2	28	10/20/2014
A-151	19	4	5.10			18.34	0.39	-2.7	7.20	2.677	18.93	0.86	-27.2	7.20	0.005	18.98	1.14	-34.6	7.26	0.003	1031	1045	2	28	10/20/2014
A-152	20	4	4.12			17.69	1.85	-20.7	7.55	0.483	17.28	0.39	-48.8	7.49	0.544	18.14	0.30	-43.9	7.47	0.548	1129	1145	2	32	10/21/2014
A-153	Unable to locate																								
A-154	13	4	3.51			16.63	0.14	-99.6	6.99	5.933	17.98	0.34	-134.5	7.54	3.041	18.44	0.32	-130.9	7.53	2.958	1000	1030	2	60	10/22/2014
A-155		4	6.50	5.99	0.51																				
A-156	8.5	2	6.02			20.55	1.81	-299.3	6.99	1.349	20.61	0.82	-322.4	7.00	1.245	20.78	0.78	-306.9	6.99	1.312	1014	1015	2	2	10/16/2014
A-157	10.4	4	5.55			17.46	0.75	-140.0	7.01	3.977	18.96	0.40	-138.2	7.04	3.049	18.96	0.41	-138.9	7.04	3.051	1255	1300	2	10	10/15/2014

Appendix C
Summary of Groundwater Field Sample Reports - October 2014
Remedial Investigation Report
AOI 5
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)					FIELD READINGS (sampling)				
	Total Depth (below toc)	Well Diameter (in)				Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conduc-tivity (mS/cm)	Purge Start	Purge Complete (sample time)	Approx. Purge Rate (gpm)	Volume Purged (gal)	Date Sampled
A-161		2	5.55	5.43	0.12																				
A-162	7.5	2	4.08			19.10	0.50	-182.7	6.99	0.287	19.20	1.38	-129.3	6.95	0.292	19.21	0.97	-131.1	6.95	0.292	0859	0900	2	2	10/13/2014
A-164	15.3	2	5.97			20.73	2.82	-108.4	6.56	0.610	20.80	2.06	-109.5	6.54	0.611	21.08	0.49	-121.4	6.70	0.546	1112	1115	2	6	10/6/2014
A-166		2	8.10	7.87	0.23																				
A-167	37	2	5.61			20.01	0.34	-12.7	6.36	2.026	20.00	0.43	-25.7	6.53	2.048	19.12	1.01	-50.0	6.55	2.006	1145	1200	2	30	10/22/2014
A-168	13	2	7.40			18.53	0.57	17.0	7.41	0.511	18.74	0.14	-75.9	7.32	0.782	18.76	0.14	-95.5	7.32	0.785	0925	0930	2	10	10/22/2014
A-16	17	4	3.95			18.63	0.65	29.5	7.04	1.044	18.70	0.31	22.6	6.96	0.899	18.68	0.30	21.2	6.97	0.892	1120	1130	2	20	10/22/2014
A-17	Unable to Locate																								
A-21		4	2.50	2.45	0.05																				
A-22		4	6.45	6.44	0.01																				
A-23	16	4	4.21			18.25	0.13	-56.6	6.75	0.897	17.86	0.30	-83.3	7.09	0.518	17.37	0.31	-82.1	7.02	0.503	1419	1430	2	22	10/22/2014
A-24	15.1	4	3.20			18.93	2.21	23.2	6.90	0.257	19.24	0.93	-73.8	6.89	0.384	19.73	0.73	-69.8	6.86	0.375	1113	1125	2	24	10/8/2014
A-25	11.6	4	5.20			19.97	0.42	-147.8	7.99	3.039	19.76	1.14	-110.3	8.19	3.005	20.14	0.36	-144.5	8.23	2.908	1014	1030	2	15	10/20/2014
A-26	14.5	-	5.70			21.04	0.36	-62.8	6.73	3.428	21.60	0.32	-140.6	6.83	3.805	21.53	0.18	-134.6	6.88	3.996	0745	0800	2	30	10/20/2014
A-27	15	4	4.27			19.91	0.34	-89.6	6.83	1.516	19.41	0.09	105.3	6.93	1.056	19.33	0.35	-99.0	6.90	1.032	0730	0800	2	60	10/22/2014
A-3	16	4	6.95			17.05	2.73	-88.4	7.54	0.697	17.96	0.33	-105.2	7.45	0.699	17.89	0.29	-110.1	7.39	0.704	0950	1000	2	20	10/20/2014
A-39	8.8	4	3.21			18.99	2.82	58.7	6.96	0.601	19.22	2.80	60.7	7.09	0.601	19.22	0.35	81.6	7.13	0.530	1105	1130	0.5	12	10/8/2014
A-4	14	4	4.21			17.62	0.28	-107.7	6.86	0.499	19.53	0.22	-109.4	6.90	0.483	19.53	0.22	-110.1	6.90	0.485	1135	1145	2	20	10/15/2014
A-40	17	4	6.98			18.45	0.95	-32.7	6.18	0.612	19.10	0.32	-47.0	6.49	0.612	18.49	0.69	-70.6	6.36	0.618	1000	1030	0.5	15	10/8/2014
A-41	12	4	4.10			18.57	1.63	-128.7	6.85	0.624	18.51	0.93	-139.6	6.89	0.625	18.93	0.20	-105.6	6.88	0.649	1205	1230	0.5	13	10/8/2014
A-44	14.3	4	8.36			21.48	0.40	-181.4	6.74	0.851	21.10	0.13	-149.9	6.86	0.953	21.09	0.13	-130.2	6.80	0.960	1309	1315	2	12	10/14/2014
A-46		4	11.89	8.91	2.98																				
A-47	13.7	4	6.12			18.81	0.95	4.41	6.84	0.933	19.45	0.30	11.2	6.71	1.063	19.33	0.28	6.8	6.77	1.041	0908	0915	2	14	10/22/2014
A-48	14.5	4	4.40			18.79	0.81	-94.6	6.57	0.426	19.30	0.63	-92.8	6.55	0.419	19.31	0.71	-42.0	6.55	0.419	1135	1145	2	20	10/13/2014
A-49		4				18.09	1.58	27.5	6.94	1.192	18.52	0.52	26.8	6.92	1.118	18.51	0.49	26.3	6.92	1.127	1020	1030	2	20	10/22/2014
A-5		4	5.10	5.05	0.05																				
A-6	17.4	4	3.98			18.25	0.48	-96.6	6.59	1.295	19.81	0.40	-106.2	6.57	1.283	19.78	0.40	-108.9	6.57	1.280	1024	1030	2	12	10/17/2014
A-7		4	3.72	3.68	0.04																				
A-9	15.4	4	3.51			17.12	0.87	-43.5	6.63	0.556	17.21	0.50	-112.5	6.65	0.564	19.40	0.34	-145.4	6.74	0.420	1348	1400	2	24	10/13/2014
SW-1		4	9.18	8.07	1.11																				
SW-2	18.8	4	8.25			21.45	0.78	-110.3	6.79	0.330	21.58	0.76	-94.5	6.77	0.340	20.59	0.78	11.6	6.93	0.535	1155	1205	2	20	10/7/2014
SW-4		4	6.10	6.05	0.05																				
SW-5		4	5.85	5.66	0.19																				
SWR-1	15.3	30	5.45			20.32	1.23	-44.8	7.30	0.214	20.33	0.80	-40.6	7.27	0.214	20.35	0.34	-2.8	7.29	0.214	1315	1415	2	120	10/7/2014
SWR-2	14.8	30	8.15			20.53	1.92	67.2	7.09	0.434	20.55	1.62	53.3	7.09	0.434	20.56	2.21	-10.8	7.10	0.436	1010	1110	2	120	10/7/2014
WP-14	11.4	2	7.64			20.60	0.41	-96.5	6.71	0.529	20.60	0.32	-104.0	6.70	0.531	20.72	1.92	-108.6	6.69	0.532	1153	1155	2	4	10/9/2014
WP16-3	14.6	2	8.69			20.38	0.25	74.7	7.62	0.978	19.22	0.35	58.6	8.17	0.968	19.97	0.31	-26.9	8.13	0.920	0830	0900	2	60	10/20/2014
WP-8	9.9	2	5.20			19.72	0.43	-50.3	6.55	0.343	19.31	0.62	-102.9	6.60	0.428	19.31	0.57	-105.5	6.60	0.427	1433	1435	2	4	10/9/2014
WP-9	12.9	2	5.59			20.74	1.84	-39.1	6.22	0.633	20.95	2.27	-31.5	6.23	0.614	20.84	0.83	-42.5	6.24	0.626	1256	1300	2	8	10/9/2014
WP9-8		2	7.10	5.3	1.80																				
WP-A		2	6.55	5.16	1.39																				
WP-B		2	7.54	7.31	0.23																				
WP-C	Unable to locate																								
WP-D	12	2	6.10			20.89	0.78	67.9	7.04	0.223	20.90	0.62	71.1	7.05	0.220	20.85	0.69	71.9	7.03	0.218	1158	1200	2	4	10/8/2014
WP-E	10.7	2	5.00			20.34	0.28	29.0	7.06	0.313	19.96	0.31	4.1	6.99	0.310	19.96	0.29	1.8	6.98	0.310	1357	1400	2	6	10/17/2014

NR - not recorded
NS-i - not sampled due to insufficient water
NS-p - Not sampled due to product.
NS - not sampled
Wells with product
**SELECT WELLS WITH PRODUCT WERE SAMPLED USING THE DEVICE CREATED TO SAMPLE GW BENEATH LNAPL.
"A-174" designation was given to an existing well that was located during the sampling activities and surveyed by Langan personnel

Appendix C
Summary of Groundwater Field Sample Reports - July 2015
Remedial Investigation Report
AOI 5
Philadelphia Energy Solutions Facility
Philadelphia, Pennsylvania

Well ID	Well Construction Details[3]		Depth to Water (feet)	Depth to Product (feet)	Product Thickness (feet)	FIELD READINGS (pre-purge)					FIELD READINGS (during purge)					FIELD READINGS (post purge)				
	Total Depth (below toc)	Well Diameter (in)				Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)
A-15	14.9	4	0.9	--	--	14.36	3.07	-128.6	6.65	0.776	14.11	1.41	-152.8	6.77	0.82	13.68	1.2	-133.1	6.45	0.809

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	5/19/2005	5.35	--	1.50	--	1.50
A-10	5/19/2005	3.94	--	4.34	--	4.34
A-11	5/19/2005	5.22	--	2.55	--	2.55
A-118	5/19/2005	3.79	--	4.51	--	4.51
A-119	5/19/2005	6.11	--	4.57	--	4.57
A-12	5/19/2005	5.53	--	2.04	--	2.04
A-120	5/19/2005	6.14	--	3.03	--	3.03
A-121	5/19/2005	6.93	--	2.39	--	2.39
A-122	5/19/2005	5.57	--	1.87	--	1.87
A-13	5/19/2005	5.81	5.51	2.67	2.97	2.94
A-133	5/19/2005	10.02	10.02	3.00	3.00	3.00
A-134	5/19/2005	7.98	--	1.16	--	1.16
A-135	5/19/2005	7.64	--	3.12	--	3.12
A-136	5/19/2005	7.85	7.75	0.85	0.95	0.95
A-137	5/19/2005	7.31	--	1.32	--	1.32
A-14	5/19/2005	7.92	7.12	2.57	3.37	3.30
A-15	5/19/2005	1.43	--	3.68	--	3.68
A-16	5/19/2005	3.54	--	5.48	--	5.48
A-17	5/19/2005	3.95	--	4.45	--	4.45
A-18	5/19/2005	3.54	--	4.93	--	4.93
A-19	5/19/2005	3.47	--	6.05	--	6.05
A-21	5/19/2005	2.65	--	5.51	--	5.51
A-22	5/19/2005	6.16	6.15	1.79	1.80	1.80
A-23	5/19/2005	4.29	--	2.02	--	2.02
A-24	5/19/2005	2.91	2.90	2.62	2.63	2.63
A-25	5/19/2005	4.96	--	3.84	--	3.84
A-26	5/19/2005	5.50	--	3.15	--	3.15
A-27	5/19/2005	6.95	--	3.06	--	3.06
A-3	5/19/2005	5.29	--	2.95	--	2.95
A-39	5/19/2005	6.46	--	1.22	--	1.22
A-4	5/19/2005	4.42	--	1.62	--	1.62
A-40	5/19/2005	7.24	--	1.39	--	1.39
A-41	5/19/2005	7.08	--	-1.45	--	-1.45
A-43	5/19/2005	6.74	--	3.69	--	3.69
A-44	5/19/2005	6.45	--	3.56	--	3.56
A-45	5/19/2005	3.02	--	1.70	--	1.70
A-46	5/19/2005	7.42	7.41	3.40	3.41	3.41
A-47	5/19/2005	4.92	4.87	2.50	2.55	2.54
A-48	5/19/2005	5.88	5.88	0.57	0.57	5.88
A-49	5/19/2005	3.51	--	3.69	--	3.69
A-5	5/19/2005	3.47	3.10	1.54	1.91	1.88

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-6	5/19/2005	3.34	--	3.40	--	3.40
A-8	5/19/2005	2.74	--	3.55	--	3.55
A-9	5/19/2005	4.37	--	1.43	--	1.43
A-91	5/19/2005	5.30	--	4.58	--	4.58
PZ-2	5/19/2005	8.16	--	2.72	--	2.72
PZ-3	5/19/2005	7.87	--	2.66	--	2.66
RWBH-1	5/19/2005	5.10	--	0.23	--	0.23
RWBH-2	5/19/2005	5.10	--	-0.97	--	-0.97
SW-1	5/19/2005	8.04	7.88	1.72	1.88	1.87
SW-2	5/19/2005	7.25	--	2.69	--	2.69
SW-3	5/19/2005	8.81	--	1.16	--	1.16
SW-4	5/19/2005	5.86	5.71	1.29	1.44	1.43
SW-5	5/19/2005	5.42	5.40	5.07	5.09	5.09
SWR-1	5/19/2005	5.36	--	2.92	--	2.92
SWR-2	5/19/2005	8.13	--	1.93	--	1.93
SWR-3	5/19/2005	9.08	--	1.53	--	1.53
WP-14	5/19/2005	6.67	--	2.45	--	2.45
WP16-3	5/19/2005	8.31	--	2.76	--	2.76
WP-8	5/19/2005	4.56	--	2.43	--	2.43
WP9-8	5/19/2005	5.95	5.70	2.92	3.17	3.12
WP-A	5/19/2005	4.90	--	4.70	--	4.70
WP-B	5/19/2005	7.23	5.13	2.85	4.95	4.81
WP-C	5/19/2005	7.97	--	-1.44	--	-1.44
WP-D	5/19/2005	5.76	--	2.50	--	2.50
WP-E	5/19/2005	4.89	4.88	2.46	2.47	2.46

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	5/19/2005	5.35	–	-5.35	–	-5.35
A-10	5/19/2005	3.94	–	-3.94	–	-3.94
A-11	5/19/2005	5.22	–	-5.22	–	-5.22
A-118	5/19/2005	3.79	–	-3.79	–	-3.79
A-119	5/19/2005	6.11	–	-6.11	–	-6.11
A-12	5/19/2005	5.53	–	-5.53	–	-5.53
A-120	5/19/2005	6.14	–	-6.14	–	-6.14
A-121	5/19/2005	6.93	–	-6.93	–	-6.93
A-122	5/19/2005	5.57	–	-5.57	–	-5.57
A-13	5/19/2005	5.81	5.51	-5.81	2.97	2.94
A-133	5/19/2005	10.02	10.02	-10.02	3.17	3.18
A-134	5/19/2005	7.98	–	-7.98	–	-7.98
A-135	5/19/2005	7.64	–	-7.64	–	-7.64
A-136	5/19/2005	7.85	7.75	-7.85	0.95	0.95
A-137	5/19/2005	7.31	–	-7.31	–	-7.31
A-13D	5/19/2005	11.80	–	-11.80	–	-11.80
A-14	5/19/2005	7.92	7.12	-7.92	3.37	3.30
A-15	5/19/2005	1.43	–	-1.43	–	-1.43
A-16	5/19/2005	3.54	–	-3.54	–	-3.54
A-17	5/19/2005	3.95	–	-3.95	–	-3.95
A-18	5/19/2005	3.54	–	-3.54	–	-3.54
A-19	5/19/2005	3.47	–	-3.47	–	-3.47
A-19D	5/19/2005	12.93	–	-12.93	–	-12.93
A-21	5/19/2005	2.65	–	-2.65	–	-2.65
A-21D	5/19/2005	17.49	–	-17.49	–	-17.49
A-22	5/19/2005	6.16	6.15	-6.16	1.80	1.80
A-23	5/19/2005	4.29	–	-4.29	–	-4.29
A-24	5/19/2005	2.91	2.9	-2.91	2.63	2.63
A-25	5/19/2005	4.96	–	-4.96	–	-4.96
A-26	5/19/2005	5.50	–	-5.50	–	-5.50
A-27	5/19/2005	6.95	–	-6.95	–	-6.95
A-3	5/19/2005	5.29	–	-5.29	–	-5.29
A-39	5/19/2005	6.46	–	-6.46	–	-6.46
A-4	5/19/2005	4.42	–	-4.42	–	-4.42
A-40	5/19/2005	7.24	–	-7.24	–	-7.24
A-41	5/19/2005	7.08	–	-7.08	–	-7.08
A-43	5/19/2005	6.74	–	-6.74	–	-6.74
A-44	5/19/2005	6.45	–	-6.45	–	-6.45
A-45	5/19/2005	3.02	–	-3.02	–	-3.02
A-46	5/19/2005	7.42	7.41	-7.42	3.41	3.41
A-47	5/19/2005	4.92	4.87	-4.92	2.55	2.54

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-48	5/19/2005	5.88	5.88	-5.88	0.57	0.58
A-49	5/19/2005	3.51	–	-3.51	–	-3.51
A-5	5/19/2005	3.47	3.1	-3.47	1.91	1.88
A-6	5/19/2005	3.34	–	-3.34	–	-3.34
A-8	5/19/2005	2.74	–	-2.74	–	-2.74
A-9	5/19/2005	4.37	–	-4.37	–	-4.37
A-91	5/19/2005	5.30	–	-5.30	–	-5.30
PZ-1	5/19/2005	NM	NM	NM	NM	NM
PZ-2	5/19/2005	8.16	–	-8.16	–	-8.16
PZ-3	5/19/2005	7.87	–	-7.87	–	-7.87
RWBH-1	5/19/2005	5.10	–	-5.10	–	-5.10
RWBH-2	5/19/2005	5.10	–	-5.10	–	-5.10
SW-1	5/19/2005	8.04	7.88	-8.04	1.88	1.87
SW-2	5/19/2005	7.25	–	-7.25	–	-7.25
SW-3	5/19/2005	8.81	–	-8.81	–	-8.81
SW-4	5/19/2005	5.86	5.71	-5.86	1.44	1.43
SW-5	5/19/2005	5.42	5.4	-5.42	5.09	5.09
SWR-1	5/19/2005	5.36	–	-5.36	–	-5.36
SWR-2	5/19/2005	8.13	–	-8.13	–	-8.13
SWR-3	5/19/2005	9.08	–	-9.08	–	-9.08
WP-10	5/19/2005	NM	NM	NM	NM	NM
WP-14	5/19/2005	6.67	–	-6.67	–	-6.67
WP16-1	5/19/2005	NM	NM	NM	NM	NM
WP16-3	5/19/2005	8.31	–	-8.31	–	-8.31
WP16-4	5/19/2005	NM	NM	NM	NM	NM
WP-8	5/19/2005	4.56	–	-4.56	–	-4.56
WP-9	5/19/2005	NM	NM	NM	NM	NM
WP9-7	5/19/2005	NM	NM	NM	NM	NM
WP9-8	5/19/2005	5.95	5.7	-5.95	3.17	Unknown
WP-A	5/19/2005	4.9	–	-4.90	–	-4.90
WP-B	5/19/2005	7.23	5.13	-7.23	4.95	4.81
WP-C	5/19/2005	7.97	–	-7.97	–	-7.97
WP-D	5/19/2005	5.76	–	-5.76	–	-5.76
WP-E	5/19/2005	4.89	4.88	-4.89	2.47	Unknown

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	11/25/2008	4.96	–	1.89	–	1.89
A-10	11/25/2008	3.63	–	4.65	–	4.65
A-11	11/25/2008	5.42	–	2.35	–	2.35
A-118	11/25/2008	2.81	–	5.49	–	5.49
A-119	11/25/2008	5.03	–	5.65	–	5.65
A-12	11/25/2008	5.21	–	2.36	–	2.36
A-121	11/25/2008	6.84	–	2.48	–	2.48
A-122	11/25/2008	5.16	–	2.28	–	2.28
A-13	11/25/2008	7.17	5.85	1.31	2.63	2.50
A-133	11/25/2008	8.91	–	4.11	–	4.11
A-134	11/25/2008	7.96	–	1.18	–	1.18
A-135	11/25/2008	7.77	–	2.99	–	2.99
A-136	11/25/2008	7.64	7.64	1.06	1.06	1.06
A-137	11/25/2008	7.41	–	1.22	–	1.22
A-138	11/25/2008	3.22	–	3.35	–	3.35
A-139	11/25/2008	5.43	–	3.69	–	3.69
A-14	11/25/2008	NM	7.79	NM	2.70	NM
A-140	11/25/2008	6.13	–	3.76	–	3.76
A-141	11/25/2008	6.25	–	3.97	–	3.97
A-142	11/25/2008	5.60	–	2.96	–	2.96
A-143	11/25/2008	6.48	–	3.02	–	3.02
A-144	11/25/2008	7.67	6.81	1.77	2.63	2.52
A-145	11/25/2008	2.45	–	5.00	–	5.00
A-146	11/25/2008	5.72	–	5.16	–	5.16
A-147	11/25/2008	1.22	–	6.29	–	6.29
A-148	11/25/2008	2.70	–	5.31	–	5.31
A-149	11/25/2008	3.22	–	5.27	–	5.27
A-15	11/25/2008	0.95	–	4.16	–	4.16
A-150	11/25/2008	5.42	5.42	4.22	4.22	5.42
A-151	11/25/2008	4.76	–	2.73	–	2.73
A-152	11/25/2008	3.12	–	1.73	–	1.73
A-155	11/25/2008	6.25	5.66	2.14	2.73	2.66
A-16	11/25/2008	3.91	–	5.11	–	5.11
A-17	11/25/2008	3.92	–	4.48	–	4.48
A-21	11/25/2008	2.67	2.66	5.49	5.50	5.50
A-22	11/25/2008	6.68	6.67	1.27	1.28	1.28
A-23	11/25/2008	3.66	–	2.65	–	2.65
A-24	11/25/2008	2.70	2.70	2.83	2.83	2.83
A-25	11/25/2008	5.49	–	3.31	–	3.31
A-26	11/25/2008	5.50	–	3.15	–	3.15
A-27	11/25/2008	5.55	–	4.46	–	4.46
A-3	11/25/2008	5.70	–	2.54	–	2.54
A-39	11/25/2008	2.15	–	5.53	–	5.53

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-4	11/25/2008	4.38	4.38	1.66	1.66	1.66
A-40	11/25/2008	7.35	–	1.28	–	1.28
A-41	11/25/2008	7.17	–	-1.54	–	-1.54
A-43	11/25/2008	7.38	–	3.05	–	3.05
A-44	11/25/2008	7.46	–	2.55	–	2.55
A-45	11/25/2008	3.41	–	1.31	–	1.31
A-46	11/25/2008	7.57	7.56	3.25	3.26	3.26
A-47	11/25/2008	5.27	5.25	2.15	2.17	2.17
A-48	11/25/2008	5.20	–	1.25	–	1.25
A-49	11/25/2008	3.64	–	3.56	–	3.56
A-5	11/25/2008	4.93	4.75	0.08	0.26	0.24
A-6	11/25/2008	4.45	–	2.29	–	2.29
A-7	11/25/2008	4.83	4.11	2.08	2.80	2.72
A-9	11/25/2008	3.29	–	2.51	–	2.51
A-91	11/25/2008	5.51	–	4.37	–	4.37
PZ-2	11/25/2008	7.81	–	3.07	–	3.07
PZ-3	11/25/2008	7.02	–	3.51	–	3.51
RWBH-1	11/25/2008	6.20	–	-0.87	–	-0.87
RWBH-2	11/25/2008	5.12	–	-0.99	–	-0.99
SW-1	11/25/2008	8.91	7.74	0.85	2.02	1.91
SW-2	11/25/2008	7.79	–	2.15	–	2.15
SW-3	11/25/2008	9.10	–	0.87	–	0.87
SW-4	11/25/2008	10.16	6.09	-3.01	1.06	0.69
SW-5	11/25/2008	5.96	5.95	4.53	4.54	4.54
SWR-1	11/25/2008	5.49	–	2.79	–	2.79
SWR-2	11/25/2008	8.03	–	2.03	–	2.03
SWR-3	11/25/2008	9.46	–	1.15	–	1.15
WP-14	11/25/2008	6.59	–	2.53	–	2.53
WP16-3	11/25/2008	8.40	–	2.67	–	2.67
WP-8	11/25/2008	3.38	–	3.61	–	3.61
WP-9	11/25/2008	5.54	–	3.03	–	3.03
WP9-8	11/25/2008	6.23	4.99	2.64	3.88	3.65
WP-A	11/25/2008	5.57	–	4.03	–	4.03
WP-B	11/25/2008	8.12	7.36	1.96	2.72	2.67
WP-C	11/25/2008	8.11	–	-1.58	–	-1.58
WP-D	11/25/2008	5.34	–	2.92	–	2.92
WP-E	11/25/2008	4.68	–	2.67	–	2.67

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-10	3/23/2009	4.44	--	3.84	--	3.84
A-11	3/23/2009	6.04	--	1.73	--	1.73
A-12	3/23/2009	5.72	--	1.85	--	1.85
A-13	3/23/2009	6.97	5.95	1.51	2.53	2.43
A-133	3/23/2009	10.66	--	2.36	--	2.36
A-134	3/23/2009	8.52	--	0.62	--	0.62
A-135	3/23/2009	8.67	--	2.09	--	2.09
A-136	3/23/2009	8.53	--	0.17	--	0.17
A-137	3/23/2009	7.99	--	0.64	--	0.64
A-138	3/23/2009	3.54	--	3.03	--	3.03
A-139	3/23/2009	5.37	--	3.75	--	3.75
A-140	3/23/2009	6.18	--	3.71	--	3.71
A-141	3/23/2009	6.53	--	3.69	--	3.69
A-142	3/23/2009	6.93	--	1.63	--	1.63
A-143	3/23/2009	6.76	--	2.74	--	2.74
A-144	3/23/2009	7.71	6.84	1.73	2.60	2.49
A-150	3/23/2009	5.71	5.71	3.93	3.93	3.93
A-155	3/23/2009	6.91	6.65	1.48	1.74	1.71
A-17	3/23/2009	6.35	--	2.05	--	2.05
A-21	3/23/2009	3.18	3.17	4.98	4.99	4.99
A-22	3/23/2009	6.88	6.88	1.07	1.07	1.07
A-24	3/23/2009	3.65	3.64	1.88	1.89	1.89
A-4	3/23/2009	5.14	--	0.90	--	0.90
A-46	3/23/2009	8.14	8.13	2.68	2.69	2.69
A-47	3/23/2009	5.75	5.75	1.67	1.67	1.67
A-5	3/23/2009	4.99	4.64	0.02	0.37	0.34
A-6	3/23/2009	4.72	--	2.02	--	2.02
A-7	3/23/2009	4.66	4.11	2.25	2.80	2.74
A-9	3/23/2009	4.23	--	1.57	--	1.57
RWBH-1	3/23/2009	4.33	--	1.00	--	1.00
RWBH-2	3/23/2009	4.51	4.51	-0.38	-0.38	-0.38
SW-1	3/23/2009	10.25	9.13	-0.49	0.63	0.53
SW-2	3/23/2009	8.91	--	1.03	--	1.03
SW-3	3/23/2009	10.02	--	-0.05	--	-0.05
SW-4	3/23/2009	8.75	6.97	-1.60	0.18	0.02
SW-5	3/23/2009	6.39	6.38	4.10	4.11	4.11
SWR-2	3/23/2009	8.53	--	1.53	--	1.53
SWR-3	3/23/2009	6.03	--	4.58	--	4.58
WP-8	3/23/2009	5.82	--	1.17	--	1.17
WP-9	3/23/2009	6.03	--	2.54	--	2.54
WP9-8	3/23/2009	7.03	6.08	1.84	2.79	2.61
WP-A	3/23/2009	6.46	6.46	3.14	3.14	3.14
WP-B	3/23/2009	8.42	8.14	1.66	1.94	1.92
WP-C	3/23/2009	8.89	--	-2.36	--	-2.36

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
WP9-8	5/18/2011	6.30	5.00	2.57	3.87	3.62
A-1	5/19/2011	4.00	--	2.85	--	2.85
A-10	5/19/2011	3.70	--	4.58	--	4.58
A-11	5/19/2011	4.58	--	3.19	--	3.19
A-118	6/2/2011	3.71	--	4.59	--	4.59
A-12	5/19/2011	5.00	--	2.57	--	2.57
A-121	5/19/2011	5.82	--	3.50	--	3.50
A-122	5/19/2011	4.73	--	2.71	--	2.71
A-13	5/19/2011	5.80	5.25	2.68	3.23	3.18
A-133	5/19/2011	7.90	7.90	5.12	5.12	5.12
A-134	5/19/2011	6.86	--	2.28	--	2.28
A-135	5/19/2011	7.85	--	2.91	--	2.91
A-136	5/19/2011	6.61	6.60	2.09	2.10	2.10
A-137	5/19/2011	5.89	--	2.74	--	2.74
A-138	5/19/2011	2.78	--	3.79	--	3.79
A-139	5/19/2011	4.39	--	4.73	--	4.73
A-14	5/19/2011	7.20	7.00	3.29	3.49	3.47
A-140	5/19/2011	4.33	--	5.56	--	5.56
A-142	5/19/2011	6.90	--	1.66	--	1.66
A-143	5/19/2011	6.00	--	3.50	--	3.50
A-144	5/19/2011	6.80	5.20	2.64	4.24	4.04
A-145	5/19/2011	3.08	--	4.37	--	4.37
A-146	5/19/2011	4.50	--	6.38	--	6.38
A-147	6/2/2011	1.73	--	5.78	--	5.78
A-148	5/19/2011	2.63	--	5.38	--	5.38
A-149	5/19/2011	3.20	--	5.29	--	5.29
A-15	5/19/2011	1.10	--	4.01	--	4.01
A-150	5/19/2011	5.23	--	4.41	--	4.41
A-151	5/19/2011	4.25	--	3.24	--	3.24
A-152	5/19/2011	3.00	--	1.85	--	1.85
A-155	5/19/2011	6.33	5.18	2.06	3.21	3.07
A-16	5/19/2011	4.76	--	4.26	--	4.26
A-21	5/19/2011	1.90	1.90	6.26	6.26	6.26
A-22	5/19/2011	4.50	--	3.45	--	3.45
A-23	5/19/2011	3.55	--	2.76	--	2.76
A-24	5/19/2011	1.60	1.60	3.93	3.93	3.93
A-25	5/19/2011	3.24	--	5.56	--	5.56
A-26	5/19/2011	4.95	--	3.70	--	3.70
A-27	5/23/2011	5.95	--	4.06	--	4.06
A-3	5/19/2011	4.85	--	3.39	--	3.39
A-39	5/19/2011	2.63	--	5.05	--	5.05

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-4	6/2/2011	4.06	--	1.98	–	1.98
A-40	5/19/2011	5.92	--	2.71	–	2.71
A-41	5/19/2011	5.69	--	-0.06	–	-0.06
A-43	5/19/2011	6.18	--	4.25	–	4.25
A-44	5/19/2011	6.63	--	3.38	–	3.38
A-45	5/19/2011	3.31	--	1.41	–	1.41
A-46	5/19/2011	7.34	7.30	3.48	3.52	3.52
A-47	5/19/2011	5.25	--	2.17	–	2.17
A-48	5/19/2011	3.78	--	2.67	–	2.67
A-49	5/19/2011	3.45	--	3.75	–	3.75
A-5	5/19/2011	4.40	4.30	0.61	0.71	0.70
A-6	5/19/2011	3.30	--	3.44	–	3.44
A-7	5/19/2011	2.95	2.95	3.96	3.96	3.96
A-9	5/19/2011	3.16	--	2.64	–	2.64
A-91	5/19/2011	4.93	--	4.95	–	4.95
PZ-2	5/19/2011	7.75	--	3.13	–	3.13
PZ-3	5/19/2011	6.30	--	4.23	–	4.23
RW-6S	5/19/2011	4.74	--	3.48	–	3.48
RWBH-1	5/19/2011	3.21	--	2.12	–	2.12
RWBH-1	8/2/2011	4.27	--	1.06	–	1.06
RWBH-2	5/19/2011	3.53	--	0.60	–	0.60
RWBH-2	8/2/2011	2.34	2.21	1.79	1.92	1.91
SW-1	6/2/2011	8.53	7.91	1.23	1.85	1.79
SW-2	6/2/2011	7.21	--	2.73	–	2.73
SW-3	6/2/2011	8.1	--	1.87	–	1.87
SW-4	6/2/2011	5.05	4.98	2.10	2.17	2.16
SW-5	6/2/2011	5.49	5.47	5.00	5.02	5.02
SWR-1	6/2/2011	5.05	--	3.23	–	3.23
SWR-2	6/2/2011	8.64	--	1.42	–	1.42
SWR-3	6/2/2011	9.52	--	1.09	–	1.09
WP-14	5/19/2011	5.79	--	3.33	–	3.33
WP16-3	5/19/2011	4.95	--	6.12	–	6.12
WP-8	5/19/2011	3.83	--	3.16	–	3.16
WP-9	5/19/2011	4.90	--	3.67	–	3.67
WP-A	6/2/2011	4.87	4.87	4.73	4.73	4.73
WP-B	6/2/2011	7.34	6.82	2.74	3.26	3.23
WP-C	6/2/2011	7.52	--	-0.99	–	-0.99
WP-D	5/19/2011	5.13	--	3.13	–	3.13
WP-E	5/19/2011	4.37	--	2.98	–	2.98

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	5/10/2012	5.00	--	1.85	--	1.85
A-10	5/10/2012	3.73	--	4.55	--	4.55
A-11	5/10/2012	5.13	--	2.64	--	2.64
A-118	5/9/2012	2.59	--	5.71	--	5.71
A-12	5/10/2012	5.01	--	2.56	--	2.56
A-121	5/10/2012	5.46	--	3.86	--	3.86
A-122	5/10/2012	4.86	--	2.58	--	2.58
A-13	5/10/2012	6.38	5.44	2.10	3.04	2.95
A-133	5/10/2012	6.93	--	6.09	--	6.09
A-134	5/10/2012	6.24	--	2.90	--	2.90
A-135	5/10/2012	7.78	--	2.98	--	2.98
A-136	5/10/2012	5.91	5.90	2.79	2.80	2.80
A-137	5/10/2012	6.85	--	1.78	--	1.78
A-138	5/9/2012	3.20	--	3.37	--	3.37
A-139	5/10/2012	5.33	--	3.79	--	3.79
A-140	5/10/2012	6.39	--	3.50	--	3.50
A-142	5/10/2012	6.34	--	2.22	--	2.22
A-143	5/10/2012	6.40	--	3.10	--	3.10
A-144	5/10/2012	7.20	6.43	2.24	3.01	2.91
A-145	5/10/2012	2.81	--	4.64	--	4.64
A-146	5/10/2012	4.23	--	6.65	--	6.65
A-147	5/9/2012	1.44	--	6.07	--	6.07
A-148	5/10/2012	2.65	--	5.36	--	5.36
A-149	5/10/2012	3.13	--	5.36	--	5.36
A-15	5/10/2012	0.57	--	4.54	--	4.54
A-150	5/10/2012	5.15	--	4.49	--	4.49
A-151	5/10/2012	4.29	--	3.20	--	3.20
A-152	5/10/2012	2.65	--	2.20	--	2.20
A-155	5/10/2012	5.40	5.34	2.99	3.05	3.04
A-16	5/10/2012	3.77	--	5.25	--	5.25
A-21	5/10/2012	2.14	2.13	6.02	6.03	6.03
A-22	5/10/2012	5.69	--	2.26	--	2.26
A-23	5/10/2012	3.39	--	2.92	--	2.92
A-24	5/10/2012	1.05	--	4.48	--	4.48
A-25	5/9/2012	1.10	--	7.70	--	7.70
A-26	5/9/2012	5.40	--	3.25	--	3.25
A-27	5/9/2012	6.70	--	3.31	--	3.31
A-3	5/10/2012	5.18	--	3.06	--	3.06
A-39	5/10/2012	2.51	--	5.17	--	5.17
A-4	5/10/2012	3.65	--	2.39	--	2.39
A-40	5/10/2012	6.83	--	1.80	--	1.80

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-41	5/10/2012	6.61	--	-0.98	--	-0.98
A-43	5/10/2012	6.09	--	4.34	--	4.34
A-44	5/10/2012	7.02	--	2.99	--	2.99
A-45	5/10/2012	3.84	--	0.88	--	0.88
A-47	5/10/2012	5.56	5.56	1.86	1.86	1.86
A-48	5/10/2012	4.25	--	2.20	--	2.20
A-49	5/10/2012	3.52	--	3.68	--	3.68
A-5	5/10/2012	5.29	4.88	-0.28	0.13	0.09
A-6	5/10/2012	3.75	--	2.99	--	2.99
A-7	5/10/2012	4.30	3.75	2.61	3.16	3.10
A-9	5/10/2012	3.46	--	2.34	--	2.34
A-91	5/10/2012	5.32	--	4.56	--	4.56
PZ-2	5/10/2012	7.66	--	3.22	--	3.22
PZ-3	5/10/2012	5.87	--	4.66	--	4.66
RW-6S	5/10/2012	4.57	--	3.65	--	3.65
RWBH-1	5/10/2012	4.35	--	0.98	--	0.98
RWBH-2	5/10/2012	1.89	--	2.24	--	2.24
SW-1	5/10/2012	8.65	7.90	1.11	1.86	1.79
SW-2	5/10/2012	7.08	--	2.86	--	2.86
SW-3	5/10/2012	7.85	--	2.12	--	2.12
SW-4	5/10/2012	4.86	4.85	2.29	2.30	2.30
SW-5	5/10/2012	4.49	4.48	6.00	6.01	6.01
SWR-1	5/10/2012	4.90	--	3.38	--	3.38
SWR-2	5/10/2012	7.01	--	3.05	--	3.05
SWR-3	5/10/2012	6.82	--	3.79	--	3.79
WP-14	5/10/2012	6.48	--	2.64	--	2.64
WP16-3	5/9/2012	8.07	--	3.00	--	3.00
WP-8	5/10/2012	3.99	--	3.00	--	3.00
WP-9	5/10/2012	5.04	--	3.53	--	3.53
WP9-8	5/9/2012	6.55	6.51	2.32	2.36	2.35
WP-A	5/10/2012	NM	3.80	NM	5.80	NM
WP-B	5/10/2012	6.35	6.30	3.73	3.78	3.78
WP-C	5/10/2012	3.85	--	2.68	--	2.68
WP-D	5/10/2012	4.95	--	3.31	--	3.31
WP-E	5/10/2012	3.51	--	3.84	--	3.84

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-156	11/21/2012	4.85	--	4.03	--	4.03
A-157	11/21/2012	5.16	--	3.46	--	3.46
A-158	11/21/2012	4.12	--	2.02	--	2.02
A-159	11/21/2012	6.59	--	3.14	--	3.14
A-160	11/21/2012	6.50	--	2.88	--	2.88
A-161	11/21/2012	5.83	5.81	2.46	2.48	2.48

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
WP9-8	3/28/2013	6.69	5.17	2.18	3.70	3.41
A-1	3/29/2013	5.10	--	1.75	--	1.75
A-10	3/29/2013	3.82	--	4.46	--	4.46
A-11	3/29/2013	5.43	--	2.34	--	2.34
A-118	3/29/2013	2.62	--	5.68	--	5.68
A-12	3/29/2013	5.15	--	2.42	--	2.42
A-121	3/29/2013	6.45	--	2.87	--	2.87
A-122	3/29/2013	4.93	--	2.51	--	2.51
A-13	3/29/2013	5.93	5.22	2.55	3.26	3.19
A-133	3/29/2013	7.98	--	5.04	--	5.04
A-134	3/29/2013	7.53	--	1.61	--	1.61
A-135	3/29/2013	7.34	--	3.42	--	3.42
A-136	3/29/2013	6.93	6.92	1.77	1.78	1.78
A-137	3/29/2013	7.14	--	1.49	--	1.49
A-138	3/29/2013	2.89	--	3.68	--	3.68
A-139	3/29/2013	4.63	--	4.49	--	4.49
A-14	3/29/2013	7.18	7.00	3.31	3.49	3.47
A-140	3/29/2013	5.72	--	4.17	--	4.17
A-142	3/29/2013	6.73	--	1.83	--	1.83
A-143	3/29/2013	6.01	--	3.49	--	3.49
A-144	3/29/2013	6.93	6.18	2.51	3.26	3.16
A-145	3/29/2013	3.44	--	4.01	--	4.01
A-148	3/29/2013	3.20	--	4.81	--	4.81
A-149	3/29/2013	3.09	--	5.40	--	5.40
A-15	3/29/2013	1.25	--	3.86	--	3.86
A-150	3/29/2013	5.14	--	4.50	--	4.50
A-151	3/29/2013	4.31	--	3.18	--	3.18
A-152	3/29/2013	2.99	--	1.86	--	1.86
A-155	3/29/2013	6.34	5.74	2.05	2.65	2.58
A-156	3/29/2013	4.82	--	4.06	--	4.06
A-157	3/29/2013	4.93	--	3.69	--	3.69
A-159	3/29/2013	6.61	--	3.12	--	3.12
A-16	3/29/2013	3.77	--	5.25	--	5.25
A-160	3/29/2013	6.29	--	3.09	--	3.09
A-161	3/29/2013	4.70	4.67	3.59	3.62	3.62
A-162	3/29/2013	2.90	--	4.51	--	4.51
A-163	3/29/2013	6.73	--	3.76	--	3.76
A-164	3/29/2013	5.54	--	3.37	--	3.37
A-21	3/29/2013	2.26	2.25	5.90	5.91	5.91
A-22	3/29/2013	6.49	--	1.46	--	1.46
A-23	3/29/2013	3.14	--	3.17	--	3.17
A-24	3/29/2013	2.65	--	2.88	--	2.88

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-25	3/29/2013	5.32	--	3.48	--	3.48
A-26	3/29/2013	5.46	--	3.19	--	3.19
A-27	3/29/2013	6.92	--	3.085	--	3.09
A-3	3/29/2013	4.9	--	3.34	--	3.34
A-39	3/29/2013	2.49	--	5.19	--	5.19
A-4	3/29/2013	4.11	--	1.93	--	1.93
A-40	3/29/2013	7.05	--	1.58	--	1.58
A-41	3/29/2013	6.87	--	-1.2431	--	-1.24
A-43	3/29/2013	6.50	--	3.93	--	3.93
A-44	3/29/2013	6.65	--	3.36	--	3.36
A-45	3/29/2013	4.01	--	0.71	--	0.71
A-46	3/29/2013	7.27	7.27	3.55	3.55	3.55
A-47	3/29/2013	5.51	--	1.91	--	1.91
A-48	3/29/2013	5.01	--	1.44	--	1.44
A-49	3/29/2013	3.30	--	3.90	--	3.90
A-5	3/29/2013	4.82	4.81	0.19	0.20	0.20
A-6	3/29/2013	4.28	--	2.46	--	2.46
A-7	3/29/2013	3.90	3.32	3.01	3.59	3.53
A-9	3/29/2013	3.23	--	2.57	--	2.57
A-91	3/29/2013	5.20	--	4.68	--	4.68
PZ-2	3/29/2013	8.12	--	2.76	--	2.76
PZ-3	3/29/2013	7.36	--	3.17	--	3.17
RW-6S	3/29/2013	4.97	--	3.25	--	3.25
RWBH-1	3/29/2013	6.23	--	-0.90	--	-0.90
RWBH-2	3/29/2013	2.85	2.85	1.28	1.28	1.28
SW-1	3/29/2013	9.18	8.24	0.58	1.52	1.44
SW-2	3/29/2013	7.44	--	2.50	--	2.50
SW-3	3/29/2013	7.87	--	2.10	--	2.10
SW-4	3/29/2013	4.96	4.85	2.19	2.30	2.29
SW-5	3/29/2013	5.27	5.25	5.22	5.24	5.24
SWR-1	3/29/2013	7.38	--	0.90	--	0.90
SWR-2	3/29/2013	8	--	2.06	--	2.06
SWR-3	3/29/2013	7.83	--	2.78	--	2.78
WP-14	3/29/2013	6.96	--	2.16	--	2.16
WP16-3	3/29/2013	8.41	--	2.66	--	2.66
WP-8	3/29/2013	5.42	--	1.57	--	1.57
WP-9	3/29/2013	5.53	--	3.04	--	3.04
WP-A	3/29/2013	4.97	4.95	4.63	4.65	4.63
WP-B	3/29/2013	7.37	7.22	2.71	2.86	2.85
WP-D	3/29/2013	5.46	--	2.8	--	2.8
WP-E	3/29/2013	4.82	--	2.53	--	2.53

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	7/16/2014	4.46	--	2.39	--	2.39
A-10	7/16/2014	3.45	--	4.83	--	4.83
A-11	7/16/2014	5.03	--	2.74	--	2.74
A-118	7/16/2014	2.62	--	5.68	--	5.68
A-12	7/16/2014	5.25	--	2.32	--	2.32
A-122	7/16/2014	4.62	--	2.82	--	2.82
A-133	6/2/2014	8.30	--	4.72	--	4.72
A-133	7/16/2014	9.89	--	3.13	--	3.13
A-134	7/16/2014	7.94	--	1.20	--	1.20
A-135	7/16/2014	7.75	--	3.01	--	3.01
A-136	7/16/2014	7.37	7.05	1.33	1.65	1.64
A-137	6/2/2014	6.50	--	2.13	--	2.13
A-137	7/16/2014	6.65	--	1.98	--	1.98
A-139	6/2/2014	4.17	--	4.95	--	4.95
A-139	7/16/2014	4.43	--	4.69	--	4.69
A-140	6/2/2014	5.32	--	4.57	--	4.57
A-142	7/16/2014	5.80	--	2.76	--	2.76
A-143	7/16/2014	5.79	--	3.71	--	3.71
A-148	7/16/2014	2.8	--	5.208	--	5.208
A-149	7/16/2014	3.18	--	5.314	--	5.314
A-15	7/16/2014	0.99	0.92	4.12	4.19	700004.05
A-150	7/16/2014	5.55	5.45	4.09	4.19	4.18015
A-151	7/16/2014	4.32	--	3.169	--	3.169
A-152	7/16/2014	3.03	--	1.817	--	1.817
A-154	7/16/2014	2.45	--	-2.45	--	-2.45
A-155	7/16/2014	6.65	5.85	1.739	2.539	2.44116
A-156	7/16/2014	5.03	--	3.852	--	3.852
A-157	7/16/2014	3.1	--	5.523	--	5.523
A-158	7/16/2014	3.22	--	2.919	--	2.919
A-16	7/15/2014	3.52	--	5.50	--	5.50
A-161	7/16/2014	5	4.9	3.29	3.39	3.37953
A-162	7/16/2014	4.4	--	3.01	--	3.01
A-163	7/16/2014	6.72	--	3.77	--	3.77
A-164	7/16/2014	5.45	--	3.46	--	3.46
A-166	7/16/2014	8.15	8	3.1249	3.2749	3.26365
A-167	7/16/2014	4.68	--	4.7752	--	4.7752
A-168	7/16/2014	8.04	--	2.6465	--	2.6465
A-169	7/16/2014	4.96	--	-4.96	--	-4.96
A-17	7/15/2014	9.15	5.35	-0.75	3.05	37999995.45
A-170	7/16/2014	2.85	--	-2.85	--	-2.85
A-171	7/16/2014	5.68	--	-5.68	--	-5.68

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-172	7/16/2014	4.52	--	-4.52	--	-4.52
A-173	7/16/2014	2.78	--	-2.78	--	-2.78
A-174	7/16/2014	5.92	--	-5.92	--	-5.92
A-175	7/16/2014	4.23	--	-4.23	--	-4.23
A-176	7/16/2014	4.2	4	-4.2	-4	-4.01752
A-178	7/16/2014	4	3.36	-4	-3.36	-3.416064

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-179	7/16/2014	4.8	2.77	-4.8	-2.77	-2.947828
A-180	7/16/2014	3.15	3.1	-3.15	-3.1	-3.10438
A-181	7/16/2014	2.1	--	-2.1	--	-2.1
A-182	7/16/2014	5.23	--	-5.23	--	-5.23
A-183	7/16/2014	7.18	--	-7.18	--	-7.18
A-184	7/16/2014	5.36	--	-5.36	--	-5.36
A-185	7/16/2014	8.9	--	-8.9	--	-8.9
A-186	7/16/2014	5.05	--	-5.05	--	-5.05
A-21	7/15/2014	NM	2.75	NM	5.41	NM
A-22	7/15/2014	6.25	6.18	1.70	1.77	1.77
A-23	7/15/2014	3.55	--	2.76	--	2.76
A-24	7/15/2014	2.96	--	2.57	--	2.57
A-25	7/15/2014	4.65	--	4.15	--	4.15
A-26	7/15/2014	5.45	--	3.20	--	3.20
A-27	7/15/2014	6.94	--	3.07	--	3.07
A-3	7/15/2014	4.65	--	3.59	--	3.59
A-39	7/15/2014	2.43	--	5.25	--	5.25
A-4	7/15/2014	3.18	--	2.86	--	2.86
A-40	7/15/2014	6.61	--	2.02	--	2.02
A-41	7/15/2014	3.72	--	1.91	--	1.91
A-44	7/15/2014	6.37	--	3.64	--	3.64
A-45	7/16/2014	3.67	--	1.05	--	1.05
A-46	7/15/2014	10.31	7.50	0.51	3.32	3.02
A-47	6/5/2014	6.12	--	1.30	--	1.30
A-47	7/15/2014	4.58	--	2.84	--	2.84
A-48	7/15/2014	4.25	--	2.20	--	2.20
A-49	7/15/2014	3.50	--	3.70	--	3.70
A-5	7/15/2014	5.48	4.85	-0.47	0.16	0.10
A-6	7/15/2014	2.61	--	4.13	--	4.13
A-7	7/15/2014	2.97	--	3.94	--	3.94
A-9	7/15/2014	2.74	--	3.06	--	3.06
SW-1	7/15/2014	8.65	7.75	1.11	2.01	1.93
SW-2	7/15/2014	6.39	--	3.55	--	3.55
SW-3	7/16/2014	7.95	--	2.02	--	2.02
SW-4	7/15/2014	5.46	5.40	1.69	1.75	1.74
SW-5	7/15/2014	9.90	5.85	0.59	4.64	4.28
SWR-1	7/15/2014	6.66	--	1.62	--	1.62
SWR-2	7/15/2014	7.79	--	2.27	--	2.27
SWR-3	7/16/2014	7.44	--	3.17	--	3.17
WP-14	6/2/2014	7.04	--	2.08	--	2.08
WP-14	7/15/2014	6.55	--	2.57	--	2.57

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
WP16-3	7/15/2014	8.10	--	2.97	--	2.97
WP-8	7/15/2014	4.11	--	2.88	--	2.88
WP-9	7/15/2014	4.45	--	4.12	--	4.12
WP9-8	7/15/2014	7.31	5.67	1.56	3.20	3.00
WP-A	7/15/2014	4.15	5.35	5.45	4.25	4.36
WP-B	7/15/2014	7.65	7.51	2.43	2.57	2.56
WP-D	7/15/2014	5.81	--	2.45	--	2.45
WP-E	7/15/2014	4.40	--	2.95	--	2.95

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	10/2/2014	5.21	--	1.64	--	1.64
A-10	10/2/2014	4.29	--	3.99	--	3.99
A-11	10/2/2014	5.61	--	2.16	--	2.16
A-118	10/2/2014	2.60	--	5.70	--	5.70
A-12	10/2/2014	5.83	--	1.74	--	1.74
A-122	10/2/2014	5.27	--	2.17	--	2.17
A-133	10/2/2014	9.85	--	3.1736	--	3.1736
A-134	10/2/2014	8.21	--	0.93	--	0.93
A-135	10/2/2014	8.57	--	2.19	--	2.19
A-136	10/2/2014	8.18	--	0.52	--	0.52
A-137	10/2/2014	7.03	--	1.6	--	1.6
A-139	10/2/2014	5.8	--	3.32	--	3.32
A-140	10/2/2014	6.8	--	3.087	--	3.087
A-142	10/2/2014	7.64	--	0.915	--	0.915
A-143	10/2/2014	7.96	--	1.542	--	1.542
A-148	10/3/2014	3.75	--	4.258	--	4.258
A-149	10/3/2014	3.45	--	5.044	--	5.044
A-15	10/3/2014	1.21	--	3.9	--	3.9
A-150	10/3/2014	5.65	--	3.99	--	3.99
A-151	10/3/2014	5.1	--	2.389	--	2.389
A-152	10/3/2014	4.12	--	0.727	--	0.727
A-154	10/3/2014	3.51	--	-3.51	--	-3.51
A-155	10/3/2014	NM	5.99	NM	2.399	NM
A-156	10/3/2014	6.02	--	2.862	--	2.862
A-157	10/6/2014	5.55	--	3.073	--	3.073
A-158	10/2/2014	4.50	--	1.64	--	1.64
A-16	10/1/2014	3.95	--	5.07	--	5.07
A-161	10/3/2014	5.55	5.43	2.74	2.86	2.847436
A-162	10/3/2014	4.08	--	3.33	--	3.33
A-163	10/2/2014	7.13	--	3.36	--	3.36
A-164	10/3/2014	5.97	--	2.94	--	2.94
A-166	10/3/2014	8.1	7.87	3.1749	3.4049	3.38765
A-167	10/3/2014	5.61	--	3.8452	--	3.8452
A-168	10/3/2014	7.4	--	3.2865	--	3.2865
A-169	10/2/2014	5.55	--	-5.55	--	-5.55
A-170	10/2/2014	4.04	--	-4.04	--	-4.04
A-171	10/2/2014	6.86	--	-6.86	--	-6.86
A-172	10/2/2014	4.30	--	-4.30	--	-4.30
A-173	10/2/2014	3.43	--	-3.43	--	-3.43
A-175	10/2/2014	4.35	--	-4.35	--	-4.35
A-176	10/2/2014	4.31	4.16	-4.31	-4.16	-4.17

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-178	10/2/2014	4.45	3.57	-4.45	-3.57	-3.65
A-179	10/2/2014	6.00	3.78	-6.00	-3.78	-3.97
A-180	10/2/2014	3.44	3.37	-3.44	-3.37	-3.38
A-181	10/2/2014	3.84	--	-3.84	--	-3.84
A-182	10/2/2014	5.21	--	-5.21	--	-5.21
A-183	10/2/2014	9.32	5.95	-9.32	-5.95	-6.25
A-184	10/2/2014	6.75	6.45	-6.75	-6.45	-6.48
A-185	10/2/2014	9.37	--	-9.37	--	-9.37
A-186	10/2/2014	5.50	--	-5.50	--	-5.50
A-21	10/1/2014	2.50	2.45	5.66	5.71	5.71
A-22	10/1/2014	6.45	6.44	1.50	1.51	1.51
A-23	10/1/2014	4.21	--	2.10	--	2.10
A-24	10/1/2014	3.20	--	2.33	--	2.33
A-25	10/1/2014	5.20	--	3.60	--	3.60
A-26	10/1/2014	5.70	--	2.95	--	2.95
A-27	10/1/2014	4.27	--	5.74	--	5.74
A-3	10/1/2014	6.95	--	1.29	--	1.29
A-39	10/1/2014	3.21	--	4.47	--	4.47
A-4	10/1/2014	4.21	--	1.83	--	1.83
A-40	10/1/2014	6.98	--	1.65	--	1.65
A-41	10/1/2014	4.10	--	1.53	--	1.53
A-44	10/1/2014	8.36	--	1.65	--	1.65
A-45	10/2/2014	3.85	--	0.87	--	0.87
A-46	10/1/2014	11.84	8.91	-1.02	1.91	1.60
A-48	10/1/2014	4.40	--	2.05	--	2.05
A-49	10/1/2014	3.80	--	3.40	--	3.40
A-5	10/1/2014	5.10	5.05	-0.09	-0.04	-0.04
A-6	10/1/2014	3.98	--	2.76	--	2.76
A-7	10/1/2014	3.72	3.68	3.19	3.23	3.23
A-9	10/1/2014	3.31	--	2.49	--	2.49
SW-1	10/1/2014	9.18	8.07	0.58	1.69	1.59
SW-2	10/1/2014	8.25	--	1.69	--	1.69
SW-3	10/2/2014	9.05	--	0.92	--	0.92
SW-4	10/1/2014	6.10	6.05	1.05	1.10	1.10
SW-5	10/1/2014	5.85	5.66	4.64	4.83	4.81
SWR-1	10/1/2014	5.95	--	2.33	--	2.33
SWR-2	10/1/2014	8.15	--	1.91	--	1.91
SWR-3	10/2/2014	8.05	--	2.56	--	2.56
WP-14	10/1/2014	7.64	--	1.48	--	1.48
WP16-3	10/1/2014	8.69	--	2.38	--	2.38
WP-8	10/1/2014	5.20	--	1.79	--	1.79

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
WP-9	10/1/2014	5.59	--	2.98	--	2.98
WP9-8	10/1/2014	7.10	5.30	1.77	3.57	3.35
WP-A	10/1/2014	6.55	5.16	3.05	4.44	4.31
WP-B	10/1/2014	7.54	7.31	2.54	2.77	2.75
WP-D	10/2/2014	6.10	--	2.16	--	2.16
WP-E	10/2/2014	5.00	--	2.35	--	2.35

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-1	5/15/2015	5.85	--	1.00	--	1.00
A-10	5/15/2015	4.20	--	4.08	--	4.08
A-11	5/15/2015	5.75	--	2.02	--	2.02
A-118	5/15/2015	3.23	--	5.07	--	5.07
A-12	5/15/2015	5.72	--	1.85	--	1.85
A-122	5/15/2015	5.45	--	1.99	--	1.99
A-133	5/15/2015	9.80	--	3.22	--	3.22
A-133	5/21/2015	9.89	--	3.1336	--	3.1336
A-134	5/15/2015	7.21	--	1.93	--	1.93
A-135	5/15/2015	7.81	--	2.95	--	2.95
A-136	5/15/2015	6.69	6.68	2.01	2.02	2.02
A-137	5/15/2015	7.66	--	0.97	--	0.97
A-137	5/21/2015	7.61	--	1.02	--	1.02
A-139	5/15/2015	6.20	--	2.92	--	2.92
A-139	5/21/2015	6.6	--	2.52	--	2.52
A-140	5/15/2015	7.29	--	2.60	--	2.60
A-140	5/21/2015	7.69	--	2.197	--	2.197
A-142	5/15/2015	7.07	--	1.49	--	1.49
A-143	5/15/2015	7.12	--	2.38	--	2.38
A-148	5/15/2015	2.64	--	5.37	--	5.37
A-149	5/15/2015	4.76	--	3.73	--	3.73
A-15	5/15/2015	1.58	--	3.53	--	3.53
A-150	5/15/2015	5.82	--	3.82	--	3.82
A-151	5/15/2015	4.67	--	2.82	--	2.82
A-152	5/15/2015	4.13	--	0.72	--	0.72
A-155	5/15/2015	5.95	5.72	2.44	2.67	2.64
A-156	5/15/2015	5.19	--	3.69	--	3.69
A-157	5/15/2015	5.67	--	2.95	--	2.95
A-163	5/15/2015	7.02	--	3.47	--	3.47
A-164	5/15/2015	5.79	--	3.12	--	3.12
A-166	5/15/2015	8.18	8.17	3.09	3.10	3.10
A-167	5/15/2015	5.84	--	3.62	--	3.62
A-168	5/15/2015	7.62	--	3.07	--	3.07
A-169	5/15/2015	5.29	--	-5.29	--	-5.29
A-21	5/15/2015	2.92	2.89	5.24	5.27	5.27
A-22	5/15/2015	6.71	--	1.24	--	1.24
A-23	5/15/2015	4.47	--	1.84	--	1.84
A-24	5/15/2015	2.84	--	2.69	--	2.69
A-25	5/15/2015	4.97	--	3.83	--	3.83
A-26	5/15/2015	5.56	--	3.09	--	3.09
A-27	5/15/2015	6.96	--	3.05	--	3.05

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-3	5/15/2015	6.00	--	2.24	--	2.24
A-39	5/15/2015	7.45	--	0.23	--	0.23
A-4	5/15/2015	4.81	--	1.23	--	1.23
A-40	5/15/2015	7.63	--	1.00	--	1.00
A-41	5/15/2015	4.75	--	0.8769	--	0.8769
A-44	5/15/2015	7.74	--	2.27	--	2.27
A-45	5/15/2015	3.81	--	0.91	--	0.91
A-46	5/15/2015	8.45	--	2.37	--	2.37
A-47	5/15/2015	5.20	5.20	2.22	2.22	#VALUE!
A-48	5/15/2015	4.47	--	1.98	--	1.98
A-49	5/15/2015	3.56	--	3.64	--	3.64
A-5	5/15/2015	4.70	4.69	0.31	0.32	0.32
A-6	5/15/2015	3.90	--	2.84	--	2.84
A-7	5/15/2015	4.96	4.33	1.95	2.58	2.51
A-9	5/15/2015	3.89	--	1.91	--	1.91
PZ-2	5/15/2015	5.59	--	5.29	--	5.29
PZ-3	5/15/2015	7.82	--	2.71	--	2.71
RW-6S	5/15/2015	5.43	--	2.79	--	2.79
RWBH-1	5/15/2015	5.07	--	0.26	--	0.26
RWBH-2	5/15/2015	2.94	2.93	1.19	1.2	1.198926
SW-1	5/15/2015	9.26	8.32	0.5	1.44	1.3554
SW-2	5/15/2015	7.62	--	2.32	--	2.32
SW-3	5/15/2015	7.62	--	2.35	--	2.35
SW-4	5/15/2015	4.7	4.69	2.45	2.46	2.4591
SW-5	5/15/2015	8.5	5.95	1.99	4.54	4.3105
SWR-1	5/15/2015	5.70	--	2.58	--	2.58
SWR-2	5/15/2015	7.99	--	2.07	--	2.07
SWR-3	5/15/2015	7.58	--	3.03	--	3.03
WP-14	5/15/2015	7.13	--	1.99	--	1.99
WP-14	5/21/2015	7.12	--	2	--	2
WP16-3	5/15/2015	8.84	--	2.23	--	2.23
WP-8	5/15/2015	5.26	--	1.73	--	1.73
WP9-8	5/20/2015	6.72	5.1	2.15	3.77	3.571874
WP-A	5/15/2015	6.21	6.16	3.39	3.44	3.44
WP-B	5/15/2015	7.45	7.43	2.63	2.65	2.65
WP-C	5/15/2015	4.11	--	2.42	--	2.42
WP-D	5/15/2015	5.68	--	2.58	--	2.58
WP-E	5/15/2015	4.90	--	2.45	--	2.45

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-15	7/31/2015	0.90	--	4.21	--	4.21
A-166	7/31/2015	7.78	7.77	3.49	3.50	3.50
A-22	7/31/2015	5.97	5.96	1.98	1.99	1.99

Monitoring Well ID	Date	Depth to Groundwater	Depth to LNAPL	Groundwater Elevation	LNAPL Elevation	Corrected Groundwater Elevation
A-136	1/21/2016	5.50	5.10	3.20	3.60	3.59
A-15	1/19/2016	0.95	0.85	4.16	4.26	4.25
A-155	1/20/2016	6.95	6.85	1.44	1.54	1.53
A-22	1/21/2016	7.10	7.05	0.85	0.90	0.90
A-5	1/22/2016	6.40	5.75	-1.39	-0.74	-0.80
WP-A	1/21/2016	NM	3.30	NM	6.30	NM

Notes:
All depths are measured in feet below top of casing
All elevations are measured in feet above mean sea level
The April 2009 event is represented by March 2009 data
The April 2013 event is represented by March 2013 data

GeoStructures

Bashar S. Qubain, Ph.D., P.E.
Eric J. Seksinsky, P.G., P.E.
Jianchao Li, P.E.

GEOTECHNICAL ENGINEERING CONSULTANTS

Project No. G14-140
July 29, 2014

Ms. Tiffani Doerr, P.G.
Aquaterra Technologies, Inc.
122 S. Church St.
West Chester, PA 19381

Re: Soil Laboratory Testing Results
Philadelphia Refinery AOI-5

GeoStructures picked up two (2) Shelby tube samples from Aquaterra on July 7, 2014 (see attached chain of custody form). The soil parameters determined are as follows: bulk density and dry density; effective & total porosity; and fraction organic carbon by loss on ignition. Refer to the testing program summary below for sample descriptions and test results.

Laboratory Testing Summary

Sample	Visual Description & Remarks	Moist Bulk Density (pcf)[1]	Dry Bulk Density (pcf)[1]	Total Porosity[2] (%)	Effective Porosity[2] (%)	Water Content (%)	Fraction Organic Carbon[3] (%)
A-170, 8.5'-10.5'	Dk. gy. elastic silt w/sand, tr. roots, organics	102.7	65.5	54.1	18.2	56.7	8.1
A-186, 8.5'-10.5'	Dk. gy. elastic silt, some organics	86.4	43.7	60.9	20.5	97.8	11.8

[1] ASTM D7263
[2] ASTM D425M .
[3] ASTM D2974, Method D.
*Unit weight is decreased by the presence of organics.

We appreciate your request for services. Please call if you have any questions.

Sincerely,

Eric J. Seksinsky, P.G., P.E.
Associate

Analysis Request/ Environmental Services Chain of Custody

Client: Aquaterra Technologies

Project Name/#: Philly Refinery A01-5

Project Manager: Tiffani Doerr

Sampler: Luke Motrycki/Noelle Stroik

Name of State where samples were collected: PA

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water (Potable / NPDES)	Other	Total # of Containers	Bulk Density (D7263)	Effective Porosity ASTM D425	FOC (2974)							Remarks	Temperature of samples upon receipt (if applicable)
PH_A01-5_A-170@8.5-10.5	6/25/14	1100	X		X			1	X	X	X								
PH-A01-5_A-186@8.5-10.5	~~7/1~~ 7/3/14	1100	X		X			1	X	X	X								

For Lab Use Only

FSC:

SCR:

Turnaround Time Requested (TAT) (please Ccircle): Normal Rush

Date results are needed: ____________

Rush results requested by (please circle): Phone Fax

Phone #: ____________ Fax #: ____________

Relinquished by:	Date	Time	Received by:	Date	Time
[signature]	7/7/14	1335	[signature]	7/7/14	13:35
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

Aquaterra Technologies, Inc., PO Box 744, West Chester, PA 19381 (610) 431-5733

Copies: Original should accompany samples to laboratory. A photocopy should be retained by the client.

N
W
E
S

Legend

Water Use

- Unknown
- Dewater
- Domestic
- Industrial
- Other
- Public Supply
- Unused
- 1 Mile Buffer of Site
- AOI Boundary

Notes:
1. World aerial imagery basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Source of aerial imagery is USDA FSA from 8/16/2015. Credits: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.
2. Well search results provided by PaGWIS, November 2016.

Figure C-1: 2016 One Mile Radius Well Search
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 1,200 2,400 Feet

SCALE: 1" = 1200'
DATE: 11/30/2016
DRN. BY: AJC
CKD. BY: DW
JOB#: 2574601

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 11 SCR\Appendix\Figure X - Well Search_113016.mxd

APPENDIX D

EVERGREEN QA/QC PLAN AND FIELD PROCEDURES MANUAL

Quality Assurance/ Quality Control Plan and Field Procedures Manual

Sunoco Partners Marcus Hook Industrial Complex and Philadelphia Energy Solutions (PES) Philadelphia Refinery Complex

Evergreen Resources Management Operations
May 20, 2016

Table of Contents Page

Appendix

1.0 INTRODUCTION

This Quality Assurance/Quality Control Plan and Field Procedures Manual (QA/QC Plan) outlines the procedures developed to ensure the collection and analysis of quality data for investigations completed under the United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA), Pennsylvania Department of Environmental Protection (PADEP) Act 2, and Pennsylvania and Delaware's Tank programs at the Sunoco Partners Marketing and Terminals, LP (Sunoco Partners) Marcus Hook Industrial Complex (MHIC) and the Philadelphia Energy Solutions Refining and Marketing, LLC (PES) Philadelphia Refinery Complex (PRC) on behalf of Evergreen Resources Management Operations (Evergreen). This document shall be used in conjunction with the site-specific work plans developed for each site and Standard Operating Procedures (SOPs) for field work as incorporated as Appendix A of this QA/QC Plan.

The QA/QC Plan is a planning document that provides a "blueprint" for obtaining the type and quality of data needed to support environmental decision making. The QA/QC Plan integrates relevant technical and quality aspects of a project and documents quality assurance and quality control.

The selection criteria and evaluation specified in this document will be used for validating the data in accordance with the USEPA Guidance on Environmental Data Verification and Data Validation (USEPA 240-R-02-004), dated November 2002 (EPA QA/G-8), USEPA Contract Laboratory Program National Functional Guidelines (NFGs) for Superfund Organic Methods Data Review (USEPA 540-R-08-01), dated June 2008 (SOM02.2) and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (USEPA 540-R-10-011), dated January 2010 (ISM02.2). Qualifiers assigned to the data will be consistent with the data qualifiers specified in the NFGs and the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA 540-R-08-01), collectively referred to herein as validation guidance.

2.0 QUALITY CONTROL REQUIREMENTS

The field and laboratory QC requirements for the characterization and remediation activities are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the referenced analytical methods.

2.1 Field Sampling Quality Control

The field QC requirements include analyzing reference standards for field instrument calibration and for routine calibration verifications. All initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer’s instructions to ensure the equipment is functioning within the specified tolerances. The calibration and maintenance history of the project-specific field instrumentation will be maintained in an active field logbook.

Field QC samples for this project include field duplicate samples to assess the overall precision of the sampling and analysis event, equipment rinse blanks to ensure proper cleaning of non-dedicated equipment is conducted between samples to avoid potential cross contamination (also generally referred to as field blanks), and trip blank samples to monitor cross contamination of water samples by volatile organic compounds (VOCs) during sample transport.

The frequency of collection of equipment rinse blanks will be one per sampling event. Field duplicate samples will only be prepared for groundwater samples, not for soil sampling events, at a collection frequency of 1 in 20 samples. One trip blank will be included for every shipment of samples to an analytical laboratory, at a minimum frequency of one trip blank per sample shipment which contains samples for VOCs analyses.

2.2 Analytical Quality Control

The laboratory QC requirements for the analyses may include evaluating chemical/thermal preservation, holding times, handling requirements, method blanks, instrument performance checks, initial calibration standards, calibration verification standards, internal standards, surrogate compound spikes, interference check samples, serial dilution samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and laboratory control samples (LCS). The acceptance criteria for the above identified requirements will be generated by the laboratory and included in the laboratory reports, along with the other laboratory QC requirements.

3.0 DATA VERIFICATION, VALIDATION, AND USABILITY

All field and laboratory data will be reviewed, verified, and/or validated. These terms are defined as follows:

- Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly.
- Data verification is the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, and/or contractual requirements.
- Data validation is an analyte-specific and sample-specific process that extends the evaluation of data beyond method, procedure, or contractual compliance (i.e., data verification) to determine the quality of a specific data set relative to the end use.

Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling, and sample handling procedures, were fulfilled.

Data verification, validation, and usability assessments performed on a percentage of lab packages to ensure that the data are scientifically defensible, properly documented, of known quality, and meet the project objectives, are described in the following sections. Data determined to be unusable may require corrective action be taken. Data use limitations will be identified in the data validation and usability assessment (VUA) report, which will be generated as required for characterization or final reporting to the agencies.

3.1 Data Review, Verification, and Validation Requirements

Data review, verification, and validation of the analytical data will be performed by each consultant completing the field activities. The exception to this scenario will be Aquaterra Technologies, Inc. (Aquaterra), in which case Aquaterra will review/verify the data and the consultant company working with Aquaterra will subsequently validate the samples.

