SITE CHARACTERIZATION/ REMEDIAL INVESTIGATION REPORT AREA OF INTEREST 2

SUNOCO, INC. (R&M) PHILADELPHIA REFINERY PHILADELPHIA, PENNSYLVANIA



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1.0 INTRODUCTION

Sunoco Inc. (R&M) (Sunoco) and the Pennsylvania Department of Environmental Protection (PADEP) entered into a Consent Order & Agreement (CO&A) in December 2003 with respect to Sunoco's Philadelphia Refinery (Refinery). 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 facility into 11 Areas of Interest (AOIs), and presented a prioritization of the AOIs based on specific risk factors. The AOIs are shown in Figure 1 and 2 of this report. 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 six AOIs (AOIs 1, 4, 5, 6, 8 and 9). For each AOI that has been characterized, Sunoco has prepared and submitted a corresponding Site Characterization Report in accordance with the Revised Phase II Corrective Action Activities schedule that was included in the CCR. Based on the Phase II Corrective Action Activities Schedule, AOI 2 along with AOIs 3 and 7 were identified by Sunoco to be investigated and characterized in 2010.

In April 2004, the PADEP and the United States Environmental Protection Agency (EPA) signed an agreement entitled "One Cleanup Program Memorandum of Agreement (PA One Cleanup Program)," which clarifies how sites remediated under Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2) program may satisfy EPA's Resource, Conservation and Recovery Act (RCRA) corrective action requirements through characterization and attainment of Act 2 remediation standards. Since November 2005, Sunoco and its representatives have met with officials of the PADEP and EPA on several occasions to discuss the applicability of PA One Cleanup Program to the ongoing remedial program for the facility. Sunoco, PADEP and EPA agreed that the ongoing remedial program can be addressed under the PA One Cleanup Program. Sunoco submitted a Notice of Intent to Remediate (NIR) on October 12, 2006 to formally enter the facility into the PA Act 2 Program. The portion of the Refinery known as the Belmont Terminal was not included in the NIR. A NIR may be submitted in the future for the Belmont Terminal. The cover letter included with the NIR expressed Sunoco's intent to enter the facility into the PA One Cleanup Program. To date, acknowledgement of formal acceptance into the PA One Cleanup Program has not been

received by EPA; however, the facility is listed on EPA's online PA One Cleanup Program list and is therefore considered to be in the PA One Cleanup Program.

Sunoco prepared a Site Characterization Work Plan (Work Plan) for AOI 2 and submitted the Work Plan to the PADEP and EPA on March 19, 2010. This Work Plan summarized proposed activities to be completed to characterize AOI 2 in accordance with the objectives of the CCR.

This Site Characterization/Remedial Investigation Report (SCR/RIR) has been prepared exclusively for AOI 2 and documents the results of the characterization activities completed in accordance with the Work Plan. The objective of this SCR/RIR is to document current environmental conditions at AOI 2 in accordance with the 2003 CO&A, the 2004 CCR and to evaluate whether the remedial objectives of the CO&A are being met based on the current conditions.

1.1 Site History and Background

The Sunoco Philadelphia Refinery is located in southwest Philadelphia. The facility has a long history of petroleum transportation, storage, and processing. The oldest portion of the facility started petroleum related activities in the 1860's, when the Atlantic Refining Company established an oil distribution center. In the 1900's, crude oil processing began and full-scale gasoline production was initiated during World War II. In addition to refining crude oil, various chemicals, such as acids and ammonia, were also produced at the site for a time. Current operations at the Refinery are limited to the production of fuels and basic petrochemicals for the chemical industry.

AOI 2, also known as the Point Breeze Processing Area, is located on the east side of the Schuylkill River. AOI2 is bordered by Passyunk Avenue to the north, AOI 1 to the east, Hartranft Street to the south, and the Schuylkill River to the west (Figures 1 and 2). AOI 2 encompasses approximately 120 acres, and is covered mainly with impervious surfaces except for the Short Pier area, the eastern portion adjacent to the tank farms, and the southeast portion of the AOI 2. Currently, AOI 2 has the only active dock (Short Pier) for loading/offloading of refined products in the Point Breeze facility. AOI 2 is primarily comprised of crude units, hydrodesulfurization units, fluid catalytic cracking (FCC), reforming, low sulfur gasoline, and alkylation units, sulfur recovery, maintenance facilities, wastewater treatment plant, parking areas, office buildings, tanks, and laboratories. There are no current RCRA Solid Waste Management Units (SWMUs) in

AOI 2. The current, historic uses/investigations, and approximate limits of impervious surfaces for AOI 2 are illustrated on Figure A-1 in Appendix A.

Numerous controls that prevent direct contact to subsurface soil and groundwater (i.e. permits governing excavation, Occupation Safety and Health Administration (OSHA) restrictions, etc.) apply to AOI 2. These controls prevent exposure to site COCs as listed in Table 1. Prior to any work being completed within AOI 2, appropriate work permits, safety and security measures, etc. must be issued by Refinery personnel. Operating areas of AOI 2 are located within a secured area to prevent unauthorized access. Direct contact to deeper site soils (soils greater than two feet beneath the ground surface) is prevented by Sunoco's permit process and the associated on-site procedures and personal protective equipment (PPE) requirements.

Historically the northern area of the AOI 2, which currently consists of office buildings and paved parking areas, was once used as process areas (Batch Stills) and processed material storage areas. The area north of the Short Pier was referred to as the Barrel Wharf. East of the Short Pier is currently an open area that was formerly an electric cogeneration facility. These area uses and other historic and current site features are shown on Figure A-1 provided in Appendix A

The existing monitoring well network in AOI 2 includes: 57 existing accessible shallow/intermediate monitoring wells, one deep (Lower Sand) monitoring well, and two river gauges. 26 shallow/intermediate and three deep monitoring wells were recently installed in AOI 2 as part of the site characterization effort in accordance with the Work Plan.

AOI 2 also has twelve recovery wells - nine vertical (RW-100, RW-101, RW-102, RW-103, RW-105, RW-106, RW-110, RW-111, and RW-112) and three horizontal (HW-1, HW-2, and HW-3), to prevent light non-aqueous phase liquid (LNAPL) from entering the Schuylkill River via migration along/through the Pollock Street Sewer. A sheet pile wall was installed near the outlet of the sewer on the south side of the sewer to minimize tidal influence in the recovery wells adjacent to the river. A well construction summary of AOI 2 monitoring and recovery wells is included in Table 2.

Groundwater gauging of select monitoring wells in AOI 2 occurs on an annual basis during the second quarter of each year. Annual gauging activities and results are reported to the PADEP and EPA in Quarterly Reports prepared by Sunoco. The annual gauging data was used in the Work Plan and this report to evaluate groundwater flow direction and LNAPL occurrence.

1.2 Selection of Compounds of Concern (COCs) and Applicable Standards

The compounds of concern (COCs) for soil and groundwater are listed in Table 1 of this report. The COCs include all current constituents from the PA Corrective Action Process (CAP) Regulation Amendments effective December 1, 2001; provided in Chapter VI, Section E of the PADEP's Closure Requirements for Underground Storage Tank Systems, with the exception of select waste oil constituents. These COCs are the same as those listed in the Work Plan and only differ from those listed in the CCR based on the addition of two compounds: 1,2,4-trimethylbenze (TMB) and 1,3,5-trimethylbenzene (TMB). These two compounds were added to the list of COCs based on PADEP's recent revisions to the Petroleum Short List of Compounds. The following sections describe the applicable standards that were used in evaluating the site characterization data.

Soil

Surface (0-2 feet below ground surface) soil samples were collected at soil boring/well locations that represents a potential complete direct contact exposure pathway to site workers (e.g., unpaved areas). These surface soil results were screened against the PADEP non-residential statewide health soil medium-specific concentrations (MSCs). As summarized in the CCR, where these MSCs are exceeded, Sunoco evaluated application of the site-specific remediation standard using either the pathway elimination or calculated risk-based standard options.

Groundwater

Groundwater sample results were screened against the PADEP non-residential, used-aquifer (TDS<2,500) statewide health groundwater MSCs. As summarized in the CCR, where these statewide health MSCs are exceeded, Sunoco evaluated application of the site-specific remediation standard using either the pathway elimination or calculated risk-based standard options.

1.3 Overview of Investigative Framework and Remedial Approach for AOI 2

The current remediation program for the Refinery is performed under the 2003 CO&A between PADEP and Sunoco. In April 2004, the PADEP and EPA signed an agreement entitled "One Cleanup Program Memorandum of Agreement" (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. On November 22, 2005, Sunoco and its representatives met with officials of the PADEP and EPA to discuss the applicability of the Sunoco Philadelphia Refinery to the One Cleanup Program. During the November 22, 2005 meeting, all parties 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.

As a follow up to the November 22, 2005 meeting, Sunoco submitted a letter dated December 2, 2005 to EPA and PADEP documenting the discussions at the meeting. Sunoco submitted a Notice of Intent to Remediate (NIR) for the Refinery, excluding the Belmont Terminal, to the PADEP on October 12, 2006 and held a public involvement meeting in South Philadelphia on September 19, 2007. On March 5, 2009, Sunoco and its representatives met again with EPA to discuss Sunoco Philadelphia Refinery's remediation progress and path forward under the One Clean-Up Program. As a follow up to the meeting, Sunoco submitted a letter dated March 11, 2009 to EPA and PADEP documenting the discussions at the meeting. The major points of this letter are below:

- EPA will provide a formal letter that acknowledges that there is a One Clean Up Program Agreement with Sunoco and it's currently operating under one US EPA ID Number (PAD049791098) for Point Breeze, Girard Point and Schuylkill River Tank Farm; and
- EPA will add in a Corrective Action Module to the Sunoco-submitted Draft Part B RCRA Permit. The module will reference the One Clean-Up Program agreement and the current remediation work being completed under the existing Consent Order and Agreement between PADEP and Sunoco, Inc.

There are no areas in AOI 2 that are currently subject to RCRA Corrective Action.

2.0 ENVIRONMENTAL SETTING

AOI 2 is bordered by Passyunk Avenue to the North, AOI 1 to the East, Hartranft Street to the South, and the Schuylkill River to the West (Figures 1 and 2). AOI 2 encompasses approximately 120 acres.

2.1 Historic and Current Use

Historic Use

Sunoco obtained available historical aerial photographs with coverage of AOI 2 from the City of Philadelphia Library and reviewed them to identify specific areas for characterization and to assist in determining previous uses of AOI 2. Aerial photos were reviewed for the following years: 1930, 1945, 1959, 1965, 1970, 1975, 1980, 1985, 1990, 1995 and 2005. A brief summary of each photograph was provided in the Work Plan, which was submitted to PADEP and EPA on March 19, 2010.

Historically the northern area of AOI 2, which is currently office buildings and paved parking areas, were once process areas (Batch Stills) and processed material storage areas. The area north of the Short Pier was referred to as the Barrel Wharf. East of the Short Pier is a currently open area that was formerly an electric cogeneration facility. These historic features are shown on the Figure A-1 in Appendix A.

Currently, AOI 2 has the only active dock (Short Pier) for loading/offloading refined products in the Point Breeze Facility. The Short Pier is located along the western boundary of AOI 2. The bulkhead located along the Short Pier area is constructed of steel and wood which extends to the river bottom, concrete facing and wood decking that extends a few feet above the Schuylkill Rivers low tide level.

AOI 2 is primarily comprised of crude units, FCC, reforming, low sulfur gasoline and alkylation units, sulfur recovery, maintenance facilities, wastewater treatment plant, parking areas, office buildings, tanks, and laboratories. There are no RCRA SWMUs in AOI 2.

The Pollock Street Sewer, a stormwater sewer, traverses the central portion of AOI 2 from east to west (Figure 2). The Pollock Street Sewer enters the Refinery along 26th Street (eastern boundary for AOI 1) and extends to AOI 2 western boundary where it discharges at the Schuylkill River. AOI 2 encompasses approximately 120 acres and is covered mainly with impervious surfaces except for the Short Pier area and at the eastern portion adjacent to the tank farms.

2.2 Geology

To further characterize geology beneath AOI 2, Sunoco advanced 26 shallow/intermediate (fill/alluvium, and Trenton Gravel) monitoring wells ranging in depths between 18 to 40 feet below ground surface (ft bgs), and three deep (Lower Sand) monitoring wells ranging in depths between 82 to 100 ft bgs. Soils were continually logged at each well location and copies of the boring/well construction logs are included as Appendix B.

To illustrate the geology beneath AOI 2, two geologic cross sections (Figures 5a and 5b) trending north-south and east-west were prepared using historic and recently completed soil boring and well construction logs. The cross section locations are shown in plan view in Figure 4.

The following paragraphs describe the primary geologic units beneath AOI 2 beginning with the deepest units to the shallowest units:

Wissahickon Formation – Bedrock beneath the Refinery and AOI 2 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. Based on historic and recent deep monitoring well and soil borings completed in AOI 2, the Wissahickon Schist is located at depths ranging between 82 and 104 ft bgs. The bedrock depth is illustrated in Figures 5a and 5b.

Lower/Middle Sand Unit of the PRM – Throughout the majority of the Refinery, the Wissahickon Formation is overlain by the Lower/Middle Sand, which is the lowest member of the Potomac-Raritan Magothy (PRM) Aquifer System.

One deep (Lower Sand) groundwater monitoring well (S-72D) existed in AOI 2 prior to the recent characterization work. Three new deep groundwater monitoring wells (S-294D, S-302D and S-305D) were installed in AOI 2 as part of the recent site characterization activities. The purpose of the additional deep (Lower Sand) monitoring wells was to obtain geologic information to refine the site conceptual model (SCM) and obtain groundwater quality data for the Lower Sand aquifer. Based on interpretation of the geology as shown in Figures 5a and 5b, all deep wells in AOI 2 are screened in the Lower Sand where the Lower/Middle Clay is present. The Middle Clay Unit, which is continuous in AOI 2, creates a divide between the Middle and Lower Sand Units throughout AOI 2.

The Lower/Middle Sand beneath AOI 2 typically consists of brown, orange and/or red, medium to coarse sand and fine to coarse gravel, poorly sorted with coarse rounded quartzite gravels that grades upward into medium-to-fine sands and contains layers of silts and clay. The Lower and Middle Sand range in thickness between 15 to 25 feet. The extent of the Lower Sand beneath AOI 2 is generally consistent with the extent illustrated by USGS (USGS, 1961).

Middle Clay/Lower – The Middle/Lower Clay is characterized by very low permeability reddish-brown, brown or gray clays, sandy clays, with trace amounts of organic matter. The Lower/Middle Clay overlies the Lower/Middle Sand in AOI 2 as shown in Figures 5a and 5b. In AOI 2, the Lower/Middle Clay is continuous and is divided by the Middle Sand Unit.

As shown in Figures 5a and 5b, the Lower Clay Unit ranges in thickness between 10 feet along the most western extent of AOI 2 (Schuylkill River) to approximately 25 feet in the eastern portion of AOI 2. The extent of the clay beneath AOI 2 as shown in Figures 5a and 5b is generally consistent with the extent illustrated by USGS (USGS, 1961). Plate 20 of the USGS publication includes a geologic cross section of the coastal plain deposits near AOI 2 and is included in Appendix B of this report.

Trenton Gravel – Throughout most of the Refinery, the Trenton Gravel typically overlies the Middle/Lower Clay and Lower Sand with thicknesses up to 80 feet and a typical thickness of 40 feet. The Trenton Gravel is of Pleistocene Age (Ice Age; less than 2 million years) and is a very heterogeneous unit comprised of a predominant brown to gray sand, gravel and minor amounts of clay (Owens and Minard, 1979). As shown in Figures 5a and 5b, the Trenton Gravel is differentiated from the fill/alluvium in AOI 2. A total of 26 shallow/intermediate monitoring wells were advanced into the fill/alluvium and Trenton Gravel as part of the recent site characterization activities. Generally the Trenton Gravel ranges in thickness between 5 to 20 feet across AOI 2.

Recent Fill/Alluvium - Fill material in AOI 2 generally consists of various sands and gravels, cinder ash, brick, wood, and glass. The alluvium deposits in AOI 2 generally consist of dark brown silts and sands, with trace amounts of clay. Fill/alluvium deposits exist throughout AOI 2 and range in thickness between 10 and 20 feet.

In addition to the above descriptions, the following general observations can be made concerning the geology in AOI 2:

- The depth to bedrock beneath AOI 2 is approximately 82 ft bgs;
- The Middle/Lower Sand overlies bedrock throughout AOI 2;
- The Middle/Lower Clay is present and is continuous throughout AOI 2,
- Trenton Gravel is differentiated from the fill/alluvium throughout AOI 2 and ranges in thickness between 5 to 20 feet; and
- The fill/alluvium materials are present throughout AOI 2 and range in thickness between 10 to 20 feet.

2.3 Hydrogeology

2.3.1 Groundwater Occurrence and Flow

Groundwater gauging data collected by Stantec Consulting, Inc. (Stantec) in July 2010 was used to generate groundwater flow contour maps for AOI 2. The groundwater elevation data from this gauging event is provided in Table 3. Well construction details for these monitoring wells are provided in Table 2 and

boring/well construction logs for the newly-installed wells are provided in Appendix B of this report. Historic boring/well logs for wells installed prior to the site characterization activities were provided in Appendix D of the CCR.

Groundwater flow within AOI 2 is described below:

- Two sets of groundwater contours were created using groundwater elevations from both the shallow/intermediate and deep (Lower Sand) wells (Figures 6 and 7);
- The Lower/Middle Clay is present throughout AOI 2 and a shallow/intermediate water table aquifer exists;
- Groundwater flow in the shallow/intermediate zone in the central portion of AOI 2 is generally controlled by recovery wells along the Pollock Street Sewer. The hydraulic gradient in the fill/alluvium and Trenton Gravel ranged from 0.001 to 0.097 with an average of 0.018;
- Groundwater flow in the shallow/intermediate zone in the northern portion of AOI 2 is towards the southwest and in the southern portion of AOI 2 is towards the north-northwest;
- Two shallow/intermediate wells (S-110 and SD-1) located in the vicinity of the Short Pier area show evidence of a perched water table. Because of these conditions, separate groundwater contours were created for this area to better represent the perched groundwater conditions;
- Beneath the clay in AOI 2, a confined deep (Lower Sand) aquifer exists in the Lower Sand;
- Groundwater flow in the deep (Lower Sand) is towards the southsouthwest with an average hydraulic gradient of 0.0013, generally in the direction of Schuylkill River; and
- Groundwater elevations in the Lower Sand are lower than the shallow/intermediate zone, indicating a downward gradient.

2.4 Surface Water

No surface water features are located in AOI 2. The nearest surface water body to AOI 2 is the Schuylkill River which represents the western boundary. A steel and wooden bulkhead extending to the bottom of the Schuylkill River is present along portions of the AOI 2 western boundary shown on Figure 3.

3.0 SITE CHARACTERIZATION ACTIVITIES

The following sections summarize the site characterization activities that were completed in AOI 2 in support of this SCR/RIR. Site characterization activities were performed between April and July 2010 by Aquaterra Technologies, Inc. (Aquaterra) and Langan in coordination with Sunoco. These activities were executed in accordance with the Work Plan.

3.1 Shallow Soil Borings and Sampling

A total of 20 shallow (0-2 ft bgs) soil samples were collected for analysis of site COCs from unpaved areas within AOI 2. The locations of all soil and monitoring well borings are shown on Figures 3 and 8. All soil borings were advanced utilizing split-spoon sampling techniques. Soil borings were advanced to a maximum depth of two feet below grade at each unpaved location in accordance with the Work Plan. Soil samples were collected at each soil boring location with a TerraCore sampler. Boring logs depicting lithology at each soil boring location are provided as Appendix B.

Soil samples were submitted to Lancaster Laboratories, Inc. (LLI) of Lancaster, Pennsylvania for analysis of site COCs. A summary of the soil analytical results screened against the PADEP non-residential soil MSCs is provided as Table 4 and the results are further discussed in Section 4.1 below. A summary of samples with concentrations above the PADEP non-residential soil MSCs are illustrated on Figure 8. The analytical reports are provided on a CD in Appendix D.

3.2 Installation of Groundwater Monitoring Wells

Well installation activities were performed between April and July 2010 by Parrat Wolff, Inc. (PWI) of East Syracuse, New York, Total Quality Drilling (TQD) of Mullica Hill, NJ and East Coast Drilling (ECDI) of Moorestown, NJ under the direct supervision of Aquaterra and Langan. The locations of all monitoring wells installed are shown on Figure 3. Monitoring wells were installed to monitor the shallow/intermediate water table aquifer above the clay and the deep aquifer beneath the clay. Monitoring wells were installed and constructed in accordance with the Work Plan. The well installation activities are discussed in the following sections.

3.2.1 Fill/Alluvium and Trenton Gravel Groundwater Monitoring Wells

Aquaterra and Langan provided direction and oversight to PWI and TQD to install 26 shallow/intermediate groundwater monitoring wells in AOI 2. One shallow/intermediate groundwater monitoring well (S-312) was installed along the western boundary of AOI 1. Due to access constraints, 11 proposed monitoring wells could not be installed in AOI 2 as originally proposed in the Work Plan. These wells will be installed as part of the Pollock Street Sewer investigations and information will be included in the Clean Up Plan for AOI 2.

Monitoring wells were installed and constructed in accordance with the Work Plan. Prior to the installation of shallow/intermediate monitoring wells, each well location was cleared for subsurface utilities to a depth of 8 to 10 ft bgs with a hydro-excavator. Shallow/intermediate wells were advanced by PWI and TQD utilizing hollow stem augers and split spoon samplers to record lithology. Split spoon samples were collected at various intervals throughout the borings typically starting at 8 to 10 ft bgs. Where shallow soil samples were collected, split spoon samples (from 0-2 ft bgs) were advanced alongside the cleared drill-hole location. Shallow/intermediate monitoring wells were constructed to maximum depths between 15 and 40 ft bgs with screen intervals of 10 to 15 feet. Monitoring wells were constructed with either flush mount manhole cover or with a stickup protective steel casing. Well construction details are provided in Table 2. Boring logs depicting monitoring well construction details and lithology are provided as Appendix B.

Following well construction, the monitoring wells were developed in accordance with the Work Plan.

3.2.2 Lower Sand Groundwater Monitoring Wells

One Lower Sand groundwater monitoring well (S-72D) had existed in AOI 2 prior to the recent characterization activities. S-72D was installed to a depth of approximately 100 ft bgs and the screen was set in the lower portion of the Lower Sand.

Aquaterra and Langan provided direction and oversight to ECDI to install three Lower Sand monitoring wells (S-294D, S-302D and S-305D) in AOI 3. The wells were installed with screened intervals set below the clay and into the Lower Sand. The purpose of the additional deep wells was to obtain lithologic information beneath AOI 2 and to characterize groundwater quality of the Lower Sand.

Prior to installation of the deep monitoring wells, each well location was cleared for subsurface utilities to a depth of 8 to 10 ft bgs with a hydro-excavator. Deep wells were advanced by ECDI utilizing hollow stem augers, mud rotary, and split spoon samplers to record lithology. The three deep wells were installed to depths ranging between 82 and 99 ft bgs, with well screened intervals of 15 feet. Well construction details are provided in Table 2 and deep soil boring/well construction logs are provided in Appendix B. Geologic information obtained from the deep soil borings completed in AOI 2 was used to prepare geologic cross sections provided as Figures 5a and 5b.

3.3 Groundwater Monitoring

On July 13 and 14, Stantec performed monitoring well gauging activities to collect liquid levels from all accessible wells in AOI 2. A total of 85 accessible monitoring wells, two river gauges, and eleven recovery wells were gauged for depth-to-water, and if applicable, depth-to-product in accordance with the Work Plan. All well gauging readings are summarized in Table 3.

The groundwater monitoring data from Table 3 was used to generate groundwater contours provided as Figures 6 and 7.

3.4 Groundwater Sampling

In July 2010, Aquaterra performed a complete round of groundwater sampling from 54 accessible monitoring wells in AOI 2. 31 wells were not sampled either due to either presence of LNAPL, pumps in the wells, absence of water, and/or inaccessibility. All groundwater sampling activities were completed in accordance with the Work Plan. The monitoring well sampling summary data sheets are provided as Appendix E.

Following well purging activities, groundwater samples were collected by lowering a disposable bailer slowly into the monitoring well to minimize excess agitation. The bailer was filled with water from the top of the water table and retrieved. Samples were then collected in laboratory-prepared bottleware and immediately placed on ice. Samples were submitted to LLI for analysis of site COCs. Once the sample was collected, the bailer, bailer cord, and nitrile gloves used to obtain the sample were discarded. Sample date, time, number, and site name were recorded on the chain-of-custody and in field books. For groundwater samples analyzed for lead, LLI filtered the samples to analyze for dissolved metals.

The groundwater analytical results for shallow/intermediate wells are presented in Table 5. The groundwater analytical results for the deep wells are presented in Table 6. The laboratory analytical reports are included on a CD in Appendix D.

3.5 LNAPL Sampling

During the July 2010 gauging event for AOI 2, 27 monitoring wells in AOI 2 had measurable LNAPL, ranging in thickness between 0.01 to 3.2 feet. LNAPL samples from select monitoring wells (S-64, S-109, S-110, S-130, S-138, S-142 and S-158) were previously collected and characterized as part of the CCR. S-142 was re-sampled as part of the Work Plan activities. Three new monitoring wells (S-297, S-313, and S-315) installed as part of the recent site characterization activities contained measurable LNAPL. Stantec collected a LNAPL sample from these new wells using a direct sampling method in accordance with the Work Plan. LNAPL samples were packaged in certified hazardous material shipping boxes and shipped to Torkelson Laboratories (Torkelson) of Tulsa, Oklahoma for LNAPL characterization. LNAPL characterization data included product types, density, proportions of product, degree of weathering, and similarities to other LNAPL samples collected at the Refinery.

Based on the LNAPL characterization performed by Torkelson, LNAPL samples collected in the above-mentioned monitoring wells were characterized as follows:

- S-64 50% lube oil and 50% middle distillate;
- S-109 50% kerosene, 30% residual oil, and 20% naphtha;
- S-110 50% naphtha, 30% gasoline, 20% kerosene;

- S-130 100% condensate;
- S-138 90% light lube oil, 10% gasoline;
- S-142 100% residual oil;
- S-158 90% residual oil, 10% naphtha, traces of gasoline;
- S-142 90% heavier material, 10% gasoline;
- S-297 75% middle distillate, 15% aviation gasoline, 10% heavier material;
- S-313 60% middle distillate, 20% unknown light material, 20% heavier material; and
- S-315 50% middle distillate, 30% unknown light material, and 20% heavier material.

Appendix H summarizes the LNAPL characterization results from the CCR, the recent site characterization activities, and includes Torkelson laboratory data packages.

3.6 Surveying Activities

Following completion of well installation and soil boring activities, the newly-installed monitoring wells and soil boring locations were surveyed by Langan 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 performed by a Pennsylvania-licensed surveyor and tied to the North American Vertical Datum (NAVD) 88 datum. The new survey data for the monitoring wells is presented in Table 3. This new survey data was used to update the Geographic Information System (GIS) and site wide database for the Refinery.

4.0 SITE CHARACTERIZATION ANALYTICAL RESULTS

The following sections discuss the analytical results of the site characterization activities performed in AOI 2.

4.1 Soil Analytical Results

The analytical results of the soil samples collected in AOI 2 are provided in Table 4. All soil samples were collected between the ground surface and two ft bgs and no saturated soils were observed at these depths. The soil sample results were screened

against the PADEP non-residential soil MSCs. Soil sample locations with results above their respective soil MSCs are shown in Figure 8.

A total of 20 shallow (0-2 ft bgs) soil samples were collected for analysis of site COCs from areas within AOI 2. COCs detected in soil at concentrations above their respective non-residential soil MSCs included the following:

- S-298_1-2 benzene (1,200 ug/kg);
- S-313_0-2 benzene (620 ug/kg); and
- S-318_1-2 lead (860 mg/kg).

No other site COCs were detected above their respective non-residential soil MSCs in all other soil samples collected in AOI 2.

4.3 Groundwater Results

The results of the groundwater samples collected from monitoring wells in AOI 2 are provided in Tables 5 and 6. The results were screened against the PADEP non-residential used aquifer (TDS<2,500) groundwater MSCs. Locations with concentrations above the groundwater MSCs are illustrated in Figure 9. A summary of the COC concentrations that exceeded their respective PADEP non-residential groundwater MSCs are presented below:

Shallow/Intermediate Wells

COCs detected in shallow/intermediate wells at concentrations above their respective PADEP non-residential groundwater MSCs included the following:

- S-294 1,2,4-TMB (410 ug/L), 1,3,5-TMB (130 ug/L), benzene (130 ug/L), chrysene (140 ug/L), naphthalene (8,500 ug/L) and pyrene (380 ug/L);
- S-295 1,2,4-TMB (360 ug/L), 1,3,5-TMB (130 ug/L), benzene (1,900 ug/L), naphthalene (740 ug/L), and lead (1.04 mg/L);
- S-72 chrysene (14 ug/L);
- S-298 1,2,4-TMB (620 ug/L), 1,3,5-TMB (210 ug/L), benzene (90 ug/L), and naphthalene (190 ug/L);
- S-71 methyl tertiary butyl ether (MTBE) (440 ug/L);

- S-108 chrysene (54 ug/L);
- SD-1 benzene (370 ug/L) and MTBE (22 ug/L);
- S-154 benzene (12 ug/L) and MTBE 31 (ug/L);
- S-153 benzene (7 ug/L) and chrysene (8 ug/L);
- S-300 benzene (14 ug/L) and MTBE (81 ug/L);
- S-301 benzene (9 ug/L);
- S-48 chrysene (75 ug/L), phenanthrene (1,900 ug/L), and pyrene (340 ug/L);
- S-165 benzene (88 ug/L) and MTBE (71 ug/L);
- S-303 benzene (6 ug/L);
- S-314 phenanthrene (1,900 ug/L);
- S-251 1,2,4-TMB (68 ug/L), 1,3,5-TMB (48 ug/L), and benzene (370 ug/L);
- S-252 1,2,4-TMB (140 ug/L), 1,3,5-TMB (42 ug/L), and benzene (1,300 ug/L);
 and
- S-306 1,2,4-TMB (40 ug/L), 1,3,5-TMB (52 ug/L), benzene (740 ug/L), and naphthalene (670 ug/L).

Deep (Lower Sand) Wells

Only one deep well (S-294D) exhibited a naphthalene concentration of 140 ug/L, exceeding its groundwater MSC. All other samples results were below the MSCs.

4.4 LNAPL Characterization Results

During the July 2010 gauging event, 27 wells in AOI 2 had measurable LNAPL, ranging between 0.01 to 3.2 feet. Previous LNAPL characterization data for wells S-64, S-109, S-110, S-130, S-138, S-142, and S-158 was obtained from the CCR and monitoring wells S-297, S-313, and S-315 was obtained as part of the SCR/RIR activities. Appendix H summarizes the LNAPL characterization results from the CCR, the recent site characterization activities and includes Torkelson laboratory data packages. Based on the LNAPL characterization performed by Torkelson, LNAPL mixtures are present in AOI 2 as described in Section 3.5.

LNAPL modeling, using the API model was completed as part of the 2004 CCR to evaluate specific volume and LNAPL mobility for product in some of these wells. Based on the LNAPL type, absence of LNAPL in the surrounding wells, groundwater flow direction, location of the bulk head/sheet pile wall, the Pollock Street Sewer Total Fluids

Recovery System, and the LNAPL modeling performed as part of the CCR, indicates that LNAPL in these wells is stable and or controlled. LNAPL observed along the Pollock Street Sewer will be further evaluated as part of the Clean Up Plan for AOI 2. No additional LNAPL modeling was completed as part of this SCR/RIR.

5.0 REMEDIAL SYSTEM UPDATE

5.1 Pollock Street Sewer

The Pollock Street Sewer Total Fluids Recovery System is the only active remedial system in AOI 2. The Pollock Street Sewer Total Fluids Recovery System consists of total fluids (groundwater and LNAPL) recovery from nine vertical recovery wells (RW-100, RW-101, RW-102, RW-103, RW-105, RW-106, RW-110, RW-111, and RW-112) and three horizontal recovery wells (HW-1, HW-2, and HW-3) along Pollock Street Sewer. The Total Fluids Recovery System was installed to prevent LNAPL from entering the Schuylkill River via the Pollock Street Sewer and surrounding backfill around the sewer. A sheet pile wall was installed in the area of the Pollock Street Sewer outfall system in order to minimize tidal influence in RW-104 through RW-109. A tide gate system was installed on the Pollock Street Sewer outfall to minimize tidal flux within the sewer.

The original horizontal well (HW-1) was installed in July 2004 along the north side of the Pollock Street Sewer from RW-103 to approximately 100 feet west of RW-101. In 2006, two additional horizontal wells (HW-2 and HW-3) were installed from RW-103 to the intersection of Pollock Street and 16th Street. Groundwater and LNAPL from the system discharge directly into a Benzene Waste Operations *National Emission Standards for Hazardous Air Pollutants*-controlled sewer and are processed through the Point Breeze Processing Area Wastewater Treatment Plant.

The Pollock Street Sewer outfall is visually monitored two times per day and field observations are recorded. Sunoco maintains spill control equipment (absorbent booms and sweeps) around the tide gate area to minimize and prevent release of fugitive LNAPL into the Schuylkill River. Outfall cleaning, including the changing of sorbents and removal of any fugitive LNAPL from the outfall, is performed twice weekly at minimum.

Sunoco has established a focus group of consultants and contractors to evaluate the Pollock Street Sewer and the performance of the existing total fluids extraction system with respect to the occurrence and migration of LNAPL. Investigation activities completed by this group included the following:

- Sewer video inspection;
- Survey of wells and other site features along the sewer;
- Groundwater and LNAPL data collection and trend evaluation (historic and recent data) along the sewer;
- Recovery well operation data collection;
- Gauging of water levels and LNAPL in wells along the sewer; and
- Creation of a sewer area cross section.

The sewer area cross section is included as Figure 11 in this report. Based on the results of the focused sewer investigation work and recent site characterization activities in AOI 2, Sunoco intends to further investigate the occurrence of LNAPL in the vicinity of the sewer and the performance of the existing pumping systems. This information will be provided in the Clean Up Plan for AOI 2. Specific areas to be further investigated include:

- 869 Unit Area;
- C-Header Area (NW 869 Unit);
- SW 868 Unit OBL Area;
- 14 Pumphouse Area;
- The Hill (9th and Pollock) Area;
- Former Tank 1515/1508 Area; and
- Short Pier Area.

5.2 Short Pier Total Phase Extraction System

The Short Pier total phase extraction system is an inactive remediation system located along the western boundary of AOI 2. This multi-point total phase extraction system has been out of operation since 2005 when the system was removed based on the

absence of LNAPL. Since 2005, there has been no evidence of LNAPL migration to the Schuylkill River at the Short Pier area.

6.0 FATE AND TRANSPORT ANALYSIS

The following sections describe fate and transport modeling activities performed as part of AOI 2 site characterization.

6.1 Soil

No fate and transport modeling was completed for the soil analytical results since the only potential exposure pathway to shallow soil is by direct contact. The soil-to-groundwater pathway is evaluated through evaluation of groundwater data. Potential exposure pathways for AOI 2 are discussed in detail in Section 8.0.

6.2 Groundwater

Fate and transport modeling was completed for wells that exhibited concentrations of COCs above their respective PADEP non-residential groundwater MSCs in AOI 2. This modeling approach is considered a worst case scenario. Results of the July 2010 groundwater sampling indicated that one metal (lead) and eight organic compounds including benzene, 1,2,4-trimethlybenzene (1,2,4-TMB), 1,3,5-trimethlybenzene (1,3,5-TMB), MTBE, chrysene, naphthalene, phenanthrene, and pyrene were detected above their respective PADEP non-residential groundwater MSCs in wells in AOI 2.

Due to the proximity of the AOI 2 site boundary to many of these sampled locations, the potential for off-site migration from AOI 2 was evaluated by performing fate and transport modeling using the Quick Domenico (QD) model. The fate and transport modeling was completed to evaluate whether the groundwater conditions above MSCs would reach either the boundary of the Refinery or the Schuylkill River. The QD Version 2 spreadsheet model and either PADEP default or site-specific data were used to perform the fate and transport calculations.

A more detailed description of QD model input parameters and results are also presented in Appendix F. Input and result summary spreadsheets for each monitoring

well modeled are included in Appendix F The results of the QD screening are located in Table F.24. A comparison between the model-predicted downgradient transport distance and the distance to the nearest property boundary and/or surface water receptor (Schuylkill River) is also included in these tables.

The QD modeling results indicated the following:

- The groundwater with concentrations above their respective groundwater MSCs in eleven shallow/intermediate wells (S-153, S-154, S-251, S-252, S-300, S-301, S-303, S-306, S-314, S-48 and S-72) and in one deep well (S-294D) is not predicted to migrate beyond the AOI 2 boundary;
- One monitoring well (S-165) contains concentrations of benzene and one monitoring wells (S-294) contain concentrations of 1,2,4-TMB, 1,3,5-TMB and benzene that have the potential to reach the AOI 2 boundary and migrate into AOI 1.
 Concentrations of these compounds above their respective groundwater MSCs are not predicted to reach the eastern boundary of AOI 1 based on the QD modeling;
- Groundwater in wells S-314, S-251, S-252, S-306, and S-303 is within the groundwater capture zone of the Pollock Street Sewer Total Fluids Recovery System;
- Chrysene in S-108, 1,2,4-TMB, 1,3,5-TMB and benzene in S-298, MTBE in S-71 and benzene in SD-1 were predicted not to attenuate to a concentration below their groundwater MSCs by the time they reached the AOI 2 western boundary (Schuylkill River). Since there are no 25 PA Code, Chapter 93 Aquatic Life Criteria for chrysene, 1,2,4-TMB, 1,3,5-TMB, and MTBE, surrogate compounds were used. For VOCs, benzene was selected as a surrogate because it had the lowest fish and aquatic criteria from all VOCs detected at the site. For SVOCs, phenanthrene was selected as a surrogate because it had the lowest fish and aquatic criteria for SVOCs detected at the site;
- QD modeled benzene concentration in monitoring well S-298 (12 ug/L) are below both the benzene acute and chronic fish criterion of 640 ug/L, and 130 ug/L, respectively;
- QD modeled benzene concentration in SD-1 (251 ug/L) is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for SD-1 using PENTOXSD modeling;

- QD modeled chrysene concentrations in S-108 (4.17 ug/L) is below the phenanthrene (the surrogate constituent used at the site for the SVOCs) acute fish criterion of 5 ug/L, but above the chronic fish criterion of 1 ug/L. Therefore, a surface water screening concentration (waste load allocation) for chrysene was calculated for S-108 using PENTOXSD modeling;
- QD modeled MTBE concentrations in S-71 (170 ug/L) is below the benzene (the surrogate constituent used at the site for the VOCs) acute fish criterion of 640 ug/L, but above the chronic fish criterion of 1 ug/L. Therefore, a surface water screening concentration (waste load allocation) for MTBE was calculated for S-108 using PENTOXSD modeling;
- QD modeled benzene concentration in S-295 (40 ug/L) is below both the benzene acute fish criterion of 640 ug/L and chronic fish criterion of 130 ug/L; and
- Lead concentrations in monitoring well S-295 (338 ug/L) is above both the acute fish criterion of 65 ug/L and the chronic fish criterion of 2.5 ug/L. Therefore, a surface water screening concentration (waste load allocation) for lead was calculated for S-295 using PENTOXSD modeling.

6.3 Surface Water

To evaluate whether the potential exists for dissolved phase concentrations in groundwater would impact the Schuylkill River, surface water screening concentrations (waste load allocations) for benzene, MTBE, chrysene and lead were calculated for SD-1, S-71, S-108, and S-295, respectively, using the PENTOXSD modeling (Appendix F).

Aquifer parameters were entered into the groundwater flow equation to calculate the volumetric aquifer discharge to the Schuylkill River. The hydraulic conductivity, hydraulic gradient and cross sectional area was taken directly from the SD-1, S-71, S-108 and S-295 QD simulations.

The PENTOXSD derived groundwater to surface water screening standard (wasteload allocation) for benzene is 12,412 ug/L, MTBE is 122,599 ug/L, chrysene is 114 ug/L and for lead is 18,726 ug/L. The predicted concentrations for these COCs (as described in Section 6.2 above) are all below the calculated surface water screening concentrations and therefore do not pose a significant risk to surface water quality in the Schuylkill

River. PENTOXSD input and output files are presented in Tables F.30 through F.41 in Appendix F.

6.4 LNAPL

Based on the LNAPL type and mobility, degree of severe LNAPL weathering, absence of LNAPL in the surrounding wells, groundwater flow/gradients, the Pollock Street Sewer Total Fluids Recovery System, bulk head/sheet pile wall restricting shallow/intermediate groundwater flow to Schuylkill River, and the LNAPL modeling performed as part of the CCR, LNAPL in wells in AOI 2 is considered to be stable and/or controlled. LNAPL recovery in the area of the Pollock Street Sewer will be further evaluated as part of the Clean Up Plan activities for AOI 2.

6.5 Vapor Intrusion to Indoor Air

The occupied buildings (potential indoor air receptors) located in AOI 2 are illustrated on Figures 8, 9, 10, and A-1 in Appendix A. All of the buildings are operated by Sunoco and regulated by OSHA.