Field information will be reviewed to ensure that all field measurements were conducted in accordance with the requirements of the site-specific work plan and this QA/QC Plan including applicable SOPs. Field measurements obtained using procedures inconsistent with the requirements of these documents will be evaluated and may require that additional samples are collected or the use of the data be restricted.

Stage 1 Verification and Validation Checks

One hundred percent of the sample results will go through a Stage 1 verification and validation. As part of the data management process, each consultant will complete verification and validation based on the validation guidance. Data verification and validation will consist of the following items based on the guidance stated.

Stage 1 verification and validation of the laboratory analytical data package consists of checks for the compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). It is recommended that the following minimum baseline checks (as relevant) be performed on the laboratory analytical data package received for a Stage 1 validation label:

1. Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requester for analyses.
2. Requested analytical methods were performed and the analysis dates are present.
3. Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result.
4. Requested target analyte result units are reported.
5. Requested reporting limits for all samples are present and results at and below the requested (required) reporting limits are clearly identified (including sample detection limits if required).
6. Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.
7. Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the validation guidance.

Stage 2 Verification and Validation Checks

A minimum of 10 percent of the samples will be flagged for VUA. When a laboratory work order is selected, the entire work order will undergo Stage 2 validation. Laboratory work orders or sample delivery groups (SDGs) that are selected for VUA will undergo validation based on the NFGs.

The selection of samples that will undergo VUA process is designed to meet the needs of the site investigation, characterization, remediation, and closure programs, such as tank closures. Sampling that falls outside these programs will not undergo the VUA process. This includes samples that are collected for permit compliance, such as RCRA and effluent wastewater, as well as product samples, onsite soil reuse samples, and waste characterization samples.

Ten percent of samples will be selected based on the following additional conditions:

1. Sample package selected will contain a field duplicate sample.
2. Sample package selected will contain an equipment rinse blank.
3. Sample package selected will be representative of the contracted analytical laboratories, sample media, parameters, time, and project goals.

QC samples that are collected in the field will provide the best information for completing the VUA reports. The conditions for selection of samples are designed to provide the most useful information regarding sample analysis. Therefore, field duplicate samples have been identified as a priority condition. However, field duplicate samples will only be prepared for groundwater samples, not for soil sampling events. This is due to the known, inherent heterogeneity of soil at the sites. For program efficiency, entire SDGs will be selected for submission in the VUA process. Individual samples should not be selected and processed unless there is an overriding reason to do so, such as a point of compliance sample result that when compared to the historic data set appears to be anomalous.

Stage 2 data validation includes a review of the following QC data deliverables:

1. Technical holding times
2. Method blanks
3. Surrogate spikes
4. MS/MSD results
5. LCS results
6. Field duplicates

7. Trip and equipment rinse blank samples

Stage 2B Verification and Validation Checks

Stage 2B verification and validation will be completed on inorganic analytical data and will contain the following (in addition to Stage 1 verification):

1. Requested methods (handling, preparation, cleanup, and analytical) are performed.
2. Method dates (including dates, times and duration of analysis for radiation counting measurements and other methods, if needed) for handling (e.g., Toxicity Characteristic Leaching Procedure), preparation, cleanup and analysis are present, as appropriate.
3. Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, deuterated monitoring compounds (DMC) recoveries, laboratory control sample (LCS) recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries, serial dilutions, post digestion spikes, standard reference materials) are provided and linked to the reported field samples (including the field quality control samples such as trip and equipment blanks).
4. Requested spike analytes or compounds (e.g., surrogate, DMCs, LCS spikes, post digestion spikes) have been added, as appropriate.
5. Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
6. Frequency of QC samples is checked for appropriateness (e.g., one LCS per twenty samples in a preparation batch).
7. Sample results are evaluated by comparing holding times and sample-related QC data to the requirements in the data validation guidance.
8. Initial calibration data (e.g., initial calibration standards, initial calibration verification [ICV] standards, initial calibration blanks [ICBs]) are provided for all requested analytes and linked to field samples reported. For each initial calibration, the calibration type used is present along with the initial calibration equation used including any weighting factor(s) applied and the associated correlation coefficients, as appropriate. Recalculations of the standard concentrations using the initial calibration curve are present, along with their associated percent recoveries, as appropriate (e.g., if required by the project, method, or contract). For the ICV standard, the associated percent recovery (or percent difference, as appropriate) is present.
9. Appropriate number and concentration of initial calibration standards are present.

10. Continuing calibration data (e.g., continuing calibration verification [CCV] standards and continuing calibration blanks [CCBs]) are provided for all requested analytes and linked to field samples reported, as appropriate. For the CCV standard(s), the associated percent recoveries (or percent differences, as appropriate) are present.
11. Reported samples are bracketed by CCV standards and CCBs standards as appropriate.
12. Method specific instrument performance checks are present as appropriate (e.g., tunes for mass spectrometry methods, DDT/Endrin breakdown checks for pesticides and aroclors, instrument blanks and interference checks for ICP methods).
13. Frequency of instrument QC samples is checked for appropriateness (e.g., gas chromatography-mass spectroscopy [GC-MS] tunes have been run every 12 hours).
14. Sample results are evaluated by comparing instrument-related QC data to the requirements in the data validation guidance.

Stage 3 Verification and Validation Checks

Stage 3 verification and validation will be completed on organic analytical data and will contain the following (in addition to Stage 2B):

1. Instrument response data (e.g., GC peak areas, ICP corrected intensities) are reported for requested analytes, surrogates, internal standards, and DMCs for all requested field samples, matrix spikes, matrix spike duplicates, LCS, and method blanks as well as calibration data and instrument QC checks (e.g., tunes, DDT/Endrin breakdowns, interelement correction factors, and Florisil cartridge checks).
2. Reported target analyte instrument responses are associated with appropriate internal standard analyte(s) for each (or selected) analyte(s) (for methods using internal standard for calibration).
3. Fit and appropriateness of the initial calibration curve used or required (e.g., mean calibration factor, regression analysis [linear or non-linear, with or without weighting factors, with or without forcing]) is checked with recalculation of the initial calibration curve for each (or selected) analyte(s) from the instrument response.
4. Comparison of instrument response to the minimum response requirements for each (or selected) analyte(s).
5. Recalculation of each (or selected) opening and closing CCV (and CCB) response from the peak data reported for each (or selected) analyte(s) from the instrument response, as appropriate.

6. Compliance check of recalculated opening and/or closing CCV (and CCB) response to recalculated initial calibration response for each (or selected) analyte(s).
7. Recalculation of percent ratios for each (or selected) tune from the instrument response, as appropriate.
8. Compliance check of recalculated percent ratio for each (or selected) tune from the instrument response.
9. Recalculation of each (or selected) instrument performance check (e.g., DDT/Endrin breakdown for pesticide analysis, instrument blanks, interference checks) from the instrument response.
10. Recalculation and compliance check of retention time windows (for chromatographic methods) for each (or selected) analyte(s) from the laboratory reported retention times.
11. Recalculation of reported results for each reported (or selected) target analyte(s) from the instrument response.
12. Recalculation of each (or selected) reported spike recovery (surrogate recoveries, DMC recoveries, LCS recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries, serial dilutions, post digestion spikes, standard reference materials etc.) from the instrument response.
13. Each (or selected) sample result(s) and spike recovery(ies) are evaluated by comparing the recalculated numbers to the laboratory reported numbers according to the requirements in the data validation guidance.

Stage 4 Verification and Validation Checks

Additional data validation may be completed for selected sites and/or sampling events, up to EPA Level 4 data review, which will require a laboratory data package inclusive of raw data. Stage 4 verification and validation includes all of the elements of the previous stages of validation and the following:

1. Evaluation of instrument performance checks (GC/MS)
2. Initial and continuing calibration checks (organic and inorganic analyses)
3. Review of internal standards (GC/MS)
4. Instrument blanks (inorganics)
5. Interference check samples (metals)
6. Recalculations of sample results and reporting limits

3.2 Validation Codes

Consultant specific validation codes will be added to the database. This will allow quick identification of the consultant that has performed the verification and/or VUA. Stantec may append additional codes for data management purposes to the codes provided in dt_result table approval_code field. Valid codes are as follows:

Langan:

- LAN1 – Historical data collected by Langan Level 1 Validation (Verification)
- LAN-VER – Langan performed verification
- LAN-USB – Langan performed usability

GHD:

- GHD-VER – GHD performed verification
- GHD-USB – GHD performed usability

Stantec:

- STN-VER – Stantec performed verification
- STN-USB – Stantec performed usability

This methodology creates a means for consultants to perform verification and usability on data collected by another consultant.

3.3 Data Updates in the Electronic Data Deliverables

All consultants will request EQuIS 4 file format Electronic Data Deliverables (EDDs) for data management from the analytical laboratories. In order to facilitate the data updates in the database, the following methodology will be used.

1. The consultant chemist / chemist team will open the .RES file for the EDD that has been selected to be validated for usability. The file can be opened using Excel, Access, Notepad, or similar tool. Although, it is a best practice to open the file in a way to preserve the textual nature of the EDD, it is not necessary.
2. The chemist will use the result_comment field in the .RES file to enter the qualifiers associated with the record and add a semicolon as a delimiter (;) followed by the reason code for the qualification.

3. The .RES file is to be saved with a .USB extension at the end of the file. This file is to be separate from the original .RES file provided and should not be used to over write the original .RES file that was sent with the EDD. This will result in the laboratory work order undergoing VUA having five files instead of four for the EDD. For example:
    - 1234.SMP
    - 1234.TST
    - 1234.BCH
    - 1234.RES
    - 1234.RES.USB
4. Stantec will use the fifth file to update the database with the appropriate qualifiers and codes in validator_qualifiers and approval_a through approval_d fields in dt_result table in the database.
5. Stantec will also change the validated y/n field in dt_result table in the database for the particular EDD.

3.4 Validation Qualifiers

The following qualifiers should be used during the validation/usability process. These are based on the NFGs, validation guidance, and commonly used qualifiers.

Data Qualifiers and Definitions

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample, potentially biased high.

J- The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample, potentially biased low.

UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NJ The analyte has been "tentatively identified" or "presumptively identified" as present and the associated numerical value is the estimated concentration in the sample.

R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

B The analyte was detected in the method, field, and/or trip blank. This qualifier is not pursuant to the NFGs.

If additional qualifiers are required, please forward the suggestions to the Stantec Data Management Team and they will be added to the list of approved codes.

Submitting Data and Validation Codes for Inclusion in the Database

EDDs will be submitted to the database using the SharePoint portal intake forms. The appropriate qualifiers and codes that have been added to the result_comment field in the .RES.USB file will be included in the submission.

Reason Codes

Following is a list of reason codes available for validation. If additional codes are required, please forward the suggestions to the Stantec Data Management Team and they will be added to the list of approved codes.

Reason Code	Reason Description
General Use	
EC	Result exceeds the calibration range.
HT	Holding time requirement was not met
MB	Method blank or preparation blank contamination
LCS	Laboratory control sample evaluation criteria not met
FB	Field blank contamination
RB	Rinsate blank contamination
SQL	The analysis meets all qualitative identification criteria, but the measured concentration is less than the reporting limit.
FD	Field duplicate evaluation criteria not met
TvP	Total to Partial criteria not met
RL	Reporting limit exceeds decision criteria (for non-detects)
Inorganic Methods	
ICV	Initial calibration verification evaluation criteria not met
CCV	Continuing calibration verification evaluation criteria not met
CCB	Continuing calibration blank contamination
PB	Preparation Blank
ICS	Interference check sample evaluation criteria not met
D	Laboratory duplicate or spike duplicate precision evaluation criteria not met
MS	Matrix spike recovery outside acceptance range
PDS	Post-digestion spike recovery outside acceptance range
MSA	Method of standard additions correction coefficient _0.995
DL	Serial dilution results did not meet evaluation criteria
Organic Methods	
TUNE	Instrument performance (tuning) criteria not met
ICAL	Initial calibration evaluation criteria not met
CCAL	Continuing calibration evaluation criteria not met
SUR	Surrogate recovery outside acceptance range
MS/SD	Matrix spike/matrix spike duplicate precision criteria not met
MS	Matrix spike recovery outside acceptance range
IS	Internal standard evaluation criteria not met
LM	The PFK lock mass SICPs indicate that ion suppression evident
ID	Target compound identification criteria not met
Results Reported for Analytes Analyzed Multiple Times	
NSR	Not selected for reporting because the result was qualified as unusable
NSDL	Not selected for reporting because diluted resulted was selected for reporting
NSQ	Not selected for reporting because result was lesser quality based on data validation
NSO	Not selected for reporting because of other reason
Bias Codes	
H	Bias in sample result likely to be high
L	Bias in sample result likely to be low
I	Bias in sample result is indeterminate

3.4 Verification and Validation Summary

Verification of sample collection procedures will consist of reviewing sample collection documentation for compliance with the requirements of the site-specific work plan and this QA/QC Plan. If alternate sampling procedures were used, the acceptability of the procedure will be evaluated to determine the effect on the usability of the data. Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in this QA/QC Plan.

The results of the data verification and validation procedure will identify data that do not meet the measurement performance criteria of this QA/QC Plan. Data verification and validation will determine whether the data are acceptable, of limited usability (qualified as estimated), or rejected. Data qualified as estimated will be reviewed and a discussion of the usability of estimated data will be included in the VUA report.

Data determined to be unusable may require corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether or not the data are critical for project data quality objectives to be achieved. Data use limitations will be identified in VUA report, which will be generated as required for characterization or final reporting to the agencies. Each consultant will be responsible for their own VUA reports.

Revision History

Revision	Description	Prepared By	Date
1.0	Initial creation of document as SOP for VUA	Stantec (Gus Sukkurwala/Jennifer Menges/Andrew Bradley)	5/31/2015
2.0	Incorporation into QA/QC Plan	GHD (Colleen Costello)	3/21/2016
3.0	Inclusion of Field Procedures. Edits from Langan (Emily Strake & Kevin McKeever)	Stantec (Jennifer Menges)	5/13/2016

APPENDIX A
EVERGREEN FIELD PROCEDURES MANUAL

Evergreen
Field Procedures Manual

Sunoco Partners Marcus Hook Industrial Complex
and Philadelphia Energy Solutions (PES)
Philadelphia Refinery Complex

Evergreen Resources Management Operations

May 20, 2016

Table of Contents

1.0 INTRODUCTION

This Field Procedures Manual outlines the standard operating procedures developed to ensure the collection and analysis of quality data for investigations completed under the United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) program, Pennsylvania Department of Environmental Protection (PADEP) Act 2 program and Pennsylvania and Delaware's Tank programs at the Sunoco Partners Marketing and Terminals, LP (Sunoco Partners) Marcus Hook Industrial Complex (MHIC) and the Philadelphia Energy Solutions Refining and Marketing, LLC (PES) Philadelphia Refinery Complex (PRC) on behalf of Evergreen Resources Management Operations (Evergreen). The MHIC and PRC are herein referred to as facility or site.

Evergreen's consultants collect data in pursuit of site characterization and remediation that will meet the expectations of the appropriate regulatory agencies. This document shall be used in conjunction with the site-specific work plans developed for each site and the QA/QC Plan of which this manual was incorporated as Appendix A.

1.1 Training Qualifications

All field personnel involved in field work at MHIC and the PRC shall have completed and where applicable, be current with OSHA 40-hour HAZWOPER training, annual OSHA 8-hour HAZWOPER refresher, Process Safety Management (PSM) training, site-specific safety module training for current facility badges (including fire watch and hole watch, if required), TWIC Card, annual drug screening, and annual respirator fit testing. All field personnel new to the facility should be provided with onsite health and safety (H&S) orientation by an experienced member of the project team. The onsite orientation should include review of the facility's emergency action plan and training on Evergreen and site-specific H&S requirements. Appropriately qualified personnel should perform field work, based on the work scope and experience level required by the task to be executed.

1.2 Health and Safety Requirements

All consultants performing work at the referenced sites on behalf of Evergreen shall comply with the *Evergreen Resources Management Operations Health and Safety Requirements* dated June 1, 2014. This includes contractors, sub-contractors, and third party companies performing work for Evergreen at MHIC and the PES PRC. Each consultant must also have their own site-specific health and safety plan (HASP) submitted to and approved by Evergreen prior to performing any work. A site-specific HASP must be reviewed and signed by all field personnel prior to commencement of field activities.

1.3 PPE Requirements

The minimum standard PPE at the facilities includes fire resistant clothing (FRC; coveralls may be Nomex or other FRC, 6 ounce minimum, orange in color) with the name of the company displayed on the back of the garment, hard hat, sturdy safety-toe boots, safety glasses, long-gauntlet leather gloves, and personal H_2S monitors. Nitrile gloves for chemical protection and hearing protection may also be required depending on the location and type of work. Workers are to be trained on these PPE requirements before being permitted onsite. An appropriate respirator may be required if site-specific air monitoring action levels are met, in accordance with the site-specific HASP. If a worker has a particular sensitivity or concern, a respirator may be worn regardless of OSHA action levels. During winter weather conditions, slip prevention footwear such as crampons or overshoes should be worn for traction. Task-specific PPE will be further identified in following sections.

1.4 Site Controls

Safety cones and/or caution tape should be used in high traffic areas. The "Buddy System" may also be employed in high traffic areas, in areas where other contractors are working, and in remote areas. Additional task-specific site controls will be detailed in following sections.

1.5 Equipment and Decontamination

Numerous practices are employed throughout the processes of site investigation and sampling to assure the integrity of the resulting data. The risk in use of non-dedicated equipment at multiple sampling locations lies in the potential for cross-contamination. While the threat of cross-contamination is always present, it can be minimized through the implementation of a consistent decontamination program during sensitive site measurement and data collection activities.

All site equipment to be used in multiple locations (non-dedicated) for sampling of soil, sediment, and/or groundwater will be decontaminated immediately prior to initial use and between uses at each location according to the following steps:

- Remove particulates with a sorbent pad or towel and/or initial rinse with clean potable tap water;
- Wash equipment with clean sponge, soft cloth, or scrub brush as necessary in a solution of tap water/laboratory grade detergent (Alconox®, Liquinox®, or equivalent);
- Rinse with tap water;
- Rinse with deionized or distilled water; and
- Air dry for as long as possible.

Rinse water generated during decontamination procedures will be treated onsite by passing the water through a bucket or tube filled with activated carbon prior to discharge to the ground surface. Additional decontamination procedures may be appropriate depending on the task, and will be identified in the following sections, as applicable.

1.6 Documentation

All site activities and conditions for characterization activities should be recorded by field personnel in a field computer (e.g., YUMA) using the EQuIS Data Gathering Engine (EDGE) application, or if necessary, a field book may be used. The entry shall include at a minimum, the date, time, weather conditions, location, personnel present onsite, field readings, sampling methodology, as well as additional comments or observations. Task specific observations which should also be recorded will be identified in the following applicable sections.

2.0 LIQUID LEVEL ACQUISITION (WELL GAUGING) PROCEDURES

2.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered as well as slip/trip/fall potential during onsite well gauging activities. Additional hazards may be mentioned in the site-specific HASP and/or the daily job safety analysis (JSA).

2.2 Materials and Equipment Necessary for Task Completion

Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy, decontamination supplies (laboratory-grade detergent, deionized or distilled water, appropriate containers, scrub brush, and sorbent pads or paper towels), socket set, flathead screwdriver (or pry bar or manhole cover lifter), clear bailers with string for confirmation of light non-aqueous phase liquids (LNAPL), if necessary, and air monitoring instruments (optional, based on previous site visits).

2.3 Methodology

This task involves the deployment of an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy into a well (in most cases), recording the measurement, and decontaminating the probe. The recorded field measurements may then be utilized for one of several applications including: well sampling, water table gradient mapping, LNAPL occurrence, LNAPL thickness, and/or gradient mapping, and various testing procedures. Wells should be gauged in order of least to most contaminated, based on existing sampling data or LNAPL occurrence, to minimize the potential for cross-contamination between wells. If LNAPL is detected in a well that does not typically have LNAPL, it should be confirmed with a clear bailer.

The proper procedure for liquid level acquisition is as follows:

1) Decontaminate the optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy prior to initial deployment, and again after each well measurement to prevent cross-contamination between wells.

2) If warranted, mark off a work area surrounding the well(s) to be gauged with safety cones and/or caution tape in order to protect personnel from auto traffic; the "Buddy System" may also be employed.

3) Where applicable, lift the manhole cover off of the well head (a screwdriver, pry bar, or manhole cover lifter may be used to lift the cover depending on the size of the manhole) or open protective well casing (stickup) and remove the well plug, if present.

4) Most wells should contain a mark or notch in the top edge of the casing from which normalized readings are to be measured (reference point elevation). Slowly lower the optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy into the well until the instrument signals contact with liquid. Note whether or not the instrument's tone is indicative of the presence of free-phase LNAPL (commonly a solid tone), or water (commonly an oscillating or beeping tone). If LNAPL is present, record the depth at which LNAPL was first indicated to the nearest hundredth of a foot, as measured from the top of well casing mark/notch. Slowly lower the probe through the LNAPL until the instrument's tone changes to indicate the presence of water. Record the depth at which water was first indicated to the nearest hundredth of a foot. A clear bailer may be used to verify the existence or approximate amount and appearance of LNAPL. If no LNAPL is apparent, record the depth to water.

5) Retract the probe from the well and secure the well appropriately.

6) Note the date and time of measurement for gauging and record all measurements and observations in the field computer or, if necessary, in a field book for subsequent electronic data entry.

7) Decontaminate the probe in accordance with the decontamination procedure outlined in Section 1.5.

8) Clean up the work area, remove gauging equipment, and remove any traffic control devices.

3.0 GROUNDWATER MONITORING PROCEDURES

3.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered as well as slip/trip/fall potential during onsite well gauging activities. Additional hazards may be mentioned in the site-specific HASP and/or the daily JSA.

3.2 Materials and Equipment Necessary for Task Completion

A list of equipment required to access, gauge, purge, and sample site monitoring wells is presented below. Also listed are materials necessary to store, label, preserve, and transport groundwater samples.

- Current site map detailing well locations;
- Field book and/or field computer for recording site data;
- Graduated, optical oil/water interface probe;
- Keys and tools to provide well access;
- Appropriate, laboratory prepared sample containers and labels;
- Appropriate well purging apparatus as determined by volume of groundwater to be purged and compounds to be analyzed;
- Water quality meter for monitoring indicator field parameters (DO, pH, specific conductance, redox potential, and turbidity if available);
- Dedicated polyethylene bottom-loading bailer or well pump and disposable tubing for groundwater sample collection;
- Clean nylon or polypropylene bailer cord;
- Disposable nitrile sampling gloves;
- Decontamination supplies;
- Calibrated five-gallon bucket and watch or stopwatch to determine discharge rate during purging;
- Blank chain-of-custody forms; and

- Cooler(s) and ice for sample preservation.

3.3 Methodology for Three Well Volume Sampling

Prior to site visitation for the groundwater sampling event, the following data will be reviewed to ensure proper preparation for field activities:

- Most recent liquid level data from all wells;
- Most recent analytical data from all wells to determine gauging and sampling sequence; and
- Well construction characteristics.

Each monitoring well to be sampled will be gauged to obtain liquid level data immediately prior to initiation of the sampling process (refer to well gauging procedures above). Liquid level data should be recorded in a field computer or if necessary, a field book. Should free-phase LNAPL be detected by the gauging process, routine groundwater sampling will not be conducted at that location. If groundwater sampling under LNAPL is warranted, refer to the sub-LNAPL sampling section and methodology in Section 3.6.

Groundwater sampling will be initiated by purging from the well a minimum of three well volumes, except in cases where the well is pumped dry, as referenced below. Well purging is performed to remove stagnant water and to draw representative water from the aquifer into the well for subsequent sampling and analysis. In extreme cases where a well is pumped dry and/or shows little recharge capacity, the well should be evacuated once prior to sampling. Wellbore storage volume should be estimated using as-built information stored in the field computer or as indicated on the well log, and the depth to water measurement obtained immediately prior to sampling.

Water quality should be monitored and readings recorded in the field computer or field book while purging, typically through use of a multi-parameter water quality meter with a flow through cell or cord for down-well measurements. Water quality readings should be recorded a minimum of three times (pre-purge, during purge, and post-purge/sample collection) or four times (pre-purge and following each well volume). The parameters to be monitored and recorded are dissolved oxygen, pH, specific conductance, redox potential, temperature, and turbidity if available.

Well purging can be performed with various equipment including: a dedicated bailer for hand bailing low volumes of water; a surface mounted electric centrifugal pump with dedicated polyethylene tubing; and/or submersible pump (particularly when the depth to water is greater than 20 feet) with dedicated polyethylene tubing. During pumping, the intake will be placed directly below the static water surface and slowly lowered during the purging process. This procedure may not be necessary in low-yielding wells but is important in high-yielding, permeable strata where an intake initially placed deep in a well may draw laterally and have little influence in exchanging water from shallower depths within the well bore.

Flow rate during well purging will be approximated by the bucket and stop watch method. The duration of pumping required to remove three well volumes will be calculated directly from this flow rate. All fluids removed during purging will be treated onsite with activated carbon or in accordance with an approved work plan.

The sequence of obtaining groundwater samples will be based upon available historical site data for existing wells and photoionization detector (PID) readings for newly installed wells. Monitoring wells will be sampled in order of those having the lowest to highest concentration of constituents of concern (or PID readings for new wells), based upon the most recent available set of laboratory analyses, to reduce the potential for cross-contamination. For general monitoring events, groundwater samples will not be obtained for analysis from any well containing measurable free product. If groundwater sampling under LNAPL is warranted, refer to the sub-LNAPL sampling section and methodology in Section 3.6.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.
2) Use a dedicated polyethylene sampling bailer for each well.
3) Use a clean pair of nitrile gloves.

4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.

5) Select appropriate laboratory-provided sample containers.

6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.

7) Retrieve bailer at a steady rate to avoid excess agitation.

8) Visually inspect bailed sample to ensure that no free product or organic detritus has been collected.

9) Uncap first designated sample vial and fill from bailer as rapidly as possible but minimizing agitation; secure septum and lid.

10) Inspect sealed sample for entrapped air; if air is present, remove the lid and gently top off sample in vial, seal and inspect. Repeat until no air is apparent.

11) Repeat Steps 9 and 10 for the remaining sample vials based on the laboratory and/or regulatory protocol.

12) Complete and attach labels to sample containers noting sample collector, date, time, and location of sample; record same data in field computer or field book.

13) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples will be maintained at a temperature of approximately 4°C.

14) Dispose of gloves, bailer, and bailer cord as solid waste and move to next sample location.

3.4 Methodology for Low-Flow Purging and Sampling

For wells that will be purged and sampled via low-flow methodology, the USEPA Region III Bulletin QAD023: *Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells* will be followed. The following data will be reviewed for each well in order to set the pump intake for the low-flow sampling:

- Soil boring lithologic log;
- Well construction log showing the screened interval;
- Identification of the most permeable zone screened by the well;
- Approximate depth to static water;

- Proposed pump intake setting; and
- Technical rationale for the pump intake setting, preferably across from the most impacted/contaminated subsurface interval.

Adjustable rate, submersible, bladder pumps in conjunction with polyethylene tubing for purging and sampling will be used. An alternate set up could include a stainless steel submersible pump, such as a Hurricane® pump or a Monsoon® pump with dedicated polyethylene tubing. The tubing diameter will be between 3/16-inch and ½-inch inner diameter and the length of the tubing extended outside of the well should be minimized. Flow-through cells will be used to monitor groundwater quality parameters during sampling. Monitoring well information, equipment specifications, water level measurements, parameter readings, and other pertinent information will be recorded during well purging and sampling.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells by the low-flow methodology.

1) PID Screening of Well: A PID measurement may be collected at the rim of the well immediately after the well cap is removed and recorded in the field computer or field book, if historic data is not available.
2) Depth to Water Measurement: A depth to water measurement will be collected and recorded. To avoid disturbing accumulated sediment and to prevent the inadvertent mixing of stagnant water, measuring the total depth of the well should be done at the completion of sampling.
3) Low Stress Purging Startup: Water pumping will commence at a rate of 100 to 400 milliliters per minute (mL/min). This pumping should cause very little drawdown in the well (less than 0.2-0.3 feet) and the water level should stabilize. Water level measurements are made frequently, and flow rate will be recorded in mL/min on the sampling form or field computer.
4) Low Stress Purging and Sampling: The water level and pumping rate will be monitored and recorded every five minutes during purging, and any pumping rate adjustments will be recorded. During the early phase of purging, emphasis will be placed on minimizing and stabilizing pumping stress, and recording any necessary adjustments. Adjustments, when necessary, will be made in the first 15 minutes of purging. If necessary, pumping rates will

be reduced to the minimum capabilities of the pump to avoid well dewatering. If the minimal drawdown exceeds 0.3 feet, but the water level stabilizes above the pump intake setting, purging will continue until indicator field parameters stabilize, as detailed in Step 5 below. If the water level drops below the pump intake setting at the absolute minimum purge rate, the pump will remain in place and the water level will be allowed to recover repeatedly until there will be sufficient water volume in the well to permit the collection of samples.

5) Indicator Field Parameter Monitoring: During well purging, indicator field parameters (DO, pH, specific conductance, redox potential, and turbidity if available) will be monitored every five minutes (or less frequently, if appropriate). Purging will be considered complete and sampling can commence when all the indicator field parameters have stabilized. Stabilization will be achieved when three consecutive readings, taken at five minute intervals (or less frequently, if appropriate), are within the following limits:
   - DO (±10 percent);
   - turbidity (±10 percent);
   - specific conductance (±3 percent);
   - pH (± 0.1 unit); and
   - redox potential ([Eh] ±10 mv).

   Temperature and depth to water will be also monitored during purging. Should any of the parameter-specific components of the water quality meter fail during monitoring, the sampling team will attempt to locate a replacement multi-meter or individual criteria meter. If none are available, the sampling team will continue recording the parameters that are operational, and proceed with the sampling. Any other field observations relating to sample quality, such as odor, foaming, effervescence, and sheens, will also be recorded in the field computer or on the sampling form.

6) Collection of Ground Water Samples: Water samples for laboratory analyses will be collected prior to the flow-through cell by either using a bypass assembly or by temporarily disconnecting the flow-through cell. All sample containers will be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing should remain filled with water in order to minimize possible changes in water chemistry upon contact with the atmosphere. Methods employed to ensure that the outlet tubing will be filled include adjusting the tubing angle upward to

completely fill the tubing and restricting the diameter of the tubing near the outlet of the tubing.

The order in which samples will be collected is as follows:

- Volatile organics;
- Gas sensitive (e.g., Fe^{+2}, CH_4, H_2S/HS);
- Base neutrals or PAHs;
- Total petroleum hydrocarbons;
- Total metals;
- Dissolved metals;
- Cyanide;
- Sulfate and chloride;
- Nitrate and ammonia;
- Preserved inorganic;
- Non-preserved inorganic; and
- Bacteria.

After the appropriate laboratory-provided glassware is filled and labeled, the samples shall be placed in an ice-filled cooler and maintained at approximate 4°C for submittal to the laboratory. Upon completion of sampling at the well, decontaminate non-dedicated equipment in accordance with the decontamination procedure outlined in Section 1.5, and dispose of all dedicated equipment (gloves, tubing, etc.) as solid waste before moving to the next location.

3.5 Methodology for Passive (No-Purge) Sampling for Groundwater Collection

There are many passive groundwater sampling devices that allow for accurate sample collection without purging. Each device has specific uses and conditions for which they are more applicable. This methodology presents details for the use of HydraSleeve samplers.

The HydraSleeve is a disposable, single use device for the collection of representative groundwater samples for laboratory analysis of physical and chemical parameters.

HydraSleeves are placed within the screened interval (or other defined interval) of the well and activated after an equilibrium period. When used according to the manufacturer's instruction, the HydraSleeve will collect a groundwater sample without purging, thus causing no drawdown, agitation, or water column mixing. The HydraSleeve collects a sample from the screened interval only, and excludes water (or other fluids) from other parts of the well by use of check valve that seals when the sampler is full. The HydraSleeve takes advantage of the continuous natural movement of groundwater, which produces an equilibrium condition between the water in a well screen and the adjacent formation. HydraSleeves produce reliable data from low yield wells where other sample methods cannot due to well screen dewatering and associated alteration in water chemistry.

The HydraSleeve consists of the following components:

1) A long (usually 3 to 5 feet), flexible, lay-flat polyethylene sample sleeve, which is sealed at the bottom, and is equipped with a reed valve at the top allowing water to enter the HydraSleeve only during active sample retrieval.
2) A reusable, stainless steel weight attached with a clip to the bottom of the sleeve. The weight is used to carry the sample sleeve down the well to the specified depth (usually the bottom of the well screen). An optional top weight is also available to compress the sleeve in wells with short well screens.
3) A tether line attached to a spring clip at the top of the sample sleeve to deploy the device within the well and later retrieve it for sample collection.
4) A discharge tube is supplied with the device, which is used to puncture the wall of the sleeve after it is recovered to allow direct filling of sample bottles.

<u>Deployment</u>

Upon retrieval, the HydraSleeve is designed to effectively collect a "core" of water from within the well screen, which is equivalent in length and diameter to the sample sleeve. The upward motion opens the valve at the top, which then allows the device to fill with water. The Hydrasleeve should be installed with the top of the sample sleeve as close to the desired sample interval as possible. This will allow the sampler to fill and the check valve to close before the top of the device is pulled past the top of the sample interval.

To assemble and deploy the HydraSleeve:

1) Remove the Hydrasleeve from its package and hold it by the top, pinching the top at the holes.
2) Attach the spring clip and tether in the holes.
3) Slide the clip and bottom weight assembly into the holes at the bottom of the sleeve.
4) Lower the Hydrasleeve by the tether to the bottom or to the specified depth and secure the tether at the wellhead (Note: do not pull the HydraSleeve upward at any time during deployment, as this could cause the check valve to open and water to fill the sleeve inadvertently).

Sample Collection

Although the HydraSleeve only displaces approximately 100 milliliters (ml) of water during deployment, the well should be allowed to stabilize prior to sample collection so that natural flow conditions and contaminant distribution can return to equilibrium conditions. In certain jurisdictions, regulatory directives may prescribe a minimum equilibration period. When used for periodic monitoring programs, such as quarterly or semi-annual sampling, the HydraSleeve can be installed and remain in the well until the next sampling event, thus providing ample time for the well to equilibrate.

To collect a sample:

1) Be sure the tether is secured to the top of the well.
2) In one smooth motion, pull the tether upward at a rate of approximately 1 foot per second. The weight of the sampler will be felt when the valve closes. Continue pulling upward until the HydraSleeve is clear of the well.
3) Discard the water trapped at the top of the HydraSleeve above the reed valve.
4) Hold the HydraSleeve at the reed valve, and puncture the sleeve with the discharge tube just below the reed valve.
5) Decant the water into sample containers.
6) Discard the HydraSleeve as solid waste and process the excess water through activated carbon prior to discharge to the ground surface.

The weight and clips should be decontaminated prior to deploying a replacement HydraSleeve in the well. Tethers can be dedicated to individual wells or decontaminated and reused.

3.6 Methodology for Sub-LNAPL Sampling

The following section describes the methodology used for obtaining groundwater samples from the water column beneath LNAPL. Wells for sub-LNAPL sampling are not purged of three well volumes prior to sampling. This will prevent the potential of drawing LNAPL into the sample and to be representative of steady-state groundwater conditions beneath the LNAPL.

The following data will be reviewed for each well in order determine the appropriate equipment necessary:

- Well construction log showing diameter and total depth of the well;
- Approximate depth to LNAPL; and
- Approximate depth to static water.

A list of equipment for sub-LNAPL sampling is presented below:

- Field book or field computer for recording site data;
- Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy;
- Keys and tools to provide well access;
- Peristaltic pump;
- Polyethylene tubing specifications of 0.25-inch outer diameter x 0.17-inch inner diameter is preferable as this small diameter assists in achieving lower flow rates;
- Silicone tubing of appropriate diameter to operate peristaltic pump;
- Polyvinyl chloride (PVC) drop tube (1.5-inch or other appropriate diameter);
- PVC rod (0.5-inch or other appropriate diameter);
- PVC end cap for drop tube;
- Tether for end cap;
- Clamps for securing drop tube to well casing;
- Appropriate sample containers and labels;

- Decontamination supplies;
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

The following sequence of procedures will be implemented for the collection of sub-LNAPL groundwater samples.

1) Determine LNAPL Thickness: Use an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy to collect depth to LNAPL and depth to water measurements.
2) Installing Sampling Equipment: Deploy a 1.5-inch (or other appropriate diameter) PVC pipe (drop tube), with an attached end cap, through the LNAPL layer in the well. The end cap should be tethered to the drop tube so it is not lost in the well when removed and in a way that allows the drop tube to be sealed during installation. Lower the drop tube until the bottom of the tube is approximately two feet into the water column below the bottom of the LNAPL. Secure the drop tube to the well, and allow the system to equilibrate, approximately one half hour. The end cap is then removed by inserting a 0.5-inch (or other appropriate diameter) PVC rod into the drop tube and pushing on the cap until the lid is removed. The cap will be removed along with the tube upon completion of sampling.
3) Collection of Groundwater Samples: Lower polyethylene tubing through the 1.5-inch drop tube into the water column. Connect the polyethylene tubing to silicon tubing and engage the peristaltic pump for groundwater retrieval. Set the flow rate to the lowest pumping rate that can be sustained so that the LNAPL is not drawn into the tubing. Begin collecting groundwater in the sample container and continue until enough volume is obtained for all bottleware required by the laboratory for the requested analyses.

3.7 Decontamination Requirements

Of particular significance to the procedures of groundwater measurement and sampling is the limitation, whenever possible, of materials inserted into a well bore and, even more importantly, of materials transferred from well to well.

Many items can be discarded between well sampling and/or gauging locations without significantly impacting project costs. Dedicated sampling equipment which can be discarded between well sampling locations, will be used whenever possible to preclude decontamination requirements. Sampling equipment included in this category are polyethylene bailers, bailer cord, nitrile gloves, and sampling tubing. However, other monitoring and sampling equipment, such as oil/water interface probes and submersible sampling pumps, must be reused from well to well.

All site equipment to be used in multiple locations (non-dedicated) for gauging and/or sampling of groundwater will be decontaminated immediately prior to initial use and between uses at each location according to the following steps:

- Remove particulates with a sorbent pad or towel and/or initial rinse with clean potable tap water;
- Wash equipment with clean sponge, soft cloth, or scrub brush as necessary in a solution of tap water/laboratory grade detergent (Alconox®, Liquinox®, or equivalent);
- Rinse with tap water;
- Rinse with deionized or distilled water; and
- Air dry for as long as possible.

Rinse water generated during decontamination procedures will be treated onsite by passing the water through a bucket filled with activated carbon prior to disposal.

3.8 Documentation

All site activities and conditions at the time of purging and groundwater sampling should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well name), personnel present onsite, PID readings, sampling methodology, purge rate, purge volume, and the aforementioned groundwater indicator parameters. A field qualifier “SL” shall be applied to each sub-LNAPL sample entry to denote sample collection as sub-LNAPL. Additional comments or observations (e.g., well damage, nearby pumping, LNAPL sheen) should also be recorded.

4.0 SOIL SAMPLING & WELL INSTALLATION PROCEDURES

4.1 Site Controls

Prior to hand augering, hydroexcavation, utilizing a backhoe, or deploying any drilling apparatus to the site, an underground utility line protection request must be made (i.e., Pennsylvania One Call) for mark-out of known subsurface utilities and associated laterals proximal to the drilling location. Site plans, if available, should be reviewed to document and avoid the location of onsite utilities.

After review of all known mapped and marked utilities, a site reconnaissance will be performed to document the location of utility meters and storm sewer drains. In addition, the location of overhead utilities must be documented. After completing the subsurface and overhead utility review, the area to drill may be considered clear of utilities, or the location may be adjusted to a nearby location, which must also be cleared.

Lastly, any drilling activities must be preceeded by clearing of the borehole, prior to advancement of augers or split spoons. To ensure the safety of workers, the borehole will be cleared by hand, hydroexcavator, or backhoe to a depth of approximately 8 feet below ground surface.

4.2 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered during soil sampling and well installation, as well as slip/trip/fall potential. Drilling is considered a high risk activity which requires facility approval prior to implementation. Additional hazards are identified in the site-specific HASP and/or the daily JSA.

4.3 Materials and Equipment Necessary for Task Completion

A list of equipment required to oversee test boring advancement and, where applicable, sample soil is presented below. Also listed are materials necessary to store, label, preserve, and transport soil samples.

- Current site map detailing well locations;
- Field computer and/or field book for recording site data;

- Appropriate, laboratory prepared sample containers and labels;
- PID;
- Single-use, disposable plastic scoops or stainless steel scoop for collecting soil samples;
- Single-use, disposable, laboratory-supplied syringes for soil sample collection (if applicable);
- Scale for weighing samples (e.g., methanol kits, if necessary);
- Disposable nitrile sampling gloves;
- Measuring tape (for measuring core recovery);
- Munsell soil color chart/book (recommended);
- Decontamination equipment (if applicable);
- Blank chain-of-custody forms; and
- Cooler(s) and ice for sample preservation.

4.4 Decontamination Requirements

All down-hole drilling equipment must be steam cleaned prior to drilling at each soil boring or well location. All soil sampling equipment must be cleaned with detergent and rinsed with deionized or distilled water prior to deployment into the borehole. All well construction materials (i.e. PVC well casing, PVC well screen, sand pack, bentonite) should be clean and dedicated to each borehole.

4.5 Methodology for Soil Boring Installation

4.5.1. Borehole Advancement

During test drilling activities, a borehole is advanced into the subsurface via a rotary or direct-push drilling technique. Various types of drilling methods could be deployed at these facilities to advance the borehole and gain access to the subsurface for characterization and sampling. A description of the most commonly utilized drilling methods is included below:

4.5.1.1 Hollow Stem Auger

A hollow, steel pipe (available diameters vary) with welded, exterior steel “flights” is used to convey subsurface material to the surface when rotated clockwise. A bit at the bottom of the lead auger cuts into the subsurface material, and the rotation conveys the loosened material (cuttings) up the flights, allowing the hole to be advanced (cuttings may not always return to the surface, such as when drilling in soft, saturated materials). The hollow center of the auger allows the driller to access the subsurface for soil sample collection and, where applicable, well installation during borehole advancement. During borehole advancement, a center stem of steel rods connected to an auger plug prevent soil cuttings from entering the drill column. Once a desired drilling depth is reached, the center plug and rods can be pulled out, leaving the auger stem in place to prevent borehole collapse. A split-spoon sampler can be threaded onto the rods in place of the plug and driven via a hammer to obtain a sample (Standard Penetration Test), or if terminal depth has been reached a monitoring well could be installed through the augers.

4.5.1.2 Air and Mud Rotary

Rotary drilling methods are similar to hollow stem auger drilling, however specialized drilling bits at the bottom of rods are used to cut into the subsurface material using compressed air, vibration, and/or pressurized drilling mud. Compressed air or mud is forced through the drilling rods via an air compressor or pump, and escapes through small holes in the drill bit. The circulation of drilling mud, or air combined with introduced water or formation water, conveys the soil cuttings to the surface (while also cooling the drilling bit and preventing borehole collapse).

4.5.1.3 Geoprobe®

A direct-push drilling method, Geoprobe® sampling utilizes a hydraulic hammer to drive steel rods into the subsurface for soil sampling. This method advances a core barrel lined with a plastic Macro-Core® sleeve into the soil column for continuous soil core collection.

4.5.1.4 Hand Auger

A stainless steel or aluminum hand auger is physically advanced to a desired soil sampling depth through rotation of the auger and head.

4.5.2 Soil Sampling

Soil samples will be obtained for lithologic logging and where appropriate, for laboratory analysis with one of three different sampling devices: Split barrel spoon sampler, hand auger, or Geoprobe® soil sampler. For either method, the sampling devices are lowered through the hollow-stem augers or open borehole to allow sampling of undisturbed sediments below the bit or drive shoe. Soil samples will be collected at regular intervals for subsurface characterization and selection of appropriate well screen interval(s). Soils which appear to be visually impacted or from intervals which exhibit the highest deflections on the screening device (PID or similar) will be sampled for laboratory analysis in accordance with an approved sampling plan.

4.5.2.1. Split barrel spoon sampler (split spoon)

The split spoon sampler will be driven into the soil column in accordance with ASTM Standard Method D1586 (Reference A6, Appendix E). Soil sampling by split spoon is characterized by drilling a borehole with a hollow-stem auger to the desired sampling depth (the standard calls for one sample per five foot depth interval). The split spoon sampler is attached to the drilling rods after removal of the auger plug. The drill operator will drive the sampler into the undisturbed soil by repeatedly striking the drilling rods with a 140 pound safety hammer over a 30 inch drop. Field personnel will record the number of blows required to drive the split spoon sampler for each successive six-inch interval. After the sampler has been filled, the driller will remove the rods and sampler from the borehole and should provide the intact sampler to field personnel for opening (the drive shoe and head can be loosened). Field personnel should split the spoon, scan with PID, measure sample recovery, thoroughly describe the soil lithology, note visual observations and odors, note degree of saturation, and where applicable collect soil sample(s) utilizing a stainless steel or disposable scoop. An approved, retractable knife may be used to trim the top and edges of the sample, and once prepared the sample should be containerized in appropriate sample containers.

4.5.2.2. Geoprobe®

The Geoprobe® operator will advance the drilling rods into the subsurface using a truck or track-mounted drill with a hydraulic hammer. A dedicated Geoprobe® Macro-Core® liner is inserted into the core barrel to collect continuous core samples, usually one per 4 foot interval. The Geoprobe® operator will remove the soil filled liner from the core barrel, cut the liner, and provide field personnel with the intact cores. After retrieval of the sample, the liner may be removed by field personnel and the soil core should be scanned with a PID and logged, including documentation of core recovery, soil lithology, visual observations and odors, and degree of saturation. Where applicable, field staff should remove the soil sample utilizing a stainless steel or disposable scoop and containerize in an appropriate sample container.

4.5.2.3. Hand Auger

The self-powered hand auger allows for soil from the desired interval to be collected directly through removal of the soil sample that is collected in the auger head for every six inches of advancement.

4.6 Methodology for Leaded Tank Bottoms Soil Sampling

Leaded tank bottom material is described as containing materials distinguished by distinctive rust/red to black, metallic, mostly oxidized scale materials, sometimes in a matrix of petroleum wax sludge. The approach for identifying leaded tank bottom materials is summarized below:

- If materials are encountered within the previously designated leaded tank bottom areas, matching the physical description given above for leaded tank bottoms, then samples should be collected for lead analysis.
- If total lead results are above the site-specific standard (SSS) for lead of 2,240 milligrams per kilogram (mg/kg) then samples should be analyzed for lead via Toxicity Characteristic Leaching Procedure (TCLP), EPA Test Method 1311.
- Delineated areas that exhibit soils that physically resemble leaded tank bottoms, exhibit lead concentrations greater than 2,240 mg/kg, and exceed 5 milligrams per liter (mg/l) for lead in the TCLP leachate (which is characteristically hazardous for lead) will retain the leaded tank bottom designation. If no soils are encountered that meet all three of these criteria, then the area will no longer be classified as a leaded tank bottom area.

4.7 Methodology for Monitoring Well or Recovery Well Installation

4.7.1 Well Construction

After drilling to a desired terminal depth via any of the drilling methods referenced above, permanent monitoring wells can be installed to allow access to groundwater for future monitoring and groundwater sampling. In general, monitoring wells are constructed of pipe with a slotted interval(s) (screen) through which groundwater can flow into the well from a desired water-bearing stratum. In most cases, PVC materials are utilized for monitoring well construction.

- For applications where LNAPL thickness measurement is necessary, the screened interval should extend above the presumed highest groundwater level.
- For applications where the shallowest groundwater interval is to be monitored (e.g., water-table aquifer), a single well casing is installed.
- For applications where multiple water bearing strata will be penetrated and where deep groundwater conditions are selected for monitoring, a double-cased well may be installed to prevent the vertical migration of contaminants to the deeper water bearing zone from shallower zone(s).

Each well construction type and considerations for field staff regarding how many casings are needed have been provided below.

4.7.1.1 Single Casing Construction

The most commonly installed monitoring well at the facilities have single casings and are constructed of PVC. To determine the length of screen used, seasonal groundwater table or tidal fluctuations should be considered to allow the water table to intercept the well screen throughout the year. Field personnel should advise the driller on the required well diameter, total well depth, screen interval, screen length, and slot size based on available subsurface information prior to drilling. Once the borehole is completed and the drilling crew has been advised on the desired construction, the drilling crew will thread the well screen onto an end cap at the wellhead and will lower the well into the borehole, adding lengths of casing until the terminal depth is reached.

While the well is held near the center of the borehole, the annular space between the well screen and formation is carefully backfilled with a sand filter pack, which consists of clean, sorted quartz sand sized to the formation grain size (typically #1 or #2 sand). The sand pack establishes continuity with the formation and acts as a filter to prevent soil from entering the well (the well screen slot size should be sized according to the formation median grain size to mitigate sediment intrusion, however is most commonly available from suppliers as 0.01 or 0.02-inch diameter slot size).

The sand pack should extend one to two feet above the top of well screen, and care must be taken by the driller to not bridge the sand or overshoot the top of sand target depth (particularly when installing wells through the auger stem). Above the sand pack, a seal (grout) is installed in the annular space between the well casing and the soil. The seal is comprised of hydrated bentonite, sometimes amended with pellets or a grout consisting of hydrated Portland cement, bentonite powder, or a blend of the two. A conventional grout blend is 95% Portland cement and 5% bentonite powder. The purpose of the seal is to prevent surface water from infiltrating the well screen. It is installed from the top of the sand to one to two feet below ground surface.

In circumstances where the top of well sand terminates below the water table (e.g., deeper groundwater or submerged screen), grout should be mixed into a slurry at the ground surface and pumped via tremmie pipe or hose to prevent bridging. Above the well seal, the annular space can be backfilled with granular bentonite or concrete. A cement cap or well pad is placed at the surface to further mitigate potential infiltration of surface water. A locking, steel protective casing (stand pipe) or a locking, flush-mounted curb box should be installed to protect the well.

4.7.1.2 Double Casing Construction

Construction of a double cased well is similar to that of a single case well; however, to prevent groundwater infiltration from shallower water bearing zones, a second casing is installed through a surface casing. This type of construction requires drilling two different diameter boreholes.

During drilling through the shallower groundwater bearing zone(s), a larger diameter borehole is drilled and should be sized according to the desired well and/or outer casing diameter. This may require reaming of the borehole depending on the conditions and drilling equipment. An outer (surface) casing is installed and the annulus is grouted. After the outer casing is installed and the grout has set, the borehole is advanced through the surface casing with a smaller diameter drill stem and bit. When the desired terminal depth is reached, a monitoring well is installed through the inner casing using the above-referenced single casing construction procedure (the annular space between the outer and inner casings above the well filter sand should be pressure grouted).

4.7.2 Handling of Soil Cuttings

Soil cuttings generated during drilling will be containerized or stockpiled on plastic until sampling and analytical data can be obtained. Soil cutting final placement (onsite soil reuse or offsite disposal) will be performed in accordance with Pennsylvania Department of Environmental Protection (PADEP) approved onsite soil reuse plans for each facility.

4.7.3 Well Development

After installation, monitoring wells will be developed to remove residual soil from within the well and filter media and to establish communication between the well and formation. Pump and surge methodology, either through use of a ditch pump or air compressor connected to black polyethylene pipe and surge block, should be utilized to successively agitate relatively clear groundwater from the well. Surging should begin from the bottom of the screened interval and continue iteratively to the top of the well screen in approximately 2 to 4-foot intervals (i.e., pump and surge each 2 to 4 foot interval of well screen several times until relatively clear discharge water is maintained, then move up to the next screen interval until all of the screen has been developed).

Alternately, a submersible pump may be used to pump water from the screened interval of shallow wells, with the screen of the well surged to evacuate silt that remains in the sand pack. The well should be alternately surged and purged until groundwater flowing from the well appears relatively free of sediments. A vacuum truck may be used for development for wells that contains product. Well development water should be managed/treated in accordance with the site-specific work plan.

4.8 Documentation

All site activities and conditions at the time of soil sampling, well installation, and well development should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well or boring name), personnel present onsite, and the aforementioned lithologic data and well construction information. The entry shall include detailed data required to create representative soil boring lithologic logs and well as-built logs (if a well is constructed). This data should include but not be limited to soil type, soil texture (e.g., USCS), soil color, relative moisture content, depth of apparent water table, PID readings, blow counts (if split spoon samples are collected), sample recovery, total depth of borehole, length of well screen, length of well casing, sand pack interval, filter sand size, grout materials used, well seal interval, and all well construction materials. Notes should also include well development pumping rate, duration, and observations. Additional comments or observations should also be recorded, as appropriate.

5.0 LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL) SAMPLING PROCEDURES

5.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered during LNAPL sampling, as well as slip/trip/fall potential. Additional hazards may be mentioned in the site-specific HASP and/or the daily JSA. If significant amounts of LNAPL are being handled, a Tyvek suit should also be worn.

5.2 Materials and Equipment Necessary for Task Completion

A list of equipment required to sample LNAPL from a monitoring well is presented below:

- Current site map detailing well locations;
- Field book or field computer for recording site data;
- Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy;
- Keys and tools to provide well access;
- Appropriate sample containers and labels. LNAPL samples will be collected in laboratory provided glassware with appropriate preservative, if applicable. A minimum of 10 ml is required for most laboratory analyses. In the case that sufficient volume is not obtained, a swabbing technique (described below) could be used;
- Sorbent pads (required for swabbing technique);
- Stainless steel or clear bottom-loading or top-loading bailer, depending on product thickness;
- Clean nylon or polypropylene bailer cord;
- Decontamination supplies;
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

5.3 Decontamination Requirements

During LNAPL sampling activities, dedicated sampling equipment (i.e., clear bailers, nitrile gloves, and bailer cord) may be utilized; thereby, minimizing decontamination requirements. However, a stainless steel bailer may be used and decontaminated between LNAPL sampling locations. The optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy used to record the presence or absence and approximate thickness of LNAPL prior to sampling also requires decontamination between sampling locations. Decontamination procedures are detailed in Section 1.5.

5.4 Sampling Procedure

Immediately prior to sampling, each monitoring well should be gauged to obtain liquid levels (i.e., depth to LNAPL and depth to water) for estimation of current LNAPL thickness. Refer to Section 3.0 for appropriate well gauging procedures. Liquid level data should be recorded in a field book or field computer through the EDGE application or, if necessary, a field book.

LNAPL sampling may be performed via two different methods, based upon the LNAPL thickness/availability at the time of sampling: direct sample or swabbing. As indicated above, a minimum LNAPL volume of 10 mL is typically required by the analytical laboratory for most LNAPL characterization.

The following sequence of procedures will be implemented for the collection of LNAPL samples from monitoring wells:

1) A clean work area will be established so that sampling equipment will not come in contact with the ground surface or any other potentially contaminated surfaces near the wellhead.
2) A pre-cleaned stainless steel bailer or dedicated disposable bailer will be used for each well.
3) A new pair of nitrile gloves will be worn during sampling and replaced for each well.
4) Based on the gauged depth to LNAPL, an appropriate length of dedicated nylon or polypropylene cord will be tied to the sampling bailer.
5) An appropriately sized (i.e., 40 ml glass vial with plastic cap fitted with Teflon® lined septum) laboratory-provided sample container will be used to containerize the LNAPL sample.

6) The sampling bailer will be slowly lowered into the well until the liquid level is encountered. Once encountered, the sampling bailer should be lowered into the standing liquid column to a depth of approximately 1 foot, or other appropriate depth based on product thickness.

7) The bailer should be retrieved at a steady rate to avoid excess agitation.

8) The bailed sample should be visually evaluated for the presence or absence of LNAPL. If sufficient LNAPL volume is present (>10 ml), a direct sample of the LNAPL will be collected into the laboratory vial. If less than 10 ml of LNAPL is apparent, a sorbent pad may be used to absorb the LNAPL from the surface of the groundwater sample and the swab placed in the laboratory vial. The site-specific work plan should dictate whether a swab sample should be analyzed, or if the well should be monitored at a later date for re-sampling.

9) Labels will be completed and attached to the sample vials, indicating the sample collector's name, date, time, and location of sample; record same data in field computer or field notebook.

10) Store samples in a secure location until possession is transferred to the laboratory.

11) Nitrile gloves, bailer, bailer cord, and any other trash will be disposed of as solid waste.

5.5 Documentation

All site activities and conditions at the time of sampling should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well name), personnel present onsite, and the aforementioned well gauging parameters. Additional comments or observations (e.g., color or apparent viscosity of LNAPL) should be recorded.

6.0 INDOOR AND AMBIENT AIR SAMPLING PROCEDURES

In preparation for indoor and/or ambient air sampling, appropriate facility personnel should be notified of intended sampling prior to mobilization. The purpose of this would be to confirm that there are not any non-routine activities occurring in the building, such as painting of indoor walls, which would cause incidental contamination of the samples.

6.1 Materials and Equipment Necessary for Task Completion

A list of equipment required to collect indoor and/or ambient air samples is presented below:

- Field data book or field computer for recording site data;
- Laboratory certified Summa canisters (standard size is 6 liters);
- Flow controllers (standard duration is 8-hours) with integrated vacuum gauge;
- Equipment for elevating sample intake height (examples: extended sampling inlets, zip ties to attach units to fencing, tables, etc);
- Camera; and
- Blank chain-of-custody forms.

6.2 Precautions to Avoid Incidental Contamination

EPA Method TO-15 is the most common method used for analysis of air samples at these sites. This method is highly sensitive to trace concentrations of volatile organic compounds (VOCs). To avoid incidental contamination:

- Do not wear cologne or fragrance on day of sampling;
- Do not use hand sanitizers or lotions;
- Do not store canisters near containers of gasoline, or any fuel; and
- Make sure there are no sources of VOCs in the vehicle used to transport the canisters.

6.3 Sampling Procedure

1) <u>Set Up Summa Canister</u>. Inlets of the flow controllers are to be placed in the breathing zone, approximately 4 to 6 feet above the ground surface. Elevate Summa canisters using appropriate materials available onsite or use laboratory-provided extended inlets (approximately 3 ft long sampling canes). Indoor air samples should be representative of air

in the buildings and should be placed away from obvious ventilation to outdoor air or sources of VOCs. Securely attach flow controller and extended sampling inlet if applicable.

2) Start Air Sample Collection. Open the valve. Document the initial vacuum (should be between approximately -30 inHg and -26 inHg) and the start time of the test. If the vacuum is significantly outside of the range or has a high rate of change, consider using an alternate canister or flow controller as there may be leakage.
3) Monitoring Summa Condition During Sampling Period. Several times during the sampling period, verify that the Summa is in good condition and that the vacuum is decreasing at an appropriate rate several times during the sampling period. An example of a reasonable frequency would be every two hours during an 8-hour event. During these checks, record the time, remaining vacuum, and canister condition. If necessary, obtain a permit to operate a camera, and take a least one photo of each sampling location.
4) Completing Air Sample Collection. Near the end of the sampling period, monitor the gauge more frequently. The sample collection should be stopped when the gauge reads approximately -5 inHg. At this point, close the canister valve. Record the sample end time and sample end vacuum. Ensure that the canister is labeled with the sample ID. Remove all of the attached equipment from the canister. Pack the canisters, flow controller wrapped in bubble wrap, chain of custody (additional information in the following section), and any other laboratory provided equipment back into the original packaging.

6.4 Documentation

All site activities and conditions at the time of air sampling should be recorded by field personnel. The entry shall include the date, time, weather conditions (including wind direction and start/end barometric pressure), sample locations and IDs, and personnel present onsite. Any observation that could influence the level of VOCs in the samples should be noted.

7.0 SURFACE WATER SAMPLING PROCEDURES

7.1 Field Procedures for Surface Water Sampling

7.1.1 General

Surface water sampling is performed to obtain samples for surface water bodies that are representative of existing surface water conditions. Surface water sampling (or gauging) within 3 feet of a bulkhead at certain facilities will require field personnel to wear a life vest.

Surface water sampling locations for surface water quality and groundwater interaction studies are selected based on the following:

1) Study objectives
2) Location of point surface discharges
3) Non-point source discharges and tributaries
4) Presence of structures (e.g., bridge, dam)
5) Accessibility

During surface water sampling it is important to obtain samples that are not impacted by the re-suspension of sediment produced because of improper or poor surface water sampling techniques.

7.1.2 Surface Water Sample Location Selection

Prior to conducting surface water sampling activities, the first requirement is the consideration and development of surface water sampling locations. It is important that all surface water sampling locations be selected in accordance with the work plan.

Wading for surface water samples increases the chances of disturbance of sediments from the floor of the surface water body. When wading for surface water samples be aware of potential safety and health risks. A life vest and safety line must be worn at all times where footing is unstable or when sampling in fast moving or more than 3 feet (0.9 m) deep. A two-person team is required for most surface water sampling activities. If the site conditions require the use of the life vest and safety line, the two people involved in the sampling must be competent swimmers.

Surface water samples must be collected with no suspended sediments. Surface water samples are collected commencing with the furthest downstream location to avoid sediment interference with upstream locations.

7.1.2.1 Rivers, Streams, and Creeks

Surface water samples are generally collected in areas of surface water bodies that are representative of the surface water body conditions. Representative surface water samples will usually be collected in sections of surface water bodies that have a uniform cross section and flow rate. Mixing is influenced by turbulence and water velocity, therefore the selection of surface water sampling locations immediately downstream of a riffle area (i.e., fast flow zone) will ensure good vertical mixing. These locations are also likely areas for deposition of sediment since this occurs in areas of decreased flow velocity.

Surface water sampling locations should not be established in areas near point source discharges. Surface water sampling of these source discharge points can be performed to assess the impact of these source areas on overall surface water quality. Sample tributaries as close to the mouth as possible. It is important to select surface water sample locations considering the impact downstream, including tributary flow and sediment.

In all instances, properly document all surface water sampling locations. Documentation may include photographs and tie-ins to known structures.

7.1.2.2. Sampling Equipment and Techniques

When collecting surface water samples, direct dipping of the sample container into the stream or water is acceptable unless the sample container contains preservatives. If preserved, a pre-cleaned unpreserved sample container should be used to collect the surface water sample. The surface water sample is then transferred to the appropriate preserved sample container. When collecting surface water samples, submerse the inverted bottle to the desired sample depth and tilt the opening of the sample container upstream to fill. During surface water sample collection, wading or movement may cause sediment deposits to be re-suspended and can result in biased samples. Wading is acceptable if the stream has a noticeable current and the samples are collected directly in the sample container when faced upstream. If the stream is too deep to wade in or if addition samples must be collected at various depths, additional sampling equipment will be required. Surface water samples should be collected about 6 inches (15 cm) below the surface, with the sample bottles being completely submerged. Taking the surface water sample at this depth eliminates the collection of floating debris in the sample container.

Surface water sample collection where the flow depth is less than 1 inch (<2.5 cm) requires the use of special equipment to eliminate sediment disturbance. Surface water sampling may be conducted with a container then transferred to the appropriate sample container, or collection may be performed using a peristaltic pump. A small excavation in the stream bed to create a sump for sample collection can also be considered but should be prepared in advance to allow all the sediment to settle prior to surface water sampling activities.

Teflon™ bailers can be used for surface water sampling if it is not necessary to collect surface water samples at specific depths. A bottom loading bailer with a check ball is sufficient. When the bailer is lowered through the water, the water is continually displaced through the bailer until the desired depth is reached. The bailer is retrieved and the check ball prohibits the release of the collected surface water sample. Bailers are not suitable in surface water bodies with strong currents, or where depth-specific sampling is required. For discrete and specified depth surface water sampling, and the parameters to be monitored do not require a Teflon™ coated sampling device, a standard Kemmerer or Van Dorn sampler can be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the sampler ends open while the sampler is being lowered. The sampler is lowered in a vertical position to allow water to pass through. The Van Dorn sampler is plastic and is lowered in a horizontal position. For both samplers, a messenger is sent down a rope when the sampler has reached the required depth. The messenger causes the stopper on the sampler to close. The sampler is then retrieved and the surface water sample can be collected through a valve. DO sample bottles can be filled by allowing overflow using a rubber tube attached to the valve. During depth-specific surface water sampling, take care not to disturb bottom sediments.

Glass beakers or stainless steel cups may also be used to collect surface water samples if parameter interference does not occur. The beaker or cup must be rinsed at least three times with the surface water sample prior to sample collection.

All equipment must be thoroughly decontaminated.

7.1.2.3 Field Notes for Surface Water Sampling

Record daily surface sampling activities, describe surface water sampling locations, sampling techniques, and, if applicable, provide a description of photographs taken. Visual observations are important and provide valuable information when interpreting surface water quality results. Observations include:

1) Weather conditions
2) Stream flow directions
3) Stream physical conditions (width, depth, etc.)
4) Tributaries
5) Effluent discharges
6) Impoundments
7) Bridges
8) Railway trestles
9) Oil sheens
10) Odors
11) Buried debris
12) Vegetation
13) Algae
14) Fish and other aquatic life
15) Surrounding industrial areas

The following factors should be considered for surface water sampling:

1) Predominant Surrounding Land Use: Observe the prevalent land use type in the vicinity and note any other land uses in the area which, although not dominant, may potentially affect surface water quality.

2) Local Watershed Erosion: Note the existing or potential erosion of soil in the local watershed and its movement into the stream. Erosion can be rated through visual observation of watershed stream characteristics including increases or decreases in turbidity.

3) Local Watershed Non-Point Source Pollution: This refers to problems or potential problems other than erosion and sedimentation. Nonpoint source pollution can be diffuse agricultural and urban runoff. Other factors may include feed lots, wetlands, septic systems, dams, impoundments, and mine seepage.

4) Estimated Stream Width: The estimated distance from shore at a transect representative of the stream width in the area.

5) Estimated Stream Depth: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from the water surface to the bottom of the surface water body at a representative depth at three locations.

6) High Water Mark: Estimate the vertical distance from the bank of the surface water body to the peak overflow level, as indicated by debris hanging in bank or flood plain vegetation, and deposition of silt. In instances where bank flow is rare, high water marks may not be evident.

7) Velocity: Record or measure the stream velocity in a representative run area.

8) Dam Present: Indicate the presence or absence of a dam upstream or downstream of the surface water sampling location. If a dam is present, include specific information detailing the alteration of the surface water flow.

9) Channelized: Indicate if the area surrounding the surface water sampling location is channelized.

10) Canopy Cover: Note the general proportion of open to shaded areas which best describes the amount of cover at the surface water sampling location.

7.2 References

For additional information pertaining to surface water sampling, the user of this manual may reference the following:

ASTM D5358 Practice for Sampling with a Dipper or Pond Sampler

ASTM D4489 Practices for Sampling of Waterborne Oils

ASTM D3325 Practice for the Preservation of Waterborne Oil Samples

ASTM D4841 Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents

ASTM D4411 Guide for Sampling Fluvial Sediment in Motion

ASTM D4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments

ASTM D3213 Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil

ASTM D3976 Practice for Preparation of Sediment Samples for Chemical Analysis

ASTM E1391 Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing

ASTM D4581 Guide for Measurement of Morphologic Characteristics of Surface Water Bodies

ASTM D5906 Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths

ASTM D5073 Practice for Depth Measurement of surface water

8.0 SEDIMENT SAMPLING PROCEDURES

8.1. Introduction

Sediment sampling is conducted to obtain samples that are representative of existing chemical and/or physical conditions of sediment.

8.2 Equipment Decontamination

On environmental sites, sediment sampling equipment (e.g., split spoons, trowel, spoons, shovels, bowls, dredges, corers, scoops) are typically cleaned as follows:

1) Wash with clean potable water and laboratory detergent, using a brush as necessary to remove particulates.
2) Rinse with tap water.
3) Rinse with deionized water.
4) Air dry for as long as possible.

Additional or different decontamination procedures may be necessary if sampling for some parameters, including VOCs and metals.

8.3 Sample Site Selection

Before any sampling is conducted, the first requirement is to consider suitable sampling locations. Sampling locations should be selected in accordance with the work plan. Wading for sediment samples in lagoons, lakes, ponds, and slow-moving rivers and streams must be done with caution since bottom deposits are easily disturbed. Sampling must only be attempted where safe conditions exist and samples must be collected from undisturbed sediments. All sediment samples are to be collected commencing with the most downstream sample to avoid sediment interference with other downstream samples. A life vest and safety line should be worn in all cases where footing is unstable or where water is fast moving or over 3 feet (0.85 m) in depth. A second person may also be required for most of the sampling scenarios.

8.3.1. Rivers, Streams, and Creeks

Sediment samples may be collected along a cross-section of a river or stream in order to adequately characterize the bed material, or from specific sediment deposits as described in the work plan. A common procedure is to sample at quarter points along the cross-section of the sampling site selected. Samples may be composited as described in the work plan. Samples of dissimilar composition (e.g., grain size, organic content) should not be combined. Representative samples can usually be collected in portions of the surface water body that have a uniform cross-section and flow rate. Since mixing is influenced by turbulence and water velocity, the selection of a site immediately downstream of a riffle area (e.g., fast flow zone) are likely areas for deposition of sediment since the greatest deposition occurs where stream velocity slows.

A site that is clear of immediate point sources (e.g., tributaries and industrial and municipal effluents) is preferred for the collection of sediment samples unless the sampling is being performed to assess these sources.

8.4 Sampling Equipment and Techniques

8.4.1. General

Any equipment or sampling technique(s) [e.g., stainless steel, polyvinyl chloride (PVC)] used to collect a sample is acceptable so long as it provides a sample which is representative of the area being sampled and is consistent with the work plan.

8.4.2. Sediment Sampling Equipment and Techniques

A variety of methods may be used to collect sediment samples from a stream, river, or lake bed. Dredging (Peterson, Ponar, Van Veen), coring and scooping are acceptable sediment sample collection techniques. Precautions shall be taken to ensure that a representative sample of the targeted sediment is collected. Caution should be exercised when wading in shallow water so as not to disturb the area to be sampled. Samplers should be selected based on the interval to be sampled, type of sediment/sludge (silt, sand, gravel), and required sample volume. More than one sampler is often required to implement a sampling program at a site. The following describes some of these methods. Manufacturer's information should be consulted to determine the limitations of each type of sampling equipment.

8.4.3 Dredging

The Peterson dredge is best used for rocky bottoms, in very deep water, or when the stream velocity is rapid. The dredge should be lowered slowly as it approaches the bottom, so as to not disturb the lighter sediments.

The Ponar dredge is similar to the Peterson dredge in size and weight. The Ponar dredge is a "clam-shell" type unit that closes on contact with the river/lake bottom. Depending on the size of the unit, a winch is required for larger units, whereas smaller units are available for lowering by a hand line. Once retrieved, the unit is opened and the sample extracted using a sample scoop or spoon. The unit has been modified by the addition of side plates and a screen on top of the sample compartment. This permits water to pass through the sampler as it descends.

The Ponar grab sampler functions by the use of a spring-latch-messenger arrangement. The sampler is lowered to the bottom of the water body by means of a rope, then the messenger is sent down to trip the latch causing the sampler to close on the sediments. The sampler is then raised slowly to minimize the disturbance of the lighter sediments. Sediment is then placed into a stainless steel bowl, homogenized, and placed into the appropriate sample container (if collecting for VOC parameters, fill the VOC jars before homogenization).

8.4.4. Corers

Core samplers are used to obtain vertical columns of sediment. Many types of coring devices are available, depending on the depth of water from which the sample is to be collected, the type of bottom material, and the length of core to be obtained. They vary from hand-push tubes to weight or gravity-driven devices to vibrating penetration devices.

Coring devices are useful in contaminant monitoring due to the minimal disturbance created during descent. The sample is withdrawn intact, allowing the removal of only those layers of interest. Core liners consisting of plastic or Teflon may also be added, thereby reducing the potential for sample contamination and maintaining a stratified sample. The samples may be shipped to the lab in the tubes in which they were collected. The disadvantage of coring devices is that only a small sampling surface area and sample size is obtained, often necessitating repetitive sampling in order to collect the required amount of sediment for analysis. It is also often difficult to extract the sediment sample back out through the water column without losing the sample.