To evaluate the vapor intrusion into indoor air pathway for all occupied buildings in AOI 2, soil and groundwater data collected during the site characterization activities were screened against the non-residential EPA/PADEP default OSHA residential permissible exposure limits (PELs) volatilization into indoor air screening values, published in the PADEP's final guidance on vapor intrusion into buildings from groundwater and soil under the Act 2 Statewide Health Standard (July 2003). The OSHA PEL soil screening values were selected as appropriate because the site and its industrial operations are regulated by OSHA.

With the exception one soil sample (S-298_1-2), results of the screening evaluation indicated that no soil or groundwater analytical results in AOI 2 exceeded the non-residential EPA/PADEP default screening values or the OSHA PEL screening values. The nearest occupied building (Bio/BFW Unit) to the soil sample location with the soil vapor screening exceedance is approximately 20 feet away. Based on the close proximity of S-298_1-2 to the Bio/BFW Unit building, and since there are no monitoring points between S-298_1-2 and this building, and the building is not under positive

pressure, further evaluation of the potential vapor intrusion into indoor air pathway for this building will be completed by Sunoco by the collection of soil gas samples.

LNAPL present in the monitoring and recovery wells in AOI 2 is located more than 100 feet away from the potential indoor receptors and there are no known preferential flow pathways connecting the LNAPL areas to the buildings. Therefore, no further evaluation of the potential vapor intrusion into indoor air pathway from LNAPL is required.

7.0 SITE CONCEPTUAL MODEL

A preliminary SCM for the Refinery, including AOI 2, was presented in the CCR. Data collected from the site characterization activities performed in AOI 2 were used to refine the SCM for this area. The revised SCM for AOI 2 is described below:

7.1 Description and Site Use

The following summarizes the site description and use in AOI 2:

- AOI 2, also known as the Point Breeze Processing Area, is bordered by Passyunk Avenue to the north, AOI 1 to the east, Hartranft Street to the south, and the Schuylkill River to the west (Figure 1 and Figure 2);
- AOI 2 encompasses approximately 120 acres, and is covered mainly with impervious surfaces except for the Short Pier area and at the eastern portion adjacent to the tank farms;
- Currently, AOI 2 has the only active dock (Short Pier) for loading/offloading of refined products in the Point Breeze facility;
- AOI 2 is primarily comprised of crude units, hydrodesulfurization units, cracking and alkylation units, sulfur recovery, maintenance facilities, wastewater treatment plant, parking areas, office buildings, and laboratories;
- Access to AOI 2 is restricted by the Schuylkill River, fencing, and by security measures; and
- Prior to any work being completed within AOI 2, appropriate work permits, safety and security measures (i.e. permits for excavation, OSHA restrictions,

etc.) must be issued by Refinery personnel. These controls prevent exposure to AOI 2 COCs.

7.2 Geology and Hydrogeology

The following summarizes the geology and hydrogeology in AOI 2, from the bedrock to ground surface:

Geology

- The depth to bedrock beneath AOI 2 is approximately 82 ft bgs;
- The Middle/Lower Sand overlies bedrock throughout AOI 2;
- The Middle/Lower Clay is present and is continuous throughout AOI 2,
- Trenton Gravel is differentiated from the fill/alluvium throughout AOI 2, and ranges in thickness between 5 to 20 feet.

Hydrogeology

- The Lower/Middle Clay is present throughout AOI 2, and a shallow/intermediate water table aguifer exists above the clay;
- Groundwater flow in the shallow/intermediate zone in the central portion of AOI 2 is generally captured by vertical and horizontal recovery wells along the Pollock Street Sewer;
- Groundwater flow in the shallow/intermediate zone in the northern portion of AOI 2 is towards the southwest and in the southern portion of AOI 2 is towards the north-northwest;
- Two shallow/intermediate wells (S-110 and SD-1) located in the vicinity of the Short Pier area show evidence of a perched water table;
- Beneath the clay in AOI 2, a confined deep (Lower Sand) aquifer exists in the Lower Sand;
- Groundwater flow in the Lower Sand towards the south-southwest, generally in the direction of Schuylkill River; and
- Groundwater elevations in the Lower Sand are lower than the shallow/intermediate zone, indicating a downward flow gradient exists.

7.3 Compounds of Concern (COCs)

The following summarizes relevant information concerning COCs in AOI 2:

- Two COCs were detected in shallow soil at concentrations above their respective non-residential soil MSCs: benzene (S-298_1-2 and S-313_0-2), and lead (S-318);
- One metal (lead) and eight organic compounds including benzene, 1,2,4-TMB, 1,3,5-TMB, MTBE, chrysene, naphthalene, phenanthrene, and pyrene were detected above their respective PADEP non-residential groundwater MSCs; and
- One COC (naphthalene in S-294D) was detected in groundwater in the Lower Sand aquifer at a concentration above the respective PADEP non-residential groundwater MSC.

The exposure assessment completed for AOI 2 COCs is discussed in Section 8.0.

7.4 LNAPL Distribution and LNAPL Mobility

The following summarizes relevant information concerning LNAPL distribution in AOI 2:

- Measurable LNAPL was detected in 27 wells;
- Based on LNAPL modeling performed for the CCR, the LNAPL type, groundwater flow/gradients, the absence of LNAPL in the surrounding wells, the Pollock Street Sewer Total Fluids Recovery System, and the occurrence of LNAPL in these wells over time, it appears the LNAPL plume is delineated and controlled, and the potential for migrating LNAPL to reach a site boundary is minimal; and
- LNAPL recovery along the Pollock Street Sewer will be further evaluated as part of the Clean Up Plan for AOI 2.

7.5 Fate and Transport of COCs

No fate and transport modeling was completed for the soil analytical results exceeding the soil MSCs because the soil-to-groundwater pathway was established through the evaluation of groundwater data.

Fate and transport modeling using the QD model was completed for each of the wells that exhibited concentrations of COCs above their respective PADEP non-residential groundwater MSCs to evaluate the potential for off-site migration of dissolved phase COCs in groundwater.

The modeling results indicated the following:

- The groundwater concentrations above their respective groundwater MSCs in eleven shallow/intermediate wells (S-153, S-154, S-251, S-252, S-300, S-301, S-303, S-306, S-314, S-48 and S-72) and in one deep well (S-294D) are not predicted to migrate beyond the AOI 2 boundary;
- Monitoring well S-165 contained concentrations of benzene and monitoring well S-294 contained concentrations of 1,2,4-TMB, 1,3,5-TMB and benzene that have the potential to reach the AOI 2 boundary and migrate into AOI 1, however these compounds above the groundwater MSCs are predicted not to reach the Refinery boundary;
- Groundwater in wells S-314, S-251, S-252, S-306, and S-303 are within the groundwater capture zone of the Pollock Street Sewer Total Fluids Recovery System;
- Chrysene in S-108, 1,2,4-TMB, 1,3,5-TMB and benzene in S-298, MTBE in S-71 and benzene in SD-1 were predicted not to attenuate to a concentration below their groundwater MSCs by the time they reached the AOI 2 western boundary (Schuylkill River). Since 25 PA Code, Chapter 93 Aquatic Life Criteria for chrysene, 1,2,4-TMB, 1,3,5-TMB and MTBE were not developed, surrogate compounds criteria (the constituents with the lowest criteria within the VOC/SVOC group) were used;
- QD modeled benzene concentration in S-298 (12 ug/L) is below both the benzene acute and chronic fish criterion of 640 ug/L, and 130 ug/L, respectively;
- QD modeled benzene concentration in SD-1 (251 ug/L) is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for SD-1 using PENTOXSD modeling;
- QD modeled chrysene concentration in S-108 (4.17 ug/L) is below the phenanthrene (the surrogate constituent used at the site for the SVOCs) acute fish criterion of 5 ug/L, but above the chronic fish criterion of 1 ug/L. Therefore, a surface water screening concentration (waste load allocation) for chrysene was calculated using PENTOXSD modeling;

- QD modeled MTBE concentration in S-71 (170 ug/L) is below the benzene (the surrogate constituent used at the site for the VOCs) acute fish criterion of 640 ug/L, but above the chronic fish criterion of 1 ug/L. Therefore, a surface water screening concentration (waste load allocation) for MTBE was calculated using PENTOXSD modeling;
- QD modeled benzene concentration in S-295 (40 ug/L) is below both the benzene acute fish criterion of 640 ug/L and chronic fish criterion of 130 ug/L; and
- QD modeled lead concentration in monitoring well S-295 (338 ug/L) is above both
 the lead acute fish criterion of 65 ug/L and the chronic fish criterion of 2.5 ug/L.
 Therefore, a surface water screening concentration (waste load allocation) for lead
 was calculated for S-295 using PENTOXSD modeling.

The results of the modeling as it relates to site receptors is further discussed in Section 7.6 below.

7.6 Potential Migration Pathways and Site Receptors

The following summarizes the relevant information concerning the potential migration pathways and site receptors for AOI 2:

- Operating areas of AOI 2 are located within a secured area to prevent unauthorized access. Direct contact to site soils (soils greater than two feet beneath the ground surface) is governed by Sunoco's on-site procedures and personal PPE;
- No human health receptors to groundwater exist for the Refinery based on onsite safety procedures and PPE requirements;
- Based on the vapor intrusion evaluation completed (Section 6.5 of this report), there are no complete exposure pathways from groundwater, soil or LNAPL into indoor air at the onsite receptors, with exception of benzene in S-298_1-2 and the nearby Bio/BFW Unit Building;
- Sunoco intends to further evaluate the potential vapor intrusion into indoor air pathway for the Bio/BFW Unit Building via soil gas sampling;
- LNAPL observed in wells in the vicinity of the Pollock Street Sewer will be further evaluated in the AOI 2 Clean Up Plan; and

• Based on the fate and transport modeling using QD model, six constituents (benzene, 1,2,4-TMB, 1,3,5-TMB, MTBE, chrysene and lead) at five wells (SD-1, S-71, S-108, S-295 and S-298) have the potential to reach the Schuylkill River at levels above their groundwater MSCs. Since the predicted concentrations for all constituents that exceeded their respective groundwater MSCs at the Schuylkill River are below the wasteload allocation limit calculated using the PENTOXSD model, these COCs in groundwater do not pose a significant risk to surface water quality in the Schuylkill River.

8.0 HUMAN HEALTH EXPOSURE ASSESSMENT/RISK ASSESSMENT

Based on the current and future intended non-residential site use, an exposure assessment was conducted for all compounds which exceeded the non-residential statewide health standards in AOI 2. Potential human health exposures for the Refinery are for an industrial worker scenario. The media evaluated included groundwater, surface soil (less than two feet below grade), and subsurface soil (greater than two feet below grade).

As described in Section 6.5, the benzene concentration detected in soil sample S-298_1-2 requires further evaluation for the potential vapor intrusion into indoor air pathway. Otherwise, no, further evaluation of the vapor intrusion pathway is required based on the lack of complete exposure pathways.

The potential direct contact pathway for soil (greater than two feet), groundwater and LNAPL under the industrial scenario is eliminated through Sunoco's established excavation procedures, PPE requirements and soil handling procedures described in Appendix K of the CCR. However, because direct contact to surface soils could occur outside of excavation activities, shallow soil samples were collected in non-paved areas of AOI 2 to assess this potential exposure pathway.

The following table serves as a summary of potential exposure pathways that can be reasonably expected under the current and intended future non-residential use for AOI 2. The table lists potentially contaminated media, potential receptors for these media, and a summary of whether any potentially complete exposure pathways exist at AOI 2 from the media to these receptors.

Exposure Pathway Evaluation Summary

Contaminated Media	Residents	Workers	Day Care	Construction	Trespassers	Recreation	Food
Groundwater	NA	No ⁽¹⁾	NA	No ⁽²⁾	No	NA	NA
Air (indoor)	NA	No ⁽³⁾	NA	No ⁽³⁾	No	NA	NA
Soil <2 feet bgs.	NA	Yes	NA	Yes	No	NA	NA
Soil >2 feet bgs.	NA	No ⁽⁴⁾	NA	No ⁽⁴⁾	No	NA	NA
Surface Water	NA	No ⁽⁵⁾	NA	No ⁽⁵⁾	NA	NA	NA
Sediment	NA	NA	NA	NA	NA	NA	NA
LNAPL	NA	No ⁽¹⁾	NA	No ⁽²⁾	NA	NA	NA

Notes:

- (1) No complete groundwater or LNAPL pathways exist for workers that are not addressed through on-site procedures and PPF
- (2) No complete groundwater or LNAPL pathway exists for construction workers due to PPE requirements and Standard Operating Procedures.
- (3) No complete pathway to indoor air exists based on the evaluation described in Section 6.5.
- (4) No complete pathway exists for site soil > 2 feet deep due to PPE requirements and Standard Operating Procedures.
- (5) No complete pathway exists for surface water due to PPE requirements and Standard Operating Procedures.
- Na Not applicable
- No No potential complete exposure pathway
- Yes Potential complete exposure pathway

A more detailed evaluation of each of these potential exposure pathways is presented in the following sections by media.

8.1 Surface Water

The nearest surface water body to AOI 2 is the Schuylkill River which borders the western boundary of AOI 2. Based on groundwater flow and results of the fate and transport modeling for wells where groundwater COCs were above their respective groundwater MSCs have the potential to reach the Schuylkill River at concentrations above the 25 PA Code, Chapter 93 Aquatic Life Criteria. To further evaluate this potential pathway, waste load allocations for benzene (12,412 ug/L), (MTBE 122,599 ug/L), chrysene (114 ug/L) and lead (8,726 ug/L) were calculated using the PENTOXSD model. The predicted QD modeled concentrations at the Schuylkill River for benzene (251 ug/L), MTBE (170 ug/L), chrysene (4.17 ug/L) and lead (338 ug/L) were calculated. These QD predicted values are below the calculated waste load allocations, and therefore do not pose a significant risk to surface water quality in the Schuylkill River.

8.2 Surface Soils (0-2 Feet Below Ground Surface)

8.2.1 Soil-to-Groundwater

The soil-to-groundwater pathway is being addressed through the groundwater pathway discussed in Section 8.3.

8.2.2 Direct Contact Exposure

Shallow soil samples collected and analyzed as part of the AOI 2 site characterization activities exhibited concentrations of benzene and lead above their respective non-residential direct contact soil MSCs. In accordance with Section IV of the PADEP's Technical Guidance Manual, site-specific standards for lead and benzene were calculated using PADEP default intake parameters for an onsite worker and a risk level of 10⁻⁴. For calculating a site-specific standard for on-site workers exposed to lead, Sunoco used the Society of Environmental Geochemistry and Health (SEGH) model used by PADEP to develop the non-residential soil MSCs.

The calculated risk-based site-specific standards presented in Appendix G are as follows:

Compound	Calculated Site-Specific Standard (mg/kg)	
Benzene	2,160	
Lead	3,140	

Concentrations of benzene and lead detected in the surface soil samples collected in AOI 2 were below the calculated site specific standards and, therefore, risk to an on-site worker due to direct contact exposure is considered to be within the acceptable Act 2 range.

The site-specific standard for lead based on the SEGH model presented in Appendix G was calculated to be 3,140 mg/kg for a worker. To develop a site specific criteria for lead, some of the parameters used by the PADEP were updated in consideration of site-specific conditions and updated lead data

collected from recent studies. These parameters are discussed in detail in Appendix G. Concentrations of lead detected in the surface soil samples collected in AOI 2 are below the site-specific standard, and, therefore, risk to an on-site worker due to exposure is considered minimal.

In addition to calculating the site-specific standards for benzene and lead, the cumulative risk of exposure was also calculated. Lead exposure is dependent on the blood/lead concentration and not risk based; therefore, lead could not be incorporated into the cumulative risk calculation. The total cumulative risk is the combined risk of exposure to the concentrations of carcinogenic compounds (benzene). In accordance with the TGM, the total cumulative risk can not exceed 10⁻⁴ and the total cumulative hazard index can not exceed 1.

As presented in Table G-6 of Appendix G, the cumulative hazard index for exposure to the non-carcinogenic compounds is less than the PADEP's requirement of 1.0. As presented in Table G-3, the total cumulative risk of exposure to the carcinogenic compounds in AOI 2 is 1.17E-⁰⁷, and therefore, no remedies are required for AOI 2 to address direct contact to benzene in soil.

8.3 Groundwater

Results of the July 2010 groundwater sampling indicates that one metal (lead) and eight organic compounds, including: benzene, MTBE, 1,2,4-TMB, 1,3,5-TMB, chrysene, naphthalene, phenanthrene and pyrene were detected above their respective groundwater MSCs. Previous investigations (URS, 2002) verified that no groundwater monitoring wells located within 1.5 miles of the Refinery are used for drinking water or agricultural use. Also, there are no complete direct contact exposure pathways for groundwater within AOI 2 because of on-site Refinery safety procedures and required PPE.

Based on the completed fate and transport modeling, the only dissolved phase COCs in groundwater that have the potential to extend off-site, along the western boundary of AOI 2 are benzene, 1,2,4-TMB, 1,3,5-TMB, MTBE, chrysene, and lead. Benzene in well SD-1, MTBE in S-71, chrysene in S-108 and lead in S-295 have the potential to reach Schuylkill River at concentrations exceeding the 25 PA Code, Chapter 93 Aquatic Life

Criteria. Based on further evaluation of this condition as described in Section 8.1, there appears to be no unacceptable risk to ecological receptors in the Schuylkill River.

8.4 LNAPL

There are no complete direct contact exposure pathways to LNAPL within AOI 2 because of on-site procedures and required PPE.

8.5 Vapor

The results of the screening evaluation using the PADEP's guidance indicated that no soil or groundwater analytical results in AOI 2 exceeded the non-residential EPA/PADEP OSHA PEL screening values, with the exception of one soil sample location (S-298_1-2). Because the nearest occupied building (Bio/BFW Building) to this sample location is approximately 20 feet away, Sunoco intends to further evaluate the potential vapor intrusion into indoor air pathway for this building.

Wells with LNAPL in AOI 2 are located more than 100 feet away of the potential indoor receptors, and therefore no further evaluation of the potential vapor intrusion into indoor air pathway for these buildings is required.

9.0 ECOLOGICAL ASSESSMENT

The majority of AOI 2 is impervious surfaces as shown in Figure A-1 in Appendix A. 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 2002, a survey of endangered, threatened and special concern wildlife was conducted by reviewing maps provided at the Pennsylvania Department of Conservation and Natural Resources. No endangered, threatened or special concern wildlife were identified using these maps or during historical investigations. Based on this information, there are no terrestrial ecological receptors of concern for AOI 2 and no related assessment was necessary.

No surface water features are located in AOI 2. The nearest surface water body to AOI 2 is the Schuylkill River which comprises the western boundary of AOI 2. Based on fate and transport modeling, dissolved phase COCs within AOI 2 groundwater will not reach the Schuylkill River at

concentrations that exceed the wasteload allocation limit calculated using the PENTOXSD model.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the completed activities, the following conclusions and recommendations have been developed for AOI 2:

SOIL

With regard to the potential direct-contact pathway to shallow soil:

- Concentrations of benzene detected in surface soil sample S-298_1-2 (1,200 ug/kg) and S-313_1-2 (620 ug/kg) were below the calculated site-specific standard of 2,160 mg/kg.
 Sunoco will delineate the benzene concentrations in soil around this location to ensure that soil in this area is below the calculated site-specific standard.
- The concentration of lead detected in surface soil sample S-318_1-2 (860 mg/kg) was below the calculated site-specific standard of 3,140 mg/kg. Sunoco will delineate the lead concentrations in soil around this location to ensure that soil in this area is below the calculated site-specific standard.
- No other shallow soil samples exhibited concentrations of COCs above their respective MSCs.

With regard to the potential direct-contact pathway to deeper soil (i.e., greater than 2 feet deep) and the soil-to-groundwater pathway:

 The direct contact pathway to soil greater than 2 feet beneath the ground surface at the Refinery is incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure. The soil-to-groundwater pathway was evaluated using shallow groundwater data as is discussed below.

GROUNDWATER

 For wells that exhibited concentrations of COCs above their respective groundwater MSCs, fate and transport modeling was completed using the QD model. Based on the QD modeling results, groundwater concentrations in exceedance of their respective groundwater MSCs are not predicted to reach the Refinery boundary, with the exception of groundwater in monitoring wells SD-1, S-71, S-108 and S-295. Based on the QD modeling results for these wells, concentrations of benzene, MTBE, chrysene and lead above their respective groundwater MSCs could potentially reach the Schuylkill River.

• To further evaluate the likelihood of benzene, MTBE, chrysene and lead in SD-1, S-71, S-108 and S-295 adversely affecting the surface water quality of the Schuylkill River, the PENTOXSD model was used to calculate a wasteload allocation for benzene, MTBE, chrysene and lead. The QD-predicted concentrations for these COCs at the interface with the Schuylkill River were below the calculated wasteload allocation, and therefore do not pose a significant risk to surface water quality in the Schuylkill River.

SOIL VAPOR

The results of the vapor intrusion screening evaluation using the PADEP guidance indicated:

• With the exception one soil sample (S-298_1-2), no soil or groundwater analytical results in AOI 2 exceeded the non-residential EPA/PADEP default screening values or the OSHA PEL screening values. The nearest occupied building (Bio/BFW Unit) to the soil sample location with the soil vapor exceedance is approximately 20 feet away. Based on the close proximity of this occupied building to this soil sample, and since there are no monitoring points between S-298_1-2 and the building, further evaluation of the potential vapor intrusion into indoor air pathway for this building will be completed by Sunoco by collecting soil gas samples.

LNAPL

- The horizontal extent of the LNAPL plumes, relative to the site boundaries, are delineated and or controlled, and the potential for migrating LNAPL to reach the site boundary is minimal with the exception of areas along the Pollock Street Sewer.
- LNAPL observed along the Pollock Street Sewer will be further evaluated and addressed as part of the Clean Up Plan for AOI 2.
- The direct contact exposure pathway to LNAPL is incomplete because of on-site procedures and PPE requirements that protect onsite workers from exposure.

POLLOCK STREET SEWER

The objectives of the proposed Clean Up Plan activities are to further evaluate performance, LNAPL occurrence, and recoverability along the sewer and to enhance the existing Pollock

Street Sewer Total Fluids Recovery System. Specifically, Sunoco intends to complete the following additional investigation activities to achieve these objectives:

- Further assess the source of groundwater mounding in the C-Header area and how this condition affects the LNAPL occurrence.
- Further characterize LNAPL in the vicinity of "The Hill" (9th and Pollock) area to assess potential LNAPL sources.
- Conduct short and long-term pumping tests on select wells, including the horizontal recovery wells, to evaluate the performance of LNAPL recovery efforts to date, to investigate potential sources of LNAPL, and to determine a remedial approach for recovering LNAPL in the Short Pier area.
- Clean existing vertical and horizontal recovery well systems to enhance the performance of these systems in the vicinity of the sewer.
- Further investigate the extent and characteristics of LNAPL in the Former Tank 1515/1508 area through installation of monitoring wells.

11.0 REFERENCES

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Table 1

Constituents of Concern for Groundwater AOI 2 Site Characterization/Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

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

VOLATILE ORGANIC COMPOUNDS	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	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
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.

Table 1 (continued)

Constituents of Concern for Soil AOI 2 Site Characterization/Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

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

VOLATILE ORGANIC COMPOUNDS	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	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
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.

Table 2 Existing Well Summary As of July 2010 AOI 2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

												Well Construction	on Details ³			
Well ID	Former Well ID ¹	Northing	Easting	Well Type	Well Classification ²	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation ⁴ (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.)
C-Header	-	222231.819	2684451.870	Monitoring Well	Shallow/Intermediate		Υ	5/28/03	21	2	20.61	20.89	19.89	-0.11	1	20
PZ-100	_	222350.300	2683602.320	Temporary Piezometer	Shallow			-	-	-	18.18	-	-	-		
PZ-101	_	222295.980	2683594.660	Temporary Piezometer	Shallow			-	-	-	17.17	-	-	-		
River Gauge GP1	-	222257.130	2682877.340	Staff Gauge					-	-		10.42	-	-		
River Gauge GP3	-	223252.760	2683290.260	Staff Gauge					-	-		9.93	-	-		
RW-100	PH-6	222348.922	2683341.466	Recovery Well - Active	Shallow/Intermediate	Y	Y	5/4/94	31	6	20.73	20.34	1.34	-8.66	19	10
RW-101	PH-10	222383.887	2683489.115	Recovery Well - Active	Shallow/Intermediate	Y	Y	5/9/94	30.5	6	19.59	19.47	1.47	-8.53	18	10
RW-102	PH-8	222320.394	2683598.420	Recovery Well - Active	Shallow/Intermediate	Y	Y	5/10/94	29	6	17.88	17.07	0.07	-9.93	17	10
RW-103	PH-7	222358.057	2683769.861	Recovery Well - Active	Shallow/Intermediate	Υ	Υ	5/9/94	31	6	19.76	19.79	-0.21	-10.21	20	10
RW-104	-	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	Υ	Υ	8/18/95	20	6	10.65	10.65	2.65	-15.35	8	18
RW-105	-	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	Υ	Υ	8/10/95	20	6	10.65	10.65	2.65	-7.35	8	10
RW-106		222348.393	2682946.513	Recovery Well - Active	Shallow/Intermediate	Y	Y	8/9/95	20	6	11.06	11.06	3.06	-6.94	8	10
RW-107	-	222276.022	2682918.762	Recovery Well - Active	Shallow/Intermediate				-	-	11.67	9.60	-	_		
RW-108	_	222180.780	2682895.300	Recovery Well - Inactive	Shallow/Intermediate	Y	Y	8/9/95	20	6	9.90	9.34	1.34	-8.66	8	10
RW-109	_	222084.011	2682882.538	Recovery Well - Inactive	Shallow/Intermediate	-	-	_	-	-	9.85	9.51	-	-		-
RW-600 ⁵	_	223296.182	2683368.779	Recovery Well - Inactive	Shallow/Intermediate	N	Υ	6/3/97	24.83	6	9.05	9.07	4.49	-15.51	4.58	20
RW-601	_	223212.994	2683325.051	Recovery Well - Inactive	Shallow/Intermediate	N	Υ	6/5/97	24.58	6	11.68	11.89	7.56	-12.44	4.33	20
RW-602	_	223248.570	2683337.660	Recovery Well - Inactive	Shallow/Intermediate	N	Υ	6/6/97	24.92	6	8.13	8.13	3.46	-16.54	4.67	20
S-105	_	223163.980	2683300.396	Monitoring Well	Shallow	Υ	Υ	7/10/96	10	2	12.53	11.14	8.14	1.14	3	7
S-106	_	223225.623	2683321.415	Monitoring Well	Shallow/Intermediate	Y	Y	7/10/96	19.59	2	11.36	11.66	9.16	-7.84	2.5	17
S-107		223258.144	2683338.425	Monitoring Well	Shallow/Intermediate	Y	Y	7/10/96	18.41	2	12.31	11.00	8.50	-5.51	2.5	14
S-108	-	223294.270	2683361.620	Monitoring Well	Shallow/Intermediate	Y	Y	6/10/96	17.09	2	10.72	8.96	5.96	-8.04	3	14
S-109		223248.050	2683300.830	Monitoring Well	Shallow	Υ	Υ	6/10/96	10.08	2	10.13	10.16	7.66	0.66	2.5	7
S-110	-	223250.196	2683409.695	Monitoring Well	Shallow/Intermediate	Y	Y	6/11/96	27.16	2	25.67	23.08	16.08	-3.92	7	20
S-128	PS-1	222366.540	2683653.780	Monitoring Well	Shallow	Y	Y	5/7/02	30	4	20.72	20.13	10.13	-9.87	10	20
S-129	PS-2	222366.110	2683689.830	Monitoring Well	Shallow	Υ	Y	5/7/02	30	4	21.03	20.29	10.29	-9.71	10	20
S-130	PS-3	222280.476	2684124.413	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/8/02	28	4	22.48	20.41	12.41	-7.59	8	20
S-131	PS-4	222306.767	2684099.464	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/8/02	26	4	18.72	19.05	13.05	-6.96	6	20
S-132	PS-5	222242.913	2684094.998	Monitoring Well	Shallow/Intermediate	Y	Υ	5/8/02	30	4	21.03	21.24	11.24	-8.76	10	20
S-133	PS-6	222302.858	2684055.920	Monitoring Well	Shallow/Intermediate	Y	Υ	5/9/02	28	4	22.02	19.63	11.63	-8.37	8	20
S-134	PS-7	222208.580	2684440.917	Monitoring Well	Shallow/Intermediate	Y	Y	5/9/02	28	4	22.03	20.61	12.61	-7.39	8	20
S-135	PS-9	222277.520	2684161.447	Monitoring Well	Shallow/Intermediate	Y	Y	5/10/02	28	4	23.08	21.12	13.12	-6.88	8	20
S-136	PS-8	222257.296	2684134.648	Monitoring Well	Shallow/Intermediate	Y	Y	5/13/02	28	4	20.59	20.95	12.95	-7.05	8	20
S-137	PS-7	222273.202	2684043.263	Monitoring Well	Shallow/Intermediate	Y	Y	5/13/02	28	4	20.04	20.46	12.46	-7.54	8	20
S-138	PS-11	222508.290	2683504.860	Monitoring Well	Shallow	Y	Y	5/14/02	28	4	22.89	21.65	13.65	-6.35	8	20
S-139	PS-12	222391.788	2683570.196	Monitoring Well	Shallow/Intermediate	Y	Y	5/14/02	28	4	21.46	18.90	10.90	-9.10	8	20
S-140	PS-13	222441.116	2683479.476	Monitoring Well	Shallow/Intermediate	Y	Y	5/14/02	28	4	22.03	20.47	12.47	-7.53	8	20
S-141	PS-14	222387.422	2683426.715	Monitoring Well	Shallow/Intermediate	Y	Y	5/15/02	28	4	21.92	19.97	11.97	-8.04	8	20
S-142	PS-15	222347.586	2683608.203	Monitoring Well	Shallow/Intermediate	Y	Y	5/15/02	28	4	19.67	17.57	9.57	-10.43	8	20
S-143	PS-16	222448.692	2683521.683	Monitoring Well	Shallow/Intermediate	Y	Y	5/15/02	28	4	22.72	21.35	13.35	-6.66	8	20
S-144 ⁵	PS-17	222338.230	2683681.590	Monitoring Well	Shallow/Intermediate	Y	Y	5/15/02	28	4	21.71	19.67	11.67	-8.33	8	20
S-145 ⁵	MW-A	223242.140	2683324.160	Monitoring Well	Shallow	Υ	Y	1/14/02	14	4	10.38	10.96	8.96	-1.04	2	10
S-146	MW-B	223263.110	2683325.130	Monitoring Well	Shallow	Υ	Y	1/15/02	9.5	4	8.80	9.40	8.90	-0.10	0.5	9
S-147 ⁵	MW-C	223227.953	2683311.082	Monitoring Well	Shallow	Y	Υ	1/15/02	13.5	4	10.28	11.18	7.68	-2.32	3.5	10
S-148	MW-D	223268.880	2683308.830	Monitoring Well	Shallow	Y	Y	1/15/02	9	4	8.43	9.04	7.04	0.04	2	7
S-149 ⁵	MW-E	223223.065	2683284.292	Monitoring Well	Shallow	Υ	Y	1/15/02	13	4	9.51	9.86	6.86	-3.14	3	10
S-150	MW-F	223189.281	2683393.409	Monitoring Well	Shallow/Intermediate	Υ	Υ	1/16/02	21.5	4	20.83	20.91	9.91	-0.09	11	10
						•		, .	•	•		-	-		•	

NOTES:

Data could not be located or determined based on available reports
 Abandoned/destroyed wells.

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

- 1. Former well IDs were derived from handwritten notes on the logs themselves or the referenced report.
- 2. Well classification based on the formation that the well is screened in. Wells screened within the Middle Clay or the Farrington Sand are classified as deep wells.

 Well classification for wells screened above the Lower/Middle Clay are based on the following: screened in Fill/Alluvium Shallow, screened in Trenton Gravel Intermediate, screened in Fill/Alluvium & Trenton Gravel Shallow/Intermediate
- 3. Well construction details were taken directly from well boring logs provided by Handex, Stantec, Aquaterra or collected from available historic reports.
- 4. Wells were surveyed by Langan in June 2009 and July 2010.
- 5. Wells could not be located.
- 6. Well is damaged.

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Table 2 Existing Well Summary As of July 2010 AOI 2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

												Well Construction	on Details ³			
Well ID	Former Well ID ¹	Northing	Easting	Well Type	Well Classification ²	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation ⁴ (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.)
S-151	MW-G	223240.610	2683456.790	Monitoring Well	Shallow	Υ	Υ	1/17/02	35	4	22.38	22.88	10.88	-9.12	12	20
S-152 ⁵	MW-H	223246.910	2683336.730	Monitoring Well	Shallow/Intermediate	Υ	Υ	1/22/02	22	4	10.71	11.47	9.47	-10.53	2	20
S-153	MW-I	223236.568	2683288.563	Monitoring Well	Shallow/Intermediate	Y	Y	1/23/02	26	4	9.81	9.96	-6.05	-16.05	16	10
S-154	MW-J	223235.541	2683290.309	Monitoring Well	Shallow/Intermediate	Υ	Υ	1/24/02	15	4	10.62	10.14	5.14	-4.86	5	10
S-155 ⁵	MW-K	223179.570	2683445.720	Monitoring Well	Shallow/Intermediate	Υ	Υ	1/24/02	28	4	21.72	22.49	14.49	-5.51	8	20
S-156	RW-1	222280.955	2684179.485	Monitoring Well	Shallow/Intermediate	Υ	Y	NA	28	6	20.81	21.06	13.06	-6.94	8	20
S-157 ⁶	RW-2	222285.030	2684106.770	Monitoring Well	Shallow/Intermediate	Υ	Y	NA	28	6	19.94	20.29	12.29	-7.71	8	20
S-158 ⁵	_	222368.900	2683265.500	Monitoring Well	Shallow/Intermediate	N	N	-	_	-	-	-	_	-	-	_
S-159		222304.318	2683729.837	Monitoring Well	Shallow/Intermediate	Υ	Y	5/14/03	20	2	18.87	19.17	14.17	-0.83	5	15
S-165		222154.023	2684907.277	Monitoring Well	Shallow/Intermediate	Y	Y	5/16/03	19.5	2	18.11	18.30	13.80	-1.20	4.5	15
S-166	_	222169.749	2684909.112	Monitoring Well	Shallow/Intermediate	Y	Y	5/16/03	20	2	18.23	18.22	13.22	-6.78	5	20
S-167 ⁵		222193.782	2684770.687	Monitoring Well	Shallow/Intermediate	Υ	Y	5/16/03	22	2	19.41	19.62	14.62	-2.38	5	17
S-168 ⁵		222194.560	2684770.850	Monitoring Well	Shallow/Intermediate	Y	· ·	5/27/03	25	4	19.62	19.85	14.85	-5.15	5	20
	_	222177.510	2684733.850	-	Shallow/Intermediate	Y	Y	5/16/03	20	2	19.29	19.81	14.81	-5.19	5	20
S-169 ⁵	-			Monitoring Well	· ·	Y	Y Y		20	2				-5.19 -2.17	5 5	_
S-174 S-175	-	222200.315 222225.601	2684537.779 2684499.744	Monitoring Well	Shallow/Intermediate	Y	Y	5/27/03 5/20/03	22	2	19.72 20.04	19.84 20.40	14.84 15.40	-2.17 -3.60	5 5	17 19
S-175 S-176		222225.601	2684499.744	Monitoring Well Monitoring Well	Shallow/Intermediate Intermediate	Y	Y V	5/20/03	20	2	20.04	20.40	17.25	0.25	3	17
S-176		222207.410	2684661.306	Monitoring Well	Shallow/Intermediate	Y	Y	5/27/03	21	2	19.56	19.69	15.69	-1.32	4	17
S-177		222187.956	2684660.879	Monitoring Well	Shallow/Intermediate	Y	\ \ \	5/27/03	22	2	19.54	19.71	14.71	-2.29	5	17
S-246A	S-246	222348.398	2682915.427	Monitoring Well	Shallow/Intermediate	N				_	11.76	9.37		-2.23		
S-240A	3-240	222381.399	2682920.978	Monitoring Well	Shallow/Intermediate	N		-			12.09	9.64			_	
S-248		222393.743	2682933.258	Monitoring Well	Shallow/Intermediate	N					10.80	8.48		_		
S-249		222443.654	2682939.250	Monitoring Well	Shallow/Intermediate	N					12.61			_		
S-250		222376.211	2683049.960	Monitoring Well	Shallow/Intermediate	N					18.71	16.34		_		
S-251		222361.858	2683285.544	Monitoring Well	Shallow/Intermediate	N			_		23.15	20.54		_		
S-252		222357.226	2683256.323	Monitoring Well	Shallow/Intermediate	N					23.05	20.48		_		
S-253	_	222420.464	2683300.367	Monitoring Well	Shallow/Intermediate	N	_	_	_	_	24.79	21.96	_	_		
S-254		222413.907	2683167.598	Monitoring Well	Other	N				-	24.36	21.97		_		
S-48	SM-11	222220.541	2684871.017	Monitoring Well	Shallow/Intermediate	Υ	N	12/18/84	24.75	-	20.83	18.71				
S-53	AS-10A	222278.899	2684179.269	Monitoring Well	Shallow/Intermediate	Υ	Y	2/12/82	27	-	21.71	-	-	-	17.5	11.5
S-54	SM-14	221765.723	2684412.265	Monitoring Well	Intermediate	Υ	N	12/20/84	30.5	-	22.97	21.54	-	-	-	
S-600	-	-		Monitoring Well	-		-	1	_	-	-	-	-	-	-	
S-61	SM-13, 61	221700.585	2683868.702	Monitoring Well	Shallow/Intermediate	Υ	N	12/17/84	25		18.30	16.32	-			
S-62	65	222318.880	2683629.517	Monitoring Well	Intermediate	Υ	Y	12/12/86	31	2	21.38	18.89	4.89	-9.11	14	14
S-63	SM-12	222268.556	2683223.536	Monitoring Well	Shallow/Intermediate	Υ	N	12/19/84	22.1		21.38	18.40				
S-64	S-77	222212.294	2682948.788	Monitoring Well	Shallow/Intermediate	Υ	Y	8/3/88	24	4	10.56	8.90	4.90	-15.10	4	20
S-65	S-78	222451.716	2682948.180	Monitoring Well	Shallow/Intermediate	Υ	Y	8/4/88	24	4	10.62	10.13	6.13	-13.87	4	20
S-70	SM-6	223133.013	2683462.983	Monitoring Well	Shallow/Intermediate	Υ	N	12/21/84	25	-	22.10	22.10	-	-		
S-71	SM-5	223177.687	2683535.027	Monitoring Well	Shallow/Intermediate	Y	N	12/20/84	12.5	-	24.04	22.03	-			
S-72	SM-37	223835.530	2683824.552	Monitoring Well	Intermediate	Υ	N	3/19/84	31		31.06	31.58	-			
S-72D		223838.100	2683833.766	Monitoring Well	Deep	N	N	3/7/94	100	2	34.51	32.08	-56.93	-66.93	89	10

NOTES:

Data could not be located or determined based on available reports

Abandoned/destroyed wells.

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

- 1. Former well IDs were derived from handwritten notes on the logs themselves or the referenced report.
- 2. Well classification based on the formation that the well is screened in. Wells screened within the Middle Clay or the Farrington Sand are classified as deep wells.
- Well classification for wells screened above the Lower/Middle Clay are based on the following: screened in Fill/Alluvium Shallow, screened in Trenton Gravel Intermediate, screened in Fill/Alluvium & Trenton Gravel Shallow/Intermediate
- 3. Well construction details were taken directly from well boring logs provided by Handex, Stantec, Aquaterra or collected from available historic reports.
- 4. Wells were surveyed by Langan in June 2009 and July 2010.
- 5. Wells could not be located.
- 6. Well is damaged.

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Table 2 Existing Well Summary As of July 2010 AOI 2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

					Ι							Well Construction	on Details ³			
Well ID	Former Well ID ¹	Northing	Easting	Well Type	Well Classification ²	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Completion Depth (ft. bgs)	Well Diameter (in)	Top of Inner Casing Elevation ⁴ (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.)
S-73	SM-35	224159.260	2684618.080	Monitoring Well	Shallow	Υ	N	3/19/85	35	-	38.54	35.31	-	-		
S-91		222271.265	2684187.983	Monitoring Well	Intermediate	Υ	Υ	8/11/93	30	4	23.13	21.30	11.30	-8.70	10	20
S-92		222193.905	2684428.041	Monitoring Well	Intermediate	Υ	Υ	8/9/93	30	4	20.18	20.54	10.54	-9.46	10	20
S-93		222338.734	2683258.775	Monitoring Well	Intermediate	Υ	Υ	8/9/93	30	4	22.24	19.51	9.51	-10.49	10	20
SD-1		223203.927	2683363.204	Monitoring Well	Shallow				-		19.11	17.05				
PH-71		-		Abandoned	-				-	-	-		-	-		
PH-72		-		Abandoned	-				-	-	-		-	-		
S-292	-	223718.469	2683561.768	Monitoring Well	Shallow/Intermediate	Υ	Υ	6/16/10	20	4	28.77	29.39	19.39	9.39	10	10
S-294	-	224162.262	2684672.756	Monitoring Well	Intermediate	Υ	Υ	5/26/10	40	4	34.47	35.12	10.12	-4.88	25	15
S-294D	-	224164.508	2684682.460	Monitoring Well	Deep	Υ	Υ	6/10/10	99	4	34.68	35.07	-48.93	-63.93	84	15
S-295	-	223800.510	2684379.192	Monitoring Well	Shallow/Intermediate	Υ	Υ	6/8/10	24	4	32.74	33.13	24.13	9.13	9	15
S-297	-	223495.264	2683614.221	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/6/10	36	4	30.02	28.95	7.95	-7.06	21	15
S-298	-	223263.415	2683858.759	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/25/10	20	4	27.00	25.48	20.48	5.48	5	15
S-299	-	222978.196	2683545.486	Monitoring Well	Shallow/Intermediate	Υ	Υ	6/8/10	28	4	24.00	21.77	8.77	-6.23	13	15
S-300	-	222829.549	2684308.401	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/20/10	30	4	25.28	23.99	8.99	-6.02	15	15
S-301	-	222550.150	2684441.814	Monitoring Well	Shallow/Intermediate	Υ	Υ	6/8/10	28	4	23.12	21.02	8.02	-6.98	13	15
S-302	-	222612.708	2683250.986	Monitoring Well	Intermediate	Υ	Υ	5/12/10	30	4	23.95	22.14	7.14	-7.86	15	15
S-302D	-	222606.828	2683247.675	Monitoring Well	Deep	Υ	Υ	5/10/10	92	4	24.60	22.05	-54.95	-69.95	77	15
S-303	-	222409.188	2683678.208	Monitoring Well	Shallow/Intermediate	Υ	Υ	5/24/10	26	4	22.59	20.71	9.71	-5.29	11	15
S-304	-	222276.798	2684505.689	Monitoring Well	Shallow/Intermediate	Υ	Υ	6/9/10	18	4	22.18	20.72	12.72	2.72	8	10
S-305	-	221997.384	2684882.600	Monitoring Well	Intermediate	Υ	Υ	5/19/10	29	4	19.73	18.21	4.21	-10.79	14	15
S-305D	-	221989.608	2684881.879	Monitoring Well	Deep	Υ	Υ	6/1/10	82	4	20.48	17.90	-49.10	-64.10	67	15
S-306		222297.333	2683117.453	Monitoring Well	Intermediate	Υ	Υ	5/19/10	30	4	22.47	20.08	5.08	-9.92	15	15
S-307	-	221764.243	2683507.725	Monitoring Well	Shallow/Intermediate	Υ	Y	6/10/10	26	4	18.57	16.45	5.45	-9.55	11	15
S-308	-	221383.028	2682915.492	Monitoring Well	Shallow/Intermediate	Υ	Y	4/30/10	20	4	28.11	25.39	20.39	5.39	5	15
S-309		221511.876	2683391.028	Monitoring Well	Shallow/Intermediate	Υ	Y	4/29/10	20	4	19.73	17.02	12.02	-2.98	5	15
S-310		221511.275	2683799.677	Monitoring Well	Shallow/Intermediate	Υ	Y	4/30/10	20	4	17.40	14.75	9.75	-5.25	5	15
S-311		221517.843	2684447.587	Monitoring Well	Intermediate	Υ	Υ	5/18/10	33	4	26.18	24.52	6.52	-8.49	18	15
S-312	-	221608.820	2684972.955	Monitoring Well	Shallow/Intermediate	Υ	Y	4/28/10	20	4	17.88	15.62	10.62	-4.38	5	15
S-313	-	222419.862	2683327.259	Monitoring Well	Shallow/Intermediate	Υ	Y	5/7/10	30	4	23.72	21.78	6.78	-8.22	15	15
S-314	-	222411.148	2683250.135	Monitoring Well	Shallow/Intermediate	Υ	Y	5/11/10	30	4	24.32	21.88	6.88	-8.12	15	15
S-315	-	222405.884	2683224.519	Monitoring Well	Shallow/Intermediate	Υ	Y	5/11/10	30	4	23.86	21.96	6.96	-8.04	15	15
S-316	-	222403.965	2683193.662	Monitoring Well	Shallow/Intermediate	Υ	Y	5/10/10	30	4	23.96	21.82	6.82	-8.18	15	15
S-317	-	222440.177	2683227.037	Monitoring Well	Shallow/Intermediate	Υ	Y	5/7/10	30	4	23.42	21.36	6.36	-8.64	15	15
S-318	-	222515.986	2683216.416	Monitoring Well	Shallow/Intermediate	Y	Y	5/12/10	30	4	23.75	21.81	6.81	-8.19	15	15
S-328		222582.161	2683641.906	Monitoring Well	Shallow/Intermediate	Υ	Y	6/11/10	26	4	21.97	22.47	11.47	-3.53	11	15

NOTES:

Data could not be located or determined based on available reports Abandoned/destroyed wells.

AOI - Area of Interest

ft. - feet

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- 5. Wells could not be located.
- 6. Well is damaged.

Table 3 **Summary of Groundwater and LNAPL Elevations** July 2010 AOI 2

Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification ¹	Used for G\	ravity (g/cc) N Correction	Depth to Product (ft btic)	Depth to GW ⁴ (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping
					S.G. ²	Source ³								
C-Header	222231.819	2684451.870	Monitoring Well	Shallow/Intermediate			NP	13.16			7.45	7.45	20.61	Static
PZ-100	222350.300	2683602.320	Temporary Piezometer	Shallow/Intermediate			NP	16.04			2.14	2.14	18.18	Static
PZ-101	222295.980	2683594.660	Temporary Piezometer	Shallow/Intermediate			NP	15.53			1.64	1.64	17.17	Static
River Gauge GP1	222257.130	2682877.340	Staff Gauge	Staff Gauge			NP	14.00			-3.58	-3.58	10.42	Static
River Gauge GP3	222425.841	2682923.822	Staff Gauge	Staff Gauge			NP	8.75			1.18	1.18	9.93	Static
RW-100	222348.922	2683341.466	Recovery Well - Active	Shallow/Intermediate			NP	25.88			-5.15	-5.15	20.73	Pumping
RW-101	222383.887	2683489.115	Recovery Well - Active	Shallow/Intermediate	0.8790	S-142	19.86	19.93	0.07	-0.27	-0.34	-0.28	19.59	Pumping
RW-102	222320.394	2683598.420	Recovery Well - Active	Shallow/Intermediate	0.8790	S-142	23.18	26.38	3.20	-5.30	-8.50	-5.69	17.88	Pumping
RW-103	222358.057	2683769.861	Recovery Well - Active	Shallow/Intermediate	0.8790	S-142	27.02	27.02	<.01	-7.26	-7.26	-7.26	19.76	Pumping
RW-104	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	13.20	13.20	<.01	-2.55	-2.55	-2.55	10.65	Static
RW-105	222412.513	2682963.477	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	17.90	17.90	<.01	-7.25	-7.25	-7.25	10.65	Pumping
RW-106	222348.393	2682946.513	Recovery Well - Active	Shallow/Intermediate	0.9049	S-64/N-48	17.93	17.93	<.01	-6.87	-6.87	-6.87	11.06	Pumping
RW-107	222276.022	2682918.762	Recovery Well - Active	Shallow/Intermediate			NP	10.85			0.82	0.82	11.67	Static
RW-108	222180.780	2682895.300	Recovery Well - Inactive	Shallow/Intermediate			NP	8.18			1.72	1.72	9.90	Static
RW-109	222084.011	2682882.538	Recovery Well - Inactive	Shallow/Intermediate			NP	8.10			1.75	1.75	9.85	Static
RW-602	223248.570	2683337.660	Recovery Well - Inactive	Shallow/Intermediate			NP	6.42			1.71	1.71	8.13	Static
S-105	223163.980	2683300.396	Monitoring Well	Shallow			NP	11.90			0.63	0.63	12.53	Static
S-106	223225.623	2683321.415	Monitoring Well	Shallow			NP	10.37			0.99	0.99	11.36	Static
S-107	223258.144	2683338.425	Monitoring Well	Shallow	0.8229	S-297	10.37	10.38	0.01	1.94	1.93	1.94	12.31	Static
S-108	223294.270	2683361.620	Monitoring Well	Intermediate			NP	7.70			3.02	3.02	10.72	Static
S-110	223250.196	2683409.695	Monitoring Well	Shallow/Intermediate			NP	14.70			10.97	10.97	25.67	Static
S-130	222280.476	2684124.413	Monitoring Well	Shallow/Intermediate			NP	19.75			2.73	2.73	22.48	Static
S-131	222306.767	2684099.464	Monitoring Well	Shallow/Intermediate	0.8623	S-130	15.46	17.15	1.69	3.26	1.57	3.03	18.72	Static
S-132	222242.913	2684094.998	Monitoring Well	Shallow/Intermediate			NP	18.75			2.28	2.28	21.03	Static
S-133	222302.858	2684055.920	Monitoring Well	Shallow/Intermediate			NP	19.01			3.01	3.01	22.02	Static
S-134	222208.580	2684440.917	Monitoring Well	Shallow/Intermediate			NP	19.84			2.19	2.19	22.03	Static
S-135	222277.520	2684161.447	Monitoring Well	Shallow/Intermediate	0.8623	S-130	21.17	22.38	1.21	1.91	0.70	1.75	23.08	Static
S-136	222257.296	2684134.648	Monitoring Well	Shallow/Intermediate			NP	18.32			2.27	2.27	20.59	Static
S-137	222273.202	2684043.263	Monitoring Well	Shallow/Intermediate			NP	17.78			2.26	2.26	20.04	Static
S-139	222391.788	2683570.196	Monitoring Well	Shallow/Intermediate	0.8790	S-142	19.40	19.40	<.01	2.06	2.06	2.06	21.46	Static
S-140	222441.116	2683479.476	Monitoring Well	Shallow/Intermediate	0.8957	S-138	20.02	20.02	<.01	2.01	2.01	2.01	22.03	Static
S-141	222387.422	2683426.715	Monitoring Well	Shallow/Intermediate			NP	20.11			1.81	1.81	21.92	Static
S-142	222347.586	2683608.203	Monitoring Well	Shallow/Intermediate	0.8790	S-142	18.21	18.22	0.01	1.46	1.45	1.45	19.67	Static
S-143	222448.692	2683521.683	Monitoring Well	Shallow/Intermediate			NP	20.08			2.64	2.64	22.72	Static
S-150	223189.281	2683393.409	Monitoring Well	Shallow/Intermediate	0.8229	S-297	17.90	18.05	0.15	2.93	2.78	2.90	20.83	Static
S-153	223236.568	2683288.563	Monitoring Well	Shallow/Intermediate			NP	9.75			0.06	0.06	9.81	Static
S-154	223235.541	2683290.309	Monitoring Well	Shallow/Intermediate			NP	11.06			-0.44	-0.44	10.62	Static

- Notes:

 1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells.

 Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.

 1. Constitution of the Constitution of the LNAPL samples collected by Aquaterra/Stantek as part of CCR and/or SCR/RIR.

- Specific Gravity (c.d.) values were determined from EVAL 2 samples edirected by Aquation you find the NAPL density measurements, the density value in the nearest well with LNAPL data was used.
 Depth to water and depth to LNAPL provided by Stantec July 2010. All wells gauged on 7/13 & 7/14/10 unless otherwise noted. g/cc = grams per cubic centimeter <.01 = Sheen or film of product on groundwater.

LNAPL = Light Non-Aqueous Phase Liquid

ft amsl = Feet Above Mean Sea Level

GW = Groundwater

NA = Not Applicable

NM = Not Measured

NP = No Product

ft btic = Feet Below Top of Inner Casing

Table 3 **Summary of Groundwater and LNAPL Elevations** July 2010 AOI 2

Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification ¹	Used for G\	ravity (g/cc) W Correction	Depth to Product (ft btic)	Depth to GW ⁴ (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping
					S.G. ²	Source ³								
S-156	222280.955	2684179.485	Monitoring Well	Shallow/Intermediate	0.8623	S-130	18.56	18.63	0.07	2.25	2.18	2.24	20.81	Static
S-159	222304.318	2683729.837	Monitoring Well	Shallow/Intermediate			17.10	17.10		1.77	1.77	1.77	18.87	Static
S-165	222154.023	2684907.277	Monitoring Well	Shallow/Intermediate			NP	16.42			1.69	1.69	18.11	Static
S-166	222169.749	2684909.112	Monitoring Well	Shallow/Intermediate			NP	15.35			2.88	2.88	18.23	Static
S-174	222200.315	2684537.779	Monitoring Well	Intermediate	0.8623	S-130	10.90	12.32	1.42	8.82	7.40	8.62	19.72	Static
S-175	222225.601	2684499.744	Monitoring Well	Intermediate	0.8623	S-130	17.49	18.88	1.39	2.55	1.16	2.35	20.04	Static
S-177	222203.514	2684661.306	Monitoring Well	Shallow/Intermediate			NP	17.67			1.89	1.89	19.56	Static
S-178	222187.956	2684660.879	Monitoring Well	Shallow/Intermediate	0.8623	S-130	17.64	17.65	0.01	1.90	1.89	1.89	19.54	Static
S-246A	222348.398	2682915.427	Monitoring Well	Shallow/Intermediate			NP	11.82			-0.06	-0.06	11.76	Static
S-247	222381.399	2682920.978	Monitoring Well	Intermediate			NP	12.48			-0.39	-0.39	12.09	Static
S-248	222393.743	2682933.258	Monitoring Well	Intermediate			NP	10.81			-0.01	-0.01	10.80	Static
S-249	222443.654	2682939.250	Monitoring Well	Intermediate			NP	14.90			-2.29	-2.29	12.61	Static
S-250	222376.211	2683049.960	Monitoring Well	Intermediate	0.8552	S-315	19.04	21.12	2.08	-0.33	-2.42	-0.64	18.71	Static
S-175	222225.601	2684499.744	Monitoring Well	Intermediate	0.8623	S-130	17.49	18.88	1.39	2.55	1.16	2.35	20.04	Static
S-177	222203.514	2684661.306	Monitoring Well	Shallow/Intermediate			NP	17.67			1.89	1.89	19.56	Static
S-178	222187.956	2684660.879	Monitoring Well	Shallow/Intermediate	0.8623	S-130	17.64	17.65	0.01	1.90	1.89	1.89	19.54	Static
S-246A	222348.398	2682915.427	Monitoring Well	Shallow/Intermediate			NP	11.82			-0.06	-0.06	11.76	Static
S-247	222381.399	2682920.978	Monitoring Well	Intermediate			NP	12.48			-0.39	-0.39	12.09	Static
S-248	222393.743	2682933.258	Monitoring Well	Intermediate			NP	10.81			-0.01	-0.01	10.80	Static
S-249	222443.654	2682939.250	Monitoring Well	Intermediate			NP	14.90			-2.29	-2.29	12.61	Static
S-250	222376.211	2683049.960	Monitoring Well	Intermediate	0.8552	S-315	19.04	21.12	2.08	-0.33	-2.42	-0.64	18.71	Static
S-251	222361.858	2683285.544	Monitoring Well	Intermediate			NP	22.71			0.44	0.44	23.15	Static
S-252	222357.226	2683256.323	Monitoring Well	Intermediate			NP	22.70			0.35	0.35	23.05	Static
S-253	222420.464	2683300.367	Monitoring Well	Intermediate			NP	23.08			1.71	1.71	24.79	Static
S-254	222413.907	2683167.598	Monitoring Well	Intermediate	0.8552	S-315	22.71	22.73	0.02	1.65	1.63	1.65	24.36	Static
S-48	222220.541	2684871.017	Monitoring Well	Shallow/Intermediate			NP	18.98			1.85	1.85	20.83	Static
S-53	222278.899	2684179.269	Monitoring Well	Shallow/Intermediate	0.8623	S-130	19.32	19.47	0.15	2.39	2.24	2.37	21.71	Static
S-54	221765.723	2684412.265	Monitoring Well	Shallow/Intermediate	0.8623	S-130	21.55	21.90	0.35	1.42	1.07	1.37	22.97	Static
S-61	221700.585	2683868.702	Monitoring Well	Shallow/Intermediate	0.8623	S-130	16.60	16.65	0.05	1.70	1.65	1.70	18.30	Static
S-62	222318.880	2683629.517	Monitoring Well	Shallow/Intermediate	0.8790	S-142	19.93	19.97	0.04	1.45	1.41	1.44	21.38	Static
S-63	222268.556	2683223.536	Monitoring Well	Shallow/Intermediate	0.8692	S-158	20.54	22.89	2.35	0.84	-1.51	0.53	21.38	Static
S-64	222212.294	2682948.788	Monitoring Well	Shallow/Intermediate	0.9049	S-64/N-48	10.90	10.97	0.07	-0.34	-0.41	-0.35	10.56	Static
S-65	222451.716	2682948.180	Monitoring Well	Shallow/Intermediate	0.9049	S-64/N-48	12.20	12.21	0.01	-1.58	-1.59	-1.58	10.62	Static
S-70	223133.013	2683462.983	Monitoring Well	Shallow/Intermediate			Dry				Dry	Dry	22.10	Static
S-71	223177.687	2683535.027	Monitoring Well	Shallow/Intermediate			NP	20.82			3.22	3.22	24.04	Static

- Notes:

 1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells.
- Based on their total depth, wells screened above the Middle Clay are classified as either a shallow and/or intermediate well.
- Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantek as part of CCR and/or SCR/RIR.
 For wells with no direct LNAPL density measurements, the density value in the nearest well with LNAPL data was used.
- 4. Depth to water and depth to LNAPL provided by Stantec July 2010. All wells gauged on 7/13 & 7/14/10 unless otherwise noted

g/cc = grams per cubic centimeter

<.01 = Sheen or film of product on groundwater. LNAPL = Light Non-Aqueous Phase Liquid

ft amsl = Feet Above Mean Sea Level

GW = Groundwater

NA = Not Applicable

NM = Not Measured

NP = No Product

ft btic = Feet Below Top of Inner Casing

Table 3 **Summary of Groundwater and LNAPL Elevations** July 2010 AOI 2

Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Monitoring Point ID	Northing	Easting	Well Type	Well Classification ¹	Used for G	ravity (g/cc) W Correction	Depth to Product (ft btic)	Depth to GW ⁴ (ft btic)	Apparent LNAPL Thickness (ft)	LNAPL Elevation (ft amsl)	GW Elevation (ft amsl)	Corrected GW Elevation (ft amsl)	TIC Elevation (ft amsl)	Static/ Pumping
					S.G. ²	Source ³								
S-72	223834.943	2683824.526	Monitoring Well	Shallow/Intermediate			NP	26.47			4.59	4.59	31.06	Static
S-72D	223838.100	2683833.766	Monitoring Well	Deep			NP	33.31			1.20	1.20	34.51	Static
S-91	222271.265	2684187.983	Monitoring Well	Shallow/Intermediate	0.8623	S-130	20.29	20.31	0.02	2.84	2.82	2.84	23.13	Static
S-92	222193.905	2684428.041	Monitoring Well	Shallow/Intermediate	0.8623	S-130	12.78	13.05	0.27	7.40	7.13	7.36	20.18	Static
S-93	222338.734	2683258.775	Monitoring Well	Shallow/Intermediate	0.8692	S-158	21.72	22.21	0.49	0.52	0.03	0.46	22.24	Static
SD-1	223203.927	2683363.204	Monitoring Well	Shallow/Intermediate			NP	8.34			10.77	10.77	19.11	Static
S-292	223718.469	2683561.768	Monitoring Well	Shallow/Intermediate			Dry	Dry			Dry	Dry	28.77	Static
S-294	224162.262	2684672.756	Monitoring Well	Shallow/Intermediate			NP	29.58			4.89	4.89	34.47	Static
S-294D	224164.508	2684682.460	Monitoring Well	Deep			NP	32.33			2.35	2.35	34.68	Static
S-295	223800.510	2684379.192	Monitoring Well	Shallow/Intermediate			NP	23.21			9.53	9.53	32.74	Static
S-297	223495.264	2683614.221	Monitoring Well	Shallow/Intermediate	0.8229	S-297	26.05	26.50	0.45	3.97	3.52	3.89	30.02	Static
S-298	223263.415	2683858.759	Monitoring Well	Shallow/Intermediate			NP	20.06			6.94	6.94	27.00	Static
S-299	222978.196	2683545.486	Monitoring Well	Shallow/Intermediate			NP	21.11			2.89	2.89	24.00	Static
S-300	222829.549	2684308.401	Monitoring Well	Shallow/Intermediate			NP	21.76			3.52	3.52	25.28	Static
S-301	222550.150	2684441.814	Monitoring Well	Shallow/Intermediate			NP	19.85			3.27	3.27	23.12	Static
S-302	222612.708	2683250.986	Monitoring Well	Shallow/Intermediate			NP	21.96			1.99	1.99	23.95	Static
S-302D	222606.828	2683247.675	Monitoring Well	Deep			NP	24.60			0.00	0.00	24.60	Static
S-303	222409.188	2683678.208	Monitoring Well	Shallow/Intermediate			NP	24.38			-1.79	-1.79	22.59	Static
S-304	222276.798	2684505.689	Monitoring Well	Shallow/Intermediate			NP	12.90			9.28	9.28	22.18	Static
S-305	221997.384	2684882.600	Monitoring Well	Shallow/Intermediate			NP	18.20			1.53	1.53	19.73	Static
S-305D	221989.608	2684881.879	Monitoring Well	Deep			NP	19.66			0.82	0.82	20.48	Static
S-306	222297.333	2683117.453	Monitoring Well	Shallow/Intermediate			NP	22.73			-0.26	-0.26	22.47	Static
S-307	221764.243	2683507.725	Monitoring Well	Shallow/Intermediate			NP	19.86			-1.29	-1.29	18.57	Static
S-308	221383.028	2682915.492	Monitoring Well	Shallow/Intermediate			NP	24.42			3.69	3.69	28.11	Static
S-309	221511.876	2683391.028	Monitoring Well	Shallow/Intermediate			NP	17.92			1.81	1.81	19.73	Static
S-310	221511.275	2683799.677	Monitoring Well	Shallow/Intermediate			NP	12.23			5.17	5.17	17.40	Static
S-311	221517.843	2684447.587	Monitoring Well	Shallow/Intermediate	0.8623	S-130	24.92	24.93	0.01	1.26	1.25	1.25	26.18	Static
S-312	221608.820	2684972.955	Monitoring Well	Shallow/Intermediate			NP	8.91			8.97	8.97	17.884	Static
S-313	222419.862	2683327.259	Monitoring Well	Shallow/Intermediate	0.8694	S-313	21.97	22.09	0.12	1.75	1.63	1.73	23.72	Static
S-314	222411.148	2683250.135	Monitoring Well	Shallow/Intermediate			NP	22.73			1.59	1.59	24.32	Static
S-315	222405.884	2683224.519	Monitoring Well	Shallow/Intermediate	0.8552	S-315	21.98	24.27	2.29	1.88	-0.41	1.55	23.86	Static
S-316	222403.965	2683193.662	Monitoring Well	Shallow/Intermediate			NP	21.87			2.09	2.09	23.96	Static
S-317	222440.177	2683227.037	Monitoring Well	Shallow/Intermediate			NP	21.72			1.70	1.70	23.42	Static
S-318	222515.986	2683216.416	Monitoring Well	Shallow/Intermediate			NP	21.89			1.86	1.86	23.75	Static
S-328	222582.161	2683641.906	Monitoring Well	Shallow/Intermediate			NP	19.43			2.54	2.54	21.97	Static

- Notes:

 1. Well type was chosen based on the formation the well screens. Wells screened within the Middle Clay or the Farrington Sand were classified as deep wells.
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- Specific Gravity (S.G.) values were determined from LNAPL samples collected by Aquaterra/Stantek as part of CCR and/or SCR/RIR.
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- 4. Depth to water and depth to LNAPL provided by Stantec July 2010. All wells gauged on 7/13 & 7/14/10 unless otherwise noted

g/cc = grams per cubic centimeter

<.01 = Sheen or film of product on groundwater. LNAPL = Light Non-Aqueous Phase Liquid

ft amsl = Feet Above Mean Sea Level

GW = Groundwater

NA = Not Applicable

NM = Not Measured

NP = No Product

ft btic = Feet Below Top of Inner Casing

Table 4 Summary of Soil Sample Analytical Results AOI-2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

			Location	Δ	OI-2			AOI-2	2	A	OI-2		А	OI-2		Δ	OI-2			AOI-2	
		DADEDN	Sample ID	S-2	97_0-2	2	S	-298_1	I-2	S-2	99_0-2		S-3	00_0-2	2	S-30)2S_1-	2	S-	-303_0-	-2
		PADEP Non-	Sample Date	5/4	1/2010		5/	/25/20	10	6/8	3/2010		5/19	9/2010	0	5/1	2/2010)	5/	21/201	10
Chemical Name	CAS No	Residential Used Aquifer Soil MSCs	Sample Matrix		Soil			Soil			Soil		:	Soil			Soil			Soil	
		(TDS<2,500)	Start Depth		0			1			0			0			1			0	
		(100\2,500)	End Depth		2			2			2			2			2			2	
			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Volatile Organic Compounds																					
1,2,4-TRIMETHYLBENZENE	95-63-6	20000	ug/kg	ND	U	5	ND	U	1100	ND	U	5	80	J	65	ND	U	5	670		120
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE	106-93-4	5	ug/kg	ND	U	5	ND	U	1100	ND	U	5	ND	U	65	ND	U	5	ND	U	120
1,2-DICHLOROETHANE	107-06-2	500	ug/kg	ND	U	5	ND	U	1100	ND	U	5	ND	U	65	ND	U	5	ND	U	120
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6200	ug/kg	ND	U	5	ND	U	1100	ND	U	5	ND	U	65	ND	U	5	ND	U	120
BENZENE	71-43-2	500	ug/kg	ND	U	5	1200	J	530	ND	U	5	130	J	33	ND	U	5	140	J	60
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	1000000	ug/kg	ND	U	5	ND	U	1100	ND	U	5	140	J	65	ND	U	5	520	J	120
ETHYLBENZENE	100-41-4	70000	ug/kg	ND	U	5	ND	U	1100	ND	U	5	110	J	65	ND	U	5	220	J	120
ISOPROPYLBENZENE (CUMENE)	98-82-8	1600000	ug/kg	ND	U	5	ND	U	1100	ND	U	5	ND	U	65	ND	U	5	3600		120
TERT-BUTYL METHYL ETHER	1634-04-4	2000	ug/kg	ND	U	5	ND	U	530	ND	U	5	ND	U	33	ND	U	5	ND	U	60
TOLUENE	108-88-3	100000	ug/kg	ND	U	5	ND	U	1100	ND	U	5	99	J	65	ND	U	5	ND	U	120
Semi-volatile Organic Compounds																					
ANTHRACENE	120-12-7	350000	ug/kg	ND	U	170	1600		37	ND	U	170	ND	U	380	ND	U	190	540	J	380
BENZO(A)ANTHRACENE	56-55-3	320000	ug/kg	ND	U	170	2500		37	ND	U	170	ND	U	380	ND	U	190	2100		380
BENZO(A)PYRENE	50-32-8	46000	ug/kg	180		170	1500		37	ND	U	170	ND	U	380	ND	U	190	1800	J	380
BENZO(B)FLUORANTHENE	205-99-2	170000	ug/kg	240		170	2100		37	ND	U	170	ND	U	380	ND	U	190	1300	J	380
BENZO(G,H,I)PERYLENE	191-24-2	180000	ug/kg	ND	U	170	660		37	ND	U	170	ND	U	380	ND	U	190	1400	J	380
CHRYSENE	218-01-9	230000	ug/kg	170		170	2700		37	ND	U	170	ND	U	380	ND	U	190	6900		380
FLUORENE	86-73-7	3800000	ug/kg	ND	U	170	3300		37	ND	U	170	ND	U	380	ND	U	190	1100	J	380
NAPHTHALENE	91-20-3	25000	ug/kg	ND	U	170	1400		37	ND	U	170	ND	U	380	ND	U	190	2200		380
PHENANTHRENE	85-01-8	1000000	ug/kg	ND	U	170	6900		370	ND	U	170	550	J	380	ND	U	190	2400		380
PYRENE	129-00-0	2200000	ug/kg	280		170	5500		370	ND	U	170	500	J	380	ND	U	190	1700	J	380
Metals																					
LEAD	7439-92-1	450	mg/kg	58.7		0.21	96		0.0336	12.2		0.2	168		0.08	47.7		0.23	121		0.0848
General Chemistry																					
MOISTURE, PERCENT	MOIST	NC	%	4		0.5	10.7		0.5	2.1		0.5	11.7		0.5	13.1		0.5	12.4		0.5

Notes:

PADEP - Pennsylvania Department of Environmental Protection

ug/kg - microgram per kilogram

mg/kg - milligram per kilogram

MSC - PADEP's Medium Specific Concentration for Soil

RL - Reporting Limit

ND - Not Detected

NC - No Criteria

TDS - Total Dissolved Solids

Qualifiers:

Q - Lab Qualifier

U - The analyte was analyzed but not detected

E - The analyte exceeded the calibration range of the instrument

J - Estimated value – The result is \geq the MDL and < the LOQ.

Exceedance Summary:

10 10 Result exceeds the PADEP Non-Residential Soil MSC RL exceeds the PADEP Non-Residential Soil MSC

Table 4 Summary of Soil Sample Analytical Results AOI-2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

			Location	-	OI-2			AOI-2		Δ	OI-2		Α	OI-2		Α	OI-2		Δ	OI-2		-	4OI-2	
		DADEDNI	Sample ID	S-30	05S_0-	.2	S-3	306_0-2	2	S-3	07_0-2	2	S-3	08_1-2	2	S-3	09_1-2	2	S-3	10_1-2	2	S-3	311_1-2	<u> </u>
		PADEP Non- Residential Used	Sample Date	5/1	9/201	0	5/2	20/2010)	6/1	0/201	0	4/3	0/2010)	4/2	9/201	0	4/2	9/201	0	4/2	29/2010)
Chemical Name	CAS No	Aquifer Soil MSCs	Sample Matrix		Soil			Soil		,	Soil		;	Soil		;	Soil			Soil			Soil	
		(TDS<2,500)	Start Depth		0			0			0			1			1			1			1	
		(100/2,300)	End Depth		2			2			2			2			2			2			2	
			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
Volatile Organic Compounds																								
1,2,4-TRIMETHYLBENZENE	95-63-6	20000	ug/kg	63	J	57	190	J	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	45		5
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE	106-93-4	5	ug/kg	ND	U	<i>57</i>	ND	U	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
1,2-DICHLOROETHANE	107-06-2	500	ug/kg	ND	U	57	ND	U	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6200	ug/kg	ND	U	57	63	J	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	39		5
BENZENE	71-43-2	500	ug/kg	ND	U	29	160	J	29	ND	U	5	ND	U	4	24		5	ND	U	4	52		5
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	1000000	ug/kg	92	J	57	360		58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	44		5
ETHYLBENZENE	100-41-4	70000	ug/kg	ND	U	57	92	J	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
ISOPROPYLBENZENE (CUMENE)	98-82-8	1600000	ug/kg	ND	U	57	ND	U	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
TERT-BUTYL METHYL ETHER	1634-04-4	2000	ug/kg	ND	U	29	ND	U	29	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
TOLUENE	108-88-3	100000	ug/kg	ND	U	57	140	J	58	ND	U	5	ND	U	4	ND	U	5	ND	U	4	ND	U	5
Semi-volatile Organic Compounds																								
ANTHRACENE	120-12-7	350000	ug/kg	ND	U	39	710		39	ND	U	180	ND	U	190	390		190	ND	U	180	ND	U	200
BENZO(A)ANTHRACENE	56-55-3	320000	ug/kg	ND	U	39	1600		39	320		180	ND	U	190	860		190	ND	U	180	330		200
BENZO(A)PYRENE	50-32-8	46000	ug/kg	ND	U	39	1300		39	290		180	ND	U	190	470		190	ND	U	180	240		200
BENZO(B)FLUORANTHENE	205-99-2	170000	ug/kg	ND	U	39	1700		39	340		180	ND	U	190	580		190	ND	U	180	310		200
BENZO(G,H,I)PERYLENE	191-24-2	180000	ug/kg	ND	U	39	820		39	ND	U	180	ND	U	190	280		190	ND	U	180	ND	U	200
CHRYSENE	218-01-9	230000	ug/kg	ND	U	39	1400		39	300		180	ND	U	190	860		190	190		180	360		200
FLUORENE	86-73-7	3800000	ug/kg	ND	U	39	390		39	ND	U	180	ND	U	190	ND	U	190	ND	U	180	ND	U	200
NAPHTHALENE	91-20-3	25000	ug/kg	ND	U	39	330		39	ND	U	180	ND	U	190	ND	U	190	ND	U	180	ND	U	200
PHENANTHRENE	85-01-8	10000000	ug/kg	ND	U	39	2800		39	570		180	ND	U	190	1800		190	ND	U	180	480		200
PYRENE	129-00-0	2200000	ug/kg	ND	U	39	3000		39	560		180	ND	U	190	1600		190	240		180	580		200
Metals																								
LEAD	7439-92-1	450	mg/kg	161		0.08	145		0.08	48.4		0.21	18.9		0.22	64.7		0.22	40.8		0.22	166		0.59
General Chemistry																								
MOISTURE, PERCENT	MOIST	NC	%	13.8		0.5	13.5		0.5	6.2		0.5	13.3		0.5	12.6		0.5	9.9		0.5	16.4		0.5

Notes:

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Exceedance Summary:

10 10 Result exceeds the PADEP Non-Residential Soil MSC RL exceeds the PADEP Non-Residential Soil MSC

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Table 4 Summary of Soil Sample Analytical Results AOI-2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

			Location	Δ.	OI-2		A	OI-2		Į.	AOI-2		А	Ol-2			AOI-2		А	OI-2		-	AOI-2	
		PADEP Non-	Sample ID	S-3	12_1-	2	S-3	13_0-2	2	S-3	314_1-2	2	S-3	15_1-2	2	S-	316_1·	-2	S-3	17_0-2	2	S-3	318_1-2	2
		Residential Used	Sample Date	4/2	8/201	0	5/6	3/2010)	5/1	1/201	0	5/1	1/2010)	5/	10/20	10	5/7	/2010		5/1	2/2010	0
Chemical Name	CAS No	Aguifer Soil MSCs	Sample Matrix		SO			Soil			Soil		;	Soil			Soil		;	Soil		·	Soil	
		(TDS<2,500)	Start Depth		1			0			1			1			1			0		·	1	
		(100/2,300)	End Depth		2			2			2			2			2			2		·	2	1
			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	d	RL	Result	Q	RL	Result	Q	RL
Volatile Organic Compounds																								
1,2,4-TRIMETHYLBENZENE	95-63-6	20000	ug/kg	ND	U	5	7400		64	ND	U	5	ND	U	67	ND	\supset	120	ND	U	5	ND	U	5
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE	106-93-4	5	ug/kg	ND	U	5	ND	U	64	ND	U	5	ND	U	<i>67</i>	ND	J	120	ND	U	5	ND	U	5
1,2-DICHLOROETHANE	107-06-2	500	ug/kg	ND	U	5	ND	U	64	ND	U	5	ND	U	67	ND	J	120	ND	U	5	ND	U	5
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6200	ug/kg	ND	U	5	5700		64	ND	U	5	ND	U	67	ND	\supset	120	ND	U	5	ND	U	5
BENZENE	71-43-2	500	ug/kg	ND	U	5	620		32	ND	U	5	190	J	33	ND	J	59	ND	U	5	6		5
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	1000000	ug/kg	ND	U	5	29000		64	ND	U	5	75	J	67	ND	J	120	ND	U	5	ND	U	5
ETHYLBENZENE	100-41-4	70000	ug/kg	ND	U	5	2100		64	ND	U	5	ND	U	67	ND	\supset	120	ND	U	5	ND	U	5
ISOPROPYLBENZENE (CUMENE)	98-82-8	1600000	ug/kg	ND	U	5	3300		64	ND	U	5	ND	U	67	ND	U	120	ND	U	5	ND	U	5
TERT-BUTYL METHYL ETHER	1634-04-4	2000	ug/kg	ND	U	5	ND	U	32	ND	U	5	ND	U	33	ND	U	59	ND	U	5	ND	U	5
TOLUENE	108-88-3	100000	ug/kg	ND	U	5	690		64	ND	U	5	ND	U	67	ND	U	120	ND	U	5	ND	U	5
Semi-volatile Organic Compounds																								
ANTHRACENE	120-12-7	350000	ug/kg	ND	U	200	2300		360	4100		1900	ND	U	940	ND	U	1100	ND	U	200	ND	U	190
BENZO(A)ANTHRACENE	56-55-3	320000	ug/kg	ND	U	200	3400		360	9600		1900	ND	U	940	1200	J	1100	ND	U	200	ND	U	190
BENZO(A)PYRENE	50-32-8	46000	ug/kg	ND	U	200	2500		360	6300		1900	ND	U	940	ND	U	1100	ND	U	200	ND	U	190
BENZO(B)FLUORANTHENE	205-99-2	170000	ug/kg	ND	U	200	3800		360	8100		1900	ND	U	940	1200	J	1100	ND	U	200	ND	U	190
BENZO(G,H,I)PERYLENE	191-24-2	180000	ug/kg	ND	U	200	1700	J	360	2600		1900	ND	U	940	ND	U	1100	ND	U	200	ND	U	190
CHRYSENE	218-01-9	230000	ug/kg	ND	U	200	4700		360	8500		1900	2000	J	940	2500	J	1100	ND	U	200	ND	U	190
FLUORENE	86-73-7	3800000	ug/kg	ND	U	200	1600	J	360	ND	U	1900	ND	U	940	ND	U	1100	ND	U	200	ND	U	190
NAPHTHALENE	91-20-3	25000	ug/kg	ND	U	200	1600	J	360	ND	U	1900	ND	U	940	2300	J	1100	ND	U	200	ND	U	190
PHENANTHRENE	85-01-8	10000000	ug/kg	ND	U	200	7000		360	11000		1900	ND	U	940	1300	J	1100	ND	U	200	280		190
PYRENE	129-00-0	2200000	ug/kg	ND	U	200	7400		360	13000		1900	2100	J	940	3700	J	1100	ND	U	200	200		190
Metals																								
LEAD	7439-92-1	450	mg/kg	54.2		0.24	335		0.16	227		0.56	79.8		0.03	384		0.186	19.8		0.24	860		5.51
General Chemistry																								
MOISTURE, PERCENT	MOIST	NC	%	16.5		0.5	8.5		0.5	11.9		0.5	11.2		0.5	20.9		0.5	17.6		0.5	11.1		0.5

Notes:

PADEP - Pennsylvania Department of Environmental Protection

ug/kg - microgram per kilogram

mg/kg - milligram per kilogram

MSC - PADEP's Medium Specific Concentration for Soil

RL - Reporting Limit

ND - Not Detected

NC - No Criteria

TDS - Total Dissolved Solids

Qualifiers:

- Q Lab Qualifier
- U The analyte was analyzed but not detected
- E The analyte exceeded the calibration range of the instrument
- J Estimated value The result is \geq the MDL and < the LOQ.