The core tube is pushed/driven into the sediment until only 4 inches (10 cm) or less of tube is above the sediment-water interface. When sampling hard or coarse sediments, a slight rotation of the tube while it is pushed will create greater penetration and reduce compaction. Cap the tube with a Teflon plug or a sheet of Teflon. The tube is then slowly withdrawn, keeping the sample in the tube. Before pulling the bottom part of the core above the water surface, it must be capped.

8.4.5 Scooping

The easiest way to collect a sediment sample is to scoop the sediment using a stainless steel spoon or scoop. This may be done by wading into the stream or pond and, while facing upstream (into the current), scooping the sample from along the bottom in an upstream direction. This method is only practical in very shallow water.

8.4.6 Mixing

Sediment samples collected for chemical analysis should be thoroughly mixed (except for VOCs) in a stainless steel bowl prior to placement in the appropriate sample container. Standard procedures exist for preparation of sediment samples (ASTM D3976). These should be followed or the laboratory informed of applicable procedures.

8.4.7 Air Monitoring

Prior to sediment/sludge sampling, measure the breathing space above the sample location with a PID, should the potential for volatiles be present, and use a hydrogen sulfide meter should hydrogen sulfide be present. Repeat these measurements during sampling. If either of these measurements exceed any of the air quality criteria established in the HASP, air purifying respirators (APRs) or supplied air systems will be required.

8.4.8 Sample Location Tie-In/Surveying

The recording of the sample locations and depth on the site plan is extremely important. This may be accomplished by manual measurement (i.e., swing ties), global positioning system (GPS) survey, or stadia methods. Manual measurements for each sample location should be tied into three permanent features (e.g., buildings, utility poles, hydrants). Diagrams with measurements should be included in the field book.

8.5 Field Notes

A bound field book is used to record daily activities, describe sampling locations and techniques, and describe photographs (if taken). Visual observations are important, as they may prove invaluable in interpreting water or sediment quality results. Observations shall include (as applicable) weather, stream flow conditions, stream physical conditions (width, depth, etc.), tributaries, effluent discharges, impoundments, bridges, railroad trestles, oil sheens, odors, buried debris, vegetation, algae, fish or other aquatic life, and surrounding industrial areas. The following observations should be considered:

- Predominant Surrounding Land Use: Observe the prevalent land use type in the vicinity (noting any other land uses in the area which, although not predominant, may potentially affect water quality).
- Local Watershed Erosion: The existing or potential erosion of soil within the local watershed (the portion of the watershed that drains directly into the stream) and its movement into a stream is noted. Erosion can be rated through visual observation of watershed and stream characteristics. (Note any turbidity observed during water quality assessment.)
- Local Watershed Non-point Source Pollution: This item refers to problems and potential problems other than siltation. Non-point source pollution is defined as diffuse agricultural and urban runoff (e.g., stormwater runoff). Other compromising factors in a watershed that may affect water quality are feedlots, wetlands, septic systems, dams and impoundments, and/or mine seepage.
- Estimated Stream Width: Estimate the distance from shore at a transect representative of the stream width in the area.

- Estimated Stream Depth: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from water surface to stream bottom at a representative depth at each of the three locations.
- High Water Mark: Estimate the vertical distance from the stream bank to the peak overflow level, as indicated by debris hanging in bank or floodplain vegetation, and deposition of silt or soil. In instances where bank overflow is rare, a high water mark may not be evident.
- Velocity: Record an estimate of stream velocity in a representative run area (see Section 12.0).
- Dam Present: Indicate the presence or absence of a dam upstream or downstream of the sampling station. If a dam is present, include specific information relating to alteration of flow.
- Channelized: Indicate whether the area around the sampling station is channelized.
- Canopy Cover: Note the general proportion of open to shaded area which best describes the amount of cover at the sampling station.
- Sediment Odors: Disturb sediment and note any odors described (or include any other odors not listed) which are associated with sediment in the area of the sampling station.
- Sediment Oils: Note the term which best describes the relative amount of any sediment oils observed in the sampling area.
- Sediment Characteristics: Note the grain size, color, consistency, layering, presence of biological organisms, man-made debris, etc. in accordance with standard ASTM soil description protocols.
- Sediment Deposits: Note those deposits described (or include any other deposits not listed) which are present in the sampling area. Also indicate whether the undersides of rocks not deeply embedded are black (which generally indicates low dissolved oxygen or anaerobic conditions).

8.6 References

For additional information pertaining to this topic, the user of this manual may reference the following:

ASTM D5358 Practice for Sampling with a Dipper or Pond Sampler

ASTM D4489 Practices for Sampling of Waterborne Oils

ASTM D3325 Practice for the Preservation of Waterborne Oil Samples

ASTM D4841 Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents

ASTM D4416 Guide for Sampling Fluvial Sediment in Motion

ASTM D4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments

ASTM D3213 Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil

ASTM D3976 Practice for Preparation of Sediment Samples for Chemical Analysis

ASTM E1391 Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing

ASTM D4581 Guide for Measurement of Morphologic Characteristics of Surface Water Bodies

ASTM D5906 Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths

ASTM D5073 Practice for Depth Measurement of Surface Water

ASTM D5413 Test Methods for Measurement of Water Levels in Open-Water Bodies

9.0 SLUG TEST PROCEDURES

9.1 Materials and Equipment Necessary for Task Completion

Water level (data) logger capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger capable of advanced logging modes); vented, direct-read cable of sufficient length (with dessicant); interface tape/probe or water level meter; solid (mechanical) slug, pneumatic slug, or packer system [the introduction or removal of water is not recommended (e.g., bailer or bucket)]; 5 gallon bucket, traffic cones and/or barricades, deionized or distilled water and Alconox®; decontamination bucket and brush; and laptop computer or rugged reader.

9.2 Decontamination Requirements

Equipment utilized during slug testing must be thoroughly decontaminated with Alconox® and deionized/distilled water prior to and between uses at each test well to prevent cross contamination between wells. Any groundwater removed from the well during testing must be containerized and either treated and discharged to ground surface, or disposed of in an approved manner, preferably in a properly installed, onsite holding tank. If LNAPL is encountered/recovered, it should be containerized and properly disposed onsite. However, the preferred test initiation methods (solid and/or pneumatic slug) do not generate any groundwater.

9.3 Methodology for Slug Testing

Slug tests are utilized to provide in-situ estimations of hydraulic conductivity (k) in saturated media, most often in geologic formations that exhibit aquifer properties (low k media can also be tested with special consideration). Slug tests involve rapidly displacing the static water level in a well, and analyzing the well's rate and pattern of recovery back to near-static conditions. Falling head or slug-in tests involve analysis of displacement due to the addition of volume, and rising head or slug-out tests involve the analysis of displacement due to the removal of volume. Displacement is initiated using either a solid or pneumatic slug. Water level response is monitored immediately following the initial displacement and for the ensuing time period until the water level has returned to near-static level (generally within 5% of static). Water level response should be recorded using a water level (data) logger capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger). Logarithmic logging modes are preferred to shorten the data file while still providing high resolution data just after test initiation.

9.4 Field Procedures

1) Test Well Construction and Configuration - Well construction details are needed to perform slug test calculations and are important considerations when selecting appropriate wells for testing. Important as-built details include: total well depth, well screened interval(s), depth to (static) water, casing diameter, screen diameter, filter pack diameter, filter pack size, and filter pack interval. While these details should be documented on the well log, static water level and total well depth should be field-confirmed before the test. Of particular importance to the testing procedure is the relationship between static water level and well screened interval, and the degree of well development. Test results for poorly or insufficiently-developed wells may be strongly affected by drilling debris/disturbance in the formation that can create skin effects, lowering the apparent formation k. Analysis of testing data for wells screened across the water-table should consider drainage of the filter pack media. In addition, a pneumatic slug assembly should not be utilized unless the test well is screened below the water table and the water level remains above the screen throughout the test.

2) Test Setup and Initiation - Upon arrival, the test well should be gauged for static depth to water and total well depth so that the total water column length can be estimated. Well gauging data should be recorded in a rugged reader using an EDGE file, if available, or field form or book.

   a. Solid Slug
   The displacement volume of the slug is needed. It is suggested that the slug be prefabricated and calibrated for displacement volume prior to site use. Calculate the expected initial well displacement, using the slug volume and well casing radius, and deploy the data logger/cable to a depth just below that level while considering the slug length (to avoid conflict and tangling of the slug and transducer). Also consider the submergence depth limit of the data logger (usually indicated on the logger body). Generally, placing the data logger a foot or two below the bottom of the slug is good practice. Once submerged, allow the

data logger temperature to equilibrate with groundwater prior to initiating the test (up to 30 minutes).

While the data logger temperature equilibrates, secure the slug to an adequate length of disposable string or rope and hang in the well to a depth just above the water surface. Mark the string/rope to accommodate the slug length and tie off. Using the rugged reader or field computer, set up a new test (logarithmic mode or sub-second recording interval) in the data logger supplied software and start the test. Indicate in the file name the type of test and test number (e.g., rising or falling head; test 1 or 2). Once logging is initiated, quickly and smoothly lower the slug (slug-in or falling head test) to the submerged depth and tie off the string/rope (displacement should be instantaneous). Monitor the data logger data until the water level has returned to near-static level. Stop the falling head test.

Without moving the slug or data logger, set up a new test in the data logger supplied software with the same settings and indicate in the file name the type of test being performed (rising head or slug out). Start the test and once the data logger is running, instantaneously lift the slug and tie off the string/rope to its pre-test position (just above static). Monitor the data being recorded by the data logger and stop the test when the water level has returned to near-static.

b. Pneumatic Slug

If a high formation k is anticipated, solid slug removal is found to be too slow to capture well recovery, or to minimize equipment decontamination for wells with submerged screens, a pneumatic slug assembly should be utilized.

Open air release valve, secure pneumatic slug assembly to well casing and tighten coupling to provide an air tight seal. Insert the data logger/cable and deploy to the target submergence depth [it is generally best to keep the data logger shallow (~1-2 feet below static water level) and use small initial displacements to avoid dynamic recovery effects in high k formations]. Close the air release valve and attach the air pump or compressor. Pressurize the well and use the pressure gauge to set initial displacement. Check for air leaks using a soapy water mixture and sprayer (assembly must be air tight). Allow the water level to return to static and remove the air pump. Using the rugged reader or field computer, set up a new test (logarithmic mode or sub-second recording interval) in the data logger supplied software and start the test. Indicate in the file name the type of test and test number (e.g., rising head; test number). Once logging is initiated, open the air release valve and monitor the test data. Stop the test when the water level has returned to near-static.

3) Test Monitoring and Guidelines - The following are general guidelines for slug testing performance as published by Midwest Geosciences Group in “Field Guide for Slug Testing and Data Analysis:”

- Conduct at least three or more tests per well and if possible conduct both rising and falling head test data.
- Use two or more initial displacement values (2 slug sizes or air pressures applied) that vary by an order of magnitude or more.
- Final slug test initial displacement should be nearly equivalent to the first test’s displacement.
- Allow tests to run until near-static conditions are achieved (+/- 5% of static)
- Digital slug test data files collected with the data loggers and/or EDGE files should be backed up to either a thumb drive, corporate email server, and/or corporate file server immediately after collection.

4) Test Data Reduction and Processing - Prior to slug test analyses, digital data logger files should be normalized so that multiple tests conducted on the same test well can be compared for the assessment of test validity and well conditions. Reducing the data as follows:

- From each raw data file, estimate the time of test initiation and the head (depth or pressure) under static conditions.

- In each slug test data file, subtract the time of test initiation from the elapsed time and save to a new field (normalized time or test time; start of test should be time zero).
- In each slug test data file, subtract the static pressure head from the test period pressure head values and save to a new field (deviation from static).
- To normalize the deviation from static values, divide that field by the displacement expected based upon the slug volume or air pressure head applied.
- Create a graphical plot of the normalized head data versus test time for each test performed on the test well. Review the data plots and confirm that the testing data for each repeat test roughly concur. Also confirm that the actual and expected initial displacements are nearly equal.
- If repeat testing data and/or expected versus actual initial displacements vary widely, review well completion details and testing methods prior to performing further analysis (step 5 below) as the results may not be valid (e.g., the well screen interval may be poorly developed or fouled, the data logger may have moved or placed too deep in the well, slug was removed too slowly). The well may need to be retested.

5) Test Data Analysis - For the purposes of this standard operating procedural document, it is assumed that slug test analysis software will be used to apply standard solution methods to the testing data. Various computer programs are available, such as AQTESOLV Professional. Choose an appropriate test solution method by considering the following well configurations (in AQTESOLV, use the Solution Expert):

   a. Submerged Screen and/or Confined Aquifer Well - If the well screen fully penetrates the intersecting aquifer, utilize the Cooper et al. Model or Hvorslev Model and analyze the curve match and/or best fit. If well is partially penetrating a confined formation, utilize the KGS Model or Hvorslev Model. If well screen is submerged in an unconfined formation, utilize the KGS Model or Bouwer and Rice Model.

b. Water-Table Intersects Well Screen - If the well screen is intersected by the water table, utilize the Bouwer and Rice Model (double straight line effect) or KGS Model.

c. Rapid Well Recovery in High k Formations - If well response to displacement is extremely rapid and normalized head plots display an oscillatory or concave-downward form, utilize the Butler and Zhan Model (most comprehensive solution available) or High-k Hvorslev Model for confined wells, or the High-k Bouwer and Rice Model.

9.5 Limitations

In general, results of slug test data analyses provide an initial estimate of formation k and have a small scale of relevance (particularly in high k settings). Slug tests can be strongly affected by the degree of well development and can be used diagnostically to assess the degree of well development. In most cases, slug testing should be performed on several wells in an area of interest to develop an understanding of the formation characteristics (e.g., heterogeneous or homogeneous formations).

10.0 PUMP TEST PROCEDURES

10.1 Materials and Equipment Necessary for Task Completion

Water-level (data) loggers (transducers) capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger capable of advanced logging modes for at least the pumping well); vented, direct-read cables of sufficient length (with dessicant packs); interface tape/probe or water-level meter; well pump (preferably a submersible pump), drop pipe and layflat or comparable discharge line of sufficient length, totalizing flow meter (recommended) and 5 gallon bucket, stop watch, rain gauge or nearby weather station; materials needed to monitor surface water bodies near the test site (e.g., staff gauge, weir, stakes, data logger, camera with permission from refinery personnel); traffic cones and/or barricades, deionized or distilled water and Alconox®; decontamination bucket and brush; laptop computer or rugged reader; portable generator or other power supply appropriate for the submersible pump; and containment (e.g., frac tank) or activated carbon filtration for the temporary staging or filtering of discharge water.

10.2 Decontamination Requirements

Equipment utilized during pumping tests must be thoroughly decontaminated with Alconox® and deionized/distilled water prior to and between uses at each test well to prevent cross contamination between wells. Any groundwater removed from the tested well must be containerized and either treated (filtered as appropriate) and discharged to ground surface, or disposed of in an approved manner, preferably in a properly installed, onsite holding tank. If LNAPL is encountered/recovered, it should be containerized and properly disposed of on or off-site.

10.3 Methodology for Pump Testing

10.3.1 Pre-test Considerations

In general, pumping tests are performed to estimate large-scale in-situ hydraulic properties of water-bearing strata in the subsurface (i.e., transmissivity and storativity) and average out local-scale heterogeneity that can limit the applicability of smaller-scale testing methods, such as slug tests. The geographical area influenced by a pumping test will be determined by the hydraulic properties of the strata being tested (including hydraulic properties of other strata supplying recharge to the pumped formation), boundary conditions, and on the duration of the test.

Pumping tests are also commonly performed to generate drawdown data from which hydraulic boundary conditions, hydraulic flow regime (e.g., anisotropy), and aquifer type (i.e., unconfined or confined, leaky confined) may be estimated. Smaller-scale pumping tests may also be utilized to address pumping efficiency and/or signal to noise ratio (pumping rate) at the pumping well, or to assist in remedial system design. However at this scale, the assumptions of some data analysis methods may not be applicable and should be considered prior to testing.

Appropriate design of a pumping test should include review of site-specific information regarding the geology and hydrogeology of the test area. Pumping test design should also consider the goal(s) of the test (i.e., scale of application of derived aquifer properties, identification of boundary influences, sources of recharge, well efficiency). This should include review of available lithologic well logs or test boring logs, geologic maps, cross sections, structure contour maps, isopach maps, and any other available information so that a conceptual model relating geologic units to hydrostratigraphic units or water-bearing strata can be developed. Additional pre-test considerations should include identification of any potential positive or negative hydraulic barriers, tidal effects, and/or influence from other wells that may be pumping in the test area. Without sufficient knowledge of factors influencing water-levels and hydrology of the test area, test results could be misinterpreted.

Often times, budget considerations and/or time limitations will necessitate the use of an existing monitoring well as the pumping well and/or existing wells as observation points. While this is generally acceptable, the wells must be screened appropriately with respect to the goals of the test and knowledge of well construction is critical to applying test solutions. Wells should also be redeveloped prior to testing if they are relatively old or if records of sufficient well development at the time of installation are not readily available.

Pumping tests can be divided into two general classifications: step-drawdown tests and constant rate tests. Step tests typically involve pumping a well at progressively higher rates or “steps” at intervals of one or two hours per step (typically up to 3 steps). They are often used to estimate the yield a well will sustain during a constant rate pumping test and to evaluate well efficiency (frictional head losses between the screen/gravel pack and the formation). Constant rate pumping tests are used primarily to evaluate hydraulic properties of water-bearing strata for design of groundwater treatment systems and/or water supply purposes (e.g., groundwater allocation). Where budgets permit, the best pumping test approach is to first perform a step-drawdown test on the pumping well to evaluate well efficiency and sustainable yield (and to gauge whether or not the pumping well needs additional development), allow recovery to near-static conditions, and then initiate a constant rate test.

The test duration is subject to goals of the test and to budget considerations. Optimally, a constant rate test should be run until all drawdowns have stabilized or boundary conditions are identified, and gravity drainage effects are curtailed; however, this is seldom practical due to time limitations. In most instances, an 8 hour constant rate test will be adequate, and a 24 hour test will be sufficient for higher sensitivity sites. Occasionally a 72 hour pumping test is warranted, though this is usually reserved for large scale water supply work. If there are any unexplained water level anomalies observed toward the scheduled end of a test, the test should be continued if at all possible.

The approximate test flow rate needs to be determined in advance for proper pump and discharge design selection, and sizing of discharge containment. If it is not appropriate to perform a step test, sustainable yield can be estimated from slug test data or a brief (<30 minutes) pumping episode the day before the actual test. Generally, it is best to pump the test well at a rate that maximizes the signal to noise ratio (a higher pumping rate does not influence test scale and should not be used as a means to shorten the test duration).

If testing must be performed in an area where contamination is known to be present, careful consideration of the impacts of the test scale should be considered prior to testing so that the spread of subsurface contamination is not increased. If floating product (LNAPL) is present at or near the pumping well, drawdown should be limited so as to not impact uncontaminated soils below the static water table (i.e., create a “smear” zone or allow for the significant migration of free-phase product). Discharge water must be either 1) treated prior to discharge or 2) containerized for on or off-site disposal. If it is to be discharged directly on-site and allowed to infiltrate, it must be routed sufficiently far enough from the test area as to avoid any artificial recharge effects. All appropriate withdrawal and discharge permits must be obtained and complied with. If discharge water is to be treated on-site, proper contaminant loading calculations for the test flow rate, approximate contaminant loading and test duration must be performed in advance to insure treatment is sufficient. Any on-site treatment should also include at least one discharge effluent sample analysis by an approved laboratory to document treatment effectiveness.

10.3.2 Pre-Test Water Level Monitoring

Water-level conditions in the test area should be monitored for at least one week prior to initiation of testing to identify background trends and factors influencing groundwater levels in the test area. Data loggers should be deployed in all wells to be utilized in the pumping test and set to record depth or pressure at a resolution that is high enough to identify any potential trends (generally a 15 minute recording interval is sufficient for background monitoring). A manual water level should be measured with a water-level meter or interface probe and referenced to the top of casing mark to calibrate the data logger data at the time of deployment and at sufficient intervals throughout the recording period to validate the data and provide backup data in the event that a data logger was to fail.

Ideally, groundwater levels should be static prior to starting a pumping test so that pumping influences alone can be readily evaluated. Any significant precipitation events within the previous several days (documented through use of a site rain gauge or nearby weather station) will usually result in noticeable water level changes. If there are any major water level changes observed that cannot be explained prior to testing, additional investigation into possible area influences (e.g., local well pumping or construction de-watering) should be conducted.

10.3.3 Pumping Test Set Up

Prior to starting the test, all well measuring points (i.e. top of casing) should be clearly marked and preferably surveyed to the nearest 0.01 feet in elevation. The horizontal distance between all wells utilized should be measured and illustrated on a base map. If there are any surface water bodies in the vicinity, a staff gauge (or similar measuring device) should be set up and surveyed to evaluate possible test influences on water levels or stream flow.

The preferred pump to be used for a pumping test is a submersible centrifugal pump powered by either existing site power or a portable generator. These pumps are not explosion proof, so a conductivity probe must be tied into the pump controls to alleviate any possibility of product coming into contact with the pump (if product is anticipated). If the test pump is designed to pump total fluids (e.g. air operated double diaphragm pump, jack pump, etc.) discharge must either be containerized, or treatment must include an oil/water separator to handle any floating product. The submersible pump should be set deep enough to maintain flow during the test period or at a maximum of just above the screened interval, using a handling line to support the pump's weight [**NOTE:** extreme care must be taken that the power cord is neither bearing any of the pumps weight, nor damaged during installation due to the potential for severe electric shock]. A check valve (or two check valves) should be installed above the pump in the discharge line to prevent backflow into the well after testing.

Discharge piping from the pump should include a flow meter (preferably with totalizer), followed by a flow adjustment valve. The flow meter should be installed in a straight section of hard piping of sufficient length to avoid meter distortion caused by turbulence (typically about 10 pipe diameters on either side of the meter). In low-flow pumping tests, flow rate can be calculated by measuring the exact time required to fill a known-sized container (bucket and stop watch) several times throughout the testing period. The bucket and stop watch method of estimating flow should also be used to back up and check the flow meter data.

Precise and frequent water-level measurements (to the nearest 0.01 feet) and time denotations before, during, and after pumping tests are critical to achieving accurate test results. In terms of prioritization, data loggers should be utilized in at least the pumping well and observation wells closest to the pumping well. Wells further from the pumping well may be manually monitored, due to the reduced likelihood that early-time drawdown will be critical at distal locations. Back-up manual measurements should be collected at least hourly during the first 8 hours of the test, and then at least every 3 hours, to verify data logger measurements. Readings from the transducers are not completely reliable until they have been submerged for at least 30 minutes (sensor equilibration period). All field personnel should have watches with a second hand, and they should all be calibrated to the same time. Liquid level measurements should be obtained using an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy for those wells with floating product. For wells without product, a water-level meter may be sufficient. All non-dedicated probes must be properly decontaminated after each level reading to prevent any possibility of cross- contamination between wells.

Data loggers should be deployed in each selected well to a depth that will maintain submergence through the test period. Data loggers selected should be capable of being submerged to that anticipated depth (typically noted on the instrument body). The transducer cable should be secured at the wellhead (manufacturer supplied hangers, well caps, or electrical tape/cable ties) to minimize any movement of the sensor. Care must be taken that the transducer cable is not damaged from rough edges at the well head, and that no vehicles run over the cable. The data logger installed in the pumping well will need to be installed at a depth that will maintain submergence through the test, but also remain clear of the submersible pump (and pump noise if possible). In addition, wells with floating product may require an inner PVC stilling well surrounding the data logger cable to prevent damage from contact with the product. A stilling well may also eliminate the need for any water-level corrections for product thickness.

10.3.4 Running the Test

Once the data loggers have been deployed and secured, tests should be set up in each device and each device either started or “future” started to begin logging when the pump is turned on. The data logger in the pumping well should be set to logarithmic logging mode to capture sub-second data during the early portion of the test. If possible, the pump discharge control valve should be have been pre-set (based on the step test or mini pump test) to the desired flow rate prior to turning on the pump. However, depending on the test pumps performance curves, minor flow rate adjustments are generally needed during the first hour or two of the test to correct for the additional lift required by the pump due to increasing drawdown. In addition, movement of the discharge hose after the test has been started should be avoided, since any change in the elevation of the discharge will affect the pumping rate. All changes in flow rate should be recorded and time stamped.

A minimum of two field personnel are needed to run a pumping test, with additional personnel required for tests with multiple observations wells or additional complexity. One person should be designated to turn on the pump, monitor and adjust flow rate, maintain discharge and treatment, maintain the generator, etc. The second person should be responsible for data logger management and manual water-level measurements. As a rule of thumb regarding the frequency of manual well gauging, one measurement every half minute during the first 5 to 10 minutes, followed by one measurement every 3 to 5 minutes during the first hour, one measurement every 10 to 20 minutes for the second hour, and one hourly measurement thereafter is acceptable.

Throughout the test, data loggers should be downloaded in real time through use of direct-read, vented cables (or non-vented with a barometric logger for compensation) to monitor water-level conditions. It is essential that some data reduction be accomplished in the field, so that major water level trends are recognized during the test. At a minimum, drawdown trends from the pumping well and two of the nearest monitoring wells need to be semi-log plotted against time so that deviations indicative of boundary conditions can be discerned before pumping is ceased. This will allow decisions to be made about whether the test should run longer than planned.

Generally, water quality samples are collected during a pumping test for laboratory analysis of constituents of concern. These are generally collected after the first hour of pumping and just prior to pump shutdown. If the test is of more than 24 hours duration, it is advisable to collect additional samples during the testing period. All groundwater samples should be collected following Evergreen Field Procedures.

10.3.5 Post-test Recovery

At the conclusion of the test, water level recovery data should be collected until near-static conditions are re-established. This requires the installation of a check valve in the discharge line above the submersible pump to prevent backflow. The recovery data has the advantage in that there are no variations in the curve produced due to variations in pumping rate and is independent of test length. In water-table aquifers, however, the effects of formation de-watering can cause the recovery trends to be substantially different from drawdown trends. Consequently, recovery (residual drawdown) data should be used in conjunction with drawdown data where possible.

10.3.6 Data Analysis

The data collected during pumping tests are analyzed to estimate aquifer hydraulic properties, such as transmissivity, conductivity, and storage. Data collected by transducers must be downloaded and transformed (dimensionless drawdown or displacement from static) prior to analysis. Analysis typically involves curve matching of site data to type curves established in literature for particular flow regimes. Curve matching is commonly performed utilizing computer software, such as HydroSOLV's AQTESOLV program, along with diagnostic methods and derivative analysis to best estimate aquifer properties through identification of flow regimes and conditions.

It is noted that the mathematical solutions used in pumping test analysis include many assumptions that must be considered in the context of each test area (e.g., the formation is of uniform thickness and of infinite areal extent). In addition, some of the values incorporated into typical pumping test solutions are not actually measured, but are educated estimates (e.g., porosity based on lithology, etc.). Many problems associated with pumping test data evaluation are due to not recognizing, and/or correcting for, deviations from the theoretical solution employed. Some of the more common analytical errors occur due to: partial well penetration effects, formation de-watering effects, casing storage effects, poor pumping well efficiency and/or the application of incorrect equations or units. Consequently, a thorough understanding of the underlying assumptions inherent to the solution employed is required before the validity of the results can be trusted.

APPENDIX E

SOIL, GROUNDWATER AND INDOOR AIR ANALYTICAL REPORTS (ON CD)

LANGAN

APPENDIX F

STANTEC INDOOR AIR ASSESSMENT REPORT AND GHD INDOOR AIR SAMPLING WORK PLAN

LANGAN

Evaluation of Specific Volatile Organic Compounds in Occupied Buildings at the former Sunoco Philadelphia Refinery

Sunoco, Inc. (R&M) Philadelphia Refinery Remediation Program

Philadelphia, Pennsylvania

Prepared for:

Sunoco, Inc. (R&M)
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March 22, 2013

Project Number: 213402094

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March 20, 2013

EVALUATION OF SPECIFIC VOLATILE ORGANIC COMPOUNDS IN OCCUPIED BUILDINGS AT THE FORMER SUNOCO PHILADELPHIA REFINERY

SUNOCO, INC. (R&M) PHILIDELPHIA REFINERY REMEDIATION PROGRAM

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Executive Summary

On Wednesday, October 24 and Thursday, October 25, 2012, Stantec Consulting Services Inc. (Stantec) conducted a comprehensive study of airborne volatile organic compounds (VOCs) in occupied buildings at the former Sunoco, Inc. (R&M) Philadelphia Refinery, now Philadelphia Energy Solutions (PES) Refining and Marketing (R&M) LLC, located at 3144 Passyunk Avenue, Philadelphia, Pennsylvania (the refinery). The study was conducted as part of Sunoco's participation in a real estate and refinery operation transaction. The study was performed to document the concentration of a number of specific chemicals which may be present inside occupied buildings from refinery activities or related refinery conditions.

Methodology

An initial site visit was conducted on September 18 and 19, 2012 by Stantec and Sunoco to select the occupied buildings to be evaluated and to determine the tentative number and locations of samples to be collected during the study. Based on the initial site visit, a sampling plan was subsequently developed which specified collection of air samples inside occupied buildings on the refinery property for analysis of petroleum-related VOCs in air utilizing United States Environmental Protection Agency (US EPA) Method TO-15 for analysis. This method calls for the collection of air samples into specially prepared vacuum SUMMA canisters (or cans). The sampling plan also specified collection of these air samples over a four (4) hour period to accommodate the possible variability in ambient VOC concentrations.

Samples were collected inside occupied areas of the selected buildings and outdoor air samples were collected for comparison. Thirty-four (34) samples were collected inside buildings and seven (7) samples outdoors. Three (3) trip blanks were also submitted for analysis. Compounds of interest for this study were consistent with the Pennsylvania Department of Environmental Protection's (PADEP) Short List of Petroleum Products, specifically: methyl tert-butyl ether (MTBE), 1,2-dichloroethane, benzene, toluene, 1,2-dibromoethane (ethylene dibromide), ethylbenzene, xylenes, isopropylbenzene (cumene), 1,2,4-trimethylbenzene (1,2,4-TMB), and 1,3,5-trimethylbenzene (1,3,5-TMB). The concentrations of VOCs detected in each sample of indoor and outdoor air were compared to occupational exposure limits (OELs) and risk-based screening levels published by US EPA and PADEP. Summary statistics were calculated to compare the ranges of concentrations of VOCs found in indoor air to concentrations in outdoor air.

Results

The concentrations of all compounds detected in indoor and outdoor air were many orders of magnitude less than the Occupational Safety and Health Administration (OSHA) Permissible

Exposure Limit (PEL) time-weighted averages (TWAs) and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs®) TWA.

The maximum concentrations of all compounds detected in all samples were equal to (benzene only) or less than the corresponding risk-based US EPA Regional Screening Levels (RSLs) and the PADEP Indoor Air Quality (IAQ) criteria for exposure in industrial environments. Note that the US EPA RSL concentrations for chemicals with cancer health effects (MTBE, benzene, and ethylbenzene) were multiplied by a factor of ten (10) to reflect a target cancer risk of 1 in 100,000 or 1E-05 which is consistent with the Pennsylvania risk-based standards.

There were notable differences in the concentrations of most of the compounds detected inside the individual buildings that are not evident from the arithmetic means of the analytical results for all indoor air samples. Specifically, the highest concentrations of benzene were found in the Point Breeze Lab samples (11 and 8.4 µg/m^3) and the 440 Building samples (9 and 7.2 µg/m^3). The highest concentrations of toluene (88 and 330 µg/m^3), ethylbenzene (11 and 6 µg/m^3), total xylenes (51.1 and 31.6 µg/m^3) were found in the PB Lab samples (west lab and 2nd floor office, respectively). The highest concentrations of 1,3,5-TMB (3.9 µg/m^3) and 1,2,4-TMB (11 µg/m^3) were found in the PB Lab, 2nd floor office sample although the PB Lab, west lab sample was not significantly different than other indoor air sample locations.

The concentrations of benzene, toluene, ethylbenzene, xylenes, and trimethylbenzenes in buildings other than the 440 Building and the PB Lab were comparable to the concentrations in outdoor air.

Conclusions

The findings of this evaluation indicate that the indoor and outdoor concentrations of VOCs associated with refinery operations were orders of magnitude lower than occupational exposure limits, and lower than or equal to (benzene only) conservative risk-based screening levels published by US EPA and PADEP for long-term exposures in industrial settings. Note that the US EPA RSL concentrations for chemicals with cancer health effects were adjusted to be consistent with the Pennsylvania risk-based standards. Assuming that the concentrations of petroleum-related VOCs found inside the occupied buildings in late October 2012 are representative of long-term conditions, there do not appear to be health concerns for people who work inside the buildings from exposure to these chemicals.

Table of Contents

1.0 Introduction

Stantec Consulting Services Inc. (Stantec) conducted a comprehensive study of airborne volatile organic compounds (VOCs) in occupied buildings at the former Sunoco, Inc. (R&M) Philadelphia Refinery, now Philadelphia Energy Solutions (PES) Refining and Marketing (R&M) LLC, located at 3144 Passyunk Avenue, Philadelphia, Pennsylvania (the refinery). The study was conducted as part of Sunoco's participation in a real estate and refinery operation transaction. The study was performed to document the concentration of a number of specific chemicals that may be present inside occupied buildings from refinery activities or related refinery conditions.

During a real estate and operational transition involving a facility such as this refinery, the potential for residual chemical exposure in occupied buildings exists and it is reasonable to assess the potential adverse health risk.

This facility refines, processes, and blends transportation fuels. The chemicals of interest for this study were consistent with the Pennsylvania Department of Environmental Protection (PADEP) Table IV-9 Short List of Petroleum Products (PADEP 2004), specifically: methyl tertiary-butyl ether (MTBE), 1,2-dichloroethane, benzene, toluene, 1,2-dibromoethane (ethylene dibromide), ethylbenzene, xylenes, isopropylbenzene (cumene), 1,2,4-trimethylbenzene (1,2,4-TMB), and 1,3,5-trimethylbenzene (1,3,5-TMB). Although the PADEP Table IV-9 Short List is for analysis of soil and water samples, all of the compounds listed for water except naphthalene, are volatile compounds of interest in air.

An initial site visit was conducted on Tuesday, September 18, and Wednesday, September 19, 2012 by Jim Oppenheim (Sunoco), Jennifer Menges (Stantec), and John Reiter (Stantec) to select the occupied buildings where sampling would be conducted and to determine the tentative number and locations of samples to be collected during the study. The sampling plan developed based on this initial site visit, and subsequently implemented by Stantec field staff in cooperation with refinery personnel in October 2012, specified collection of air samples inside occupied buildings on the refinery property for analysis of concentrations of VOCs in air by United States Environmental Protection Agency (US EPA) Method TO-15 (US EPA 1999).

US EPA Method TO-15 calls for the collection of air samples into specially prepared vacuum SUMMA canisters (or cans). The sampling plan specified collection of these air samples over a four (4) hour period of time to accommodate the possible variability in ambient VOC concentrations. Samples were collected inside occupied areas of the buildings and outside samples were collected for comparison. Thirty-four (34) samples were collected inside of buildings and seven (7) samples were collected outdoors. Three (3) trip blanks were also submitted for laboratory analysis.

Analytical results were compared to occupational exposure limits (OELs), specifically the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values

(TLVs®). Results were also compared to current (November 2012) US EPA risk-based Regional Screening Levels (RSL) for industrial occupancies and PADEP Indoor Air Quality (IAQ) criteria for industrial occupancies. Additionally, PADEP-referenced odor thresholds were cited.

2.0 Chemical Constituents and Applicable Exposure Limits

The facility is a refinery that processes and blends large quantities of petroleum-based transportation fuels. The refining and blending processes generate the volatile petroleum-based organic compounds of interest for this investigation. In addition to being flammable, these volatile compounds may cause adverse health effects ranging from upper respiratory tract irritation at lower concentrations of exposure to more severe effects such as central nervous system depression or intoxication at high concentrations of exposure. Benzene is also considered to be a human carcinogen based on epidemiologic studies demonstrating an increased risk for acute myelogenous leukemia in occupational cohorts exposed to high concentrations (e.g. exceeding approximately 10 parts per million (ppm)) over many years (ATSDR 2007). The potential for adverse health effects correlates with increasing concentrations and duration of exposure.

All of the compounds monitored in this study have relevant occupational standards and risk-based screening levels. The OELs were developed based on the precept that nearly all persons may be exposed to a concentration of the chemical at or below the exposure limit, day after day, week after week, for a working lifetime, without experiencing any adverse health effects due to the chemical exposure.

Risk-based screening levels are concentrations of chemicals in environmental media (soil, ambient air, and drinking water) that correspond to pre-determined levels of cancer risk and/or non-cancer hazard, under the assumption that an individual will be exposed daily over thirty (30) years (residential) or twenty-five (25) years working life-time. Two sources of risk-based screening concentrations are presented in this report: US EPA RSLs and PADEP IAQ criteria. All screening concentrations used to evaluate sampling results were developed for exposures in industrial settings.

The US EPA RSLs have been harmonized across US EPA Regions and are generally accepted as a quick and conservative method for initial evaluation of constituents found in environmental media. RSLs are presented by the US EPA as being protective for members of the general population (including sensitive groups) over a lifetime. Thus concentrations of chemicals in environmental media that are less than the RSLs are believed to be of no concern for public health. Concentrations of chemicals above conservative RSLs do not necessarily mean that health effects will occur as a result of exposure, but that further evaluation of the situation should be considered. There are carcinogenic target risk (TR) screening concentrations and non-carcinogenic hazard index (HI) screening concentrations. All chemicals produce non-cancer health effects at some level of exposure and some may also be carcinogenic. Screening concentrations generally (although not always) reflect the more sensitive outcome and lowest associated concentration.

Although the non-residential PADEP IAQ criteria were developed under the Pennsylvania Land Recycling Program to assist in the evaluation of vapor intrusion into non-residential buildings, these risk-based concentrations are analogous to US EPA RSLs and provide additional references for evaluating the results of the samples collected during this study.

3.0 Sampling Methodology

3.1 COLLECTION OF AMBIENT AIR SAMPLES

Ambient air samples were prepared by first checking the laboratory-provided SUMMA canister vacuum using a digital gauge and documenting the pre-sample pressure. Flow regulators with integral pressure gauges were attached to the canisters and tightened by hand. Sampling was initiated by opening the SUMMA canister valve to its fully open position.

Samples were collected at breathing zone height by placing the SUMMA canisters on elevated surfaces so that the sample collection intake ports were approximately three (3) to six (6) feet above the ground or floor surface. Samples were collected for approximately four (4) hours. While grab samples may have been sufficient, sample durations were intentionally longer to provide some assurance that if the concentration of the compound(s) were variable, the sample would be representative.

Samples were collected at indoor and outdoor locations previously selected and discussed during the initial site visit and sampling plan development. However, since sample conditions are dynamic and may have been different at the time of sample collection, the field technicians used their best judgment in sample location selection and, as a result, some locations may be different than originally planned. Three (3) trip blanks were provided to the lab for analysis.

3.2 QUALITY ASSURANCE PROCEDURES FOR SAMPLE COLLECTION

Sample quality assurance encompasses procedures used for pre-sample preparation; handling of samples before, during, and after collection; elimination of potential cross contamination; and elimination of collection of interfering compounds or materials. The need for some of these is unnecessary when using SUMMA canisters due the inherent relatively failsafe technology.

Flow rate and volume are not critical since the sample methodology is for whole air (i.e., a prescribed total volume) regardless of the rate of sampling or total volume of air collected. The flow regulators provide an approximate canister fill time. Following sample completion the final pressure is recorded for assurance that air was indeed collected into the canister.

Contemporary sampling media provides little opportunity for cross-contamination or external contamination. SUMMA canisters were cleaned and prepared by the analytical laboratory in a manner consistent and appropriate for re-use and the methodology and compounds selected for analysis.

Onsite recordkeeping included SUMMA can serial number, flow controller serial number, start time, stop time, total sample time, location of sample, pre-sample pressure, post-sample pressure, and notes pertaining to the location of the sample. This information is provided in Table 1.

The laboratory received the samples according to their strict receipt requirements and documentation. A *Sample Acceptance Check Form* is provided with the laboratory analytical reports provided in Appendix A.

4.0 Sampling Locations

Figure 1 illustrates the locations of buildings in which samples were collected and outside sample locations. The indoor sample locations were selected during the initial site visit by Jim Oppenheim (Sunoco), Jennifer Menges (Stantec), and John Reiter (Stantec). The indoor sample locations were selected based on the current and anticipated occupancy and use of the buildings, populations in the buildings, and locations of occupants within the buildings. The number and locations of indoor air samples per building were selected to be representative of conditions and potential exposure to the building occupants. Outdoor sample locations were selected based on the proximity to buildings in which samples were collected, and in some instances, proximity to pumping and product handling equipment. The number and locations of outdoor air samples were selected to be representative of petroleum-related compounds in ambient air that may contribute to the presence of the same compounds in indoor air.

Samples were collected in building locations identified in Table 1 and shown on Figure 1. Indoor air samples were collected in the following locations:

- Blending & Shipping (B&S) Office
- 24 Gate Building
- Girard Point (GP) Training Building
- GP Main Office Building
- 440 Building
- 15 Pump House
- North Yard Scale House
- Schuylkill River Tank Farm (SRTF) Propane Loading
- SRTF Main Pump House
- Point Breeze (PB) Main Office Building
- PB Lab
- PB Refinery Hall
- PB Maintenance Shop

Duplicate samples were collected in the 24 Gate Building (1st floor), the GP Main Office Building (2nd floor east), and the PB Refinery Hall (2nd floor east wing).

Outdoor samples were collected in the following locations:

- near the B&S Office
- outside the GP Main Office Building
- outside 15 Pump House, under the equipment roof at grade
- outside 15 Pump House, under the equipment roof approximately eight (8) to ten (10) feet below grade
- outside the North Yard Scale House
- outside the SRTF Main Pump House
- outside in the PB gate area, near the PB buildings

5.0 Analytical Results

Table 1 lists the sample location, date of sampling, start time, stop time, total sample duration, canister ID, regulator ID, pre-sample pressure, and post-sample pressure. Table 2 presents the analytical results for each indoor and outdoor sample location. Summary statistics for indoor and outdoor air samples are presented in Table 3 along with occupational exposure standards and risk-based screening concentrations. Laboratory analytical reports are provided in Appendix A.

The table below presents the arithmetic mean for all compounds detected in two (2) or more samples, or the only concentration detected. The maximum detected concentrations are shown below the means in bold, italic font. Two (2) of the compounds of interest, 1,2-dichloroethane and 1,2-dibromoethane were not detected in any of the samples and are not included on this summary table. The three (3) duplicate samples corresponding to sample numbers 3, 15, and 40 on Table 2 yielded analytical results that were virtually identical to the results of the corresponding "sample" and are not factored into the summary statistics.

Summary of Air Sampling Results [1)]

Compound	OSHA PEL[2)]	ACGIH TLV [3)]	RSL Ind. [4)]	PADEP Ind. [5)]	Indoor		Outdoor	
					Freq. Detect	Concentration (mean / ***max***)	Freq. Detect	Concentration (mean / ***max***)
MTBE [6)]	—	1.8E+05	4.7E+02	3.1E+02	2/34	1.28E+00 ***1.6E+00***	0/7	—
Benzene	3.19E+03	1.6E+03	1.6E+01	1.1E+01	34/34	2.9E+00 ***1.1E+01***	6/7	2.62E+00 ***4.9E+00***
Ethylbenzene	4.34E+05	8.68E+04	4.90E+01	7.30E+01	30/34	1.77E+00 ***1.1E+01***	2/7	1.97E+00 ***3.1E+00***
Toluene	7.54E+05	7.54E+05	2.20E+04	1.20E+03	34/34	1.88E+01 ***3.3E+02***	7/7	7.61E+00 ***1.9E+01***
Xylenes	4.34E+05	4.34E+05	4.40E+02	3.00E+02	34/34	7.50E+00 ***5.11E+01***	5/7	6.55E+00 ***1.71E+01***
Cumene	2.46E+05	2.46E+05	1.80E+03	1.10E+03	17/34	1.42E+00 ***2.6E+00***	1/7	2.0E+00 ***2.0E+00***
1,3,5-TMB [7)]	—	1.23E+05	3.10E+01	1.70E+01	7/34	1.53E+00 ***3.9E+00***	1/7	1.6E+00 ***1.6E+00***
1,2,4-TMB [8)]	—	1.23E+05	3.10E+01	1.70E+01	31/34	1.96E+00 ***1.1E+01***	4/7	1.69E+00 ***3.6E+00***

Footnotes:

1) All concentrations, including those for occupational standards are given in $\mu g/m^3$
2) OSHA Permissible Exposure Limit (PEL)
3) ACGIH Threshold Limit Value (TLV)
4) EPA Regional Screening Level (RSL) for industrial exposure
5) Pennsylvania Department of Environmental Protection IAQ criteria for industrial exposure
6) methyl tert-butyl ether
7) 1,3,5-trimethylbenzene (RSL for 1,2,4-trimethylbenzene)
8) 1,2,4-trimethylbenzene

The analytical results are discussed in the following sections with concentrations provided in micrograms per cubic meter ($\mu g/m^3$).

5.1 COMPARISON OF INDOOR AIR SAMPLES

5.1.1 Indoor Air Samples

Of the ten (10) compounds analyzed (m,p-xylenes and o-xylene were combined into total xylenes), 1,2-dichloroethane and 1,2-dibromoethane were not detected in any sample and MTBE was detected only in two (2) samples, both on the second floor of the PB Refinery Hall. Benzene, toluene, and xylene were detected in the majority of the indoor and outdoor samples. No compounds were detected in the trip blanks.

There were notable differences in the concentrations of most of the compounds detected inside the individual buildings that are not evident from the arithmetic means of the analytical results for all indoor air samples. Specifically, the highest concentrations of benzene were found in the PB Lab samples (11 and 8.4 $\mu g/m^3$) and the 440 Building samples (9 and 7.2 $\mu g/m^3$). The highest concentrations of toluene (88 and 330 $\mu g/m^3$), ethylbenzene (11 and 6 $\mu g/m^3$), total xylenes (51.1 and 31.6 $\mu g/m^3$) were found in the PB Lab samples (west lab and 2nd floor office, respectively). The highest concentrations of 1,3,5-TMB (3.9 $\mu g/m^3$) and 1,2,4-TMB (11 $\mu g/m^3$) were found in the PB Lab, 2nd floor office sample although the PB Lab, west lab sample was not significantly different than other indoor air sample locations.

MTBE was detected only in samples collected in the PB Refinery Hall building (2nd floor, both conference room and east wing) and was undetected in any other inside or outside sample.

The concentrations of benzene, toluene, ethylbenzene, xylenes, and trimethylbenzenes in buildings other than the 440 Building and the PB Lab were similar to the concentrations in outdoor air. As shown in the table below, the range of concentrations detected in air samples from the 440 Building and the PB Lab are compared to the range of concentrations found in all of the other buildings (as a group; not including non-detects) from which samples were collected.

Range of Concentrations Detected in Indoor Air by Building [1)]

Compound	440 Building		PB Lab		All Other Buildings		Outdoor	
	low	high	low	high	low	high	low	high
MTBE [2)]	—	—	—	—	0.96	1.6	—	—
Benzene	7.2	9.0	8.4	11	0.94	4.3	1.2	4.9
Ethylbenzene	0.97	1.8	6.0	11	0.74	2.9	0.83	3.1
Toluene	8.2	8.3	88	330	3.6	14	2.0	19
Xylenes	4.4	5.8	31.6	51.1	2.5	14.7	2.0	17.1
Cumene	1.9	2.5	1.3	2.6	0.77	2.1	2.0	2.0
1,3,5-TMB [3)]	—	—	1.4	3.9	0.87	1.3	1.6	1.6
1,2,4-TMB [4)]	1.2	1.3	3.9	11	0.78	4.0	0.92	3.6

Footnotes:

1) All concentrations are given in $\mu g/m^3$
2) methyl tert-butyl ether
3) 1,3,5-trimethylbenzene
4) 1,2,4-trimethylbenzene

It is apparent that the concentrations of VOCs found indoors on the second floor of the PB Lab were higher than in the other buildings and higher than outdoor air. In particular, the lowest concentrations of ethylbenzene, toluene, and total xylenes detected in the PB Lab were higher than the highest concentrations of those same compounds found in all other buildings combined. These results indicate that sources in the PB Lab were likely contributing to the concentrations of VOCs in this space.

5.1.2 Outdoor Ambient Air Samples

From the discussion above, it can be seen that the range of VOC concentrations detected in samples of outdoor air overlap the range of the same compounds detected in air from all of the buildings except for the PB Lab. While benzene, toluene, xylenes, and 1,2,4-TMB were found in more than 50% of the outdoor air samples as shown in Table 3, MTBE, cumene, and 1,3,5-TMB were less prevalent in outdoor air than in indoor air.

With the exceptions of the 440 Building and the PB Lab noted previously, the range of concentrations of VOCs were similar in indoor and outdoor air.

6.0 Comparison of Inside Samples to Applicable Exposure Limits

6.1 OCCUPATIONAL EXPOSURE LIMITS

OELs published as OSHA PELs and ACGIH TLVs® are presented in Table 3 for all constituents for which these were available. ACGIH TLVs are health-based values and refer to concentrations of chemicals to which it is believed nearly all workers may be repeatedly exposed, day after day, over a working lifetime, without adverse health effects. The majority of OSHA PELs are based on 1969 TLVs with the exception that some have been updated as chemical-specific standards to reflect more current toxicological data and research (e.g., benzene).

As shown by Table 3, the concentrations of all detected compounds inside the buildings and in outdoor air samples are more than 100 times lower than the lowest OEL (benzene).

6.2 RISK-BASED SCREENING LEVELS

US EPA RSLs and PADEP IAQ criteria concentrations for exposure to constituents in air in industrial settings are presented on Table 3 and discussed briefly below.

6.2.1 US EPA RSLs

US EPA RSLs for carcinogenic chemicals are derived to correspond to an excess lifetime cancer risk of 1 in 1,000,000 (1 in 1 million or 1E-06) for a person (receptor) who is assumed to be exposed to that concentration over an extended period of time (twenty-five (25) years for industrial). The RSL concentrations for cancer health effects (MTBE, benzene, and ethylbenzene) were multiplied by a factor of 10 to correspond to the Pennsylvania target risk of 1 in 100,000 (1 in one hundred thousand or 1E-05). To put the conservatism of the risk-based screening levels for cancer health effects into perspective, between 1 in 4 and 1 in 3 people in the United States develop some type of cancer during their lifetime.

RSLs for chemicals that produce adverse non-cancer effects are concentrations that are very unlikely to produce health effects in people who are exposed over many years. Concentrations of constituents below applicable RSL concentrations are generally not considered to be of concern for public health. Concentrations above RSLs do not necessarily mean that adverse health effects will occur, but do indicate that additional evaluation may be appropriate. All RSL concentrations for non-cancer health effects (toluene, all xylene isomers, cumene and both trimethylbenzene isomers) correspond to a Hazard Quotient (HQ) of 1.0. The HQ is the ratio of the potential exposure to the chemical on a daily basis to the level of exposure at which no non-cancer adverse health effects would be expected to occur. Like the risk-based screening levels for cancer as a health outcome, screening levels for non-cancer health effects are also extremely conservative (protective). No adjustments to non-cancer screening level concentrations were required because both the EPA RSLs and PADEP IAQ criteria were derived to correspond to HQ of 1.0.

6.2.2 PADEP Indoor Air Quality Criteria

Similar to the US EPA RSLs, the PADEP IAQ criteria for evaluating vapor intrusion into non-residential buildings are derived using risk-based algorithms. The concentrations correspond to a target cancer risk of 1E-05 and HQ of 1.0. These values were developed as guidelines for remediation and were published in the Land Recycling Program Technical Guidance Manual (January 24, 2004). For the majority of the compounds found in this investigation, the US EPA RSLs and PADEP IAQ criteria values are similar. The most notable exception is toluene, where the EPA RSL is approximately ten (10) times higher than the PADEP IAQ criteria. It should also be noted that the PADEP criteria were published in 2004 and the EPA RSLs are current as of November 2012.

The PADEP odor thresholds are also shown on Table 3. None of the petroleum-related compounds selected for analysis in indoor or outdoor samples were detected in concentrations approaching or exceeding these published odor thresholds.

6.2.3 Comparison of Results to Risk-Based Screening Levels

As can be seen from Table 3, none of the concentrations of VOCs detected in either samples of indoor air or outdoor air were higher than the corresponding risk-based screening levels for long-term exposure in an industrial setting. The highest concentration of benzene found in the second floor of the PB Lab (11 $\mu g/m^3$) was equal to the PADEP industrial (non-residential) IAQ criteria, but slightly less than the current (November 2012) EPA RSL (16 $\mu g/m^3$) adjusted to a cancer risk of 1E-05.

7.0 Summary and Conclusions

With the exception of the concentrations of all chemicals found in the air of the PB Lab, and for benzene in the 440 Building, the average indoor concentrations of VOCs were similar to the average outdoor concentrations.

The concentrations of all chemicals detected in indoor and outdoor air were several orders of magnitude less than the OSHA PEL TWAs and the ACGIH TLV® TWAs. No concentration of any chemical remotely approached the corresponding odor threshold listed by PADEP.

The maximum concentrations of all chemicals detected in all samples were equal to (benzene in the PB Lab) or less than the corresponding conservative risk-based US EPA RSL and the PADEP IAQ criteria for exposure in industrial environments. Note that the US EPA RSL concentrations for chemicals with cancer health effects (MTBE, benzene, and ethylbenzene) were multiplied by a factor of ten (10) to reflect a target cancer risk of 1 in 100,000 or 1E-05 which is consistent with the Pennsylvania risk-based standards. US EPA RSLs are derived to correspond to a target cancer risk of 1 in 1,000,000 or 1E-06. Non-cancer screening criteria (toluene, xylenes, 1,3,5-TMB and 1,2,4-TMB) correspond to a HQ of 1.0.

In general, the concentrations of petroleum-related VOCs found in the air inside and outside of the buildings were low, considering that the facility is a petroleum refinery. The concentrations of individual VOCs found during this investigation can be put into perspective by comparing the results to regional ambient air concentrations reported by PADEP.

Regional ambient air quality in the Philadelphia area where the refinery is located is best represented by data from the Marcus Hook monitoring station (latitude 39.8178, longitude -75.4142). The table below shows the arithmetic mean indoor and outdoor concentrations of benzene, toluene, ethylbenzene, xylenes (m-, p- isomers), 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene documented at the facility alongside regional outdoor air concentrations from the Marcus Hook monitoring station (PADEP 2003).

Comparison of Concentrations Detected to Regional Air [1)]

Compound	***Facility Results*** [2)]		***Marcus Hook*** [3)]
	Indoors	***Outdoors***	
Benzene	2.9 (±2.45)	2.62 (±1.48)	2.84
Ethylbenzene	1.77 (±1.99)	1.97 (±1.61)	0.91
Toluene	18.77 (±56.76)	7.61 (±5.65)	5.46
Xylenes (m,p)	5.67 (±7.44)	4.86 (±4.59)	2.91
1,3,5-TMB [4)]	1.53 (±1.06)	1.6	0.34
1,2,4-TMB [5)]	1.96 (±1.91)	1.69 (±1.29)	0.88

Footnotes:

1) All concentrations are given in $\mu g/m^3$
2) *Mean (Standard Deviation)* values from Table 3
3) From PADEP 2003
4) 1,3,5-trimethylbenzene
5) 1,2,4-trimethylbenzene

As would be expected, the concentrations of petroleum-related compounds in the outdoor air at the facility were somewhat higher than regional background. However, the average concentrations of benzene in both indoor and outdoor air at the facility were similar to the annual average concentration reported for the Marcus Hook monitoring station in 2000 (PADEP 2003). As discussed previously, the arithmetic mean of the toluene concentrations from all of the indoor air samples is highly influenced by the concentrations detected in the PB Lab.

In conclusion, the findings of this study show that the concentrations of volatile organic compounds associated with refinery operations found in indoor and outdoor air were orders of magnitude lower than occupational exposure standards, and lower than or equal to (benzene only) conservative risk-based screening levels published by US EPA and PADEP for long-term exposures in industrial (non-residential) settings. The concentrations of petroleum-related compounds detected in the air inside occupied buildings on the former Sunoco Philadelphia Refinery are not anticipated to pose an adverse health risk for persons working in those buildings.

8.0 References

Agency for Toxic Substances and Disease Registry (ATSDR), Toxicological Profile for Benzene, August, 2007.

American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances, ACGIH Publication No. 0113, 2013.

Pennsylvania Department of Environmental Protection (PADEP), Bureau of Land Recycling and Land Management, Technical Guidance Manual-Section IV.A.4 Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard. Table 3-Indoor Air Criteria, January 24, 2004.

Pennsylvania Department of Environmental Protection, Southern Delaware County Air Monitoring Project, Third Interim Report. Table 2.3, July 31, 2003. (http://www.dep.state.pa.us/dep/deputate/airwaste/aq/toxics/projects/sdel/sdelrpt3.pdf)

Code of Federal Regulations Chapter 29 Part 1910, Occupational Safety and Health Standards, Subpart Z – Toxic and Hazardous Substances, Table Z-1 Limits for Air Contaminants. (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992)

US EPA Regional Screening Levels Table, November 2012.

US EPA, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition. Compendium Method TO-15. Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/ Mass Spectrometry (GC/MS). January 1999.

FIGURE

SOURCE: BASEMAP PROVIDED BY LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES

LEGEND

- OUTDOOR AIR SAMPLING LOCATION
- AREA OF INTEREST
- BUILDING LOCATION FOR INDOOR AIR SAMPLING

FIGURE 1

SITE PLAN

FOR:

Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA. 19145

0 250 500 FEET

SCALE: AS SHOWN
DATE: 8/28/2013
DRN: TFB
CHD: JLM

TABLES

Table 1: Sample Locations and Parameters - Sunoco Philadelphia Refinery

Sample No.	Location/Description	Date	Start Time	Stop Time	Sample Duration (hr:min)	Canister ID	Regulator ID	Pre-Sample Pressure, (PSI) [1]	Post-Sample Pressure, (PSI) [1]
1	B&S Office	10/24/2012	10:35	14:35	4:00	AC01003	FCA00317	29.5	8.0
2	B&S Office (outside)	10/24/2012	10:37	14:39	4:02	AC00760	FCA00595	29.5	13.0
3	24 Gate Building (1st floor)	10/24/2012	10:50	14:50	4:00	AC01853	FCA00134	29.5	7.0
4	24 Gate Building (2nd floor)	10/24/2012	10:52	14:52	4:00	AC01010	FCA00188	29.6	7.3
5	GP Training Building (1st floor vending area)	10/24/2012	11:07	15:07	4:00	AC01928	FCA00161	29.5	9.0
6	GP Training Building (1st floor west)	10/24/2012	11:10	15:10	4:00	AC01669	FCA00564	29.5	9.0
7	GP Training Building (3rd floor gym)	10/24/2012	11:12	15:13	4:01	AC00641	FCA00023	29.5	6.5
8	GP Training Building (basement)	10/24/2012	11:10	15:16	4:06	AC00747	FCA00604	29.5	7.5
9	GP Main Office Building (basement west)	10/24/2012	12:26	16:26	4:00	AC01113	FCA00575	29.5	7.0
10	GP Main Office Building (basement center)	10/24/2012	12:31	16:31	4:00	AC01436	FCA00521	29.4	10.0
11	GP Main Office Building (basement east)	10/24/2012	12:33	16:33	4:00	AC01376	FCA00349	29.4	8.0
12	GP Main Office Building (1st floor entrance)	10/24/2012	12:36	16:37	4:01	AC00672	FCA00198	29.4	4.8
13	GP Main Office Building (1st floor west)	10/24/2012	12:48	16:48	4:00	AC00475	FCA00402	29.5	3.5
14	GP Main Office Building (2nd floor west)	10/24/2012	12:54	16:54	4:00	AC01263	FCA00516	29.4	9.5
15	GP Main Office Building (2nd floor east)	10/24/2012	12:40	16:40	4:00	AC01145	FCA00374	29.4	6.5
16	GP Main Office Building (outside west)	10/24/2012	12:44	16:44	4:00	AC00782	FCA00298	29.6	0.0
17	440 Building (2nd floor Room 221, inspection)	10/24/2012	13:10	17:10	4:00	AC01215	FCA00365	29.5	8.0
18	440 Building (2nd floor meeting room)	10/24/2012	13:13	17:13	4:00	AC01670	FCA00319	29.6	5.5
19	15 Pump House (inside)	10/24/2012	13:27	17:27	4:00	AC01930	FCA00016	29.5	7.0
20	15 Pump House (under roof w/ pump equipment, approximately 8-10' below grade)	10/24/2012	13:30	17:30	4:00	AC01420	FCA00397	29.5	6.3
21	15 Pump House (outside, at grade)	10/24/2012	13:35	17:35	4:00	AC01464	FCA00034	29.5	3.0
22	North Yard Scale House (inside)	10/24/2012	13:51	17:51	4:00	AC00590	FCA00168	29.5	7.8
23	North Yard Scale House (outside)	10/25/2012	8:17	12:18	4:01	AC01664	FCA00422	29.0	11.0
24	“Trip blank,” regulator attached, unopened	10/25/2012	---	---	---	AC01830	FCA00480	29.4	29.4

Table 1: Sample Locations and Parameters - Sunoco Philadelphia Refinery

Sample No.	Location/Description	Date	Start Time	Stop Time	Sample Duration (hr:min)	Canister ID	Regulator ID	Pre-Sample Pressure, (PSI) [1]	Post-Sample Pressure, (PSI) [1]
25	"Trip blank," regulator attached, unopened	10/25/2012	---	---	---	AC01093	FCA00058	29.5	29.5
26	SRTF Propane Loading (inside)	10/25/2012	8:59	12:59	4:00	AC00540	FCA00482	29.3	8.5
27	SRTF Main Pump House (inside)	10/25/2012	9:07	13:08	4:01	AC01810	FCA00609	29.4	8.0
28	SRTF Main Pump House (outside)	10/25/2012	9:10	13:10	4:00	AC01350	FCA00454	29.5	5.0
29	PB Main Office Building, (safety office)	10/25/2012	8:23	12:23	4:00	AC00716	FCA00239	29.5	0.0
30	PB Main Office Building, (medical area)	10/25/2012	8:29	12:29	4:00	AC00501	FCA00015	29.5	6.0
31	PB Main Office Building, (1st floor lobby)	10/25/2012	8:34	12:34	4:00	AC00765	FCA00303	29.5	5.8
32	PB Main Office Building,(1st floor east wing)	10/25/2012	8:37	12:37	4:00	AC01403	FCA00432	29.5	10.0
33	PB Main Office Building, (1st floor west wing)	10/25/2012	8:41	12:41	4:00	AC01573	FCA00449	29.5	3.0
34	PB Main Office Building, (2nd floor west wing)	10/25/2012	8:44	12:44	4:00	AC00947	FCA00632	29.5	5.0
35	PB Main Office Building, (2nd floor center file room)	10/25/2012	8:48	12:48	4:00	AC00033	FCA00473	29.5	4.0
36	PB Main Office Building, (2nd floor east conference room)	10/25/2012	8:51	12:51	4:00	AC01790	FCA00538	29.5	3.5
37	PB Lab (west lab)	10/25/2012	9:00	13:00	4:00	AC01886	FCA00274	29.5	5.0
38	PB Lab (2nd floor office)	10/25/2012	9:08	13:08	4:00	AC01487	FCA00418	29.5	4.5
39	PB Refinery Hall (2nd floor conference room)	10/25/2012	9:40	13:40	4:00	AC01115	FCA00563	29.6	6.5
40	PB Refinery Hall (2nd floor east wing)	10/25/2012	9:43	13:43	4:00	AC01243	FCA00603	29.4	2.0
41	PB Maintenance Shop (break room)	10/25/2012	9:51	13:51	4:00	AC01218	FCA00405	29.6	9.0
42	PB Maintenance Shop (office)	10/25/2012	9:55	13:55	4:00	AC01179	FCA00040	29.6	4.8
43	PB buildings (adjacent gate area)	10/25/2012	10:00	14:00	4:00	AC00870	FCA00215	29.5	6.0
44	"Trip blank," regulator attached, unopened	10/25/2012	---	---	---	AC00993	FCA00619	29.5	29.5

1. PSI = pounds per square inch

Table 2: Laboratory Analytical Results – Select Volatile Organic Compounds (VOCs) - Sunoco Philadelphia Refinery [1,2,3]

Sample	Type[4]	Location/Description	Methyl Tertiary Butyl Ether (MTBE)	1,2-dichloroethane	Benzene	Toluene	1,2 Dibromoethane	Ethylbenzene	m,p-Xylene	o-Xylene	total Xylene	Cumene	1,3,5-Trimethyl benzene	1,2,4-Trimethyl benzene
1	I	B&S Office	ND[5]	ND	4.3	7.4	ND	1.3	4.5	1.6	6.1	2.1	ND	1.5
3	I	24 Gate Building (1st floor)	ND	ND	2.1	7.0	ND	1.5	4.0	1.5	5.5	1.0	ND	1.7
4	I	24 Gate Building (2nd floor)	ND	ND	1.8	6.8	ND	1.2	3.8	1.4	5.2	ND	ND	1.5
5	I	GP Training Building (1st floor vending area)	ND	ND	3.5	7.2	ND	1.3	3.7	1.4	5.1	1.0	ND	1.6
6	I	GP Training Building (1st floor west)	ND	ND	4.2	7.5	ND	2.2	4.6	1.7	6.3	1.3	ND	1.8
7	I	GP Training Building (3rd floor gym)	ND	ND	4.2	12	ND	1.8	6.3	2.2	8.5	2.0	1.2	4.0
8	I	GP Training Building (basement)	ND	ND	3.1	7.8	ND	1.5	4.9	1.8	6.7	1.5	0.97	3.2
9	I	GP Main Office Building (basement west)	ND	ND	2.3	6.9	ND	1.3	4.2	1.5	5.7	1.4	ND	1.6
10	I	GP Main Office Building (basement center)	ND	ND	2.2	6.9	ND	1.2	3.6	1.3	4.9	1.0	ND	1.3
11	I	GP Main Office Building (basement east)	ND	ND	1.6	6.1	ND	0.86	2.7	1.0	3.7	ND	ND	0.93
12	I	GP Main Office Building (1st floor entrance)	ND	ND	1.7	6.2	ND	0.99	2.9	1.1	4.0	ND	ND	1.0
13	I	GP Main Office Building (1st floor west)	ND	ND	1.5	5.6	ND	0.86	2.6	0.96	3.56	ND	ND	ND
14	I	GP Main Office Building (2nd floor west)	ND	ND	1.6	6	ND	1.1	3.0	1.1	4.1	0.79	ND	1.0
15	I	GP Main Office Building (2nd floor east)	ND	ND	1.9	6.4	ND	1.2	3.4	1.2	4.6	1.0	ND	1.2
17	I	440 Building (2nd floor Room 221, inspection)	ND	ND	9.0	8.3	ND	1.8	4.3	1.5	5.8	2.5	ND	1.3
18	I	440 Building (2nd floor meeting room)	ND	ND	7.2	8.2	ND	0.97	3.2	1.2	4.4	1.9	ND	1.2
19	I	15 Pump House (inside)	ND	ND	3.6	14	ND	2.9	11	3.7	14.7	0.77	1.3	3.3
22	I	North Yard Scale House (inside)	ND	ND	1.7	9.2	ND	1.7	4.6	1.5	6.1	0.85	ND	1.2
26	I	SRTF Propane Loading (inside)	ND	ND	2.1	4.0	ND	0.99	3.8	1.3	5.1	1.1	ND	1.4
27	I	SRTF Main Pump House (inside)	ND	ND	2.3	3.6	ND	ND	3	1.1	4.1	ND	ND	ND
29	I	PB Main Office Building, (safety office)	ND	ND	1.6	6.5	ND	0.95	3.3	1.1	4.4	ND	ND	0.99
30	I	PB Main Office Building, (medical area)	ND	ND	1.2	4.4	ND	ND	2.3	0.87	3.17	ND	ND	1.1
31	I	PB Main Office Building, (1st floor lobby)	ND	ND	1.3	4.8	ND	ND	2.5	0.91	3.41	ND	ND	0.94
32	I	PB Main Office Building,(1st floor east wing)	ND	ND	1.3	5.2	ND	ND	2.5	ND	2.5	ND	ND	ND
33	I	PB Main Office Building, (1st floor west wing)	ND	ND	1.4	5	ND	0.93	3.5	1.1	4.6	ND	ND	0.97
34	I	PB Main Office Building, (2nd floor west wing)	ND	ND	1.3	4.9	ND	0.89	3.3	1.3	4.6	ND	ND	1.1

Table 2: Laboratory Analytical Results – Select Volatile Organic Compounds (VOCs) - Sunoco Philadelphia Refinery [1,2,3]

Sample	Type[4]	Location/Description	Methyl Tertiary Butyl Ether (MTBE)	1,2-dichloroethane	Benzene	Toluene	1,2 Dibromoethane	Ethylbenzene	m,p-Xylene	o-Xylene	total Xylene	Cumene	1,3,5-Trimethyl benzene	1,2,4-Trimethyl benzene
35	I	PB Main Office Building, (2nd floor center file room)	ND	ND	1.2	5.9	ND	1.0	3.7	1.4	5.1	ND	ND	0.95
36	I	PB Main Office Building, (2nd floor east conf. room)	ND	ND	0.94	4.0	ND	0.74	2.5	0.97	3.47	ND	ND	0.78
37	I	PB Lab (west lab)	ND	ND	11	88	ND	11	42	9.1	51.1	1.3	1.4	3.9
38	I	PB Lab (2nd floor office)	ND	ND	8.4	330	ND	6.0	24	7.6	31.6	2.6	3.9	11
39	I	PB Refinery Hall (2nd floor conference room)	0.96	ND	1.4	6.4	ND	1.1	3.9	1.4	5.3	ND	ND	1.1
40	I	PB Refinery Hall (2nd floor east wing)	1.6	ND	2.0	8.8	ND	1.4	5.4	1.8	7.2	ND	ND	1.5
41	I	PB Maintenance Shop (break room)	ND	ND	1.8	9.0	ND	1.3	5.2	1.9	7.1	ND	1.1	3.1
42	I	PB Maintenance Shop (office)	ND	ND	1.7	8.2	ND	1.1	4.6	1.7	6.3	ND	0.87	2.5
2	O	B&S Office (outside)	ND	ND	3.9	6.5	ND	ND	3.7	1.4	5.1	2.0	ND	1.3
16	O	GP Main Office Building (outside west)	ND	ND	1.3	4.6	ND	ND	2.0	ND	2.0	ND	ND	ND
20	O	15 Pump House (under roof w/ pump equipment, approximately 8-10' below grade)	ND	ND	2.1	7.4	ND	0.83	2.8	1.1	3.9	ND	ND	0.92
21	O	15 Pump House (outside, at grade)	ND	ND	4.9	19	ND	3.1	13	4.1	17.1	ND	1.6	3.6
23	O	North Yard Scale House (outside)	ND	ND	ND	3.8	ND	ND	ND	ND	ND	ND	ND	ND
28	O	SRTF Main Pump House (outside)	ND	ND	2.3	2	ND	ND	ND	ND	ND	ND	ND	ND
43	O	PB buildings (adjacent gate area)	ND	ND	1.2	10	ND	ND	2.8	0.99	3.79	ND	ND	0.93
24	TB	"Trip blank" - not opened	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25	TB	"Trip blank" - not opened	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
44	TB	"Trip blank" - not opened	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

1. All units are in micrograms per cubic meter of air (ug/m^3) by volume
2. All samples were analyzed utilizing EPA Method TO-15.
3. Copies of Laboratory Analytical Results are provided as Appendix A.
4. "I"=Indoor air sample; "O"=Outdoor air sample; "TB"= Trip Blank, SUMMA canisters which were not opened, used for QA/QC.
5. "ND"=Non-Detect

Table 3: Summary Statistics – Select Volatile Organic Compounds (VOCs) - Sunoco Philadelphia Refinery [1,2,3]

	Analytes	Methyl Tertiary Butyl Ether (MTBE)	1,2-dichloroethane	Benzene	Toluene	1,2 Dibromoethane	Ethyl benzene	mp-Xylene	o-Xylene	total Xylene	Cumene	1,3,5-Trimethyl benzene	1,2,4-Trimethyl benzene
	Health Effects [4,5]	c	c	c	nc	c	c	nc	nc	nc	nc	nc	nc
Occupational and Risk-Based Screening Criteria													
	OSHA PELs [6]	--	2.02E+05	3.19E+03	7.54E+05	1.54E+05	4.34E+05	4.34E+05	4.34E+05	4.34E+05	2.46E+05	--	--
	ACGIH TLVs® [6]	1.80E+05	4.05E+04	1.60E+03	7.54E+04	--	8.68E+04	4.34E+05	4.34E+05	4.34E+05	2.46E+05	1.23E+05	1.23E+05
	EPA RSLs Industrial [7]	4.70E+02	7.70E+01	1.60E+01	2.20E+04	2.00E-01	4.90E+01	4.40E+02	4.40E+02	4.40E+02	1.80E+03	3.10E+01	3.10E+01
	PADEP IAQ Industrial [8]	3.10E+02	3.10E+00	1.10E+01	1.20E+03	3.70E-01	7.30E+01	3.00E+02	3.00E+02	3.00E+02	1.10E+03	1.70E+01	1.70E+01
	PADEP Odor	1.90E+02	2.40E+04	2.70E+03	6.40E+02	1.92E+05	6.08E+05	2.00E+03	2.00E+03	2.00E+03	6.00E+01	--	--
Summary Statistics for Indoor Samples													
Indoor	Number - total	34	34	34	34	34	34	34	34	34	34	34	34
	Non-Detects	32	34	0	0	34	4	0	1	0	17	27	3
	Detects	2	0	34	34	0	30	34	33	34	17	7	31
	Minimum	0.96	--	0.94	3.6	--	0.74	2.3	0.87	3.17	0.77	0.87	0.78
	Maximum	1.6	--	11	330	--	11	42	9.1	51.1	2.6	3.9	11
	Median	1.28	--	1.85	6.85	--	1.2	3.75	1.4	5.1	1.3	1.2	1.3
	Mean	1.28	--	2.90	18.77	--	1.77	5.67	1.85	7.50	1.42	1.53	1.96
	Std. Deviation	0.45	--	2.45	56.76	--	1.99	7.44	1.76	9.15	0.59	1.06	1.91
Summary Statistics for Outdoor Samples													
Outdoor	Number - total	7	7	7	7	7	7	7	7	7	7	7	7
	Non-Detects	7	7	1	0	7	5	2	3	2	6	6	3
	Detects	0	0	6	7	0	2	5	4	5	1	1	4
	Minimum	.	.	1.2	2	.	0.83	2	0.99	2.85	2	1.6	0.92
	Maximum	.	.	4.9	19	.	3.1	13	4.1	17.1	2	1.6	3.6
	Median	.	.	2.2	6.5	.	1.965	2.8	1.25	3.9	2	1.6	1.115
	Mean	.	.	2.62	7.61	.	1.97	4.86	1.90	6.55	2.00	1.60	1.69
	Std. Deviation	.	.	1.48	5.65	.	1.61	4.59	1.48	5.95	.	.	1.29

1. All units are in micrograms per cubic meter of air (ug/m^3)
2. All samples were analyzed utilizing EPA Method TO-15.
3. VOCs were not detected in any of the three "Trip Blank" SUMMA canisters.
4. "c" – EPA classifies as Carcinogen
5. "nc" – EPA classifies as Non-Carcinogen.
6. Occupational Safety and Health Permissible Exposure Limits (OSHA PELs) and American Conference of Industrial Hygienists Threshold Limit Values (TLVs®) were converted from parts per billion (ppb) to ug/m^3 using the following formula: ug/m^3=(ppb*MW)/24.45.
7. US EPA Regional Screening Levels, November 2012, adjusted to 1E-05 for carcinogens; HI of 1.0 for non-carcinogens.
8. Pennsylvania Department of Environmental Protection (PADEP), Bureau of Land Recycling and Land Management, Technical Guidance Manual-Section IV.A.4 Vapor Intrusion into buildings from Groundwater and Soil under the Act 2 Statewide Health Standard. January 24, 2004 (Table 3-Indoor Air Criteria).

APPENDIX A

Columbia Analytical Services INC
Now part of the ALS Group

2655 Park Center Drive, Suite A, Simi Valley, CA 93065 | 805.526.7161 | www.caslab.com

LABORATORY REPORT

November 8, 2012

John Reiter
Stantec Consulting Services, Inc.
12075 Corporate Pkwy, Ste. 200
Mequon, WI 53092

RE: Sunoco IH Air Testing / 213402094

Dear John:

Enclosed are the results of the samples submitted to our laboratory on October 31, 2012. For your reference, these analyses have been assigned our service request number P1204493.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA01527Z012-Z; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Samantha Henningsen
Project Manager

Client:	Stantec Consulting Services, Inc.	Service Request No:	P1204493
Project:	Sunoco IH Air Testing / 213402094		

CASE NARRATIVE

The samples were received intact under chain of custody on October 31, 2012 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Volatile Organic Compound Analysis

The samples were analyzed for selected volatile organic compounds in accordance with EPA Method TO-15 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition (EPA/625/R-96/010b), January, 1999. The analytical system was comprised of a gas chromatograph / mass spectrometer (GC/MS) interfaced to a whole-air preconcentrator.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

DETAIL SUMMARY REPORT

Client: Stantec Consulting Services, Inc. Service Request: P1204493
Project ID: Sunoco IH Air Testing / 213402094

Date Received: 10/31/2012
Time Received: 09:10

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pf1 (psig)	TO-15 - VOC Cans
Sample 1	P1204493-001	Air	10/24/2012	14:35	AC01003	-3.85	3.67	X
Sample 2	P1204493-002	Air	10/24/2012	14:39	AC00760	-6.54	3.79	X
Sample 3	P1204493-003	Air	10/24/2012	14:50	AC01853	-3.60	3.61	X
Sample 4	P1204493-004	Air	10/24/2012	14:52	AC01010	-3.29	3.63	X
Sample 5	P1204493-005	Air	10/24/2012	15:07	AC01928	-3.21	3.60	X
Sample 6	P1204493-006	Air	10/24/2012	15:10	AC01669	-4.20	3.70	X
Sample 7	P1204493-007	Air	10/24/2012	15:13	AC00641	-3.08	3.75	X
Sample 8	P1204493-008	Air	10/24/2012	15:16	AC00747	-3.67	3.78	X
Sample 9	P1204493-009	Air	10/24/2012	16:26	AC01113	-3.10	3.67	X
Sample 10	P1204493-010	Air	10/24/2012	16:31	AC01436	-5.08	3.56	X
Sample 11	P1204493-011	Air	10/24/2012	16:33	AC01376	-3.84	3.74	X
Sample 12	P1204493-012	Air	10/24/2012	16:37	AC00672	-2.29	3.58	X
Sample 13	P1204493-013	Air	10/24/2012	16:40	AC01145	-4.00	3.75	X
Sample 14	P1204493-014	Air	10/24/2012	16:44	AC00782	0.31	3.62	X
Sample 15	P1204493-015	Air	10/24/2012	16:48	AC00475	-1.47	3.55	X
Sample 16	P1204493-016	Air	10/24/2012	16:54	AC01263	-3.77	3.76	X
Sample 17	P1204493-017	Air	10/24/2012	17:10	AC01215	-2.97	3.72	X
Sample 18	P1204493-018	Air	10/24/2012	17:13	AC01670	-2.52	3.64	X
Sample 19	P1204493-019	Air	10/24/2012	17:27	AC01930	-2.75	3.57	X
Sample 20	P1204493-020	Air	10/24/2012	17:30	AC01420	-3.07	3.72	X
Sample 21	P1204493-021	Air	10/24/2012	17:35	AC01464	-1.69	3.65	X
Sample 22	P1204493-022	Air	10/24/2012	17:51	AC00590	-2.29	3.77	X
Sample 24 TB	P1204493-023	Air	10/24/2012	00:00	AC01830	-14.50	3.68	X

Columbia Analytical Services
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No. P1204493

CAS Contact:

Company Name & Address (Reporting Information): Stantec, 12075 Corporate Pkwy, Mequon, WI 53092

Project Name: Sunoco IH AirTesting

Project Number: 213402094

Project Manager: John Reiter

P.O. # / Billing Information: John Reiter

Phone: 262-643-9154

Fax: 262-241-4901

Email Address for Result Reporting: John.Reiter@Stantec.com

Sampler (Print & Sign):

Analysis Method

Comments e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume			Comments
Sample 1	1 -3.59	10/24/12	10:35 14:35	AC01003	FCA00317	29.5	8				
Sample 2	2 -6.55	10/24/12	10:37 14:39	AC00760	FCA00595	29.5	13.0				
Sample 3	3 -3.63	10/24/12	10:50 14:50	AC01853	FCA00134	29.5	7.0				
Sample 4	4 -3.33	10/24/12	10:53 14:53	AC01010	FCA00188	29.6	7.25				
Sample 5	5 -3.19	10/24/12	11:07 15:07	AC01928	FCA00161	29.5	9.0				
Sample 6	6 -4.21	10/24/12	11:10 15:10	AC01689	FCA00564	29.5	9.0				
Sample 7	7 -3.07	10/24/12	11:13 15:13	AC00641	FCA00023	29.5	6.5				
Sample 8	8 -3.67	10/24/12	11:16 15:16	AC00747	FCA00604	29.5	7.5				
Sample 9	9 -3.14	10/24/12	12:26 16:26	AC01113	FCA00575	29.5	7.0				
Sample 10	10 -5.11	10/24/12	12:31 16:31	AC01436	FCA00521	29.4	10.0				
Sample 11	11 -3.87	10/24/12	12:33 16:33	AC01376	FCA00349	29.4	8.0				
Sample 12	12 -2.33	10/24/12	12:36 16:37	AC00672	FCA00198	29.4	4.75				
Sample 13	13 -4.03	10/24/12	12:40 16:40	AC01145	FCA00374	29.4	6.5				
Sample 14	14 +0.25	10/24/12	12:44 16:44	AC00782	FCA00298	29.6	0.0				

Report Tier Levels - please select
Tier I - Results (Default if not specified) ____
Tier II (Results + QC Summaries) ____
Tier III (Results + QC & Calibration Summaries) ____
Tier IV (Data Validation Package) 10% Surcharge ____

EDD required Yes / No
Type: ________

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Date	Time
[signature]	10/24/12	18:30	[signature]	10/26/12	0910
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ___ °C

COC AIR REV 3.11

Columbia Analytical Services
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No. P1204443
CAS Contact:

Company Name & Address (Reporting Information): Stantec, 12075 Corporate Pkwy, Mequon, WI 53092
Project Name: Sunoco IH Air Testing
Project Number: 213402094
Project Manager: John Reiter
P.O. # / Billing Information: John Reiter
Phone: 262-643-9154
Fax: 262-241-4901
Email Address for Result Reporting: John.reiter@stantec.com
Sampler (Print & Sign): Richard Page

Analysis Method

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume	Analysis Method		Comments e.g. Actual Preservative or specific instructions
Sample 15	15 -1.53	10/24/12	12:48 16:48	AC00475	FCA00402	29.5	3.5				
Sample 16	16 -3.82	10/24/12	12:59 16:59	AC01263	FCA00516	29.4	9.5				
Sample 17	17 -3.04	10/24/12	13:10 17:10	AC01215	FCA00365	29.5	8.0				
Sample 18	18 -2.63	10/24/12	13:13 17:13	AC01670	FCA00319	29.6	5.5				
Sample 19	19 -2.77	10/24/12	13:27 17:27	AC01930	FCA00016	29.5	7.0				
Sample 20	20 -3.14	10/24/12	13:38 17:38	AC01420	FCA00397	29.5	6.25				
Sample 21	21 -1.78	10/24/12	13:35 17:35	AC01464	FCA00034	29.5	3.0				
Sample 22	22 -2.39	10/24/12	13:51 17:51	AC00590	FCA00168	29.8	7.75				
~~Sample 23~~		~~10/24/12~~	~~13:54~~	~~AC01664~~	~~FCA00422~~	~~29.5~~					Not Collected
Sample 24TB	23 -14.47	10/24/12	—	AC01830	—	29.4	29.4				

Report Tier Levels - please select
Tier I - Results (Default if not specified) ____
Tier II (Results + QC Summaries) ____
Tier III (Results + QC & Calibration Summaries) ____
Tier IV (Data Validation Package) 10% Surcharge ____

EDD required Yes / No
Type: ____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
[signature]	10/24/12	18:30	[signature]	10/26/12	0910
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank Temperature ____ °C

COC AIR REV 3-11

Sample Acceptance Check Form

Client: Stantec Consulting Services, Inc. Work order: P1204493

Project: Sunoco IH Air Testing / 213402094

Sample(s) received on: 10/31/12 Date opened: 10/31/12 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

#	Question	Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Container(s) **supplied by CAS**?	☒	☐	☐
3	Did **sample containers** arrive in good condition?	☒	☐	☐
4	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
5	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
6	Was **sample volume** received adequate for analysis?	☒	☐	☐
7	Are samples within specified holding times?	☒	☐	☐
8	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☐	☐	☒
9	Was a **trip blank** received?	☐	☒	☐
10	Were **custody seals** on outside of cooler/Box?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
	Were custody seals on outside of sample container?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
11	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were **VOA vials** checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
12	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
	Do they contain moisture?	☐	☐	☒
13	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204493-001.01	6.0 L Ambient Can					
P1204493-002.01	6.0 L Ambient Can					
P1204493-003.01	6.0 L Ambient Can					
P1204493-004.01	6.0 L Ambient Can					
P1204493-005.01	6.0 L Ambient Can					
P1204493-006.01	6.0 L Ambient Can					
P1204493-007.01	6.0 L Ambient Can					
P1204493-008.01	6.0 L Ambient Can					

Explain any discrepancies: (include lab sample ID numbers): ______

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

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Sample Acceptance Check Form

Client: Stantec Consulting Services, Inc. Work order: P1204493
Project: Sunoco IH Air Testing / 213402094
Sample(s) received on: 10/31/12 Date opened: 10/31/12 by: MZAMORA

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204493-009.01	6.0 L Ambient Can					
P1204493-010.01	6.0 L Ambient Can					
P1204493-011.01	6.0 L Ambient Can					
P1204493-012.01	6.0 L Ambient Can					
P1204493-013.01	6.0 L Ambient Can					
P1204493-014.01	6.0 L Ambient Can					
P1204493-015.01	6.0 L Ambient Can					
P1204493-016.01	6.0 L Ambient Can					
P1204493-017.01	6.0 L Ambient Can					
P1204493-018.01	6.0 L Ambient Can					
P1204493-019.01	6.0 L Ambient Can					
P1204493-020.01	6.0 L Ambient Can					
P1204493-021.01	6.0 L Ambient Can					
P1204493-022.01	6.0 L Ambient Can					
P1204493-023.01	6.0 L Ambient Can					

Explain any discrepancies: (include lab sample ID numbers):

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 1** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-001

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01003

Initial Pressure (psig): -3.85 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.69

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.85	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.85	ND	0.21	
71-43-2	Benzene	**4.3**	0.85	**1.3**	0.26	
108-88-3	Toluene	**7.4**	0.85	**2.0**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.85	ND	0.11	
100-41-4	Ethylbenzene	**1.3**	0.85	**0.31**	0.19	
179601-23-1	m,p-Xylenes	**4.5**	1.7	**1.0**	0.39	
95-47-6	o-Xylene	**1.6**	0.85	**0.37**	0.19	
98-82-8	Cumene	**2.1**	0.85	**0.43**	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.85	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	**1.5**	0.85	**0.30**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 2**
Client Project ID: **Sunoco IH Air Testing / 213402094**

CAS Project ID: P1204493
CAS Sample ID: P1204493-002

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister
Test Notes:
Container ID: AC00760

Date Collected: 10/24/12
Date Received: 10/31/12
Date Analyzed: 11/3/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -6.54 Final Pressure (psig): 3.79

Canister Dilution Factor: 2.27

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	1.1	ND	0.31	
107-06-2	1,2-Dichloroethane	ND	1.1	ND	0.28	
71-43-2	Benzene	**3.9**	1.1	**1.2**	0.36	
108-88-3	Toluene	**6.5**	1.1	**1.7**	0.30	
106-93-4	1,2-Dibromoethane	ND	1.1	ND	0.15	
100-41-4	Ethylbenzene	ND	1.1	ND	0.26	
179601-23-1	m,p-Xylenes	**3.7**	2.3	**0.86**	0.52	
95-47-6	o-Xylene	**1.4**	1.1	**0.32**	0.26	
98-82-8	Cumene	**2.0**	1.1	**0.40**	0.23	
108-67-8	1,3,5-Trimethylbenzene	ND	1.1	ND	0.23	
95-63-6	1,2,4-Trimethylbenzene	**1.3**	1.1	**0.26**	0.23	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 3**	CAS Project ID:	P1204493
Client Project ID:	**Sunoco IH Air Testing / 213402094**	CAS Sample ID:	P1204493-003
Test Code:	EPA TO-15	Date Collected:	10/24/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9	Date Received:	10/31/12
Analyst:	Wida Ang	Date Analyzed:	11/3/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01853		

Initial Pressure (psig): -3.60 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.65

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.83	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.83	ND	0.20	
71-43-2	Benzene	**2.1**	0.83	**0.66**	0.26	
108-88-3	Toluene	**7.0**	0.83	**1.9**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.83	ND	0.11	
100-41-4	Ethylbenzene	**1.5**	0.83	**0.35**	0.19	
179601-23-1	m,p-Xylenes	**4.0**	1.7	**0.93**	0.38	
95-47-6	o-Xylene	**1.5**	0.83	**0.35**	0.19	
98-82-8	Cumene	**1.0**	0.83	**0.21**	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.83	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	**1.7**	0.83	**0.35**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 4** — CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** — CAS Sample ID: P1204493-004

Test Code: EPA TO-15 — Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 — Date Received: 10/31/12
Analyst: Wida Ang — Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01010

Initial Pressure (psig): -3.29   Final Pressure (psig): 3.63

Canister Dilution Factor: 1.61

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.81	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.81	ND	0.20	
71-43-2	Benzene	**1.8**	0.81	**0.56**	0.25	
108-88-3	Toluene	**6.8**	0.81	**1.8**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.81	ND	0.10	
100-41-4	Ethylbenzene	**1.2**	0.81	**0.28**	0.19	
179601-23-1	m,p-Xylenes	**3.8**	1.6	**0.88**	0.37	
95-47-6	o-Xylene	**1.4**	0.81	**0.33**	0.19	
98-82-8	Cumene	ND	0.81	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.81	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.5**	0.81	**0.31**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 5** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-005

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01928

Initial Pressure (psig): -3.21 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.59

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.80	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.80	ND	0.20	
71-43-2	Benzene	**3.5**	0.80	**1.1**	0.25	
108-88-3	Toluene	**7.2**	0.80	**1.9**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.80	ND	0.10	
100-41-4	Ethylbenzene	**1.3**	0.80	**0.31**	0.18	
179601-23-1	m,p-Xylenes	**3.7**	1.6	**0.86**	0.37	
95-47-6	o-Xylene	**1.4**	0.80	**0.32**	0.18	
98-82-8	Cumene	**1.0**	0.80	**0.21**	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.80	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.6**	0.80	**0.33**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 6** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-006

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01669

Initial Pressure (psig): -4.20 Final Pressure (psig): 3.70

Canister Dilution Factor: 1.75

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.88	ND	0.24	
107-06-2	1,2-Dichloroethane	ND	0.88	ND	0.22	
71-43-2	Benzene	**4.2**	0.88	**1.3**	0.27	
108-88-3	Toluene	**7.5**	0.88	**2.0**	0.23	
106-93-4	1,2-Dibromoethane	ND	0.88	ND	0.11	
100-41-4	Ethylbenzene	**2.2**	0.88	**0.50**	0.20	
179601-23-1	m,p-Xylenes	**4.6**	1.8	**1.1**	0.40	
95-47-6	o-Xylene	**1.7**	0.88	**0.38**	0.20	
98-82-8	Cumene	**1.3**	0.88	**0.26**	0.18	
108-67-8	1,3,5-Trimethylbenzene	ND	0.88	ND	0.18	
95-63-6	1,2,4-Trimethylbenzene	**1.8**	0.88	**0.37**	0.18	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 7** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-007

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00641

Initial Pressure (psig): -3.08 Final Pressure (psig): 3.75

Canister Dilution Factor: 1.59

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.80	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.80	ND	0.20	
71-43-2	Benzene	**4.2**	0.80	**1.3**	0.25	
108-88-3	Toluene	**12**	0.80	**3.1**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.80	ND	0.10	
100-41-4	Ethylbenzene	**1.8**	0.80	**0.41**	0.18	
179601-23-1	m,p-Xylenes	**6.3**	1.6	**1.4**	0.37	
95-47-6	o-Xylene	**2.2**	0.80	**0.51**	0.18	
98-82-8	Cumene	**2.0**	0.80	**0.41**	0.16	
108-67-8	1,3,5-Trimethylbenzene	**1.2**	0.80	**0.25**	0.16	
95-63-6	1,2,4-Trimethylbenzene	**4.0**	0.80	**0.82**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 8** — CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** — CAS Sample ID: P1204493-008

Test Code: EPA TO-15 — Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 — Date Received: 10/31/12
Analyst: Wida Ang — Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00747

Initial Pressure (psig): -3.67 Final Pressure (psig): 3.78

Canister Dilution Factor: 1.68

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.84	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.84	ND	0.21	
71-43-2	Benzene	**3.1**	0.84	**0.97**	0.26	
108-88-3	Toluene	**7.8**	0.84	**2.1**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.84	ND	0.11	
100-41-4	Ethylbenzene	**1.5**	0.84	**0.34**	0.19	
179601-23-1	m,p-Xylenes	**4.9**	1.7	**1.1**	0.39	
95-47-6	o-Xylene	**1.8**	0.84	**0.42**	0.19	
98-82-8	Cumene	**1.5**	0.84	**0.30**	0.17	
108-67-8	1,3,5-Trimethylbenzene	**0.97**	0.84	**0.20**	0.17	
95-63-6	1,2,4-Trimethylbenzene	**3.2**	0.84	**0.65**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 9** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-009

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01113

Initial Pressure (psig): -3.10 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.58

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.20	
71-43-2	Benzene	**2.3**	0.79	**0.72**	0.25	
108-88-3	Toluene	**6.9**	0.79	**1.8**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**1.3**	0.79	**0.29**	0.18	
179601-23-1	m,p-Xylenes	**4.2**	1.6	**0.97**	0.36	
95-47-6	o-Xylene	**1.5**	0.79	**0.36**	0.18	
98-82-8	Cumene	**1.4**	0.79	**0.28**	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.79	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.6**	0.79	**0.32**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 10** — CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** — CAS Sample ID: P1204493-010

Test Code: EPA TO-15 — Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 — Date Received: 10/31/12
Analyst: Wida Ang — Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01436

Initial Pressure (psig): -5.08 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.90

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.95	ND	0.26	
107-06-2	1,2-Dichloroethane	ND	0.95	ND	0.23	
71-43-2	Benzene	**2.2**	0.95	**0.69**	0.30	
108-88-3	Toluene	**6.9**	0.95	**1.8**	0.25	
106-93-4	1,2-Dibromoethane	ND	0.95	ND	0.12	
100-41-4	Ethylbenzene	**1.2**	0.95	**0.27**	0.22	
179601-23-1	m,p-Xylenes	**3.6**	1.9	**0.83**	0.44	
95-47-6	o-Xylene	**1.3**	0.95	**0.31**	0.22	
98-82-8	Cumene	**1.0**	0.95	**0.20**	0.19	
108-67-8	1,3,5-Trimethylbenzene	ND	0.95	ND	0.19	
95-63-6	1,2,4-Trimethylbenzene	**1.3**	0.95	**0.26**	0.19	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 11** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-011

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01376

Initial Pressure (psig): -3.84 Final Pressure (psig): 3.74

Canister Dilution Factor: 1.70

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.85	ND	0.24	
107-06-2	1,2-Dichloroethane	ND	0.85	ND	0.21	
71-43-2	Benzene	**1.6**	0.85	**0.50**	0.27	
108-88-3	Toluene	**6.1**	0.85	**1.6**	0.23	
106-93-4	1,2-Dibromoethane	ND	0.85	ND	0.11	
100-41-4	Ethylbenzene	**0.86**	0.85	**0.20**	0.20	
179601-23-1	m,p-Xylenes	**2.7**	1.7	**0.63**	0.39	
95-47-6	o-Xylene	**1.0**	0.85	**0.24**	0.20	
98-82-8	Cumene	ND	0.85	ND	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.85	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	**0.93**	0.85	**0.19**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 12** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-012

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00672

Initial Pressure (psig): -2.29 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.47

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.74	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	0.74	ND	0.18	
71-43-2	Benzene	**1.7**	0.74	**0.54**	0.23	
108-88-3	Toluene	**6.2**	0.74	**1.6**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.74	ND	0.096	
100-41-4	Ethylbenzene	**0.99**	0.74	**0.23**	0.17	
179601-23-1	m,p-Xylenes	**2.9**	1.5	**0.67**	0.34	
95-47-6	o-Xylene	**1.1**	0.74	**0.25**	0.17	
98-82-8	Cumene	ND	0.74	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.74	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**1.0**	0.74	**0.21**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 13**	CAS Project ID:	P1204493
Client Project ID:	**Sunoco IH Air Testing / 213402094**	CAS Sample ID:	P1204493-013
Test Code:	EPA TO-15	Date Collected:	10/24/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9	Date Received:	10/31/12
Analyst:	Wida Ang	Date Analyzed:	11/6/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01145		

Initial Pressure (psig): -4.00 Final Pressure (psig): 3.75

Canister Dilution Factor: 1.72

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.86	ND	0.24	
107-06-2	1,2-Dichloroethane	ND	0.86	ND	0.21	
71-43-2	Benzene	**1.5**	0.86	**0.47**	0.27	
108-88-3	Toluene	**5.6**	0.86	**1.5**	0.23	
106-93-4	1,2-Dibromoethane	ND	0.86	ND	0.11	
100-41-4	Ethylbenzene	**0.86**	0.86	**0.20**	0.20	
179601-23-1	m,p-Xylenes	**2.6**	1.7	**0.60**	0.40	
95-47-6	o-Xylene	**0.96**	0.86	**0.22**	0.20	
98-82-8	Cumene	ND	0.86	ND	0.18	
108-67-8	1,3,5-Trimethylbenzene	ND	0.86	ND	0.18	
95-63-6	1,2,4-Trimethylbenzene	ND	0.86	ND	0.18	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 14** — CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** — CAS Sample ID: P1204493-014

Test Code: EPA TO-15 — Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 — Date Received: 10/31/12
Analyst: Wida Ang — Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00782

Initial Pressure (psig): 0.31 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.22

CAS #	Compound	Result μg/m³	MRL μg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.61	ND	0.17	
107-06-2	1,2-Dichloroethane	ND	0.61	ND	0.15	
71-43-2	Benzene	**1.6**	0.61	**0.51**	0.19	
108-88-3	Toluene	**6.0**	0.61	**1.6**	0.16	
106-93-4	1,2-Dibromoethane	ND	0.61	ND	0.079	
100-41-4	Ethylbenzene	**1.1**	0.61	**0.26**	0.14	
179601-23-1	m,p-Xylenes	**3.0**	1.2	**0.70**	0.28	
95-47-6	o-Xylene	**1.1**	0.61	**0.26**	0.14	
98-82-8	Cumene	**0.79**	0.61	**0.16**	0.12	
108-67-8	1,3,5-Trimethylbenzene	ND	0.61	ND	0.12	
95-63-6	1,2,4-Trimethylbenzene	**1.0**	0.61	**0.20**	0.12	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 15** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-015

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00475

Initial Pressure (psig): -1.47 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.69	ND	0.19	
107-06-2	1,2-Dichloroethane	ND	0.69	ND	0.17	
71-43-2	Benzene	**1.9**	0.69	**0.61**	0.22	
108-88-3	Toluene	**6.4**	0.69	**1.7**	0.18	
106-93-4	1,2-Dibromoethane	ND	0.69	ND	0.090	
100-41-4	Ethylbenzene	**1.2**	0.69	**0.28**	0.16	
179601-23-1	m,p-Xylenes	**3.4**	1.4	**0.78**	0.32	
95-47-6	o-Xylene	**1.2**	0.69	**0.29**	0.16	
98-82-8	Cumene	**1.0**	0.69	**0.21**	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.69	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	**1.2**	0.69	**0.25**	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 16** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-016

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01263

Initial Pressure (psig): -3.77 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.69

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.85	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.85	ND	0.21	
71-43-2	Benzene	**1.3**	0.85	**0.42**	0.26	
108-88-3	Toluene	**4.6**	0.85	**1.2**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.85	ND	0.11	
100-41-4	Ethylbenzene	ND	0.85	ND	0.19	
179601-23-1	m,p-Xylenes	**2.0**	1.7	**0.46**	0.39	
95-47-6	o-Xylene	ND	0.85	ND	0.19	
98-82-8	Cumene	ND	0.85	ND	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.85	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	ND	0.85	ND	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 17** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-017

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01215

Initial Pressure (psig): -2.97 Final Pressure (psig): 3.72

Canister Dilution Factor: 1.57

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.19	
71-43-2	Benzene	**9.0**	0.79	**2.8**	0.25	
108-88-3	Toluene	**8.3**	0.79	**2.2**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**1.8**	0.79	**0.41**	0.18	
179601-23-1	m,p-Xylenes	**4.3**	1.6	**0.98**	0.36	
95-47-6	o-Xylene	**1.5**	0.79	**0.34**	0.18	
98-82-8	Cumene	**2.5**	0.79	**0.50**	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.79	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.3**	0.79	**0.25**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 18** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-018

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister
Test Notes:
Container ID: AC01670

Date Collected: 10/24/12
Date Received: 10/31/12
Date Analyzed: 11/5/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.52 Final Pressure (psig): 3.64

Canister Dilution Factor: 1.51

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.76	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.76	ND	0.19	
71-43-2	Benzene	**7.2**	0.76	**2.2**	0.24	
108-88-3	Toluene	**8.2**	0.76	**2.2**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.76	ND	0.098	
100-41-4	Ethylbenzene	**0.97**	0.76	**0.22**	0.17	
179601-23-1	m,p-Xylenes	**3.2**	1.5	**0.75**	0.35	
95-47-6	o-Xylene	**1.2**	0.76	**0.28**	0.17	
98-82-8	Cumene	**1.9**	0.76	**0.39**	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.76	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**1.2**	0.76	**0.24**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 19** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-019

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01930

Initial Pressure (psig): -2.75 Final Pressure (psig): 3.57

Canister Dilution Factor: 1.53

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.77	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.77	ND	0.19	
71-43-2	Benzene	**3.6**	0.77	**1.1**	0.24	
108-88-3	Toluene	**14**	0.77	**3.6**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.77	ND	0.10	
100-41-4	Ethylbenzene	**2.9**	0.77	**0.66**	0.18	
179601-23-1	m,p-Xylenes	**11**	1.5	**2.6**	0.35	
95-47-6	o-Xylene	**3.7**	0.77	**0.85**	0.18	
98-82-8	Cumene	**0.77**	0.77	**0.16**	0.16	
108-67-8	1,3,5-Trimethylbenzene	**1.3**	0.77	**0.27**	0.16	
95-63-6	1,2,4-Trimethylbenzene	**3.3**	0.77	**0.68**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 20**	CAS Project ID:	P1204493
Client Project ID:	**Sunoco IH Air Testing / 213402094**	CAS Sample ID:	P1204493-020

Test Code:	EPA TO-15	Date Collected:	10/24/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9	Date Received:	10/31/12
Analyst:	Wida Ang	Date Analyzed:	11/6/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01420		

Initial Pressure (psig): -3.07 Final Pressure (psig): 3.72

Canister Dilution Factor: 1.58

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.20	
71-43-2	Benzene	**2.1**	0.79	**0.65**	0.25	
108-88-3	Toluene	**7.4**	0.79	**2.0**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**0.83**	0.79	**0.19**	0.18	
179601-23-1	m,p-Xylenes	**2.8**	1.6	**0.65**	0.36	
95-47-6	o-Xylene	**1.1**	0.79	**0.24**	0.18	
98-82-8	Cumene	ND	0.79	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.79	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**0.92**	0.79	**0.19**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 21**	CAS Project ID:	P1204493
Client Project ID:	**Sunoco IH Air Testing / 213402094**	CAS Sample ID:	P1204493-021
Test Code:	EPA TO-15	Date Collected:	10/24/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9	Date Received:	10/31/12
Analyst:	Wida Ang	Date Analyzed:	11/5/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01464		

Initial Pressure (psig): -1.69 Final Pressure (psig): 3.65

Canister Dilution Factor: 1.41

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.71	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	0.71	ND	0.17	
71-43-2	Benzene	**4.9**	0.71	**1.5**	0.22	
108-88-3	Toluene	**19**	0.71	**5.0**	0.19	
106-93-4	1,2-Dibromoethane	ND	0.71	ND	0.092	
100-41-4	Ethylbenzene	**3.1**	0.71	**0.70**	0.16	
179601-23-1	m,p-Xylenes	**13**	1.4	**3.0**	0.32	
95-47-6	o-Xylene	**4.1**	0.71	**0.94**	0.16	
98-82-8	Cumene	ND	0.71	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	**1.6**	0.71	**0.33**	0.14	
95-63-6	1,2,4-Trimethylbenzene	**3.6**	0.71	**0.74**	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 22** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-022

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00590

Initial Pressure (psig): -2.29 Final Pressure (psig): 3.77

Canister Dilution Factor: 1.49

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.75	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.75	ND	0.18	
71-43-2	Benzene	**1.7**	0.75	**0.53**	0.23	
108-88-3	Toluene	**9.2**	0.75	**2.4**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.75	ND	0.097	
100-41-4	Ethylbenzene	**1.7**	0.75	**0.39**	0.17	
179601-23-1	m,p-Xylenes	**4.6**	1.5	**1.1**	0.34	
95-47-6	o-Xylene	**1.5**	0.75	**0.34**	0.17	
98-82-8	Cumene	**0.85**	0.75	**0.17**	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.75	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**1.2**	0.75	**0.24**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 24 TB** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-023

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01830

Canister Dilution Factor: 1.00

CAS #	**Compound**	**Result µg/m³**	MRL µg/m³	**Result ppbV**	MRL ppbV	**Data Qualifier**
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121103-MB

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:

Canister Dilution Factor: 1.00

CAS #	Compound	Result $\mu g/m^3$	MRL $\mu g/m^3$	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121105-MB

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:

Canister Dilution Factor: 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121106-MB

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/6/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:

Canister Dilution Factor: 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

SURROGATE SPIKE RECOVERY RESULTS

Client: **Stantec Consulting Services, Inc.**
Client Project ID: **Sunoco IH Air Testing / 213402094**
CAS Project ID: P1204493

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 10/24/12
Date(s) Received: 10/31/12
Date(s) Analyzed: 11/3 - 11/6/12

Client Sample ID	CAS Sample ID	1,2-Dichloroethane-d4 Percent Recovered	Toluene-d8 Percent Recovered	Bromofluorobenzene Percent Recovered	Acceptance Limits	Data Qualifier
Method Blank	P121103-MB	**97**	**98**	**102**	70-130	
Method Blank	P121105-MB	**96**	**102**	**104**	70-130	
Method Blank	P121106-MB	**94**	**100**	**106**	70-130	
Lab Control Sample	P121103-LCS	**99**	**101**	**104**	70-130	
Lab Control Sample	P121105-LCS	**97**	**98**	**106**	70-130	
Lab Control Sample	P121106-LCS	**97**	**100**	**108**	70-130	
Sample 1	P1204493-001	**97**	**99**	**104**	70-130	
Sample 2	P1204493-002	**101**	**98**	**102**	70-130	
Sample 3	P1204493-003	**100**	**98**	**104**	70-130	
Sample 3	P1204493-003DUP	**98**	**95**	**103**	70-130	
Sample 4	P1204493-004	**102**	**96**	**105**	70-130	
Sample 5	P1204493-005	**97**	**98**	**106**	70-130	
Sample 6	P1204493-006	**98**	**98**	**105**	70-130	
Sample 7	P1204493-007	**98**	**96**	**107**	70-130	
Sample 8	P1204493-008	**96**	**100**	**108**	70-130	
Sample 9	P1204493-009	**99**	**98**	**107**	70-130	
Sample 10	P1204493-010	**97**	**100**	**105**	70-130	
Sample 11	P1204493-011	**98**	**98**	**106**	70-130	
Sample 12	P1204493-012	**95**	**101**	**106**	70-130	
Sample 13	P1204493-013	**96**	**97**	**107**	70-130	
Sample 14	P1204493-014	**96**	**101**	**107**	70-130	
Sample 15	P1204493-015	**97**	**100**	**103**	70-130	
Sample 15	P1204493-015DUP	**94**	**104**	**110**	70-130	
Sample 16	P1204493-016	**97**	**97**	**105**	70-130	
Sample 17	P1204493-017	**99**	**98**	**109**	70-130	
Sample 18	P1204493-018	**96**	**100**	**106**	70-130	
Sample 19	P1204493-019	**96**	**101**	**107**	70-130	
Sample 20	P1204493-020	**95**	**101**	**108**	70-130	
Sample 21	P1204493-021	**98**	**98**	**102**	70-130	
Sample 22	P1204493-022	**97**	**99**	**100**	70-130	
Sample 24 TB	P1204493-023	**94**	**105**	**103**	70-130	

Surrogate percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly from the on-column percent recovery.

LABORATORY CONTROL SAMPLE SUMMARY

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Lab Control Sample** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121103-LCS

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/03/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 0.125 Liter(s)
Test Notes:

CAS #	**Compound**	Spike Amount µg/m³	**Result µg/m³**	**% Recovery**	CAS Acceptance Limits	**Data Qualifier**
1634-04-4	Methyl tert-Butyl Ether	204	**231**	**113**	67-116	
107-06-2	1,2-Dichloroethane	208	**220**	**106**	70-118	
71-43-2	Benzene	208	**214**	**103**	66-121	
108-88-3	Toluene	208	**211**	**101**	67-111	
106-93-4	1,2-Dibromoethane	208	**228**	**110**	73-122	
100-41-4	Ethylbenzene	206	**217**	**105**	71-117	
179601-23-1	m,p-Xylenes	412	**427**	**104**	70-116	
95-47-6	o-Xylene	200	**212**	**106**	70-116	
98-82-8	Cumene	196	**210**	**107**	70-116	
108-67-8	1,3,5-Trimethylbenzene	208	**230**	**111**	71-121	
95-63-6	1,2,4-Trimethylbenzene	200	**228**	**114**	73-127	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

LABORATORY CONTROL SAMPLE SUMMARY

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Lab Control Sample** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121105-LCS

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/05/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 0.125 Liter(s)
Test Notes:

CAS #	Compound	Spike Amount µg/m³	Result µg/m³	% Recovery	CAS Acceptance Limits	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	204	**210**	**103**	67-116	
107-06-2	1,2-Dichloroethane	208	**199**	**96**	70-118	
71-43-2	Benzene	208	**199**	**96**	66-121	
108-88-3	Toluene	208	**191**	**92**	67-111	
106-93-4	1,2-Dibromoethane	208	**211**	**101**	73-122	
100-41-4	Ethylbenzene	206	**205**	**100**	71-117	
179601-23-1	m,p-Xylenes	412	**407**	**99**	70-116	
95-47-6	o-Xylene	200	**202**	**101**	70-116	
98-82-8	Cumene	196	**198**	**101**	70-116	
108-67-8	1,3,5-Trimethylbenzene	208	**216**	**104**	71-121	
95-63-6	1,2,4-Trimethylbenzene	200	**213**	**107**	73-127	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

LABORATORY CONTROL SAMPLE SUMMARY

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Lab Control Sample** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P121106-LCS

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: NA
Analyst: Wida Ang Date Analyzed: 11/06/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 0.125 Liter(s)
Test Notes:

CAS #	Compound	Spike Amount µg/m³	Result µg/m³	% Recovery	CAS Acceptance Limits	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	204	**221**	**108**	67-116	
107-06-2	1,2-Dichloroethane	208	**209**	**100**	70-118	
71-43-2	Benzene	208	**203**	**98**	66-121	
108-88-3	Toluene	208	**202**	**97**	67-111	
106-93-4	1,2-Dibromoethane	208	**221**	**106**	73-122	
100-41-4	Ethylbenzene	206	**210**	**102**	71-117	
179601-23-1	m,p-Xylenes	412	**416**	**101**	70-116	
95-47-6	o-Xylene	200	**206**	**103**	70-116	
98-82-8	Cumene	196	**206**	**105**	70-116	
108-67-8	1,3,5-Trimethylbenzene	208	**226**	**109**	71-121	
95-63-6	1,2,4-Trimethylbenzene	200	**223**	**112**	73-127	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

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LABORATORY DUPLICATE SUMMARY RESULTS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 3** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-003DUP

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01853

Initial Pressure (psig): -3.60 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.65

Compound	Sample Result µg/m³	Sample Result ppbV	**Duplicate Sample Result µg/m³**	**Duplicate Sample Result** ppbV	Average µg/m³	**% RPD**	RPD Limit	**Data Qualifier**
Methyl tert-Butyl Ether	ND	ND	ND	ND	-	-	25	
1,2-Dichloroethane	ND	ND	ND	ND	-	-	25	
Benzene	2.12	0.663	2.30	0.721	2.21	**8**	25	
Toluene	6.97	1.85	6.97	1.85	6.97	**0**	25	
1,2-Dibromoethane	ND	ND	ND	ND	-	-	25	
Ethylbenzene	1.53	0.352	1.58	0.364	1.555	**3**	25	
m,p-Xylenes	4.03	0.928	4.16	0.957	4.095	**3**	25	
o-Xylene	1.51	0.348	1.54	0.356	1.525	**2**	25	
Cumene	1.02	0.209	1.03	0.210	1.025	**1**	25	
1,3,5-Trimethylbenzene	ND	ND	ND	ND	-	-	25	
1,2,4-Trimethylbenzene	1.73	0.352	1.78	0.362	1.755	**3**	25	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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LABORATORY DUPLICATE SUMMARY RESULTS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 15** CAS Project ID: P1204493
Client Project ID: **Sunoco IH Air Testing / 213402094** CAS Sample ID: P1204493-015DUP

Test Code: EPA TO-15 Date Collected: 10/24/12
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9 Date Received: 10/31/12
Analyst: Wida Ang Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00475

Initial Pressure (psig): -1.47 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.38

Compound	Sample Result µg/m³	Sample Result ppbV	**Duplicate Sample Result µg/m³**	**Duplicate Sample Result ppbV**	Average µg/m³	**% RPD**	RPD Limit	**Data Qualifier**
Methyl tert-Butyl Ether	ND	ND	ND	ND	-	-	25	
1,2-Dichloroethane	ND	ND	ND	ND	-	-	25	
Benzene	1.95	0.609	2.06	0.645	2.005	**5**	25	
Toluene	6.44	1.71	6.80	1.80	6.62	**5**	25	
1,2-Dibromoethane	ND	ND	ND	ND	-	-	25	
Ethylbenzene	1.21	0.279	1.21	0.279	1.21	**0**	25	
m,p-Xylenes	3.40	0.784	3.41	0.785	3.405	**0.3**	25	
o-Xylene	1.25	0.288	1.28	0.294	1.265	**2**	25	
Cumene	1.01	0.205	1.08	0.220	1.045	**7**	25	
1,3,5-Trimethylbenzene	ND	ND	ND	ND	-	-	25	
1,2,4-Trimethylbenzene	1.24	0.251	1.28	0.261	1.26	**3**	25	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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LABORATORY REPORT

November 8, 2012

John Reiter
Stantec Consulting Services, Inc.
12075 Corporate Pkwy, Ste. 200
Mequon, WI 53092

RE: Sunoco IH Air Testing / 213402094

Dear John:

Enclosed are the results of the samples submitted to our laboratory on October 31, 2012. For your reference, these analyses have been assigned our service request number P1204494.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA200007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L11-203; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-12-3; Minnesota Department of Health, NELAP Certificate No. 362188; Washington State Department of Ecology, ELAP Lab ID: C946, State of Utah Department of Health, NELAP Certificate No. CA01527Z012-Z; Los Angeles Department of Building and Safety, Approval No: TA00001. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Samantha Henningsen
Project Manager

Client: Stantec Consulting Services, Inc. Service Request No: P1204494
Project: Sunoco IH Air Testing / 213402094

CASE NARRATIVE

The samples were received intact under chain of custody on October 31, 2012 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Volatile Organic Compound Analysis

The samples were analyzed for selected volatile organic compounds in accordance with EPA Method TO-15 from the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition (EPA/625/R-96/010b), January, 1999. The analytical system was comprised of a gas chromatograph / mass spectrometer (GC/MS) interfaced to a whole-air preconcentrator.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. dba ALS Environmental (ALS) is not responsible for utilization of less than the complete report.

DETAIL SUMMARY REPORT

Client: Stantec Consulting Services, Inc.
Project ID: Sunoco IH Testing / 213402094

Service Request: P1204494

Date Received: 10/31/2012
Time Received: 09:10

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	Container ID	Pi1 (psig)	Pf1 (psig)	TO-15 - VOC Cans
Sample 23	P1204494-001	Air	10/25/2012	12:17	AC01664	-6.14	3.79	X
Sample 25	P1204494-002	Air	10/25/2012	00:00	AC01093	-14.50	3.74	X
Sample 26	P1204494-003	Air	10/25/2012	12:59	AC00540	-3.15	3.59	X
Sample 27	P1204494-004	Air	10/25/2012	13:08	AC01810	-4.85	3.59	X
Sample 28	P1204494-005	Air	10/25/2012	13:10	AC01350	-2.60	3.71	X
Sample 29	P1204494-006	Air	10/25/2012	12:23	AC00716	-0.41	4.20	X
Sample 30	P1204494-007	Air	10/25/2012	12:29	AC00501	-2.50	3.61	X
Sample 31	P1204494-008	Air	10/25/2012	12:34	AC00765	-3.73	3.68	X
Sample 32	P1204494-009	Air	10/25/2012	12:37	AC01403	-5.30	3.76	X
Sample 33	P1204494-010	Air	10/25/2012	12:41	AC01573	-0.55	3.66	X
Sample 34	P1204494-011	Air	10/25/2012	12:44	AC00947	-2.79	3.49	X
Sample 35	P1204494-012	Air	10/25/2012	12:48	AC00033	-2.24	3.50	X
Sample 36	P1204494-013	Air	10/25/2012	12:51	AC01790	-2.23	3.48	X
Sample 37	P1204494-014	Air	10/25/2012	13:00	AC01886	-3.04	3.62	X
Sample 38	P1204494-015	Air	10/25/2012	13:08	AC01487	-2.38	3.62	X
Sample 39	P1204494-016	Air	10/25/2012	13:40	AC01115	-3.59	3.71	X
Sample 40	P1204494-017	Air	10/25/2012	13:43	AC01243	-0.40	3.96	X
Sample 41	P1204494-018	Air	10/25/2012	13:51	AC01218	-3.00	3.67	X
Sample 42	P1204494-019	Air	10/25/2012	13:55	AC01179	-1.52	3.71	X
Sample 43	P1204494-020	Air	10/25/2012	14:00	AC00870	-3.27	3.76	X
Sample 44	P1204494-021	Air	10/25/2012	10:05	AC00993	-14.47	3.72	X

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Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No. P1204494

CAS Contact:

Company Name & Address (Reporting Information): Stantec 12075 Corporate Pky Mequon, WI 53092

Project Manager: John Reiter

Phone: 262-

Fax: 262-241-4901

Email Address for Result Reporting: John.REITER@Stantec.com

Project Name: Sunoco IH Testing

Project Number: 213402094

P.O. # / Billing Information: John Reiter

Sampler (Print & Sign): Richard Pager

Analysis Method

Comments e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume	Analysis Method		Comments
Sample 23	(1)-1.16	10/25/12	8:17 12:17	AC01664	FCA00422	29.0	11.0				
Sample 25	(2)-14.45	10/25/12		AC01093	FCA00058	29.5	—		Field		Blank
Sample 26	(3)-3.18	10/25/12	8:59 12:59	AC00540	FCA00482	29.3	8.5				
Sample 27	(4)-4.88	10/25/12	9:07 13:06	AC01830	FCA00609	29.4	8.0				
Sample 28	(5)-2.65	10/25/12	9:10 13:10	AC01350	FCA00454	29.5	5.0				
Sample 29	(6)-0.47	10/25/12	8:23 12:23	AC00716	FCA00239	29.5	0.0				
Sample 30	(7)-2.59	10/25/12	8:29 12:29	AC00501	FCA00015	29.5	6.0				
Sample 31	(8)-3.74	10/25/12	8:34 12:34	AC00765	FCA00303	29.5	5.75				
Sample 32	(9)-5.62	10/25/12	8:37 12:37	AC01403	FCA00432	29.5	10.0				
Sample 33	(10)-0.55	10/25/12	8:41 12:41	AC01573	FCA00449	29.5	3.0				
Sample 34	(11)-2.74	10/25/12	8:44 12:44	AC00947	FCA00632	29.5	5.0				
Sample 35	(12)-2.77	10/25/12	8:48 12:48	AC00033	FCA00473	29.5	4.0				
Sample 36	(13)-2.23	10/25/12	8:51 12:51	AC01790	FCA00538	29.5	3.5				
Sample 37	(14)-3.00	10/25/12	9:00 13:00	AC01886	FCA00275	29.5	5.0				

Report Tier Levels - please select
Tier I - Results (Default if not specified) ____
Tier II (Results + QC Summaries) ____
Tier III (Results + QC & Calibration Summaries) ____
Tier IV (Data Validation Package) 10% Surcharge ____

EDD required Yes / No
Type: ____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Richard Pager	10:25	15:09	[illegible]	10/31/12	0910

Cooler / Blank Temperature ____ °C

COC AIR REV 3-11

Columbia Analytical Services
2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day-Standard

CAS Project No. P1204494

CAS Contact:

Company Name & Address (Reporting Information)

Project Name

Project Number

Project Manager

P.O. # / Billing Information

Phone

Fax

Email Address for Result Reporting

Sampler (Print & Sign) Richard Pager Richard Pager

Analysis Method

Comments e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Canister ID (Bar code # - AC, SC, etc.)	Flow Controller ID (Bar code # - FC #)	Canister Start Pressure "Hg	Canister End Pressure "Hg/psig	Sample Volume	Analysis Method		Comments
Sample 38	(15)-236	10/25/12	9:08 13:08	AC01487	FCA00418	29.5	4.5				
Sample 39	(16)-356	10/25/12	9:40 13:40	AC01115	FCA00503	29.6	6.5				
Sample 40	(17)-040	10/25/12	9:43 13:43	AC01243	FCA00603	29.4	2.0				
Sample 41	(18)-300	10/25/12	9:51 13:51	AC01218	FCA00405	29.6	9.0				
Sample 42	(19)-155	10/25/12	9:55 13:55	AC01179	FCA00040	29.6	4.75				
Sample 43	(20)-331	10/25/12	10:00 14:00	AC00870	FCA00215	29.5	6.0				
Sample 44	(21)-1440	10/25/12	10:05	AC00993	FCA00619	29.5	~~FRTP~~ Field		Blank		
	-1947(3)										

Report Tier Levels - please select
Tier I - Results (Default if not specified) ____
Tier II (Results + QC Summaries) ____
Tier III (Results + QC & Calibration Summaries) ____
Tier IV (Data Validation Package) 10% Surcharge ____

EDD required Yes / No
Type: ____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Richard Pager	10/25	15:09	[signature]	10/31/12	0910

Cooler / Blank Temperature ____ °C

COC AIR REV 3-11

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Sample Acceptance Check Form

Client: Stantec Consulting Services, Inc. Work order: P1204494
Project: Sunoco IH Testing / 213402094
Sample(s) received on: 10/31/12 Date opened: 10/31/12 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

#	Question	Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☐	☒	☐
2	Container(s) **supplied by CAS**?	☒	☐	☐
3	Did **sample containers** arrive in good condition?	☒	☐	☐
4	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
5	Did **sample container labels** and/or tags agree with custody papers?	☐	☒	☐
6	Was **sample volume** received adequate for analysis?	☒	☐	☐
7	Are samples within specified holding times?	☒	☐	☐
8	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☐	☐	☒
9	Was a **trip blank** received?	☐	☒	☐
10	Were **custody seals** on outside of cooler/Box?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
	Were custody seals on outside of sample container?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
11	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were **VOA vials** checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
12	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
	Do they contain moisture?	☐	☐	☒
13	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204494-001.01	6.0 L Ambient Can					
P1204494-002.01	6.0 L Ambient Can					
P1204494-003.01	6.0 L Ambient Can					
P1204494-004.01	6.0 L Ambient Can					
P1204494-005.01	6.0 L Ambient Can					
P1204494-006.01	6.0 L Ambient Can					
P1204494-007.01	6.0 L Ambient Can					
P1204494-008.01	6.0 L Ambient Can					

Explain any discrepancies: (include lab sample ID numbers):
Sample -002 has an ID of "Sample 25" on the COC, and "Sample 28" on the canister tag.
Sample -004 has canister SN AC01830, we received canister AC01810.
Sample -018 has an ID of "Sample 41" on the COC, and "Sample 40" on the canister tag.

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

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Sample Acceptance Check Form

Client: Stantec Consulting Services, Inc. Work order: P1204494
Project: Sunoco IH Testing / 213402094
Sample(s) received on: 10/31/12 Date opened: 10/31/12 by: MZAMORA

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1204494-009.01	6.0 L Ambient Can					
P1204494-010.01	6.0 L Ambient Can					
P1204494-011.01	6.0 L Ambient Can					
P1204494-012.01	6.0 L Ambient Can					
P1204494-013.01	6.0 L Ambient Can					
P1204494-014.01	6.0 L Ambient Can					
P1204494-015.01	6.0 L Ambient Can					
P1204494-016.01	6.0 L Ambient Can					
P1204494-017.01	6.0 L Ambient Can					
P1204494-018.01	6.0 L Ambient Can					
P1204494-019.01	6.0 L Ambient Can					
P1204494-020.01	6.0 L Ambient Can					
P1204494-021.01	6.0 L Ambient Can					

Explain any discrepancies: (include lab sample ID numbers):

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 23** — CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** — CAS Sample ID: P1204494-001

Test Code: EPA TO-15 — Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 — Date Received: 10/31/12
Analyst: Lusine Hakobyan — Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01664

Initial Pressure (psig): -6.14 Final Pressure (psig): 3.79

Canister Dilution Factor: 2.16

CAS #	Compound	Result μg/m³	MRL μg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	1.1	ND	0.30	
107-06-2	1,2-Dichloroethane	ND	1.1	ND	0.27	
71-43-2	Benzene	ND	1.1	ND	0.34	
108-88-3	Toluene	**3.8**	1.1	**1.0**	0.29	
106-93-4	1,2-Dibromoethane	ND	1.1	ND	0.14	
100-41-4	Ethylbenzene	ND	1.1	ND	0.25	
179601-23-1	m,p-Xylenes	ND	2.2	ND	0.50	
95-47-6	o-Xylene	ND	1.1	ND	0.25	
98-82-8	Cumene	ND	1.1	ND	0.22	
108-67-8	1,3,5-Trimethylbenzene	ND	1.1	ND	0.22	
95-63-6	1,2,4-Trimethylbenzene	ND	1.1	ND	0.22	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 25** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-002

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01093

Canister Dilution Factor: 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 26**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-003
Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/2/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC00540		

Initial Pressure (psig): -3.15 Final Pressure (psig): 3.59

Canister Dilution Factor: 1.58

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.20	
71-43-2	Benzene	**2.1**	0.79	**0.67**	0.25	
108-88-3	Toluene	**4.0**	0.79	**1.1**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**0.99**	0.79	**0.23**	0.18	
179601-23-1	m,p-Xylenes	**3.8**	1.6	**0.87**	0.36	
95-47-6	o-Xylene	**1.3**	0.79	**0.31**	0.18	
98-82-8	Cumene	**1.1**	0.79	**0.22**	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.79	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.4**	0.79	**0.29**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 27** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-004

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01810

Initial Pressure (psig): -4.85 Final Pressure (psig): 3.59

Canister Dilution Factor: 1.86

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.93	ND	0.26	
107-06-2	1,2-Dichloroethane	ND	0.93	ND	0.23	
71-43-2	Benzene	**2.3**	0.93	**0.71**	0.29	
108-88-3	Toluene	**3.6**	0.93	**0.96**	0.25	
106-93-4	1,2-Dibromoethane	ND	0.93	ND	0.12	
100-41-4	Ethylbenzene	ND	0.93	ND	0.21	
179601-23-1	m,p-Xylenes	**3.0**	1.9	**0.69**	0.43	
95-47-6	o-Xylene	**1.1**	0.93	**0.26**	0.21	
98-82-8	Cumene	ND	0.93	ND	0.19	
108-67-8	1,3,5-Trimethylbenzene	ND	0.93	ND	0.19	
95-63-6	1,2,4-Trimethylbenzene	ND	0.93	ND	0.19	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 28**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-005
Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/2/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01350		

Initial Pressure (psig): -2.60 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.52

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.76	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.76	ND	0.19	
71-43-2	Benzene	**2.3**	0.76	**0.70**	0.24	
108-88-3	Toluene	**2.0**	0.76	**0.54**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.76	ND	0.099	
100-41-4	Ethylbenzene	ND	0.76	ND	0.18	
179601-23-1	m,p-Xylenes	ND	1.5	ND	0.35	
95-47-6	o-Xylene	ND	0.76	ND	0.18	
98-82-8	Cumene	ND	0.76	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.76	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	ND	0.76	ND	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 29** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-006

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00716

Initial Pressure (psig): -0.41 Final Pressure (psig): 4.20

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.66	ND	0.18	
107-06-2	1,2-Dichloroethane	ND	0.66	ND	0.16	
71-43-2	Benzene	**1.6**	0.66	**0.50**	0.21	
108-88-3	Toluene	**6.5**	0.66	**1.7**	0.18	
106-93-4	1,2-Dibromoethane	ND	0.66	ND	0.086	
100-41-4	Ethylbenzene	**0.95**	0.66	**0.22**	0.15	
179601-23-1	m,p-Xylenes	**3.3**	1.3	**0.76**	0.30	
95-47-6	o-Xylene	**1.1**	0.66	**0.25**	0.15	
98-82-8	Cumene	ND	0.66	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.66	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	**0.99**	0.66	**0.20**	0.13	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 30** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-007

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00501

Initial Pressure (psig): -2.50 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.50

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.75	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.75	ND	0.19	
71-43-2	Benzene	**1.2**	0.75	**0.36**	0.23	
108-88-3	Toluene	**4.4**	0.75	**1.2**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.75	ND	0.098	
100-41-4	Ethylbenzene	ND	0.75	ND	0.17	
179601-23-1	m,p-Xylenes	**2.3**	1.5	**0.53**	0.35	
95-47-6	o-Xylene	**0.87**	0.75	**0.20**	0.17	
98-82-8	Cumene	ND	0.75	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.75	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**1.1**	0.75	**0.23**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 31** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-008

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00765

Initial Pressure (psig): -3.73 Final Pressure (psig): 3.68

Canister Dilution Factor: 1.68

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.84	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.84	ND	0.21	
71-43-2	Benzene	**1.3**	0.84	**0.41**	0.26	
108-88-3	Toluene	**4.8**	0.84	**1.3**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.84	ND	0.11	
100-41-4	Ethylbenzene	ND	0.84	ND	0.19	
179601-23-1	m,p-Xylenes	**2.5**	1.7	**0.57**	0.39	
95-47-6	o-Xylene	**0.91**	0.84	**0.21**	0.19	
98-82-8	Cumene	ND	0.84	ND	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.84	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	**0.94**	0.84	**0.19**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 32**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-009

Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/2/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01403		

Initial Pressure (psig): -5.30 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.96

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.98	ND	0.27	
107-06-2	1,2-Dichloroethane	ND	0.98	ND	0.24	
71-43-2	Benzene	**1.3**	0.98	**0.41**	0.31	
108-88-3	Toluene	**5.2**	0.98	**1.4**	0.26	
106-93-4	1,2-Dibromoethane	ND	0.98	ND	0.13	
100-41-4	Ethylbenzene	ND	0.98	ND	0.23	
179601-23-1	m,p-Xylenes	**2.5**	2.0	**0.58**	0.45	
95-47-6	o-Xylene	ND	0.98	ND	0.23	
98-82-8	Cumene	ND	0.98	ND	0.20	
108-67-8	1,3,5-Trimethylbenzene	ND	0.98	ND	0.20	
95-63-6	1,2,4-Trimethylbenzene	ND	0.98	ND	0.20	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 33** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-010

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01573

Initial Pressure (psig): -0.55 Final Pressure (psig): 3.66

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.65	ND	0.18	
107-06-2	1,2-Dichloroethane	ND	0.65	ND	0.16	
71-43-2	Benzene	**1.4**	0.65	**0.45**	0.20	
108-88-3	Toluene	**5.0**	0.65	**1.3**	0.17	
106-93-4	1,2-Dibromoethane	ND	0.65	ND	0.085	
100-41-4	Ethylbenzene	**0.93**	0.65	**0.21**	0.15	
179601-23-1	m,p-Xylenes	**3.5**	1.3	**0.81**	0.30	
95-47-6	o-Xylene	**1.1**	0.65	**0.26**	0.15	
98-82-8	Cumene	ND	0.65	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.65	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	**0.97**	0.65	**0.20**	0.13	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 34** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-011

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00947

Initial Pressure (psig): -2.79 Final Pressure (psig): 3.49

Canister Dilution Factor: 1.53

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.77	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.77	ND	0.19	
71-43-2	Benzene	**1.3**	0.77	**0.41**	0.24	
108-88-3	Toluene	**4.9**	0.77	**1.3**	0.20	
106-93-4	1,2-Dibromoethane	ND	0.77	ND	0.10	
100-41-4	Ethylbenzene	**0.89**	0.77	**0.21**	0.18	
179601-23-1	m,p-Xylenes	**3.3**	1.5	**0.75**	0.35	
95-47-6	o-Xylene	**1.3**	0.77	**0.30**	0.18	
98-82-8	Cumene	ND	0.77	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.77	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**1.1**	0.77	**0.23**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 35** — CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** — CAS Sample ID: P1204494-012

Test Code: EPA TO-15 — Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 — Date Received: 10/31/12
Analyst: Lusine Hakobyan — Date Analyzed: 11/3/12
Sample Type: 6.0 L Summa Canister — Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00033

Initial Pressure (psig): -2.24 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.46

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.73	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	0.73	ND	0.18	
71-43-2	Benzene	**1.2**	0.73	**0.39**	0.23	
108-88-3	Toluene	**5.9**	0.73	**1.6**	0.19	
106-93-4	1,2-Dibromoethane	ND	0.73	ND	0.095	
100-41-4	Ethylbenzene	**1.0**	0.73	**0.24**	0.17	
179601-23-1	m,p-Xylenes	**3.7**	1.5	**0.84**	0.34	
95-47-6	o-Xylene	**1.4**	0.73	**0.31**	0.17	
98-82-8	Cumene	ND	0.73	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.73	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**0.95**	0.73	**0.19**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 36** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-013

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01790

Initial Pressure (psig): -2.23 Final Pressure (psig): 3.48

Canister Dilution Factor: 1.46

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.73	ND	0.20	
107-06-2	1,2-Dichloroethane	ND	0.73	ND	0.18	
71-43-2	Benzene	**0.94**	0.73	**0.29**	0.23	
108-88-3	Toluene	**4.0**	0.73	**1.1**	0.19	
106-93-4	1,2-Dibromoethane	ND	0.73	ND	0.095	
100-41-4	Ethylbenzene	**0.74**	0.73	**0.17**	0.17	
179601-23-1	m,p-Xylenes	**2.5**	1.5	**0.59**	0.34	
95-47-6	o-Xylene	**0.97**	0.73	**0.22**	0.17	
98-82-8	Cumene	ND	0.73	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.73	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	**0.78**	0.73	**0.16**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 37**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-014

Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/5/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01886		

Initial Pressure (psig): -3.04 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.57

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.19	
71-43-2	Benzene	**11**	0.79	**3.6**	0.25	
108-88-3	Toluene	**88**	0.79	**23**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**11**	0.79	**2.5**	0.18	
179601-23-1	m,p-Xylenes	**42**	1.6	**9.7**	0.36	
95-47-6	o-Xylene	**9.1**	0.79	**2.1**	0.18	
98-82-8	Cumene	**1.3**	0.79	**0.26**	0.16	
108-67-8	1,3,5-Trimethylbenzene	**1.4**	0.79	**0.28**	0.16	
95-63-6	1,2,4-Trimethylbenzene	**3.9**	0.79	**0.79**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 38** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-015

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes: 0.10 Liter(s)
Container ID: AC01487

Initial Pressure (psig): -2.38 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.49

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.75	ND	0.21	
107-06-2	1,2-Dichloroethane	ND	0.75	ND	0.18	
71-43-2	Benzene	**8.4**	0.75	**2.6**	0.23	
108-88-3	Toluene	**330**	7.5	**87**	2.0	**D**
106-93-4	1,2-Dibromoethane	ND	0.75	ND	0.097	
100-41-4	Ethylbenzene	**6.0**	0.75	**1.4**	0.17	
179601-23-1	m,p-Xylenes	**24**	1.5	**5.5**	0.34	
95-47-6	o-Xylene	**7.6**	0.75	**1.8**	0.17	
98-82-8	Cumene	**2.6**	0.75	**0.52**	0.15	
108-67-8	1,3,5-Trimethylbenzene	**3.9**	0.75	**0.80**	0.15	
95-63-6	1,2,4-Trimethylbenzene	**11**	0.75	**2.2**	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
D = The reported result is from a dilution.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 39** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-016

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01115

Initial Pressure (psig): -3.59 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.66

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	**0.96**	0.83	**0.27**	0.23	
107-06-2	1,2-Dichloroethane	ND	0.83	ND	0.21	
71-43-2	Benzene	**1.4**	0.83	**0.45**	0.26	
108-88-3	Toluene	**6.4**	0.83	**1.7**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.83	ND	0.11	
100-41-4	Ethylbenzene	**1.1**	0.83	**0.25**	0.19	
179601-23-1	m,p-Xylenes	**3.9**	1.7	**0.89**	0.38	
95-47-6	o-Xylene	**1.4**	0.83	**0.32**	0.19	
98-82-8	Cumene	ND	0.83	ND	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.83	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	**1.1**	0.83	**0.23**	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 40** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-017

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01243

Initial Pressure (psig): -0.40 Final Pressure (psig): 3.96

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	**1.6**	0.65	**0.43**	0.18	
107-06-2	1,2-Dichloroethane	ND	0.65	ND	0.16	
71-43-2	Benzene	**2.0**	0.65	**0.64**	0.20	
108-88-3	Toluene	**8.8**	0.65	**2.3**	0.17	
106-93-4	1,2-Dibromoethane	ND	0.65	ND	0.085	
100-41-4	Ethylbenzene	**1.4**	0.65	**0.33**	0.15	
179601-23-1	m,p-Xylenes	**5.4**	1.3	**1.2**	0.30	
95-47-6	o-Xylene	**1.8**	0.65	**0.42**	0.15	
98-82-8	Cumene	ND	0.65	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.65	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	**1.5**	0.65	**0.31**	0.13	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 41**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-018
Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/5/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01218		

Initial Pressure (psig): -3.00 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.57

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.79	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.79	ND	0.19	
71-43-2	Benzene	**1.8**	0.79	**0.55**	0.25	
108-88-3	Toluene	**9.0**	0.79	**2.4**	0.21	
106-93-4	1,2-Dibromoethane	ND	0.79	ND	0.10	
100-41-4	Ethylbenzene	**1.3**	0.79	**0.31**	0.18	
179601-23-1	m,p-Xylenes	**5.2**	1.6	**1.2**	0.36	
95-47-6	o-Xylene	**1.9**	0.79	**0.44**	0.18	
98-82-8	Cumene	ND	0.79	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	**1.1**	0.79	**0.22**	0.16	
95-63-6	1,2,4-Trimethylbenzene	**3.1**	0.79	**0.64**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client:	**Stantec Consulting Services, Inc.**		
Client Sample ID:	**Sample 42**	CAS Project ID:	P1204494
Client Project ID:	**Sunoco IH Testing / 213402094**	CAS Sample ID:	P1204494-019
Test Code:	EPA TO-15	Date Collected:	10/25/12
Instrument ID:	Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16	Date Received:	10/31/12
Analyst:	Lusine Hakobyan	Date Analyzed:	11/5/12
Sample Type:	6.0 L Summa Canister	Volume(s) Analyzed:	1.00 Liter(s)
Test Notes:			
Container ID:	AC01179		

Initial Pressure (psig): -1.52 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.40

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.70	ND	0.19	
107-06-2	1,2-Dichloroethane	ND	0.70	ND	0.17	
71-43-2	Benzene	**1.7**	0.70	**0.53**	0.22	
108-88-3	Toluene	**8.2**	0.70	**2.2**	0.19	
106-93-4	1,2-Dibromoethane	ND	0.70	ND	0.091	
100-41-4	Ethylbenzene	**1.1**	0.70	**0.25**	0.16	
179601-23-1	m,p-Xylenes	**4.6**	1.4	**1.1**	0.32	
95-47-6	o-Xylene	**1.7**	0.70	**0.38**	0.16	
98-82-8	Cumene	ND	0.70	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	**0.87**	0.70	**0.18**	0.14	
95-63-6	1,2,4-Trimethylbenzene	**2.5**	0.70	**0.50**	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 43** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-020

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00870

Initial Pressure (psig): -3.27 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.62

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.81	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.81	ND	0.20	
71-43-2	Benzene	**1.2**	0.81	**0.37**	0.25	
108-88-3	Toluene	**10**	0.81	**2.7**	0.22	
106-93-4	1,2-Dibromoethane	ND	0.81	ND	0.11	
100-41-4	Ethylbenzene	ND	0.81	ND	0.19	
179601-23-1	m,p-Xylenes	**2.8**	1.6	**0.65**	0.37	
95-47-6	o-Xylene	**0.99**	0.81	**0.23**	0.19	
98-82-8	Cumene	ND	0.81	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.81	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	**0.93**	0.81	**0.19**	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 44** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-021

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC00993

Canister Dilution Factor: 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P121102-MB

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: NA
Analyst: Lusine Hakobyan Date Analyzed: 11/2/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:

Canister Dilution Factor: 1.00

CAS #	**Compound**	**Result µg/m³**	MRL µg/m³	**Result ppbV**	MRL ppbV	**Data Qualifier**
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

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RESULTS OF ANALYSIS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Method Blank** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P121105-MB

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: NA
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:

Canister Dilution Factor: 1.00

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	ND	0.50	ND	0.14	
107-06-2	1,2-Dichloroethane	ND	0.50	ND	0.12	
71-43-2	Benzene	ND	0.50	ND	0.16	
108-88-3	Toluene	ND	0.50	ND	0.13	
106-93-4	1,2-Dibromoethane	ND	0.50	ND	0.065	
100-41-4	Ethylbenzene	ND	0.50	ND	0.12	
179601-23-1	m,p-Xylenes	ND	1.0	ND	0.23	
95-47-6	o-Xylene	ND	0.50	ND	0.12	
98-82-8	Cumene	ND	0.50	ND	0.10	
108-67-8	1,3,5-Trimethylbenzene	ND	0.50	ND	0.10	
95-63-6	1,2,4-Trimethylbenzene	ND	0.50	ND	0.10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

SURROGATE SPIKE RECOVERY RESULTS

Client: **Stantec Consulting Services, Inc.**
Client Project ID: **Sunoco IH Testing / 213402094**
CAS Project ID: P1204494

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16
Analyst: Lusine Hakobyan
Sample Type: 6.0 L Summa Canister(s)
Test Notes:

Date(s) Collected: 10/25/12
Date(s) Received: 10/31/12
Date(s) Analyzed: 11/2 - 11/5/12

Client Sample ID	CAS Sample ID	1,2-Dichloroethane-d4 Percent Recovered	Toluene-d8 Percent Recovered	Bromofluorobenzene Percent Recovered	Acceptance Limits	Data Qualifier
Method Blank	P121102-MB	**101**	**99**	**96**	70-130	
Method Blank	P121105-MB	**102**	**100**	**97**	70-130	
Lab Control Sample	P121102-LCS	**99**	**99**	**100**	70-130	
Lab Control Sample	P121105-LCS	**99**	**100**	**99**	70-130	
Sample 23	P1204494-001	**101**	**101**	**95**	70-130	
Sample 25	P1204494-002	**101**	**101**	**95**	70-130	
Sample 26	P1204494-003	**101**	**101**	**97**	70-130	
Sample 27	P1204494-004	**102**	**100**	**97**	70-130	
Sample 28	P1204494-005	**101**	**100**	**96**	70-130	
Sample 29	P1204494-006	**101**	**100**	**97**	70-130	
Sample 30	P1204494-007	**101**	**100**	**97**	70-130	
Sample 31	P1204494-008	**101**	**99**	**96**	70-130	
Sample 32	P1204494-009	**102**	**99**	**97**	70-130	
Sample 33	P1204494-010	**101**	**99**	**97**	70-130	
Sample 34	P1204494-011	**102**	**100**	**97**	70-130	
Sample 35	P1204494-012	**101**	**100**	**97**	70-130	
Sample 36	P1204494-013	**100**	**101**	**97**	70-130	
Sample 37	P1204494-014	**100**	**101**	**97**	70-130	
Sample 38	P1204494-015	**99**	**100**	**98**	70-130	
Sample 39	P1204494-016	**101**	**100**	**98**	70-130	
Sample 40	P1204494-017	**101**	**100**	**97**	70-130	
Sample 40	P1204494-017DUP	**100**	**100**	**96**	70-130	
Sample 41	P1204494-018	**101**	**101**	**97**	70-130	
Sample 42	P1204494-019	**100**	**102**	**96**	70-130	
Sample 43	P1204494-020	**101**	**101**	**98**	70-130	
Sample 44	P1204494-021	**100**	**101**	**96**	70-130	

Surrogate percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly from the on-column percent recovery.