Exceedance Summary:

10 10 Result exceeds the PADEP Non-Residential Soil MSC RL exceeds the PADEP Non-Residential Soil MSC

Q:\Data6\2574601\Office Data\Reports\Site Characterization Reports\AOI 2\Tables\Table 4 - AOI2_Summary of Soil Analytical Result081610.xlsx

		PADEP Non-Residential	Location Sample ID	C-	C-140 140_072	010		-HEADE ADER_0			PZ-101 101_071	510		RW-600 -600_07		S-	S-108* 108_072	310	S-1	S-110 110_0723	310	S-	S-132 132_071	310	S-1	S-133 33_071			S-134 134_0714	410
Chemical Name	CAS No	Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample Date Sample Matrix		7/20/201 oundwa			7/14/201 oundwa			/15/201 oundwa			7/23/201 oundwa			//23/201 oundwa			/23/201 oundwa			7/13/201 roundwa			/13/201 oundwa			7/14/2010 oundwa	
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	3		2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	2		2	ND	U	2	3		2	4		2	3		2	3		2	31		2	ND	U	2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	1		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	\Box	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	ND	U	1	ND	U	1	ND	U	1	2		1	1		1	3		1	ND	U	1	1		1	ND	U	1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	2		1	ND	U	1	ND	U	1	ND	U	1	1		1	ND	U	1	ND	U	1	ND	U	1	2		1
Semi-volatile Organic Compounds																														
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	54		50	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	50	ND	U	5	ND	U	5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	50	ND	U	5	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	50	ND	U	5	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	6		5	ND	U	5	ND	U	5	ND	U	5	110		50	ND	U	5	ND	U	5	ND	U	5	ND	U	5
Metals																														
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	0.0011		0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

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MSC - PADEP's Medium Specific Concentration for Groundwater

RL - Reporting Limit ND - Not Detected

TDS - Total Dissolved Solids

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

Qualifiers: Q - Lab Qualifier

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument

		PADEP Non-Residential	Location		S-136			S-137			S-139*			S-140*			S-141*			S-143*			S-153			S-154			S-165	
Chemical Name	CAS No	Used Aquifer TDS <2,500 mg/L	Sample ID Sample Date		136_071 7/15/201		_	137_071 7/13/201			39_071 /12/201			140_071 7/12/201			141_071; 7/12/201			143_072 7/26/201			153_072 7/23/201			/23/201			165_0714 7/14/2010	
		Groundwater MSCs	Sample Matrix	Gr	oundwa	ater	G	roundwa	iter	Gre	oundwa	ter	Gr	oundwa	iter	Gr	oundwa	iter	Gr	roundwa	iter	Gı	roundwa	ter	Gre	oundwa	nter	Gre	oundwa	ter
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	4		2	4		4
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	4
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	2
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	7	ND	1	12		1	88	1	2
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	3		2	3		2	3		2	ND	U	2	36		2	ND	U	2	13	ND	2	7		2	4		4
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	4		1	2		2
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.028	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	ND	U	1	11		1	ND	U	1	7		1	9		1	ND	U	1	4	ND	1	31		1	71	i '	2
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	2	ND	1	11		1	10		2
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	7	ND	1	40		1	18		2
Semi-volatile Organic Compounds																														
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	49	ND	U	49	ND	U	51	ND	U	50	8	ND	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	ND	U	5	ND	U	5	ND	U	49	ND	U	49	91		51	54		50	12	ND	5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	12		5	ND	U	5	ND	U	49	ND	U	49	ND	U	51	ND	U	50	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	5	ND	U	5	ND	U	49	ND	U	49	190		51	ND	U	50	29	ND	5	ND	U	5	7		5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	49	ND	U	49	61		51	ND	U	50	25	ND	5	ND	U	5	ND	U	5
Metals																														
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

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RL - Reporting Limit ND - Not Detected

TDS - Total Dissolved Solids

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

Qualifiers: Q - Lab Qualifier

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument

		PADEP Non-Residential	Location		S-166			S-177			S-246A			S-247			S-248			S-249			S-251*			S-252*			S-253*	
Chemical Name	CAS No	Used Aquifer TDS <2,500 mg/L	Sample ID Sample Date		166_071 7/14/201			·177_071 7/14/201			246_0722 7/22/201			247_072 7/22/201			248_072 7/22/201			249_072 7/22/201			·251_071: 7/12/201			252_071 /12/201			253_0709 7/9/2010	
		Groundwater MSCs	Sample Matrix	Gı	oundwa	nter	G	roundwa	iter	Gr	roundwa	ater	Gr	oundwa	ter	Gr	oundwa	iter	Gr	roundwa	iter	G	roundwa	ter	Gre	oundwa	ater	Gr	oundwa	ter
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	68		10	140		4	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	48		10	42		4	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	5	ND	U	2	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	2		1	ND	U	1	370		5	1300		10	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	7		2	5		2	ND	U	2	ND	U	2	3		2	ND	U	2	34		10	13		4	21		2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	120		5	96		2	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.03	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	10		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	5	5		2	16		1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	5	9		2	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	3		1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	33		5	250		2	ND	U	1
Semi-volatile Organic Compounds																														
CHRYSENE	218-01-9	1.9	ug/l	ND	U	50	ND	U	50	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	49	ND	U	49	ND	U	49
FLUORENE	86-73-7	1900	ug/l	ND	U	50	ND	U	50	ND	U	5	ND	U	5	7		5	ND	U	5	ND	U	49	ND	U	49	ND	U	49
NAPHTHALENE	91-20-3	100	ug/l	ND	U	50	ND	U	50	ND	U	5	ND	U	5	ND	U	5	ND	U	5	ND	U	49	ND	U	49	ND	U	49
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	50	ND	U	50	ND	U	5	ND	U	5	9		5	ND	U	5	ND	U	49	ND	U	49	ND	U	49
PYRENE	129-00-0	130	ug/l	ND	U	50	ND	U	50	ND	U	5	ND	U	5	7		5	ND	U	5	ND	U	49	ND	U	49	ND	U	49
Metals																														
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

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		PADEP Non-Residential	Location Sample ID	S-	S-294 294_071!	510	S-2	S-295* 95_0715	10		S-298** 98_0708			S-299* 299_070		S-:	S-300* 300_070	810	S-S	S-301* 301_070		S-	S-302* 302_070			S-303* 303_072			S-304* 304_0708	
Chemical Name	CAS No	Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Sample Date Sample Matrix		7/15/201 roundwa			/15/201			7/8/2010 oundwa			7/8/201 oundwa			7/8/201			7/8/2010 oundwa			7/9/201 roundwa			0/26/20 oundwa			7/8/2010 roundwa	
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	410		20	360		10	620		10	ND	U	2	ND	U	2	9		2	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	130		20	130		10	210		10	ND	U	2	ND	U	2	4		2	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	10	ND	\subset	5	ND	U	5	DN	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	130		10	1900		50	90		5	ND	U	1	14		1	9		1	ND	U	1	6		1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	110		20	71		10	29		10	22		2	29		2	41		2	50		2	13		2	3		2
ETHYLBENZENE	100-41-4	700	ug/l	470		10	140		5	68		5	DN	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.028	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	ND	U	10	ND	\subset	5	ND	U	5	16		1	81		1	4		1	9		1	ND	U	1	ND	U	1
TOLUENE	108-88-3	1000	ug/l	ND	U	10	560		5	170		5	ND	U	1	ND	U	1	ND	U	1	ND	U	1	1		1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	720		10	1200		5	520		5	2		1	ND	U	1	ND	U	1	1		1	2		1	ND	U	1
Semi-volatile Organic Compounds																														
CHRYSENE	218-01-9	1.9	ug/l	140		47	ND	U	50	ND	U	50	ND	U	49	ND	U	49	ND	U	500	ND	U	49	ND	U	24	ND	U	49
FLUORENE	86-73-7	1900	ug/l	480		47	ND	U	50	ND	U	50	ND	U	49	ND	U	49	ND	U	500	ND	U	49	28		24	ND	U	49
NAPHTHALENE	91-20-3	100	ug/l	8500		470	740		50	190		50	ND	U	49	ND	U	49	ND	U	500	ND	U	49	48		24	ND	U	49
PHENANTHRENE	85-01-8	1100	ug/l	1000		47	97		50	110		50	ND	U	49	ND	U	49	ND	U	500	65		49	54		24	ND	U	49
PYRENE	129-00-0	130	ug/l	380		47	ND	U	50	55		50	ND	U	49	ND	U	49	ND	U	500	ND	U	49	ND	U	24	ND	U	49
Metals																														
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	1.04		0.005	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater

RL - Reporting Limit ND - Not Detected

TDS - Total Dissolved Solids

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

Qualifiers: Q - Lab Qualifier

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument

		PADEP Non-Residential	Location		S-305	440	0.4	S-306*		•	S-307			S-309*			S-310*	040		S-312	040		S-314*	040		S-316*			S-317*	
Chemical Name	CAS No	Used Aquifer TDS <2,500 mg/L	Sample ID Sample Date		305_071 7/14/201			306_0709 7/9/2010			07_0713 /13/201			309_070 7/8/201			310_070 7/8/201			312_0708 7/8/2010			314_0709 7/9/2010			316_070 7/9/201			317_0709 7/9/2010	
		Groundwater MSCs	Sample Matrix	Gr	oundwa	nter	Gr	oundwa	ter	Gro	oundwa	ter	Gr	oundwa	iter	Gr	oundwa	iter	Gre	oundwa	ter	Gr	oundwa	ater	Gre	oundwa	nter	Gr _'	oundwa	ter
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	4	40		2	ND	U	2	ND	U	2	ND	U	2	ND	U	2									
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	4	52		2	ND	U	2	ND	U	2	ND	U	2	ND	U	2									
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	2	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	2	740		10	ND	U	1	ND	U	1	ND	U	1	ND	U	1	1		1	5		1	1		1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	58		4	73		2	ND	U	2	17		2	ND	U	2	ND	U	2	100		2	36		2	84		2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	2	490		10	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.028	ND	U	0.029	ND	U	0.029	ND	U	0.028	ND	U	0.029	ND	U	0.027	ND	U	0.029	ND	U	0.028
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	2		2	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	4		1	2		1	9		1
TOLUENE	108-88-3	1000	ug/l	ND	U	2	52		1	ND	U	1	ND	U	1	ND	U	1	1		1									
XYLENES (TOTAL)	1330-20-7	10000	ug/l	ND	U	2	300		1	ND	U	1	2		1	3		1	3		1									
Semi-volatile Organic Compounds																														
CHRYSENE	218-01-9	1.9	ug/l	ND	U	50	ND	U	500	ND	U	5	ND	U	49	ND	U	49	ND	U	5	ND	U	500	ND	U	49	ND	U	500
FLUORENE	86-73-7	1900	ug/l	ND	U	50	ND	U	500	ND	U	5	ND	U	49	ND	U	49	ND	U	5	870		500	ND	U	49	ND	U	500
NAPHTHALENE	91-20-3	100	ug/l	ND	U	50	670		500	ND	U	5	ND	U	49	ND	U	49	ND	U	5	ND	U	500	ND	U	49	ND	U	500
PHENANTHRENE	85-01-8	1100	ug/l	66		50	850		500	ND	U	5	ND	U	49	ND	U	49	ND	U	5	1900		500	ND	U	49	ND	U	500
PYRENE	129-00-0	130	ug/l	ND	U	50	ND	U	500	ND	U	5	ND	U	49	ND	U	49	ND	U	5	ND	U	500	ND	U	49	ND	U	500
Metals																														
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater

RL - Reporting Limit ND - Not Detected

TDS - Total Dissolved Solids

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

Qualifiers: Q - Lab Qualifier

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument

		PADEP Non-Residential	Location		S-318*			S-328			S-48*			S-71			S-72			SD-1*	
		Used Aguifer TDS	Sample ID		318_070			328_071		_	48_0714			71_0715			·72_071)-1_0723	
Chemical Name	CAS No	<2,500 mg/L	Sample Date		7/9/201	0	7	7/12/201	10	7.	/14/201	10	7.	/15/201	0		7/15/201	10	7	/23/201	0
		Groundwater MSCs	Sample Matrix	Gr	oundwa	iter	Gr	oundwa	ater	Gro	oundwa	ater	Gro	oundwa	iter	Gı	oundwa	ater	Gr	oundwa	iter
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	4		2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	ND	U	2	ND	U	2	ND	U	2	ND	U	2	ND	U	2	3		2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	2		1	ND	U	1	370		10
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	51		2	13		2	48		2	6		2	35		2	2		2
ETHYLBENZENE	100-41-4	700	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	1		1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	20		1	3		1	8		1	440		1	ND	U	1	22		1
TOLUENE	108-88-3	1000	ug/l	ND	U	1	ND	U	1	ND	U	1	1		1	2		1	11		1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	1		1	ND	U	1	ND	U	1	3		1	4		1	15		1
Semi-volatile Organic Compounds																					
CHRYSENE	218-01-9	1.9	ug/l	ND	U	48	ND	U	5	75		50	ND	U	5	14		5	ND	U	48
FLUORENE	86-73-7	1900	ug/l	ND	U	48	ND	U	5	690		50	ND	U	5	13		5	ND	U	48
NAPHTHALENE	91-20-3	100	ug/l	ND	U	48	ND	U	5	ND	U	50	ND	U	5	ND	U	5	ND	U	48
PHENANTHRENE	85-01-8	1100	ug/l	ND	U	48	12		5	1900		500	ND	U	5	10		5	ND	U	48
PYRENE	129-00-0	130	ug/l	ND	U	48	ND	U	5	340		50	ND	U	5	20		5	ND	U	48
Metals																					
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection
ug/l - microgram per liter
mg/l - milligram per liter
MSC - PADEP's Medium Specific Concentration for Groundwater

RL - Reporting Limit ND - Not Detected

TDS - Total Dissolved Solids

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

Qualifiers: Q - Lab Qualifier

U - The analyte was analyzed but not detected
E - The analyte exceeded the calibration range of the instrument

Table 6 Summary of Groundwater Analytical Results Deep (Lower Sand) Monitoring Wells AOI-2

Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Chemical Name	CAS No	PADEP Non-Residential Used Aquifer TDS <2,500 mg/L Groundwater MSCs	Location Sample ID Sample Date	S-29	S-294D 94D_072 /23/201	2310		S-302D 02D_072 /26/201	2610		S-305D 05D_072 /26/201	2610	S-72	S-72D 2D_072 /23/201	310
		IVISCS	Sample Matrix	Gre	oundwa	ater	Gr	oundwa	ter	Gr	oundwa	ter	Gro	undwa	iter
Volatile Organic Compounds			Units	Result	Q	RL	Result	Q	RL	Result	Q	RL	Result	Q	RL
1,2,4-TRIMETHYLBENZENE	95-63-6	35	ug/l	15		2	ND	U	2	ND	U	2	ND	U	2
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	35	ug/l	6		2	ND	U	2	ND	U	2	ND	U	2
1,2-DICHLOROETHANE	107-06-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1
BENZENE	71-43-2	5	ug/l	ND	U	1	ND	U	1	ND	U	1	ND	U	1
ISOPROPYLBENZENE (CUMENE)	98-82-8	2300	ug/l	3		2	ND	U	2	5		2	ND	U	2
ETHYLBENZENE	100-41-4	700	ug/l	17		1	ND	U	1	ND	U	1	ND	U	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	0.05	ug/l	ND	U	0.029	ND	U	0.029	ND	U	0.029	ND	U	0.029
TERT-BUTYL METHYL ETHER	1634-04-4	20	ug/l	ND	U	1	ND	U	1	ND	U	1	1		1
TOLUENE	108-88-3	1000	ug/l	1		1	ND	U	1	ND	U	1	ND	U	1
XYLENES (TOTAL)	1330-20-7	10000	ug/l	19		1	ND	U	1	ND	U	1	1		1
Semi-volatile Organic Compounds															
CHRYSENE	218-01-9	1.9	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5
FLUORENE	86-73-7	1900	ug/l	6		5	ND	U	5	ND	U	5	ND	U	5
NAPHTHALENE	91-20-3	100	ug/l	140		24	ND	U	5	ND	U	5	ND	U	5
PHENANTHRENE	85-01-8	1100	ug/l	8		5	ND	U	5	ND	U	5	ND	U	5
PYRENE	129-00-0	130	ug/l	ND	U	5	ND	U	5	ND	U	5	ND	U	5
Metals															
LEAD	7439-92-1	0.005	mg/l	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001

Notes:

PADEP - Pennsylvania Department of Environmental Protection

ug/l - microgram per liter

mg/l - milligram per liter

MSC - PADEP's Medium Specific Concentration for Groundwater

RL - Reporting Limit

ND - Not Detected

TDS - Total Dissolved Solids

- * Samples required an initial dilution due to sample matrix interference.
- ** Samples were diluted.

Qualifiers:

Q - Lab Qualifier

U - The analyte was analyzed but not detected

E - The analyte exceeded the calibration range of the instrument

Exceedance Summary:

10 - Result exceeds the PADEP Non-Residential Groundwater MSC

- RL exceeds the PADEP Non-Residential Groundwater MSC

Table 7 Summary of Soil Analytical Results Screened for Protection of Indoor Air AOI-2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

				Location	AOI-2	AOI-2	AOI-2	AOI-2	AOI-2						
		USEPA-PA Defaults	USEPA-PA Defaults	Sample ID	C-137_1-2	S-135_0-2	S-297_0-2	S-298_1-2	S-299_0-2	S-300_0-2	S-302S_1-2	S-303_0-2	S-305S_0-2	S-306_0-2	S-307_0-2
		Nonresidential	Nonresidential PELs	Sample Date	5/27/2010	6/10/2010	5/4/2010	5/25/2010	6/8/2010	5/19/2010	5/12/2010	5/21/2010	5/19/2010	5/20/2010	6/10/2010
Chemical Name	CAS No	Volatilization to	Volatilization to	Sample Matrix	Soil	Soil	Soil	Soil	Soil						
		Indoor Air Screen	Indoor Air Screen	Start Depth	1	0	0	1	0	0	1	0	0	0	0
		maddi Ali Galdan	macor Am Corcon	End Depth	2	2	2	2	2	2	2	2	2	2	2
				Units	Result	Result	Result	Result	Result						
Volatile Organic Compounds															
1,2,4-TRIMETHYLBENZENE	95-63-6	29,000	310,000	ug/kg	ND	ND	ND	ND	ND	80	ND	670	63	190	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	290	1,000,000	ug/kg	ND	ND	ND	ND	ND						
1,2-DICHLOROETHANE	107-06-2	73	8,300	ug/kg	ND	ND	ND	ND	ND						
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6,400	87,000	ug/kg	ND	ND	ND	63	ND						
BENZENE	71-43-2	630	380,000	ug/kg	ND	ND	ND	1,200	ND	130	ND	140	ND	160	ND
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	77,000	170,000	ug/kg	ND	ND	ND	ND	ND	140	ND	520	92	360	ND
ETHYLBENZENE	100-41-4	9,500	110,000	ug/kg	ND	ND	ND	ND	ND	110	ND	220	ND	92	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	360,000	360,000	ug/kg	9	ND	ND	ND	ND	ND	ND	3,600	ND	ND	ND
TERT-BUTYL METHYL ETHER	1634-04-4	86,000	6,400,000	ug/kg	ND	ND	ND	ND	ND						
TOLUENE	108-88-3	110,000	240,000	ug/kg	ND	ND	ND	ND	ND	99	ND	ND	ND	140	ND
Semi-volatile Organic Compounds															
ANTHRACENE	120-12-7	NOC	NOC	ug/kg	1,900	ND	ND	1,600	ND	ND	ND	540	ND	710	ND
BENZO(A)ANTHRACENE	56-55-3	NCA	NCA	ug/kg	2,300	ND	ND	2,500	ND	ND	ND	2,100	ND	1,600	320
BENZO(A)PYRENE	50-32-8	NCA	NCA	ug/kg	1,900	ND	180	1,500	ND	ND	ND	1,800	ND	1,300	290
BENZO(B)FLUORANTHENE	205-99-2	NCA	NCA	ug/kg	2,200	ND	240	2,100	ND	ND	ND	1,300	ND	1,700	340
BENZO(G,H,I)PERYLENE	191-24-2	NCA	NCA	ug/kg	1,300	ND	ND	660	ND	ND	ND	1,400	ND	820	ND
CHRYSENE	218-01-9	NCA	NCA	ug/kg	2,300	ND	170	2,700	ND	ND	ND	6,900	ND	1,400	300
FLUORENE	86-73-7	NOC	NOC	ug/kg	1,800	ND	ND	3,300	ND	ND	ND	1,100	ND	390	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/kg	5,400	ND	ND	1,400	ND	ND	ND	2,200	ND	330	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/kg	4,400	ND	ND	6,900	ND	550	ND	2,400	ND	2,800	570
PYRENE	129-00-0	NCA	NCA	ug/kg	ND	ND	280	5,500	ND	500	ND	1,700	ND	3,000	560
Metals															
LEAD	7439-92-1	NCA	NCA	mg/kg	251	4.31	58.7	96	12.2	168	47.7	121	161	145	48.4
General Chemistry															
MOISTURE, PERCENT	MOIST	NCA	NCA	%	20.5	3	4	10.7	2.1	11.7	13.1	12.4	13.8	13.5	6.2

Notes:

USEPA - United States Enivironmental Protection Agency

ug/kg - microgram per kilogram mg/kg - milligram per kilogram

ND - Not Detected

NOC - Not of Concern NCA - No Criterion Available

All laboratory qualifiers and reporting limits are provided in Table 4.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Table 7 Summary of Soil Analytical Results Screened for Protection of Indoor Air AOI-2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

				Location	AOI-2	AOI-2									
		USEPA-PA Defaults	USEPA-PA Defaults	Sample ID	S-308_1-2	S-309_1-2	S-310_1-2	S-311_1-2	S-312_1-2	S-313_0-2	S-314_1-2	S-315_1-2	_	S-317_0-2	
		Nonresidential	Nonresidential PELs	Sample Date	4/30/2010	4/29/2010			4/28/2010			5/11/2010	5/10/2010		
Chemical Name	CAS No	Volatilization to	Volatilization to	Sample Matrix	Soil	Soil	Soil	Soil	SO	Soil	Soil	Soil	Soil	Soil	Soil
		Indoor Air Screen	Indoor Air Screen	Start Depth	1	1	1	1	1	0	1	1	1	0	1
		macol 7th Coloon		End Depth	2	2	2	2	2	2	2	2	2	2	2
				Units	Result	Result									
Volatile Organic Compounds															
1,2,4-TRIMETHYLBENZENE	95-63-6	29,000	310,000	ug/kg	ND	ND	ND	45	ND	7,400	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	290	1,000,000	ug/kg	ND	ND									
1,2-DICHLOROETHANE	107-06-2	73	8,300	ug/kg	ND	ND									
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	6,400	87,000	ug/kg	ND	ND	ND	39	ND	5,700	ND	ND	ND	ND	ND
BENZENE	71-43-2	630	380,000	ug/kg	ND	24	ND	52	ND	620	ND	190	ND	ND	6
DIMETHYL BENZENE/ XYLENES, TOTAL	1330-20-7	77,000	170,000	ug/kg	ND	ND	ND	44	ND	29,000	ND	75	ND	ND	ND
ETHYLBENZENE	100-41-4	9,500	110,000	ug/kg	ND	ND	ND	ND	ND	2,100	ND	ND	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	360,000	360,000	ug/kg	ND	ND	ND	ND	ND	3,300	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER	1634-04-4	86,000	6,400,000	ug/kg	ND	ND									
TOLUENE	108-88-3	110,000	240,000	ug/kg	ND	ND	ND	ND	ND	690	ND	ND	ND	ND	ND
Semi-volatile Organic Compounds															
ANTHRACENE	120-12-7	NOC	NOC	ug/kg	ND	390	ND	ND	ND	2,300	4,100	ND	ND	ND	ND
BENZO(A)ANTHRACENE	56-55-3	NCA	NCA	ug/kg	ND	860	ND	330	ND	3,400	9,600	ND	1,200	ND	ND
BENZO(A)PYRENE	50-32-8	NCA	NCA	ug/kg	ND	470	ND	240	ND	2,500	6,300	ND	ND	ND	ND
BENZO(B)FLUORANTHENE	205-99-2	NCA	NCA	ug/kg	ND	580	ND	310	ND	3,800	8,100	ND	1,200	ND	ND
BENZO(G,H,I)PERYLENE	191-24-2	NCA	NCA	ug/kg	ND	280	ND	ND	ND	1,700	2,600	ND	ND	ND	ND
CHRYSENE	218-01-9	NCA	NCA	ug/kg	ND	860	190	360	ND	4,700	8,500	2,000	2,500	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/kg	ND	ND	ND	ND	ND	1,600	ND	ND	ND	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/kg	ND	ND	ND	ND	ND	1,600	ND	ND	2,300	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/kg	ND	1,800	ND	480	ND	7,000	11,000	ND	1,300	ND	280
PYRENE	129-00-0	NCA	NCA	ug/kg	ND	1,600	240	580	ND	7,400	13,000	2,100	3,700	ND	200
Metals			-	3, 3		,				,		,	-,		
LEAD	7439-92-1	NCA	NCA	mg/kg	18.9	64.7	40.8	166	54.2	335	227	79.8	384	19.8	860
General Chemistry															
MOISTURE, PERCENT	MOIST	NCA	NCA	%	13.3	12.6	9.9	16.4	16.5	8.5	11.9	11.2	20.9	17.6	11.1

Notes:

USEPA - United States Enivironmental Protection Agency

ug/kg - microgram per kilogram

mg/kg - milligram per kilogram

ND - Not Detected

NOC - Not of Concern

NCA - No Criterion Available

All laboratory qualifiers and reporting limits are provided in Table 4.

Exceedance Summary:

____________ - Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name		USEPA-PA Defaults Nonresidential	USEPA-PA Defaults Nonresidential PELs	Location Sample ID	C-HEADER	PZ-101 PZ-101 071510	RW-600 RW-600 072310	S-108* S-108 072310	S-110 S-110 072310	S-132 S-132 071310	S-133 S-133 071310	S-134 S-134 071410
	CAS No	Volatilization to Indoor Air Screening Criteria	Volatilization to Indoor Air Screening Criteria	Sample Date	7/14/2010	7/15/2010	7/23/2010	7/23/2010 7/23/2010		7/13/2010	7/13/2010	7/14/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	ND	3	4	3	3	31	ND	ND
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	2	1	3	ND	1	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	ND	ND	1	ND	ND	ND	2
Semi-volatile Organic Compounds												
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	54	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	110	ND	ND	ND	ND
Metals												
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	0.0011	ND	ND	ND

Notes:
USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit ug/I - microgram per liter

mg/l - milligram per liter

ND - Not Detected

NOC - Not of Concern

NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor Air Screening Criteria	USEPA-PA Defaults Nonresidential PELs Volatilization to Indoor Air Screening Criteria	Location Sample ID Sample Date	S-136 S-136_071510 7/15/2010	S-137 S-137_071310 7/13/2010	S-139* S-139_071210 7/12/2010	S-140* S-140_071210 7/12/2010	S-141* S-141_071210 7/12/2010	S-143* S-143_072610 7/26/2010	S-153 S-153_072310 7/23/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	ND	ND	ND	ND	ND	7
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	3	3	3	ND	36	ND	13
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	11	ND	7	9	ND	4
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	2
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	7
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	8
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	91	54	12
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	12	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	ND	ND	190	ND	29
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	61	ND	25
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit ug/I - microgram per liter

mg/l - milligram per liter

ND - Not Detected

NOC - Not of Concern

NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor		Location Sample ID	S-154 S-154_072310	S-165 S-165_071410	S-166 S-166_071410	S-177 S-177_071410	S-246A S-246_072210	S-247 S-247_072210	S-248 S-248_072210
		Air Screening Criteria		Sample Date	7/23/2010	7/14/2010	7/14/2010	7/14/2010	7/22/2010	7/22/2010	7/22/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	4	4	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	12	88	ND	ND	ND	ND	2
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	7	4	7	5	ND	ND	3
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	4	2	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	31	71	10	ND	ND	ND	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	11	10	ND	ND	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	40	18	3	ND	ND	ND	ND
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	7
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	7	ND	ND	ND	ND	9
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	7
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit ug/I - microgram per liter

mg/l - milligram per liter ND - Not Detected

NOC - Not of Concern NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

		USEPA-PA Defaults	USEPA-PA Defaults	Location	S-249	S-251*	S-252	S-253*	S-294	S-295*	S-298**
Chemical Name	CAS No	Nonresidential	Nonresidential PELs	Sample ID	S-249_072210	S-251_071210	S-252_071210	S-253_070910	S-294_071510	S-295_071510	S-298_070810
	CAS NO	Volatilization to Indoor Air Screening Criteria	Volatilization to Indoor Air Screening Criteria	Sample Date	7/22/2010	7/12/2010	7/12/2010	7/9/2010	7/15/2010	7/15/2010	7/8/2010
				Sample Matrix	Groundwater	Groundwater	WG	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	RL	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	68	4	ND	410	360	620
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	48	4	ND	130	130	210
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	2	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	370	10	ND	130	1900	90
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	ND	34	4	21	110	71	29
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	120	2	ND	470	140	68
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	0.029	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	2	16	ND	ND	ND
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	2	ND	ND	560	170
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	ND	33	2	ND	720	1200	520
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	49	ND	140	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	49	ND	480	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	49	ND	8500	740	190
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	49	ND	1000	97	110
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	49	ND	380	ND	55
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	0.001	ND	ND	1.04	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit

ug/l - microgram per liter mg/l - milligram per liter

ND - Not Detected

NOC - Not of Concern

NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name		USEPA-PA Defaults Nonresidential		Location Sample ID	S-299* S-299_070810	S-300* S-300_070810	S-301* S-301_070810	S-302* S-302_070910	S-303** S-303_072610	S-304* S-304_070810	S-305 S-305_071410
	CAS No	Volatilization to Indoor Air Screening Criteria		Sample Date	7/8/2010	7/8/2010	7/8/2010	7/9/2010	7/26/2010	7/8/2010	7/14/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	9	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	4	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	ND	14	9	ND	6	ND	ND
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	22	29	41	50	13	3	58
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	16	81	4	9	ND	ND	2
TOLUENE	108-88-3	NOC	NOC	ug/l	ND	ND	ND	ND	1	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	2	ND	ND	1	2	ND	ND
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	28	ND	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	48	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	ND	65	54	ND	66
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	ND
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit

ug/l - microgram per liter

mg/l - milligram per liter ND - Not Detected

NOC - Not of Concern

NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential	Nonresidential Nonresidential PELs Sample ID S-306_070910 S-307_071310 S-309_070810 S-310_070810 Olatilization to Indoor Volatilization to Indoor Volatilization to Indoor Sample ID S-306_070910 S-307_071310 S-309_070810 S-310_070810	S-310* S-310_070810	S-312 S-312_070810	S-314* S-314_070910	S-316* S-316_070910				
	CAS NO	Volatilization to Indoor Air Screening Criteria		Sample Date	7/9/2010	7/13/2010	7/8/2010	7/8/2010	7/8/2010	7/9/2010	7/9/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	40	ND	ND	ND	ND	ND	ND
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	52	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	740	ND	ND	ND	ND	1	5
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	73	ND	17	ND	ND	100	36
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	490	ND	ND	ND	ND	ND	ND
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	ND	ND	ND	ND	ND	4	2
TOLUENE	108-88-3	NOC	NOC	ug/l	52	ND	ND	ND	ND	ND	ND
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	300	ND	ND	ND	ND	2	3
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	ND	ND	870	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	670	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	850	ND	ND	ND	ND	1900	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	ND	ND	ND	ND
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit

ug/l - microgram per liter

mg/l - milligram per liter

ND - Not Detected NOC - Not of Concern

NCA - No Criterion Available

* - Samples required an initial dilution due to sample matrix interference.

** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air

Chemical Name	CAS No	USEPA-PA Defaults Nonresidential Volatilization to Indoor	Air Screening Criteria	Location Sample ID	S-317* S-317_070910	S-318* S-318_070910	S-328 S-328_071210	S-48* S-48_071410	S-71 S-71_071510	S-72 S-72_071510	SD-1* SD-1_072310
		Air Screening Criteria		Sample Date	7/9/2010	7/9/2010	7/12/2010	7/14/2010	7/15/2010	7/15/2010	7/23/2010
				Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds				Units	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	95-63-6	12,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	4
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	108-67-8	10,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	3
1,2-DICHLOROETHANE	107-06-2	4,600	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
BENZENE	71-43-2	5,900	NOC	ug/l	1	ND	ND	ND	2	ND	370
ISOPROPYLBENZENE (CUMENE)	98-82-8	NOC	NOC	ug/l	84	51	13	48	6	35	2
ETHYLBENZENE	100-41-4	45,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	1
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	1,000	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
TERT-BUTYL METHYL ETHER (MTBE)	1634-04-4	640,000	NOC	ug/l	9	20	3	8	440	ND	22
TOLUENE	108-88-3	NOC	NOC	ug/l	1	ND	ND	ND	1	2	11
XYLENES (TOTAL)	1330-20-7	NOC	NOC	ug/l	3	1	ND	ND	3	4	15
Semi-volatile Organic Compounds											
CHRYSENE	218-01-9	NCA	NCA	ug/l	ND	ND	ND	75	ND	14	ND
FLUORENE	86-73-7	NOC	NOC	ug/l	ND	ND	ND	690	ND	13	ND
NAPHTHALENE	91-20-3	NOC	NOC	ug/l	ND	ND	ND	ND	ND	ND	ND
PHENANTHRENE	85-01-8	NOC	NOC	ug/l	ND	ND	12	1900	ND	10	ND
PYRENE	129-00-0	NCA	NCA	ug/l	ND	ND	ND	340	ND	20	ND
Metals											
LEAD	7439-92-1	NCA	NCA	mg/l	ND	ND	ND	ND	ND	ND	ND

Notes: USEPA - United States Enivironmental Protection Agency

PEL - Permissible Exposure Limit ug/I - microgram per liter

mg/l - milligram per liter

ND - Not Detected NOC - Not of Concern

NCA - No Criterion Available

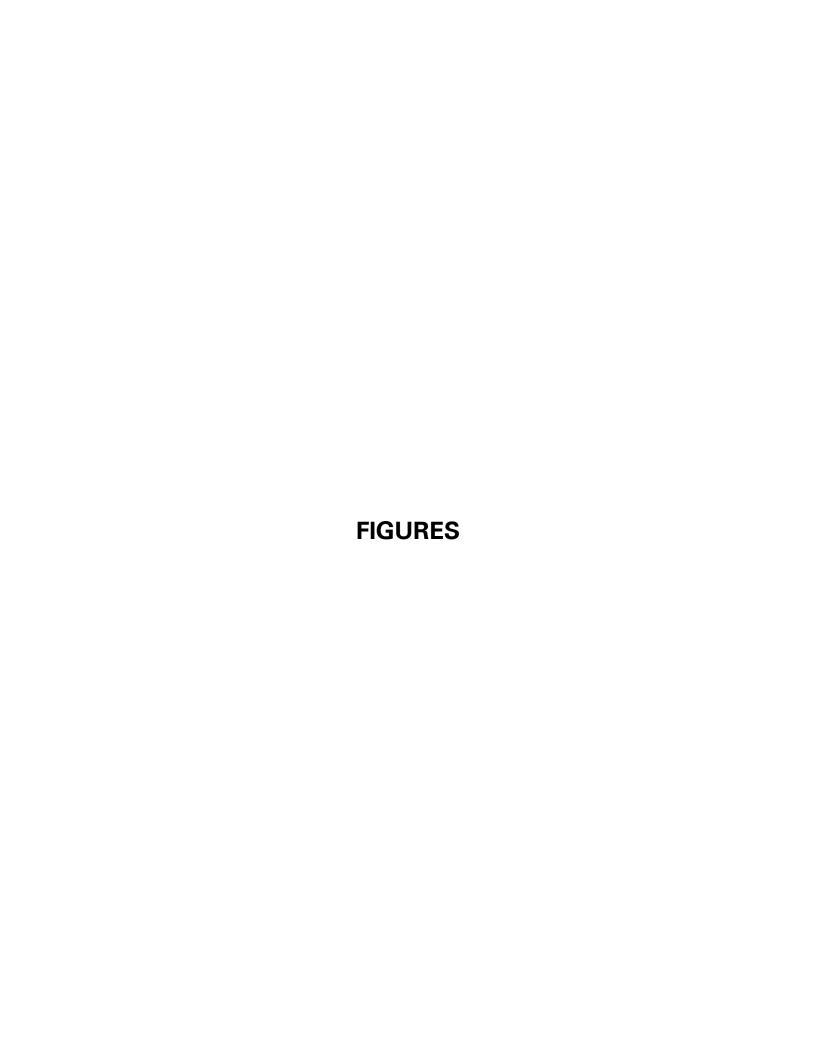
* - Samples required an initial dilution due to sample matrix interference.

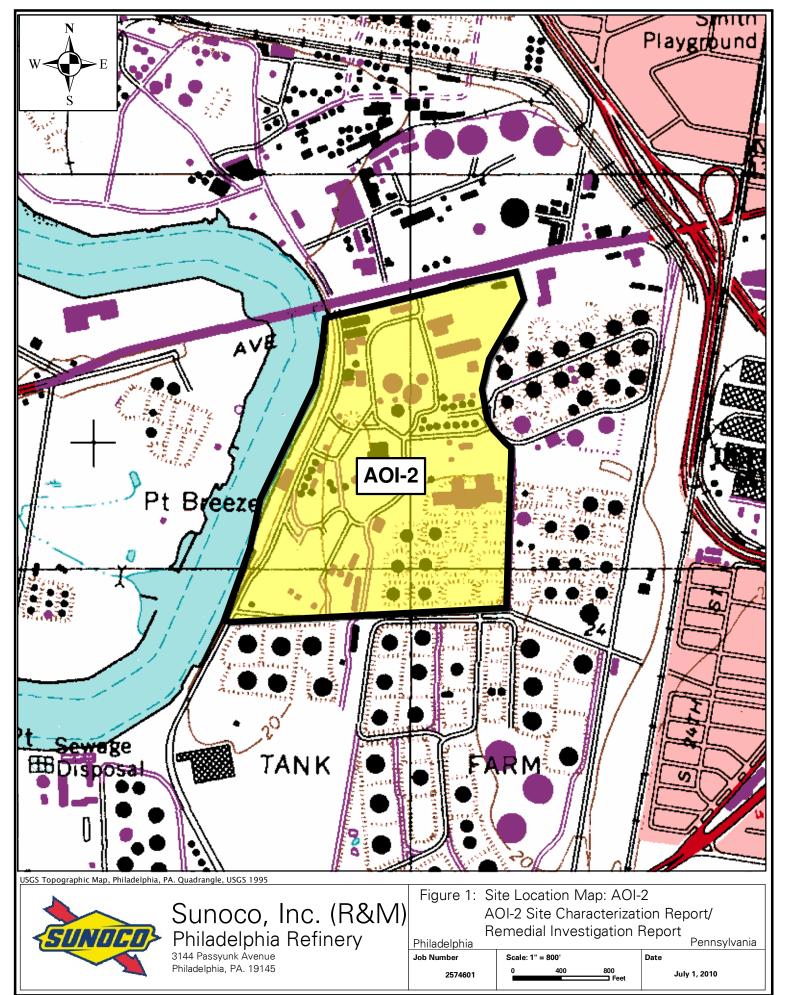
** - Samples were diluted.

All laboratory qualifiers and reporting limits are provided in Tables 5 and 6.

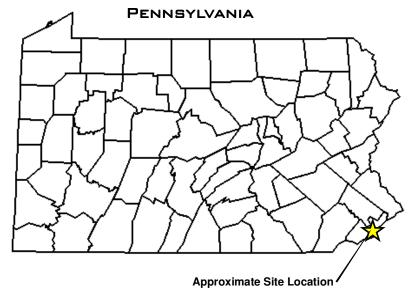
Exceedance Summary:

- Result exceeds the USEPA-PA Default Nonresidential Volatilization to Indoor Air



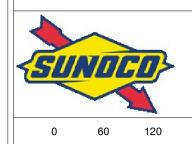






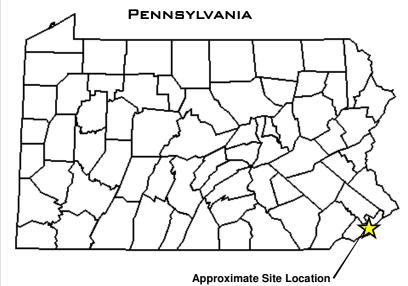
AOIs

Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania



Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145





New Shallow/Intermediate Groundwater Monitoring Well With No Soil Sample Deep Monitoring Well

S=1773 👍 Intermediate Monitoring Well G±1233 👍 Shallow Monitoring Well 9**-1**000 🕁 Shallow/Intermediate Monitoring Well S-251 |

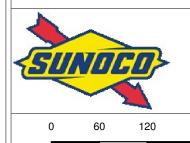
Abandoned/Damaged/Unable to Locate Horizontal Well Location

Pollock Street Sewer

Area of Interest (AOI)

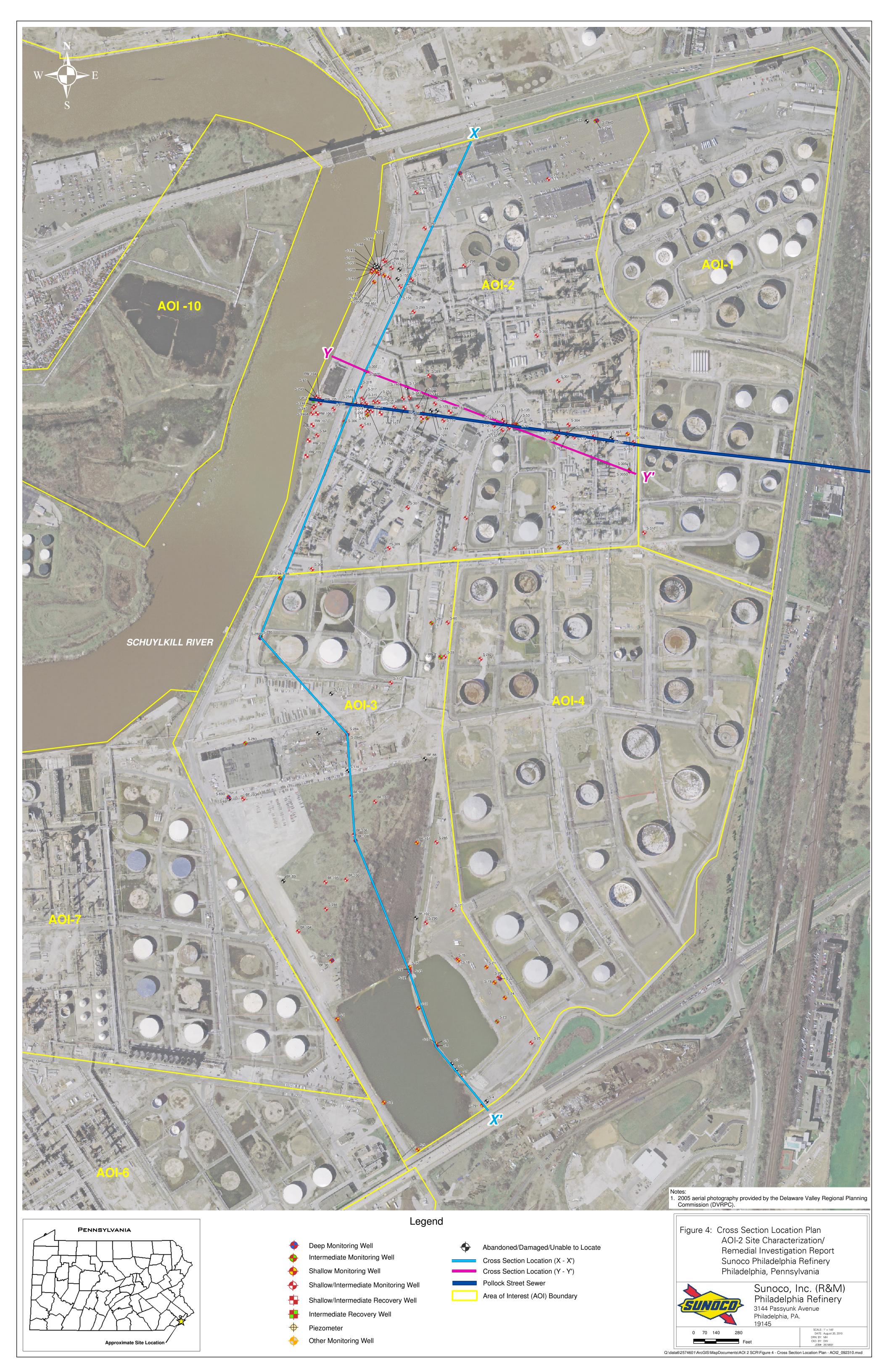
Bulkhead

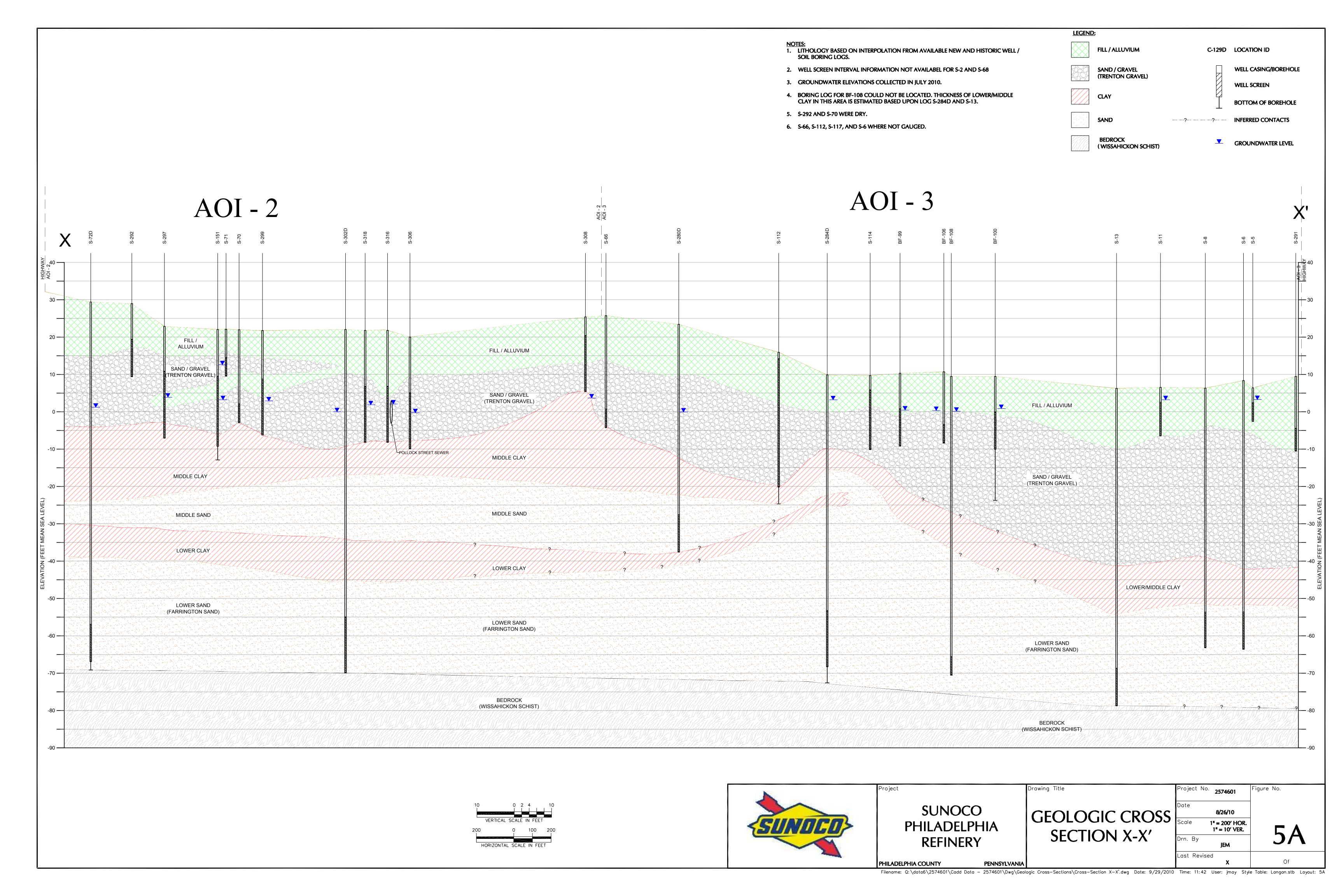
Philadelphia, Pennsylvania



Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA. 19145

Q:\data6\2574601\ArcGIS\MapDocuments\AOI 2 SCR\Figure 3 - Completed Activities Plan - AOI2_9-23-10.mxd





NOTES:
1. LITHOLOGY BASED ON INTERPOLATION FROM AVAILABLE NEW AND HISTORIC WELL/
SOIL BORING LOGS.
2. DEPTH OF BULKHEAD APPROXIMATED FROM DWG. NO. 9-0-1E/140011, SHEET PILING
PLAN POLLOGK STREET SEWER OUTFALL, PREPARED BY TERRY FOUNDATION, INC.,
OCTOBER 11, 1995.
3. GROUNDWATER ELEVATIONS COLLECTED IN JULY 2010.

SAND

CLAY

BOTTOM OF BOREHOLE

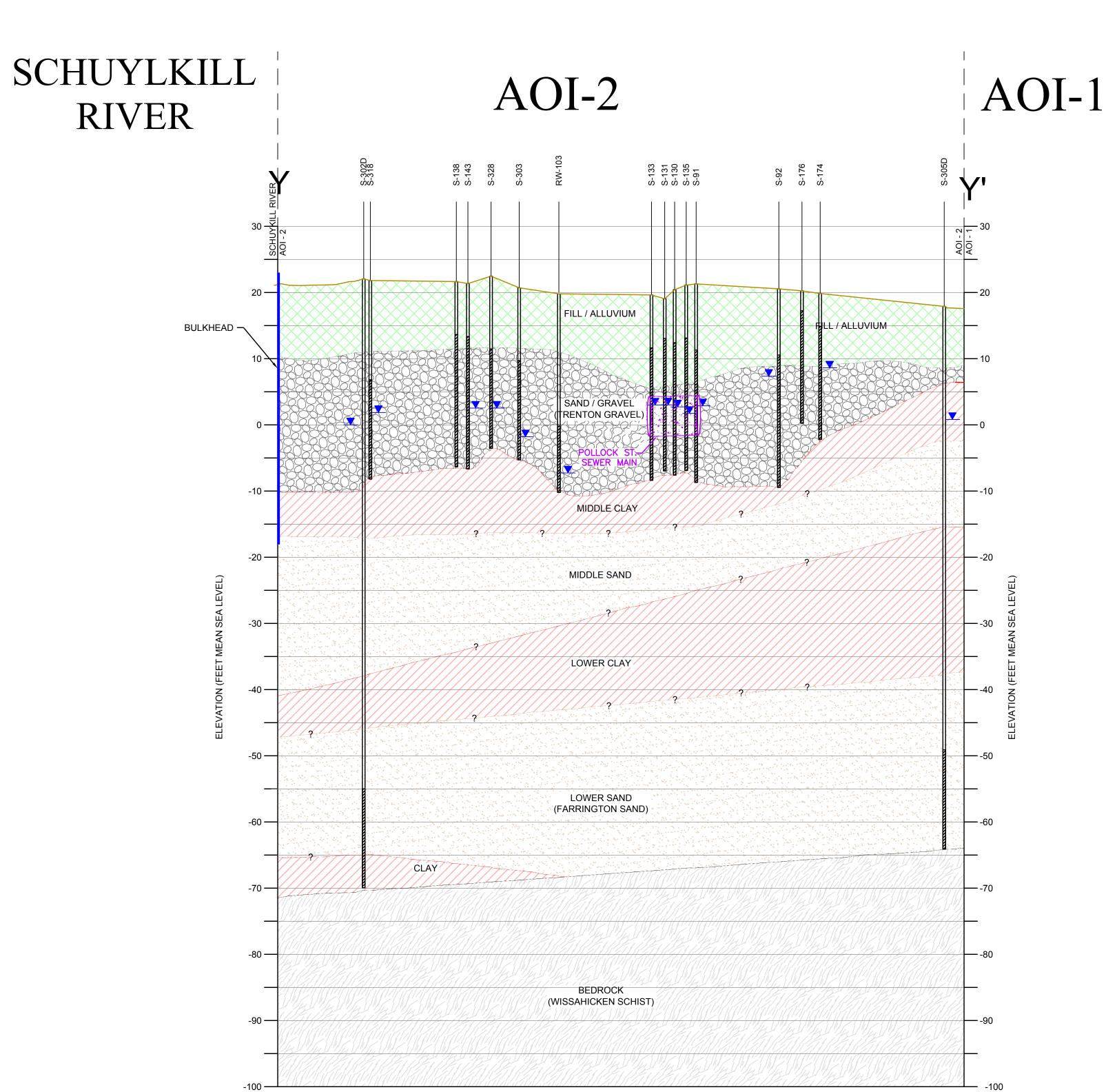
SAND

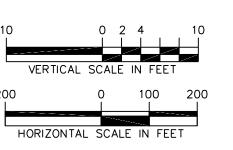
REDROCK
(WISSAHICKEN SCHIST)

GROUNDWATER LEVEL

BULKHEAD

BULKHEAD







SUNOCO PHILADELPHIA REFINERY

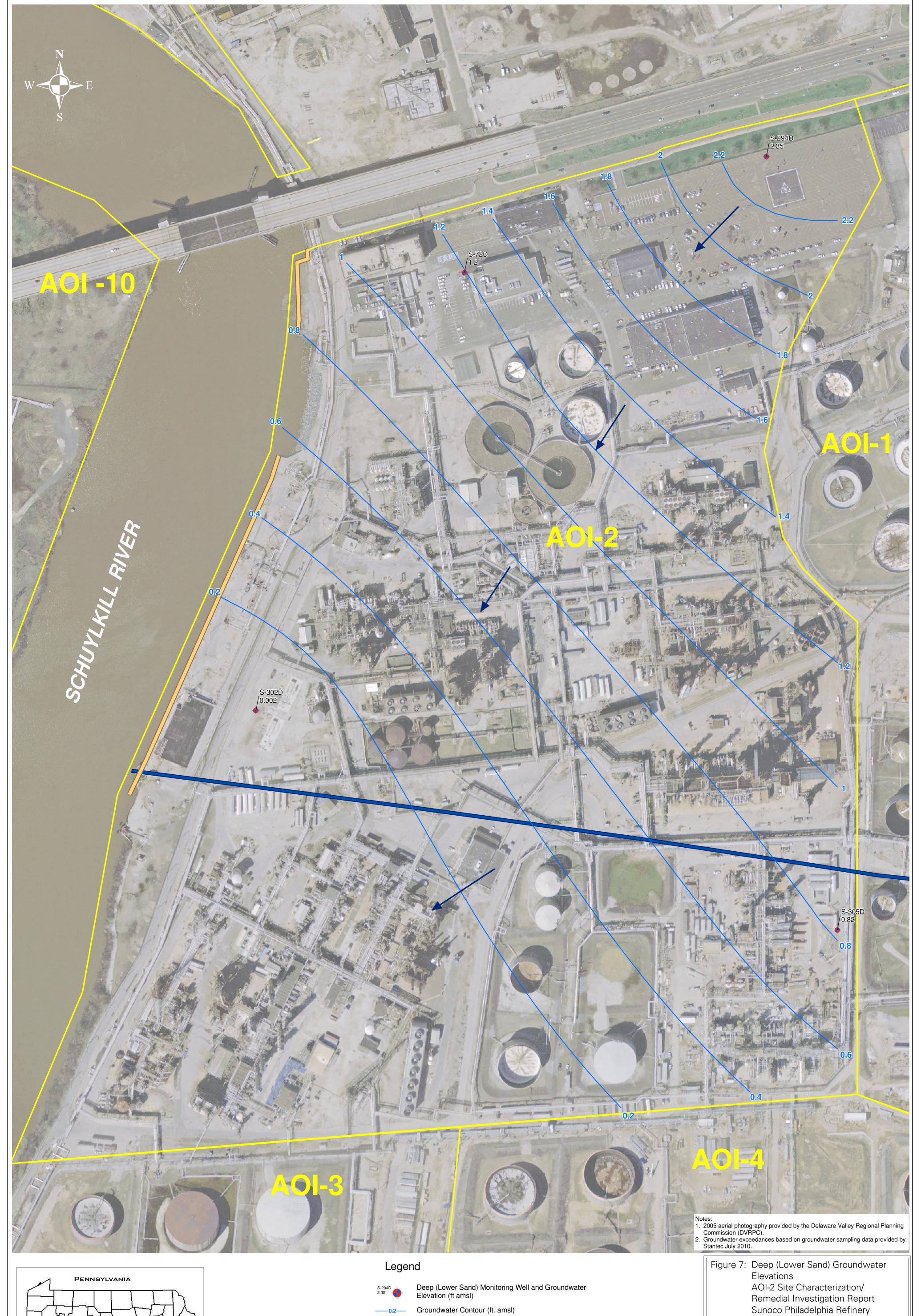
GEOLOGIC CROSS SECTION Y-Y'

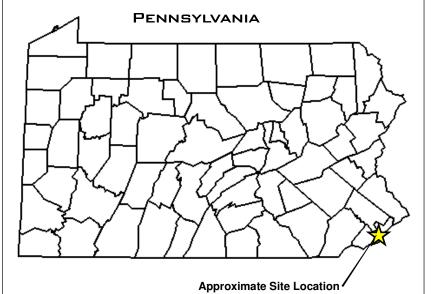
Project No. 2574601	Figure No.
Date 8/26/2010	ГО
Scale 1" = 200' HOR. 1" = 10' VER.	5B
Orn. By JEM	
ast Revised	

ename: Q:\data6\2574601\Cadd Data - 2574601\Dwa\Geologic Cross-Sections\Cross-Section Y-Y'.dwa Date: 9/29/2010 Time: 12:06 User: imay Style Table: Langan.stb Layout:



Q:\data6\2574601\ArcGIS\MapDocuments\AOI 2 SCR\Figure 6 - Shallow Intermediate GW Contours - AOI2_rev9-28-10.mxd





Inferred Groundwater Flow Direction

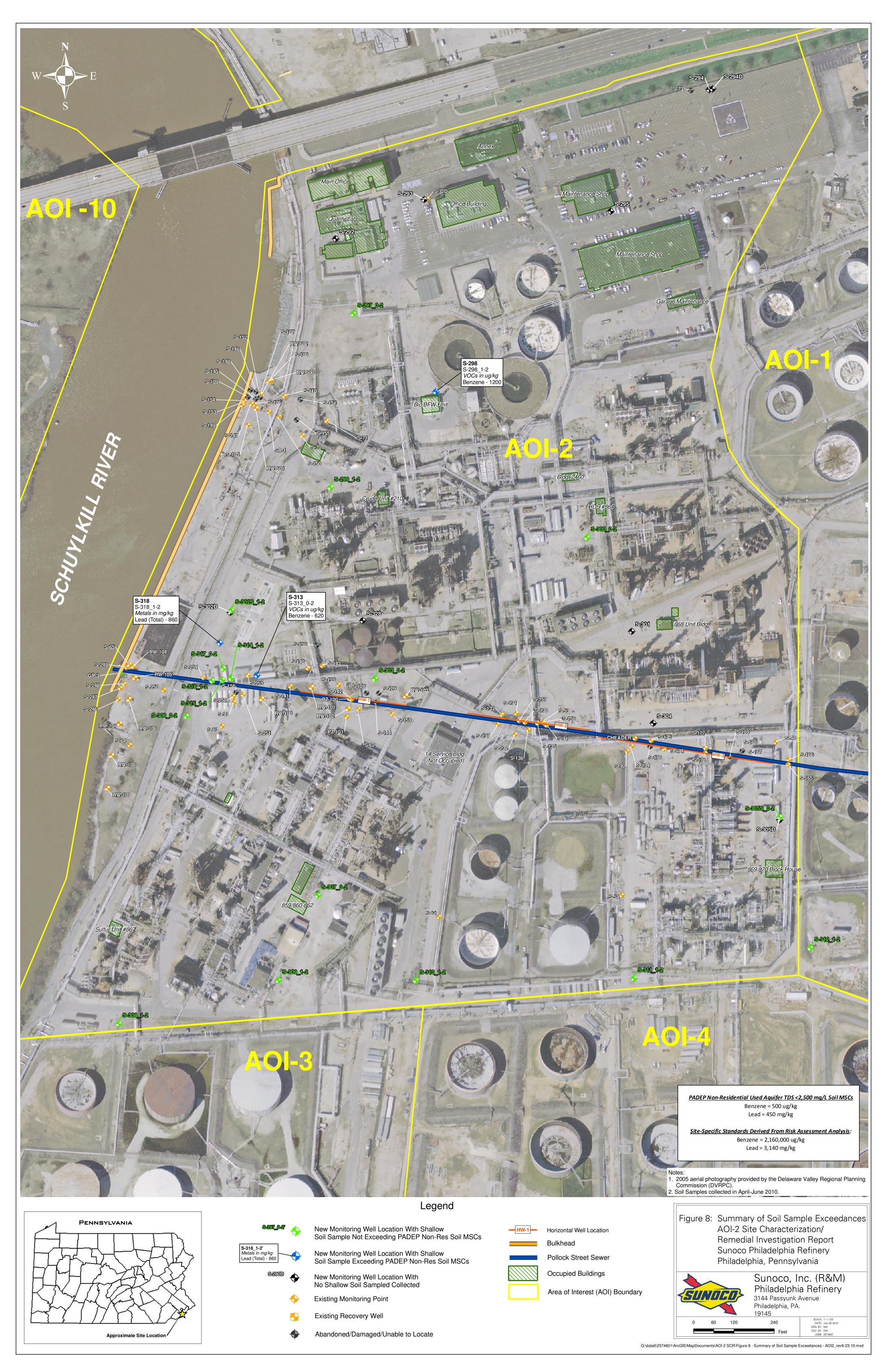
Pollock Street Sewer Area of Interest (AOI) Boundary

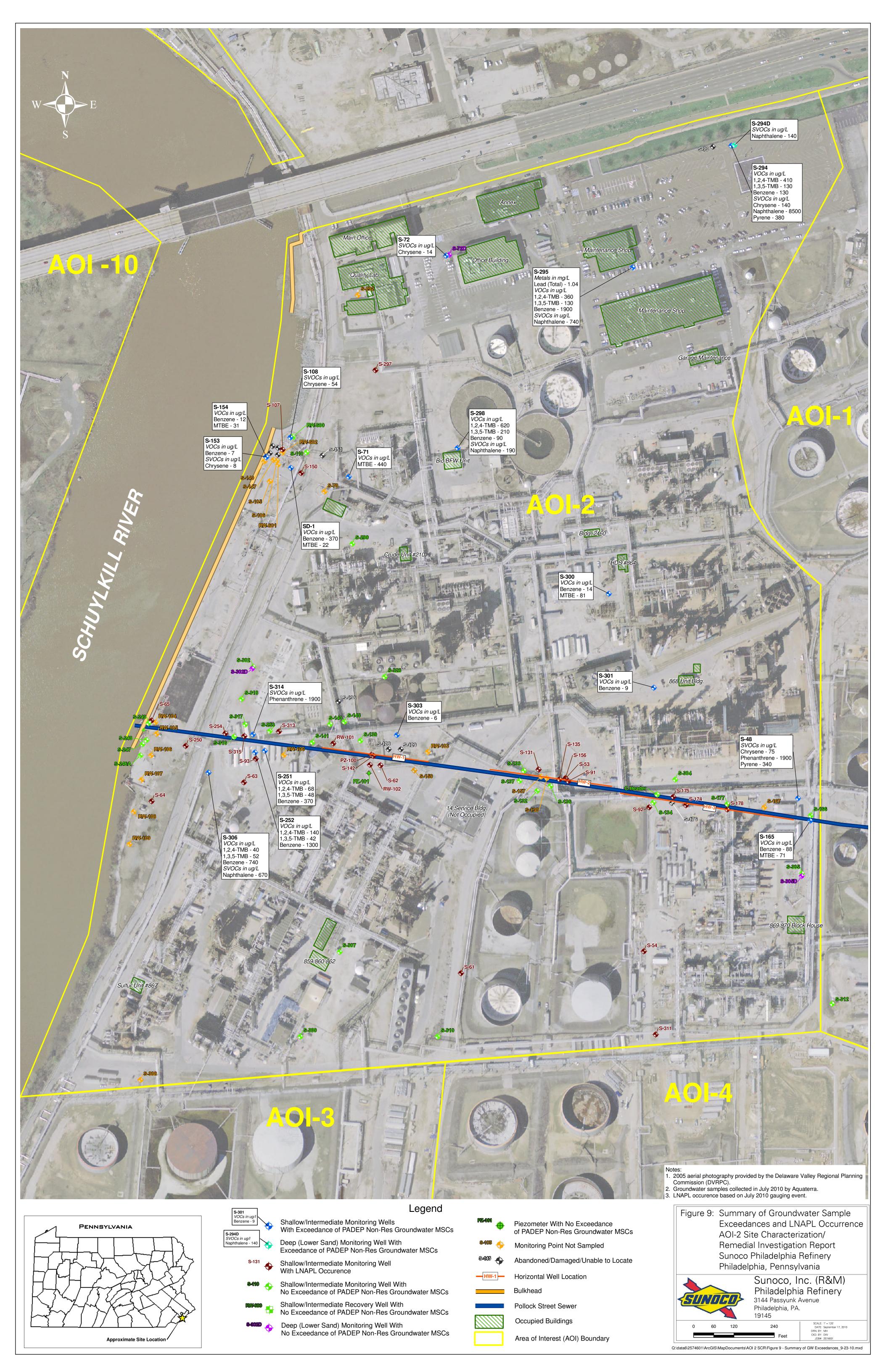
Bulkhead

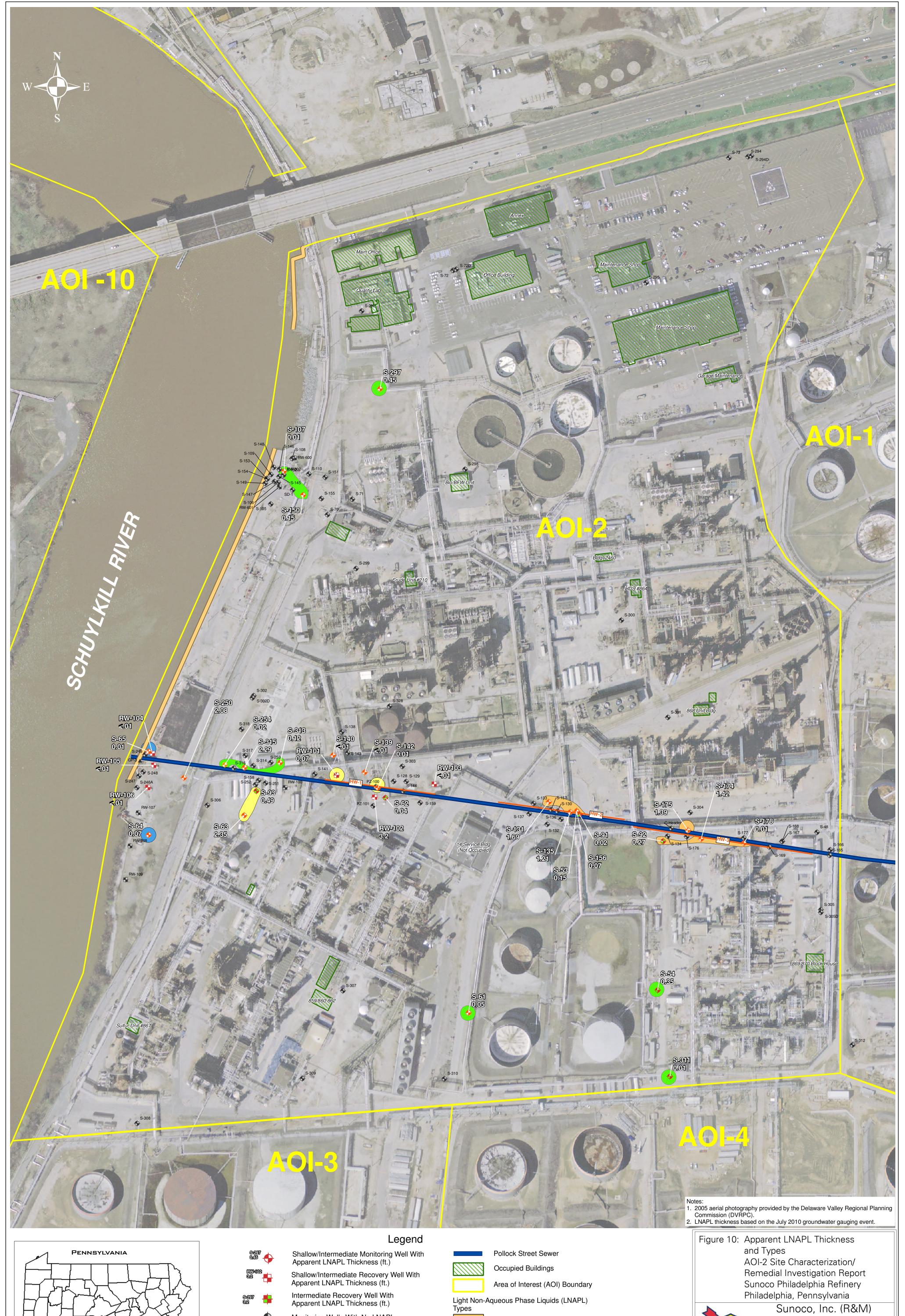
{SUNDCO}

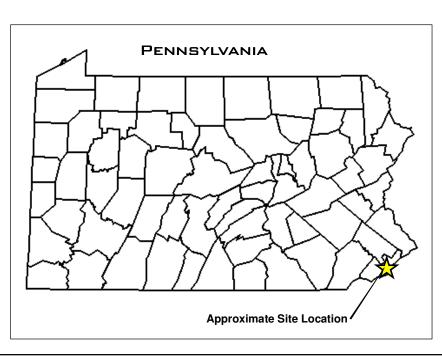
Philadelphia, Pennsylvania Sunoco, Inc. (R&M)
Philadelphia Refinery
3144 Passyunk Avenue
Philadelphia, PA.
19145

Q:\data6\2574601\ArcGIS\MapDocuments\AOI 2 SCR\Figure 7 - Deep GW Contours - AOI2_rev9-17-10.mxd









Monitoring Wells With No LNAPL Staff Gauges

Sheen Observed in Groundwater Horizontal Well Location

Bulkhead

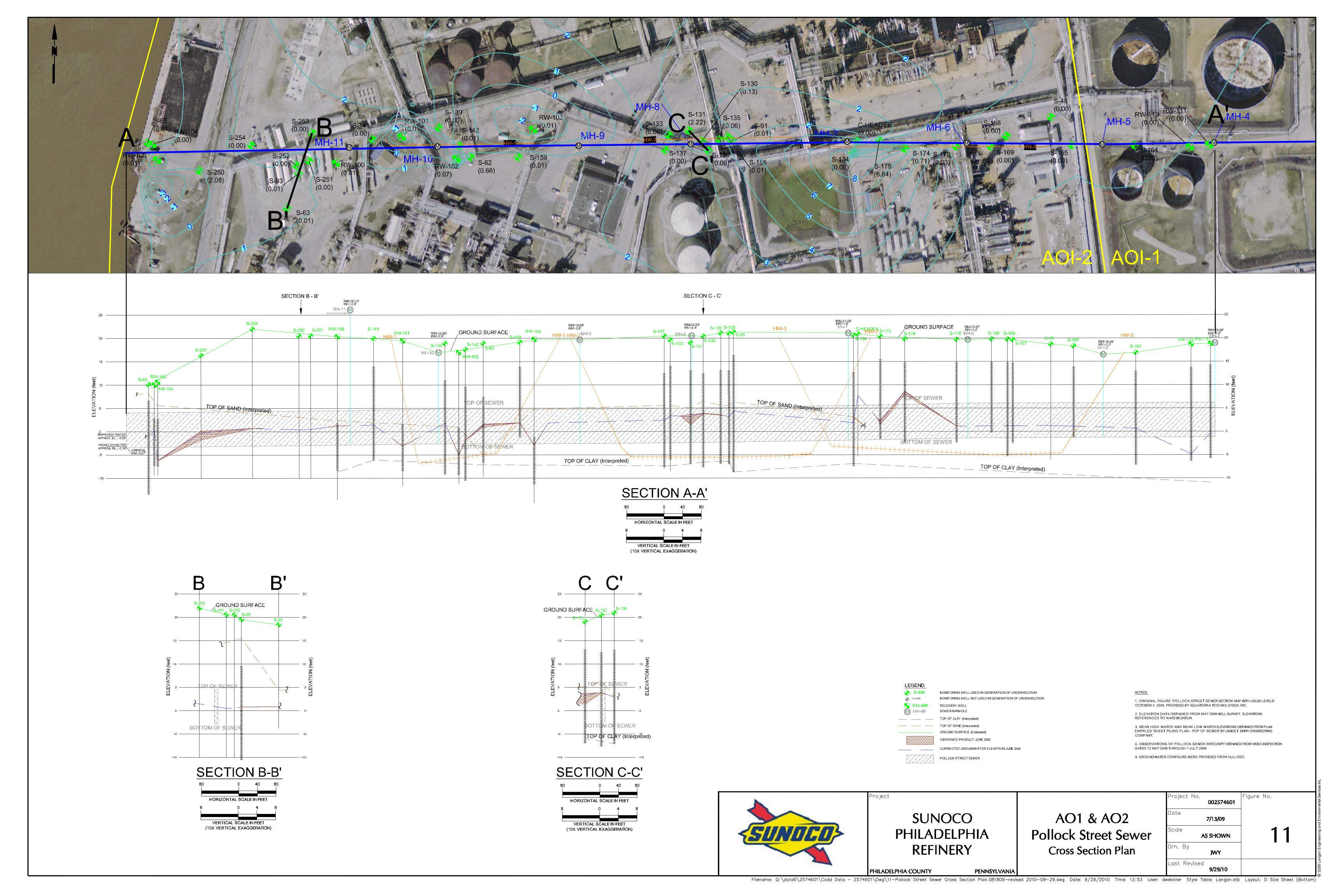
Condensate Lube Oil Residual Oil

Middle Distillate



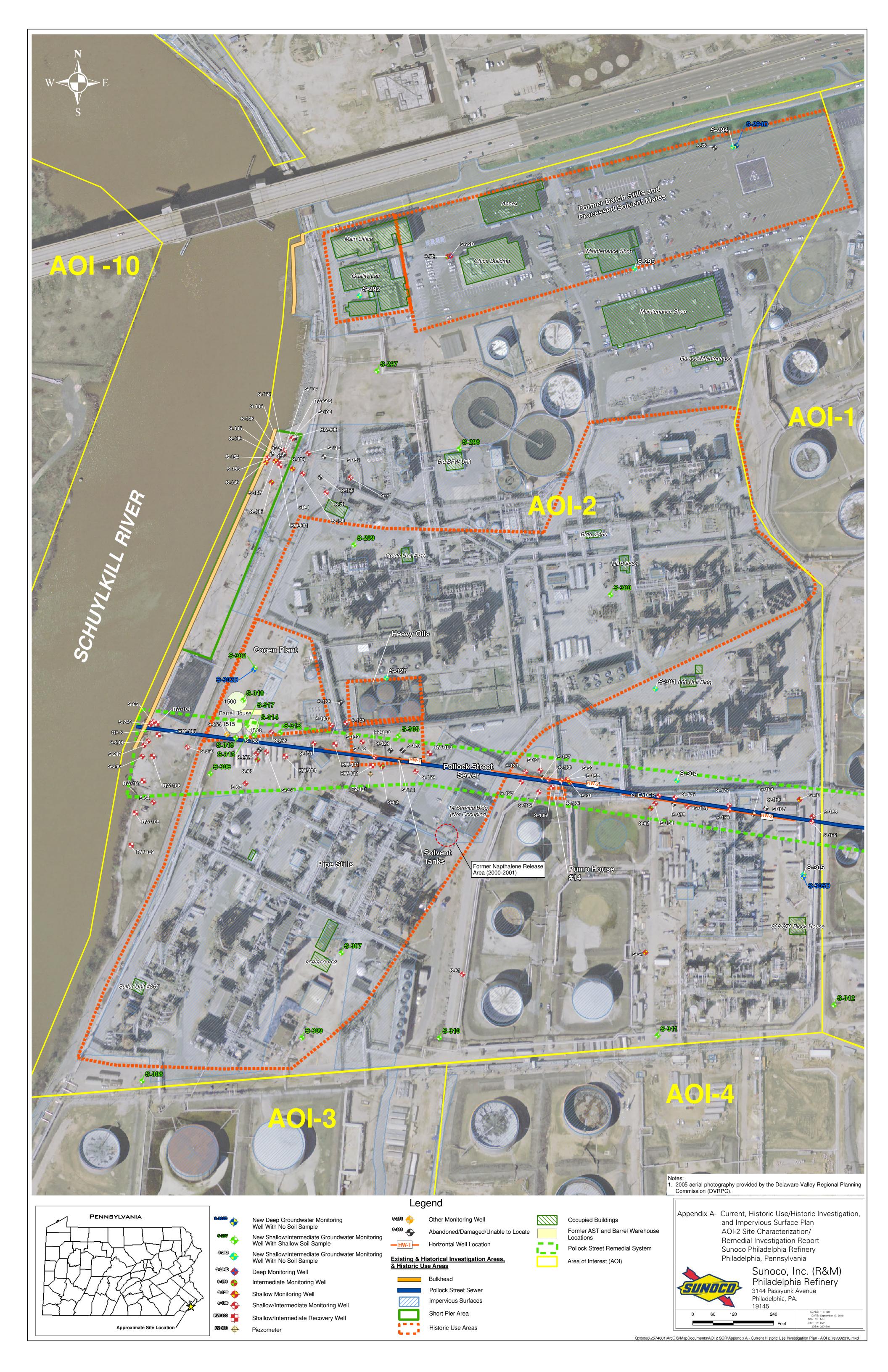
Philadelphia Refinery 3144 Passyunk Avenue Philadelphia, PA. 19145

SCALE: 1" = 120'
DATE: August 20, 2010
DRN. BY: MH
CKD. BY: DW
JOB#: 2574601 Q:\data6\2574601\ArcGIS\MapDocuments\AOI 2 SCR\Figure 10 - Apparent LNAPL Thickness - AOI2_rev9-23-10.mxd



APPENDIX A

Current, Historic Use/Historic Investigation, and Impervious Surface Plan



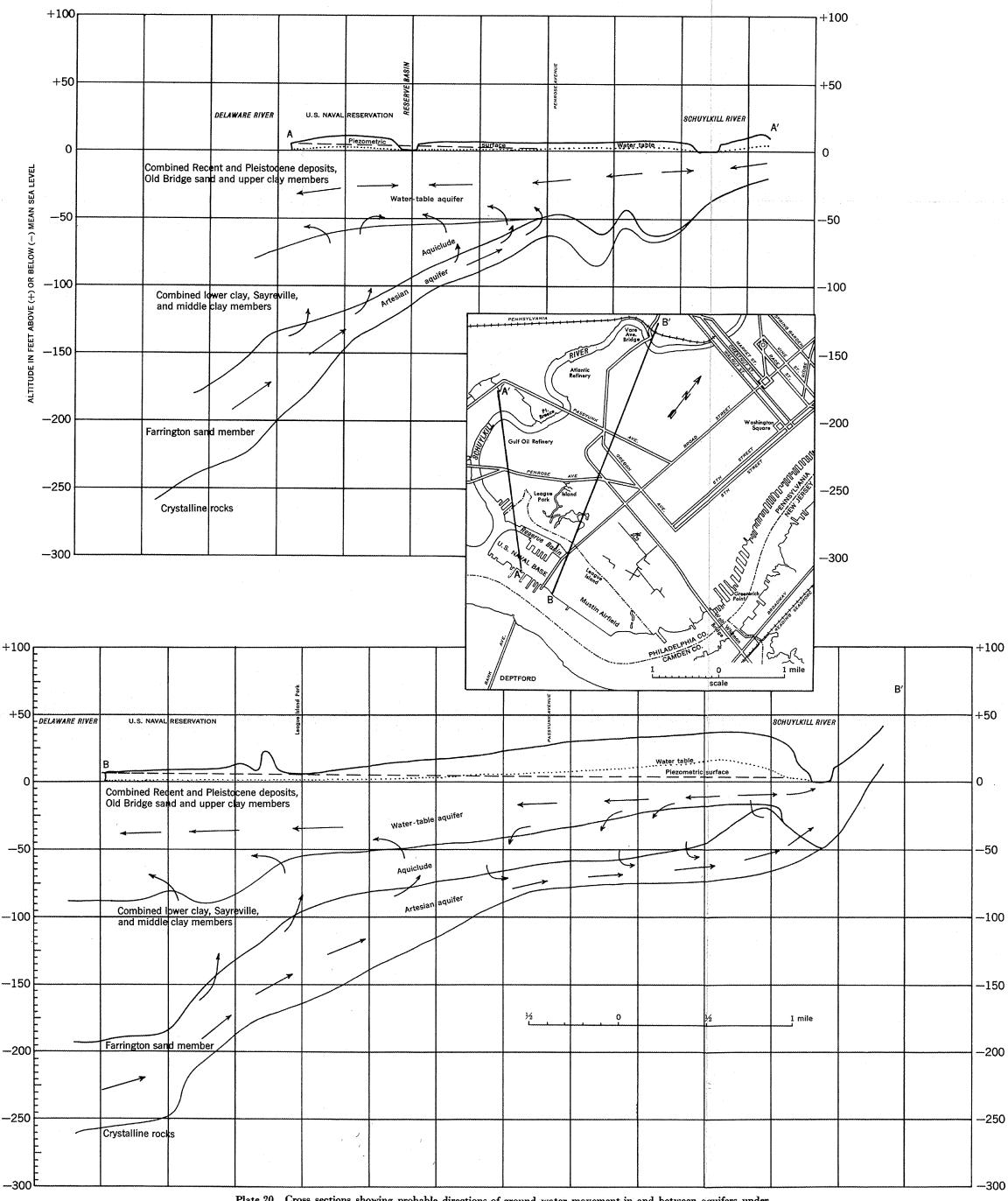
Please see separate file on CD

APPENDIX B

Soil Boring Logs and Monitoring Well Construction
Summaries

APPENDIX C

USGS Plate 20



IN FEET ABOVE (+) OR BELOW (-) MEAN SEA LEVEL

ALTITUDE

Plate 20 Cross sections showing probable directions of ground water movement in and between aquifers under natural conditions near the junction of the Delaware and Schuylkill Rivers in Pennsylvania.