LABORATORY CONTROL SAMPLE SUMMARY

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Lab Control Sample** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P121102-LCS

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: NA
Analyst: Lusine Hakobyan Date Analyzed: 11/02/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 0.125 Liter(s)
Test Notes:

CAS #	Compound	Spike Amount µg/m³	Result µg/m³	% Recovery	CAS Acceptance Limits	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	204	**187**	**92**	67-116	
107-06-2	1,2-Dichloroethane	208	**180**	**87**	70-118	
71-43-2	Benzene	208	**187**	**90**	66-121	
108-88-3	Toluene	208	**172**	**83**	67-111	
106-93-4	1,2-Dibromoethane	208	**182**	**88**	73-122	
100-41-4	Ethylbenzene	206	**170**	**83**	71-117	
179601-23-1	m,p-Xylenes	412	**328**	**80**	70-116	
95-47-6	o-Xylene	200	**163**	**82**	70-116	
98-82-8	Cumene	196	**160**	**82**	70-116	
108-67-8	1,3,5-Trimethylbenzene	208	**169**	**81**	71-121	
95-63-6	1,2,4-Trimethylbenzene	200	**165**	**83**	73-127	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

LABORATORY CONTROL SAMPLE SUMMARY

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Lab Control Sample** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P121105-LCS

Test Code: EPA TO-15 Date Collected: NA
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: NA
Analyst: Lusine Hakobyan Date Analyzed: 11/05/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 0.125 Liter(s)
Test Notes:

CAS #	Compound	Spike Amount µg/m³	Result µg/m³	% Recovery	CAS Acceptance Limits	Data Qualifier
1634-04-4	Methyl tert-Butyl Ether	204	**191**	**94**	67-116	
107-06-2	1,2-Dichloroethane	208	**184**	**88**	70-118	
71-43-2	Benzene	208	**190**	**91**	66-121	
108-88-3	Toluene	208	**178**	**86**	67-111	
106-93-4	1,2-Dibromoethane	208	**189**	**91**	73-122	
100-41-4	Ethylbenzene	206	**174**	**84**	71-117	
179601-23-1	m,p-Xylenes	412	**338**	**82**	70-116	
95-47-6	o-Xylene	200	**167**	**84**	70-116	
98-82-8	Cumene	196	**164**	**84**	70-116	
108-67-8	1,3,5-Trimethylbenzene	208	**173**	**83**	71-121	
95-63-6	1,2,4-Trimethylbenzene	200	**171**	**86**	73-127	

Laboratory Control Sample percent recovery is verified and accepted based on the on-column result.
Reported results are shown in concentration units and as a result of the calculation, may vary slightly.

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LABORATORY DUPLICATE SUMMARY RESULTS

Client: **Stantec Consulting Services, Inc.**
Client Sample ID: **Sample 40** CAS Project ID: P1204494
Client Project ID: **Sunoco IH Testing / 213402094** CAS Sample ID: P1204494-017DUP

Test Code: EPA TO-15 Date Collected: 10/25/12
Instrument ID: Tekmar AUTOCAN/Agilent 5975Cinert/6890N/MS16 Date Received: 10/31/12
Analyst: Lusine Hakobyan Date Analyzed: 11/5/12
Sample Type: 6.0 L Summa Canister Volume(s) Analyzed: 1.00 Liter(s)
Test Notes:
Container ID: AC01243

Initial Pressure (psig): -0.40 Final Pressure (psig): 3.96

Canister Dilution Factor: 1.30

Compound	Sample Result µg/m³	Sample Result ppbV	**Duplicate Sample Result µg/m³**	**Duplicate Sample Result** ppbV	Average µg/m³	**% RPD**	RPD Limit	**Data Qualifier**
Methyl tert-Butyl Ether	1.55	0.431	1.57	0.436	1.56	**1**	25	
1,2-Dichloroethane	ND	ND	ND	ND	-	-	25	
Benzene	2.03	0.637	2.03	0.634	2.03	**0**	25	
Toluene	8.79	2.33	8.75	2.32	8.77	**0.5**	25	
1,2-Dibromoethane	ND	ND	ND	ND	-	-	25	
Ethylbenzene	1.45	0.333	1.43	0.329	1.44	**1**	25	
m,p-Xylenes	5.39	1.24	5.35	1.23	5.37	**0.7**	25	
o-Xylene	1.83	0.422	1.82	0.419	1.825	**0.5**	25	
Cumene	ND	ND	ND	ND	-	-	25	
1,3,5-Trimethylbenzene	ND	ND	ND	ND	-	-	25	
1,2,4-Trimethylbenzene	1.54	0.314	1.53	0.311	1.535	**0.7**	25	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

November 9, 2016 Reference No. 11109626

Ms. Tiffani L. Doerr, PG
Evergreen Resources Management Operations
2 Righter Parkway, Suite No. 200
Wilmington, DE 19803

Dear Ms. Doerr:

Re: Air Data Evaluation –
Philadelphia Energy Solutions Complex

As requested, GHD Services, Inc. (GHD) has prepared this letter summarizing the approach and results of the air data collection activities that were performed in 2015/2016 at the Philadelphia Energy Solutions (PES) Complex (Site) on behalf of Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC (Evergreen). This letter includes the air data collected in March 2015 at Area of Interest (AOI) 1 by Stantec and the 2016 data collected at AOIs 1, 2, 3, 5, 6, 7, 8, and 9 by GHD.

The procedures to obtain access, the sampling methodologies, the results of the indoor air sampling, and evaluation of the data are included herein for the samples collected in 2016. All detected concentrations of constituents in indoor air were below the Pennsylvania Department of Environmental Protection (PADEP) generic non-residential Statewide Health Standard (SHS) for indoor air except for one benzene result from the Control Room Building 6627 in AOI 6. However, this concentration is below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL). No unacceptable risk to workers via indoor air inhalation was identified by these results.

1. Investigation Activities

During the 2015/2016 sampling event, Stantec and GHD collected indoor air samples from potentially occupied buildings not previously sampled as part of a vapor intrusion assessment. GHD performed the following activities as part of the 2016 air sampling activities at the Site.

1.1 Obtain of Work Permits

Prior to commencing work, Work Permits were obtained from PES. The Work Permits were for GHD's survey/inspection of buildings, collection of indoor air samples within those buildings, and collection of outdoor air samples around those buildings to establish background conditions for comparison to the indoor air samples. All work was conducted in accordance with applicable safety standards and GHD's Health and Safety protocol as presented in a site-specific Health and Safety Plan.

1.2 Building Survey and Inspection

After obtaining work permits and prior to indoor air sample collection, a detailed building survey and inspection was conducted to identify any potential indoor air sources of volatile organic compounds (VOCs) possibly already present within the building (e.g., smoking, cleaning products, building products, manufacturing chemicals, etc.), the number and frequency of occupants within the various buildings, and potential preferential migration pathways through the building slab (e.g., utility conduits, slab cracking, etc.). At each building GHD completed a Building Survey and Indoor Air Sampling Field Sheet.

1.3 Indoor and Outdoor Air Sampling

Each proposed indoor air sample location was selected based on occupancy and specific building characteristics such as building size and location of the occupied space within a building. The numbers of samples collected for each building was based on a combined approach from Appendix Z of the draft PADEP VI Guidance and professional judgement. The location of indoor and outdoor air samples is shown in Figure 1.

The samples were collected using 6-liter capacity Summa™ canisters in a suitable location(s) in each building at a representative breathing zone height (i.e., 3 to 5 feet above grade). Canisters were laboratory-certified clean in accordance with Appendix Z of the PADEP draft VI guidance. The canisters were fitted with a laboratory-calibrated critical orifice flow-regulation device sized to limit the indoor air sample collection flow rate to allow for 8-hour sample collection. Canisters maintained a minimum residual negative pressure of approximately 1 to 5 inches of mercury following sample collection.

Written documentation of all field activities, conditions, and sampling processes, including names of field personnel, dates and times, etc. were recorded. Documentation included building designation, building use, occupant information, and weather conditions at the time of sampling (temperature, barometric pressure, wind direction and speed, and humidity).

Outdoor air sampling locations were selected for collection of an air sample in each AOI. The outdoor locations were set at the same general elevation of the samples in the buildings and were in a position that is generally upwind of the buildings being assessed.

2. Data Evaluation

The detected concentrations in indoor air were screened in accordance with the generic screening criteria as presented in Table 1. Table 1 summarizes the indoor air data and compares the detected concentrations to the generic indoor air screening criteria from PADEP and USEPA, both calculated at a target cancer risk of $1x10^{-5}$ and a hazard quotient of 1. In addition, Table 1 also compares the indoor air results to $1/10^{th}$ of the PADEP SHS, generic USEPA criteria calculated at a target cancer risk of $1x10^{-6}$ and a hazard quotient of 0.1, and occupational inhalation limits.

As shown on Table 1, all detected concentrations of constituents in indoor air were below the Pennsylvania generic non-residential SHS for indoor air except for one benzene result from the Control Room of Building 6627 in AOI 6. However, this concentration of 36 micrograms per cubic meter (ug/m^3) is below the OSHA PEL of 3,190 ug/m^3, which is the applicable standard at the Site.

The detected concentrations in ambient/outdoor air are presented in Table 2. Table 2 also includes outdoor air results from a nearby PADEP monitoring station and background residential indoor air levels as a point of reference.

3. Conclusions

The comparison of these detected concentrations in indoor air to generic non-residential criteria for indoor air and OSHA PELs did not identify any unacceptable risk to workers via indoor air inhalation at the Site.

The ambient/outdoor air results are within the range of background concentrations.

Should you require any additional information, please do not hesitate to contact us.

Yours truly,

GHD Services Inc.

Colleen Costello   Francis C. Ramacciotti

Encl.

Figure 1 – Indoor Air and Ambient Air Sampling Locations
Table 1 – Air Sampling Data

cc: David Steele, GHD

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location											**AOI1_AI-01**	**AOI1-AI-16-001**	**AOI2-AI-16-001**
											Indoor Air Inline Blender Bldg	**Control Room, Block BRM**	**Bio Area**
Sample Date											**13-Mar-15**	**22-Mar-16**	**22-Mar-16**
Sample ID											**AOI1_AI-01**	**IA-AOI1-2429**	**IA-AOI2-5920**
Sampling Company											**STANTEC**	**GHD**	**GHD**
Laboratory											**ALS**	**LL**	**LL**
Laboratory Work Order											**P1501053**	**MHF23**	**MHF23**
Laboratory Sample ID											**P1501053-001**	**8302469**	**8302470**
Sample Type	**Units**	**VI-PA**[A]	**1/10th VI-PA**[B]	**OSHA**[C]	**USEPA RSL**[D]	**USEPA RSL**[E]	**ACGIH TLV**[F]	**NIOSH**[G]	**MH Air Tox**	**EPA Res IA**			
Volatile Organic Compounds													
BENZENE	µg/m3	16	1.6	3,190	16	1.6	1,600	319	2.59	29	4.2	***12*** [BE]	***3.7*** [BE]
1,2-DIBROMOETHANE (EDB)	µg/m3	0.2	0.02	153,700	0.2	0.02	n/v	346	n/v	n/v	ND (0.24)	ND (7.7)	ND (7.7)
1,2-DICHLOROETHANE (EDC)	µg/m3	4.7	0.47	202,400	4.7	0.47	40,500	4,000	0.16	0.2	ND (0.75)	ND (4.0)	ND (4.0)
ETHYLBENZENE	µg/m3	49	4.9	435,000	49	4.9	86,800	435,000	0.68	17	4	***7.1*** [BE]	ND (4.3)
ISOPROPYLBENZENE (CUMENE)	µg/m3	1,800	180	245,000	1,800	180	246,000	245,000	11.2	n/v	ND (0.75)	ND (4.9)	ND (4.9)
METHYL TERTIARY BUTYL ETHER	µg/m3	470	47	n/v	470	47	180,000	n/v	n/v	72	ND (0.75)	ND (3.6)	ND (3.6)
NAPHTHALENE	µg/m3	3.6	0.36	50,000	3.6	0.36	52,000	50,000	n/v	4.8*	ND (0.75)	ND (5.2)	ND (5.2)
TOLUENE	µg/m3	22,000	2,200	754,000	22,000	2,200	75,400	375,000	4.52	144	22	48	3.9
1,2,4-TRIMETHYLBENZENE**	µg/m3	31	3.1	n/v	260	26	123,000	125,000	1.12	19	6.3	6.6	ND (4.9)
1,3,5-TRIMETHYLBENZENE**	µg/m3	31	3.1	n/v	260	26	123,000	125,000	0.38	6.5	2	2.7 J	ND (4.9)
TOTAL XYLENE	µg/m3	440	44	435,000	440	44	434,000	435,000	3.14	63.5	24.4	38.9	1.9 J

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5 [A]	Concentration exceeds the VI-PA SHS
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location											AOI1_AI-01	AOI1-AI-16-001	AOI2-AI-16-001
											Indoor Air Inline Blender Bldg	Control Room, Block BRM	Bio Area
Sample Date											13-Mar-15	22-Mar-16	22-Mar-16
Sample ID											AOI1_AI-01	IA-AOI1-2429	IA-AOI2-5920
Sampling Company											STANTEC	GHD	GHD
Laboratory											ALS	LL	LL
Laboratory Work Order											P1501053	MHF23	MHF23
Laboratory Sample ID											P1501053-001	8302469	8302470
Sample Type	Units	VI-PA[A]	1/10th VI-PA[B]	OSHA[C]	USEPA RSL[D]	USEPA RSL[E]	ACGIH TLV[F]	NIOSH[G]	MH Air Tox	EPA Res IA			

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI2-AI-16-002	AOI2-AI-16-003	AOI2-AI-16-004	AOI2-AI-16-005	AOI2-AI-16-006	AOI3-AI-16-001	AOI3-AI-16-002	AOI3-AI-16-003	AOI3-AI-16-004
		Bio Area, Bldg 6628	Control Room, Kitchen, on Stove	Control Room	Control Room	Short Pier Building 11	Safway Trailer	AOI3 Central Warehouse 3324	Warehouse Near Seal/Safety Store	Central Warehouse Bldg 3324 Walled Office
Sample Date		22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	28-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16
Sample ID		IA-AOI2-6628	IA-AOI2-2435	IA-AOI2-6624	IA-AOI2-2520	IA-AOI2-011	IA-AOI3-SAFWAY	IA-AOI3-3324-1	IA-AOI3-3324-2	IA-AOI3-3324-3
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		MHF23	MHF23	MHF23	MHF23	MHF24	MHF23	MHF23	MHF23	MHF23
Laboratory Sample ID		8302471	8302472	8302473	8302474	8316891	8302476	8302477	8302478	8302479
Sample Type	**Units**									
Volatile Organic Compounds										
BENZENE	µg/m3	***4.6***[BE]	***2.8 J***[BE]	***3.2***[BE]	***5.9***[BE]	1.3 J	***2.1 J***[BE]	***2.4 J***[BE]	***3.0 J***[BE]	***3.0 J***[BE]
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)
ETHYLBENZENE	µg/m3	2.9 J	ND (4.3)	ND (4.3)	1.3 J	ND (4.3)	ND (4.3)	ND (4.3)	***6.2***[BE]	1.0 J
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)
METHYL TERTIARY BUTYL ETHER	µg/m3	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)
NAPHTHALENE	µg/m3	ND (5.2)	ND (5.2)	ND (5.2)	***3.0 J***[BE]	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)
TOLUENE	µg/m3	8.9	2.6 J	3.0 J	4.4	4.3	1.8 J	3.5 J	13	22
1,2,4-TRIMETHYLBENZENE**	µg/m3	1.8 J	ND (4.9)	ND (4.9)	6.6	1.2 J	ND (4.9)	ND (4.9)	2.1 J	1.9 J
1,3,5-TRIMETHYLBENZENE**	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)	2.2 J	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)
TOTAL XYLENE	µg/m3	11.5 J	3 J	3.07 J	6.9 J	3.9 J	ND (4.3)	1.4 J	36.3	3.8 J

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5[A]	Concentration exceeds the VI-PA SHS
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI2-AI-16-002	AOI2-AI-16-003	AOI2-AI-16-004	AOI2-AI-16-005	AOI2-AI-16-006	AOI3-AI-16-001	AOI3-AI-16-002	AOI3-AI-16-003	AOI3-AI-16-004
		Bio Area, Bldg 6628	Control Room, Kitchen, on Stove	Control Room	Control Room	Short Pier Building 11	Safway Trailer	AOI3 Central Warehouse 3324	Warehouse Near Seal/Safety Store	Central Warehouse Bldg 3324 Walled Office
Sample Date		22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	28-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16	22-Mar-16
Sample ID		IA-AOI2-6628	IA-AOI2-2435	IA-AOI2-6624	IA-AOI2-2520	IA-AOI2-011	IA-AOI3-SAFWAY	IA-AOI3-3324-1	IA-AOI3-3324-2	IA-AOI3-3324-3
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		MHF23	MHF23	MHF23	MHF23	MHF24	MHF23	MHF23	MHF23	MHF23
Laboratory Sample ID		8302471	8302472	8302473	8302474	8316891	8302476	8302477	8302478	8302479
Sample Type	Units									

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI3-AI-16-005	AOI3-AI-16-006	AOI3-AI-16-007	AOI3-AI-16-008	AOI3-AI-16-009	AOI5-AI-16-001	AOI5-AI-16-002	AOI5-AI-16-003	AOI5-AI-16-004
		Central 3324 Bldg Open Warehouse	Central 3324 Bldg Open Warehouse	Central Warehouse Shipping/Receiving Warehouse	Tek-Solv-Trailer Southeast Corner of Trailer Lot	018 Bulidlung, Main Contractor Processing Trailer with Skirt	Control Room	Dock Warf Office 2nd Floor	Sample on Desk	Dock Office, Brick Bldg, Steam Heat
Sample Date		22-Mar-16	22-Mar-16	22-Mar-16	28-Mar-16	29-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16
Sample ID		IA-AOI3-3324-4	IA-AOI3-3324-5	IA-AOI3-3324-6	IA-AOI3-TRAILER13	IA-AOI3-018	IA-AOI5-625	IA-AOI5-526-2	IA-AOI5-526-1	IA-AOI5-501
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	ESC	LL	LL	LL	LL
Laboratory Work Order		MHF23	MHF23	MHF23	MHF24	L827327	MHF24	MHF24	MHF24	MHF24
Laboratory Sample ID		8302480	8302481	8302482	8316882	L827327-01	8316884	8316885	8316886	8316887
Sample Type	Units									
Volatile Organic Compounds										
BENZENE	µg/m3	***3.7*** BE	***3.4*** BE	***3.7*** BE	***1.8 J*** BE	***5.25*** BE	1.4 J	***4.3*** BE	***2.6 J*** BE	***4.4*** BE
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (1.54)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (0.810)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)
ETHYLBENZENE	µg/m3	2.2 J	ND (4.3)	0.91 J	ND (4.3)	ND (0.867)	1.3 J	ND (4.3)	1.2 J	1.1 J
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	1.13	9.8	18	8.6	ND (4.9)
METHYL TERTIARY BUTYL ETHER	µg/m3	0.75 J	ND (3.6)	ND (3.6)	ND (3.6)	ND (0.721)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)
NAPHTHALENE	µg/m3	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (3.30)	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)
TOLUENE	µg/m3	13 J	24 J	13	4.0	4.79	3.1 J	5.0	7.9	15
1,2,4-TRIMETHYLBENZENE**	µg/m3	1.8 J	1.1 J	1.6 J	ND (4.9)	1.23	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)
1,3,5-TRIMETHYLBENZENE**	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)	ND (0.982)	ND (4.9)	ND (4.9)	ND (4.9)	ND (4.9)
TOTAL XYLENE	µg/m3	9.2 J	1.9 J	3.8 J	3.9 J	2.23	4.9 J	1.7 J	4.1 J	3.8 J

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5 A	Concentration exceeds the VI-PA SHS
6.5 A	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI3-AI-16-005	AOI3-AI-16-006	AOI3-AI-16-007	AOI3-AI-16-008	AOI3-AI-16-009	AOI5-AI-16-001	AOI5-AI-16-002	AOI5-AI-16-003	AOI5-AI-16-004
		Central 3324 Bldg Open Warehouse	Central 3324 Bldg Open Warehouse	Central Warehouse Shipping/Receiving Warehouse	Tek-Solv-Trailer Southeast Corner of Trailer Lot	018 Buildiung, Main Contractor Processing Trailer with Skirt	Control Room	Dock Warf Office 2nd Floor	Sample on Desk	Dock Office, Brick Bldg, Steam Heat
Sample Date		22-Mar-16	22-Mar-16	22-Mar-16	28-Mar-16	29-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16
Sample ID		IA-AOI3-3324-4	IA-AOI3-3324-5	IA-AOI3-3324-6	IA-AOI3-TRAILER13	IA-AOI3-018	IA-AOI5-625	IA-AOI5-526-2	IA-AOI5-526-1	IA-AOI5-501
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	ESC	LL	LL	LL	LL
Laboratory Work Order		MHF23	MHF23	MHF23	MHF24	L827327	MHF24	MHF24	MHF24	MHF24
Laboratory Sample ID		8302480	8302481	8302482	8316882	L827327-01	8316884	8316885	8316886	8316887
Sample Type	Units									

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI5-AI-16-005	AOI5-AI-16-006	AOI6-AI-16-001	AOI6-AI-16-002	AOI6-AI-16-003	AOI6-AI-16-004	AOI6-AI-16-005	AOI6-AI-16-006	AOI6-AI-16-007
		GP2 Dock	034A/B Building	475 Building	745 Building	Control Room, 6627 Building	Truck Scale House, 6636 Building	Control Room, 739 Building	726 Building, Carpenter Shop	178 Building, Carpenter Trade Shop
Sample Date		28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI5-GP DOCK 2	IA-AOI5-034A/B	IA-AOI6-475	IA-AOI6-745	IA-AOI6-6627	IA-AOI6-6636	IA-AOI6-739	IA-AOI6-726	IA-AOI6-178
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	LL	LL	LL	ESC	ESC
Laboratory Work Order		MHF24	MHF24	MHF24	MHF24	MHF24	MHF24	MHF24	L827327	L827327
Laboratory Sample ID		8316888	8316889	8316892	8316893	8316894	8316895	8316896	L827327-02	L827327-03
Sample Type	Units									
Volatile Organic Compounds										
BENZENE	µg/m3	***1.8 J***[BE]	***1.8 J***[BE]	***5.5***[BE]	1.3 J	***36***[ABDE]	***2.1 J***[BE]	***4.5***[BE]	***3.46***[BE]	***5.05***[BE]
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (7.7)	ND (1.54)	ND (1.54)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	ND (0.810)	ND (0.810)
ETHYLBENZENE	µg/m3	1.9 J	1.9 J	1.1 J	ND (4.3)	2.0 J	2.1 J	3.2 J	ND (0.867)	ND (0.867)
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (4.9)	1.5 J	9.1	ND (4.9)	7.8	ND (4.9)	2.8 J	1.45	1.60
METHYL TERTIARY BUTYL ETHER	µg/m3	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	ND (0.721)	ND (0.721)
NAPHTHALENE	µg/m3	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (5.2)	ND (3.30)	ND (3.30)
TOLUENE	µg/m3	3.1 J	4.6	3.9	2.2 J	13	2.6 J	3.9	2.06	2.57
1,2,4-TRIMETHYLBENZENE**	µg/m3	1.1 J	12	1.4 J	ND (4.9)	3.6 J	1.1 J	ND (4.9)	ND (0.982)	ND (0.982)
1,3,5-TRIMETHYLBENZENE**	µg/m3	ND (4.9)	3.2 J	ND (4.9)	ND (4.9)	1.3 J	ND (4.9)	ND (4.9)	ND (0.982)	ND (0.982)
TOTAL XYLENE	µg/m3	7.7	11.1	4.7 J	3.3 J	11.9	9.8	14.1	ND (1.73)	1.76

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5[A]	Concentration exceeds the VI-PA SHS
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI5-AI-16-005	AOI5-AI-16-006	AOI6-AI-16-001	AOI6-AI-16-002	AOI6-AI-16-003	AOI6-AI-16-004	AOI6-AI-16-005	AOI6-AI-16-006	AOI6-AI-16-007
		GP2 Dock	034A/B Building	475 Building	745 Building	Control Room, 6627 Building	Truck Scale House, 6636 Building	Control Room, 739 Building	726 Building, Carpenter Shop	178 Building, Carpenter Trade Shop
Sample Date		28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	28-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI5-GP DOCK 2	IA-AOI5-034A/B	IA-AOI6-475	IA-AOI6-745	IA-AOI6-6627	IA-AOI6-6636	IA-AOI6-739	IA-AOI6-726	IA-AOI6-178
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		LL	LL	LL	LL	LL	LL	LL	ESC	ESC
Laboratory Work Order		MHF24	MHF24	MHF24	MHF24	MHF24	MHF24	MHF24	L827327	L827327
Laboratory Sample ID		8316888	8316889	8316892	8316893	8316894	8316895	8316896	L827327-02	L827327-03
Sample Type	Units									

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI6-AI-16-008	AOI6-AI-16-009	AOI7-AI-16-001	AOI7-AI-16-002	AOI7-AI-16-003	AOI7-AI-16-004	AOI7-AI-16-005	AOI7-AI-16-006	AOI7-AI-16-007
		295 GP Office Building 1st Floor	295 GP Office Building 2nd Floor	595 Canteen Building	450 Elect Building, Computer Room	450 Building Elect Warehouse, Back Addition on Shelf	450 Building Elect Warehouse, North Side	450 Building Elect Warehouse, Walled area Middle Bldg, Elect Testing	450 Building Elect Warehouse Table East Side Near Open Offices	442 Building Firehouse Office Table Office
Sample Date		29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI6-295-1	IA-AOI6-295-2	IA-AOI7-595	IA-AOI7-450-1	IA-AOI7-450-2	IA-AOI7-450-3	IA-AOI7-450-4	IA-AOI7-450-5	IA-AOI7-442
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order		L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327
Laboratory Sample ID		L827327-05	L827327-06	L827327-07	L827327-08	L827327-09	L827327-10	L827327-11	L827327-12	L827327-13
Sample Type	Units									
Volatile Organic Compounds										
BENZENE	µg/m3	***3.97*** [BE]	***3.94*** [BE]	***4.63*** [BE]	1.00	0.860	0.973	1.54	***1.99*** [BE]	***1.68*** [BE]
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)
ETHYLBENZENE	µg/m3	ND (0.867)	0.960	ND (0.867)	1.12	ND (0.867)	ND (0.867)	1.19	2.58	1.38
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)
METHYL TERTIARY BUTYL ETHER	µg/m3	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)
NAPHTHALENE	µg/m3	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)
TOLUENE	µg/m3	3.12	3.11	5.51	10.5	3.15	4.12	8.91	49.8	19.1
1,2,4-TRIMETHYLBENZENE**	µg/m3	2.18	2.04	1.09	1.05	ND (0.982)	ND (0.982)	1.23	2.13	1.22
1,3,5-TRIMETHYLBENZENE**	µg/m3	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)
TOTAL XYLENE	µg/m3	2.2	2.29	3.371	6.25	2.09	ND (1.73)	4.46	10.76	4.99

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5 [A]	Concentration exceeds the VI-PA SHS
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI6-AI-16-008	AOI6-AI-16-009	AOI7-AI-16-001	AOI7-AI-16-002	AOI7-AI-16-003	AOI7-AI-16-004	AOI7-AI-16-005	AOI7-AI-16-006	AOI7-AI-16-007
		295 GP Office Building 1st Floor	295 GP Office Building 2nd Floor	595 Canteen Building	450 Elect Building, Computer Room	450 Building Elect Warehouse, Back Addition on Shelf	450 Building Elect Warehouse, North Side	450 Building Elect Warehouse, Walled area Middle Bldg, Elect Testing	450 Building Elect Warehouse Table East Side Near Open Offices	442 Building Firehouse Office Table Office
Sample Date		29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI6-295-1	IA-AOI6-295-2	IA-AOI7-595	IA-AOI7-450-1	IA-AOI7-450-2	IA-AOI7-450-3	IA-AOI7-450-4	IA-AOI7-450-5	IA-AOI7-442
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order		L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327
Laboratory Sample ID		L827327-05	L827327-06	L827327-07	L827327-08	L827327-09	L827327-10	L827327-11	L827327-12	L827327-13
Sample Type	Units									

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI7-AI-16-008	AOI7-AI-16-009	AOI7-AI-16-010	AOI7-AI-16-011	AOI8-AI-16-001	AOI8-AI-16-002	AOI8-AI-16-003	AOI8-AI-16-004	
		711 Building, WTP	6622 Building, Control Room, Rear Table Center of Room	6626 Building, Control Room	6625 Building, Control Room, MF Unit	6642 Building, North Yard Trailers	6641 Building, North Yard Trailer	3326 Building North Yard Scale House	27 Building, North Yard Old Scale House	27 Building, North Yard Old Scale House
Sample Date		29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI7-711	IA-AOI7-6622	IA-AOI7-6626	IA-AOI7-6625	IA-AOI8-6642	IA-AOI8-6641	IA-AOI8-3326	IA-AOI8-27	IA-AOI8-27-DUP
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order		L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327
Laboratory Sample ID		L827327-14	L827327-16	L827327-17	L827327-18	L827327-19	L827327-20	L827327-21	L827327-22	L827327-23
Sample Type	Units									Field Duplicate
Volatile Organic Compounds										
BENZENE	µg/m3	***2.22*** BE	***3.52*** BE	***3.36*** BE	***1.63*** BE	ND (0.639)	ND (0.639)	ND (0.639)	ND (0.639)	ND (0.639)
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)	ND (1.54)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)	ND (0.810)
ETHYLBENZENE	µg/m3	ND (0.867)	***4.94*** BE	1.60	4.22	ND (0.867)	ND (0.867)	ND (0.867)	ND (0.867)	ND (0.867)
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (0.983)	1.27	2.09	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)	ND (0.983)
METHYL TERTIARY BUTYL ETHER	µg/m3	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)	ND (0.721)
NAPHTHALENE	µg/m3	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)	ND (3.30)
TOLUENE	µg/m3	3.93	7.29	3.06	71.4	1.23	2.56	1.14	ND (0.753)	1.01
1,2,4-TRIMETHYLBENZENE**	µg/m3	2.94	21.6	3.81	6.40	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)
1,3,5-TRIMETHYLBENZENE**	µg/m3	0.984	6.81	1.19	1.78	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)	ND (0.982)
TOTAL XYLENE	µg/m3	3.5	24.69	7.19	17.05	ND (1.73)	ND (1.73)	1.78	ND (1.73)	ND (1.73)

Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5 A	Concentration exceeds the VI-PA SHS
6.5 A	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI7-AI-16-008	AOI7-AI-16-009	AOI7-AI-16-010	AOI7-AI-16-011	AOI8-AI-16-001	AOI8-AI-16-002	AOI8-AI-16-003	AOI8-AI-16-004	
		711 Building, WTP	6622 Building, Control Room, Rear Table Center of Room	6626 Building, Control Room	6625 Building, Control Room, MF Unit	6642 Building, North Yard Trailers	6641 Building, North Yard Trailer	3326 Building North Yard Scale House	27 Building, North Yard Old Scale House	27 Building, North Yard Old Scale House
Sample Date		29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16	29-Mar-16
Sample ID		IA-AOI7-711	IA-AOI7-6622	IA-AOI7-6626	IA-AOI7-6625	IA-AOI8-6642	IA-AOI8-6641	IA-AOI8-3326	IA-AOI8-27	IA-AOI8-27-DUP
Sampling Company		GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD	GHD
Laboratory		ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order		L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327	L827327
Laboratory Sample ID		L827327-14	L827327-16	L827327-17	L827327-18	L827327-19	L827327-20	L827327-21	L827327-22	L827327-23
Sample Type	Units									Field Duplicate

J Indicates an estimated value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		**AOI9-AI-16-001**	**AOI9-AI-16-002**	
		SR2 Corner Office	**Loading Dock Office SR9**	**Loading Dock Office SR9**
Sample Date		**5-Apr-16**	**5-Apr-16**	**5-Apr-16**
Sample ID		**IA-AOI9-SR2**	**IA-AOI9-SR9**	**IA-AOI9-SR9-DUP**
Sampling Company		**GHD**	**GHD**	**GHD**
Laboratory		**LL**	**LL**	**LL**
Laboratory Work Order		**MHF26**	**MHF26**	**MHF26**
Laboratory Sample ID		**8322922**	**8322924**	**8322925**
Sample Type	**Units**			**Field Duplicate**
Volatile Organic Compounds				
BENZENE	µg/m3	1.3 J	0.71 J	0.64 J
1,2-DIBROMOETHANE (EDB)	µg/m3	ND (7.7)	ND (7.7)	ND (7.7)
1,2-DICHLOROETHANE (EDC)	µg/m3	ND (4.0)	ND (4.0)	ND (4.0)
ETHYLBENZENE	µg/m3	2.9 J	ND (4.3)	1.5 J
ISOPROPYLBENZENE (CUMENE)	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)
METHYL TERTIARY BUTYL ETHER	µg/m3	ND (3.6)	ND (3.6)	ND (3.6)
NAPHTHALENE	µg/m3	ND (5.2)	ND (5.2)	ND (5.2)
TOLUENE	µg/m3	4.1	0.88 J	0.88 J
1,2,4-TRIMETHYLBENZENE**	µg/m3	1.2 J	ND (4.9)	ND (4.9)
1,3,5-TRIMETHYLBENZENE**	µg/m3	ND (4.9)	ND (4.9)	ND (4.9)
TOTAL XYLENE	µg/m3	14.5	1.1 J	7 J

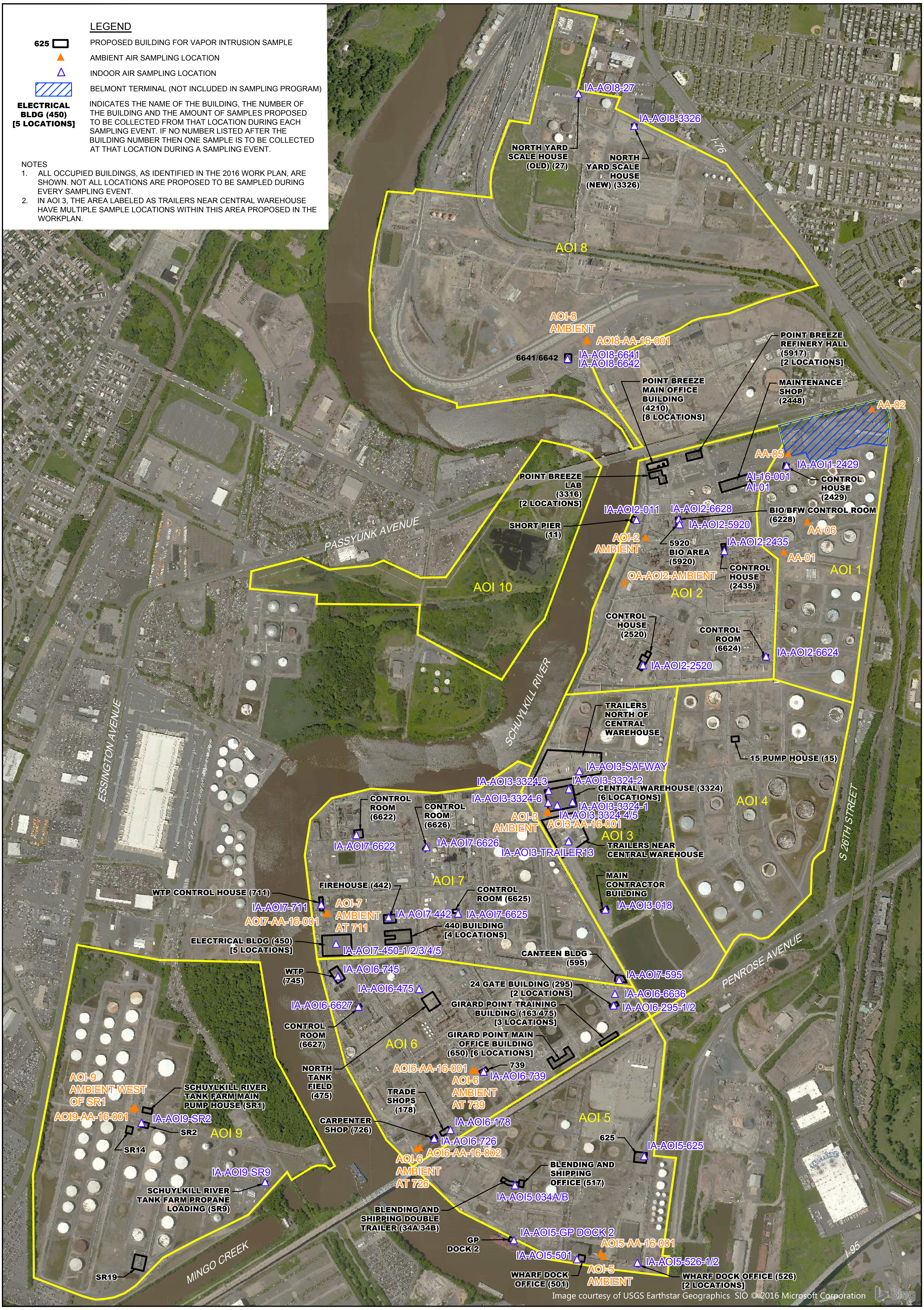
Notes:

VI-PA[A]	PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
VI-PA[B]	1/10th of the PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening Values, Non-Residential (Draft, July 2015).
OSHA[C]	Occupational Safety and Health Administration - Permissible Exposure Limits
USEPA RSL[D]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-5 and Hazard Index of 1.
USEPA RSL[E]	United States Environmental Protection Agency Non-residential indoor air Cancer Risk of 1E-6 and Hazard Index of 0.1.
**	The RSL for TMB were calculated using the September 2016 final IRIS RfD.
ACGIH TLV[F]	American Conference of Governmental Industrial Hygienists - Threshold Limit Value
NIOSH[G]	National Institute for Occupational Safety and Health - Recommended Exposure Limits
MH Air Tox	Marcus Hook Air Toxics Monitor 2015, maximum value of PADEP data accessed February 5, 2016.
EPA Res IA	USEPA Background Residential Indoor Air 2011, 95th percentile.
*	95th percentile value not provided, value is 90th percentile.
6.5[A]	Concentration exceeds the VI-PA SHS
6.5[A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.03)	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.

Table 1
Indoor Air Sampling Data
Philadelphia Energy Systems Complex, on behalf of Evergreen Resources Group, LLC

Sample Location		AOI9-AI-16-001	AOI9-AI-16-002	
		SR2 Corner Office	Loading Dock Office SR9	Loading Dock Office SR9
Sample Date		5-Apr-16	5-Apr-16	5-Apr-16
Sample ID		IA-AOI9-SR2	IA-AOI9-SR9	IA-AOI9-SR9-DUP
Sampling Company		GHD	GHD	GHD
Laboratory		LL	LL	LL
Laboratory Work Order		MHF26	MHF26	MHF26
Laboratory Sample ID		8322922	8322924	8322925
Sample Type	Units			Field Duplicate

J Indicates an estimated value.



Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Acquisition Date: June 2014, Accessed: 2016.

0 500 1000ft

Coordinate System: PENNSYLVANIA SOUTH NAD83

N

GHD

PHILADELPHIA ENERGY SOLUTIONS FACILITY
PHILADELPHIA, PENNSYLVANIA

INDOOR AIR AND AMBIENT AIR SAMPLING LOCATIONS

11109626-00

Oct 20, 2016

FIGURE 1

CAD File: P:\drawings\11109000s\11109626\11109626-CORR\11109626-00(DOER001)\11109626-00(DOER001)GN\11109626-00(DOER001)GN-WA001.dwg

APPENDIX G

LNAPL CHARACTERIZATION

APPENDIX G
LNAPL CHARACTERIZATION DATA

Characterization Results[1] Compiled for Current Conditions Report Interpretation of Product Type(s), Proportions and Weathering					
Well ID	**Density (gm/ml @ 60ºF)**	**Characterized LNAPL Type**	**Torkleson LNAPL Type(s)**	**Proportions**	**Weathering**
A-13	0.9015	Heavy Distillate	Lube Oil	90	Extreme
			Middle Distillate	10	Extreme
A-14	0.9143	Heavy Distillate	Aviation Gasoline	4	Severe
			Lube Oil	90	Extreme
			Middle Distillate	6	Severe
A-22	0.9356	Middle Distillate	Heavier Material	20	Extreme
			Middle Distillate	80	Extreme
A-47	0.8926	Heavy Distillate	Lube Oil	100	Severe
A-133	QNS[2] (.9767)	Heavy Distillate	Residual Oil	100	Severe
A-136	QNS[2] (.9767)	Heavy Distillate	Middle Distillate	25	Severe
			Residual Oil	75	Severe
Characterization Results Compiled for AOI 5 Site Characterization Interpretation of Product Type(s), Proportions and Weathering					
Well ID	**Density (gm/ml @ 60ºF)**	**LNAPL Type(s)**	**Torkleson LNAPL Type(s)**	**Proportions**	**Weathering**
A-4	QNS[2] (.9100)	Middle Distillate	Heavier Material	10	Extreme
			Middle Distillate	90	Extreme
A-5	0.9124	Heavy Distillate	Lube Oil	100	Extreme
A-7	0.8901	Heavy Distillate	Light Lube Oil	100	Extreme
A-20	0.9220	Middle Distillate	Middle Distillate	75	Extreme
			Heavier Material	25	Extreme
A-24	0.8953	Middle Distillate	Middle Distillate	80	Extreme
			Heavier Material	20	Extreme
A-48	QNS[2] (.9100)	Middle Distillate	Middle Distillate	70	Extreme
			Heavier Material	30	Extreme
A-144	0.8753	Middle Distillate	Middle Distillate	80	Extreme
			Unknown Lighter Material	10	Unknown
			Heavier Material	10	Extreme
A-155	0.877	Middle Distillate	Middle Distillate	75	Extreme
			Stoddard Solvent	5	Extreme
			Unknown Lighter Material	10	Unknown
			Heavier Material	10	Extreme
SW-1	0.91	Middle Distillate	Middle Distillate	70	Extreme
			Heavier Material	30	Extreme
SW-4	QNS[2]	Middle Distillate	Middle Distillate	70	Extreme
			Heavier Material	30	Extreme
RWBH-2	0.906	Heavy Distillate	NA	NA	NA

Notes:
1. Characterization Data Provided by Torkelson Geochemistry of Tulsa, OK
2. Insufficient sample volume to determine density values. Density values determined using similar product types in the study
3. RWBH-2 LNAPL sample was analyzed by an on-site PES facility laboratory.
   The density was calculated using the laboratory reported API Gravity of 24.7 degrees API.
4. gm/ml - grams per milliliter
5. NA - not available

Torkelson Geochemistry, Inc.
2528 S. Columbia Place
Tulsa, OK 74114-3233
Phone: 918-749-8441 e-mail: BTorkelson@aol.com
Fax: 918-749-6005

CHAIN-OF-CUSTODY RECORD

Project: Sunoco Refinery - Philadelphia
Location: A01-5
Proj. No.:
P.O.:
Sampled By:

Report/Bill To: Jason Hanna
Address: Langan Engineering
P.O. Box 1569
Doylestown PA 18901
Phone: 215 491-6500
Fax:
e-mail: Jhanna@Langan.com

Additional Instructions
please provide brief interpolation consistent with other LNAPL Characterizations for the Philadelphia Refinery
*see attached
Requested Turn-Around Time: Normal

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None					ANALYSES REQUESTED: GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur					REMARKS
1	A01-5-SW-4	12-26-06			1						X												
2	A01-5-SW-1	12-26-06			1						X												
3	A01-5-A-4	12-26-06			1						X												
4	A01-5-A-7	12-26-06			1						X												
5	A01-5-A-5	12-26-06			1						X												
6	A01-5-A-48	12-26-06			1						X												
7																							
8																							
9																							
10																							

	RELINQUISHED BY	ACCEPTED BY	DATE	TIME
		Bruce Torkelson	12-27-06	0900

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-4
Acquired : Jan 04, 2007 10:26:21

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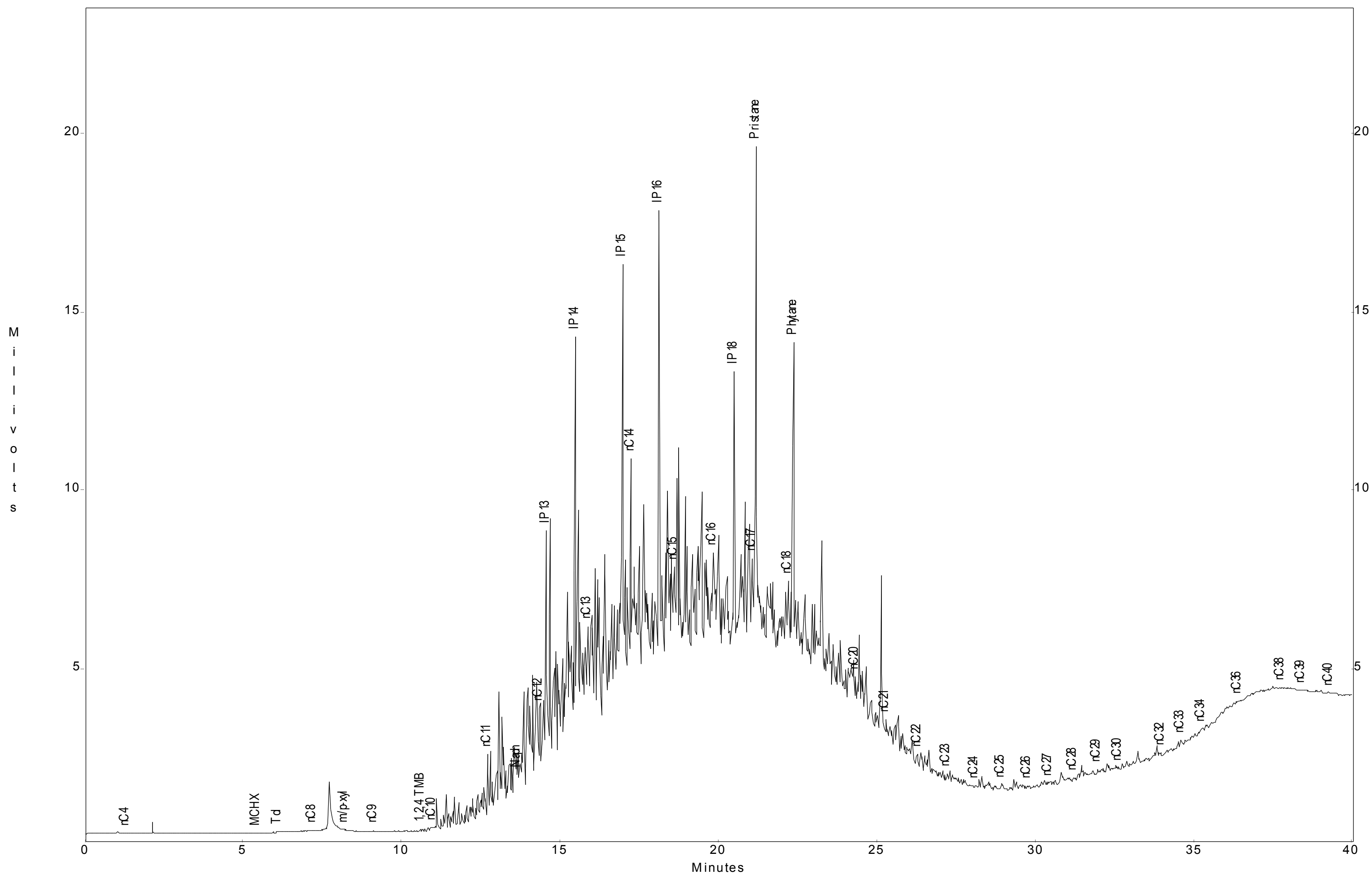

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-5
Acquired : Jan 04, 2007 12:53:27

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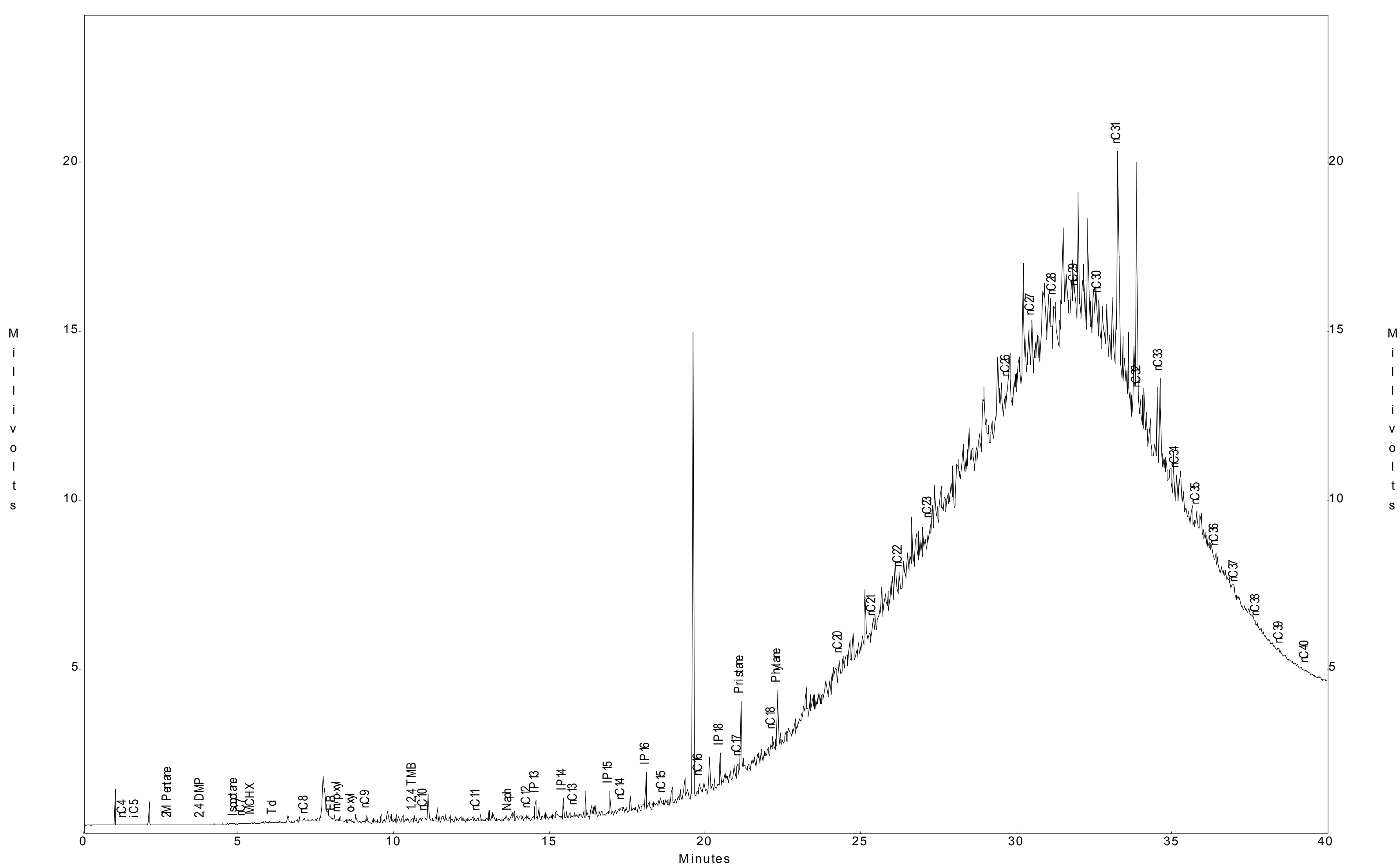

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-7
Acquired : Jan 04, 2007 11:14:28

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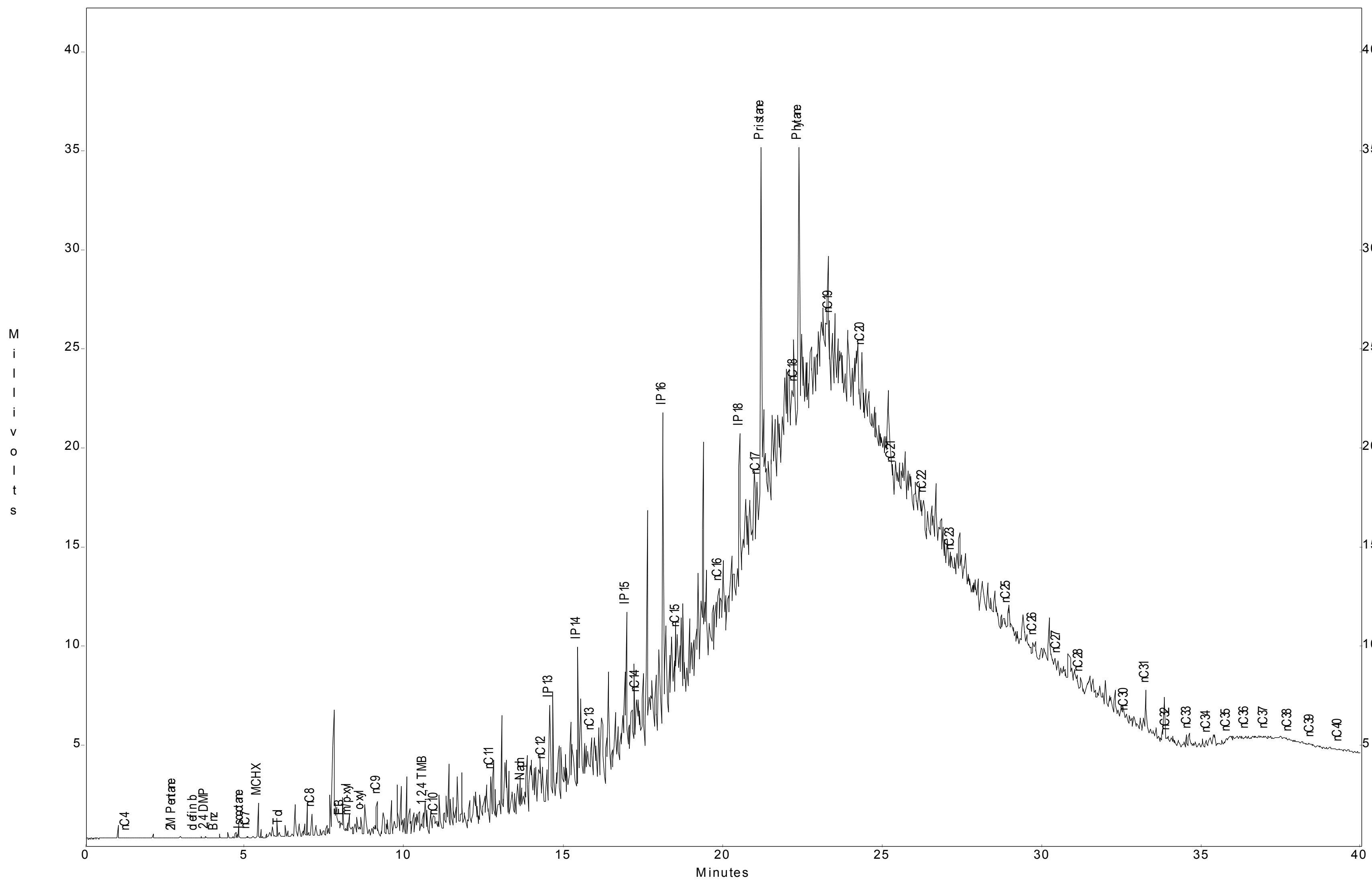

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-48
Acquired : Jan 04, 2007 14:38:17

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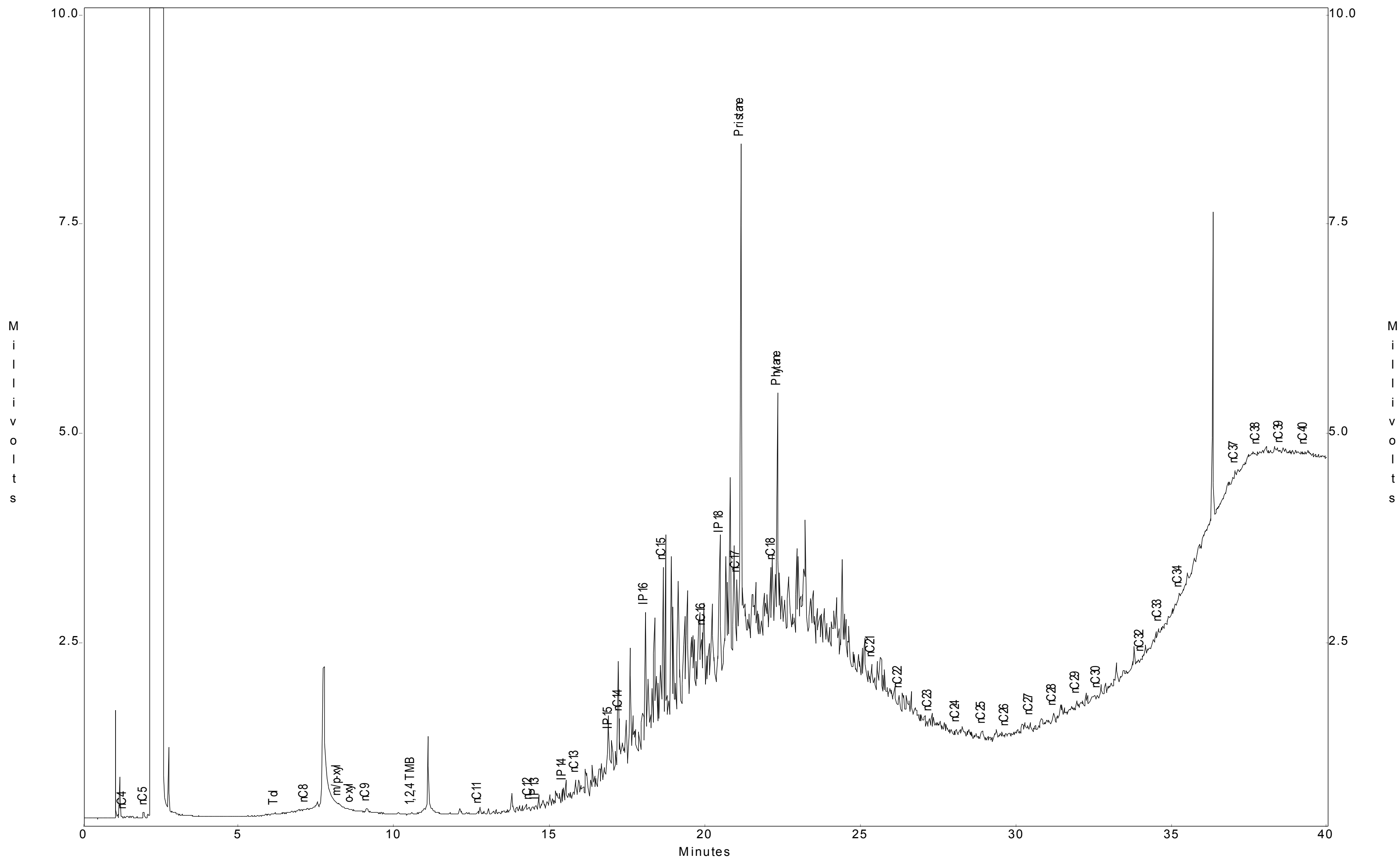

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-SW-1
Acquired : Jan 04, 2007 08:48:08

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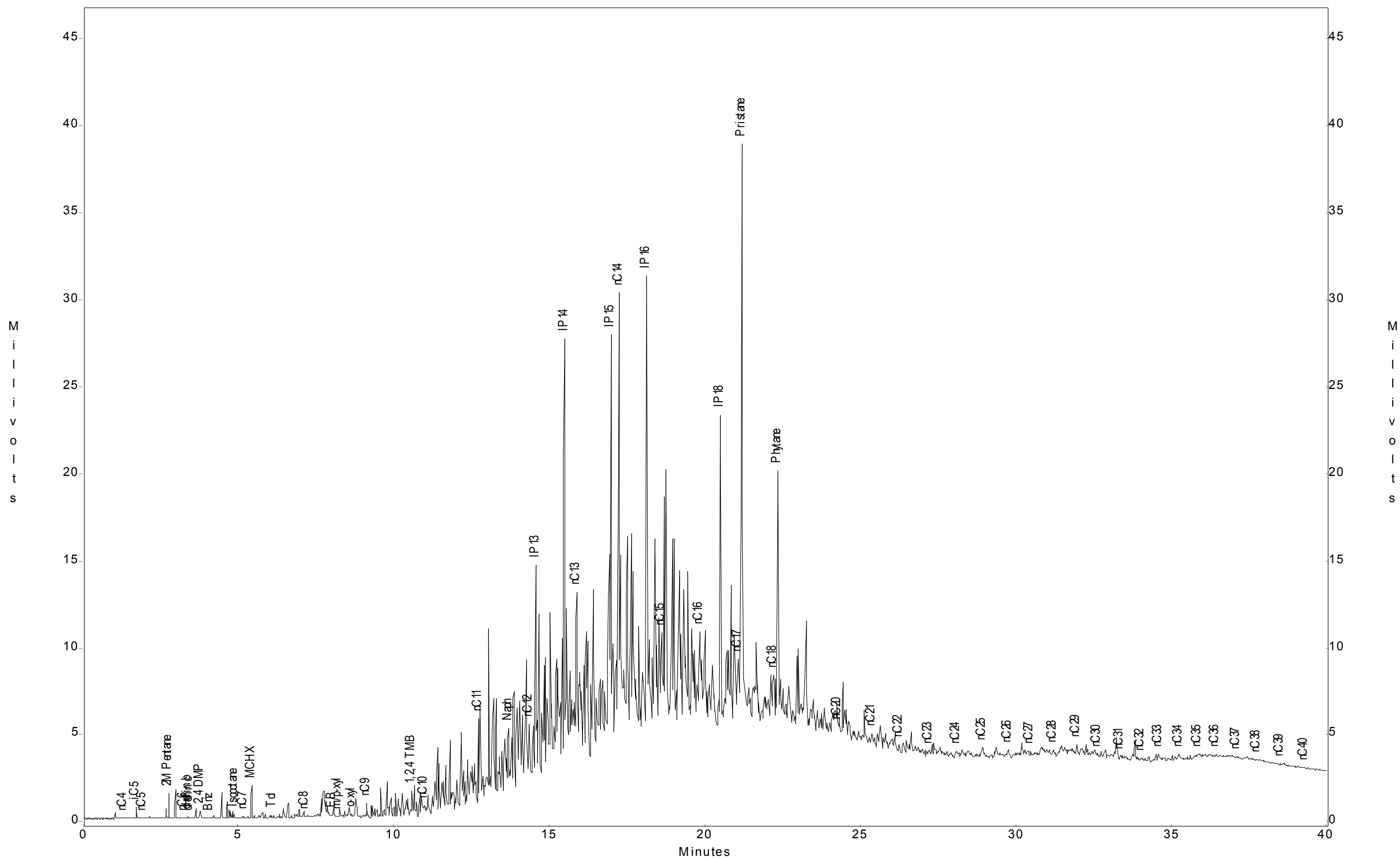

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-SW-4
Acquired : Jan 04, 2007 13:42:09

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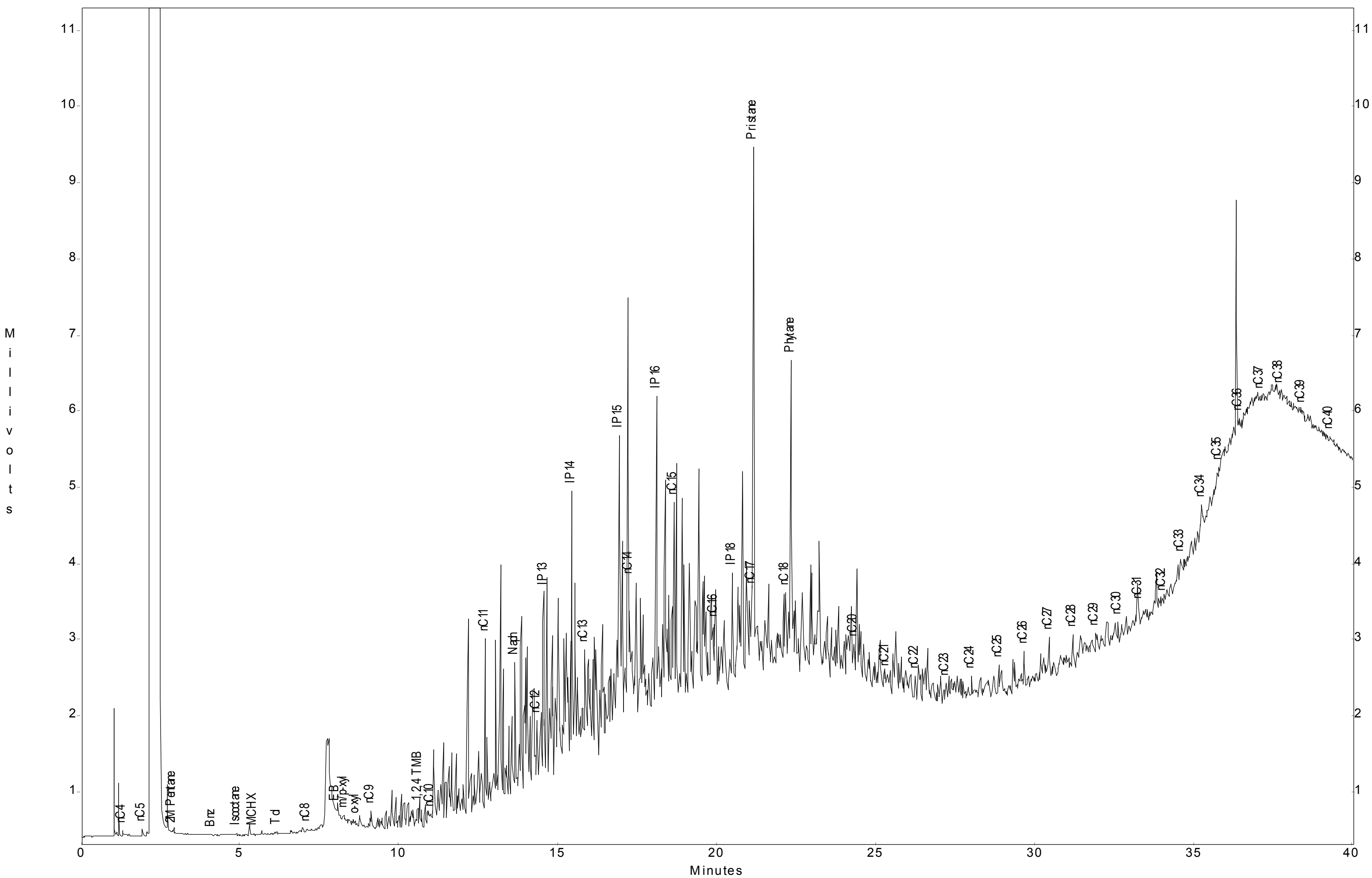

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : Gas/Dies/Wax std
Acquired : Jan 04, 2007 12:04:06

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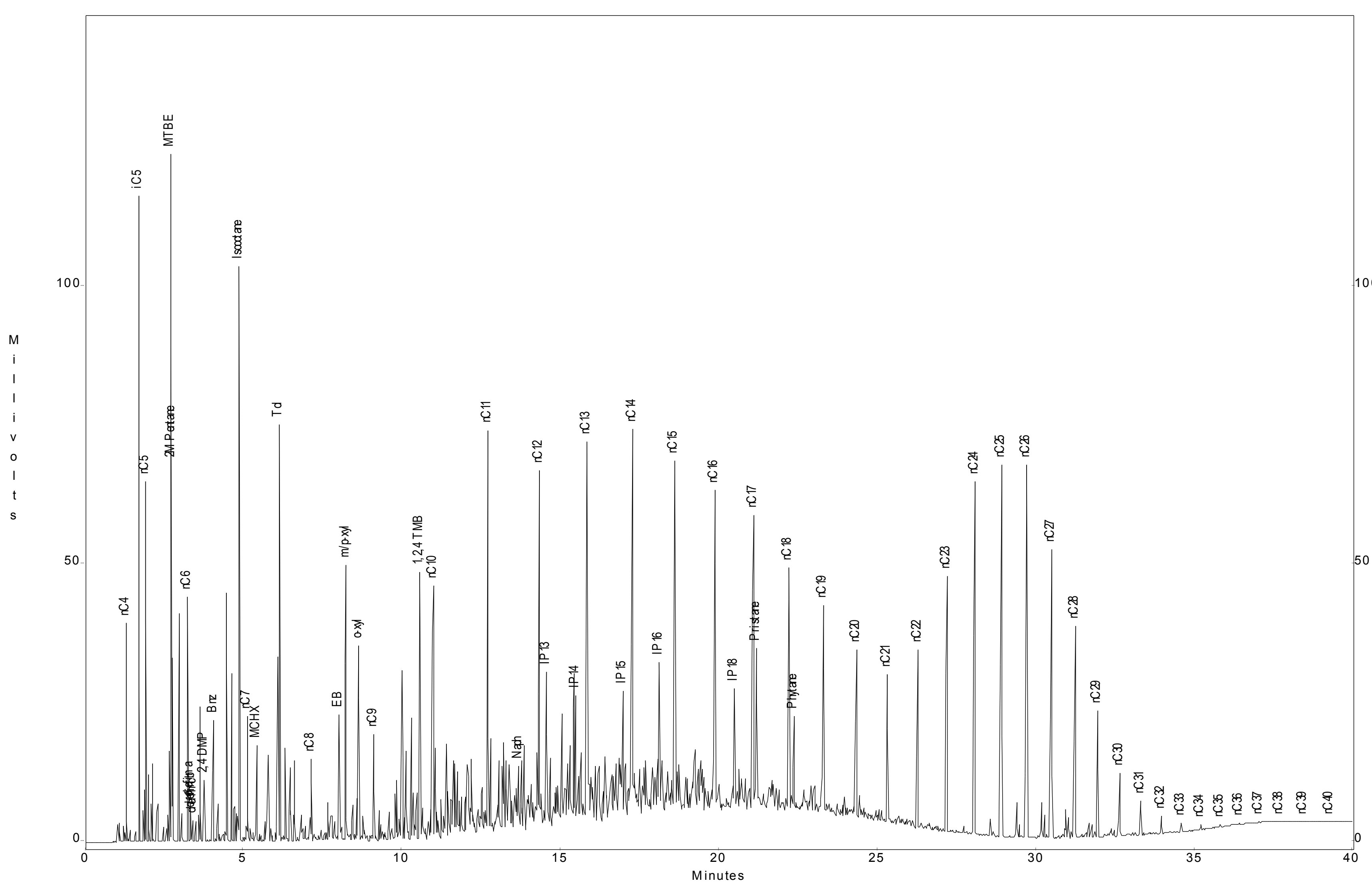

Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-4
Acquired : Jan 04, 2007 10:26:21

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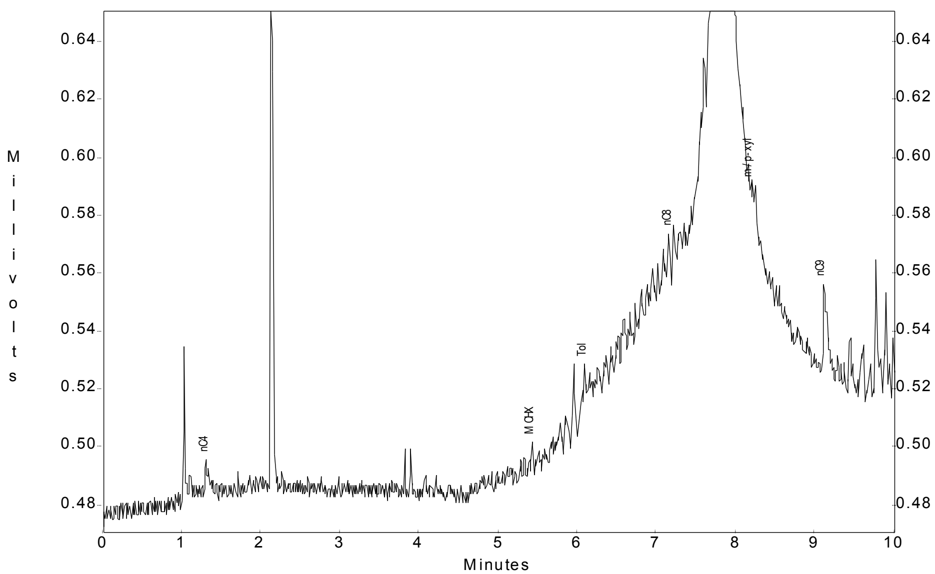

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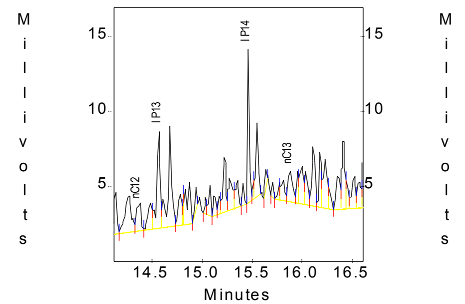
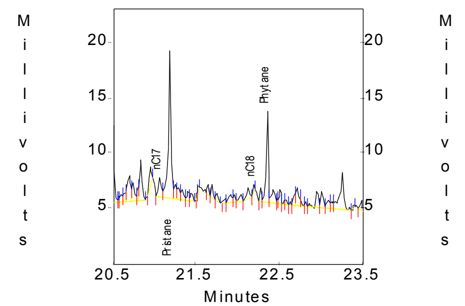
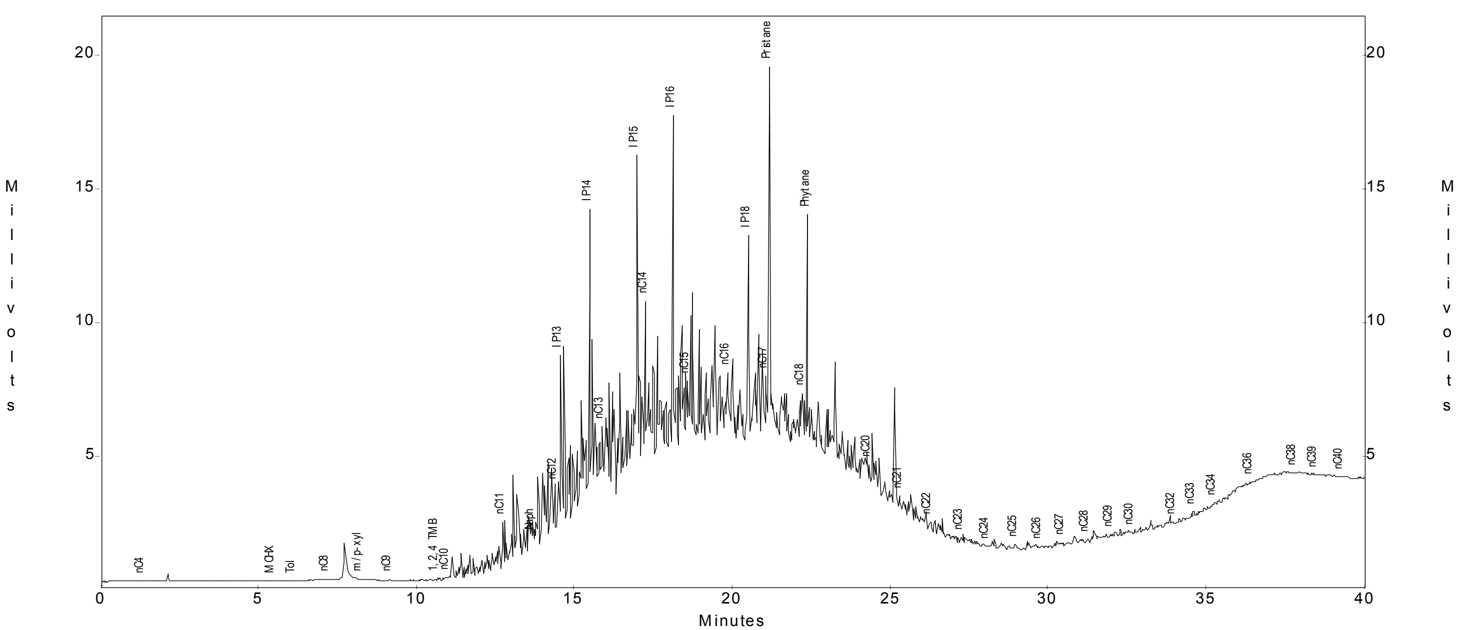


c:\ezchrom\chrom\06182\a-4.2 -- Channel A



c:\ezchrom\chrom\06182\a-4.2 -- Channel A



Channel A Results

Peak	Area	Height
nC4	24	11
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	0	0
Isooctane	0	0
nC7	0	0
MCHX	12	9
Tol	59	17
nC8	134	45
EB	0	0
m/p-xyl	137	51
o-xyl	0	0
nC9	123	31
1,2,4 TMB	139	67
nC10	600	104
nC11	2923	1708
Naph	1692	416
nC12	5587	1690
IP13	12877	6446
IP14	13675	10138
nC13	6958	2039
IP15	25847	12316
nC14	15023	6738
IP16	34022	13256
nC15	9747	3074
nC16	11186	2830
IP18	19232	7580
nC17	4143	1801
Pristane	30856	13489
nC18	1001	834
Phytane	16927	8395
nC19	0	0
nC20	1772	842
nC21	1943	523
nC22	1145	317
nC23	535	202
nC24	136	53
nC25	1471	179
nC26	384	74
nC27	723	99
nC28	500	96
nC29	219	97
nC30	117	36
nC31	0	0
nC32	137	61
nC33	519	160
nC34	107	54
nC35	0	0
nC36	46	20
nC37	0	0
nC38	76	33
nC39	117	26
nC40	47	19

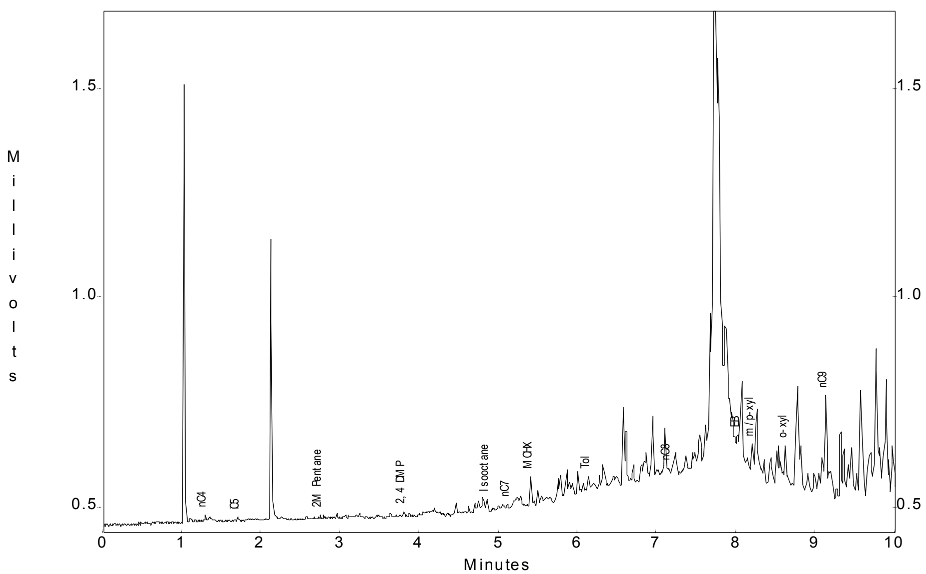
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location

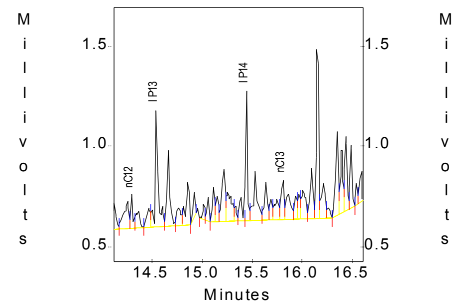
Sample ID : AO1-5-A-5

Acquired : Jan 04, 2007 12:53:27

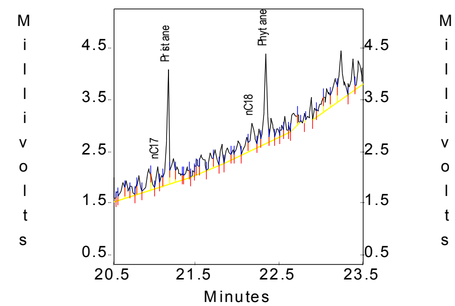
c:\ezchrom\chrom\06182\a-5 -- Channel A



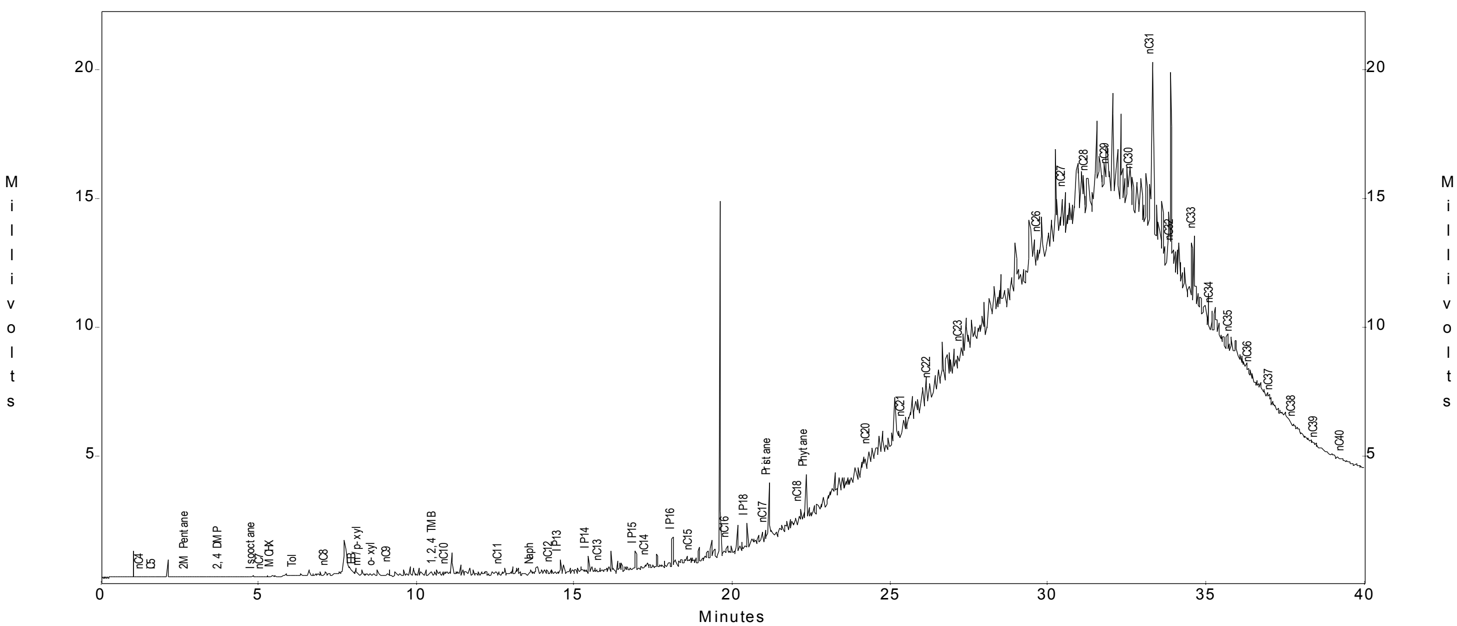
c:\ezchrom\chrom\06182\a-5 -- Channel A



c:\ezchrom\chrom\06182\a-5 -- Channel A



c:\ezchrom\chrom\06182\a-5 -- Channel A



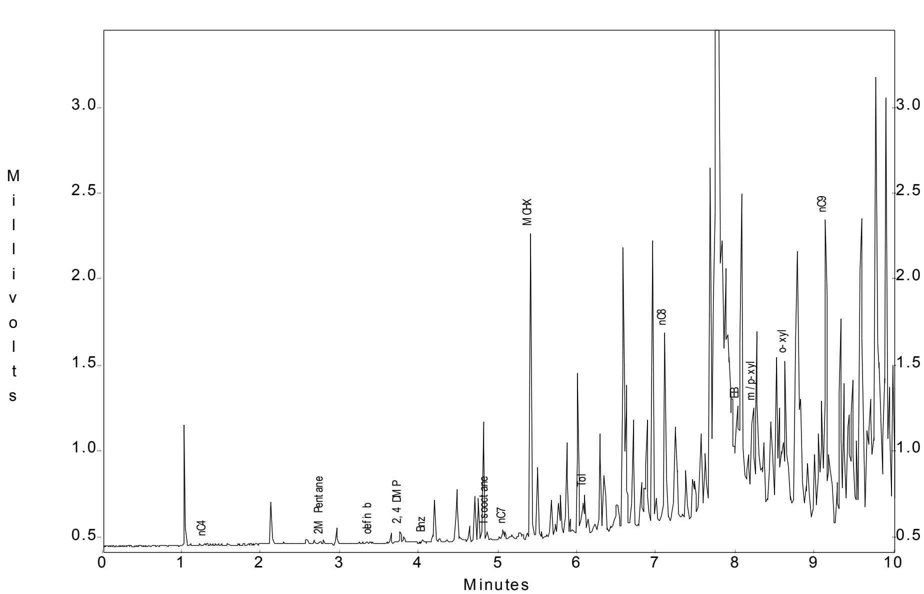
Channel A Results

Peak	Area	Height
nC4	18	17
iC5	13	11
nC5	0	0
MTBE	0	0
2M Pentane	12	10
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	24	13
Bnz	0	0
Isooctane	41	27
nC7	10	9
MCHX	93	70
Tol	79	41
nC8	55	38
EB	228	132
m/p-xyl	276	113
o-xyl	179	119
nC9	423	247
1,2,4 TMB	427	132
nC10	716	123
nC11	332	99
Naph	187	98
nC12	238	169
IP13	1195	587
IP14	909	647
nC13	429	193
IP15	1120	707
nC14	398	208
IP16	2297	1137
nC15	448	195
nC16	1405	407
IP18	2500	1037
nC17	819	431
Pristane	4904	2226
nC18	1585	510
Phytane	4010	1727
nC19	0	0
nC20	1886	673
nC21	1800	463
nC22	2246	608
nC23	1113	419
nC24	0	0
nC25	0	0
nC26	2348	1004
nC27	3563	1592
nC28	8162	1369
nC29	784	847
nC30	2575	1155
nC31	18391	5680
nC32	464	236
nC33	6235	2522
nC34	1765	780
nC35	534	289
nC36	198	226
nC37	78	98
nC38	35	39
nC39	119	61
nC40	38	32

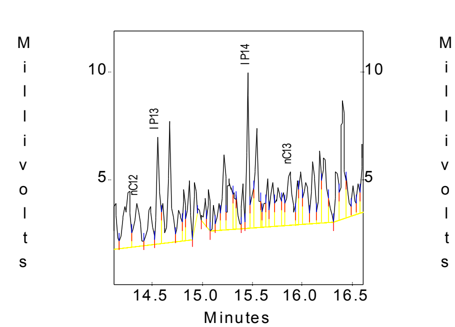
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-7
Acquired : Jan 04, 2007 11:14:28

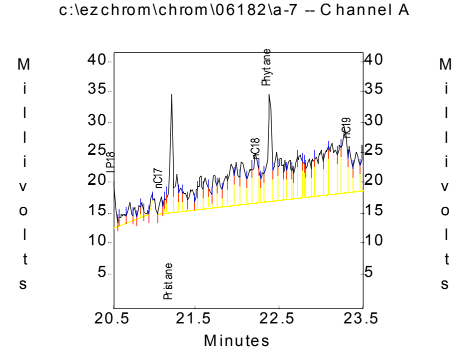
c:\ezchrom\chrom\06182\a-7 -- Channel A



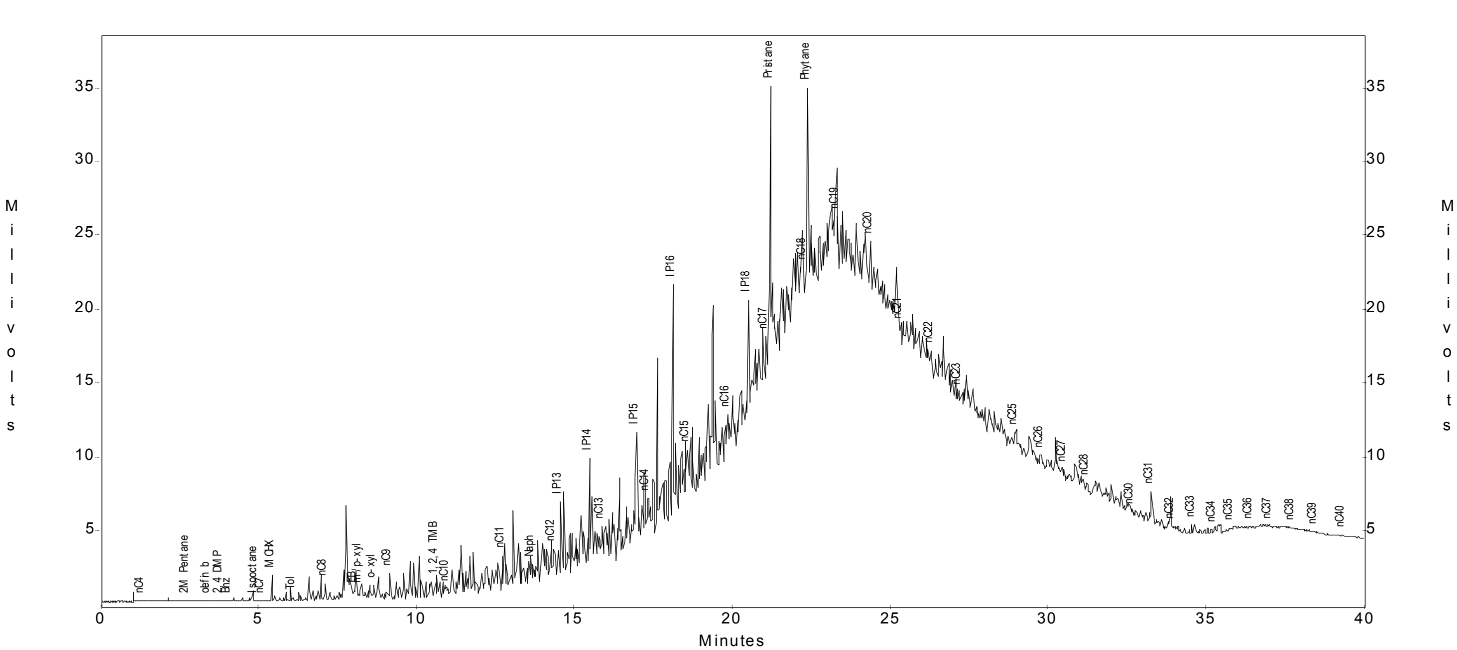
c:\ezchrom\chrom\06182\a-7 -- Channel A



c:\ezchrom\chrom\06182\a-7 -- Channel A



c:\ezchrom\chrom\06182\a-7 -- Channel A



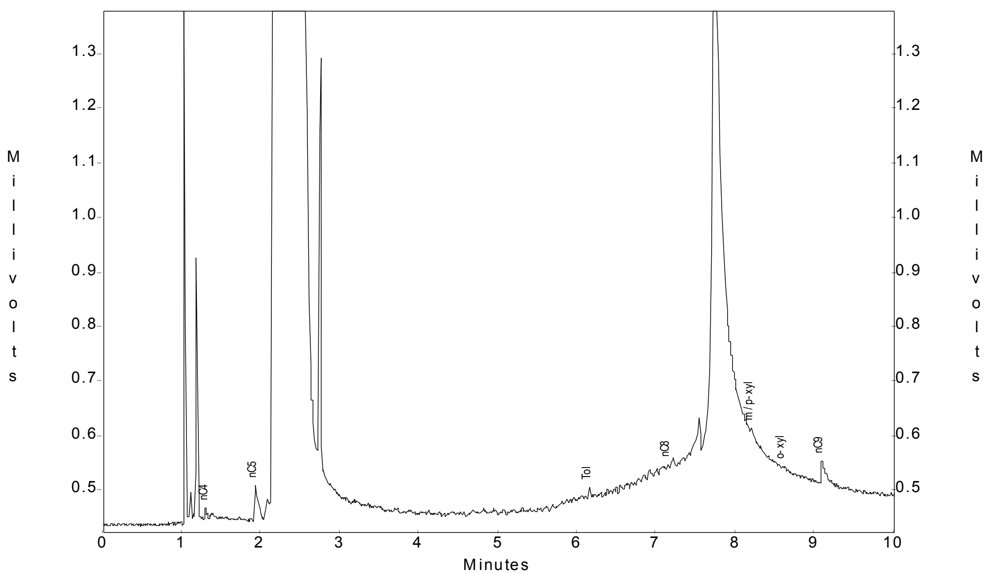
Channel A Results

Peak	Area	Height
nC4	13	12
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	23	15
nC6	0	0
olefin a	0	0
olefin b	11	9
olefin c	0	0
2,4 DMP	129	73
Bnz	24	17
Isooctane	87	52
nC7	77	53
MCHX	2096	1771
Tol	311	241
nC8	2355	1156
EB	1710	703
m/p-xyl	1426	691
o-xyl	1416	954
nC9	2811	1763
1,2,4 TMB	2262	1058
nC10	671	536
nC11	4011	2288
Naph	2087	1266
nC12	7391	1978
IP13	9190	4955
IP14	10929	7218
nC13	8714	2454
IP15	14698	7645
nC14	6674	2648
IP16	34850	15666
nC15	8652	3423
nC16	5881	2711
IP18	22099	7688
nC17	5835	2824
Pristane	46965	19519
nC18	8368	5749
Phytane	60611	17676
nC19	20502	7512
nC20	13671	4295
nC21	3325	943
nC22	6349	1695
nC23	2591	601
nC24	0	0
nC25	8805	1266
nC26	3165	746
nC27	1919	718
nC28	3057	605
nC29	0	0
nC30	535	28
nC31	5875	1929
nC32	286	37
nC33	2148	538
nC34	92	118
nC35	319	136
nC36	122	83
nC37	285	66
nC38	47	47
nC39	32	21
nC40	193	67

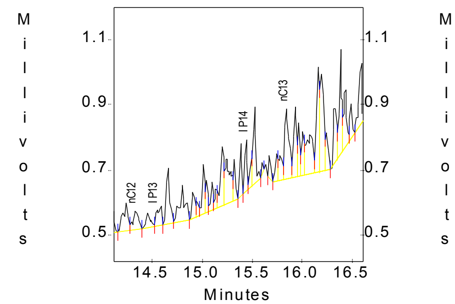
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-A-48
Acquired : Jan 04, 2007 14:38:17

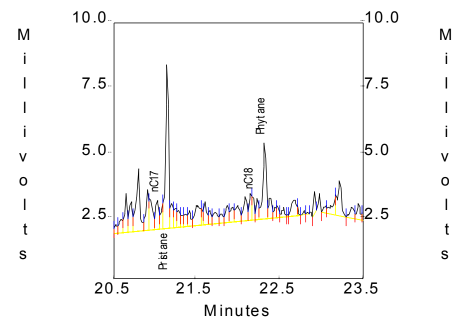
c:\ezchrom\chrom\06182\a-48 -- Channel A



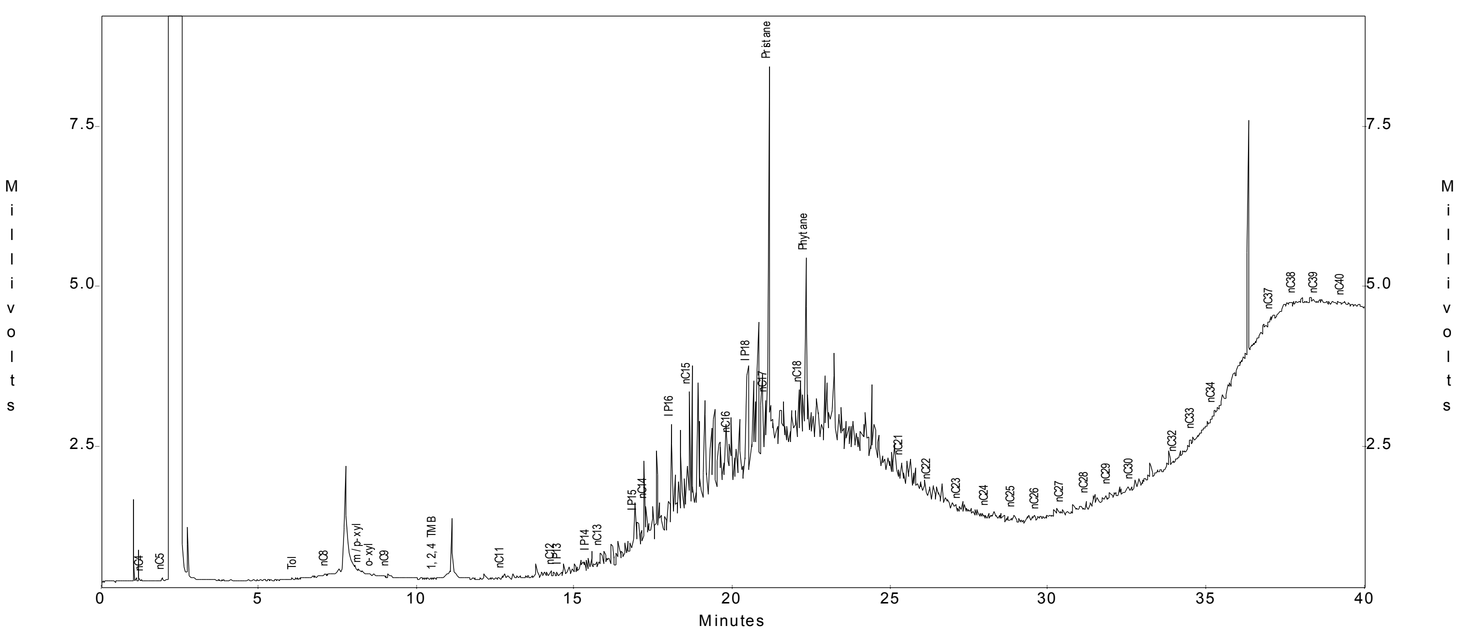
c:\ezchrom\chrom\06182\a-48 -- Channel A



c:\ezchrom\chrom\06182\a-48 -- Channel A



c:\ezchrom\chrom\06182\a-48 -- Channel A



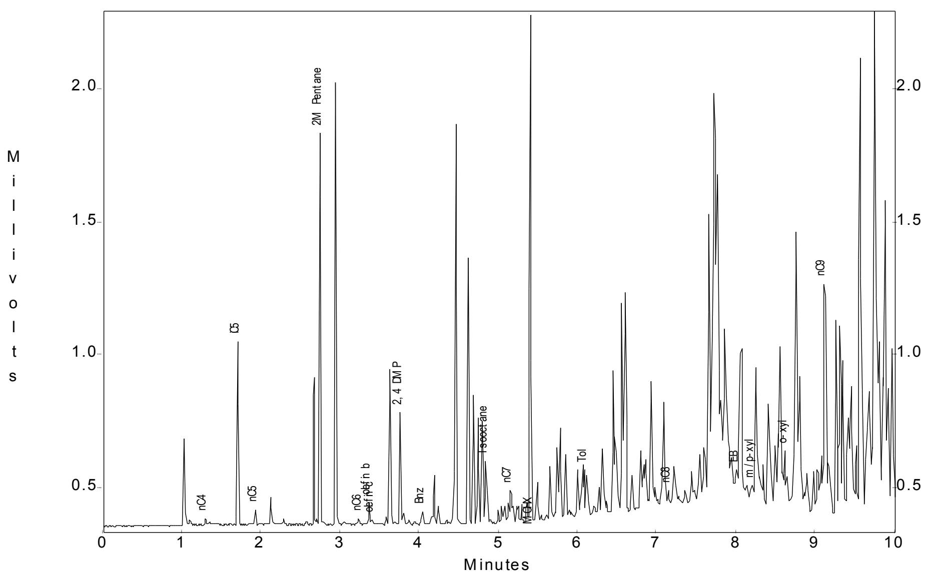
Channel A Results

Peak	Area	Height
nC4	36	19
iC5	0	0
nC5	197	64
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin c	0	0
olefin a	0	0
olefin b	0	0
2,4 DMP	0	0
Bnz	0	0
Isooctane	0	0
nC7	0	0
MCHX	0	0
Tol	87	29
nC8	107	50
EB	0	0
m/p-xyl	520	95
o-xyl	51	15
nC9	201	41
1,2,4 TMB	81	17
nC10	0	0
nC11	93	42
Naph	0	0
nC12	208	55
IP13	206	44
IP14	223	160
nC13	647	213
IP15	444	346
nC14	853	502
IP16	3968	1625
nC15	4013	1980
nC16	1503	816
IP18	5869	1757
nC17	3545	1098
Pristane	14234	6276
nC18	1582	899
Phytane	6937	2927
nC19	0	0
nC20	0	0
nC21	701	270
nC22	608	162
nC23	317	107
nC24	305	74
nC25	904	122
nC26	130	52
nC27	157	96
nC28	389	126
nC29	340	94
nC30	81	40
nC31	0	0
nC32	32	22
nC33	131	69
nC34	136	47
nC35	0	0
nC36	0	0
nC37	118	62
nC38	118	47
nC39	86	27
nC40	28	29

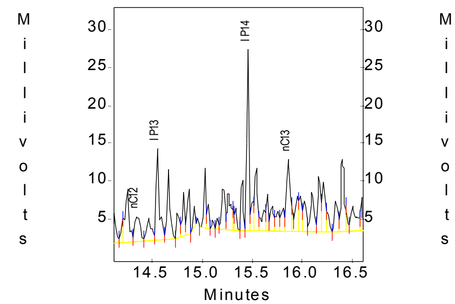
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-SW-1
Acquired : Jan 04, 2007 08:48:08

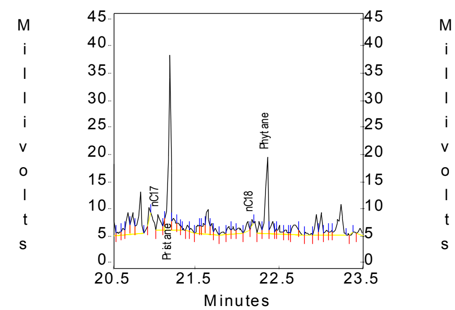
c:\ezchrom\chrom\06182\sw-1 -- Channel A



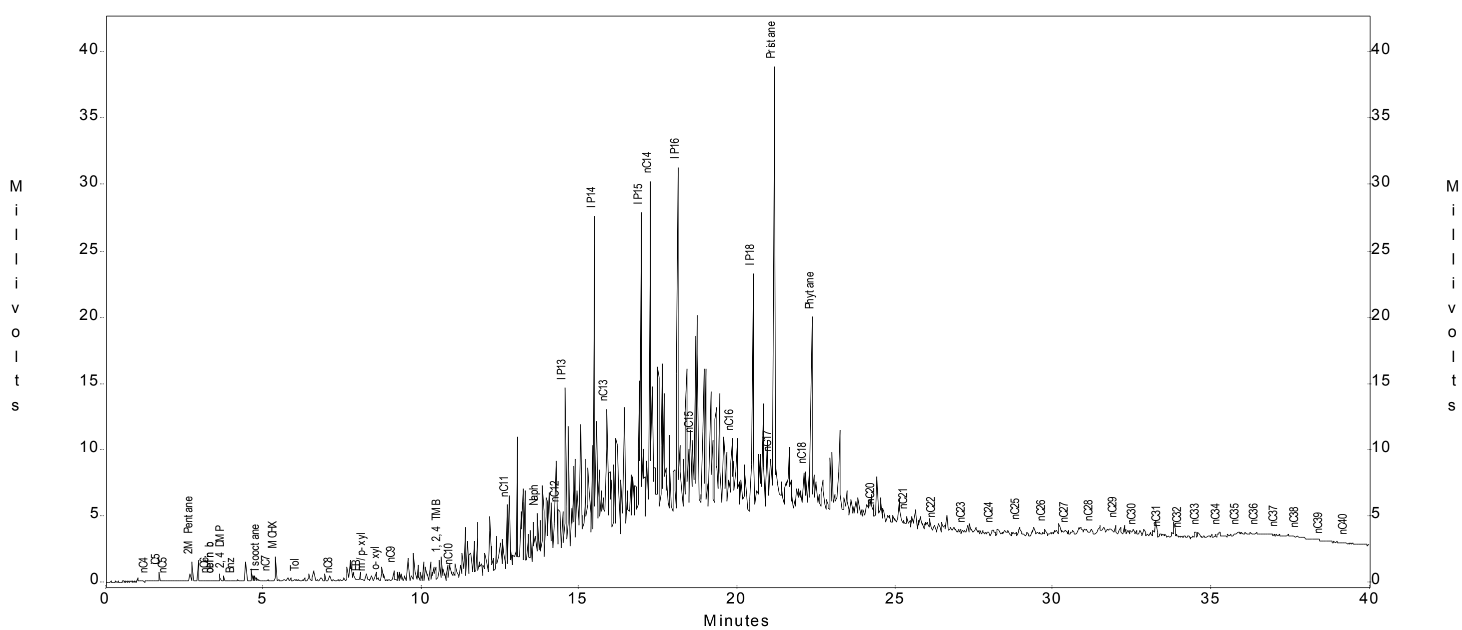
c:\ezchrom\chrom\06182\sw-1 -- Channel A



c:\ezchrom\chrom\06182\sw-1 -- Channel A



c:\ezchrom\chrom\06182\sw-1 -- Channel A



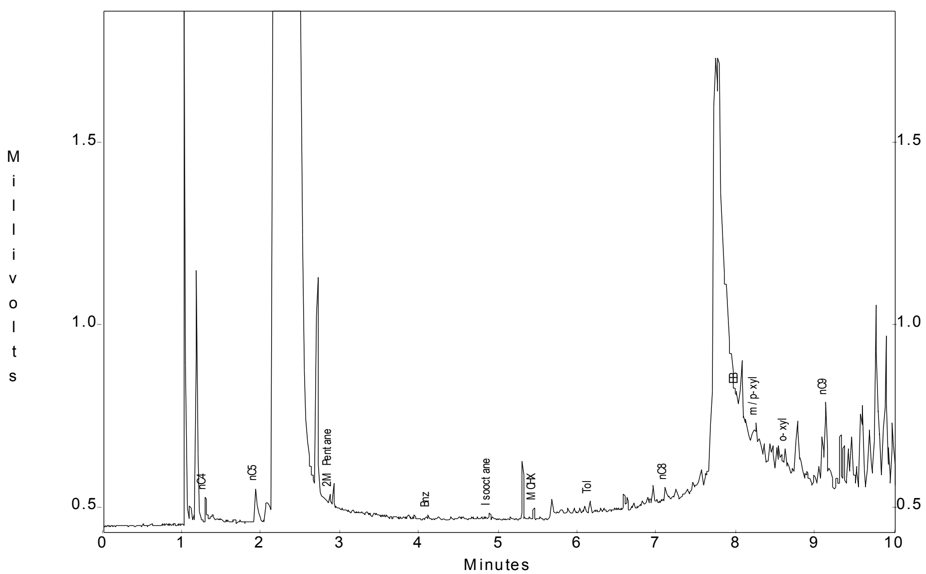
Channel A Results

Peak	Area	Height
nC4	50	26
iC5	722	691
nC5	53	51
MTBE	0	0
2M Pentane	1478	1474
nC6	23	19
olefin a	0	0
olefin b	89	78
olefin c	20	19
2,4 DMP	496	423
Bnz	82	50
Isooctane	323	235
nC7	223	125
MCHX	2291	1912
Tol	224	188
nC8	209	102
EB	400	171
m/p-xyl	288	113
o-xyl	366	244
nC9	1331	864
1,2,4 TMB	2933	1508
nC10	2866	551
nC11	7928	4805
Naph	4126	2933
nC12	11501	3165
IP13	26472	12080
IP14	39102	23909
nC13	22164	9440
IP15	41168	23999
nC14	62315	26264
IP16	48341	26813
nC15	23314	6099
nC16	17536	5574
IP18	41118	17802
nC17	6743	2685
Pristane	74220	32261
nC18	1206	883
Phytane	30741	14171
nC19	0	0
nC20	1233	29
nC21	2154	737
nC22	1910	469
nC23	1428	290
nC24	1705	406
nC25	2702	576
nC26	1582	430
nC27	829	345
nC28	1623	368
nC29	1932	572
nC30	166	0
nC31	248	104
nC32	162	116
nC33	515	263
nC34	429	218
nC35	100	67
nC36	199	97
nC37	178	97
nC38	217	77
nC39	38	26
nC40	176	49

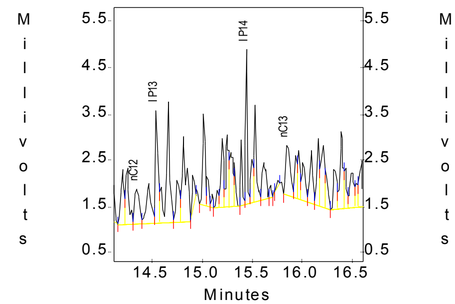
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : AO1-5-SW-4
Acquired : Jan 04, 2007 13:42:09

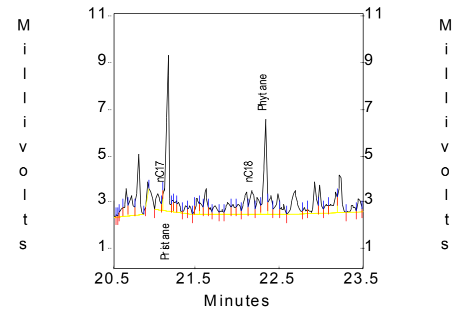
c:\ezchrom\chrom\06182\sw-4 -- Channel A



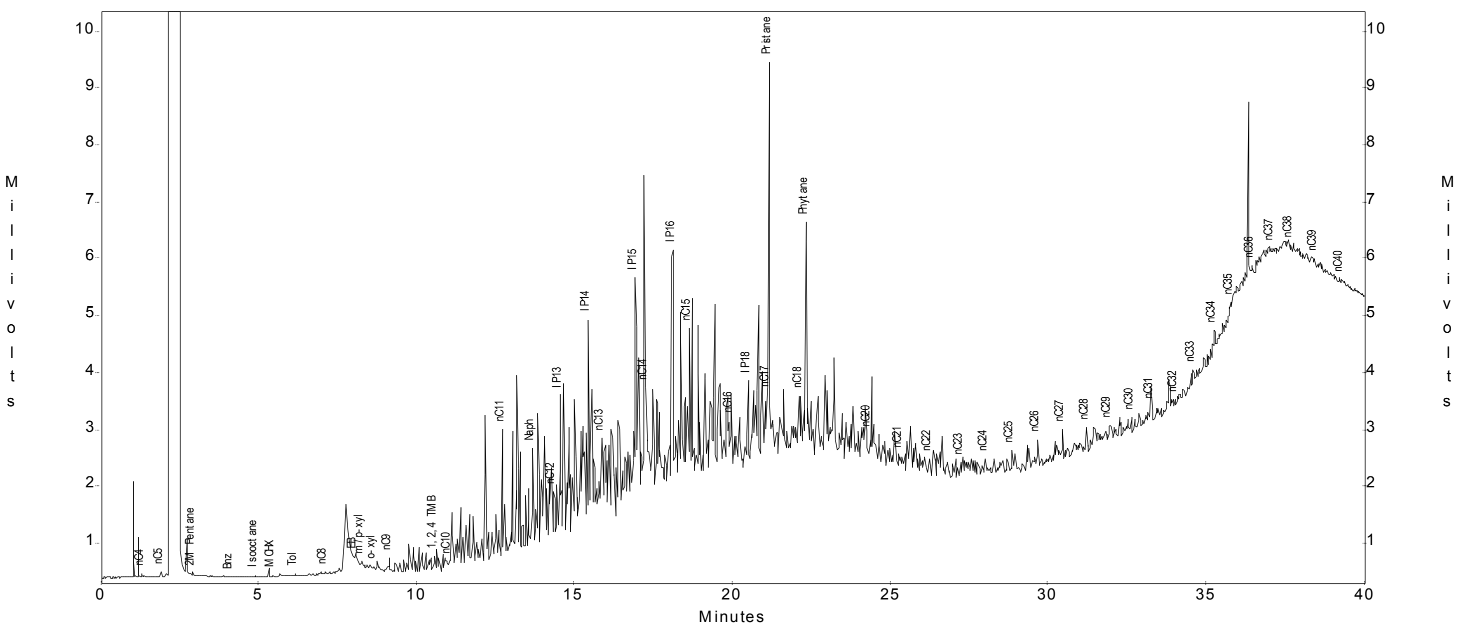
c:\ezchrom\chrom\06182\sw-4 -- Channel A



c:\ezchrom\chrom\06182\sw-4 -- Channel A



c:\ezchrom\chrom\06182\sw-4 -- Channel A



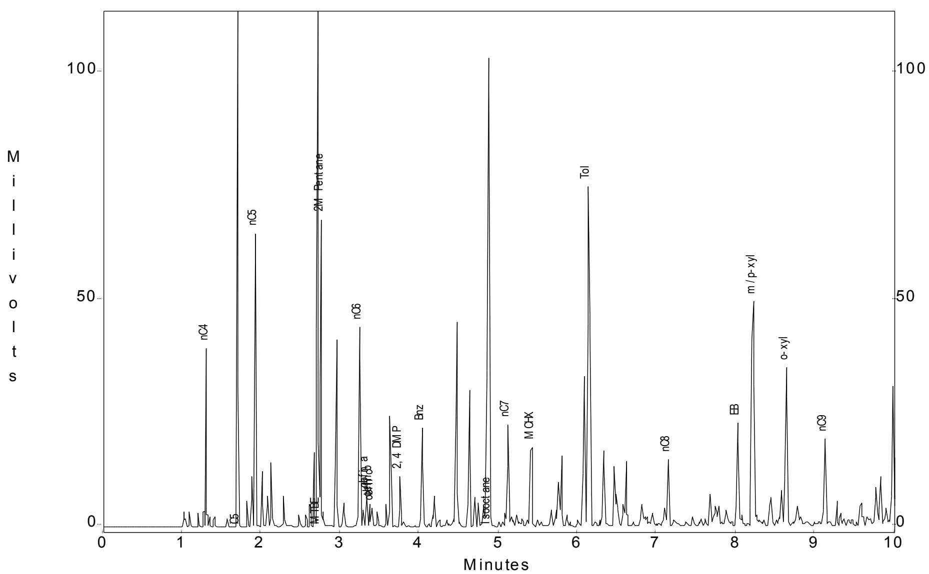
Channel A Results

Peak	Area	Height
nC4	110	65
iC5	0	0
nC5	230	90
MTBE	0	0
2M Pentane	26	27
nC6	0	0
olefin c	0	0
olefin a	0	0
olefin b	0	0
2,4 DMP	0	0
Bnz	16	10
Isooctane	23	18
nC7	0	0
MCHX	42	33
Tol	51	36
nC8	186	56
EB	675	299
m/p-xyl	1091	212
o-xyl	368	133
nC9	691	253
1,2,4 TMB	614	260
nC10	489	136
nC11	3553	2233
Naph	2565	1600
nC12	2274	769
IP13	4766	2431
IP14	4647	3364
nC13	3395	1087
IP15	9290	4067
nC14	5373	2082
IP16	9722	4322
nC15	6620	2814
nC16	1655	933
IP18	3387	1456
nC17	1151	897
Pristane	13817	6749
nC18	3565	1032
Phytane	9190	4097
nC19	0	0
nC20	606	347
nC21	131	83
nC22	917	283
nC23	761	251
nC24	625	277
nC25	909	410
nC26	1071	500
nC27	1609	542
nC28	1346	435
nC29	1068	242
nC30	370	231
nC31	30	13
nC32	181	89
nC33	794	222
nC34	677	245
nC35	33	64
nC36	61	72
nC37	94	67
nC38	110	94
nC39	31	41
nC40	198	56

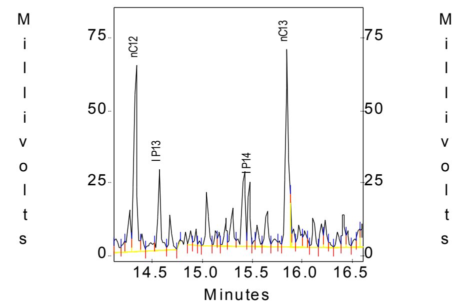
Torkelson Geochemistry, Inc.

Sunoco Refinery - Philadelphia, AO1-5 Location
Sample ID : Gas/Dies/Wax std
Acquired : Jan 04, 2007 12:04:06

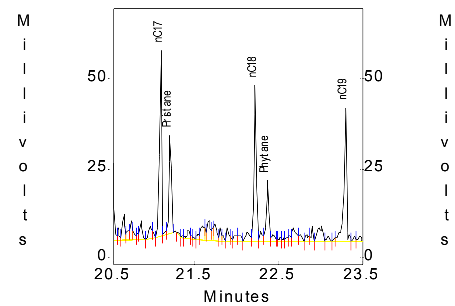
c:\ezchrom\chrom\06182\gadiwax2 -- Channel A



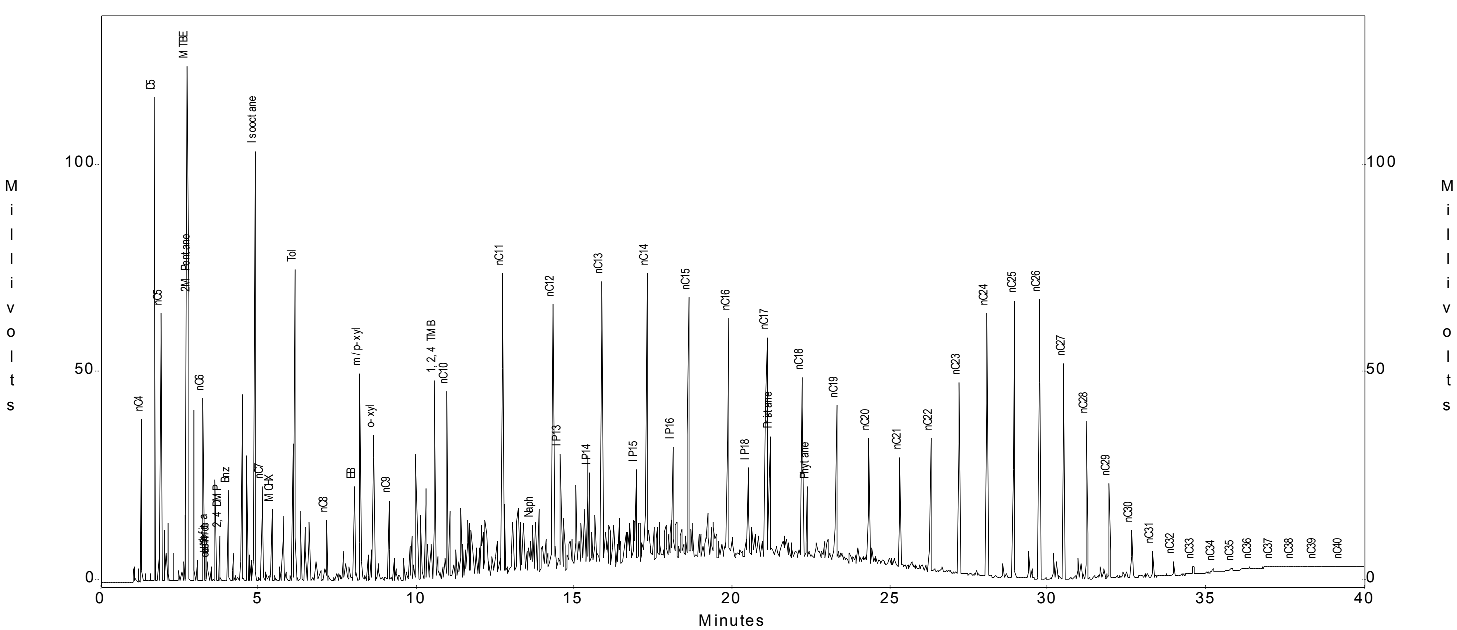
c:\ezchrom\chrom\06182\gadiwax2 -- Channel A



c:\ezchrom\chrom\06182\gadiwax2 -- Channel A



c:\ezchrom\chrom\06182\gadiwax2 -- Channel A



Channel A Results

Peak	Area	Height
nC4	21818	39287
iC5	79042	116375
nC5	46726	64743
MTBE	115568	123890
2M Pentane	59410	67884
nC6	43201	44039
olefin a	7435	6719
olefin b	4838	4953
olefin c	4368	3919
2,4 DMP	11462	11095
Bnz	26364	21842
Isooctane	144237	103446
nC7	27544	22624
MCHX	21278	17355
Tol	118531	75068
nC8	17901	14697
EB	31052	22625
m/p-xyl	105392	49760
o-xyl	49846	35157
nC9	29696	19299
1,2,4 TMB	78908	48080
nC10	67352	45411
nC11	120763	71958
Naph	29479	11402
nC12	114077	64370
IP13	53911	27861
IP14	31149	22223
nC13	136201	68297
IP15	46428	23042
nC14	144839	70235
IP16	61154	27792
nC15	126548	63785
nC16	120736	57880
IP18	52029	21751
nC17	97095	52248
Pristane	51399	27354
nC18	81418	43735
Phytane	34433	17040
nC19	83751	37342
nC20	54191	30136
nC21	45002	26580
nC22	57052	32113
nC23	91925	46116
nC24	138801	63483
nC25	163173	66837
nC26	162661	67044
nC27	121333	51999
nC28	74927	38001
nC29	40969	22687
nC30	21708	11490
nC31	10528	6117
nC32	5547	3295
nC33	3047	1668
nC34	1738	985
nC35	1048	597
nC36	573	291
nC37	497	175
nC38	260	101
nC39	188	62
nC40	269	51

Sunoco Refinery - Philadelphia, AO1-5 Location						
TGI Job 06182						
Interpretation of Product Type(s), Proportions and Weathering				Similarities to Other Samples in this Study		
Sample	Product Type(s)	Proportions	Weathering	Quite Similar to	Fairly Similar to	Somewhat Similar to
AO1-5-A-4	Middle Distillate	90	Extreme		AO1-5-SW-1	AO1-5-A-4 and AO1-5-SW-4
	Heavier Material	10	Extreme			all other heavier materials in this study
AO1-5-A-5	Lube Oil	100	Extreme	unique		
AO1-5-A-7	Light Lube Oil	100	Extreme	unique		
AO1-5-A-48	Middle Distillate	80	Extreme			AO1-5-A-4, AO1-5-SW-1, AO1-5-SW-4
	Heavier Material	20	Extreme			all other heavier materials in this study
AO1-5-SW-1	Middle Distillate	70	Extreme		AO1-5-A-4, AO1-5-SW-4	AO1-5-A-48
	Heavier Material	30	Extreme			all other heavier materials in this study
AO1-5-SW-4	Middle Distillate	70	Extreme		AO1-5-SW-4	AO1-5-A-4, AO1-5-A-48, AO1-5-SW-1
	Heavier Material	30	Extreme			all other heavier materials in this study

Torkelson Geochemistry, Inc.

Density Measurements

Paar DMA 512 / DMA 60 ASTM Method 4052

Sample	Density gm/ml @ 60F	Job Number	Date
AOI-5 A-5	0.9124	06182	7/10/2007
AOI-5 A-7	0.8905	06182	7/10/2007
AOI-5 SW-1	0.9100	06182	7/10/2007
AOI-5 A-7	0.8901	07068	7/10/2007
AOI-5 A-144	0.8753	07068	7/10/2007
AOI-5 A-155	0.8777	07068	7/10/2007

B # 2

Sample Date	24-NOV-15		
Sample ID	204291279		
Batch Number			
User SampleID	20151124-279		
Sample Type	PBPSSO POLLOCK STREET SEWER OUTFALL		
Tag	11/20/15 1330		
Material Name	MISC. UNDEFINED PRODUCT	Material Type	PLANT SAMPLE
Condition	ONLINE		
EPA Batch #			
Comments	CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS		

Component	Result	Units	Inspec	Low	High
API OBSERVED	25	deg API	N/A		
TEMPERATURE	65.0	deg F	N/A		
API GRAVITY	24.7	deg API	N/A		
INITIAL BOILING POINT (GC)		deg F			
01 % (GC)		deg F			
02 % (GC)		deg F			
03 % (GC)		deg F			
04 % (GC)		deg F			
05 % (GC)		deg F			
10 % (GC)		deg F			
20 % (GC)		deg F			
30 % (GC)		deg F			
40 % (GC)		deg F			
50 % (GC)		deg F			
60 % (GC)		deg F			
70 % (GC)		deg F			
80 % (GC)		deg F			
90 % (GC)		deg F			
95 % (GC)		deg F			
END POINT (GC)		deg F			
BROMINE NUMBER	0.92	NONE	N/A		
SULFUR	0.7424	wt.%	N/A		
SULFUR FOR COA	7424	ppm	N/A		
INITIAL BOILING POINT (GC)	260	deg F	N/A		
01 % (GC)	295.4	deg F	N/A		
02 % (GC)	322.2	deg F	N/A		
03 % (GC)	347.6	deg F	N/A		
04 % (GC)	359.6	deg F	N/A		
05 % (GC)	371.6	deg F	N/A		
10 % (GC)	416	deg F	N/A		
20 % (GC)	471.6	deg F	N/A		
30 % (GC)	522.2	deg F	N/A		
40 % (GC)	575.6	deg F	N/A		
50 % (GC)	624.8	deg F	N/A		
60 % (GC)	699.2	deg F	N/A		
70 % (GC)	830	deg F	N/A		
80 % (GC)	1025.2	deg F	N/A		
90 % (GC)	1247	deg F	N/A		
95 % (GC)	1247	deg F	N/A		
END POINT (GC)	1247	deg F	N/A		
RECOVERED	88.8	vol.%	N/A		
IBP ATM C	378.0	deg F	N/A		
05 % ATM C	411.8	deg F	N/A		
10 % ATM C	462.0	deg F	N/A		
20 % ATM C	516.9	deg F	N/A		

Component	Result	Units	Inspec	Low	High
30 % ATM C	558.9	deg F	N/A		
40 % ATM C	600.6	deg F	N/A		
50 % ATM C	641.8	deg F	N/A		
60 % ATM C	709.5	deg F	N/A		
70 % ATM C	829.8	deg F	N/A		
80 % ATM C	983.8	deg F	N/A		
90 % ATM C	1186	deg F	N/A		
95 % ATM C	1077	deg F	N/A		
END POINT ATM C	995.6	deg F	N/A		
INSTRUMENT ID	HT-SimDist#1	NONE	N/A		
METHOD ID	HT750A-7890	NONE	N/A		

APPENDIX H

DATA USABILITY ASSESSMENT

APPENDIX H
DATA USABILITY ASSESSMENT
AOI 5: PES FACILITY
PHILADELPHIA, PENNSYLVANIA

The purpose and objective of the data usability assessment is to determine if the specific goals of the project were achieved by evaluating the sensitivity, validity, reliability, representativeness, comparability, and completeness of the collected data. The process documents that analytical results used for decision-making are accurate, precise, and representative of environmental conditions. The Data Usability Assessment includes an examination of the reported laboratory analytical data, the supporting data, and field notes, when necessary. A review of the deficiencies identified in the data, appended data qualifiers, identification of biases and unreliable data, and assessments of field and laboratory performance are completed and reconciled with project data quality objectives. Reported results may be considered be sufficiently valid when the sampling and method performance criteria were achieved or, alternatively, the results may be considered estimates and qualified by the laboratory or a data validator. In the case of organic analyses, these laboratory flags include "J" qualifiers to indicate a reported result is estimated below the laboratory reporting limit; and "B" qualifiers to indicate a reported result may be affected by blank contamination. For inorganic analyses, laboratory-applied "J" and "B" qualifiers are frequently defined inversely.

For the purposes of this investigation, groundwater and soil results summarized in eighteen laboratory reports provided by Lancaster Laboratories, Pace Analytical, and Accutest Laboratories are evaluated in the sections below for usability. These samples were collected from July 2006 through November 2012 by Aquaterra Technologies, Inc., Langan, Stantec and Secor, on behalf of Sunoco, Inc. Samples were analyzed for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), ethylene dibromide (EDB), metals and wet chemistry parameters. Copies of the laboratory reports are provided in this appendix for reference. Any analytical data, data qualifiers, and QA/QC results provided in these reports were evaluated to determine the reliability and validity of the data and its appropriateness for use in the decision-making process. The criteria used in the data usability summary are presented in the following sections.

A complete list of SDGs included in the AOI 5 evaluation is as follows:

Laboratory	*Year*	*SDGs*
Lancaster Laboratories	2006	998945, 1001388, 1002813, 1017232
	2008	1101191, 1110636
Lancaster Laboratories	2009	1147007
	2011	1277209
	2012	1286382, 1286383, 1286586, 1328172, 1327576, 1327576
Pace Analytical	2007	07-4140
Accutest Laboratories	2012	MC15595, JB21965, JB20893
	2013	JB30169, JB30878/30878R, JB30722, JB30589

Data Quality Indicators

Data quality indicators (DQIs) are qualitative and quantitative measures of data quality "attributes," which are descriptors used to express various properties of analytical data. Thus, DQIs are the various measures of the individual data characteristics that collectively comprise the general, all-encompassing term "data quality." Quality attributes used to assess the data usability include:

- Method selectivity/specificity
- Method sensitivity
- Accuracy (bias, validity)
- Precision (reliability)
- Representativeness
- Comparability
- Completeness

These indicators, as they relate to the data collected during the site characterization, are described in more detail below.

<u>Method Selectivity/Specificity</u>

Method selectivity/specificity is defined as the compound type or class that can be detected by the instrument or detector. Instruments that are used to detect a compound class (i.e., hydrocarbons) are said to be selective. Instruments that are used to detect a specific element group (e.g., halogens) are said to be specific. Groundwater and soil samples, as well as trip blanks, were analyzed for the following parameters using the listed specific methods:

- GC/MS Volatile via SW-846 Method 8260B,
- GC/MS Semi-volatiles in water via SW-846 Methods 8270C, 8270C with SIM, 8270D and 8310,
- Ethylene Dibromide via SW-846 Method 8011,
- Hexavalent Chromium via SW-846 Method 7196A,
- Metals via SW-846 Methods 6010B, 6010C, 6020, 7471A and
- Wet Chemistry via EPA Method 160.3, and Standard Method SM20 2540G.

Method Sensitivity

Method sensitivity is the degree to which an analyte can be detected above a statistically derived method detection limit and the associated laboratory reporting limit. Method sensitivity permits decision-making when data are reported at or near state and federal benchmarks.

The following non-detect soil sample results should not be used for the purpose of delineation because reporting limits initially exceeded screening criteria (i.e., the PADEP Soil MSCs), or samples required dilution factors that raised laboratory reporting limits above the corresponding screening criteria. Specifically, EDB in samples AOI5_BH-13-22_2-2.5_030813, AOI5_BH-13-24_2-2.5_030813, AOI5_BH-13-25_2.5-3_030813, AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-16_3.5-4_031113, AOI5_BH-13-39_2-2.5_030513, A-156-2', AOI5_BH-13-25_1.5-2_030813, A-159_2', A-160_2', AOI5_BH-13-36_1.5-2_30613, AOI5_BH-13-34_1.5-2_30613, AOI5_BH-13-29_1-1.5_30613, AOI5_BH-13-32_1.5-2_30613, AOI5_BH-13-16_1.5-2_031113, AOI5_BH-13-27_1.5-2_30713, AOI5_BH-13-33_1.5-2_30713; 1,2-dichloroethane in samples AOI5_BH-13-24_2-2.5_030813, AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-29_1-1.5_30613, AOI5_BH-13-32_1.5-2_30613; 1,2,4-trimethylbenzene in samples AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-29_1-1.5_30613, AOI5_BH-13-32_1.5-2_30613; 1,3,5-trimethylbenzene in samples AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-29_1-1.5_30613, AOI5_BH-13-32_1.5-2_30613; MTBE in samples AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-29_1-1.5_30613, AOI5_BH-13-32_1.5-2_30613; and benzene in sample AOI5_BH-13-29_1-1.5_30613.

Accuracy (Bias)

Accuracy is the degree of the bias in a measurement system, and can be defined as the agreement between a measurement and an accepted reference or true value. Bias can be positive or negative, which means that the "true" concentration is likely higher or lower (respectively) than the reported laboratory result. While bias direction can be estimated for data quality impacts, the degree to which bias affects the laboratory result cannot be quantified.

Indicators of accuracy include, but are not limited to, sample hold times and preservation, surrogate spike recoveries, laboratory control sample (LCS) and LCS duplicate recoveries, and matrix spike sample (MS) and spike duplicate (SD) recoveries. The acceptable ranges of accuracy for each of the above listed indicators are method and matrix specific, and are defined within the published analytical test methods specified in the section above. Laboratory recovery limits may differ from those identified in the methods. For the purposes of this assessment, accuracy [or bias] was evaluated by reviewing the following indicators, and deficiencies are identified in the Summary of Findings:

- *Sample hold times* to determine if samples were extracted and analyzed within method-specific timeframes. *Sample preservation* to determine that samples were properly stored on ice at 4°C ± 2°, and method-specific adjustment in pH occurred. If hold times are exceeded or preservation requirements were not met, reported concentrations may be biased low.

- *Laboratory method, equipment, and trip blank samples* to determine if sample results are potentially affected by contamination resulting from laboratory procedures, sampling equipment decontamination, or sample transport.

- *Percent recovery of surrogate spikes* (system monitoring compounds injected into each sample prior to sample extraction or preparation to determine that these compounds were recovered within the laboratory acceptance limits. Because surrogate compounds are added to each sample at known concentrations, a measure of accuracy can be established based upon a comparison of the measured concentration to the actual amount spiked into a sample. If surrogates are recovered below this range then concentrations reported for the target analytes may be biased low: similarly, if surrogates are recovered above this range then concentrations reported for the target analytes may be biased high.

- *Percent recovery of each compound analyzed in the laboratory QA/QC samples [Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (LCSD)] and field QC samples [Matrix Spike (MS) and Matrix Spike Duplicate (SD)]*.

  LCS and LCSD samples are samples of reagent water or suitable reference matrix spiked with known concentrations of the target analytes. LCS and LCSD samples are run at a rate of one per sample batch (approximately 20 samples) and are indicators of method performance. If compounds within the LCS or LCSD are recovered above or below the acceptable ranges than concentrations of those compounds may be biased in each of the normal environmental samples within the corresponding batch.

  MS and SD samples are normal environmental samples collected at the project site and spiked with known concentrations of the target analytes. MS and SD samples are typically run at the same frequency as LCS and LCSD samples, and are indicators of potential bias based on the sampling matrix. If analytes in the MS or SD are recovered above or below the acceptable ranges, then reported results may be biased in each of the normal environmental samples within the corresponding batch.

Internal and external instrument calibration and verification are a central part of the analytical process, and are reviewed to determine that the procedures stipulated within a particular analytical method are followed. For the purpose of this Data Usability Assessment, calibration information was not provided and not specifically reviewed unless a nonconformance was noted in the laboratory data package.

Precision

Precision is defined as the ability to reproduce analytical results, and is the measure of variability between individual sample measurements under prescribed conditions. Precision is assessed by the analysis of duplicate samples and expressed in terms of relative percent difference (RPD). For this project, analytical variability was measured as the relative percent difference (RPD) between 1) analytical laboratory duplicates (LCS and LCSD), and 2) the matrix spike (MS) and matrix spike duplicate (SD). Field duplicate samples are not required under the sampling guidelines and were not collected.

Each laboratory sample delivery group listed in the section above was evaluated for precision. Generally, the LCS/LCSD and MS/SD in each of these laboratory SDGs for each parameter group [VOCs, SVOCs, metals, EDB and wet chemistry] are below the maximum allowable RPD and meet the criteria for precision. Exceptions are listed by method in the Summary of Findings.

Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criteria may be satisfied by making certain the sampling locations are selected properly and that a sufficient number of samples are collected to fulfill program objectives.

Groundwater and soil samples were collected from locations biased to potential source areas and/or sensitive receptors (surface water bodies, occupied buildings, and residential properties). The analytes analyzed in groundwater and soil samples include those currently identified in the Pennsylvania Corrective Action Process (CAP) Regulation Amendments effective

December 1, 2001; provided in Chapter VI, Section E of PADEP's Closure Requirements for Underground Storage Tank Systems (with exception for the waste oil parameters since waste oil is only stored in small tanks within the facility maintenance garages).

The data collected during this investigation is considered representative of groundwater and soil in AOI 5 based on the distribution of the monitoring wells and soil boring sampling locations within the sampling program, the frequency of sample collection, and the suite of parameters analyzed.

Comparability

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal was achieved by using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. The sample collection methods used were based on the PADEP's guidelines summarized in the Groundwater Monitoring Guidance Manual dated December 1, 2001 and the Groundwater Sampling and Analysis Plan, dated January 17, 2008. The analytical methods used are EPA solid waste methods or Standard Methods.

Based on this data quality analysis, the data are considered comparable to other groundwater and soil data collected as part of other sampling programs.

Completeness

Completeness is defined as the percentage of usable data in the total data population generated. Completeness was calculated for each analyte where data were qualified as rejected. Completeness is determined as the difference between the total number of data points and the number of rejected data points divided by the total number of results. For soil and groundwater results associated with AOC 5, 100% percent of the data is considered complete.

Summary of Findings (by Method)

VOCs by SW-846 Method 8260B:

Multiple samples displayed internal standard area counts outside of control limits and were reanalyzed by the analytical laboratory. In each case, the failing internal standard was not identified nor was the direction and magnitude of the failure indicated. This data is, therefore, not subject to review and conclusions regarding data usability are not formed.

The MS/SD RPDs associated with sample batch X122301AA (SDG 1328172) were greater than the control limits for the majority of spiked compounds. The spiked sample did not originate from AOI 5; precision is not assessed on this basis.

MS recoveries of ethylbenzene, isopropylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene were less than the lower control limit for spiked sample P746624 associated with sample batch X122221AA (SDG 1327576). The spiked sample did not originate from AOI 5; accuracy is not assessed on this basis.

Multiple MS/SD recoveries and RPDs were outside of control limit for spiked sample P750276 associated with sample batch Q1222261AA (SDG 1327576). The spiked sample did not originate from AOI 5; accuracy and precision are not assessed on this basis.

Sample BH-14-12_3.5-4 displayed a surrogate recovery for 4-bromofluorobenzene greater than the control limit (i.e., 131%) at 148%. The remaining three system monitoring compounds recovered within control limits; positive bias is not assessed on this basis.

Sample BH-03-12_2.5-3 displayed surrogate recoveries greater than the control limit for 1,2-dichloroethane-d4 at 141%, toluene-d8 at 463%, and 4-bromofluorobenzene at 143%. The positive detections for ethylbenzene, isopropylbenzene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes may be biased high.

The benzene result associated with sample GP-1208-LINE-5 is not usable because the laboratory used the volume provided in the percent moisture jar to complete the volatile analysis. Soils collected in the percent moisture jar are not preserved with methanol and was not analyzed until thirteen days following collection.

Sample STF-3-VOC4 displayed surrogate recoveries less than the lower control limit for 1,2-dichloroethane-d4, toluene-d8, and 4-bromofluorobenzene at 65%, 69%, 65%, respectively. The positive sample results for benzene, toluene, 1,2,4-trimethylbenzene, and total xylenes may be biased low.

Samples STF-2-VOC1, STF-2-VOC2, STF-2-VOC3, and STF-2-VOC6 displayed surrogate recoveries less than the lower control limit for 4-bromofluorobenzene at 67%, 66%, 68%, and

68%, respectively. The remaining three system monitoring compounds recovered within control limits; negative bias is not assessed on this basis.

Samples GP1209-SW-3.0-3.5, GP1209-E-2.8-3.3, GP1209-1210-2.6-3.1, GP1209-NW-2.8-3.3, GP1210-NW-2.9-3.4, GP1210-NE-2.8-3.3 and GP1210-SW-3.3-3.8 displayed multiple surrogate recoveries outside of control limits. The samples were analyzed at dilution factors of multiple orders of magnitude, which diluted out the system monitoring compounds; bias is not assessed on this basis.

Samples 17-C and 17-D displayed surrogate recoveries less than the lower control limit for toluene and 4-bromofluorobenzene. The samples were analyzed at dilution factors greater than 10X, which diluted out the system monitoring compounds; bias is not assessed on this basis.

South T.F. VOC 10 Grab Soil Sample, South Tank Yard Background 3 Composite Soil, and South T.F. VOC 18 Grab Soil Sample displayed surrogate recoveries less than the lower control limit for toluene and 4-bromofluorobenzene. The samples were analyzed at dilution factors greater than 10X, which diluted out the system monitoring compounds; bias is not assessed on this basis.

Sample BH-03-12_2.5-3 displayed a surrogate recovery greater than the upper control limit for 4-bromofluorobenzene at 148%. The remaining three system monitoring compounds recovered within control limits; bias is not assessed on this basis.

Sample BH-03-12_2.5-3 displayed surrogate recoveries greater than the upper control limit for 1,2-dichloroethane-d4, toluene-d8, and 4-bromofluorobenzene at 141%, 463%, and 143%, respectively. The reported detections for ethylbenzene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes may be positively biased. The isopropylbenzene result was analyzed at a dilution in a separate sample batch and is not affected.

Multiple MS/SD recoveries and RPDs associated with spiked samples P746624 and P750276 were outside of control limits. The spiked samples did not originate from AOI 5; accuracy and precision are not assessed on this basis.

MS/SD sample P752350 displayed multiple RPDs greater than the control limit for sample batch X122301AA. The spiked sample did not originate from AOI 5; precision is not assessed on this basis.

The laboratory duplicate RPD for benzene and toluene associated with sample batch VV5640 were greater than the control limits at 44% and 36%, respectively. The sample results were less than the reporting limit; therefore, ±RL is the appropriate measure of acceptable analytical precision. All results were within the control limit.

Sample A-156_2' displayed a surrogate recovery greater than the control limit for 4-bromofluorobenzene at 221%. The remaining four system monitoring compounds recovered within control limits; bias is not assessed on this basis.

Sample A-160_2' displayed a surrogate recovery greater than the control limit for 4-bromofluorobenzene at 148%. The remaining system monitoring compounds recovered within control limits; bias is not assessed on this basis.

The LCS associated with sample batch VX5793 displayed a recovery greater than the upper control limit (i.e., 134%) for 1,2-dichloroethane at 137%. The associated sample results were non-detect; therefore there is no positive bias assessed.

Method blank sample VA7251-MB analyzed in conjunction with sample batch VA7251displayed a positive detection for system artifact in the volatile TIC scan at approximately 5.4 μg/kg. TIC reporting was not requested for the investigative sample results; there is no impact on data usability.

Method blank sample VA7261-MB analyzed in conjunction with sample batch VA7261displayed a positive detection for system artifact in the volatile TIC scan at approximately 6.2 μg/kg. TIC reporting was not requested for the investigative sample results; there is no impact on data usability.