APPENDIX D Soil and Groundwater Analytical Reports (on CD)



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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 05/04/2010 Group Number: 1193050 PO Number: PHILA REF AOI-2 State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-308_1-2' Grab Soil	5970547
S-309_1-2' Grab Soil	5970548
S-310_1-2' Grab Soil	5970549
S-311_1-2' Grab Soil	5970550

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		
ELECTRONIC	Aquaterra Tech	Attn: Loretta Belfiglio
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



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Page 1 of 2 REVISED

Sample Description: S-308 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-308 1-2'

LLI Sample # SW 5970547 LLI Group # 1193050 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/30/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-308

CAT No.	Analysis Name		CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene		71-43-2	< 4	4	0.4	0.78
10102	1,2-Dibromoethane		106-93-4	< 4	4	0.9	0.78
10102	1,2-Dichloroethane		107-06-2	< 4	4	0.9	0.78
10102	Ethylbenzene		100-41-4	< 4	4	0.9	0.78
10102	Isopropylbenzene		98-82-8	< 4	4	0.9	0.78
10102	Methyl Tertiary But	yl Ether	1634-04-4	< 4	4	0.4	0.78
10102	Toluene		108-88-3	< 4	4	0.9	0.78
10102	1,2,4-Trimethylbenze	ene	95-63-6	< 4	4	0.9	0.78
10102	1,3,5-Trimethylbenze	ene	108-67-8	< 4	4	0.9	0.78
10102	Xylene (Total)		1330-20-7	< 4	4	0.9	0.78
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 190	190	38	1
10724	Benzo(a)anthracene		56-55-3	< 190	190	38	1
10724	Benzo(a)pyrene		50-32-8	< 190	190	38	1
10724	Benzo(b) fluoranthen	9	205-99-2	< 190	190	38	1
10724	Benzo(g,h,i)perylen	9	191-24-2	< 190	190	38	1
10724	Chrysene		218-01-9	< 190	190	38	1
10724	Dibenz(a,h)anthrace	ne	53-70-3	< 190	190	38	1
10724	Fluorene		86-73-7	< 190	190	38	1
10724	Indeno(1,2,3-cd)pyre	ene	193-39-5	< 190	190	38	1
10724	Naphthalene		91-20-3	< 190	190	38	1
10724	Phenanthrene		85-01-8	< 190	190	38	1
10724	Pyrene		129-00-0	< 190	190	38	1
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	18.9	0.222	0.0333	2
Wet Cl	nemistry	SM20 2	540 G	%	%	%	
00111	Moisture		n.a.	13.3	0.50	0.50	1
	"Moisture" represent	elsius. T		ne sample afte	er oven drying at		

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

as-received basis.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analysis Analyst Dilution No. Date and Time Factor



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Sample Description: S-308 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-308 1-2'

LLI Sample # SW 5970547 LLI Group # 1193050 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/30/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-308

Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method		Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor		
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035	1	201012521042	04/30/2010	09:45	Client Supplied	1		
02392	L/H Field Preserved Bisulfate	SW-846	5035	1	201012521042	04/30/2010	09:45	Client Supplied	1		
02392	L/H Field Preserved Bisulfate	SW-846	5035	2	201012521042	04/30/2010	09:45	Client Supplied	1		
10102	UST - Soils by 8260B	SW-846	8260B	1	X101261AA	05/06/2010	12:39	Chelsea B Eastep	0.78		
10724	PAH 8270 (microwave)	SW-846	8270C	1	10125SLA026	05/07/2010	02:22	Gregory J Drahovsky	1		
10814	BNA Soil Microwave PAH	SW-846	3546	1	10125SLA026	05/05/2010	23:30	Patricia L Foreman	1		
06135	Lead	SW-846	6020	1	101266150002A	05/10/2010	12:16	Choon Y Tian	2		
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1		
00111	Moisture	SM20 2	540 G	1	10125820005B	05/05/2010	15:11	Scott W Freisher	1		



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Sample Description: S-309 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-309 1-2'

LLI Sample # SW 5970548 LLI Group # 1193050 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-309

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene		71-43-2	24	5	0.5	0.8
10102	1,2-Dibromoethane		106-93-4	< 5	5	0.9	0.8
10102	1,2-Dichloroethane		107-06-2	< 5	5	0.9	0.8
10102	Ethylbenzene		100-41-4	< 5	5	0.9	0.8
10102	Isopropylbenzene		98-82-8	< 5	5	0.9	0.8
10102	Methyl Tertiary But	yl Ether	1634-04-4	< 5	5	0.5	0.8
10102	Toluene		108-88-3	< 5	5	0.9	0.8
10102	1,2,4-Trimethylbenz	ene	95-63-6	< 5	5	0.9	0.8
10102	1,3,5-Trimethylbenz	ene	108-67-8	< 5	5	0.9	0.8
10102	Xylene (Total)		1330-20-7	< 5	5	0.9	0.8
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	390	190	38	1
10724	Benzo(a)anthracene		56-55-3	860	190	38	1
10724	Benzo(a)pyrene		50-32-8	470	190	38	1
10724	Benzo(b)fluoranthen	e	205-99-2	580	190	38	1
10724	Benzo(g,h,i)perylen	е	191-24-2	280	190	38	1
10724	Chrysene		218-01-9	860	190	38	1
10724	Fluorene		86-73-7	< 190	190	38	1
10724	Naphthalene		91-20-3	< 190	190	38	1
10724	Phenanthrene		85-01-8	1,800	190	38	1
10724	Pyrene		129-00-0	1,600	190	38	1
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	64.7	0.222	0.0333	2
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	12.6	0.50	0.50	1
	"Moisture" represen 103 - 105 degrees C as-received basis.		ss in weight of th	ne sample afte	er oven drying at		

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201012521042	04/29/2010 14:00	Client Supplied	1



Stipkovits

Scott W Freisher

1

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LLI Sample # SW 5970548

LLI Group # 1193050 Account # 10132

Sample Description: S-309_1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-309_1-2'

SM20 2540 G

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

05/05/2010 15:11

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-309

00111 Moisture

Laboratory Sample Analysis Record CAT Analysis Name Method Trial# Batch# Analysis Analyst Dilution No. Date and Time 02392 L/H Field Preserved SW-846 5035 1 201012521042 04/29/2010 14:00 Client Supplied Bisulfate 02392 L/H Field Preserved SW-846 5035 2 201012521042 04/29/2010 14:00 Client Supplied 1 Bisulfate 10102 UST - Soils by 8260B SW-846 8260B 1 X101261AA Chelsea B Eastep 05/06/2010 13:02 05/07/2010 09:59 10724 PAH 8270 (microwave) SW-846 8270C 1 10125SLA026 Joseph M Gambler 10814 BNA Soil Microwave PAH SW-846 3546 1 10125SLA026 05/05/2010 23:30 Patricia L Foreman 1 SW-846 6020 1 101266150002A 05/10/2010 12:20 Choon Y Tian 06135 Lead 06150 ICP/MS SW-846 Solid Digest SW-846 3050B 1 101266150002 05/06/2010 20:07 Annamaria 1

1 10125820005B



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Sample Description: S-310 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-310 1-2'

LLI Sample # SW 5970549 LLI Group # 1193050

Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

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West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-310

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene		71-43-2	< 4	4	0.4	0.78
10102	1,2-Dibromoethane		106-93-4	< 4	4	0.9	0.78
10102	1,2-Dichloroethane		107-06-2	< 4	4	0.9	0.78
10102	Ethylbenzene		100-41-4	< 4	4	0.9	0.78
10102	Isopropylbenzene		98-82-8	< 4	4	0.9	0.78
10102	Methyl Tertiary But	yl Ether	1634-04-4	< 4	4	0.4	0.78
10102	Toluene		108-88-3	< 4	4	0.9	0.78
10102	1,2,4-Trimethylbenze	ene	95-63-6	< 4	4	0.9	0.78
10102	1,3,5-Trimethylbenze	ene	108-67-8	< 4	4	0.9	0.78
10102	Xylene (Total)		1330-20-7	< 4	4	0.9	0.78
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 180	180	37	1
10724	Benzo(a)anthracene		56-55-3	< 180	180	37	1
10724	Benzo(a)pyrene		50-32-8	< 180	180	37	1
10724	Benzo(b) fluoranthen	9	205-99-2	< 180	180	37	1
10724	Benzo(g,h,i)perylen	9	191-24-2	< 180	180	37	1
10724	Chrysene		218-01-9	190	180	37	1
10724	Fluorene		86-73-7	< 180	180	37	1
10724	Naphthalene		91-20-3	< 180	180	37	1
10724	Phenanthrene		85-01-8	< 180	180	37	1
10724	Pyrene		129-00-0	240	180	37	1
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	40.8	0.216	0.0323	2
Wet Ch	nemistry	SM20 25	540 G	8	8	%	
00111	Moisture		n.a.	9.9	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees Co as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201012521042	04/29/2010 11:00	Client Supplied	1



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Page 2 of 2 **REVISED**

LLI Sample # SW 5970549

LLI Group # 1193050 Account # 10132

Choon Y Tian

1

1

Annamaria

Stipkovits

05/05/2010 15:11 Scott W Freisher

Sample Description: S-310 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-310 1-2'

SW-846 6020

SW-846 3050B

SM20 2540 G

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

05/10/2010 12:22

05/06/2010 20:07

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

06150 ICP/MS SW-846 Solid Digest

09/15/2010 Discard:

S-310

06135 Lead

00111 Moisture

Laboratory Sample Analysis Record CAT Analysis Name Method Trial# Batch# Analysis Analyst Dilution No. Date and Time 02392 L/H Field Preserved SW-846 5035 1 201012521042 04/29/2010 11:00 Client Supplied Bisulfate 02392 L/H Field Preserved SW-846 5035 2 201012521042 04/29/2010 11:00 Client Supplied 1 Bisulfate 10102 UST - Soils by 8260B SW-846 8260B 05/06/2010 12:17 05/07/2010 10:24 1 X101261AA Chelsea B Eastep 0.78 10724 PAH 8270 (microwave) SW-846 8270C 1 10125SLA026 Joseph M Gambler 10814 BNA Soil Microwave PAH SW-846 3546 1 10125SLA026 05/05/2010 23:30 Patricia L Foreman 1

1 101266150002A

1 101266150002

1 10125820005B



Dry

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Sample Description: S-311 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-311 1-2'

LLI Sample # SW 5970550 LLI Group # 1193050 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 09:30 by SS SUN: Aquaterra Tech.

PO Box 744

Dry

West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-311

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10102	Benzene		71-43-2	52	5	0.5	0.8
10102	1,2-Dibromoethane		106-93-4	< 5	5	1	0.8
10102	1,2-Dichloroethane		107-06-2	< 5	5	1	0.8
10102	Ethylbenzene		100-41-4	< 5	5	1	0.8
10102	Isopropylbenzene		98-82-8	< 5	5	1	0.8
10102	Methyl Tertiary But	yl Ether	1634-04-4	< 5	5	0.5	0.8
10102	Toluene		108-88-3	< 5	5	1	0.8
10102	1,2,4-Trimethylbenz	ene	95-63-6	45	5	1	0.8
10102	1,3,5-Trimethylbenz	ene	108-67-8	39	5	1	0.8
10102	Xylene (Total)		1330-20-7	44	5	1	0.8
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 200	200	40	1
10724	Benzo(a)anthracene		56-55-3	330	200	40	1
10724	Benzo(a)pyrene		50-32-8	240	200	40	1
10724	Benzo(b) fluoranthen	е	205-99-2	310	200	40	1
10724	Benzo(g,h,i)perylen	е	191-24-2	< 200	200	40	1
10724	Chrysene		218-01-9	360	200	40	1
10724	Fluorene		86-73-7	< 200	200	40	1
10724	Naphthalene		91-20-3	< 200	200	40	1
10724	Phenanthrene		85-01-8	480	200	40	1
10724	Pyrene		129-00-0	580	200	40	1
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	166	0.586	0.0880	5
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	16.4	0.50	0.50	1
	"Moisture" represen 103 - 105 degrees C as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201012521042	04/29/2010 09:30	Client Supplied	1



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LLI Sample # SW 5970550

LLI Group # 1193050 # 10132 Account

Sample Description: S-311 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 232889 S-311 1-2'

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 04/29/2010 09:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/04/2010 16:55 Reported: 07/16/2010 10:42

Discard: 09/15/2010

S-311

Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor			
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201012521042	04/29/2010	09:30	Client Supplied	1			
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201012521042	04/29/2010	09:30	Client Supplied	1			
10102	UST - Soils by 8260B	SW-846 8260B	1	X101261AA	05/06/2010	13:25	Chelsea B Eastep	0.8			
10724	PAH 8270 (microwave)	SW-846 8270C	1	10125SLA026	05/07/2010	10:48	Joseph M Gambler	1			
10814	BNA Soil Microwave PAH	SW-846 3546	1	10125SLA026	05/05/2010	23:30	Patricia L Foreman	. 1			
06135	Lead	SW-846 6020	1	101266150002A	05/10/2010	12:51	Choon Y Tian	5			
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101266150002	05/06/2010	20:07	Annamaria Stipkovits	1			
00111	Moisture	SM20 2540 G	1	10125820005B	05/05/2010	15:11	Scott W Freisher	1			



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Page 1 of 3 REVISED

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1193050

Reported: 07/16/10 at 10:42 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: X101261AA	Sample num	ber(s): 59	970547-597	0550					
Benzene	< 5	5.	0.5	ug/kg	95		80-120		
1,2-Dibromoethane	< 5	5.	1	ug/kg	95		80-120		
1,2-Dichloroethane	< 5	5.	1	ug/kg	102		71-129		
Ethylbenzene	< 5	5.	1	ug/kg	100		80-120		
Isopropylbenzene	< 5	5.	1	ug/kg	100		76-120		
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	102		74-121		
Toluene	< 5	5.	1	ug/kg	96		80-120		
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	101		79-120		
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	102		78-120		
Xylene (Total)	< 5	5.	1	ug/kg	101		80-120		
Batch number: 10125SLA026	Sample num	ber(s): 59	970547-597	0550					
Anthracene	< 170	170.	33	uq/kq	106		89-109		
Benzo(a)anthracene	< 170	170.	33	ug/kg	105		86-113		
Benzo(a) pyrene	< 170	170.	33	ug/kg	75		63-138		
Benzo(b) fluoranthene	< 170	170.	33	ug/kg	77		61-133		
Benzo(q,h,i)perylene	< 170	170.	33	ug/kg	72		63-130		
Chrysene	< 170	170.	33	ug/kg	101		84-117		
Dibenz (a,h) anthracene	< 170	170.	33	ug/kg	72		67-129		
Fluorene	< 170	170.	33	ug/kg	102		84-113		
Indeno(1,2,3-cd)pyrene	< 170	170.	33	ug/kg	72		64-128		
Naphthalene	< 170	170.	33	ug/kg	102		83-112		
Phenanthrene	< 170	170.	33	ug/kg	102		86-109		
Pyrene	< 170	170.	33	ug/kg	114		86-122		
Batch number: 101266150002A	Sample num	ber(s): 59	970547-597	0550					
Lead	< 0.200	0.200	0.0300	mg/kg	110		80-120		
Batch number: 10125820005B	Sample num	ber(s): 59	970547-597	0550					
Moisture	-				100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP <u>RPD</u>	Dup RPD <u>Max</u>
Batch number: X101261AA	Sample	number(s)): 5970547	7-59705	50 UNSP	K: P970734			
Benzene	111	106	55-143	19	30				
1,2-Dibromoethane	110	103	54-129	22	30				
1,2-Dichloroethane	112	105	53-143	21	30				

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1193050

Reported: 07/16/10 at 10:42 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DUP	Dup RPD
<u>Analysis Name</u>	%REC	%REC	<u>Limits</u>	RPD	MAX	Conc	Conc	RPD	<u>Max</u>
Ethylbenzene	111	129	44-141	0	30				
Isopropylbenzene	91	124	38-144	16	30				
Methyl Tertiary Butyl Ether	123	118	55-129	19	30				
Toluene	141	144	50-146	13	30				
1,2,4-Trimethylbenzene	127	174*	37-149	17	30				
1,3,5-Trimethylbenzene	142	199*	38-150	19	30				
Xylene (Total)	102	123	44-136	4	30				
Batch number: 10125SLA026	Sample	number(s	s): 597054'	7-59705	50 UNS	PK: 5970547			
Anthracene	100	101	76-111	1	30				
Benzo(a)anthracene	100	105	78-111	5	30				
Benzo(a)pyrene	68	72	57-129	6	30				
Benzo(b)fluoranthene	67	74	53-131	10	30				
Benzo(g,h,i)perylene	66	70	60-123	5	30				
Chrysene	95	101	76-114	6	30				
Dibenz(a,h)anthracene	67	68	62-125	2	30				
Fluorene	97	101	75-111	4	30				
Indeno(1,2,3-cd)pyrene	66	70	61-123	5	30				
Naphthalene	97	103	33-140	5	30				
Phenanthrene	98	102	69-115	4	30				
Pyrene	112	119	76-124	6	30				
Batch number: 101266150002A	Sample	number(s	5): 597054	7-59705	50 UNS	PK: P972031	BKG: P972	031	
Lead	439 (2) -14 (2) 75-125	20	20	61.7	62.1	1	20
Batch number: 10125820005B	Sample	number(s	s): 597054'	7-59705	50 BK	G: P970734			
Moisture						59.6	49.0	19*	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST - Soils by 8260B

Batch number: X101261AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzer
5970547	102	108	91	86
5970548	99	102	105	85
5970549	102	106	93	98
5970550	97	97	100	93
Blank	98	102	93	100
LCS	101	105	100	97
MS	105	105	137*	69*
MSD	103	104	135*	70
Limits:	71-114	70-109	70-123	70-111

Analysis Name: PAH 8270 (microwave)

Batch number: 10125SLA026

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 07/16/10 at 10:42 AM Group Number: 1193050

Surrogate Quality Control

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
5970547	108	99	100	
5970548	106	104	88	
5970549	106	102	89	
5970550	102	98	86	
Blank	114	104	101	
LCS	109	96	97	
MS	102	95	96	
MSD	109	100	102	
Limits:	55-121	74-110	57-112	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only Acct. # 1013Z Group# 1193050 Sample # 5970547-50

COC#

232889

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Table 1 (continued) Constituents of Concern for Soil AOI 7 Work Plan for Site Characterization Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

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

VOLATILE ORGANIC	
COMPOUNDS	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	98-85-8
Ethylbenzene	100-41-4
Ethylene dibromide	106-93-4
Methyl tertiary butyl ether	1634-04-4
Toluene	108-88-3
Xylenes (total)	1330-20-7

SEMI-VOLATILE ORGANIC COMPOUNDS	CAS No.
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo (g,h,i) perylene	191-24-2
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
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.



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Inorganic Qualifiers

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

	3		3
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 05/11/2010 Group Number: 1194091 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample DescriptionLancaster Labs (LLI) #S-297_0-2 Composite Soil5977139S-313_0-2 Composite Soil5977140S-317_0-2 Composite Soil5977141

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC Langan Attn: Dennis Webster

COPY TO

ELECTRONIC SUN: Aquaterra Tech. Attn: Tiffani Doerr

COPY TO

ELECTRONIC LLI Attn: EDD Group

COPY TO

ELECTRONIC Langan Attn: Kristen Ward

COPY TO

ELECTRONIC Aquaterra Tech Attn: Loretta Belfiglio

COPY TO



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



Dry

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Page 1 of 2 REVISED

Sample Description: S-297 0-2 Composite Soil

Philadelphia Refinery AOI-2 COC: 233634 S-297 0-2 LLI Sample # SW 5977139 LLI Group # 1194091 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/04/2010 13:45 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Dry

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Discard: 09/15/2010

297-0

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.92
10950	1,2-Dibromoethane		106-93-4	< 5	5	1	0.92
10950	1,2-Dichloroethane		107-06-2	< 5	5	1	0.92
10950			100-41-4	< 5	5	1	0.92
10950	Isopropylbenzene		98-82-8	< 5	5	1	0.92
10950	Methyl Tertiary But	yl Ether	1634-04-4	< 5	5	0.5	0.92
10950	Toluene		108-88-3	< 5	5	1	0.92
10950	1,2,4-Trimethylbenz	ene	95-63-6	< 5	5	1	0.92
10950	1,3,5-Trimethylbenz	ene	108-67-8	< 5	5	1	0.92
10950	Xylene (Total)		1330-20-7	< 5	5	1	0.92
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 170	170	35	1
10724	Benzo(a)anthracene		56-55-3	< 170	170	35	1
10724	Benzo(a)pyrene		50-32-8	180	170	35	1
10724	Benzo(b) fluoranthen	e	205-99-2	240	170	35	1
10724	Benzo(g,h,i)perylen	e	191-24-2	< 170	170	35	1
10724	Chrysene		218-01-9	170	170	35	1
10724	Fluorene		86-73-7	< 170	170	35	1
10724	Naphthalene		91-20-3	< 170	170	35	1
10724	Phenanthrene		85-01-8	< 170	170	35	1
10724	Pyrene		129-00-0	280	170	35	1
	LCS recovery is outs edance allowance of						
Stan	dards. The following racene						
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	58.7	0.206	0.0309	2
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	4.0	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees C as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Sample Description: S-297 0-2 Composite Soil

Philadelphia Refinery AOI-2 COC: 233634 S-297 0-2

LLI Group # 1194091 Account # 10132

LLI Sample # SW 5977139

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/04/2010 13:45 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Discard: 09/15/2010

297-0

			Laboratory Sa	ample Analysi	s Record			
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035 1	201013221107	05/04/2010	13:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846	5035 1	201013221107	05/04/2010	13:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846	5035 2	201013221107	05/04/2010	13:45	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846	8260B 1	X101321AA	05/12/2010	21:53	Nicholas P Riehl	0.92
10724	PAH 8270 (microwave)	SW-846	8270C 1	10132SLC026	05/14/2010	16:39	Linda M Hartenstine	1
10814	BNA Soil Microwave PAH	SW-846	3546 1	10132SLC026	05/13/2010	02:30	Sherry L Morrow	1
06135	Lead	SW-846	6020 1	101326150001A	05/19/2010	14:05	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B 1	101326150001	05/12/2010	19:58	Annamaria Stipkovits	1
00111	Moisture	SM20 25	40 G 1	10132820004A	05/12/2010	15:30	Scott W Freisher	1



Drv

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Page 1 of 2 REVISED

Sample Description: S-313 0-2 Composite Soil

Philadelphia Refinery AOI-2 COC: 233634 S-313 0-2

LLI Group # 1194091 Account # 10132

LLI Sample # SW 5977140

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/06/2010 12:45 by JRW SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Discard: 09/15/2010

313-0

CAT No.	Analysis Name	CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	620		32	320	58.35
10950	1,2-Dibromoethane	106-93-4	N.D.		64	320	58.35
10950	1,2-Dichloroethane	107-06-2	N.D.		64	320	58.35
10950	Ethylbenzene	100-41-4	2,100		64	320	58.35
10950	Isopropylbenzene	98-82-8	3,300		64	320	58.35
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		32	320	58.35
10950	Toluene	108-88-3	690		64	320	58.35
10950	1,2,4-Trimethylbenzene	95-63-6	7,400		64	320	58.35
10950	1,3,5-Trimethylbenzene	108-67-8	5,700		64	320	58.35
10950	Xylene (Total)	1330-20-7	29,000		64	320	58.35
GC/MS	Semivolatiles SW-846	8270C	ug/kg		ug/kg	ug/kg	
10724	Anthracene	120-12-7	2,300		360	1,800	1
10724	Benzo(a)anthracene	56-55-3	3,400		360	1,800	1
10724	Benzo(a)pyrene	50-32-8	2,500		360	1,800	1
10724	Benzo(b) fluoranthene	205-99-2	3,800		360	1,800	1
10724	Benzo(g,h,i)perylene	191-24-2	1,700	J	360	1,800	1
10724	Chrysene	218-01-9	4,700		360	1,800	1
10724	Fluorene	86-73-7	1,600	J	360	1,800	1
10724	Naphthalene	91-20-3	1,600	J	360	1,800	1
10724	Phenanthrene	85-01-8	7,000		360	1,800	1
10724	Pyrene	129-00-0	7,400		360	1,800	1
D116	to cample matrix interferences	c observed during	the extract	ion	the		

Due to sample matrix interferences observed during the extraction, the normal reporting limits were not attained.

The LCS recovery is outside the stated QC window but within the marginal exceedance allowance of +/- 4 standard deviations as defined in the NELAC Standards. The following analytes are accepted based on this allowance: anthracene

Metals		SW-846 60	20	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	335	0.164	1.09	10
Wet Ch	emistry	SM20 2540) G	%	%	8	
00111	Moisture		n.a.	8.5	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Sample Description: S-313 0-2 Composite Soil

Project Name: SUN: Philadelphia Refinery AOI-2

Philadelphia Refinery AOI-2 COC: 233634 S-313 0-2

LLI Group # 1194091 Account # 10132

LLI Sample # SW 5977140

coc. 255051 b 515_0 2

Collected: 05/06/2010 12:45 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Discard: 09/15/2010

313-0

	Laboratory Sample Analysis Record							
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5	035 1	201013221107	05/06/2010	12:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5	035 1	201013221107	05/06/2010	12:45	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5	035 2	201013221107	05/06/2010	12:45	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 82	260B 1	R101381AA	05/18/2010	16:55	Nicholas R Rossi	58.35
10724	PAH 8270 (microwave)	SW-846 82	270C 1	10132SLC026	05/14/2010	17:50	Linda M Hartenstine	1
10814	BNA Soil Microwave PAH	SW-846 3!	546 1	10132SLC026	05/13/2010	02:30	Sherry L Morrow	1
06135	Lead	SW-846 6	020 1	101326150001A	05/19/2010	14:24	Choon Y Tian	10
06150	ICP/MS SW-846 Solid Digest	SW-846 3	050B 1	101326150001	05/12/2010	19:58	Annamaria Stipkovits	1
00111	Moisture	SM20 254	0 G 1	10132820004A	05/12/2010	15:30	Scott W Freisher	1



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Page 1 of 2 **REVISED**

Sample Description: S-317 0-2 Composite Soil

Philadelphia Refinery AOI-2 COC: 233634 S-317 0-2

Account

Drv

LLI Sample # SW 5977141 LLI Group # 1194091 # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

by JRW SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Collected: 05/07/2010 09:15

Discard: 09/15/2010

317-0

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.81
10950	1,2-Dibromoethane		106-93-4	< 5	5	1	0.81
10950	1,2-Dichloroethane		107-06-2	< 5	5	1	0.81
10950	Ethylbenzene		100-41-4	< 5	5	1	0.81
10950	Isopropylbenzene		98-82-8	< 5	5	1	0.81
10950	Methyl Tertiary Buty	yl Ether	1634-04-4	< 5	5	0.5	0.81
10950	Toluene		108-88-3	< 5	5	1	0.81
10950	1,2,4-Trimethylbenze	ene	95-63-6	< 5	5	1	0.81
10950	1,3,5-Trimethylbenze	ene	108-67-8	< 5	5	1	0.81
10950	Xylene (Total)		1330-20-7	< 5	5	1	0.81
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 200	200	40	1
10724	Benzo(a)anthracene		56-55-3	< 200	200	40	1
10724	Benzo(a)pyrene		50-32-8	< 200	200	40	1
10724	Benzo(b) fluoranthen	9	205-99-2	< 200	200	40	1
10724	Benzo(g,h,i)perylen	е	191-24-2	< 200	200	40	1
10724	Chrysene		218-01-9	< 200	200	40	1
10724	Fluorene		86-73-7	< 200	200	40	1
10724	Naphthalene		91-20-3	< 200	200	40	1
10724	Phenanthrene		85-01-8	< 200	200	40	1
10724	Pyrene		129-00-0	< 200	200	40	1
Metals	;	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	19.8	0.240	0.0360	2
Wet Ch	nemistry	SM20 25	540 G	8	8	%	
00111	Moisture		n.a.	17.6	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees Co as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201013221107	05/07/2010 09:15	Client Supplied	1



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Sample Description: S-317 0-2 Composite Soil

Philadelphia Refinery AOI-2 COC: 233634 S-317 0-2

LLI Group # 1194091 Account # 10132

LLI Sample # SW 5977141

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/07/2010 09:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/11/2010 17:20 Reported: 07/16/2010 09:59

Discard: 09/15/2010

317-0

		Labo	ratory Sa	ample Analysi	s Record			
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201013221107	05/07/2010	09:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201013221107	05/07/2010	09:15	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101321AA	05/12/2010	22:16	Nicholas P Riehl	0.81
10724	PAH 8270 (microwave)	SW-846 8270C	1	10132SLC026	05/14/2010	18:14	Linda M Hartenstine	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10132SLC026	05/13/2010	02:30	Sherry L Morrow	1
06135	Lead	SW-846 6020	1	101326150001A	05/19/2010	14:11	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101326150001	05/12/2010	19:58	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10132820004A	05/12/2010	15:30	Scott W Freisher	1



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Page 1 of 3 **REVISED**

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1194091

Reported: 07/16/10 at 09:59 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD <u>%REC</u>	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: X101321AA	Sample nu	umber(s): 5	977139,59	77141					
Benzene	< 5	5.	0.5	ug/kg	98	97	80-120	1	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	96	97	80-120	1	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	100	100	71-129	0	30
Ethylbenzene	< 5	5.	1	ug/kg	99	97	80-120	2	30
Isopropylbenzene	< 5	5.	1	ug/kg	101	97	76-120	3	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	103	105	74-121	2	30
Toluene	< 5	5.	1	ug/kg	98	96	80-120	2	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	99	97	79-120	2	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	101	98	78-120	3	30
Xylene (Total)	< 5	5.	1	ug/kg	99	97	80-120	2	30

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>MDL**</u>	Blank <u>LOQ</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: R101381AA	Sample nu	umber(s): 59	977140						
Benzene	N.D.	25.	250	ug/kg	97	92	80-120	6	30
1,2-Dibromoethane	N.D.	50.	250	ug/kg	93	92	80-120	1	30
1,2-Dichloroethane	N.D.	50.	250	ug/kg	100	96	71-129	4	30
Ethylbenzene	N.D.	50.	250	ug/kg	92	88	80-120	5	30
Isopropylbenzene	N.D.	50.	250	ug/kg	92	88	76-120	5	30
Methyl Tertiary Butyl Ether	N.D.	25.	250	ug/kg	102	99	74-121	2	30
Toluene	N.D.	50.	250	ug/kg	93	88	80-120	5	30
1,2,4-Trimethylbenzene	N.D.	50.	250	ug/kg	90	85	79-120	6	30
1,3,5-Trimethylbenzene	N.D.	50.	250	ug/kg	90	84	78-120	7	30
Xylene (Total)	N.D.	50.	250	ug/kg	93	88	80-120	5	30
Batch number: 10132SLC026	Sample nu	umber(s): 59	977139-59	77141					
Anthracene	N.D.	33.	170	ug/kg	112*		89-109		
Benzo(a)anthracene	N.D.	33.	170	ug/kg	105		86-113		
Benzo(a)pyrene	N.D.	33.	170	ug/kg	103		63-138		
Benzo(b)fluoranthene	N.D.	33.	170	ug/kg	99		61-133		
Benzo(g,h,i)perylene	N.D.	33.	170	ug/kg	104		63-130		
Chrysene	N.D.	33.	170	ug/kg	112		84-117		
Fluorene	N.D.	33.	170	ug/kg	108		84-113		
Naphthalene	N.D.	33.	170	ug/kg	102		83-112		
Phenanthrene	N.D.	33.	170	ug/kg	108		86-109		
Pyrene	N.D.	33.	170	ug/kg	117		86-122		
Batch number: 101326150001A	Sample nu	umber(s): 59	977139-59	77141					
Lead	N.D.	0.0300	0.200	mg/kg	102		80-120		
Batch number: 10132820004A	Sample nu	umber(s): 59	977139-59	77141					

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1194091

Reported: 07/16/10 at 09:59 AM

Laboratory Compliance Quality Control

Blank Blank Blank Report LCS LCSD LCS/LCSD MDL** %REC RPD Max Analysis Name Result LOQ <u>Units</u> %REC <u>Limits</u> RPD

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD <u>Max</u>
Batch number: X101321AA	Sample	number(s)	: 5977139	,597714	1 UNSPI	K: 5977141			
Benzene	101		55-143						
1,2-Dibromoethane	101		54-129						
1,2-Dichloroethane	106		53-143						
Ethylbenzene	90		44-141						
Isopropylbenzene	76		38-144						
Methyl Tertiary Butyl Ether	112		55-129						
Toluene	98		50-146						
1,2,4-Trimethylbenzene	75		37-149						
1,3,5-Trimethylbenzene	75		38-150						
Xylene (Total)	88		44-136						
Batch number: 10132SLC026	Sample	number(s)	: 5977139	-597714	1 UNSPI	K: 5977139			
Anthracene	110	108	76-111	2	30				
Benzo(a)anthracene	110	113*	78-111	2	30				
Benzo(a) pyrene	101	102	57-129	1	30				
Benzo(b)fluoranthene	97	101	53-131	4	30				
Benzo(g,h,i)perylene	110	112	60-123	2	30				
Chrysene	107	110	76-114	2	30				
Fluorene	103	103	75-111	1	30				
Naphthalene	101	104	33-140	3	30				
Phenanthrene	106	106	69-115	1	30				
Pyrene	120	124	76-124	3	30				
Batch number: 101326150001A	Sample	number(s)	: 5977139	-597714	11 UNSP	K: P976155 F	BKG: P976155	5	
Lead	3 (2)	161 (2)		18	20	23.5	22.1	6	20
Batch number: 10132820004A	Sample	number(s)	: 5977139	-597714	1 BKG	: P975348			
Moisture	<u>-</u>	== (27				6.3	6.6	5	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil)

Batch number: R101381AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5977140	94	92	82	102
Blank	92	97	88	88

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

	me: SUN: Aquaterra Te 07/16/10 at 09:59 A		Group Number: 1	194091
		Surrogate Qu	ality Control	
LCS	93	97	89	89
LCSD	86	92	85	84
Limits:	71-114	70-109	70-123	70-111
	me: TCL(4.3)by 8260(soil) r: X101321AA			
	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5977139	101	110*	94	93
5977141	101	105	94	97
Blank	100	102	92	98
LCS	100	103	99	97
LCSD	100	106	99	98
MS	102	109	97	96
Limits:	71-114	70-109	70-123	70-111
	me: PAH 8270 (microwave) r: 10132SLC026			
	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
5977139	79	93	86	
5977140	92	105	91	
5977141	87	107	95	
Blank	95	103	101	
LCS	98	107	103	
MS	92	107	102	
MSD	95	109	103	
Limits:	55-121	74-110	57-112	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10137 Group# 1194091 Sample # 5977139-41

COC# 233634

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Project Manager: Tiffani Doc((P.O.#:			_	4				(foth.)	(08 267	دوي.	y ten	sta!	an .	F 20	در له ار له		N=HNO ₃ B=NaO		
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Name of state where samples were collected					ļ	22		8 -	700	22 4 10 11.916	#14 14 14.00	the Co	Miller	thrac	325	100	કુ	LANCASTER W		3
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	BMQL	Below Minimum Quantitation Level
N.D.	none detected	MPN	Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- **J** estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

X,Y,Z

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
Ε	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Defined in case narrative

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 Prepared for:

SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 05/13/2010 Group Number: 1194462 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-316_1-2' Grab Soil	5979368
S-315_1-2' Grab Soil	5979369
S-314_1-2' Grab Soil	5979370
S-318_1-2' Grab Soil	5979371
S-302S_1-2' Grab Soil	5979372

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		
ELECTRONIC	Aquaterra Tech	Attn: Loretta Belfiglio
COPY TO	-	•



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



Drv

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Page 1 of 2 **REVISED**

Sample Description: S-316 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-316 1-2'

LLI Sample # SW 5979368 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/10/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

09/15/2010 Discard:

2-316

CAT No.	Analysis Name	CAS Number	Dry Result	Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene	71-43-2	N.D.	59	590	93.46
10950	1,2-Dibromoethane	106-93-4	N.D.	120	590	93.46
10950	1,2-Dichloroethane	107-06-2	N.D.	120	590	93.46
10950	Ethylbenzene	100-41-4	N.D.	120	590	93.46
10950	Isopropylbenzene	98-82-8	N.D.	120	590	93.46
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.	59	590	93.46
10950	Toluene	108-88-3	N.D.	120	590	93.46
10950	1,2,4-Trimethylbenzene	95-63-6	N.D.	120	590	93.46
10950	1,3,5-Trimethylbenzene	108-67-8	N.D.	120	590	93.46
10950	Xylene (Total)	1330-20-7	N.D.	120	590	93.46

The $\operatorname{GC/MS}$ volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the reporting limits were raised.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg		ug/kg	ug/kg	
10724	Anthracene		120-12-7	N.D.		1,100	5,300	5
10724	Benzo(a)anthracene		56-55-3	1,200	J	1,100	5,300	5
10724	Benzo(a)pyrene		50-32-8	N.D.		1,100	5,300	5
10724	Benzo(b)fluoranthene	:	205-99-2	1,200	J	1,100	5,300	5
10724	Benzo(g,h,i)perylene	:	191-24-2	N.D.		1,100	5,300	5
10724	Chrysene		218-01-9	2,500	J	1,100	5,300	5
10724	Fluorene		86-73-7	N.D.		1,100	5,300	5
10724	Naphthalene		91-20-3	2,300	J	1,100	5,300	5
10724	Phenanthrene		85-01-8	1,300	J	1,100	5,300	5
10724	Pyrene		129-00-0	3,700	J	1,100	5,300	5

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.

Due to sample matrix interferences observed during the extraction, the normal reporting limits were not attained.

Metal	s	SW-84	6 602	20	mg/kg	mg/kg	mg/kg	
06135	Lead			7439-92-1	384	0.186	1.24	10
Wet C	hemistry	SM20	2540	G	%	%	%	
00111	Moisture			n.a.	20.9	0.50	0.50	1
	"Moisture"	represents the	loss i	n weight of the	sample after	oven drving at		

103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Sample Description: S-316 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-316 1-2'

LLI Sample # SW 5979368 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/10/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-316

	Laboratory Sample Analysis Record												
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor					
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5	5035 1	201013321123	05/10/2010	13:30	Client Supplied	1					
02392	L/H Field Preserved Bisulfate	SW-846 5	5035 1	201013321123	05/10/2010	13:30	Client Supplied	1					
02392	L/H Field Preserved Bisulfate	SW-846 5	5035 2	201013321123	05/10/2010	13:30	Client Supplied	1					
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8	3260B 1	R101381AA	05/18/2010	17:40	Nicholas R Rossi	93.46					
10724	PAH 8270 (microwave)	SW-846 8	3270C 1	10135SLC026	05/20/2010	21:40	Gregory J Drahovsky	5					
10814	BNA Soil Microwave PAH	SW-846 3	3546 1	10135SLC026	05/17/2010	10:20	Doreen K Robles	1					
06135	Lead	SW-846 6	5020 1	101346150002A	05/20/2010	15:36	Choon Y Tian	10					
06150	ICP/MS SW-846 Solid Digest	SW-846 3	3050B 1	101346150002	05/14/2010	20:48	Annamaria Stipkovits	1					
00111	Moisture	SM20 254	10 G 2	10138820005A	05/18/2010	18:01	Scott W Freisher	1					



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Sample Description: S-315 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-315 1-2'

LLI Group # 1194462 Account # 10132

LLI Sample # SW 5979369

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/11/2010 08:00 by SS SUN: Aquaterra Tech.

PO Box 744

Drv

Submitted: 05/13/2010 15:25 West Chester PA 19381

Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-315

CAT No.	Analysis Name	CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	190	J	33	330	59.42
10950	1,2-Dibromoethane	106-93-4	N.D.		67	330	59.42
10950	1,2-Dichloroethane	107-06-2	N.D.		67	330	59.42
10950	Ethylbenzene	100-41-4	N.D.		67	330	59.42
10950	Isopropylbenzene	98-82-8	N.D.		67	330	59.42
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		33	330	59.42
10950	Toluene	108-88-3	N.D.		67	330	59.42
10950	1,2,4-Trimethylbenzene	95-63-6	N.D.		67	330	59.42
10950	1,3,5-Trimethylbenzene	108-67-8	N.D.		67	330	59.42
10950	Xylene (Total)	1330-20-7	75	J	67	330	59.42

The GC/MS volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the

reporting limits were raised.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg		ug/kg	ug/kg	
10724	Anthracene		120-12-7	N.D.		940	4,700	5
10724	Benzo(a)anthracene		56-55-3	N.D.		940	4,700	5
10724	Benzo(a)pyrene		50-32-8	N.D.		940	4,700	5
10724	Benzo(b)fluoranthene	9	205-99-2	N.D.		940	4,700	5
10724	Benzo(g,h,i)perylene	9	191-24-2	N.D.		940	4,700	5
10724	Chrysene		218-01-9	2,000	J	940	4,700	5
10724	Fluorene		86-73-7	N.D.		940	4,700	5
10724	Naphthalene		91-20-3	N.D.		940	4,700	5
10724	Phenanthrene		85-01-8	N.D.		940	4,700	5
10724	Pyrene		129-00-0	2,100	J	940	4,700	5

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.

Due to sample matrix interferences observed during the extraction, the normal reporting limits were not attained.

Metals	5	SW-846 60	20	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	79.8	0.0331	0.221	2
Wet Cl	hemistry	SM20 2540	G	%	%	%	
00111	Moisture		n.a.	11.2	0.50	0.50	1
	"Moisture" represer	nts the loss	in weight of the	sample after o	oven drving at		

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Page 2 of 2 REVISED

Sample Description: S-315 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-315 1-2'

LLI Sample # SW 5979369 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/11/2010 08:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-315

	Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor				
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201013321123	05/11/2010	08:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201013321123	05/11/2010	08:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201013321123	05/11/2010	08:00	Client Supplied	1				
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	R101381AA	05/18/2010	18:02	Nicholas R Rossi	59.42				
10724	PAH 8270 (microwave)	SW-846 8270C	1	10135SLC026	05/20/2010	22:51	Gregory J Drahovsky	5				
10814	BNA Soil Microwave PAH	SW-846 3546	1	10135SLC026	05/17/2010	10:20	Doreen K Robles	1				
06135	Lead	SW-846 6020	1	101346150002A	05/20/2010	15:05	Choon Y Tian	2				
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101346150002	05/14/2010	20:48	Annamaria Stipkovits	1				
00111	Moisture	SM20 2540 G	2	10138820005B	05/18/2010	18:01	Scott W Freisher	1				



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Page 1 of 2 REVISED

Sample Description: S-314 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-314 1-2'

LLI Sample # SW 5979370 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/11/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

Drv

Submitted: 05/13/2010 15:25 West Chester PA 19381

Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-314

CAT No.	Analysis Name	CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene	71-43-2	< 5	5	0.5	0.84
10950	1,2-Dibromoethane	106-93-4	< 5	5	1	0.84
10950	1,2-Dichloroethane	107-06-2	< 5	5	1	0.84
10950	Ethylbenzene	100-41-4	< 5	5	1	0.84
10950	Isopropylbenzene	98-82-8	< 5	5	1	0.84
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.84
10950	Toluene	108-88-3	< 5	5	1	0.84
10950	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.84
10950	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.84
10950	Xylene (Total)	1330-20-7	< 5	5	1	0.84

The GC/MS volatile internal standard peak areas were outside the QC limits for both the initial analysis and the re-analysis. The values reported here are from the initial analysis of the sample. A surrogate recovery was also outside of QC limits for the initial analysis.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	4,100	1,900	380	5
10724	Benzo(a)anthracene		56-55-3	9,600	1,900	380	5
10724	Benzo(a)pyrene		50-32-8	6,300	1,900	380	5
10724	Benzo(b)fluoranthene	9	205-99-2	8,100	1,900	380	5
10724	Benzo(g,h,i)perylene	9	191-24-2	2,600	1,900	380	5
10724	Chrysene		218-01-9	8,500	1,900	380	5
10724	Fluorene		86-73-7	< 1,900	1,900	380	5
10724	Naphthalene		91-20-3	< 1,900	1,900	380	5
10724	Phenanthrene		85-01-8	11,000	1,900	380	5
10724	Pyrene		129-00-0	13,000	1,900	380	5

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.

Due to sample matrix interferences observed during the extraction, the normal reporting limits were not attained.

Metals 06135 Lead	SW-846 6020 7439-92-1	mg/kg 227	mg/kg 0.562	mg/kg 0.0843	5
Wet Chemistry	SM20 2540 G	%	%	8	
00111 Moisture	n.a.	11.9	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Page 2 of 2

REVISED LLI Sample # SW 5979370

LLI Group # 1194462 Account # 10132

Sample Description: S-314_1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-314 1-2'

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/11/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-314

	Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor				
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5	5035 1	201013321123	05/11/2010	11:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 5	5035 1	201013321123	05/11/2010	11:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 5	5035 2	201013321123	05/11/2010	11:00	Client Supplied	1				
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8	3260B 1	X101371AA	05/17/2010	21:19	Emily R Styer	0.84				
10724	PAH 8270 (microwave)	SW-846 8	3270C 1	10135SLC026	05/20/2010	23:15	Gregory J Drahovsky	5				
10814	BNA Soil Microwave PAH	SW-846 3	1 546	10135SLC026	05/17/2010	10:20	Doreen K Robles	1				
06135	Lead	SW-846 6	020 1	101346150002A	05/20/2010	15:45	Choon Y Tian	5				
06150	ICP/MS SW-846 Solid Digest	SW-846 3	050B 1	101346150002	05/14/2010	20:48	Annamaria Stipkovits	1				
00111	Moisture	SM20 254	0 G 1	10137820005A	05/17/2010	16:23	Scott W Freisher	1				



0.50

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Page 1 of 2 REVISED

Sample Description: S-318 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-318 1-2'

LLI Group # 1194462 Account # 10132

LLI Sample # SW 5979371

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/12/2010 09:20 by SS SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-318

Analysis Name	CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
Volatiles SW-846	8260B	ug/kg	ug/kg	ug/kg	
Benzene	71-43-2	6	5	0.5	0.89
1,2-Dibromoethane	106-93-4	< 5	5	1	0.89
1,2-Dichloroethane	107-06-2	< 5	5	1	0.89
Ethylbenzene	100-41-4	< 5	5	1	0.89
Isopropylbenzene	98-82-8	< 5	5	1	0.89
Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.89
Toluene	108-88-3	< 5	5	1	0.89
1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.89
1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.89
Xylene (Total)	1330-20-7	< 5	5	1	0.89
	Volatiles SW-846 Benzene 1,2-Dibromoethane 1,2-Dichloroethane Ethylbenzene Isopropylbenzene Methyl Tertiary Butyl Ether Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene	Volatiles SW-846 8260B Benzene 71-43-2 1,2-Dibromoethane 106-93-4 1,2-Dichloroethane 107-06-2 Ethylbenzene 100-41-4 Isopropylbenzene 98-82-8 Methyl Tertiary Butyl Ether 1634-04-4 Toluene 108-88-3 1,2,4-Trimethylbenzene 95-63-6 1,3,5-Trimethylbenzene 108-67-8	Volatiles SW-846 8260B ug/kg Benzene 71-43-2 6 1,2-Dibromoethane 106-93-4 < 5	Analysis Name CAS Number Dry Result Limit of Quantitation* Volatiles SW-846 8260B ug/kg ug/kg Benzene 71-43-2 6 5 1,2-Dibromoethane 106-93-4 < 5	Volatiles SW-846 8260B ug/kg ug/kg ug/kg ug/kg Benzene 71-43-2 6 5 0.5 1,2-Dibromoethane 106-93-4 < 5

A GC/MS volatile internal standard peak area was outside the QC limits. The only analytes that reference this internal standard are 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene, which were not detected in this sample. The sample could not be repeated to confirm a matrix effect because of an instrument problem.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 190	190	37	1
10724	Benzo(a)anthracene		56-55-3	< 190	190	37	1
10724	Benzo(a)pyrene		50-32-8	< 190	190	37	1
10724	Benzo(b)fluoranthene	е	205-99-2	< 190	190	37	1
10724	Benzo(g,h,i)perylene	e	191-24-2	< 190	190	37	1
10724	Chrysene		218-01-9	< 190	190	37	1
10724	Fluorene		86-73-7	< 190	190	37	1
10724	Naphthalene		91-20-3	< 190	190	37	1
10724	Phenanthrene		85-01-8	280	190	37	1
10724	Pyrene		129-00-0	200	190	37	1
Metals	S	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	860	5.51	0.827	50
Wet Ch	nemistry	SM20 25	540 G	%	%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



Drahovsky

Annamaria

Stipkovits

Doreen K Robles

Scott W Freisher

50

1

Choon Y Tian

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Page 2 of 2 **REVISED**

Sample Description: S-318 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-318 1-2'

SW-846 3546

SW-846 6020

SW-846 3050B

SM20 2540 G

LLI Sample # SW 5979371 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/12/2010 09:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

05/17/2010 10:20 05/20/2010 15:47

05/14/2010 20:48

05/17/2010 16:23

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

10814 BNA Soil Microwave PAH

06150 ICP/MS SW-846 Solid Digest

2-318

CAT

No.

06135 Lead

00111 Moisture

Analysis Name Method Trial# Batch# Analysis Analyst Dilution Date and Time 06646 GC/MS HL Bulk Sample Prep SW-846 5030A 1 201013421127 05/14/2010 08:37 Larry E Bevins n.a. 1 201013321123 Client Supplied 02392 L/H Field Preserved SW-846 5035 05/12/2010 09:20 1 Bisulfate 02392 L/H Field Preserved SW-846 5035 2 201013321123 Client Supplied 05/12/2010 09:20 Bisulfate 10950 BTEX/MTBE/EDB/EDC/Cumene/TM SW-846 8260B 1 X101371AA 05/17/2010 20:12 Emily R Styer 0.89 10724 PAH 8270 (microwave) SW-846 8270C 1 10135SLC026 05/20/2010 23:39 1 Gregory J

10135SLC026

1 101346150002A

1 101346150002

1 10137820005A

1

Laboratory Sample Analysis Record



Dry

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Page 1 of 2 REVISED

Sample Description: S-302S 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-302S_1-2'

LLI Sample # SW 5979372 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/12/2010 13:35 by SS SUN: Aquaterra Tech.

PO Box 744

Dry

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-302

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.87
10950	1,2-Dibromoethane		106-93-4	< 5	5	1	0.87
10950	1,2-Dichloroethane		107-06-2	< 5	5	1	0.87
10950	Ethylbenzene		100-41-4	< 5	5	1	0.87
10950	Isopropylbenzene		98-82-8	< 5	5	1	0.87
10950	Methyl Tertiary Buty	yl Ether	1634-04-4	< 5	5	0.5	0.87
10950	Toluene		108-88-3	< 5	5	1	0.87
10950	1,2,4-Trimethylbenze	ene	95-63-6	< 5	5	1	0.87
10950	1,3,5-Trimethylbenze	ene	108-67-8	< 5	5	1	0.87
10950	Xylene (Total)		1330-20-7	< 5	5	1	0.87
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 190	190	38	1
10724	Benzo(a)anthracene		56-55-3	< 190	190	38	1
10724	Benzo(a)pyrene		50-32-8	< 190	190	38	1
10724	Benzo(b) fluoranthene	е	205-99-2	< 190	190	38	1
10724	Benzo(g,h,i)perylene	е	191-24-2	< 190	190	38	1
10724	Chrysene		218-01-9	< 190	190	38	1
10724	Fluorene		86-73-7	< 190	190	38	1
10724	Naphthalene		91-20-3	< 190	190	38	1
10724	Phenanthrene		85-01-8	< 190	190	38	1
10724	Pyrene		129-00-0	< 190	190	38	1
Metals	;	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	47.7	0.226	0.0338	2
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	13.1	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees Co as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201013321123	05/12/2010 13:35	Client Supplied	1



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Page 2 of 2 REVISED

Sample Description: S-302S 1-2' Grab Soil

Philadelphia Refinery AOI-2 COC: 221513 S-302S 1-2' LLI Sample # SW 5979372 LLI Group # 1194462 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/12/2010 13:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/13/2010 15:25 Reported: 07/16/2010 09:55

Discard: 09/15/2010

2-302

Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor			
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201013321123	05/12/2010	13:35	Client Supplied	1			
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201013321123	05/12/2010	13:35	Client Supplied	1			
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260)B 1	X101371AA	05/17/2010	20:34	Emily R Styer	0.87			
10724	PAH 8270 (microwave)	SW-846 8270)C 1	10135SLC026	05/21/2010	00:02	Gregory J Drahovsky	1			
10814	BNA Soil Microwave PAH	SW-846 3546	1	10135SLC026	05/17/2010	10:20	Doreen K Robles	1			
06135	Lead	SW-846 6020	1	101346150002A	05/20/2010	15:18	Choon Y Tian	2			
06150	ICP/MS SW-846 Solid Digest	SW-846 3050)B 1	101346150002	05/14/2010	20:48	Annamaria Stipkovits	1			
00111	Moisture	SM20 2540 G	1	10137820005A	05/17/2010	16:23	Scott W Freisher	1			



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1194462

Reported: 07/16/10 at 09:55 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>LOQ**</u>	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD <u>%REC</u>	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: X101371AA	Sample nu	umber(s): 5	979370-59	79372					
Benzene	< 5	5.	0.5	ug/kg	103	100	80-120	3	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	96	93	80-120	3	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	106	102	71-129	4	30
Ethylbenzene	< 5	5.	1	ug/kg	100	96	80-120	4	30
Isopropylbenzene	< 5	5.	1	ug/kg	100	97	76-120	3	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	107	104	74-121	3	30
Toluene	< 5	5.	1	ug/kg	99	96	80-120	4	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	97	94	79-120	3	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	99	95	78-120	4	30
Xylene (Total)	< 5	5.	1	ug/kg	100	97	80-120	3	30

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank MDL**	Blank <u>LOQ</u>	Report <u>Units</u>	LCS <u>%REC</u>	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: R101381AA	Sample num	ber(s): 59	79368-597	9369					
Benzene	N.D.	25.	250	ug/kg	97	92	80-120	6	30
1,2-Dibromoethane	N.D.	50.	250	ug/kg	93	92	80-120	1	30
1,2-Dichloroethane	N.D.	50.	250	ug/kg	100	96	71-129	4	30
Ethylbenzene	N.D.	50.	250	ug/kg	92	88	80-120	5	30
Isopropylbenzene	N.D.	50.	250	ug/kg	92	88	76-120	5	30
Methyl Tertiary Butyl Ether	N.D.	25.	250	ug/kg	102	99	74-121	2	30
Toluene	N.D.	50.	250	ug/kg	93	88	80-120	5	30
1,2,4-Trimethylbenzene	N.D.	50.	250	ug/kg	90	85	79-120	6	30
1,3,5-Trimethylbenzene	N.D.	50.	250	ug/kg	90	84	78-120	7	30
Xylene (Total)	N.D.	50.	250	ug/kg	93	88	80-120	5	30
Batch number: 10135SLC026	Sample num	ber(s): 59	79368-597	9372					
Anthracene	N.D.	33.	170	ug/kg	104		89-109		
Benzo(a)anthracene	N.D.	33.	170	ug/kg	97		86-113		
Benzo(a)pyrene	N.D.	33.	170	ug/kg	93		63-138		
Benzo(b)fluoranthene	N.D.	33.	170	ug/kg	88		61-133		
Benzo(g,h,i)perylene	N.D.	33.	170	ug/kg	94		63-130		
Chrysene	N.D.	33.	170	ug/kg	100		84-117		
Fluorene	N.D.	33.	170	ug/kg	97		84-113		
Naphthalene	N.D.	33.	170	ug/kg	100		83-112		
Phenanthrene	N.D.	33.	170	ug/kg	102		86-109		
Pyrene	N.D.	33.	170	ug/kg	105		86-122		
Batch number: 101346150002A Lead	Sample num	ber(s): 59	979368-597 0.200	9372 mg/kg	106		80-120		
2044		0.0500	0.200		_00		00 120		

^{*-} Outside of specification

Page 1 of 4

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1194462

Reported: 07/16/10 at 09:55 AM

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS <u>%REC</u>	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: 10137820005A Moisture	Sample nu	mber(s): 5	979370-59	79372	100		99-101		

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>MDL**</u>	Blank <u>LOO</u>	Report <u>Units</u>	LCS <u>%REC</u>	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: 10138820005A Moisture	Sample num	ber(s): 5	979368		100		99-101		
Batch number: 10138820005B Moisture	Sample num	ber(s): 5	979369		100		99-101		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP <u>RPD</u>	Dup RPD <u>Max</u>
Batch number: X101371AA	Sample	number(s): 5979370	-59793	72 UNSP	K: P979790			
Benzene	116		55-143						
1,2-Dibromoethane	114		54-129						
1,2-Dichloroethane	124		53-143						
Ethylbenzene	108		44-141						
Isopropylbenzene	108		38-144						
Methyl Tertiary Butyl Ether	128		55-129						
Toluene	109		50-146						
1,2,4-Trimethylbenzene	108		37-149						
1,3,5-Trimethylbenzene	109		38-150						
Xylene (Total)	109		44-136						
Batch number: 10135SLC026	Sample	number(s) - 5979368	-59793	72 UNSP	K: 5979368			
Anthracene	125*	133*	76-111	6	30	5575500			
Benzo(a)anthracene	91	93	78-111	1	30				
Benzo(a) pyrene	147*	141*	57-129	4	30				
Benzo(b) fluoranthene	80	83	53-131	2	30				
Benzo(g,h,i)perylene	126*	118	60-123	6	30				
Chrysene	124*	90	76-114	15	30				
Fluorene	117*	121*	75-111	3	30				
Naphthalene	88	82	33-140	3	30				
Phenanthrene	104	95	69-115	5	30				
Pyrene	155*	133*	76-124	7	30				
Batch number: 101346150002A	Sample	number(s	1 . 5979368	-59793	72 IINSP	к. р979722	BKG: P97972	2	
Lead	538 (2)		75-125	8	20	68.8	80.8	16	20
Batch number: 10137820005A	Sample	number(s): 5979370	-59793	72 BKG	: P979526			
	r -								

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 3 of 4 **REVISED**

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1194462

Reported: 07/16/10 at 09:55 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name Moisture	MS <u>%REC</u>	MSD <u>%REC</u>	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc 24.8	DUP <u>Conc</u> 26.5	DUP <u>RPD</u> 6	Dup RPD <u>Max</u> 15
Batch number: 10138820005A Moisture	Sample	number(s)	: 5979368	BKG:	5979368	3 20.9	20.9	0	15
Batch number: 10138820005B Moisture	Sample	number(s)	: 5979369	BKG:	5979369) 11.2	11.2	0	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil)

Batch number: R101381AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5979368	75	74	69*	58*
5979369	80	80	73	67*
Blank	92	97	88	88
LCS	93	97	89	89
LCSD	86	92	85	84
Limits:	71-114	70-109	70-123	70-111

Analysis Name: TCL(4.3)by 8260(soil)

Batch number: X101371AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5979370	104	110*	103	78
5979371	102	107	94	88
5979372	102	107	92	89
Blank	100	99	89	97
LCS	101	107	97	99
LCSD	102	103	97	100
MS	102	110*	96	97
Limits:	71-114	70-109	70-123	70-111

Analysis Name: PAH 8270 (microwave)

Batch number: 10135SLC026 Nitrobenzene-d5		2-Fluorobiphenyl	Terphenyl-d14	
5979368	81	86	85	
5979369	80	82	81	
5979370	75	76	70	
5979371	92	104	95	
5979372	84	99	91	
Blank	98	100	94	
LCS	101	103	97	

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 4 of 4 **REVISED**

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 07/16/10 at 09:55 AM Group Number: 1194462

Surrogate Quality Control

MS	93	97	92	
MSD	85	93	82	
Limits:	55-121	74-110	57-112	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

4	_ancas	ter
	_abora	tories

For Lancaster Laboratories use only Group# 194462 Sample # 5979368 - 77 COC # Acct. # 10132 221513

Laboratorie	.5 ·	Pie	ease print. Ins	truction	s on rever	se side d	corresp	ond with	circle	d numb	oers.		(3.5	٥ در) Familiak (Jan Onli)		
									5)						For Lab Use Only FSC:		_
lient: SUN- AQUATE	RRA	Acct. #:			18 18 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4		<u>g</u>	Pre	servat	tion	Codes	<u> </u>	,]	SCR#:		
roject Name/#: PHILA REI		PWSID#	ŧ					¥ -			وغ	8	<u> </u>		Preservation Codes		
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 05/25/2010 Group Number: 1195950 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-303_0-2 Soil	5989366
S-305S_0-2 Soil	5989367
S-306_0-2 Soil	5989368
S-300_0-2 Soil	5989369

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		
ELECTRONIC	Aquaterra Tech	Attn: Loretta Belfiglio
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



Dry

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Page 1 of 2 REVISED

Sample Description: S-303 0-2 Soil

S-303_0-2 Soil LLI Sample # SW 5989366 Philadelphia Refinery AOI-2 LLI Group # 1195950 COC: 230375 S-303 0-2 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/21/2010 10:30 by JRW SUN: Aquaterra Tech.

PO Box 744

Dry

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2303

CAT No.	Analysis Name			CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846	826	0B	ug/kg		ug/kg	ug/kg	
10950	Benzene			71-43-2	140	J	60	600	104.84
10950	1,2-Dibromoethane			106-93-4	N.D.		120	600	104.84
10950	1,2-Dichloroethane			107-06-2	N.D.		120	600	104.84
10950	Ethylbenzene			100-41-4	220	J	120	600	104.84
10950	Isopropylbenzene			98-82-8	3,600		120	600	104.84
10950	Methyl Tertiary But	yl Ether		1634-04-4	N.D.		60	600	104.84
10950	Toluene			108-88-3	N.D.		120	600	104.84
10950	1,2,4-Trimethylbenz	ene		95-63-6	670		120	600	104.84
10950	1,3,5-Trimethylbenz	ene		108-67-8	N.D.		120	600	104.84
10950	Xylene (Total)			1330-20-7	520	J	120	600	104.84
GC/MS	Semivolatiles	SW-846	827	0C	ug/kg		ug/kg	ug/kg	
10724	Anthracene			120-12-7	540	J	380	1,900	10
10724	Benzo(a)anthracene			56-55-3	2,100		380	1,900	10
10724	Benzo(a)pyrene			50-32-8	1,800	J	380	1,900	10
10724	Benzo(b)fluoranthen	е		205-99-2	1,300	J	380	1,900	10
10724	Benzo(g,h,i)perylen	е		191-24-2	1,400	J	380	1,900	10
10724	Chrysene			218-01-9	6,900		380	1,900	10
10724	Fluorene			86-73-7	1,100	J	380	1,900	10
10724	Naphthalene			91-20-3	2,200		380	1,900	10
10724	Phenanthrene			85-01-8	2,400		380	1,900	10
10724	Pyrene			129-00-0	1,700	J	380	1,900	10
Metals	5	SW-846	602	0	mg/kg		mg/kg	mg/kg	
06135	Lead			7439-92-1	121		0.0848	0.565	5
Wet Cl	nemistry	SM20 25	540	G	%		8	%	
00111	Moisture			n.a.	12.4		0.50	0.50	1
	"Moisture" represen 103 - 105 degrees C as-received basis.								

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201014621251	05/21/2010 10:30	Client Supplied	1



Stipkovits

Scott W Freisher

05/27/2010 17:09

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Page 2 of 2 REVISED

Sample Description: S-303 0-2 Soil LLI Sample # SW 5989366

Philadelphia Refinery AOI-2 LLI Group # 1195950 COC: 230375 S-303 0-2 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/21/2010 10:30 by JRW SUN: Aquaterra Tech.

SM20 2540 G

PO Box 744

Submitted: 05/25/2010 14:25 West Chester PA 19381

Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2303

00111 Moisture

Laboratory Sample Analysis Record CAT Analysis Name Method Trial# Batch# Analysis Analyst Dilution No. Date and Time SW-846 5035 1 201014621251 05/21/2010 10:30 Client Supplied 02392 L/H Field Preserved Bisulfate 02392 L/H Field Preserved SW-846 5035 2 201014621251 05/21/2010 10:30 Client Supplied Bisulfate 10950 BTEX/MTBE/EDB/EDC/Cumene/TM SW-846 8260B 1 R101531AA 06/02/2010 20:35 Kristen D Pelliccia Bs 1 10146SLB026 10724 PAH 8270 (microwave) SW-846 8270C 05/28/2010 13:07 Linda M 1.0 Hartenstine 10814 BNA Soil Microwave PAH SW-846 3546 1 10146SLB026 05/26/2010 23:00 Patricia L Foreman 1 SW-846 6020 Choon Y Tian 06135 Lead 1 101486150002A 06/04/2010 16:52 5 06150 ICP/MS SW-846 Solid Digest SW-846 3050B 1 101486150002 05/30/2010 21:10 Annamaria 1

1 10147820004A



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Page 1 of 2 **REVISED**

Sample Description: S-305S 0-2 Soil

Philadelphia Refinery AOI-2 COC: 230375 S-305S 0-2

LLI Group # 1195950 Account # 10132

LLI Sample # SW 5989367

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/19/2010 08:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2305

CAT No.	Analysis Name	CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	N.D.		29	290	49.26
10950	1,2-Dibromoethane	106-93-4	N.D.		57	290	49.26
10950	1,2-Dichloroethane	107-06-2	N.D.		57	290	49.26
10950	Ethylbenzene	100-41-4	N.D.		57	290	49.26
10950	Isopropylbenzene	98-82-8	N.D.		57	290	49.26
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		29	290	49.26
10950	Toluene	108-88-3	N.D.		57	290	49.26
10950	1,2,4-Trimethylbenzene	95-63-6	63	J	57	290	49.26
10950	1,3,5-Trimethylbenzene	108-67-8	N.D.		57	290	49.26
10950	Xylene (Total)	1330-20-7	92	J	57	290	49.26
	GC/MS volatile analysis was p			_			
ani 1	mothed due to the level of r	on target gemnelind	la Thora	foro	+ho		

soil method due to the level of non-target compounds. Therefore, the

reporting limits were raised.

00111 Moisture

GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	N.D.	39	190	1
10724	Benzo(a)anthracene		56-55-3	N.D.	39	190	1
10724	Benzo(a)pyrene		50-32-8	N.D.	39	190	1
10724	Benzo(b)fluoranthene	е	205-99-2	N.D.	39	190	1
10724	Benzo(g,h,i)perylene	е	191-24-2	N.D.	39	190	1
10724	Chrysene		218-01-9	N.D.	39	190	1
10724	Fluorene		86-73-7	N.D.	39	190	1
10724	Naphthalene		91-20-3	N.D.	39	190	1
10724	Phenanthrene		85-01-8	N.D.	39	190	1
10724	Pyrene		129-00-0	N.D.	39	190	1
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	161	0.0837	0.558	5
Wet Ch	nemistry	SM20 2	540 G	%	%	%	

13.8

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

n.a.

General Sample Comments

0.50

0.50

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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Sample Description: S-305S_0-2 Soil LLI Sample # SW 5989367
Philadelphia Refinery AOI-2 LLI Group # 1195950

LLI Group # 1195950 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/19/2010 08:15 by JRW SUN: Aquaterra Tech.

COC: 230375 S-305S 0-2

PO Box 744

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2305

			Laboratory S	Sa	mple Analysis	Record			
CAT No.	Analysis Name	Method	Trial	#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035	1	201014621251	05/19/2010	08:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846	5035 1	1	201014621251	05/19/2010	08:15	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846	5035	2	201014621251	05/19/2010	08:15	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846	8260B 1	1	R101531AA	06/02/2010	19:49	Kristen D Pelliccia	49.26
10724	PAH 8270 (microwave)	SW-846	8270C 1	1	10146SLB026	05/28/2010	13:30	Linda M Hartenstine	1
10814	BNA Soil Microwave PAH	SW-846	3546	1	10146SLB026	05/26/2010	23:00	Patricia L Foreman	1
06135	Lead	SW-846	6020	1	101486150002A	06/04/2010	12:26	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B 1	1	101486150002	05/30/2010	21:10	Annamaria Stipkovits	1
00111	Moisture	SM20 25	340 G 1	1	10147820004A	05/27/2010	17:09	Scott W Freisher	1



Drv

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Page 1 of 2

Sample Description: S-306 0-2 Soil

Philadelphia Refinery AOI-2

COC: 230375 S-306 0-2

REVISED LLI Sample # SW 5989368

LLI Group # 1195950 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/20/2010 13:20 by JRW SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2306

CAT No.	Analysis Name	CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	160	J	29	290	49.78
10950	1,2-Dibromoethane	106-93-4	N.D.		58	290	49.78
10950	1,2-Dichloroethane	107-06-2	N.D.		58	290	49.78
10950	Ethylbenzene	100-41-4	92	J	58	290	49.78
10950	Isopropylbenzene	98-82-8	N.D.		58	290	49.78
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		29	290	49.78
10950	Toluene	108-88-3	140	J	58	290	49.78
10950	1,2,4-Trimethylbenzene	95-63-6	190	J	58	290	49.78
10950	1,3,5-Trimethylbenzene	108-67-8	63	J	58	290	49.78
10950	Xylene (Total)	1330-20-7	360		58	290	49.78

The GC/MS volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the

reporting limits were raised.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	710	39	190	1
10724	Benzo(a)anthracene		56-55-3	1,600	39	190	1
10724	Benzo(a)pyrene		50-32-8	1,300	39	190	1
10724	Benzo(b)fluoranthene	е	205-99-2	1,700	39	190	1
10724	Benzo(g,h,i)perylene	е	191-24-2	820	39	190	1
10724	Chrysene		218-01-9	1,400	39	190	1
10724	Fluorene		86-73-7	390	39	190	1
10724	Naphthalene		91-20-3	330	39	190	1
10724	Phenanthrene		85-01-8	2,800	39	190	1
10724	Pyrene		129-00-0	3,000	39	190	1
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	145	0.0842	0.561	5
Wet Cl	nemistry	SM20 25	540 G	%	8	%	
00111	Moisture		n.a.	13.5	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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LLI Sample # SW 5989368

LLI Group # 1195950 Account # 10132

Sample Description: S-306_0-2 Soil

Philadelphia Refinery AOI-2 COC: 230375 S-306 0-2

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/20/2010 13:20 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2306

		Labora	tory Sa	ample Analysi	s Record			
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tim	ne	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201014621251	05/20/2010	13:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201014621251	05/20/2010	13:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201014621251	05/20/2010	13:20	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	R101531AA	06/02/2010	18:41	Kristen D Pelliccia	49.78
10724	PAH 8270 (microwave)	SW-846 8270C	1	10146SLB026	05/28/2010	13:53	Linda M Hartenstine	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10146SLB026	05/26/2010	23:00	Patricia L Foreman	1
06135	Lead	SW-846 6020	1	101486150002A		12:28	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101486150002	05/30/2010	21:10	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10147820004A	05/27/2010	17:09	Scott W Freisher	1



Drv

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Page 1 of 2 REVISED

Sample Description: S-300 0-2 Soil

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/19/2010 14:20 by JRW SUN: Aquaterra Tech.

PO Box 744

Drv

Submitted: 05/25/2010 14:25 West Chester PA 19381

Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2300

CAT No.	Analysis Name	CAS Number	Dry Result		Method Detection Limit*	Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	130	J	33	330	57.6
10950	1,2-Dibromoethane	106-93-4	N.D.		65	330	57.6
10950	1,2-Dichloroethane	107-06-2	N.D.		65	330	57.6
10950	Ethylbenzene	100-41-4	110	J	65	330	57.6
10950	Isopropylbenzene	98-82-8	N.D.		65	330	57.6
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		33	330	57.6
10950	Toluene	108-88-3	99	J	65	330	57.6
10950	1,2,4-Trimethylbenzene	95-63-6	80	J	65	330	57.6
10950	1,3,5-Trimethylbenzene	108-67-8	N.D.		65	330	57.6
10950	Xylene (Total)	1330-20-7	140	J	65	330	57.6

The GC/MS volatile analysis was performed according to the high level soil method due to the level of non-target compounds. Therefore, the

reporting limits were raised.

GC/MS	Semivolatiles	SW-846	8270C	ug/kg		ug/kg	ug/kg	
10724	Anthracene		120-12-7	N.D.		380	1,900	10
10724	Benzo(a)anthracene		56-55-3	N.D.		380	1,900	10
10724	Benzo(a)pyrene		50-32-8	N.D.		380	1,900	10
10724	Benzo(b)fluoranthene	е	205-99-2	N.D.		380	1,900	10
10724	Benzo(g,h,i)perylene	е	191-24-2	N.D.		380	1,900	10
10724	Chrysene		218-01-9	N.D.		380	1,900	10
10724	Fluorene		86-73-7	N.D.		380	1,900	10
10724	Naphthalene		91-20-3	N.D.		380	1,900	10
10724	Phenanthrene		85-01-8	550	J	380	1,900	10
10724	Pyrene		129-00-0	500	J	380	1,900	10

Due to the sample matrix an initial dilution was necessary to perform the analysis. Therefore, the reporting limits for the GC/MS semivolatile compounds were raised.

The recoveries of several compounds were outside of QC limits in the LCS. This sample was re-extracted outside of the method required holding time, and acceptable QC and comparable data were observed. The data reported here is from the initial extraction of the sample.

Metals	SW-846 6020	mg/kg	mg/kg	mg/kg	
06135 Lead	7439-92-1	168	0.0849	0.566	5
Wet Chemistry	SM20 2540 G	%	%	%	
00111 Moisture	n.a.	11 7	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.



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Page 2 of 2 REVISED

Sample Description: S-300 0-2 Soil

Philadelphia Refinery AOI-2 COC: 230375 S-300 0-2

LLI Group # 1195950 Account # 10132

LLI Sample # SW 5989369

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 05/19/2010 14:20 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 05/25/2010 14:25 Reported: 07/16/2010 10:04

Discard: 09/15/2010

A2300

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	1	201014621251	05/19/2010	14:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201014621251	05/19/2010	14:20	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201014621251	05/19/2010	14:20	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	R101531AA	06/02/2010	19:04	Kristen D Pelliccia	57.6
10724	PAH 8270 (microwave)	SW-846 8270C	1	10149SLC026	06/03/2010	22:48	Gregory J Drahovsky	10
10814	BNA Soil Microwave PAH	SW-846 3546	1	10149SLC026	05/30/2010	21:15	Patricia L Foreman	. 1
06135	Lead	SW-846 6020	1	101486150002A	06/04/2010	12:15	Choon Y Tian	5
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101486150002	05/30/2010	21:10	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10147820004A	05/27/2010	17:09	Scott W Freisher	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1195950

Reported: 07/16/10 at 10:04 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank MDL**	Blank <u>LOO</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: R101531AA	Sample numb	ber(s): 59	89366-598	9369					
Benzene	N.D.	25.	250	uq/kq	101	98	80-120	2	30
1,2-Dibromoethane	N.D.	50.	250	ug/kg	103	99	80-120	4	30
1,2-Dichloroethane	N.D.	50.	250	ug/kg	105	103	71-129	2	30
Ethylbenzene	N.D.	50.	250	ug/kg	99	98	80-120	1	30
Isopropylbenzene	N.D.	50.	250	ug/kg	98	97	76-120	1	30
Methyl Tertiary Butyl Ether	N.D.	25.	250	ug/kg	102	101	74-121	1	30
Toluene	N.D.	50.	250	ug/kg	98	97	80-120	1	30
1,2,4-Trimethylbenzene	N.D.	50.	250	ug/kg	95	96	79-120	0	30
1,3,5-Trimethylbenzene	N.D.	50.	250	ug/kg	96	95	78-120	1	30
Xylene (Total)	N.D.	50.	250	ug/kg	100	99	80-120	1	30
Batch number: 10146SLB026	Sample numb								
Anthracene	N.D.	33.	170	ug/kg	102		89-109		
Benzo(a)anthracene	N.D.	33.	170	ug/kg	97		86-113		
Benzo(a)pyrene	N.D.	33.	170	ug/kg	92		63-138		
Benzo(b) fluoranthene	N.D.	33.	170	ug/kg	87		61-133		
Benzo(g,h,i)perylene	N.D.	33.	170	ug/kg	95		63-130		
Chrysene	N.D.	33.	170	ug/kg	94		84-117		
Fluorene	N.D.	33.	170	ug/kg	101		84-113		
Naphthalene	N.D.	33.	170	ug/kg	97		83-112		
Phenanthrene	N.D.	33.	170	ug/kg	99		86-109		
Pyrene	N.D.	33.	170	ug/kg	102		86-122		
Batch number: 10149SLC026	Sample numb	ber(s): 59	89369						
Anthracene	N.D.	33.	170	ug/kg	84*		89-109		
Benzo(a)anthracene	N.D.	33.	170	ug/kg	83*		86-113		
Benzo(a)pyrene	N.D.	33.	170	ug/kg	88		63-138		
Benzo(b) fluoranthene	N.D.	33.	170	ug/kg	94		61-133		
Benzo(g,h,i)perylene	N.D.	33.	170	ug/kg	93		63-130		
Chrysene	N.D.	33.	170	ug/kg	88		84-117		
Fluorene	N.D.	33.	170	ug/kg	86		84-113		
Naphthalene	N.D.	33.	170	ug/kg	83		83-112		
Phenanthrene	N.D.	33.	170	ug/kg	85*		86-109		
Pyrene	N.D.	33.	170	ug/kg	86		86-122		
Batch number: 101486150002A	Sample numb								
Lead	N.D.	0.0300	0.200	mg/kg	106		80-120		
Batch number: 10147820004A	Sample numb	ber(s): 59	89366-598	9369					
Moisture					100		99-101		

Sample Matrix Quality Control

Page 1 of 3

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Page 2 of 3 **REVISED**

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1195950

Reported: 07/16/10 at 10:04 AM

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: 10146SLB026	Sample	number(s)	: 5989366	-598936	8 UNSP	K: P989057			
Anthracene	107	108	76-111	1	30				
Benzo(a)anthracene	103	104	78-111	0	30				
Benzo(a)pyrene	101	102	57-129	1	30				
Benzo(b)fluoranthene	96	102	53-131	6	30				
Benzo(g,h,i)perylene	106	106	60-123	1	30				
Chrysene	101	103	76-114	2	30				
Fluorene	101	102	75-111	1	30				
Naphthalene	102	102	33-140	0	30				
Phenanthrene	106	108	69-115	2	30				
Pyrene	116	118	76-124	2	30				
Batch number: 10149SLC026	Sample	number(s)	: 5989369	UNSPK:	59893	69			
Anthracene	99	94	76-111	5	30				
Benzo(a)anthracene	107	109	78-111	2	30				
Benzo(a)pyrene	110	109	57-129	1	30				
Benzo(b) fluoranthene	120	113	53-131	6	30				
Benzo(g,h,i)perylene	101	103	60-123	3	30				
Chrysene	114	116*	76-114	2	30				
Fluorene	132*	120*	75-111	10	30				
Naphthalene	106	110	33-140	4	30				
Phenanthrene	119*	101	69-115	13	30				
Pyrene	97	99	76-124	2	30				
Batch number: 101486150002A	Sample	number(s)	: 5989366	-598936	9 UNSP	K: 5989369	BKG: 598936	9	
Lead	288 (2)	690 (2)		7	20	148	143	4	20
Batch number: 10147820004A	Sample	number(s)	: 5989366	-598936	59 BKG	: P989505			
Moisture		== (27				18.9	18.6	2	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil) Batch number: R101531AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
5989366	86	85	105	419*
5989367	83	83	92	93
5989368	86	89	91	94
5989369	86	83	89	91
Blank	83	86	80	83
LCS	97	96	94	104
LCSD	95	93	91	95
Limits:	71-114	70-109	70-123	70-111

Analysis Name: PAH 8270 (microwave)

Batch number: 10146SLB026

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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74-110

Page 3 of 3 REVISED

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1195950

Reported: 07/16/10 at 10:04 AM

55-121

Surrogate Quality Control

57-112

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
5989366	206*	87	72	
5989367	91	95	92	
5989368	96	99	90	
Blank	104	108	96	
LCS	99	103	93	
MS	99	109	101	
MSD	100	109	102	
Limits:	55-121	74-110	57-112	
	Jame: PAH 8270 (microwav	e)		
Datell Hullik	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
	Niciobelizelle d5	2 Truoropiphenyr	resplicity surf	
5989369	92	86	75	
Blank	81	83	71	
LCS	80	83	73	
MS	113	90	78	
MSD	100	90	80	

Limits:

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1195950 Sample # 5989366-69 COC #

230375

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	BMQL	Below Minimum Quantitation Level
N.D.	none detected	MPN	Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

X,Y,Z

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
Ε	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Defined in case narrative

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by: Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2/AOI-7

Submittal Date: 06/01/2010 Group Number: 1196722 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-298_1-2' Grab Soil	5994011
C-140_1-2' Grab Soil	5994012
C-138_1-2' Grab Soil	5994013
C-137_1-2' Grab Soil	5994014
C-136 1-2' Grab Soil	5994015

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO ELECTRONIC	LLI	Attn: EDD Group
COPY TO ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		Attii. Kristen Ward
ELECTRONIC COPY TO	Aquaterra Tech	Attn: Loretta Belfiglio



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



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Page 1 of 2 **REVISED**

Sample Description: S-298 1-2' Grab Soil

LLI Sample # SW 5994011 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 S-298 1-2' Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/25/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

Submitted: 06/01/2010 14:35 West Chester PA 19381

Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9298

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene	71-43-2	1,200	J	530	5,300	952.62
10950	1,2-Dibromoethane	106-93-4	N.D.		1,100	5,300	952.62
10950	1,2-Dichloroethane	107-06-2	N.D.		1,100	5,300	952.62
10950	Ethylbenzene	100-41-4	N.D.		1,100	5,300	952.62
10950	Isopropylbenzene	98-82-8	N.D.		1,100	5,300	952.62
10950	Methyl Tertiary Butyl Ether	1634-04-4	N.D.		530	5,300	952.62
10950	Toluene	108-88-3	N.D.		1,100	5,300	952.62
10950	1,2,4-Trimethylbenzene	95-63-6	N.D.		1,100	5,300	952.62
10950	1,3,5-Trimethylbenzene	108-67-8	N.D.		1,100	5,300	952.62
10950	Xylene (Total)	1330-20-7	N.D.		1,100	5,300	952.62
soil	GC/MS volatile analysis was po method due to the level of no rting limits were raised.		_	,			

GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	1,600	37	190	1
10724	Benzo(a)anthracene		56-55-3	2,500	37	190	1
10724	Benzo(a)pyrene		50-32-8	1,500	37	190	1
10724	Benzo(b)fluoranthen	е	205-99-2	2,100	37	190	1
10724	Benzo(g,h,i)perylen	е	191-24-2	660	37	190	1
10724	Chrysene		218-01-9	2,700	37	190	1
10724	Fluorene		86-73-7	3,300	37	190	1
10724	Naphthalene		91-20-3	1,400	37	190	1
10724	Phenanthrene		85-01-8	6,900	370	1,900	10
10724	Pyrene		129-00-0	5,500	370	1,900	10
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	96.0	0.0336	0.224	2
Wet Cl	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	10.7	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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Sample Description: S-298 1-2' Grab Soil

Philadelphia Refinery AOI-2/AOI-7 DUNS# COC: 235827 S-298_1-2' LLI Sample # SW 5994011 LLI Group # 1196722 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/25/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/01/2010 14:35 Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9298

Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	T	rial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor		
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035	1	201015321304	05/25/2010	08:30	Client Supplied	1		
02392	L/H Field Preserved Bisulfate	SW-846	5035	1	201015321304	05/25/2010	08:30	Client Supplied	1		
02392	L/H Field Preserved Bisulfate	SW-846	5035	2	201015321304	05/25/2010	08:30	Client Supplied	1		
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846	8260B	1	R101581AA	06/07/2010	19:38	Nicholas R Rossi	952.62		
10724	PAH 8270 (microwave)	SW-846	8270C	1	10153SLE026	06/08/2010	21:19	William T Parker	1		
10724	PAH 8270 (microwave)	SW-846	8270C	1	10153SLE026	06/09/2010	06:51	Brian K Graham	10		
10814	BNA Soil Microwave PAH	SW-846	3546	1	10153SLE026	06/03/2010	09:30	Kerrie A Freeburn	1		
06135	Lead	SW-846	6020	1	101536150003A	06/09/2010	08:29	Choon Y Tian	2		
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B	1	101536150003	06/02/2010	20:34	Annamaria Stipkovits	1		
00111	Moisture	SM20 25	540 G	1	10154820002A	06/03/2010	17:47	Scott W Freisher	1		



0.50

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Sample Description: C-140 1-2' Grab Soil

LLI Sample # SW 5994012 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-140 1-2' Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/26/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

Submitted: 06/01/2010 14:35 West Chester PA 19381

Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9140

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Volatiles SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene	71-43-2	< 5	5	0.5	0.85
10950	1,2-Dibromoethane	106-93-4	< 5	5	1	0.85
10950	1,2-Dichloroethane	107-06-2	< 5	5	1	0.85
10950	Ethylbenzene	100-41-4	< 5	5	1	0.85
10950	Isopropylbenzene	98-82-8	< 5	5	1	0.85
10950	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	0.5	0.85
10950	Toluene	108-88-3	< 5	5	1	0.85
10950	1,2,4-Trimethylbenzene	95-63-6	< 5	5	1	0.85
10950	1,3,5-Trimethylbenzene	108-67-8	< 5	5	1	0.85
10950	Xylene (Total)	1330-20-7	< 5	5	1	0.85
for	GC/MS volatile internal stand both the initial analysis and from the initial analysis of	the re-analysis.				