Method blank samples VX5798-MB and VX5801-MB displayed positive detections in the volatile TIC scan for carbon dioxide at estimated concentrations of 270 μg/kg and 280 μg/kg, respectively. Carbon dioxide is not a target analyte; bias is not assessed on this basis.

SVOCs by SW-846 Method 8270C, 8270C with SIM, and 8270D:

Sample BH-01-12_2-2.5 displayed a surrogate recovery greater than the upper control limit (i.e., 123%) for nitrobenzene-d5 at 134%. More than one base-neutral extractable surrogate must fail in order to warrant assessment of bias.

MS sample STF-2-COMP1 displayed a recovery greater than the upper control limit for bis(2-ethylhexyl)phthalate at 160%. In addition, the MS/SD RPD was greater than the control limit at 42%. Precision and accuracy are not assessed on the basis of MS/SD recoveries or RPDs alone.

The SD recovery of phenanthrene associated with spiked sample STF-2-COMP11 was greater than the upper control limit at 185%. In addition, the MS/SD RPD for phenanthrene and fluoranthene was greater than the control limit at 44% and 54%, respectively. Accuracy and precision are not assessed on the basis of MS/SD recoveries and RPDs alone.

MS sample P532949 displayed recoveries less than the lower control limit for benzo(g,h,i)perylene, chrysene, and phenanthrene at 71%, 73%, and 79%, respectively. The spiked sample did not originate from AOI 5; bias is not assessed on this basis.

MS sample P833980 displayed recoveries less than the lower control limit for all reported semi-volatiles. In addition, the MS/SD RPD was greater than the control limit for all analytes. The spiked sample did not originate from AOI 5; accuracy and precision are not assessed on this basis.

MS sample South T.F. Composite 7 Soil Sample displayed recoveries less than the lower control limit for pyrene at 18%, fluoranthene at 2%, benzo(a)anthracene at 28%, and chrysene at 38%. Bias is not assessed on the basis of MS recoveries alone.

Sample BH-01-12_2-2.5 displayed a surrogate recovery greater than the upper control limit for nitrobenzene-d5 at 134%. The remaining two base-neutral extractable system monitoring compounds recovered within control limits; bias is not assessed on this basis.

The MS/SD RPD for benzo(b)fluoranthene associated with spiked sample JB22051-1 was greater than the control limit at 36%. The spiked sample did not originate from AOI 5; accuracy and precision are not assessed on this basis.

Sample A-156_112112 was received by the laboratory with a pH of 6. The sample was otherwise properly preserved on ice and analyzed within the required holdtime. The associated sample results may be biased low, but are usable.

Method blank samples analyzed in conjunction with batches EP3064 and EZ4018 displayed multiple positive detections for system artifacts, unknowns, and aldol condensates in the TIC scan. TICs were not reported for the investigative sample results and data is not assessed for bias on the basis of contamination associated with unidentified compounds.

Matrix spike duplicate sample A015-BH-13-03_0-.5 displayed recoveries greater than the upper control limit for phananthrene and pyrene at 167% and 156%, respectively. In addition the MS/SD RPD was greater than the control limit for anthracene, benzo(a)pyrene, benzo(a)anthrancene, benzo(b)fluoranthene, chrysene, phenanthrene, and pyrene. Bias is not assessed on the basis of MS/SD recoveries or RPDs alone and the associated control samples recovered within control limits.

Method blank samples analyzed in conjunction with sample batches VX5800, VX5801, and VX5802 displayed positive detections for carbon dioxide in the volatile TIC scan. TIC reporting was not requested for the investigative sample results; there is no impact on data usability.

The laboratory duplicate sample associated with sample batch VX5802 displayed a RPD greater than the control limit for benzene at 31%. The sample concentrations were less than the reporting limit; therefore, the appropriate control limit is ± the RL. The precision criteria are met for the laboratory duplicate and data usability is not impacted.

Method blank sample OP64455-MB1 analyzed in conjunction with sample batch EM3744 displayed positive detections for unknowns and system artifacts in the semi-volatile TIC scan ranging from approximately 160 μg/kg to 2,700 μg/kg, respectively. TIC reporting was not requested for the investigative sample results; there is no impact on data usability.

All PAH results except naphthalene associated with sample AOI5_BH-13-28_1.5-2_30713 displayed positive detections over the linear range of the instrument calibration. The sample was not reanalyzed at a higher dilution factor; therefore, the reported results should be considered estimated, but usable.

MS/SD sample S-363_4-6′ (collected from AOI-2 but used as the batch spike for AOI 5 samples) displayed recoveries greater than the upper control limit for 1,2,4-trimethylbenzene (974%/958%) and 1,3,5-trimethylbenzene (407%/401%). Positive detections for these constituents may be biased high.

SVOCs by SW-846 Method 8310:

Samples GP1209-SW-3.0-3.5, GP1209-1210-2.6-3.1, GP1209-NW-2.8-3.3, GP1210-SW-3.3-3.8, GP1210-NW-2.9-3.4, and GP1210-NE-2.8-3.3 displayed surrogate spike recoveries outside of control limits for nitrobenzene and triphenylene. All samples were analyzed at a dilution factor greater than 10X; bias is not assessed on this basis.

Lead by SW-846 Method 6020:

The MS/SD RPD associated with spiked sample BH-17-12_.5-1 was greater than the control limit at 41%. The original sample result was greater than 4X the spiked amount; precision is not assessed on this basis.

The laboratory duplicate sample (BH-17-12_.5-1) displayed a RPD greater than the control limit at 31%. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batch 122225708002A: BH-17-12_.5-1, BH-19-12_.5-1, BH-21-12_.5-1, BH-21-12_5.5-6, BH-20-12_3.5-4, BH-07-12_.5-1, BH-14-12_3.5-4, BH-04-12_2-2.5, BH-03-12_2.5-3, BH-16-12_3.5-4, BH-15-12_4-4.5, BH-40-12_.5-1, BH-40-12_3-3.5, BH-36-12_.5-1, BH-36-12_3.5-4, BH-34-12_.5-1, BH-34-12_4-4.5, BH-38-12_3-3.5, BH-39-12_2-2.5.

The MS/SD RPD associated with sample batch 122225708002A was greater than the control limit at 41%. The original sample result was greater than 4X the spiked amount; precision is not assessed on this basis.

The laboratory duplicate RPD associated with sample batch 122225708002A was greater than the control limit at 31%. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batch: BH-17-12_.5-1, BH-19-12_.5-1, BH-21-12_.5-1, BH-21-12_5.5-6, BH-20-12_3.5-4, BH-07-12_3-3.5, BH-14-12_3.5-4, BH-04-12_2-2.5, BH-03-12_2.5-3, BH-16-12_3.5-4, BH-15-12_4-4.5, BH-40-12_.5-1, BH-40-12_3-3.5, BH-36-12_.5-1, BH-36-12_3.5-4, BH-34-12_.5-1, BH-34-12_4-4.5, BH-38-12_3-3.5, BH-39-12_2-2.5.

MS/SD sample 680 displayed recoveries less than the lower control limit at -878% and -3,081%, respectively. The original sample result was greater than 4X the spiked amount; accuracy is not assessed on this basis.

Metals by SW-846 Method 6010B and 6010C:

Laboratory duplicate sample P415538 displayed a RPD greater than the control limit (i.e., 20%) for arsenic at 39%. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batch 082035708004: STF-2-COMP1, STF-2-COMP2, and STF-2-COMP3.

Laboratory duplicate sample STF-2-COMP4 displayed RPDs greater than the control limit for arsenic and chromium at 25% and 154%, respectively. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batch 082045708002: STF-2-COMP4, STF-2-COMP5, STF-2-COMP6, STF-2-COMP7, STF-2-COMP8, STF-2-COMP9, STF-2-COMP10, STF-2-COMP11, STF-2-COMP12, STF-3-COMP1, STF-3-COMP2, STF-3-COMP3, STF-3-COMP4, STF-3-COMP5, and STF-3-COMP6.

The SD recovery and MS/SD RPD for chromium associated with spiked sample STF-2-COMP4 were greater than the control limits at 246% and 28%, respectively. There may be a positive bias associated with results reported from sample batch 082045708002: STF-2-COMP4, STF-2-COMP5, STF-2-COMP6, STF-2-COMP7, STF-2-COMP8, STF-2-COMP9, STF-2-COMP10, STF-2-COMP11, STF-2-COMP12, STF-3-COMP1, STF-3-COMP2, STF-3-COMP3, STF-3-COMP4, STF-3-COMP5, and STF-3-COMP6.

The MS/SD RPD for lead associated with spiked sample STF-2-COMP4 was greater than the control limit at 41%. The original sample result was greater than 4X the spiked amount; precision is not assessed on this basis.

Laboratory duplicate RPDs associated with sample batches 120275708002 and 120305708002 were greater than the control limit at 26% and 67%, respectively. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batches: GP1209-SW-3.0-3.5, GP1209-E-2.8-3.3, GP1209-1210-2.6-3.1, GP1209-NW-2.8-3.3, GP1209-PP-0.5, GP1210-SW-3.3-3.8, GP1210-NW-2.9-3.4, and GP1210-NE-2.8-3.3.

Laboratory duplicate RPDs associated with sample batch 062155708005 were greater than the control limit for chromium and lead at 22% and 113%, respectively. There may be imprecision in the laboratory measurement system associated with samples: South Yard 1 – Background Composite Soil Sample, South Yard 2 – Background Composite Soil Sample, and North Yard 1 – Background Composite Soil Sample.

Laboratory duplicate sample P841678 displayed RPDs greater than the control limit for arsenic and lead at 34% and 200%, respectively. The original sample results were less than 5X the RL;

therefore, ±RL is the appropriate control limit rather than the RPD. The duplicate results were within ±RL and met the acceptance criteria for laboratory duplicate samples.

Laboratory duplicate sample South T.F. Composite 11 Soil Sample displayed a RPD greater than the control limit for total chromium at 74%. There may be imprecision in the laboratory measurement system associated with samples: South T.F. Composite 11 Soil Sample, South T.F. Composite 12 Soil Sample, South T.F. Composite 13 Soil Sample, South T.F. Composite 14 Soil Sample, and South T.F. Composite 15 Soil Sample.

Laboratory duplicate sample South T.F. Composite 16 Soil Sample displayed RPDs greater than the control limit for arsenic, chromium, and lead at 42%, 42%, and 32%, respectively. The original result for arsenic was less than 5X the RL; therefore ±RL was used as the control limit and the duplicate result met the acceptance criteria. There may be imprecision in the laboratory measurement system associated with total chromium and lead results for samples South T.F. Composite 16 Soil Sample, South T.F. Composite 17 Soil Sample, and South T.F. Composite 18 Soil Sample.

MS sample MC15546-15 displayed a recovery less than the lower control limit for lead at 73.6%. The spiked sample did not originate from AOI 5; bias is not assessed on this basis.

SD sample AOI2_S-361_0-.5_30813 was used as the batch spike for AOI 5 samples and displayed a recovery less than the lower control limit for lead at 51.8%. In addition, the MS/SD RPD was greater than the control limit at 21.2%. The associated sample results may be biased low.

A low-level calibration check standard (20 µg/L) analyzed on 3/20/2013 at 00:26 displayed a recovery less than the lower control limit at 64.0%. The calibration check standards at 2.5 µg/L and 3.0 µg/L displayed acceptable recoveries; bias is not assessed on this basis.

The continuing calibration blank analyzed on 3/20/2013 at 00:04 displayed a positive detection for lead at 1.9 µg/L. The associated sample results were multiple orders of magnitude greater than the blank concentration; bias is not assessed on this basis.

MS/SD sample AOI5_BH-13-30_1.5-2_30713 displayed recoveries less than the lower control limit for lead at -208.1% and -136.5%, respectively. In addition, the MS/SD RPD was greater than the control limit (i.e., 20%) at 21.3%. The original sample result was greater than 4X the spiked amount; bias and precision are not assessed on this basis.

The ICP serial dilution displayed a %D greater than the control limit (i.e., 10%) at 54%. The original sample result was less than 50X the IDL; bias and precision are not assessed on this basis.

Low-level calibration check standard CRID4 analyzed on 3/18/2013 at 08:40 displayed a percent recovery greater than the control limit at 176%. No project samples were bracketed by the check standard.

Sample AOI2_S-356_0-1_030613 was used as a batch spike for samples associated with AOI 5 and it displayed recoveries for lead less than the lower control limit (i.e., 75%) at 15.8% and 67.3%, respectively. The following sample results are potentially biased low: AOI2_S-356_0-1_030613, AOI2_S-356_2-3_030613, AOI2_S-357_0-5_030613, AOI2_S-357_4-5_030613, S-354_0-2', S-354_4-6', S-354_8-10', S-355_0-2', S-355_8-10'.

MS/SD sample AOI5_BH-13-31_1.5-2_030613 displayed recoveries for lead less than the lower control limit at 47.8% and -131.7%, respectively. In addition, the MS/SD RPD was greater than the control limit (i.e., 20%) at 56%, attributable to sample heterogeneity. The following sample results are potentially biased low: AOI5_BH-13-36_1.5-2_30613, AOI5_BH-13-35_1.5-2_30613, AOI5_BH-13-34_1.5-2_30613, AOI5_BH-13-34_2.5-3_30613, AOI5_BH-13-32_1.5-2_30613, AOI5_BH-13-29_1-1.5_30613.

Mercury by SW-846 Method 7471A:
Laboratory duplicate sample STF-2-COMP4 displayed a RPD greater than the control limit at 31%. There may be imprecision in the laboratory measurement system associated with samples analyzed in sample batch 082045744002: STF-2-COMP4, STF-2-COMP5, STF-2-COMP6, STF-2-COMP7, STF-2-COMP8, STF-2-COMP9, STF-2-COMP10, STF-2-COMP11, STF-2-COMP12, STF-3-COMP1, STF-3-COMP2, STF-3-COMP3, STF-3-COMP4, STF-3-COMP5, and STF-3-COMP6.

The MS/SD RPD associated with spiked sample STF-2-COMP4 was greater than the control limit at 35%. The original sample result was greater than 4X the spiked amount; analytical precision is not assessed on this basis.

The SD recovery associated with spiked sample P829857 was greater than the upper control limit at 122%. The sample volume did not originate from AOI 5; bias is not assessed on this basis.

Laboratory duplicate sample P841678 displayed a RPD greater than the control limit at 200%. The original sample results was non-detect; therefore, ±RL is the appropriate control limit rather than the RPD. The duplicate result was within ±RL and met the acceptance criteria for laboratory duplicate samples.

Laboratory duplicate sample P851653 displayed a RPD greater than the control limit at 35%. The original sample result was less than 5X the RL; therefore, ±RL is the appropriate control limit rather than the RPD. The duplicate result was within ±RL and met the acceptance criteria for laboratory duplicate samples.

Hexavalent Chromium by SW-846 Method 7496A:
Laboratory duplicate samples P825600 and P833980 displayed RPDs greater than the control limit at 200% and 21%, respectively. The original sample results was non-detect or less than 5X the RL; therefore, ±RL is the appropriate control limit rather than the RPD. The duplicate results were within ±RL and met the acceptance criteria for laboratory duplicate samples.

Laboratory duplicate sample South T.F. Composite 7 Soil Sample displayed a RPD greater than the control limit at 200%. The original sample results was non-detect; therefore, ±RL is the appropriate control limit rather than the RPD. The duplicate result was within ±RL and met the acceptance criteria for laboratory duplicate samples.

Summary and Conclusions

For the purposes of this investigation, sample results were summarized in eighteen sample delivery groups provided by Lancaster Laboratories, Pace Analytical, and Accutest Laboratories. Results were evaluated in the sections above for usability. Copies of the laboratory reports are provided in this appendix for reference.

The laboratory performed quality assurance and quality control (QA/QC) analyses, including analysis of LCS/LCSDs, MS/SDs, surrogate spikes, and method blanks. Laboratory QA/QC summaries are provided in each data package, where available. The analytical data, data qualifiers, and QA/QC results provided in these reports were evaluated to determine whether

AOC 5 groundwater and soil data met data quality objectives and could be used in the decision-making process.

One trip blank sample was collected during a groundwater sampling event, and was non-detect for target analytes. All samples were properly preserved and were extracted/prepared, and analyzed within sample hold times, with the exceptions noted above. Target analytes were not detected above the reporting limit in the laboratory method blanks, and recoveries in LCS/LCSDs were within acceptable recovery control limits, with the exception of a high recovery of 1,2-dichloroethane. Multiple surrogates and MS/SDs recovered outside of the acceptable range as described in detail above.

On the basis of this evaluation, the analytical laboratories appear to have followed the specified analytical methods according to the provisions of the methods, with the exception of the errors discussed above. If a given fraction or SDG is not mentioned above, that indicates that all specified criteria were met. All data are usable for characterizing the site and identifying compounds of concern, with the exception of the GP-1208-LINE-5 benzene result. As described above, non-detect sample results with reporting limits in exceedance of the associated screening level are not usable for delineating potential impacts.

DATA USABILITY ASSESSMENT
AOI 5 WORK PLAN FOR SITE CHARACTERIZATION
PES FACILITY
PHILADELPHIA, PENNSYLVANIA

The purpose and objective of the data usability assessment is to determine if the specific goals of the project were achieved by the evaluation of sensitivity, validity, reliability, representativeness, comparability and completeness of the collected data. This process documents that analytical results used for decision-making are accurate, precise and representative of environmental conditions. This Data Usability Assessment includes an examination of the reported laboratory analytical data, the supporting data and field notes when necessary. A review of the deficiencies identified in the data, appended data qualifiers, identification of biases and unreliable data and assessments of field and laboratory performance are completed and reconciled with project data quality objectives. Reported results may be considered to be sufficiently valid when the sampling and method performance criteria were achieved or, alternatively, when the results may be considered estimates and qualified by the laboratory or data validator. In the case of organic and inorganic analyses, these flags include "J" qualifiers to indicate a reported result is an estimated or a result that is below the laboratory reporting limit (RL) and above the laboratory method detection limit (MDL); "UJ" qualifiers indicate estimated laboratory detection limits; "B" qualifiers indicate a reported result may be affected by blank contamination.

For the purposes of this investigation, groundwater and soil results summarized in twenty-three laboratory sample delivery groups (SDGs) provided by Accutest Laboratories are evaluated in the sections below for usability. These samples were collected from July 2014 through October 2014 by Langan on behalf of Sunoco, Inc. Samples were analyzed for volatile organic compounds (VOCS), semi-volatile organic compounds (SVOCs), lead and wet chemistry parameters. Any analytical data, data qualifiers and QA/QC results provided in these results were evaluated to determine the reliability and validity of the data and its appropriateness for use in the decision-making process. The criteria used in the data usability summary are presented in the following sections.

A complete list of SDGs included in the AOI 5 evaluation is as follows:

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB72104	JB72014-1	A-44_071814	7/18/14	VOCs, SVOCs (SIM), Metals
JB72104	JB72104-2	A-1_071814	7/18/14	VOCs, SVOCs (SIM), Metals

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB72104	JB72104-3	A-139_071814	7/18/14	VOCs, SVOCs (SIM), Metals
JB72104	JB72104-4	A140-071814	7/18/14	VOCs, SVOCs (SIM), Metals
JB72104	JB72104-5	A143-071814	7/18/14	VOCs, SVOCs (SIM), Metals
JB72107	JB72107-1	A-4_071714	7/17/14	VOCs, SVOCs (SIM), Metals
JB72107	JB72107-2	A-142_071714	7/17/14	VOCs, SVOCs (SIM), Metals
JB72107	JB72107-3	A-39_071714	7/17/14	VOCs, SVOCs (SIM), Metals
JB72107	JB72107-4	A-40_071714	7/17/14	VOCs, SVOCs (SIM), Metals
JB72107	JB72107-5	A-137_071714	7/17/14	VOCs, SVOCs (SIM), Metals
JB72238	JB72238-1	SWR-1_072114	7/21/14	VOCs, SVOCs (SIM), Metals
JB72238	JB72238-2	A-24_072114	7/21/14	VOCs, SVOCs (SIM), Metals
JB72238	JB72238-3	A-47_072114	7/21/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-1	A-168-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-2	A-154-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-3	A-27-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-4	DWR2-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-5	SWR3-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-6	A-172-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-7	A-11-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-8	A-182-072214	7/22/14	VOCs, SVOCs (SIM), Metals
JB72373	JB72373-9	TRIP BLANK	7/22/14	VOCs
JB72379	JB72379-1	A-186_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-2	A-151_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-3	A-152_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-4	A-16_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-5	A-23_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-6	A-170_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-7	A-164_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-8	WRD_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-9	A-169_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-10	A-163_072314	7/23/14	VOCs, SVOCs (SIM), Metals
JB72379	JB72379-11	TB	7/23/14	VOCs
JB72517	JB72517-1	A-49_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-2	WP-E_072414	7/24/14	VOCs, SVOCs (SIM), Metals

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB72517	JB72517-3	A-162_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-4	A-135_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-5	A-134_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-6	A-133_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-7	A-118_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-8	TRIP BLANK	7/24/14	VOCs
JB72517	JB72517-9	A-10_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-10	A-175_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-11	A-177_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-12	A-173_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72517	JB72517-13	A-3_072414	7/24/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-1	A-174_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-2	A-158_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-3	A-25_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-4	A-26_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-5	WP-16-3_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-6	A-181_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-7	WP-14_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-8	A-48_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-9	WP-9_072514	7/25/14	VOCs, SVOCs (SIM), Metals
JB72605	JB72605-10	TB	7/25/14	VOCs
JB72810	JB72810-1	A-41_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-2	A-122_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-3	A-149_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-4	A-148_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-5	A-157_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-6	A-185_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-7	A-171_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-8	SW-2_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-9	SW-3_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72810	JB72810-10	A-167_072914	7/29/14	VOCs, SVOCs (SIM), Metals
JB72811	JB72811-1	WP-8_072814	7/28/14	VOCs, SVOCs (SIM), Metals
JB72811	JB72811-2	A-184_072814	7/28/14	VOCs, SVOCs (SIM), Metals

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB72811	JB72811-3	A-183_072814	7/28/14	VOCs, SVOCs (SIM), Metals
JB72811	JB72811-4	A-156_072814	7/28/14	VOCs, SVOCs (SIM), Metals
JB72811	JB72811-5	A-9_072814	7/28/14	VOCs, SVOCs (SIM), Metals
JB72811	JB72811-6	TRIP BLANK	7/28/14	VOCs
JB72900	JB72900-1	A-6_073014	7/30/14	VOCs, SVOCs (SIM), Metals
JB72900	JB72900-2	A-12_073014	7/30/14	VOCs, SVOCs (SIM), Metals
JB72900	JB72900-3	A-155_073014	7/30/14	VOCs, SVOCs (SIM), Metals
JB73006	JB73006-1	A-161_073114	7/31/14	VOCs, SVOCs (SIM), Metals
JB73006	JB73006-2	WP-A-073114	7/31/14	VOCs, SVOCs (SIM), Metals
JB73138	JB73138-1	A-136_080114	8/1/14	VOCs, SVOCs (SIM), Metals
JB73138	JB73138-2	A-5_080114	8/1/14	VOCs, SVOCs (SIM), Metals
JB73138	JB73138-3	A-178_080114	8/1/14	VOCs, SVOCs (SIM), Metals
JB78486	JB78486-1	A-163_100614	10/6/14	VOCs, SVOCs (SIM), Metals
JB78486	JB78486-2	A-154_100614	10/6/14	VOCs, SVOCs (SIM), Metals
JB78486	JB78486-3	SWR-3_100614	10/6/14	VOCs, SVOCs (SIM), Metals
JB78486	JB78486-4	A-169_100614	10/6/14	VOCs, SVOCs (SIM), Metals
JB78486	JB78486-5	A-156_100614	10/6/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-1	SW-2_100714	10/7/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-2	SWR-1_100714	10/7/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-3	SWR-2_100714	10/7/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-4	SW-3_100714	10/7/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-5	A-156_100714	10/7/14	VOCs, SVOCs (SIM), Metals
JB78735	JB78735-6	TRIP BLANK	10/7/14	VOCs
JB78750	JB78750-1	A-40_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB78750	JB78750-2	A-39_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB78750	JB78750-3	A-41_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB78750	JB78750-4	A-24_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB78750	JB78750-5	WP-D_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB78750	JB78750-6	A-185_100814	10/8/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-1	WP-8_101014	10/10/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-2	A-181_10104	10/10/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-3	A-182_101014	10/10/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-4	A-12_101014	10/10/14	VOCs, SVOCs (SIM), Metals

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB79002	JB79002-5	WP-8_100914	10/9/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-6	A-172_100914	10/9/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-7	A-11_100914	10/9/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-8	WP-14_100914	10/9/14	VOCs, SVOCs (SIM), Metals
JB79002	JB79002-9	WP-9_100914	10/9/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-1	A-9_101314	10/13/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-2	A-10_101314	10/13/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-3	A-48_101314	10/13/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-4	A-134_101314	10/13/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-5	A-162_101314	10/13/14	VOCs, SVOCs (SIM), Metals
JB79151	JB79151-6	A-12_10314	10/10/14	VOCs, SVOCs (SIM), Metals
JB79299	JB79299-1	A-177_101414	10/14/14	VOCs, SVOCs (SIM), Metals
JB79299	JB79299-2	A-175_101414	10/14/14	VOCs, SVOCs (SIM), Metals
JB79299	JB79299-3	A-173_101414	10/14/14	VOCs, SVOCs (SIM), Metals
JB79299	JB79299-4	A-44_101414	10/14/14	VOCs, SVOCs (SIM), Metals
JB79299	JB79299-5	A-143_101414	10/14/14	VOCs, SVOCs (SIM), Metals
JB79372	JB79372-1	A-137_101514	10/15/14	VOCs, SVOCs (SIM), Metals
JB79372	JB79372-2	A-142_101514	10/15/14	VOCs, SVOCs (SIM), Metals
JB79372	JB79372-3	A-4_101514	10/15/14	VOCs, SVOCs (SIM), Metals
JB79372	JB79372-4	A-157_101514	10/15/14	VOCs, SVOCs (SIM), Metals
JB79372	JB79372-5	A-158_101514	10/15/14	VOCs, SVOCs (SIM), Metals
JB79844	JB79844-1	A-140_102114	10/21/14	VOCs, SVOCs (SIM), Metals
JB79844	JB79844-2	A-139_102114	10/21/14	VOCs, SVOCs (SIM), Metals
JB79844	JB79844-3	A-152_102114	10/21/14	VOCs, SVOCs (SIM), Metals
JB79844	JB79844-4	A-170_102114	10/21/14	VOCs, SVOCs (SIM), Metals
JB79844	JB79844-5	A-133_102114	10/21/14	VOCs, SVOCs (SIM), Metals
JB79845	JB79845-1	A-6_101714	10/17/14	VOCs, SVOCs (SIM), Metals
JB79845	JB79845-2	A-136_101714	10/17/14	VOCs, SVOCs (SIM), Metals
JB79845	JB79845-3	A-135_101714	10/17/14	VOCs, SVOCs (SIM), Metals
JB79845	JB79845-4	WP-E_101714	10/17/14	VOCs, SVOCs (SIM), Metals
JB79845	JB79845-5	TRIP BLANK	10/17/14	VOCs
JB79846	JB79846-1	A-26_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-2	WP16-3_102014	10/22/14	VOCs, SVOCs (SIM), Metals

SDG	Lab ID	Client ID	Sampling Date	Parameters
JB79846	JB79846-3	A-25_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-4	A-186_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-5	A-118_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-6	TRIP BLANK	10/22/14	VOCs
JB79846	JB79846-7	A-3_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-8	A-151_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-9	A-150_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-10	A-122_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79846	JB79846-11	A-15_102014	10/22/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-1	A-27_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-2	A-168_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-3	A-154_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-4	A-167_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-5	A-1_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-6	A-23_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-7	A-47_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-8	A-49_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-9	A-16_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-10	A-148_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-11	A-149_102214	10/23/14	VOCs, SVOCs (SIM), Metals
JB79950	JB79950-12	TRIP BLANK	10/23/14	VOCs

Data Quality Indicators

Data quality indicators (DQIs) are qualitative and quantitative measures of data quality “attributes”, which are descriptors used to express various properties of analytical data. Thus, DQIs are the various measures of the individual data characteristics that collectively comprise the general, all-encompassing term “data quality”. Quality attributes used to assess the data usability include:

- Method selectivity/specificity
- Method sensitivity
- Accuracy (bias/validity)
- Precision (reliability)
- Representativeness

- Comparability
- Completeness

These indicators, as they relate to the data collected during the site characterization, are described in more detail below.

<u>Method Selectivity/Specificity</u>
Method selectivity/specificity is defined as the compound type or class that can be detected by in the instrument or detector. Instruments that are used to detect a compound class are said to be selective. Instruments that are used to detect a specific element group are said to specific. Groundwater, soil samples and trip blanks were analyzed for the following parameters using the listed specific methods:

- Volatile Organic Compounds via USEPA SW-846 Method 8260B and 8011
- Semi-volatile Organic Compounds via USEPA SW-846 Method 8270D (Selected Ion Monitoring)
- Metals via USEPA SW-846 Method 6010C and 7471A

<u>Method Sensitivity</u>
Method sensitivity is the degree to which an analyte can be detected above a statistically derived method detection limit and the associated laboratory reporting limit. Method sensitivity permits decision-making when data are reported at or near state and federal benchmarks.

<u>Accuracy (Bias)</u>
Accuracy is the degree of the bias in a measurement system and can be defined as the agreement between a measurement and an accepted reference or true value. Bias can be positive or negative which means that the "true" concentration is likely higher lower (respectively) than the reported laboratory result. While bias direction can be estimated for data quality impacts, the degree to which bias affects the laboratory result cannot be quantified.

Indicators of accuracy include, but are not limited to, sample hold times and preservation, surrogate/spike recoveries, laboratory control sample (LCS) and LCS duplicate recoveries and matrix spike (MS) and MS duplicate (MSD) recoveries. The acceptable ranges of accuracy for each of the above listed indicators are method and matrix specific and are defined within the published analytical test methods specified in the section above. Laboratory recovery limits may differ from those identified in the methods. For the purposes of this assessment, accuracy (or bias) was evaluated by reviewing the following indicators and deficiencies are identified in the Summary of Findings:

- *Sample hold times* to determine if samples were extracted and analyzed within method-specific timeframes. *Sample preservation* to determine that samples were properly stored on ice at 4°C ± 2° and method-specific adjustment in pH occurred. If hold times are exceeded or preservation requirements were not met, reported concentrations may be biased low.
- *Laboratory method, equipment and trip blank samples* to determine if sample results are potentially affected by contamination resulting from laboratory procedures, sampling equipment decontamination or sample transport.
- *Percent recovery of surrogate spikes* (system monitoring compounds) injected into each sample prior to sample extraction or preparation to determine that these compounds were recovered within the laboratory acceptance limits. Because surrogate compounds are added to each sample at known concentrations, a measure of accuracy can be established based upon a comparison of the measured concentration to the actual amount spike into a sample. If surrogates are recovered below this range then concentration reported for the target analytes may be biased low. Similarly, if surrogates are recovered above this range then concentrations reported the target analytes may be biased high.
- *Percent recovery of each compound analyzed in the laboratory QA/QC samples [Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (LCSD)] and field QC samples [Matrix Spike (MS) and Matrix Spike Duplicate (SD)]*.

LCS and LCSD samples are samples of reagent water or suitable reference matrix spiked with known concentrations of the target analytes. LCS and LCSD samples are run at a rate of one per sample batch (approximately 20 samples) and are indicators of method performance. If compounds within the LCS or LCSD are recovered above or below the acceptable ranges than concentrations of those compounds may be biased in each of the normal environmental samples within the corresponding batch.

MS and MSD samples are normal environmental samples collected at the project site and spiked with known concentrations of the target analytes. MS and MSD samples are typically run at the same frequency as LCS and LCSD samples, and are indicators of potential bias based on the sampling matrix. If analytes in the MS or MSD are recovered above or below the acceptable ranges, then reported results may be biased in each of the normal environmental samples within the corresponding batch.

Internal and external instrument calibration and verification are a central part of the analytical process, and are reviewed to determine that the procedures stipulated within a particular analytical method are followed.

Precision

Precision is defined as the ability to reproduce analytical results, and is the measure of variability between individual sample measurements under prescribed conditions. Precision is assessed by the analysis of duplicate samples and expressed in terms of relative percent difference (RPD). For this project, analytical variability was measured as the relative percent difference (RPD) between 1) analytical laboratory duplicates (LCS and LCSD), and 2) the matrix spike (MS) and matrix spike duplicate (MSD).

Each laboratory sample delivery group listed in the section above was evaluated for precision. Generally, the LCS/LCSD and MS/MSD in each of these laboratory SDGs for each parameter group [VOCs, SVOCs and lead] are below the maximum allowable RPD and meet the criteria for precision. Exceptions are listed by method in the Summary of Findings.

Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter most concerned with the proper design of the sampling program. The representativeness criteria may be satisfied by making certain the sampling locations are selected properly and that a sufficient number of samples are collected to fulfill program objectives.

The data collected during this investigation is considered representative of groundwater in AOI 5 based on the distribution of the monitoring well locations within the sampling program, the frequency of sample collection, and the suite of parameters analyzed.

Comparability

Comparability is the degree to which data from one study can be compared with data from other similar studies, reference values (such as background), reference materials, and screening values. This goal was achieved by using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. The sample collection methods used were based on the PADEP's guidelines summarized in the Groundwater Monitoring Guidance Manual dated December 1, 2001 and the Groundwater Sampling and Analysis Plan, dated January 17, 2008. The analytical methods used are EPA SW846 methods.

Completeness

Completeness is defined as the percentage of usable data in the total data population generated. Completeness was calculated for each analyte where data were qualified as rejected. Completeness is determined as the difference between the total number of data points and the number of rejected data points divided by the total number of results. For groundwater results associated with AOC 5, 100% percent of the data is considered complete.

Summary of Findings (by Method)

Finished packages: JB72104, JB72107, JB72238, JB72373, JB72379, JB72517, JB72605, JB72810, JB72811, JB72900, JB73006, JB73138, JB78486, JB78735, JB78750, JB79002, JB79151, JB79299, JB79372, JB79844, JB79845

VOCs by SW-846 Method 8260B:

VOCs by SW-846 Method 8011:

SVOCs by SW-846 Method 8270D by SIM:

The MS/MSD for parent sample JB72104-1 recovered below the control limits for benzo(a)anthracene (46%/45%), benzo(a)pyrene (31%,33%), benzo(b)fluoranthene (33%,35%), benzoP(g,h,i)perylene (26%,26%) and chrysene (49%); the associated results in samples JB721041 through 5 may be biased low.

The surrogate nitrobenzene-d5 recovered below the control limits (i.e <23%) in sample A-40_071714; the associated results may be biased low.

LCS OP76670A-BS12 recovered below the control limits (i.e. <47%) for benzo(g,h,i)perylene; the associated result in sample A-47_072114 may be biased low.

The MS/MSD pair for parent sample JB72373-1 recovered below the control limits for benzo(a)anthracene (2% ,2%), benzo(a)pyrene (-9%, -8%), benzo(b)fluoranthene (-5%, -6%),

benzo(g,h,i)perylene (0%, 0%), chrysene (2%, -1%) and pyrene (-46%, -45%). The associated results in samples JB72373-1 through 8 may be biased low.
The surrogate recovery in sample A-49_072414 for nitrobenzene was below the control limits (i.e. <23%); the sample was re-extracted and the low surrogate recovery was confirmed. The low recovery can be was due to matrix interference.

The MS/MSD pair for parent sample JB72517-6 recovered above the control limits (i.e. >122%); the associated positive detections in samples JB72517- 6, 7, 9, 10, 11, 12 and 13 may be biased high.

The nitrobenzene-d5 surrogate in sample A-174_072514 recovered below the control limits (i.e. <23%) and there was no remaining sample left to confirm via re-extraction; the associated results may be biased low.

LCS OP77022A-BS12 recovered below the control limits (i.e. <47%) for benzo(g,h,i)perylene; the associated positive detection in sample JB72605-2 may be biased low.

The MS/MSD pair for parent sample JB72605-1 recovered below the control limits for benzo(a)pyrene (43%/44%) and benzo(g,h,i)perylene (30%/30%); the associated results in samples JB72605-1, 3, 4, 5, 6, 7, 8 and 9 may be biased low.

The surrogate nitrobenzene-d5 in sample A-155_073014 was recovered above the control limits (i.e. >131%); the associated positive detections resulting from the first run may be biased high. The results for anthracene, benzo(g,h,i)perylene and naphthalene were determined by the second run; these results are unaffected by this surrogate recovery.

MB OP77142A-MB1 detected naphthalene at 0.190 ug/l; the associated result in sample JB73138-3 was non-detect and therefore no qualification was necessary.

The MS/MSD pair for parent sample JB73138-1 recovered outside the control limits for anthracene (174%/134%), benzo(a)anthracene (177%; RPD = 27%), benzo(a)pyrene (159%; RPD = 42%), benzo(b)fluoranthene (210%; RPD = 38%), benzo(g,h,i)perylene (165%; RPD = 55%), chrysene (203%/124%; RPD = 33%), fluorene (204%/160%), phenanthrene (184%/131%; RPD = 24%) and pyrene (401%/236%; RPD = 28%). The associated results in samples JB73138-1 and 2 may be biased high.

The continuing calibration on 10/15/14 at 9:31 a.m. exhibited a percent difference (%D) greater than the control limits (i.e. >20%) with a positive bias for fluorene; the associated result in sample A-156_100714 may be biased high.

The MS/MSD pair for parent sample JB78750-1 recovered did not meet the precision criteria for anthracene (RPD = 22%) and benzo(a)anthracene (RPD = 20%); the RPD limits were 21% and 20%, respectively. The associated positive detections in samples JB78750-4, 5 and 6 may be affected by indeterminate bias.

The MS/MSD pair for parent sample JB79002-1 recovered below the control limits and did not meet the precision criteria for anthracene (0%/0%), benzo(a)anthracene (0%/0%; RPD = 32%), benzo(a)pyrene (0%/0%; RPD = 28%), benzo(b)fluoranthene (0%/0%), benzo(g,h,i)perylene (0%/0%; RPD = 24%), chrysene (0%/0%; RPD = 36%), fluorene (0%/0%), phenanthrene (0%/0%; RPD = 24%) and pyrene (0%/0%; RPD = 27%). The associated results in samples JB79002-1, 2, 3, 4, 6, 7, 8 and 9 may be biased low. The associated results that are non-detect are considered unusable.

The MS/MSD pair for parent sample JB79002-1 recovered above the control limits for naphthalene (214%/202%); the associated positive detections in samples JB79002-2, 4, 7, 8 and 9 may be affected by high bias.

The surrogate nitrobenzene-d5 recovered above the control limits (i.e. >131%) on the second run for sample A-4_101514; the associated positive detections for phenanthrene and pyrene may be affected by high bias.

Lead by SW-846 Method 6010C:

Summary and Conclusions

For the purposes of this investigation, sample results were summarized in twenty-three sample delivery groups provided by Accutest Laboratories. Results were evaluated in the sections above for usability.

The laboratory performed quality assurance and quality control (QA/QC) analyses, including analysis of LCS/LCSDs, MS/MSDs, surrogate spikes, and method blanks. Laboratory QA/QC summaries are provided in each data package, where available. The analytical data, data qualifiers, and QA/QC results provided in these reports were evaluated to determine whether

AOC 5 groundwater data met data quality objectives and could be used in the decision-making process.

Several trip blank samples were collected during the soil and groundwater sampling events, and were non-detect for target analytes. All samples were properly preserved and were extracted/prepared, and analyzed within sample hold times with the exceptions noted above. Target compounds were not detected above the reporting limit in the laboratory method blanks, and recoveries in LCS/LCSDs were within acceptable recovery control limits, limiting potential bias. Multiple surrogates and MS/SDs recovered outside of the acceptable range as described in detail above.

- On the basis of this evaluation, the analytical laboratories appear to have followed the specified analytical methods according to the provisions of the methods, with the exception of the errors discussed above. If a given fraction or SDG is not mentioned above, that indicates that all specified criteria were met. All data are usable for characterizing the site and identifying compounds of concern.

APPENDIX I

FATE AND TRANSPORT MODELING

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APPENDIX I

Qualitative Fate & Transport Assessment

Remedial Investigation Report – AOI 5
Philadelphia Energy Solutions Refining & Marketing
Philadelphia Refinery

Introduction

In September 2015, representatives from Evergreen's team, PADEP and EPA met to discuss the fate and transport (F&T) approach for the facility. It was agreed upon during the meeting that AOI Remedial Investigation Reports (RIRs) would provide a qualitative F&T assessment and that a site-wide groundwater flow and transport model would be presented for the facility as part of a separate report. The site-wide model will provide a quantitative F&T assessment for the facility utilizing a site-wide numerical groundwater flow and contaminant transport model currently being developed by Stantec and other consultants on behalf of Evergreen.

This appendix contains the qualitative assessment for AOI 5. The assessment includes information regarding the following conditions in AOI 5:

- Geologic framework;
- Hydrogeologic conditions;
- Hydrologic conditions;
- Anthropogenic features (such as the sheet pile wall along the Schuylkill River);
- Constituent of concern (COC) plume stability; and
- Potential receptors.

The purpose of this assessment is to qualitatively evaluate the potential fate and transport of dissolved COCs in groundwater and to refine the current conceptual site model (CSM) for AOI 5.

Framework Summary

General Geologic Framework

The facility occurs within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the "Fall Line," where crystalline bedrock of the Appalachian foothills intersects the ground surface (outcrops). The Atlantic Coastal Plain is a physiographic province that is defined as having relatively flat topography and as being underlain by a characteristic wedge of unconsolidated sediments that thicken in a southeasterly direction, away from sediment source areas in the Appalachian Mountains. These sediments were deposited atop a sloping bedrock surface in complex fluvial, estuarine, and marginal marine environments along the passive Atlantic margin. Overall, subsidence of the Piedmont land surface in conjunction with cyclical sea-level fluctuations have been the primary controlling mechanisms driving periods of deposition, non-deposition and erosion in the Atlantic Coastal Plain (Trapp and Meisler, 1992). In general, the resulting sedimentary record in the vicinity of the Philadelphia Refinery is complex, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity. A summary of those deposits is presented below.

Anthropogenic Fill

Throughout most of the facility the surface is covered by anthropogenic fill. These materials are heterogeneous and have been described on borehole logs as a mixture of compacted soil and anthropogenic debris, including sand, clay, silt, gravel, cinders, concrete, asphalt, crushed stone, ash, glass, brick fragments, and wood.

Quaternary Deposits

A recent (Holocene) Alluvium deposit is present throughout most of the facility beneath the anthropogenic fill. The Holocene Alluvium generally consists of predominantly gray, muddy deposits with occasional sandy, gravelly, and organic-rich lenses. These sediments were deposited in dynamic floodplain, channel, and marsh environments through the Holocene. The Trenton Gravel is present throughout most of the facility beneath the Holocene Alluvium. The Trenton Gravel is of Pleistocene Age and is a very heterogeneous unit comprised of a predominant brown to gray sand, gravel and minor amounts of clay (Owens and Minard, 1979).

Cretaceous Deposits

The Cretaceous deposits in the area and are configured in a southeasterly-thickening wedge, overlain by the much younger Quaternary deposits, and underlain by the Wissahickon Formation. The wedge is made up of a series of vertically alternating aquifers and confining units called the Potomac-Raritan-Magothy (PRM) aquifer system. Each of the geological units of the PRM progressively pinches-out to the northwest. The PRM aquifer system consists of six units:

- Upper Clay unit;

- Upper Sand unit;
- Middle Clay unit;
- Middle Sand unit;
- Lower Clay unit, and
- Lower Sand unit.

AOI 5-Specific Geological Framework

In AOI 5, surface materials consist of anthropogenic fill and Holocene Alluvium with a combined thickness ranging from 41 to 60 feet. Based on the available lithologic information from available soil borings completed within AOI 5, the Holocene Alluvium deposits generally consist of two distinct stratigraphic layers:

- Silt layer: a soft, medium brown to dark gray silt with organics and pieces of wood, trace to some clay, and interbedded thin sand and gravel lenses; overlain by a
- Clay layer: a soft, dark gray clay, with trace to some silt, trace fine sand, and trace organics.

The Holocene silt and clay layers range in thickness from approximately 20 to 36 feet and 0 to 12 feet, respectively, across AOI 5. The thick, low permeability, Holocene Alluvium deposits within AOI 5 tends to limit the free interchange of water between the Schuylkill River and the unconfined aquifer. The Holocene silt layer appears to thicken to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. The Holocene clay layer is believed to be fairly extensive across AOI 5 and eventually pinches out to the north (absent in A-19D well log), and may thin in the vicinity of historic tributaries to the Schuylkill River. The southern and western boundary of AOI 5 is bound by a sheet pile wall which is keyed into the Holocene clay layer as shown in Figure 5.

Throughout most of the refinery, the Trenton Gravel (Pleistocene formation) overlies the Cretaceous deposits. However, most Pleistocene deposits have been eroded away along the Schuylkill River, which appears to be the case in AOI 5.

The shallowest PRM unit present in AOI 5 is the Middle Clay (the Upper Clay and Upper Sand units are not present in AOI 5) which rests directly on the Lower Clay unit (the Middle Sand unit is also absent in AOI 5). The combined thickness of the Lower/Middle Clay ranges from approximately 0 feet to 23 feet in AOI 5. Based on the absence of the Lower/Middle Clay in the A-13D well log, the clay layer is believed to pinch out to the southeast in the direction of the confluence of the Schuylkill and Delaware Rivers. Below the Lower/Middle Clay is the Lower Sand that ranges from approximately 12 to 40 feet in thickness in AOI 5. Beneath the Lower Sand is the Wissahickon Schist bedrock located at depths of approximately 60 to 90 feet below ground surface (bgs).

General Hydrogeologic Framework

The hydrogeologic frame work is defined by grouping geologic units that are laterally extensive and have similar hydrogeologic properties. The generalized hydrostratigraphy of the facility consists of seven layers (Schreffler, 2001, Sloto 2012):

- Layer 1: Combined anthropogenic fill, Holocene Alluvium and Trenton Gravel (Trenton Gravel does not appear to be present in AOI 5);
- Layer 2: Upper Clay unit of the PRM;
- Layer 3: Upper Sand unit of the PRM;
- Layer 4: Middle Clay unit of the PRM;
- Layer 5: Middle Sand unit of the PRM;
- Layer 6: Lower Clay unit of the PRM, and
- Layer 7: Lower Sand unit of the PRM.

AOI-5-Specific Hydrogeologic Framework

Within AOI 5, the hydrogeologic framework consists of the combined anthropogenic fill and Holocene Alluvium (which is referred to as the unconfined aquifer and makes up the water table aquifer). At depth and where less permeable, the Holocene Alluvium also acts as a leaky confining unit. Beneath the Holocene Alluvium is the Lower/Middle Clay confining unit (referred to as the clay aquitard). Beneath the clay aquitard is the Lower Sand which is a semi-confined to confined aquifer (lower aquifer). The Lower Sand lies above the Wissahickon Schist bedrock.

The lower aquifer is separated from the unconfined aquifer by subsequent confining, leaky confining, and confining units of the Holocene clay layer, Holocene silt layer, and the Lower/Middle Clay unit. Head potentials observed during the May 2011 gauging event in unconfined and lower aquifer monitoring well pairs confirm the two aquifers are hydraulically separated. The head differences measured in May 2011 between A-13 and A-13D, and A-21 and A-21D, were 4.59 and 11.3 feet, respectively. The observed head differences correspond to downward vertical hydraulic gradients of 0.082 and 0.16 feet per feet (ft/ft) at the A-13 and A-21 monitoring well pairs, respectively.

AOI-5 Groundwater Flow Patterns

Interpreted groundwater flow patterns and hydraulic gradients in the unconfined aquifer within AOI 5 are depicted on a groundwater elevation map constructed using long-term average groundwater elevation data (Figure I-2). Groundwater gauging data from as far back as 4/11/97 and as recent as 5/10/12 was used for the preparation of Figure I-2. This contour map was prepared using AOI-wide synoptic groundwater gauging events and does not directly address river tidal effects. Based on the average flow contours, groundwater in the unconfined aquifer generally flows south towards the Schuylkill River under a typical hydraulic gradient of 0.005 feet per feet (ft/ft). Flow paths towards the Schuylkill River appear to be influenced by in-filled historic tributaries of the Schuylkill River as indicated by the valley-like gradient patterns in the vicinity of these features due to the contrast in hydraulic conductivity between natural and fill materials. Unconfined groundwater flow in AOI 5 is also influenced by the presence of the sheet pile wall which extends along the Schuylkill River and is keyed into the Holocene clay. Localized groundwater mounding is apparent behind portions of the wall. Similar localized groundwater mounding was also observed during the July and October 2014 groundwater gauging events (Figures 7 and 8 in the RIR).

As reference above, published hydraulic conductivity estimates for the Lower Sand range between 123 to 152 feet per day (ft/d) with a mean of 135 ft/d (Paulachok, 1991). Based on limited lower aquifer monitoring wells within AOI 5, groundwater in the lower aquifer is assumed to flow southwest towards the Schuylkill River, under hydraulic gradient of 0.004 ft/ft. This assessment of lower aquifer groundwater conditions, generally corresponds with the groundwater flow direction and gradients collected during the March 2013 site-wide gauging of the lower aquifer, and the 2007 lower aquifer groundwater flow map included in the 2011 AOI 5 Site Characterization Report/Remedial Investigation Report/Clean-up Plan (SCR/RIR/CUP).

Aquifer Properties

Hydraulic Conductivity of Fill/Alluvium Aquifer

A series of rising and falling head slug tests were performed by Aquaterra in June 2007 at monitoring wells A-140, A-147, A-151, and A-154 (Table I-1). Slug test hydraulic conductivity estimates ranged from 10 to 56 ft/d, except at A-140 where the well drained too quickly to build up sufficient head to measure. In February 1987, Dames & Moore conducted two constant rate aquifer tests at monitoring wells A-22 and A-24. Constant rate test hydraulic conductivity estimates from monitoring wells A-22 and A-24 are 0.35 ft and 9.57 ft/d, respectively. All the wells in AOI 5 with aquifer test data specified above are screened across the anthropogenic fill and Holocene clay layer. It is reasonable to assume the higher hydraulic conductivity estimates are more representative of the fill material, and the lower range is a more appropriate value for the Holocene clay layer. A geometric mean of the averaged results from each individual test location (both slug tests and constant rate tests) was calculated to be 18.5 ft/d (Table I-1).

In the calibrated groundwater flow model created by the United States Geologic Survey (USGS) (Schreffler, 2001), the combined fill/alluvium and Trenton Gravel has a hydraulic conductivity of 5.47 feet/day. Site-specific hydraulic conductivity estimates are significantly higher than the value used in the 2001 USGS groundwater flow model for combined fill/alluvium and Trenton Gravel. As stated above, the higher site-specific hydraulic conductivity for AOI 5 is possibly attributed to the majority of the screened intervals being located within the coarse grained anthropogenic fill. The site-specific hydraulic conductivities from AOI-5 may be incorporated into the future quantitative fate and transport model for the PES facility.

Porosity

In July 2014, two Shelby tube soil samples from the shallow soils of AOI 5 were collected to determine soil properties (Appendix J within the AOI 5 RIR). Soil sample A-170 8.5’-10.5’ and A-186 8.5’-10.5’ were both collected from a depth interval of 8.5 to 10.5 feet bgs. The soil sample from monitoring well A-170, described as dark gray elastic silt with sand, trace roots, and organics, had a total porosity of 0.541 and an effective porosity of 0.182. The soil sample from monitoring well A-186, described as dark gray elastic silt, with some organics, had a total porosity of 0.609 and an effective porosity of 0.205. The average total and effective porosities of the two samples are 0.575 and 0.194, respectively. In the calibrated groundwater flow model created by the USGS (Schreffler, 2001), a porosity of 0.3 was used for the unconfined aquifer. The effective porosity values obtained from the 2014 Shelby tube analysis are significantly lower than the value used in the USGS groundwater flow model due to the extensive Holocene clay and silt deposits throughout AOI 5. This data may be used as part of the future quantitative fate and transport model for the PES facility.

Groundwater Seepage Velocities

Groundwater seepage velocity (seepage velocity) is an estimate of the rate of groundwater movement through the pores in a geologic material. Seepage velocity does not take into account processes such as dispersion, sorption or biotransformation, which can significantly affect the migration of dissolved COCs relative to groundwater. The calculation of seepage velocity also assumes homogenous aquifer conditions and a uniform hydraulic gradient. The seepage velocity equation is:

$$V_x = \frac{K \times i}{n_e}$$

Where:

V_x = seepage velocity (Length/Time)

K = hydraulic conductivity (Length/Time)

i = hydraulic gradient (unitless)

n_e = effective porosity (unitless)

For alluvium with K = 18.5 feet/day, i = 0.005 and n_e = 0.194, the seepage velocity is 0.48 feet/day or 175 feet/year (Table I-2).

Hydrology

Topography and Drainage

Based on a LiDAR dataset from January, 2010, AOI 5 ground surface elevations range from approximately six feet below mean sea level along the southern boundary with the Schuylkill River to 10 feet above mean sea level (amsl) at the northern end of the property (Figure I-3). The ground surface throughout most of the AOI is generally flat and is broken up by tank containment berms ranging in height from approximately 2 to 10 feet above grade.

Rainfall

Average yearly precipitation at Philadelphia International Airport, located about one mile southwest of AOI 5, is 41.45 inches (www.usclimatedata.com). A significant portion of precipitation does not reach the water table due to several processes. In AOI 5, some of the precipitation becomes runoff that is redirected by impermeable surfaces such as roadways and above ground storage tanks (Figure I-4) and is intercepted by storm water control facilities.

Surface Water Bodies

The Schuylkill River, located to the south, is the only existing surface water body in the vicinity of AOI 5. The AOI 5 boundary is also within a mile of the confluence of the Schuylkill and Delaware Rivers. Based on a review of available historical maps and photos, several small tributaries to the Schuylkill River were once present within AOI 5 (Figure I-5).

The USGS river gauging station located at the Fairmount Dam, several miles upriver from AOI 5, recorded a mean surface water discharge rate of 2,773 cubic feet per second between 1932 and 2005. The lowest elevation of the Schuylkill riverbed near AOI 5 is approximately 45 feet below mean sea level where the bottom has been dredged. The average stage of the Schuylkill River at AOI 5 is approximately 0.5 feet amsl (Schreffler, 2001).

Anthropogenic Site Features

There are currently no active remediation systems within AOI 5; therefore, no pumping is occurring that could influence local groundwater flow. A sheet pile wall, which is keyed into the Holocene clay, extends along the entire western and majority of the southern boundary of AOI 5 and the Schuylkill River. The extent of the wall is shown on Figure I-6.

Constituents of Concern, Groundwater Plumes, and Plume Stability

Delineated areas where COC concentrations in groundwater are above their respective medium-specific concentrations (MSCs) have been grouped into two primary groundwater source areas. The east source area is in the vicinity of the heavy distillate plume (previously characterized as a lube oil plume), located to the north of the former warehouse building in a former tankage area (Figure I-7). The west source area encompasses several isolated middle distillate light non-aqueous phase liquid (LNAPL) bodies most likely associated with former tankage in the area.

Historically, the following COCs have been detected in unconfined aquifer wells at concentrations exceeding their respective PADEP non-residential groundwater MSCs in both east and west source areas: lead, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, and methyl tert-butyl ether (MTBE).

There have also been one-time detections exceeding the PADEP non-residential groundwater MSC of pyrene (2014), indeno(1,2,3-cd)pyrene (2005), cumene (2007), and 1,2,4-TMB (2014). Pyrene was detected at a concentration exceeding the PADEP non-residential groundwater MSC in one well (A-4) near the east source area. Indeno(1,2,3-cd)pyrene was also detected at a concentration exceeding the PADEP non-residential groundwater MSC in one well (WP-A) at the west source area. Cumene was detected at a concentration exceeding the PADEP non-residential groundwater MSC in one well (A-138) along the eastern site boundary. 1,2,4-TMB was detected at a concentration exceeding the PADEP non-residential groundwater MSC in one well (A-161) in the west source area.

MTBE was detected at concentrations exceeding the PADEP non-residential groundwater MSC in one unconfined aquifer well (WP-A) within the west source area and one lower aquifer well (A-19D) in the northern and hydraulically upgradient point of AOI-5, indicating a source outside of AOI-5. Except for the single detections noted above and two detections of MTBE, the COCs in groundwater above the MSC consist of semi volatile compounds, dissolved lead, and benzene. Therefore, for the AOI 5 CSM plume assessments, groundwater concentration trends for benzene, the most mobile of the COCs, was the focus. However, all COCs that exceeded their respective PADEP non-residential MSCs were included in the trend graphs.

Lower aquifer groundwater in monitoring well A-19D historically exhibited concentrations of MTBE exceeding the respective PADEP non-residential groundwater MSC. No other COCs have historically been detected in the lower aquifer within AOI 5 above their respective PADEP non-residential groundwater MSCs. During the March 2013 sampling event, monitoring well A-19D exhibited concentrations of MTBE similar to historic detections at this well. Additionally, lead was detected in both A-19D and A-21D at concentrations exceeding the respective PADEP non-residential groundwater MSC.

Plume Stability Assessment

The persistence of a dissolved plume was assessed by plotting COC concentration versus time from wells located in each plume. With sufficient analytical data, a decreasing COC concentration trend in a well can be interpreted as the presence of a shrinking plume with respect to that COC at that location. Similarly, an increasing trend can be interpreted as an expanding plume area (EPA, 2002). No significant changes in groundwater concentration can be interpreted as a stable-plume. Using multiple wells in a single plume, the overall stability of the plume can be assessed.

In addition to evaluating COCs over time in the wells, plume stability at AOI 5 was also assessed using a series of isoconcentration maps that depict the horizontal distribution of benzene in the unconfined aquifer. Over time, a reduction, redistribution of mass, and/or a decrease in extent can indicate plume attenuation. Conclusions drawn regarding overall plume stability in AOI 5 are preliminary and qualitative.

Plume stability assessment in AOI 5 is described below.

East Source Area

Groundwater concentration trend graphs of multiple COCs detected in monitoring wells A-4, A-5, A-47, and A-150 were created using analytical results from 2007 through 2016 where available (Figures I-8 and I-11). Three of the four wells (A-4, A-47, and A-150) only have two rounds of sampling data. Based on the limited data available, the changes in concentration shown are subjective to seasonal fluctuations and can only be used as a very preliminary assessment of plume stability. Most of the concentrations of COCs in the east source area wells do not vary more than an order of magnitude, and therefore the plume is assumed to be stable at this time. A-150 is the only monitoring well in the east source area that had benzene detections above the PADEP non-residential groundwater MSC. A-150 was sampled in May 2007 and October 2014, and over that timeframe benzene has decreased an order of magnitude (Figure I-11). Therefore, it appears the heavy distillate body is not a continuous source of dissolved benzene in groundwater.

Groundwater isoconcentration maps for benzene were created using analytical results from May 2007, July 2014 and October 2014 sampling events (Figures I-12 through I-14). Interpreting the figures, the following observations can be made for the east source area:

- The east source area has attenuated with respect to dissolved benzene concentrations, as observed in A-150.
- The observed LNAPL used to define the heavy distillate source area does not appear to be a continuous dissolved source of benzene in groundwater.
- Based on concentrations observed during the limited sampling events, the east plume appears to be stable in respect to all other COCs.

West Source Area

Groundwater concentration trend graphs for multiple COCs detected in monitoring wells A-22, A-24, A-134, A-135, A-136, A-155, A-158, SW-2, WP-A, and WP-E were created using groundwater analytical results from 2005 through 2016, where available (Figures I-15 and I-24). COCs shown on the trend graphs charts include benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, lead, and MTBE. These trend charts, with the exception of SW-2, suggest the west plume is decreasing in size or stable with respect to all identified COCs. At SW-2, based on limited data available, it appears the plume is increasing in size with respect to all COCs (Figure I-23). SW-2 is located along the sheet pile wall and coincides with the confluence of the backfilled western tributary and the Schuylkill River. Limited mounding is also observed around SW-2. Observed increasing concentrations of COCs at SW-2 may indicate diffusive transport of COCs emanating from the localized middle distillate body centered on SW-1, and accumulation behind the sheet pile wall.

Groundwater isoconcentration maps for benzene were created using analytical results from May 2007, July 2014 and October 2014 sampling events (Figures I-12 through I-14). Interpreting the figures, the following observations can be made for the west source area:

- Concentrations and the horizontal extent of benzene in the unconfined aquifer have remained stable over time.
- The leading edge of the benzene plume located along the boundary of AOI 5 and AOI 6 in the vicinity of WP9-8 and A-154 appears to have attenuated or constricted over time.
- The observed LNAPL used to define the isolated middle distillate source areas does not appear to be a continuous dissolved source of benzene in groundwater.
- The sheet pile wall appears to be inhibiting the transport of benzene (and other COCs) and limiting discharge to the Schuylkill River.

Potential Receptors

Potential human health and ecological receptors to COCs in groundwater in AOI 5 include:

- Workers in occupied buildings that are not under positive pressure (from vapor intrusion into indoor air);

- Ecological receptors in the Schuylkill River.

Fate and Transport Assessment Summary

- Groundwater in the unconfined aquifer generally flows south towards the Schuylkill River. Groundwater flow paths towards the Schuylkill appear to be influenced by historic tributaries of the Schuylkill River that have been filled in, as indicated by the valley-like groundwater flow patterns, in the vicinity of these features. Unconfined groundwater flow in AOI 5 is also influenced by the presence of the sheet pile wall which extends along the Schuylkill River and is keyed into the Holocene clay. Localized groundwater mounding is apparent behind certain portions of the wall.

- Historically, the following COCs have been detected in unconfined aquifer monitoring wells at concentrations exceeding their respective PADEP non-residential groundwater MSCs in both east and west source areas: lead, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, and MTBE.

- There have also been limited one-time detections exceeding the PADEP non-residential groundwater MSC of pyrene, indeno(1,2,3-cd)pyrene, cumene, and 1,2,4-TMB.

- Two groundwater source areas have been identified based on COC exceedances of PADEP groundwater MSCs. The east source area is related to a heavy distillate LNAPL body plume located to the north of the former warehouse building. Based on the current plume stability assessment, this source area is stable, and has attenuated with respect to benzene. Also, due to the presence of an underlying clay aquitard (alluvium clay) and the sheet pile wall along the river, the east plume is unlikely to migrate further or reach any potential receptors. The west source area is related to several isolated middle distillate LNAPL bodies. Concentration trends suggest this source area is stable. Due to the plume stability and the presence of an underlying clay aquitard (alluvium clay and lower/middle clay) and presence of a sheet pile wall, the west plume is unlikely to migrate further or discharge to the Schuylkill River.

- Based on the LNAPL fingerprinting analysis completed as part of the Current Conditions Report and 2007 Site Characterization Report, all LNAPL samples were extremely to severely weathered, indicating these LNAPL bodies have been undergoing degradation within the subsurface for a significant time period.

- LNAPL thickness trends and dissolved phase plume stability in both source areas support that the existing LNAPL bodies are immobile within AOI 5.

- MTBE and lead were detected in the lower aquifer groundwater during the March 2013 groundwater sampling event at concentrations above their respective used-aquifer, non-residential groundwater MSCs. These and other historic sampling results will be utilized in a site-wide quantitative groundwater model to support fate and transport analysis and remediation standard attainment demonstration in the Final Report.

- The quantitative fate and transport modeling will be used to assess the appropriate remedial approach for the groundwater concentrations above the non-residential MSCs at the point-of-compliance (POC) of AOI 5.

Table I-1
Fill/Alluvium Hydraulic Conductivity Assessment Summary
AOI 5 Fate and Transport Analysis
PES Facility
Philadelphia, Pennsylvania

Slug Testing Results [1]					
Monitoring Well ID	Bouwer-Rice (ft/d)	Bouwer-Rice Arithmetic Average (ft/d)	Hvorslev (ft/d)	Hvorslev Arithmetic Average (ft/d)	Arithmetic Average for All Methods (ft/d)
A-147	2.534 - 19.870	11.26	11.610 - 23.620	16.49	13.88
A-151	10.060 - 56.27	25.74	--	--	25.74
A-154	20.140 - 45.28	34.6	--	--	34.60
A-140	no measurable response				

Constant Rate Testing Results [2]				
Monitoring Well ID	Saturated thickness (ft)	Transmissivity (ft^2/d)	Hydraulic Conductivity (ft/d)	Comments
A-24	6.4	61.22	9.57	Saturated thickness calculated from average water level (2.9 ft-msl) calculated between 11/19/1996 and 5/10/2012; elevation of the top of the lower/middle clay (-3.5 ft-msl) taken from Langan cross section R-R' in 2007 SCR.
A-22	4.44	1.54	0.35	Saturated thickness calculated from the average water level (1.94 ft-msl) calculated between 12/18/1995 and 5/10/2012; elevation of the top of the lower/middle clay (-2.5 ft-msl) by comparing the elevation of the top of the clay layer at the location of A-21D relative to the river and extrapolating the elevation of the top of the clay unit from Langan cross section R-R' to A-22 in 2007 SCR.

Monitoring Well ID	Summary Hydraulic Conductivities (ft/d)
A-147	13.88
A-151	25.74
A-154	34.60
A-24	9.57
A-22	low outlier, not used to calculate geometric mean
Geometric Mean	**18.5**

NOTES:
1. Langan Engineering. August 24, 2007. Sunoco AOI 5 Site Characterization Report. Appendix C.
2. Dames & Moore. February 13, 1987. Site Assessment Investigation Chevron-Gulf Refinery, Volume II (Appendices).
3. feet per day = ft/d.
4. feet squared per day = ft^2/d.
5. feet = ft.

Table I-2
Groundwater Seepage Velocity and COC Retardation Estimates
AOI 5 Fate and Transport Analysis
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Constituent	Koc	Kd	R Shallow Aquifer	Vc Shallow Aquifer	Aerobic Conditions Lambda	Aerobic Conditions Half-life	
	L/kg		unitless	ft/d	yr-1	years	days
METALS							
Lead (Total)	na	900	7,841	6.1E-05	na		
VOCs							
1,2,4-Trimethylbenzene	2,200	4.4	39	0.01	4.5	0.154	56
Benzene	58	0.116	2	0.24	0.35	1.98	723
Methyl Tertiary Butyl Ether	12	0.024	1	0.40	0.69	1.00	367
SVOCs/ PAHs							
Benzo(a)anthracene	350,000	700	6,099	7.9E-05	0.19	3.65	1,332
Benzo(a)pyrene	910,000	1820	15,856	3.0E-05	0.24	2.89	1,054
Benzo(b)fluoranthene	550,000	1100	9,583	5.0E-05	0.21	3.30	1,205
Benzo(g,h,i)perylene	2,800,000	5600	48,785	9.8E-06	0.19	3.65	1,332
Chrysene	950	1.9	18	2.7E-02	0.98	0.71	258
Pyrene	68,000	136	1,186	4.05E-04	0.07	9.90	3,614

Notes:
Aerobic half-lives from PA Code Chapter 250, Appendix A, Table 5A
Koc = soil organic carbon-water partitioning coefficient
Kd = soil-water partitioning coefficient
R = retardation
Vc = retarded seepage velocity
L/kg = liters per kilogram
ft/d = feet per day
yr-1 = 1/year
gram/cc = grams per cubic centimeter
VOCs = volatile organic compounds
SVOCs = semi-volatile organic compounds
PAHs = polycyclic aromatic hydrocarbons
na = not applicable

porosity - surface soils	0.194	unitless
bulk density	1.69	gram/cc
fraction of organic carbon	0.002	unitless
seepage velocity	0.48	ft/d

Figure I-1 – Generalized Stratigraphic Section of the Coastal Plain in South Philadelphia, Pennsylvania
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

SYSTEM	SERIES	GEOLOGIC UNIT		HYDROGEOLOGIC UNIT
Quaternary	Holocene	alluvium		water-table aquifer
	Pleistocene	"Trenton gravel"		
Cretaceous	Upper Cretaceous	Potomac-Raritan-Magothy aquifer system	upper clay unit	
			upper sand unit	
			middle clay unit	confined aquifer
			middle sand unit	
			lower clay unit	
	Lower Cretaceous		lower sand unit	
pre-Cretaceous		crystalline rocks		

Notes:
1) Modified from Schreffler, 2001.
2) Geologic and Hydrogeologic Units highlighted in blue are present at AOI 5.

N
W E
S

Legend

- Wells
- Average Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Sheet Pile Wall
- AOI Boundary

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. ft amsl = feet above mean sea level
4. Groundwater contours were generated as an average of all available gauging events.

Figure I-2: Average Groundwater Flow Conditions in Unconfined Aquifer in AOI 5
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: April 27, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-2 - Average Groundwater Flow Conditions in Unconfined Shallow Aquifer in AOI 5.mxd

Legend

2 Foot Topographic Contours (ft amsl)

AOI Boundary

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Topographic contours developed from 2010 LiDAR data for the City of Philadelphia.
4. ft amsl = feet above mean sea level

Figure I-3: AOI-5 Topography
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: April 27, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Path: \\langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-3 - AOI 5 Topography.mxd

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).

Figure I-4: Impermeable Surface Locations in AOI 5
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: April 27, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-4 - Impermeable Surface Locations in AOI 5.mxd

"A Map of Philadelphia and Parts Adjacent, 1750 (circa)", Zebooker collection, Athenaeum of Philadelphia.

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

Figure I-5: Historical Surface Water Features at AOI 5
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery

Philadelphia — Pennsylvania

Job Number	Scale: 1" = 1,500'	Date
2574602	0 750 1,500 Feet	March 9, 2016

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-5 - Historical Surface Water Features at AOI 5.mxd

Legend

Sheet Pile Wall

AOI Boundary

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).

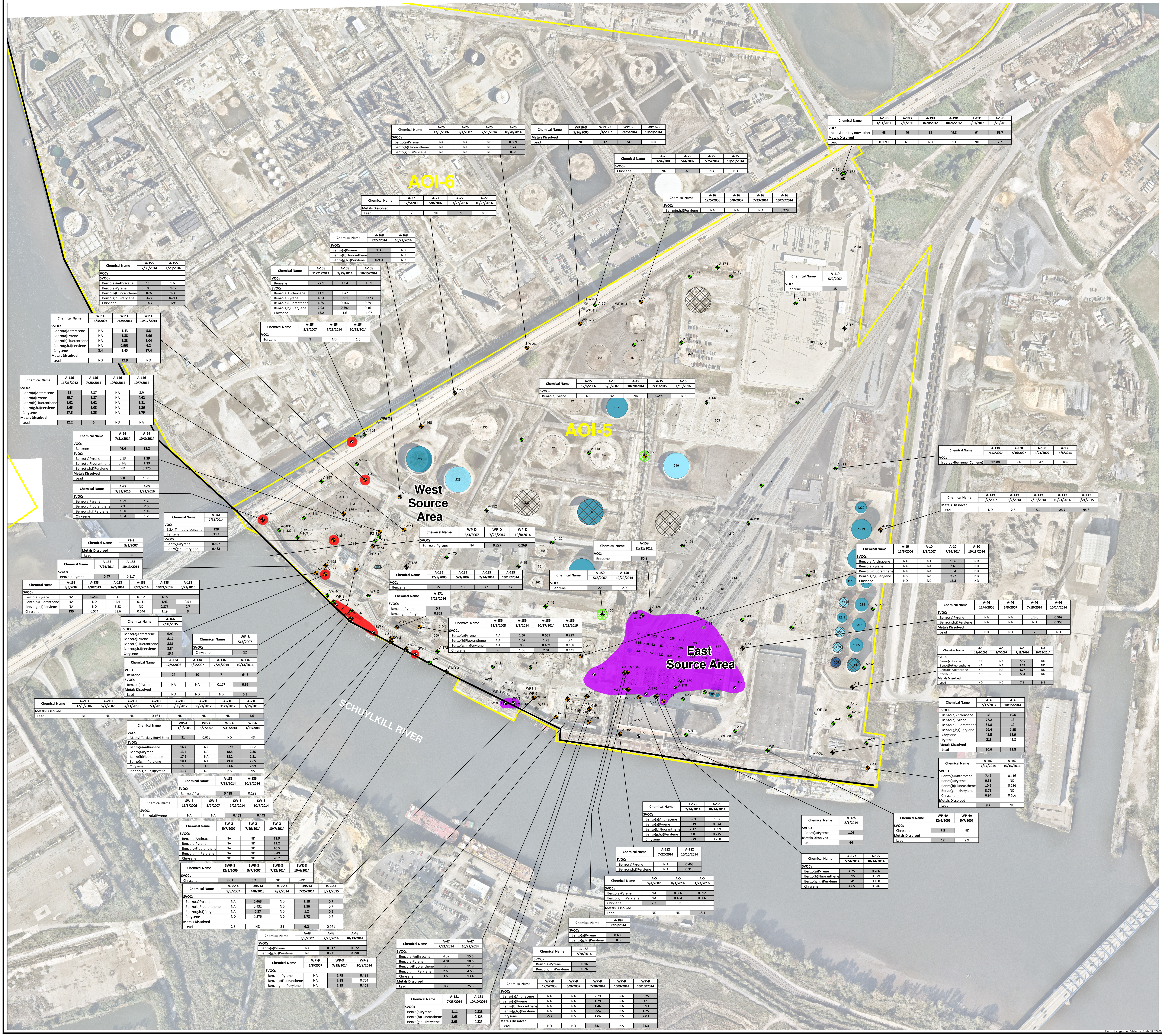
Figure I-6: Anthropogenic Site Features in AOI 5
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources
Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: April 27, 2015
DRN. BY: MH
CKD. BY: KM
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-6 - Anthropogenic Site Features in AOI 5.mxd



N
W E
S

Legend

- Groundwater Sample with an Exceedance between 2014 - 2016
- Groundwater Sample with No Exceedance between 2014 - 2016
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- Sheet Pile Wall
- Closed in Place
- Closed in Place Tank With Open Incident
- Active Tank With Open Incident
- Removed Tank With Open Incident
- Tank Currently Out of Service
- Tank In Service
- Removed Tank
- AOIs
- 10 Result Exceeds PADEP Non-Residential Used Aquifer MSC TDS<2500 mg/L

LNAPL Types

- Middle Distillate
- Heavy Distillate
- Unknown

Groundwater Screening Criteria

Chemical Name	CAS No.	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs (ug/L)
Volatile Organic Compounds		
1,2,4-Trimethylbenzene	95-63-6	62
Benzene	71-43-2	5
Isopropylbenzene (cumene)	98-82-8	3500
Methyl Tertiary Butyl Ether	1634-04-4	20
Semi-Volatile Organic Compounds		
Benzo(a)anthracene	56-55-3	4.9
Benzo(a)pyrene	50-32-8	0.2
Benzo(b)fluoranthene	205-99-2	1.2
Benzo(g,h,i)perylene	191-24-2	0.26
Chrysene	218-01-9	1.9
Indeno(1,2,3-c,d)pyrene	193-39-5	3.6
Pyrene	129-00-0	130
Metals Dissolved		
Lead	7439-92-1	5

Notes:
1. Aerial imagery provided by Nearmap.com as is dated 07/29/15.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater exceedances or criteria displayed in micrograms per liter (ug/L)

Figure I-7: Summary of Groundwater Sample Exceedances
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

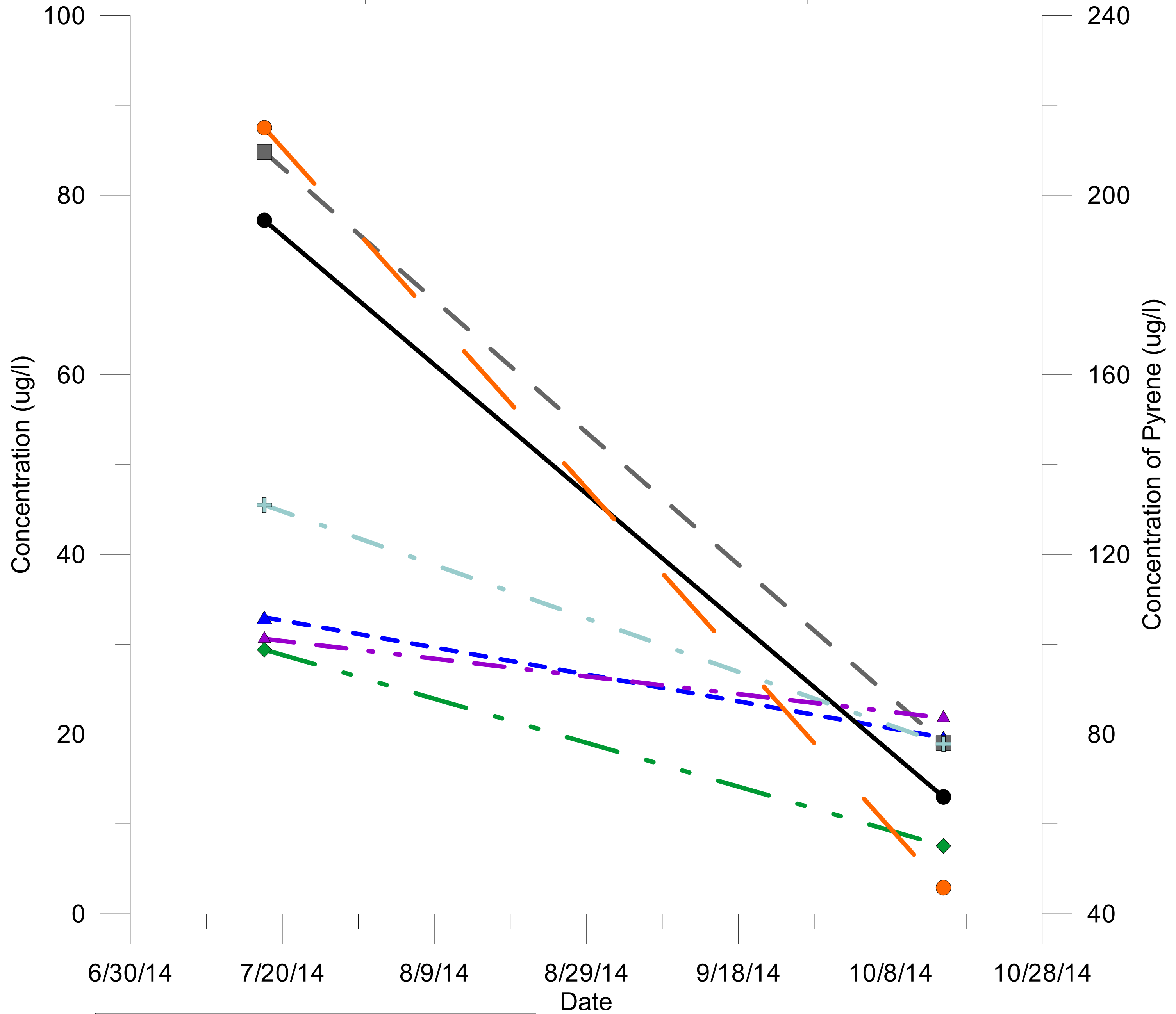
Philadelphia Refinery Operations
A Series of Evergreen Resources Group, LLC.
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 140 280 Feet

SCALE: 1" = 140'
DATE: 11/23/2016
DRN. BY: AJC
CKD. BY: ED
JOB#: 2574602

YL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-7 - Locations of Interpreted Groundwater Impact Source Areas in AOI 5.mxd

Figure I-8
East Source Area
COC Concentration Trends at Well A-4
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA

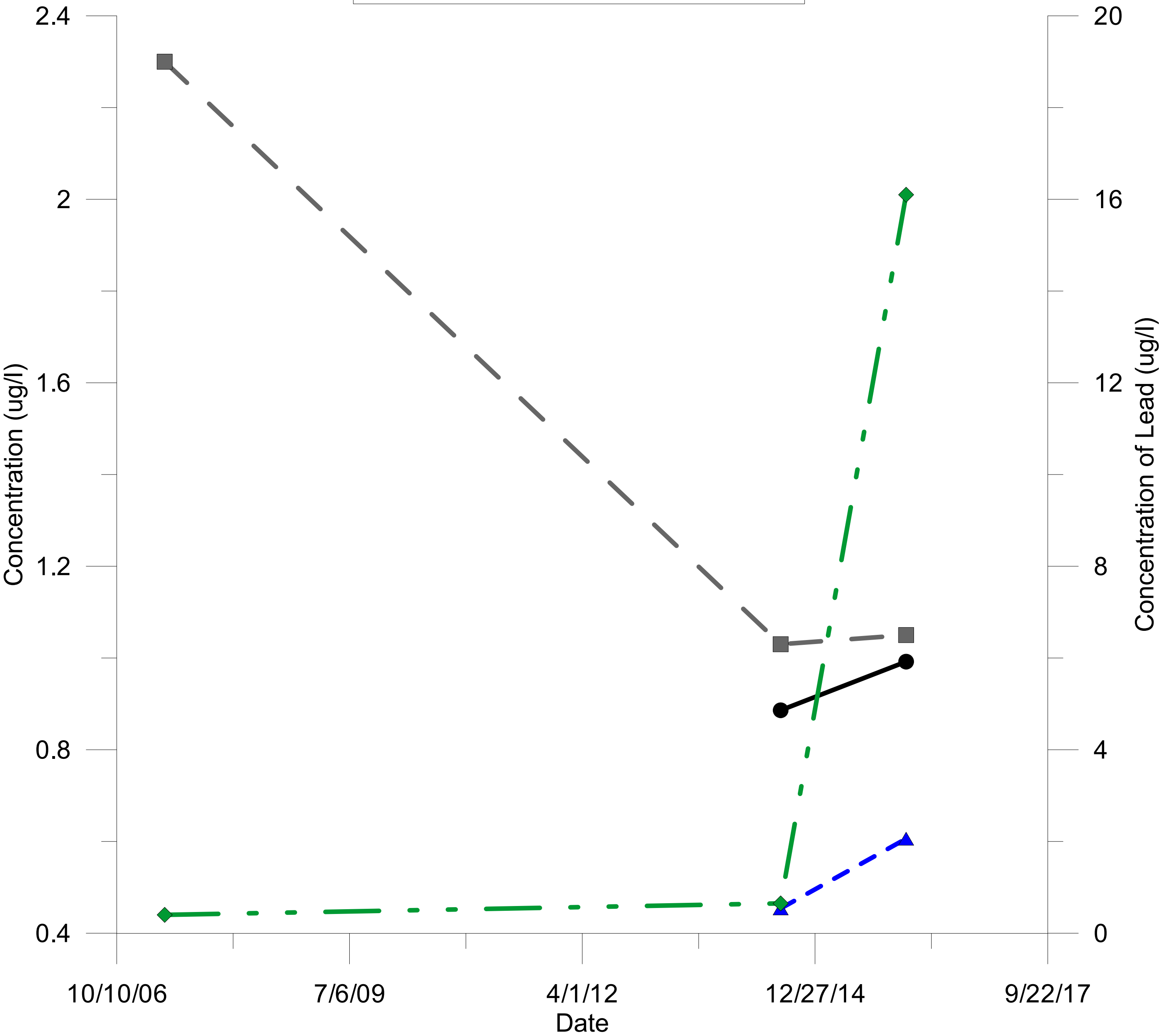


Legend (primary axis)
- Benzo(a)pyrene
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Chrysene
- Dissolved Lead

Legend (secondary axis)
- Pyrene

Notes:
1. Analytical data was obtained from July 2014 and October 2014 sampling events.
2. ug/l = microgram per liter.

Figure I-9
East Source Area
COC Concentration Trends at Well A-5
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA

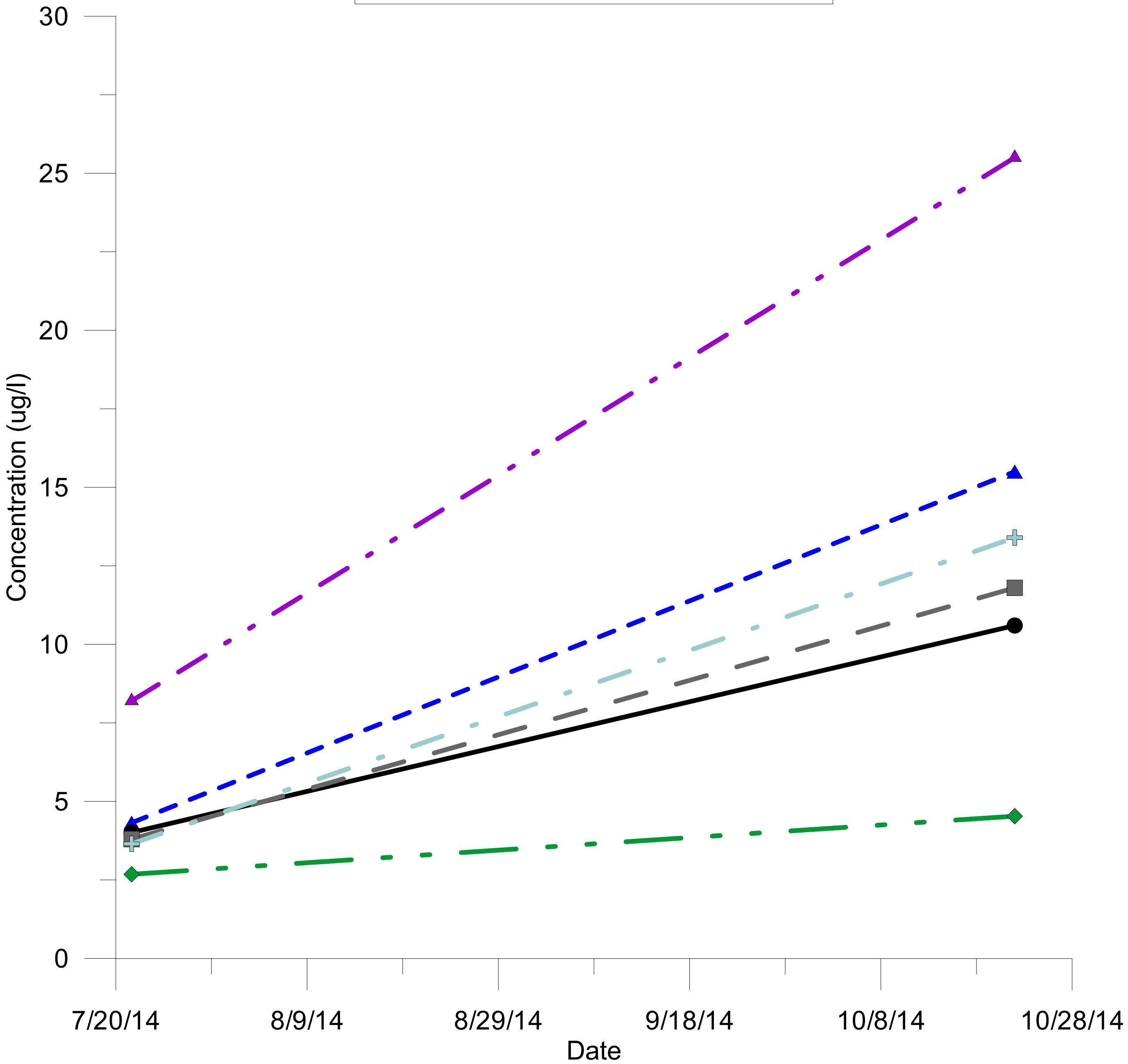


Legend (primary axis)
- Benzo(a)pyrene
- Benzo(g,h,i)perylene
- Chrysene

Legend (secondary axis)
- Dissolved Lead

Notes:
1. Analytical data was obtained from May 2007, July 2014, and January 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater samples from A-5 were collected beneath LNAPL during the July 2014 and January 2016 sampling events.

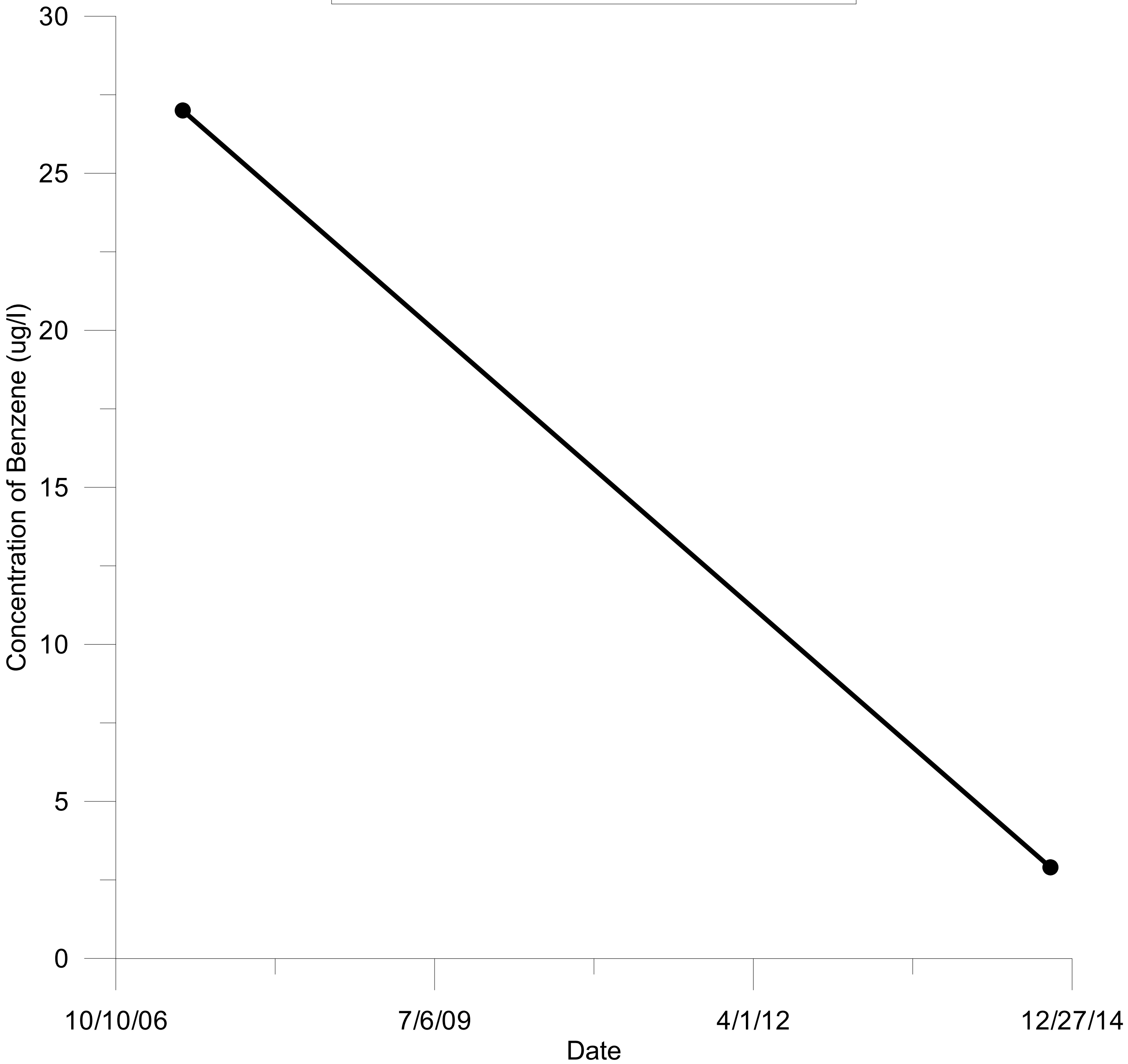
Figure I-10
East Source Area
COC Concentration Trends at Well A-47
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Legend
Benzo(a)pyrene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Chrysene
Dissolved Lead

Notes:
1. Analytical data was obtained from July 2014 and October 2014 sampling events.
2. ug/l = microgram per liter.

Figure I-11
East Source Area
Benzene Concentration Trend at Well A-150
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Legend
Benzene

Notes:
1. Analytical data was obtained from May 2007 and October 2014 sampling events.
2. ug/l = microgram per liter.

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater sampling completed in May, 2007, by Aquaterra.
4. Groundwater contours were generated from the May 2007 gauging event and are shown as depicted in the 2007 Site Characterization Report.
5. All benzene concentrations are in micrograms per liter (ug/L).
6. LNAPL presence based on October 2014 groundwater gauging.

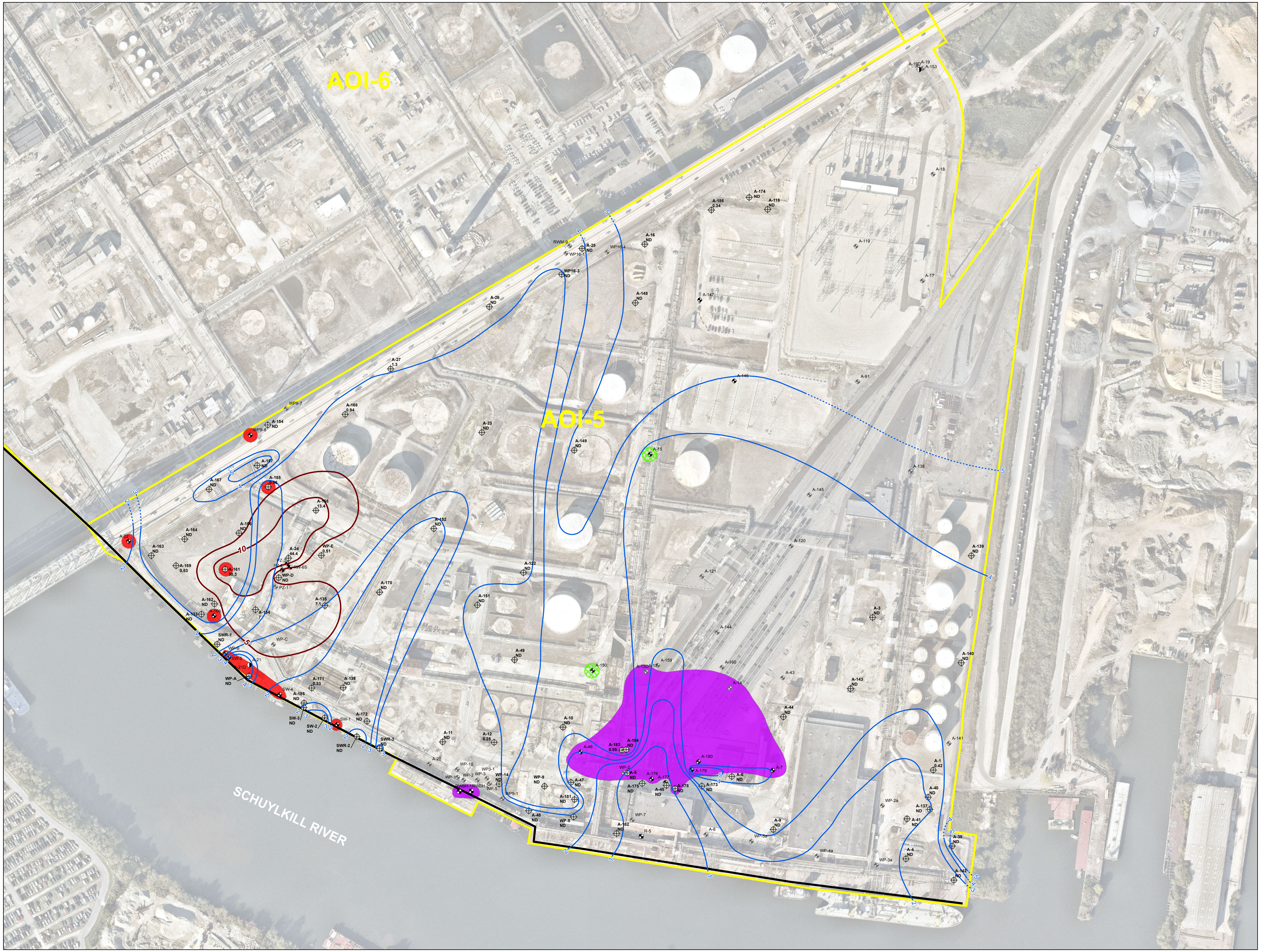
Figure I-12: Unconfined Aquifer Benzene Concentrations May 2007
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: March 9, 2016
DRN. BY: MH
CKD. BY: ED
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-12 - Shallow Aquifer Benzene Concentrations May 2007_3-9-16.mxd



N
W E
S

Legend

A-155
0.56 — Benzene Groundwater Results (July 2014)
- Lower Aquifer Monitoring Well
- Unconfined Aquifer Monitoring Well
- Unconfined Aquifer Piezometer
- Unconfined Aquifer Recovery Well
- Monitoring Well Abandoned/Damaged/ Unable to Locate
- Benzene Contours (ug/L)
- Average Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Sheet Pile Wall
- AOI Boundary

LNAPL Types
- Middle Distillate
- Heavy Distillate
- Unknown

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater sampling completed in July, 2014, by Aquaterra.
4. Groundwater contours were generated from the July 2014 gauging event.
5. All benzene concentrations are in micrograms per liter (ug/L).
6. LNAPL presence based on October 2014 groundwater gauging.

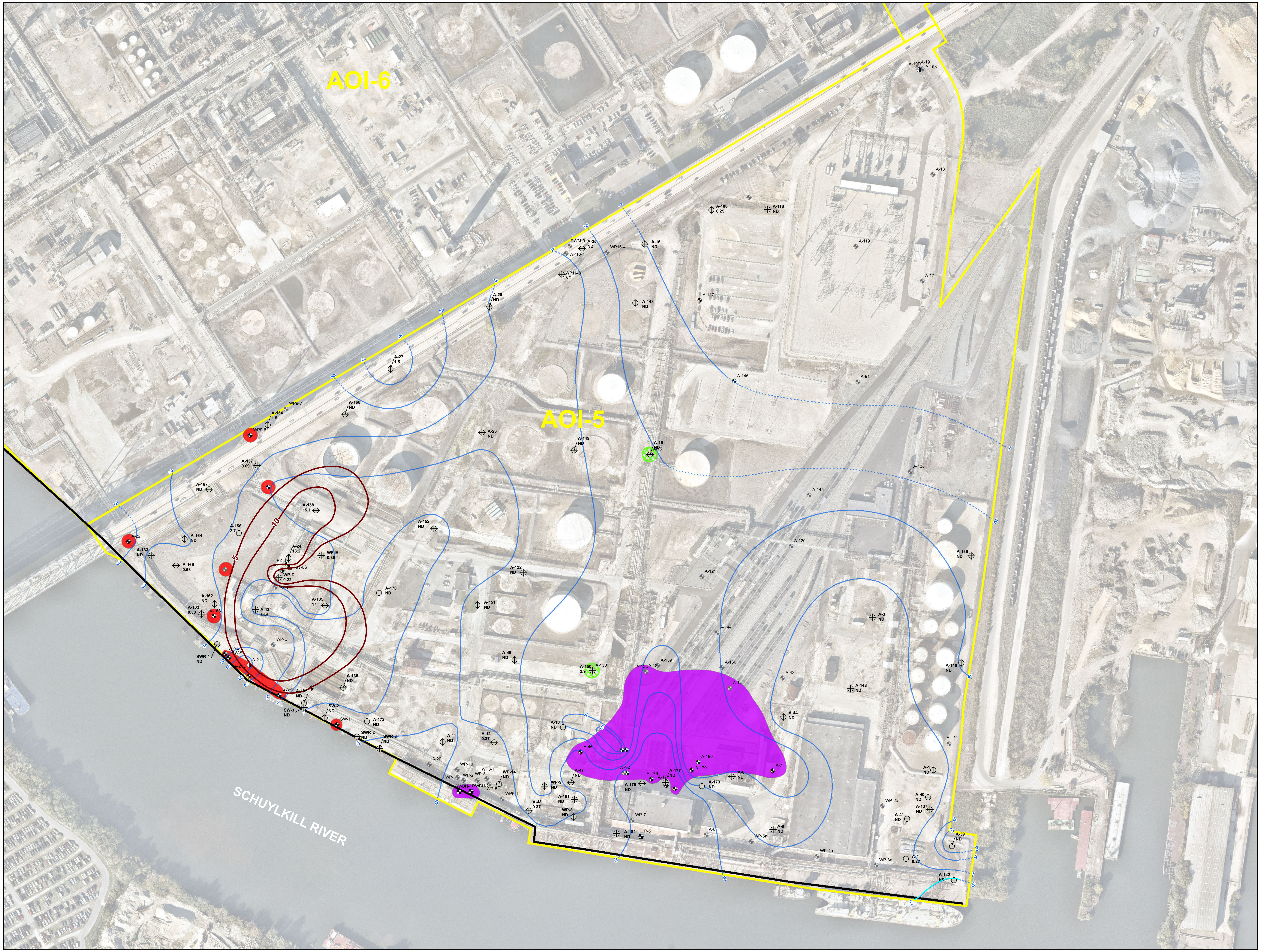
Figure I-13: Unconfined Aquifer Benzene Concentrations July 2014
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 150 300 Feet

SCALE: 1" = 150'
DATE: March 9, 2016
DRN. BY: MH
CKD. BY: ED
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-13 - Shallow Aquifer Benzene Concentrations July 2014_3-9-16.mxd



N
W E
S

Legend

A-156 2.7	Benzene Groundwater Results (October 2014)
	Lower Aquifer Monitoring Well
	Unconfined Aquifer Monitoring Well
	Unconfined Aquifer Piezometer
	Unconfined Aquifer Recovery Well
	Monitoring Well Abandoned/Damaged/ Unable to Locate
	Benzene Contours (ug/L)
	Average Groundwater Elevation Contour
	Inferred Groundwater Elevation Contour
	Sheet Pile Wall
	AOI Boundary

LNAPL Types

- Middle Distillate
- Heavy Distillate
- Unknown

Notes:
1. Aerial photography provided by Nearmap.com, dated 10/19/2015.
2. Area of Interest boundaries referenced from 2011 ALTA/ACSM Land Title Survey, prepared for Sunoco Inc. (R&S).
3. Groundwater sampling completed in October, 2014, by Aquaterra.
4. Groundwater contours were generated from the October 2014 gauging event.
5. All benzene concentrations are in micrograms per liter (ug/L).
6. LNAPL presence based on October 2014 groundwater gauging.

Figure I-14: Unconfined Aquifer Benzene Concentrations October 2014
AOI-5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, Pennsylvania

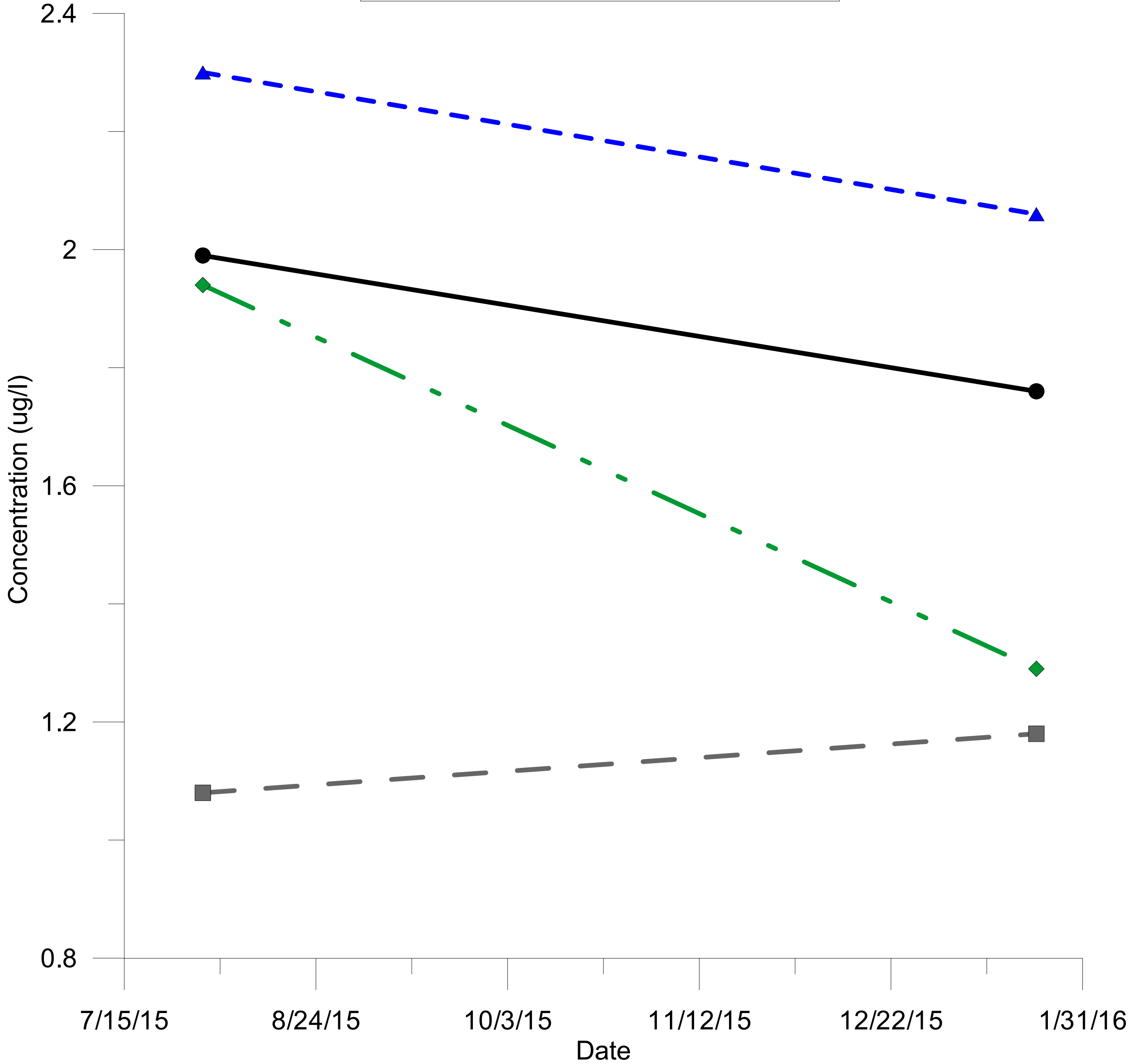
Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

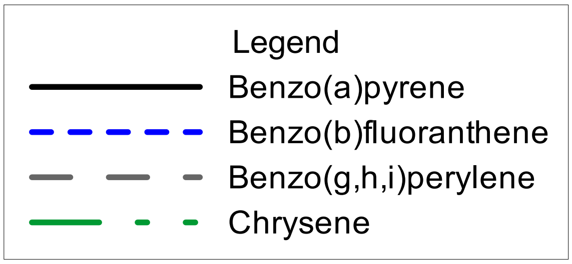
0 150 300 Feet

SCALE: 1" = 150'
DATE: March 9, 2016
DRN. BY: MH
CKD. BY: ED
JOB#: 2574602

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 5 RIR 2015\Fate and Transport\Figure I-14 - Shallow Aquifer Benzene Concentrations Oct 2014_3-10-16REV.mxd

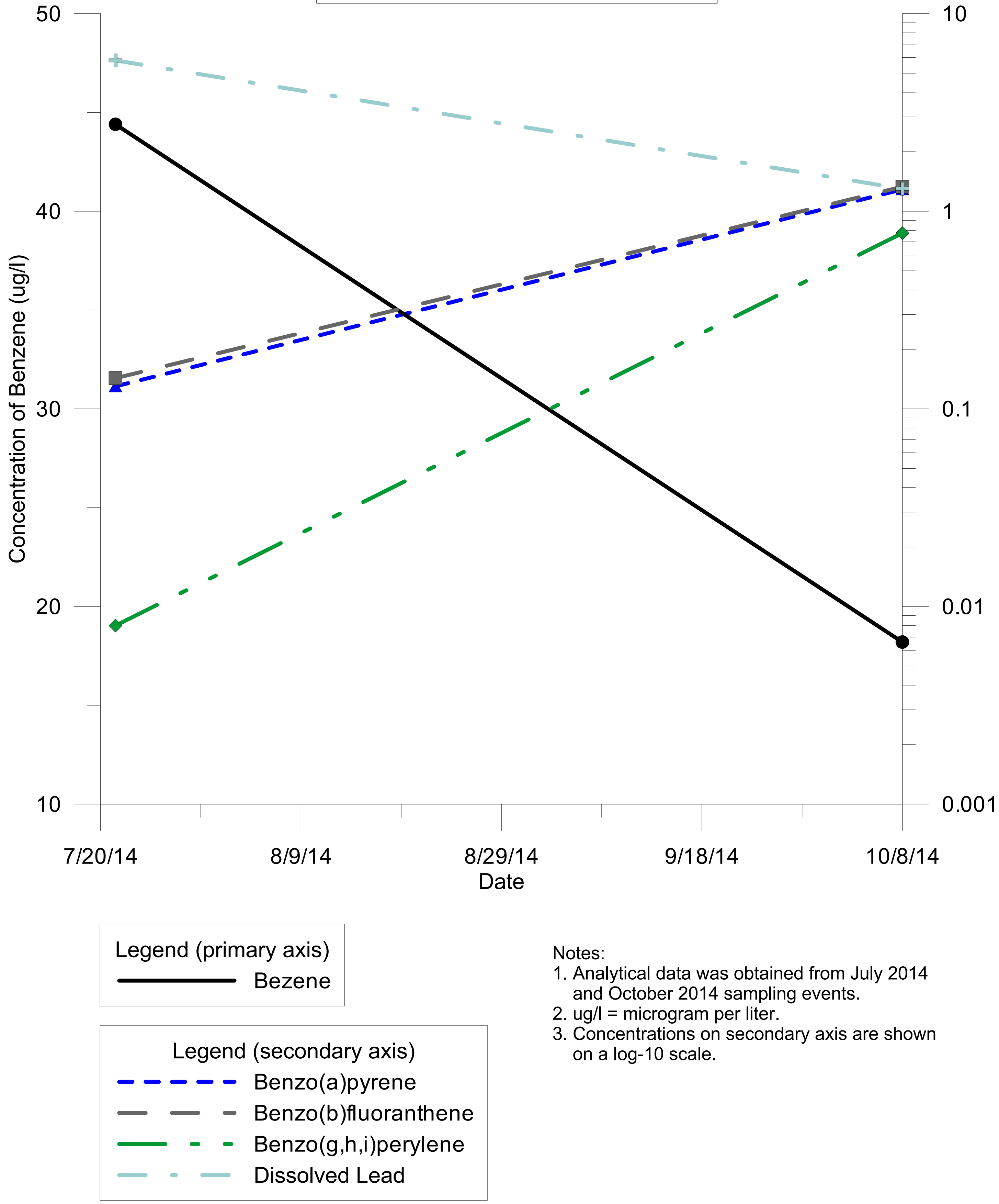
Figure I-15
West Source Area
COC Concentration Trends at Well A-22
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA





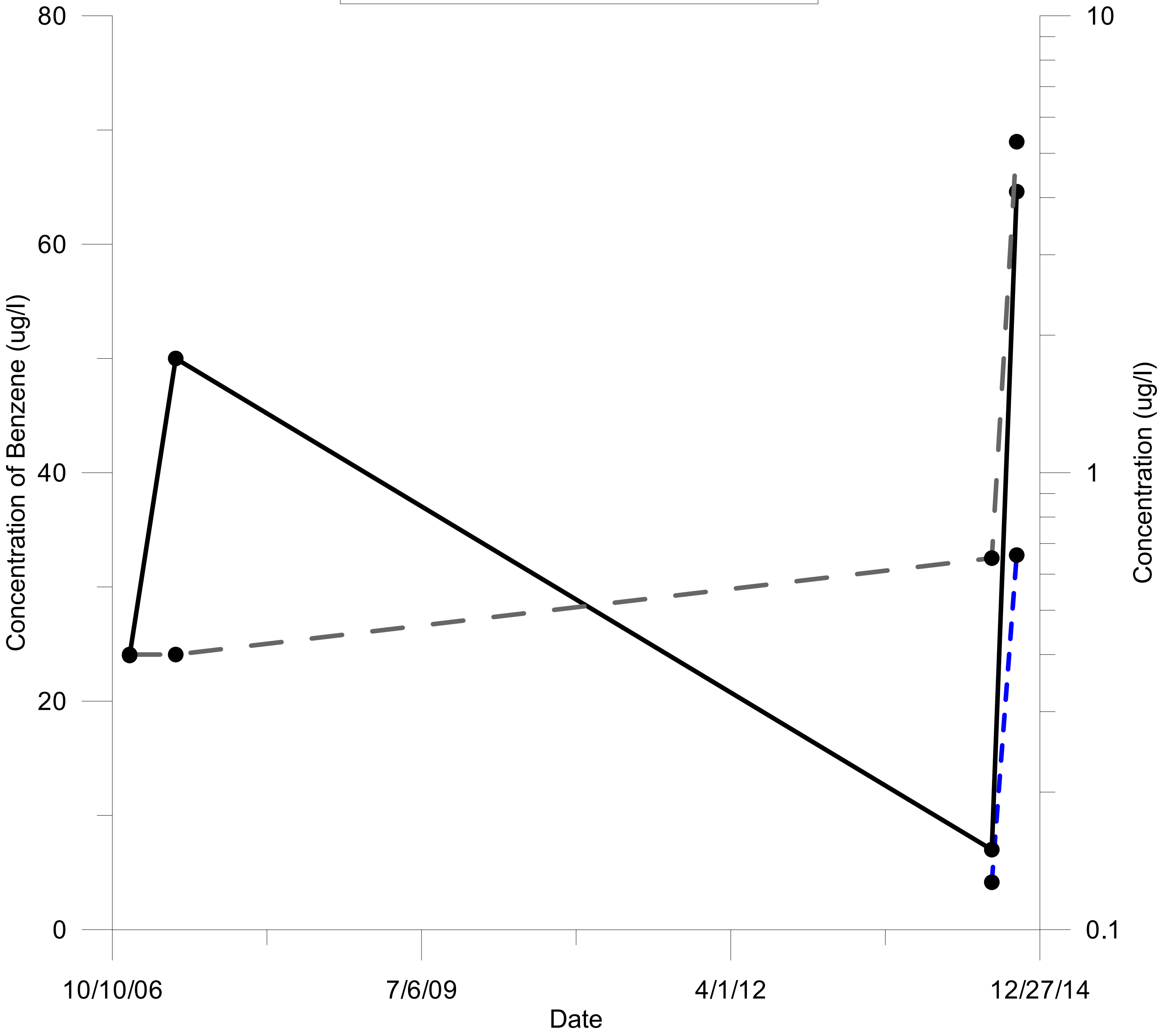
Notes:
1. Analytical data was obtained from July 2014 and January 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater samples from A-22 were collected from beneath LNAPL during both sampling events.

Figure I-16
West Source Area
COC Concentration Trends at Well A-24
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Notes:
1. Analytical data was obtained from July 2014 and October 2014 sampling events.
2. ug/l = microgram per liter.
3. Concentrations on secondary axis are shown on a log-10 scale.

Figure I-17
West Source Area
COC Concentration Trends at Well A-134
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA

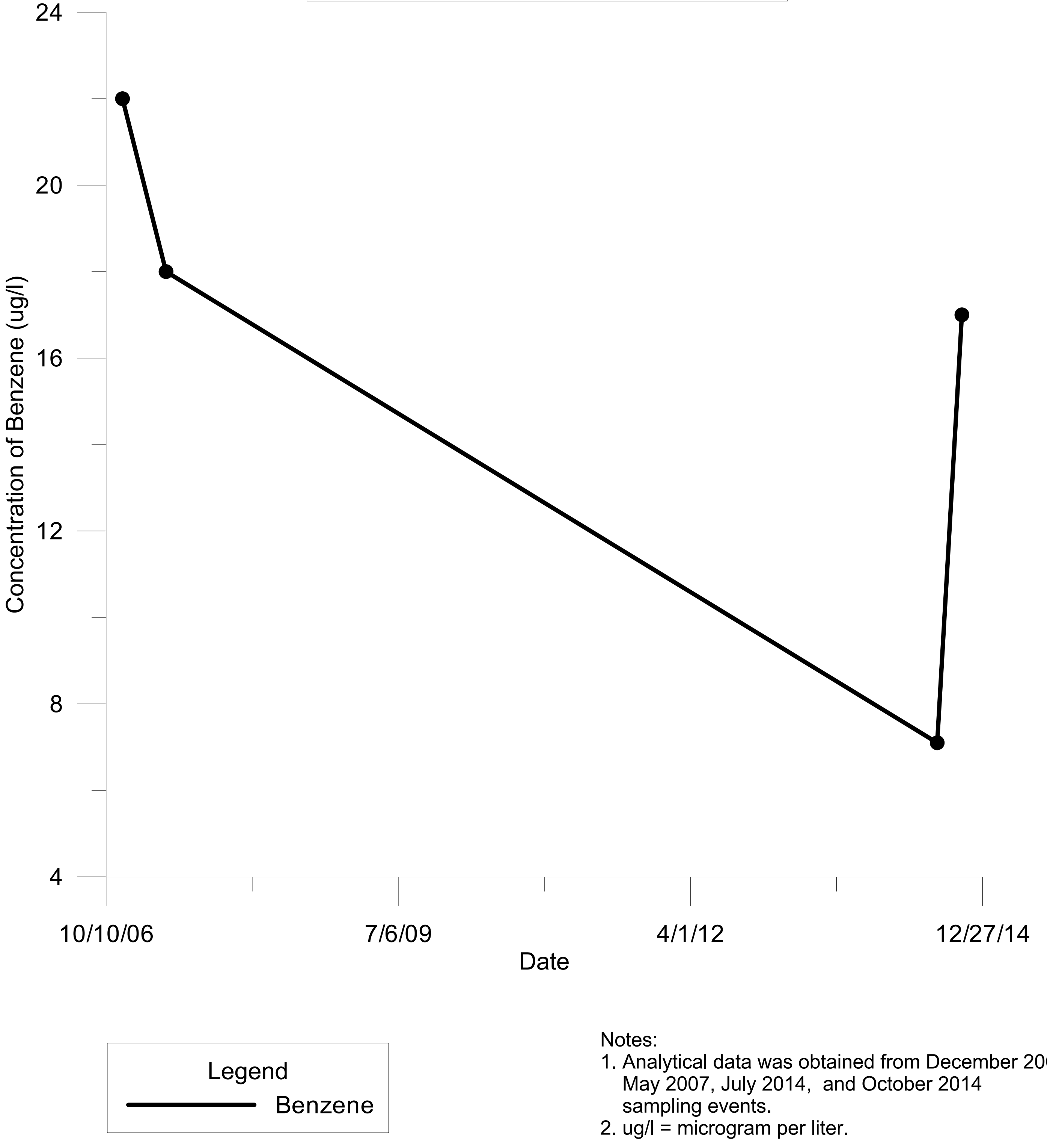


Legend (primary axis)
Benzene

Legend (secondary axis)
Benzo(a)pyrene
Dissolved Lead

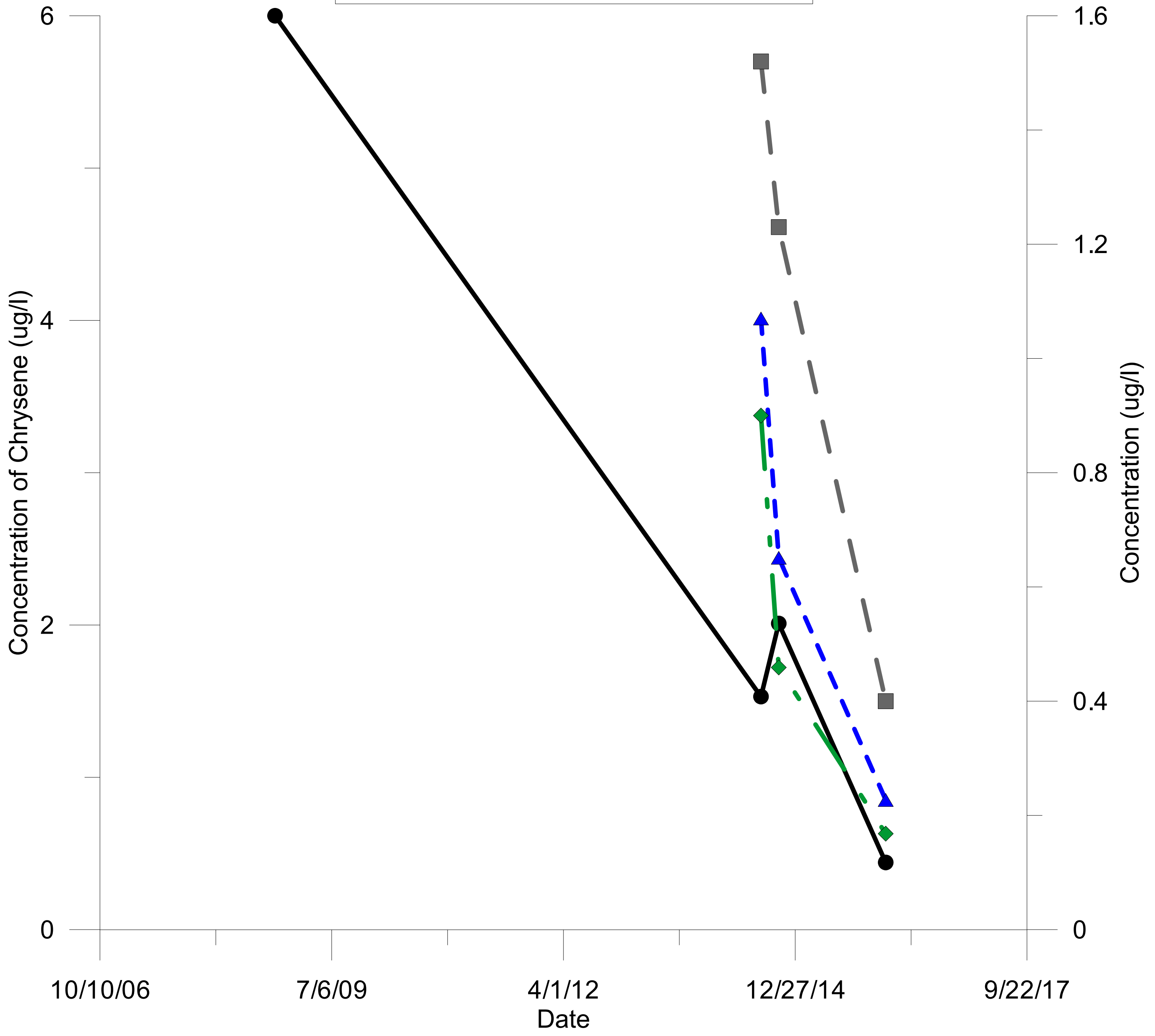
Notes:
1. Analytical data was obtained from December 2006, May 2007, July 2014, and October 2014 sampling events.
2. ug/l = microgram per liter.
3. Benzo(a)pyrene and lead concentrations are displayed on a log-10 scale.

Figure I-18
West Source Area
Benzene Concentration Trend at Well A-135
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Notes:
1. Analytical data was obtained from December 2006, May 2007, July 2014, and October 2014 sampling events.
2. ug/l = microgram per liter.

Figure I-19
West Source Area
COC Concentration Trends at Well A-136
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA

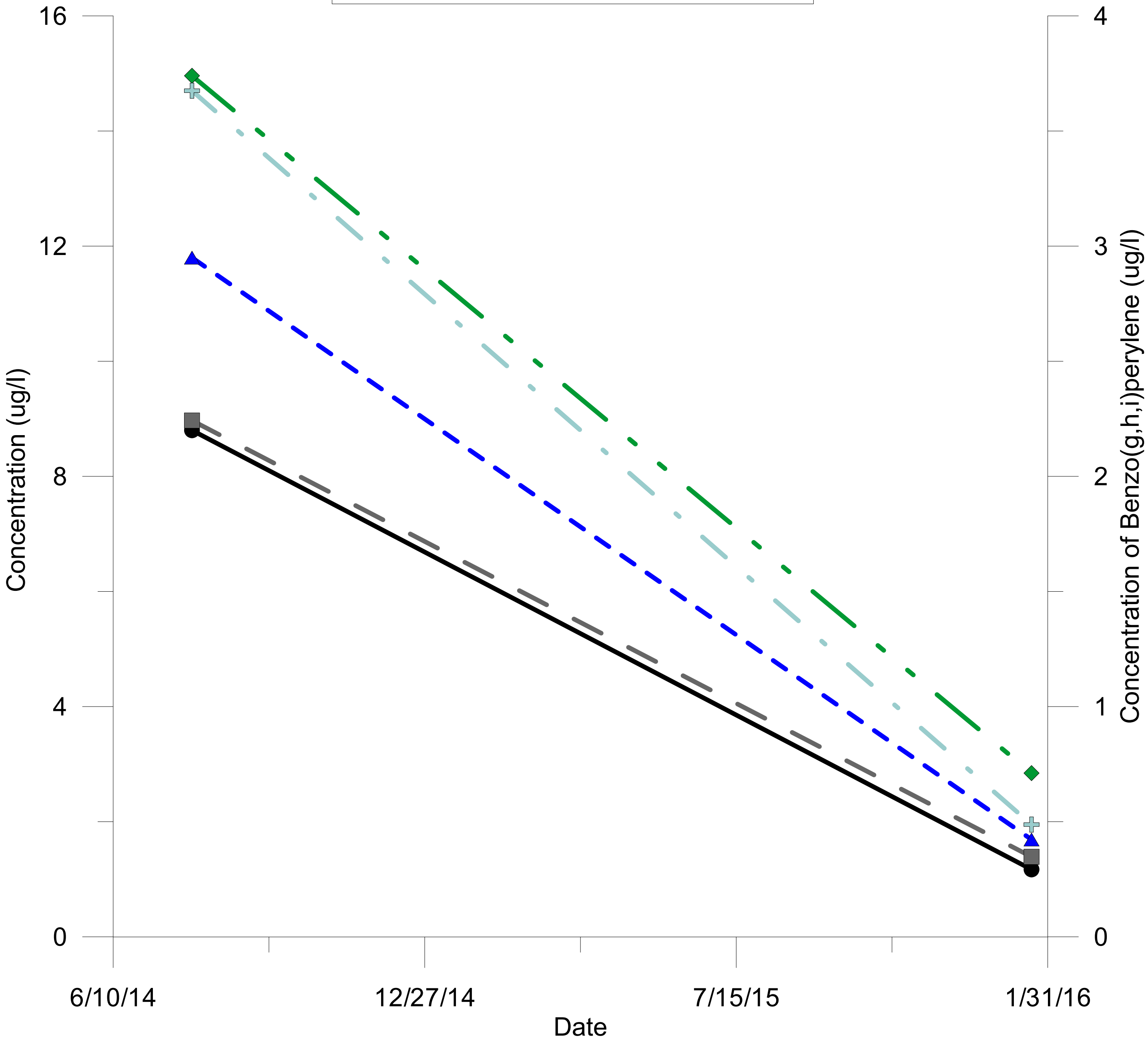


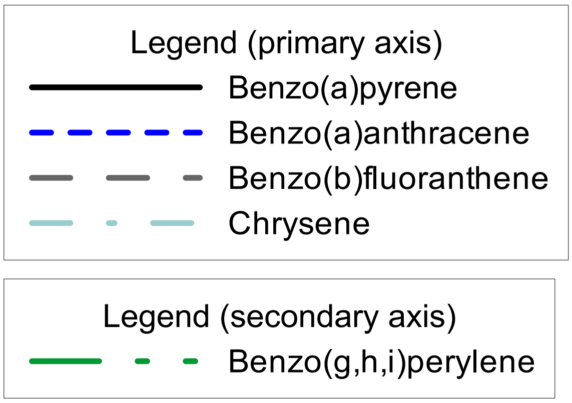
Legend (primary axis)
Chyrsene

Legend (secondary axis)
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene

Notes:
1. Analytical data was obtained from November 2008, July 2014, October 2014, and January 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater samples from A-136 were collected from beneath LNAPL during July 2014 and January 2016 sampling events.

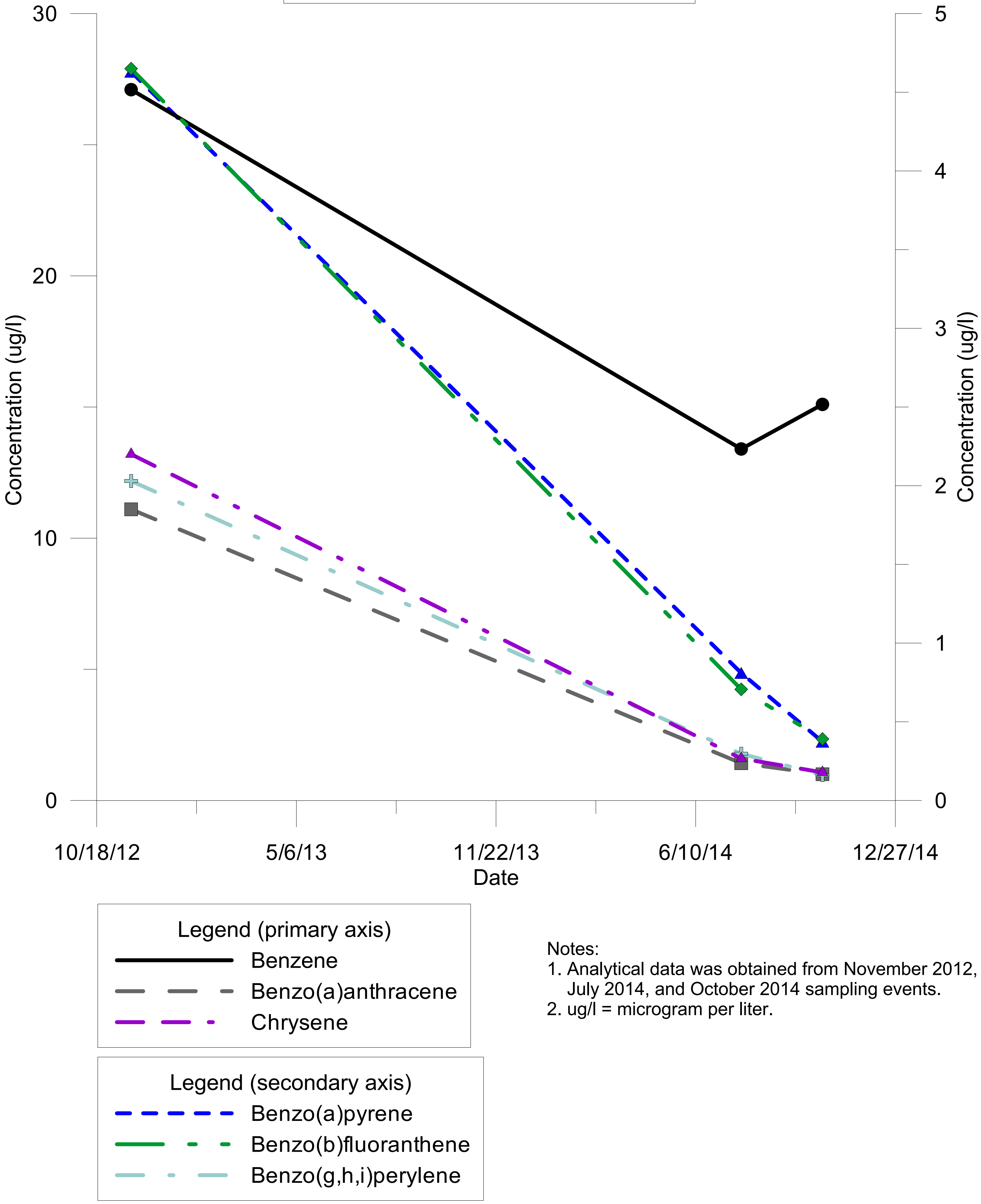
Figure I-20
West Source Area
COC Concentration Trends at Well A-155
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA





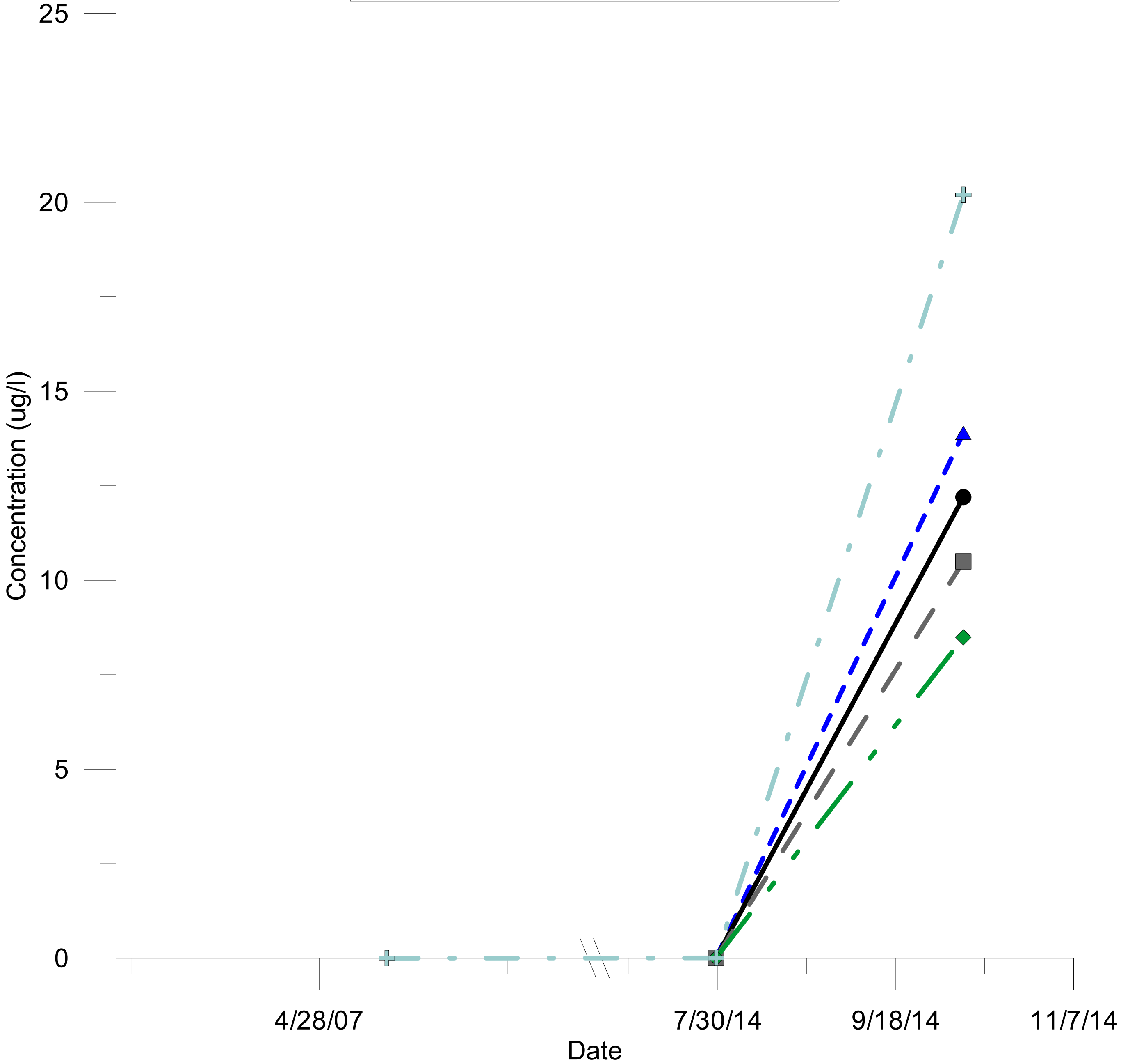
Notes:
1. Analytical data was obtained from July 2014 and January 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater samples from A-155 were collected from beneath LNAPL during both sampling events.

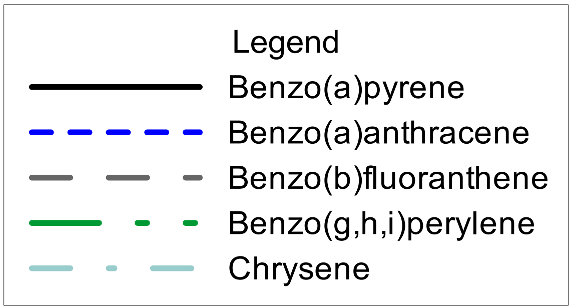
Figure I-21
West Source Area
COC Concentration Trends at Well A-158
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Notes:
1. Analytical data was obtained from November 2012, July 2014, and October 2014 sampling events.
2. ug/l = microgram per liter.

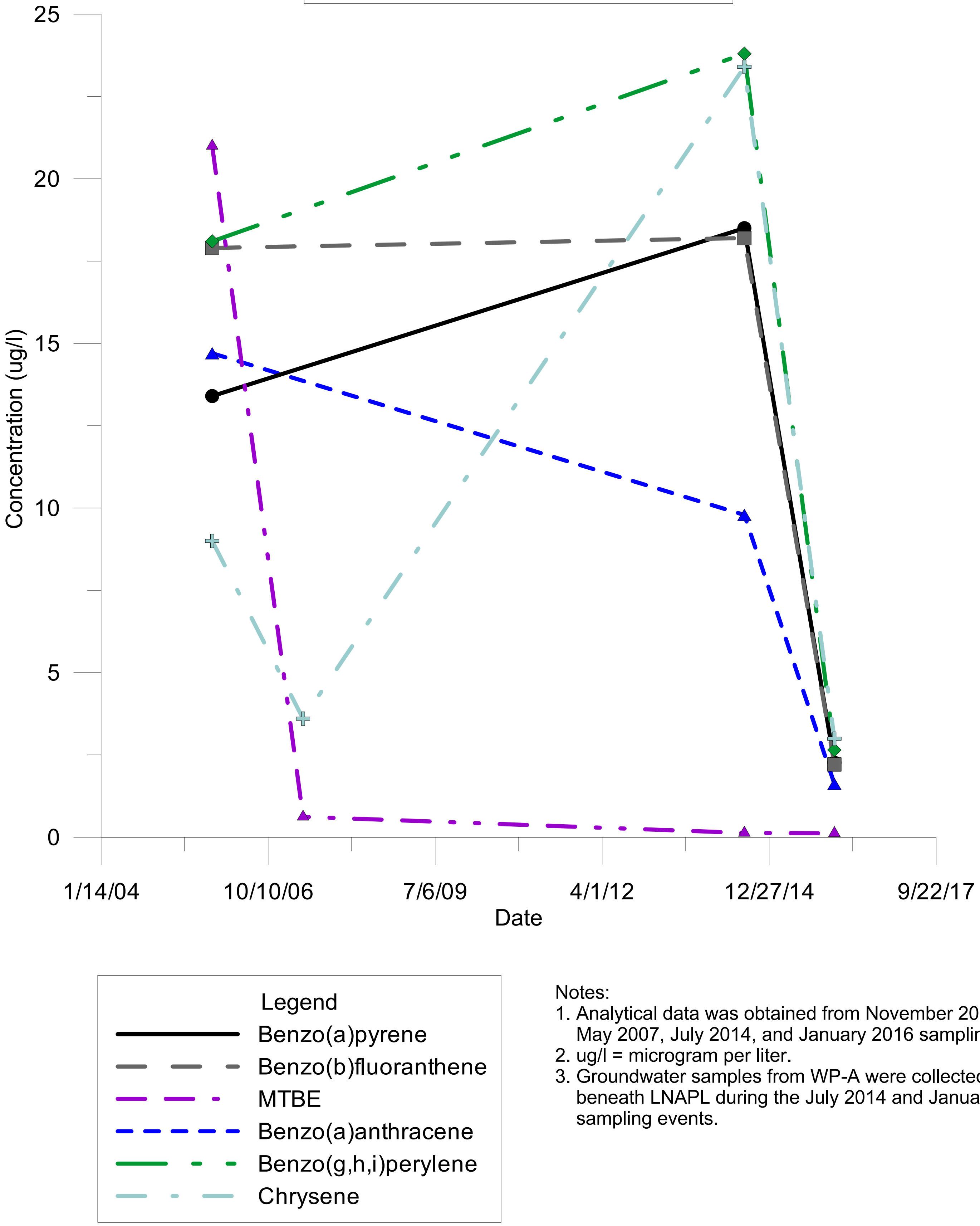
Figure I-22
West Source Area
COC Concentration Trends at Well SW-2
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA





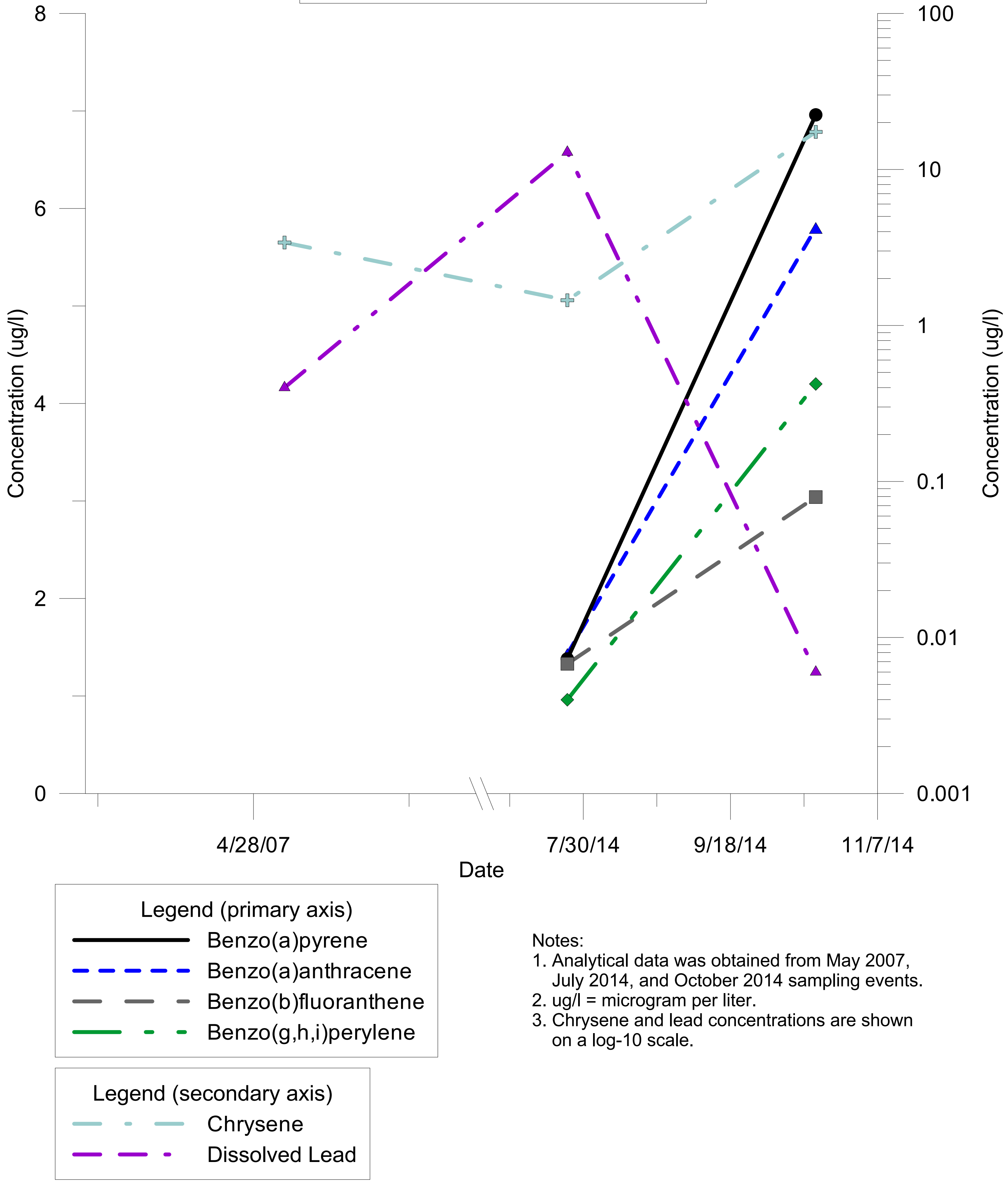
Notes:
1. Analytical data was obtained from May 2007, July 2014, and October 2014 sampling events.
2. ug/l = microgram per liter.

Figure I-23
West Source Area
COC Concentration Trends at Well WP-A
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Notes:
1. Analytical data was obtained from November 2005, May 2007, July 2014, and January 2016 sampling events.
2. ug/l = microgram per liter.
3. Groundwater samples from WP-A were collected from beneath LNAPL during the July 2014 and January 2016 sampling events.

Figure I-24
West Source Area
COC Concentration Trends at Well WP-E
AOI 5 Remedial Investigation Report
PES Philadelphia Refinery
Philadelphia, PA



Notes:
1. Analytical data was obtained from May 2007, July 2014, and October 2014 sampling events.
2. ug/l = microgram per liter.
3. Chrysene and lead concentrations are shown on a log-10 scale.

APPENDIX J

AOI 5 HISTORICAL REPORTS (ON CD)

LANGAN