		7					
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	380	190	38	1
10724	Benzo(a)anthracene		56-55-3	1,200	190	38	1
10724	Benzo(a)pyrene		50-32-8	1,200	190	38	1
10724	Benzo(b)fluoranthene	9	205-99-2	1,400	190	38	1
10724	Benzo(g,h,i)perylene	9	191-24-2	1,000	190	38	1
10724	Chrysene		218-01-9	1,300	190	38	1
10724	Fluorene		86-73-7	< 190	190	38	1
10724	Naphthalene		91-20-3	470	190	38	1
10724	Phenanthrene		85-01-8	990	190	38	1
10724	Pyrene		129-00-0	1,900	190	38	1
Metals	5	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	98.6	0.557	0.0836	5

00111 Moisture 12.9 0.50 n.a. "Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an

as-received basis.

Wet Chemistry

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

SM20 2540 G

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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LLI Sample # SW 5994012 LLI Group # 1196722 Account # 10132

Sample Description: C-140_1-2' Grab Soil

Philadelphia Refinery AOI-2/AOI-7 DUNS# COC: 235827 C-140_1-2'

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/26/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/01/2010 14:35 Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9140

	Laboratory Sample Analysis Record												
CAT No.	Analysis Name	Method	נ	rial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor				
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035	1	201015321304	05/26/2010	14:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846	5035	1	201015321304	05/26/2010	14:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846	5035	2	201015321304	05/26/2010	14:00	Client Supplied	1				
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846	8260B	1	X101571AA	06/07/2010	07:11	Angela D Sneeringer	0.85				
10724	PAH 8270 (microwave)	SW-846	8270C	1	10153SLE026	06/08/2010	22:34	William T Parker	1				
10814	BNA Soil Microwave PAH	SW-846	3546	1	10153SLE026	06/03/2010	09:30	Kerrie A Freeburn	1				
06135	Lead	SW-846	6020	1	101536150003A	06/09/2010	09:00	Choon Y Tian	5				
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B	1	101536150003	06/02/2010	20:34	Annamaria Stipkovits	1				
00111	Moisture	SM20 25	540 G	1	10154820002A	06/03/2010	17:47	Scott W Freisher	1				



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Sample Description: C-138 1-2' Grab Soil

LLI Sample # SW 5994013 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-138 1-2' Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/27/2010 09:00 by SS SUN: Aquaterra Tech.

PO Box 744

Submitted: 06/01/2010 14:35 West Chester PA 19381

Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9138

00111 Moisture

CAT No.	Analysis Name		CAS Number	Dry Result		Dry Method Detection Limit*	Dry Limit of Quantitation	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg		ug/kg	ug/kg	
10950	Benzene		71-43-2	12	J	1	12	1.53
10950	1,2-Dibromoethane		106-93-4	N.D.		2	12	1.53
10950	1,2-Dichloroethane		107-06-2	N.D.		2	12	1.53
10950	Ethylbenzene		100-41-4	14		2	12	1.53
10950	Isopropylbenzene		98-82-8	3	J	2	12	1.53
10950	Methyl Tertiary But	yl Ether	1634-04-4	N.D.		1	12	1.53
10950	Toluene		108-88-3	54		2	12	1.53
10950	1,2,4-Trimethylbenz	ene	95-63-6	14		2	12	1.53
10950	1,3,5-Trimethylbenz	ene	108-67-8	7	J	2	12	1.53
10950	Xylene (Total)		1330-20-7	72		2	12	1.53
are	both the initial ana from the initial ana Semivolatiles		the sample.	ug/kg	.в тере	ug/kg	ug/kg	
10724	Anthracene		120-12-7	94	J	51	260	1
10724	Benzo(a)anthracene		56-55-3	240	J	51	260	1
10724	Benzo(a)pyrene		50-32-8	200	J	51	260	1
10724	Benzo(b) fluoranthen	.e	205-99-2	320		51	260	1
10724	Benzo(g,h,i)perylen	.e	191-24-2	150	J	51	260	1
10724	Chrysene		218-01-9	300		51	260	1
10724	Fluorene		86-73-7	N.D.		51	260	1
10724	Naphthalene		91-20-3	110	J	51	260	1
10724	Phenanthrene		85-01-8	240	J	51	260	1
10724	Pyrene		129-00-0	360		51	260	1
Metals	5	SW-846	6020	mg/kg		mg/kg	mg/kg	
06135	Lead		7439-92-1	103		0.0462	0.308	2
Wet Cl	nemistry	SM20 25	540 G	%		%	%	

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

n.a.

General Sample Comments

0.50

0.50

35.1

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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Sample Description: C-138 1-2' Grab Soil

LLI Sample # SW 5994013 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-138 1-2' # 10132 Account

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

by SS Collected: 05/27/2010 09:00 SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/01/2010 14:35 Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9138

	Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor				
07579	GC/MS-Field PreservedMeOH-NC	SW-846 503	35 1	201015321304	05/27/2010	09:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 503	35 1	201015321304	05/27/2010	09:00	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 503	35 2	201015321304	05/27/2010	09:00	Client Supplied	1				
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 826	60B 1	X101571AA	06/07/2010	06:48	Angela D Sneeringer	1.53				
10724	PAH 8270 (microwave)	SW-846 82	70C 1	10153SLE026	06/08/2010	22:59	William T Parker	1				
10814	BNA Soil Microwave PAH	SW-846 354	46 1	10153SLE026	06/03/2010	09:30	Kerrie A Freeburn	1				
06135	Lead	SW-846 602	20 1	101536150003A	06/09/2010	08:42	Choon Y Tian	2				
06150	ICP/MS SW-846 Solid Digest	SW-846 305	50B 1	101536150003	06/02/2010	20:34	Annamaria Stipkovits	1				
00111	Moisture	SM20 2540	G 1	10154820002A	06/03/2010	17:47	Scott W Freisher	1				



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Sample Description: C-137 1-2' Grab Soil

LLI Sample # SW 5994014 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-137 1-2' Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/27/2010 13:00 by SS SUN: Aquaterra Tech.

PO Box 744

Dry

Submitted: 06/01/2010 14:35 West Chester PA 19381

Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9137

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.76
10950	1,2-Dibromoethane		106-93-4	< 5	5	0.9	0.76
10950	1,2-Dichloroethane		107-06-2	< 5	5	0.9	0.76
10950	Ethylbenzene		100-41-4	< 5	5	0.9	0.76
10950	Isopropylbenzene		98-82-8	9	5	0.9	0.76
10950	Methyl Tertiary Buty	vl Ether	1634-04-4	< 5	5	0.5	0.76
10950	Toluene		108-88-3	< 5	5	0.9	0.76
10950	1,2,4-Trimethylbenze	ene	95-63-6	< 5	5	0.9	0.76
10950	1,3,5-Trimethylbenze	ene	108-67-8	< 5	5	0.9	0.76
10950	Xylene (Total)		1330-20-7	< 5	5	0.9	0.76
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	1,900	210	42	1
10724	Benzo(a)anthracene		56-55-3	2,300	210	42	1
10724	Benzo(a)pyrene		50-32-8	1,900	210	42	1
10724	Benzo(b) fluoranthene	9	205-99-2	2,200	210	42	1
10724	Benzo(g,h,i)perylene	9	191-24-2	1,300	210	42	1
10724	Chrysene		218-01-9	2,300	210	42	1
10724	Fluorene		86-73-7	1,800	210	42	1
10724	Naphthalene		91-20-3	5,400	2,100	420	10
10724	Phenanthrene		85-01-8	4,400	2,100	420	10
10724	Pyrene		129-00-0	< 210	210	42	1
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	251	0.617	0.0925	5
Wet Ch	nemistry	SM20 25	540 G	%	8	%	
00111	Moisture		n.a.	20.5	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees Co as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201015321304	05/27/2010 13:00	Client Supplied	1



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Sample Description: C-137 1-2' Grab Soil

LLI Sample # SW 5994014 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-137 1-2' # 10132 Account

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

by SS Collected: 05/27/2010 13:00 SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/01/2010 14:35 Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9137

	Laboratory Sample Analysis Record												
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor					
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201015321304	05/27/2010	13:00	Client Supplied	1					
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201015321304	05/27/2010	13:00	Client Supplied	1					
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101591AA	06/09/2010	02:50	Lauren C Temple	0.76					
10724	PAH 8270 (microwave)	SW-846 8270C	1	10153SLE026	06/08/2010	23:24	William T Parker	1					
10724	PAH 8270 (microwave)	SW-846 8270C	1	10153SLE026	06/09/2010	07:16	Brian K Graham	10					
10814	BNA Soil Microwave PAH	SW-846 3546	1	10153SLE026	06/03/2010	09:30	Kerrie A Freeburn	1					
06135	Lead	SW-846 6020	1	101536150003A	06/09/2010	09:15	Choon Y Tian	5					
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101536150003	06/02/2010	20:34	Annamaria Stipkovits	1					
00111	Moisture	SM20 2540 G	1	10154820002A	06/03/2010	17:47	Scott W Freisher	1					



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Sample Description: C-136 1-2' Grab Soil

LLI Sample # SW 5994015 Philadelphia Refinery AOI-2/AOI-7 LLI Group # 1196722 DUNS# COC: 235827 C-136 1-2' Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/28/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

Dry

Submitted: 06/01/2010 14:35 West Chester PA 19381

Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9136

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles S	W-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	7	5	0.5	0.87
10950	1,2-Dibromoethane		106-93-4	< 5	5	1	0.87
10950	1,2-Dichloroethane		107-06-2	< 5	5	1	0.87
10950	Ethylbenzene		100-41-4	< 5	5	1	0.87
10950	Isopropylbenzene		98-82-8	< 5	5	1	0.87
10950	Methyl Tertiary Butyl	Ether	1634-04-4	< 5	5	0.5	0.87
10950	Toluene		108-88-3	8	5	1	0.87
10950	1,2,4-Trimethylbenzen	.e	95-63-6	< 5	5	1	0.87
10950	1,3,5-Trimethylbenzen	.e	108-67-8	< 5	5	1	0.87
10950	Xylene (Total)		1330-20-7	< 5	5	1	0.87
for :	GC/MS volatile interna both the initial analy from the initial analy	sis and	the re-analysis.				
GC/MS	Semivolatiles S	W-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 180	180	37	1
10724	Benzo(a)anthracene		56-55-3	370	180	37	1
10724	Benzo(a)pyrene		50-32-8	380	180	37	1
10724	Benzo(b)fluoranthene		205-99-2	550	180	37	1
10724	Benzo(g,h,i)perylene		191-24-2	390	180	37	1
10724			218-01-9	410	180	37	1
10724			86-73-7	< 180	180	37	1
10724	-		91-20-3	550	180	37	1
10724	Phenanthrene		85-01-8	360	180	37	1
10724	Pyrene		129-00-0	440	180	37	1
Metals	s S	W-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	218	1.09	0.163	10
Wet Cl	nemistry S	M20 25	540 G	%	%	%	
00111	Moisture		n.a.	9.7	0.50	0.50	1
	"Moisture" represents 103 - 105 degrees Cel		ss in weight of the	he sample afte	er oven drying at		

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

as-received basis.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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Page 2 of 2

REVISED

Sample Description: C-136 1-2' Grab Soil

Philadelphia Refinery AOI-2/AOI-7
DUNS# COC: 235827 C-136_1-2'

LLI Sample # SW 5994015 LLI Group # 1196722 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 05/28/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/01/2010 14:35 Reported: 07/16/2010 09:51

Discard: 09/15/2010

I9136

Laboratory Sample Analysis Record									
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor	
07579	GC/MS-Field PreservedMeOH-NC	SW-846 5035	5 1	201015321304	05/28/2010	08:30	Client Supplied	1	
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201015321304	05/28/2010	08:30	Client Supplied	1	
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201015321304	05/28/2010	08:30	Client Supplied	1	
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260)B 1	X101571AA	06/07/2010	02:16	Angela D Sneeringer	0.87	
10724	PAH 8270 (microwave)	SW-846 8270)C 1	10153SLE026	06/08/2010	23:49	William T Parker	1	
10814	BNA Soil Microwave PAH	SW-846 3546	1	10153SLE026	06/03/2010	09:30	Kerrie A Freeburn	1	
06135	Lead	SW-846 6020	1	101536150003A	06/09/2010	09:05	Choon Y Tian	10	
06150	ICP/MS SW-846 Solid Digest	SW-846 3050)B 1	101536150003	06/02/2010	20:34	Annamaria Stipkovits	1	
00111	Moisture	SM20 2540 G	1	10154820002A	06/03/2010	17:47	Scott W Freisher	1	



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1196722

Reported: 07/16/10 at 09:51 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>LOQ**</u>	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD <u>%REC</u>	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: X101591AA	Sample nu	umber(s): 5	994014						
Benzene	< 5	5.	0.5	ug/kg	99	97	80-120	2	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	99	96	80-120	2	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	102	102	71-129	0	30
Ethylbenzene	< 5	5.	1	ug/kg	103	98	80-120	5	30
Isopropylbenzene	< 5	5.	1	ug/kg	102	98	76-120	4	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	97	98	74-121	1	30
Toluene	< 5	5.	1	ug/kg	100	98	80-120	3	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	99	95	79-120	4	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	101	96	78-120	4	30
Xylene (Total)	< 5	5.	1	ug/kg	103	99	80-120	4	30

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank MDL**	Blank <u>LOO</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: R101581AA	Sample numb	per(s): 59	94011						
Benzene	N.D.	25.	250	uq/kq	95	100	80-120	5	30
1,2-Dibromoethane	N.D.	50.	250	ug/kg	97	101	80-120	4	30
1,2-Dichloroethane	N.D.	50.	250	ug/kg	99	103	71-129	4	30
Ethylbenzene	N.D.	50.	250	ug/kg	96	100	80-120	4	30
Isopropylbenzene	N.D.	50.	250	ug/kg	96	99	76-120	3	30
Methyl Tertiary Butyl Ether	N.D.	25.	250	ug/kg	97	102	74-121	4	30
Toluene	N.D.	50.	250	ug/kg	96	99	80-120	4	30
1,2,4-Trimethylbenzene	N.D.	50.	250	ug/kg	96	100	79-120	3	30
1,3,5-Trimethylbenzene	N.D.	50.	250	ug/kg	96	99	78-120	4	30
Xylene (Total)	N.D.	50.	250	ug/kg	96	100	80-120	4	30
Batch number: X101571AA	Sample numb	per(s): 59	94012-599	4013,5994015	5				
Benzene	N.D.	0.5	5	ug/kg	94		80-120		
1,2-Dibromoethane	N.D.	1.	5	ug/kg	94		80-120		
1,2-Dichloroethane	N.D.	1.	5	ug/kg	109		71-129		
Ethylbenzene	N.D.	1.	5	ug/kg	98		80-120		
Isopropylbenzene	N.D.	1.	5	ug/kg	99		76-120		
Methyl Tertiary Butyl Ether	N.D.	0.5	5 5	ug/kg	95		74-121		
Toluene	N.D.	1.	5	ug/kg	94		80-120		
1,2,4-Trimethylbenzene	N.D.	1.	5	ug/kg	97		79-120		
1,3,5-Trimethylbenzene	N.D.	1.	5	ug/kg	98		78-120		
Xylene (Total)	N.D.	1.	5	ug/kg	98		80-120		
Batch number: 10153SLE026	Sample numb	per(s): 59	94011-599	4015					
Anthracene	N.D.	33.	170	uq/kq	98		89-109		
Benzo(a) anthracene	N.D.	33.	170	uq/kq	95		86-113		
Benzo(a) pyrene	N.D.	33.	170	ug/kg	84		63-138		
				- 5, 5	-				

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1196722

Reported: 07/16/10 at 09:51 AM

Laboratory Compliance Quality Control

Analysis Name Benzo(b)fluoranthene Benzo(g,h,i)perylene Chrysene Fluorene Naphthalene Phenanthrene	Blank Result N.D. N.D. N.D. N.D. N.D. N.D. N.D.	Blank MDL** 33. 33. 33. 33. 33. 33.	Blank LOQ 170 170 170 170 170 170	Report Units ug/kg ug/kg ug/kg ug/kg ug/kg ug/kg ug/kg	LCS %REC 85 84 96 101 96	LCSD <u>%REC</u>	LCS/LCSD Limits 61-133 63-130 84-117 84-113 83-112 86-109	RPD	RPD Max
Pyrene Batch number: 101536150003A Lead Batch number: 10154820002A Moisture	N.D. Sample num N.D. Sample num	0.0300	0.200	mg/kg	91 105 100		86-122 80-120 99-101		

Sample Matrix Quality Control Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

		-		_					
Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	<u>RPD</u>	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP <u>RPD</u>	Dup RPD Max
Batch number: X101591AA		number(s)	: 5994014	UNSPK:	P9969	65			
Benzene	106		55-143						
1,2-Dibromoethane	109		54-129						
1,2-Dichloroethane	111		53-143						
Ethylbenzene	105		44-141						
Isopropylbenzene	99		38-144						
Methyl Tertiary Butyl Ether	106		55-129						
Toluene	113		50-146						
1,2,4-Trimethylbenzene	118		37-149						
1,3,5-Trimethylbenzene	122		38-150						
Xylene (Total)	102		44-136						
Batch number: X101571AA	Sample	number(s)	: 5994012	-599401	3,5994	015 UNSPK	: P993546		
Benzene	94	108	55-143	11	30				
1,2-Dibromoethane	82	96	54-129	13	30				
1,2-Dichloroethane	107	118	53-143	7	30				
Ethylbenzene	95	111	44-141	13	30				
Isopropylbenzene	95	111	38-144	12	30				
Methyl Tertiary Butyl Ether	87	102	55-129	13	30				
Toluene	92	107	50-146	12	30				
1,2,4-Trimethylbenzene	94	109	37-149	12	30				
1,3,5-Trimethylbenzene	95	111	38-150	13	30				
Xylene (Total)	93	109	44-136	12	30				
Batch number: 10153SLE026	Sample	number(s)	: 5994011	-599401	.5 UNSP	K: 599401	1		
Anthracene	74*	72*	76-111	1	30				
Benzo(a)anthracene	71*	65*	78-111	3	30				
Benzo(a)pyrene	60	58	57-129	1	30				
Benzo(b) fluoranthene	53	39*	53-131	9	30				
Benzo(g,h,i)perylene	73	76	60-123	3	30				
Chrysene	66*	49*	76-114	8	30				

^{*-} Outside of specification

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- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1196722

Reported: 07/16/10 at 09:51 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD <u>Max</u>
Fluorene	56*	45*	75-111	5	30	<u> </u>	<u> </u>	<u>111 D</u>	
Naphthalene	76	70	33-140	4	30				
Phenanthrene	72	39*	69-115	8	30				
Pyrene	72*	45*	76-124	7	30				
Batch number: 101536150003A	Sample	number(s)	: 5994011	-599401	15 UNSPI	K: 5994011	BKG: 5994011		
Lead	272 (2)	-233 (2)	75-125	18	20	85.8	79.6	7	20
Batch number: 10154820002A Moisture	Sample	number(s)	: 5994011	-59940:	15 BKG	: P996043 41.5	49.5	18*	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil) Batch number: R101581AA Dibromofluoromethane

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene		
5994011	85	80	94	92		
Blank	82	84	81	85		
LCS	94	94	92	93		
LCSD	98	99	96	96		
Limits:	71-114	70-109	70-123	70-111		
	Name: TCL(4.3)by 8260(soil)				
Baccii iiulik	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene		
5994012	108	104	110	70		
5994013	106	101	107	88		
5994015	106	100	115	73		
Blank	109	97	93	96		
LCS	105	105	103	102		
MS	106	95	102	101		
MSD	103	99	103	98		
Limits:	71-114	70-109	70-123	70-111		
	Name: TCL(4.3)by 8260(soil)				
	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene		
5994014	99	104	120	108		
Blank	100	99	95	98		
LCS	102	98	103	102		
LCSD	101	104	102	100		

^{*-} Outside of specification

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- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 07/16/10 at 09:51 AM Group Number: 1196722

Surrogate Quality Control

MS	101	100	109	87
Limits:	71-114	70-109	70-123	70-111
	Name: PAH 8270 (microwav ber: 10153SLE026 Nitrobenzene-d5	e) 2-Fluorobiphenyl	Terphenyl-d14	
	Niciobelizelle-ds		Terphenyr-dr4	
5994011	93	90	82	
5994012	88	94	79	
5994013	94	101	88	
5994014	77	79	64	
5994015	96	106	86	
Blank	92	96	87	
LCS	92	99	82	
MS	87	82	75	
MSD	92	92	80	
Limits:	55-121	74-110	57-112	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1196722 Sample # 5994011-15

COC#

235827

1	Client: SUN-AQUATERRA	Acct. #:	lease print. Insi	-		latrix	(4)	25424 15184	incoloroscopio ***) Au	alys	25 R	eque Code		For Lab Use Only FSC: SCR#:		-	
	Project Name/#: Philosophia Refrer, AC Project Manager: DOERR Sampler: SYKES	PWSID P.O.#: P.O.#: Quote #	#:		1	otabia checkif	mainers.	(((()	SE Comerce	than de	Trimethylknee	Frome	iron?		Preservation Codes H=HCI T=Thiosulf N=HNO ₃ B=NaOH S=H ₂ SO ₄ O=Other	ate	Imples (9)	
٦	Name of state where samples were collected: Sample Identification	Date Collected	"Time Collected	3 cens	100 mg 100	Water D	Total # sf Co.	Leady	GTEX, MTE	1,2 dichlored	1<5/5/	Chassee F	Phenontho		Remarks		Temperature of sa upon receipt (if re	
	S-298_1-2' C-140_j-2' C-138_j-2' C-137_1-2! C-136_1-2'	5/25/10 5/26/10 5/27/10 5/27/10 5/28/10	1300	X X X X	XXXXX		4 4 4	XXXXX	XXXXX	X X X	XXXX	×	XXXXX		Archolyses per Cace attatch Sheet/1:3 No attained St Pun Imager U T.D. GAN 10/2	heet. H per	4	
7	Turnaround Time Requested (TAT) (please (Rush TAT is subject to Lancaster Laboratories app Date results are needed: Rush results requested by (please circle): Phone #: Fax #:	roval and surcharhone Fax SD YOR	E-mail G Complete?	Re Re	lingui	shed by	<u> </u>	in it is a second of the secon	/AQ		Date S/28/ Date 6/1/ Date 5 Date	/b e e	190 Fime 1010 Fime	Received by:		Date Date Date	Time (1) Time COY Time Time	$\left\{ ight.$
	Type III (Reduced NJ) Type IV (CLP SOW) Type VI (Raw Data Only) Site-specific QC of the specific QC of th	bmit triplicate volume.)		Re	linqui	shed by	<i>r</i> :				Date		Time	Received by:	havel	Date		1



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 16, 2010

Project: SUN: Philadelphia Refinery AOI-2/AOI-7

Submittal Date: 06/15/2010 Group Number: 1198981 PO Number: PHILADELPHIA State of Sample Origin: PA

 Client Sample Description
 Lancaster Labs (LLI) #

 S-307_0-2 Grab Soil
 6007699

 S-135_0-2 Grab Soil
 6007700

 S-299_0-2 Grab Soil
 6007701

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC Langan Attn: Dennis Webster

COPY TO

ELECTRONIC SUN: Aquaterra Tech. Attn: Megan Breen

COPY TO

ELECTRONIC SUN: Aquaterra Tech. Attn: Tiffani Doerr

COPY TO

ELECTRONIC LLI Attn: EDD Group

COPY TO

ELECTRONIC Langan Attn: Kristen Ward

COPY TO



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

advene Kull

Adrienne Kuhl

Specialist Group Leader



Dry

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Sample Description: S-307 0-2 Grab Soil

Philadelphia Refinery AOI-2

COC: 234217 S-307 0-2

REVISED LLI Sample # SW 6007699

LLI Group # 1198981 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/10/2010 12:00 by JRW SUN: Aquaterra Tech.

PO Box 744

Drv

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP307

CAT No.	Analysis Name	CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles SW-84	6 8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene	71-43-2	< 5	5	0.5	0.88
10950	1,2-Dibromoethane	106-93-4	< 5	5	0.9	0.88
10950	1,2-Dichloroethane	107-06-2	< 5	5	0.9	0.88
10950	Ethylbenzene	100-41-4	< 5	5	0.9	0.88
10950	Isopropylbenzene	98-82-8	< 5	5	0.9	0.88
10950	Methyl Tertiary Butyl Ethe	r 1634-04-4	< 5	5	0.5	0.88
10950	Toluene	108-88-3	< 5	5	0.9	0.88
10950	1,2,4-Trimethylbenzene	95-63-6	< 5	5	0.9	0.88
10950	1,3,5-Trimethylbenzene	108-67-8	< 5	5	0.9	0.88
10950	Xylene (Total)	1330-20-7	< 5	5	0.9	0.88
for 1	GC/MS volatile internal star both the initial analysis ar from the initial analysis of	nd the re-analysis.				
		6 8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene	120-12-7	< 180	180	36	1
10724		56-55-3	320	180	36	1
	Benzo(a)pyrene	50-32-8	290	180	36	1
	Benzo(b)fluoranthene	205-99-2	340	180	36	1
	Benzo(g,h,i)perylene	191-24-2	< 180	180	36	1
10724	2	218-01-9	300	180	36	1
10724		86-73-7	< 180	180	36	1
10724	-	91-20-3	< 180	180	36	1
10724		85-01-8	570	180	36	1
10724	Pyrene	129-00-0	560	180	36	1
Metals	SW-84	6 6020	mg/kg	mg/kg	mg/kg	
06135	Lead	7439-92-1	48.4	0.211	0.0106	2
Wet Cl	nemistry SM20	2540 G	%	%	%	
00111	Moisture	n.a.	6.2	0.50	0.50	1
	"Moisture" represents the 103 - 105 degrees Celsius. as-received basis.					

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT Analysis Name Method Trial# Batch# Analyst Dilution Date and Time No. Factor



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Page 2 of 2 REVISED

Sample Description: S-307 0-2 Grab Soil

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/10/2010 12:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP307

	Laboratory Sample Analysis Record											
CAT No.	Analysis Name	Method		Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor			
07579	GC/MS-Field PreservedMeOH-NC	SW-846	5035	1	201016721436	06/10/2010	12:00	Client Supplied	1			
02392	L/H Field Preserved Bisulfate	SW-846	5035	1	201016721436	06/10/2010	12:00	Client Supplied	1			
02392	L/H Field Preserved Bisulfate	SW-846	5035	2	201016721436	06/10/2010	12:00	Client Supplied	1			
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846	8260B	1	X101731AA	06/22/2010	18:03	Kelly E Keller	0.88			
10724	PAH 8270 (microwave)	SW-846	8270C	1	10167SLF026	06/24/2010	21:05	Barton C Conner	1			
10814	BNA Soil Microwave PAH	SW-846	3546	1	10167SLF026	06/17/2010	10:30	Kerrie A Freeburn	1			
06135	Lead	SW-846	6020	1	101676150001A	06/23/2010	15:48	Choon Y Tian	2			
06150	ICP/MS SW-846 Solid Digest	SW-846	3050B	1	101676150001	06/16/2010	20:38	Annamaria Stipkovits	1			
00111	Moisture	SM20 2	540 G	1	10168820006A	06/17/2010	18.33	Scott W Freisher	1			



Dry

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Sample Description: S-135 0-2 Grab Soil

Philadelphia Refinery AOI-7

COC: 234217 S-135_0-2

REVISED
LLI Sample # SW 6007700

LLI Group # 1198981 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/10/2010 09:15 by JRW SUN: Aquaterra Tech.

PO Box 744

Dry

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP135

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.88
10950	1,2-Dibromoethane		106-93-4	< 5	5	0.9	0.88
10950	1,2-Dichloroethane		107-06-2	< 5	5	0.9	0.88
10950	Ethylbenzene		100-41-4	< 5	5	0.9	0.88
10950	Isopropylbenzene		98-82-8	< 5	5	0.9	0.88
10950	Methyl Tertiary But	yl Ether	1634-04-4	< 5	5	0.5	0.88
10950	Toluene		108-88-3	< 5	5	0.9	0.88
10950	1,2,4-Trimethylbenz	ene	95-63-6	< 5	5	0.9	0.88
10950	1,3,5-Trimethylbenz	ene	108-67-8	< 5	5	0.9	0.88
10950	Xylene (Total)		1330-20-7	< 5	5	0.9	0.88
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 170	170	34	1
10724	Benzo(a)anthracene		56-55-3	< 170	170	34	1
10724	Benzo(a)pyrene		50-32-8	< 170	170	34	1
10724	Benzo(b) fluoranthen	е	205-99-2	< 170	170	34	1
10724	Benzo(g,h,i)perylen	е	191-24-2	< 170	170	34	1
10724	Chrysene		218-01-9	< 170	170	34	1
10724	Fluorene		86-73-7	< 170	170	34	1
10724	Naphthalene		91-20-3	< 170	170	34	1
10724	Phenanthrene		85-01-8	< 170	170	34	1
10724	Pyrene		129-00-0	< 170	170	34	1
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	4.31	0.202	0.0101	2
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	3.0	0.50	0.50	1
	"Moisture" represen 103 - 105 degrees C as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201016721436	06/10/2010 09:1	Client Supplied	1



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Sample Description: S-135 0-2 Grab Soil

Philadelphia Refinery AOI-7

COC: 234217 S-135 0-2

LLI Sample # SW 6007700

LLI Group # 1198981 # 10132 Account

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/10/2010 09:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP135

Laboratory Sample Analysis Record												
CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor				
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201016721436	06/10/2010	09:15	Client Supplied	1				
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201016721436	06/10/2010	09:15	Client Supplied	1				
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101731AA	06/22/2010	18:26	Kelly E Keller	0.88				
10724	PAH 8270 (microwave)	SW-846 8270C	1	10167SLF026	06/24/2010	21:55	Barton C Conner	1				
10814	BNA Soil Microwave PAH	SW-846 3546	1	10167SLF026	06/17/2010	10:30	Kerrie A Freeburn	1				
06135	Lead	SW-846 6020	1	101676150001A	06/23/2010	15:49	Choon Y Tian	2				
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101676150001	06/16/2010	20:38	Annamaria Stipkovits	1				
00111	Moisture	SM20 2540 G	1	10168820006A	06/17/2010	18:33	Scott W Freisher	1				



Dry

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Sample Description: S-299 0-2 Grab Soil

Philadelphia Refinery AOI-2

COC: 234217 S-299_0-2

REVISED
LLI Sample # SW 6007701

LLI Group # 1198981 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/08/2010 13:00 by JRW SUN: Aquaterra Tech.

PO Box 744

Dry

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP299

CAT No.	Analysis Name		CAS Number	Dry Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/kg	ug/kg	ug/kg	
10950	Benzene		71-43-2	< 5	5	0.5	0.9
10950	1,2-Dibromoethane		106-93-4	< 5	5	0.9	0.9
10950	1,2-Dichloroethane		107-06-2	< 5	5	0.9	0.9
10950	Ethylbenzene		100-41-4	< 5	5	0.9	0.9
10950	Isopropylbenzene		98-82-8	< 5	5	0.9	0.9
10950	Methyl Tertiary Buty	/l Ether	1634-04-4	< 5	5	0.5	0.9
10950	Toluene		108-88-3	< 5	5	0.9	0.9
10950	1,2,4-Trimethylbenze	ene	95-63-6	< 5	5	0.9	0.9
10950	1,3,5-Trimethylbenze	ene	108-67-8	< 5	5	0.9	0.9
10950	Xylene (Total)		1330-20-7	< 5	5	0.9	0.9
GC/MS	Semivolatiles	SW-846	8270C	ug/kg	ug/kg	ug/kg	
10724	Anthracene		120-12-7	< 170	170	34	1
10724	Benzo(a)anthracene		56-55-3	< 170	170	34	1
10724	Benzo(a)pyrene		50-32-8	< 170	170	34	1
10724	Benzo(b) fluoranthene	9	205-99-2	< 170	170	34	1
10724	Benzo(g,h,i)perylene	9	191-24-2	< 170	170	34	1
10724	Chrysene		218-01-9	< 170	170	34	1
10724	Fluorene		86-73-7	< 170	170	34	1
10724	Naphthalene		91-20-3	< 170	170	34	1
10724	Phenanthrene		85-01-8	< 170	170	34	1
10724	Pyrene		129-00-0	< 170	170	34	1
Metals	3	SW-846	6020	mg/kg	mg/kg	mg/kg	
06135	Lead		7439-92-1	12.2	0.202	0.0101	2
Wet Ch	nemistry	SM20 25	540 G	%	%	%	
00111	Moisture		n.a.	2.1	0.50	0.50	1
	"Moisture" represent 103 - 105 degrees Co as-received basis.						

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07579	GC/MS-Field PreservedMeOH-	SW-846 5035	1	201016721436	06/08/2010 13:00	Client Supplied	1



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Sample Description: S-299 0-2 Grab Soil

Philadelphia Refinery AOI-2

COC: 234217 S-299_0-2

REVISED LLI Sample # SW 6007701

LLI Group # 1198981 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2/AOI-7

Collected: 06/08/2010 13:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 06/15/2010 18:25 Reported: 07/16/2010 09:44

Discard: 09/15/2010

SP299

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
02392	L/H Field Preserved Bisulfate	SW-846 5035	1	201016721436	06/08/2010	13:00	Client Supplied	1
02392	L/H Field Preserved Bisulfate	SW-846 5035	2	201016721436	06/08/2010	13:00	Client Supplied	1
10950	BTEX/MTBE/EDB/EDC/Cumene/TM Bs	SW-846 8260B	1	X101691AA	06/18/2010	09:34	Angela D Sneeringer	0.9
10724	PAH 8270 (microwave)	SW-846 8270C	1	10167SLF026	06/24/2010	22:44	Barton C Conner	1
10814	BNA Soil Microwave PAH	SW-846 3546	1	10167SLF026	06/17/2010	10:30	Kerrie A Freeburn	1
06135	Lead	SW-846 6020	2	101676150001A	06/24/2010	09:35	Choon Y Tian	2
06150	ICP/MS SW-846 Solid Digest	SW-846 3050B	1	101676150001	06/16/2010	20:38	Annamaria Stipkovits	1
00111	Moisture	SM20 2540 G	1	10168820006A	06/17/2010	18:33	Scott W Freisher	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1198981

Reported: 07/16/10 at 09:44 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>LOQ**</u>	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: X101691AA	Sample num	ber(s): 60	007701						
Benzene	< 5	5.	0.5	ug/kg	92	90	80-120	2	30
1,2-Dibromoethane	< 5	5.	1	uq/kq	90	86	80-120	4	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	96	93	71-129	4	30
Ethylbenzene	< 5	5.	1	ug/kg	92	90	80-120	2	30
Isopropylbenzene	< 5	5.	1	ug/kg	90	91	76-120	0	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	107	102	74-121	5	30
Toluene	< 5	5.	1	ug/kg	90	87	80-120	4	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	88	87	79-120	1	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg	88	86	78-120	2	30
Xylene (Total)	< 5	5.	1	ug/kg	93	92	80-120	1	30
Batch number: X101731AA	Sample num	ber(s) · 60	007699-600	7700					
Benzene	< 5	5.	0.5	uq/kq	91	87	80-120	4	30
1,2-Dibromoethane	< 5	5.	1	ug/kg	91	88	80-120	3	30
1,2-Dichloroethane	< 5	5.	1	ug/kg	94	90	71-129	4	30
Ethylbenzene	< 5	5.	1	ug/kg	93	89	80-120	4	30
Isopropylbenzene	< 5	5.	1	ug/kg	93	89	76-120	5	30
Methyl Tertiary Butyl Ether	< 5	5.	0.5	ug/kg	104	100	74-121	4	30
Toluene	< 5	5.	1	ug/kg	89	87	80-120	3	30
1,2,4-Trimethylbenzene	< 5	5.	1	ug/kg	87	86	79-120	2	30
1,3,5-Trimethylbenzene	< 5	5.	1	ug/kg ug/kg	87	86	78-120	1	30
Xylene (Total)	< 5	5.	1	ug/kg	93	90	80-120	4	30
Aylene (local)				5. 5	23	50	00 120	-	30
Batch number: 10167SLF026	Sample num	ber(s): 60	07699-600	7701					
Anthracene	< 170	170.	33	ug/kg	94		89-109		
Benzo(a)anthracene	< 170	170.	33	ug/kg	100		86-113		
Benzo(a)pyrene	< 170	170.	33	ug/kg	92		63-138		
Benzo(b)fluoranthene	< 170	170.	33	ug/kg	104		61-133		
Benzo(g,h,i)perylene	< 170	170.	33	ug/kg	103		63-130		
Chrysene	< 170	170.	33	ug/kg	96		84-117		
Fluorene	< 170	170.	33	ug/kg	106		84-113		
Naphthalene	< 170	170.	33	ug/kg	91		83-112		
Phenanthrene	< 170	170.	33	ug/kg	93		86-109		
Pyrene	< 170	170.	33	ug/kg	101		86-122		
Batch number: 101676150001A	Sample num	ber(s): 60	007699-600	7701					
Lead	< 0.200	0.200	0.0100	mg/kg	110		80-120		
Batch number: 10168820006A	Sample num	her(a). G	107699_600	7701					
Moisture	sample num	ner(2): p(000-6601	//01	100		99-101		

Sample Matrix Quality Control

Page 1 of 3

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1198981

Reported: 07/16/10 at 09:44 AM

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD <u>Max</u>
Batch number: X101691AA	Sample	number(s)	: 6007701	UNSPK:	P0046	40			
Benzene	78		55-143						
1,2-Dibromoethane	76		54-129						
1,2-Dichloroethane	86		53-143						
Ethylbenzene	83		44-141						
Isopropylbenzene	88		38-144						
Methyl Tertiary Butyl Ether	90		55-129						
Toluene	57		50-146						
1,2,4-Trimethylbenzene	70		37-149						
1,3,5-Trimethylbenzene	76		38-150						
Xylene (Total)	79		44-136						
Batch number: X101731AA	Sample	number(s)	. 6007699	-600770	O IINSP	K: P007872			
Benzene	104	namber (b)	55-143	000770	0 01101	1007072			
1,2-Dibromoethane	102		54-129						
1,2-Dichloroethane	107		53-143						
Ethylbenzene	101		44-141						
Isopropylbenzene	101		38-144						
Methyl Tertiary Butyl Ether	120		55-129						
Toluene	100		50-146						
1,2,4-Trimethylbenzene	99		37-149						
1,3,5-Trimethylbenzene	100		38-150						
Xylene (Total)	102		44-136						
Batch number: 10167SLF026	Cample	numbor(a)	. 6007600	600770	1 IIMCD	K: P007702			
Anthracene	94	95	76-111	1	30	K: P007702			
Benzo(a) anthracene	88	86	78-111	2	30				
Benzo(a) pyrene	76	76	57-129	0	30				
Benzo(b) fluoranthene	79	81	53-131	2	30				
Benzo(g,h,i)perylene	93	80	60-123	13	30				
Chrysene	89	87	76-114	2	30				
Fluorene	98	96	75-114	1	30				
Naphthalene	57	36	33-140	16	30				
Phenanthrene	5 / 85	36 81		3	30				
	93	89	69-115 76-124	3	30				
Pyrene	93	69	76-124	3	30				
Batch number: 101676150001A	Sample	number(s)	: 6007699	-600770	1 UNSP	K: P007928	BKG: P00792	8	
Lead		489 (2)		15	20	58.2	98.7	52*	20
Batch number: 10168820006A	Campla	numbor (a)	. 6007600	600770	ם מס	. D007707			
Moisture	sample	mumber (S)	: 6007699	-600//0	T DVG	21.2	23.6	11	15

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: TCL(4.3)by 8260(soil)

Batch number: X101691AA

Dibromofluoromethane

1,2-Dichloroethane-d4

Toluene-d8

4-Bromofluorobenzene

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.

^{*-} Outside of specification



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Quality Control Summary

Client Na	me: SUN: Aquaterra T	ech.	Group Number: 1	1198981
Reported:	07/16/10 at 09:44 A			
		Surrogate Qu	ality Control	
6007701	102	108	89	88
Blank	100	97	94	93
LCS	102	102	99	95
LCSD	99	99	99	96
MS	102	111*	98	99
Limits:	71-114	70-109	70-123	70-111
	me: TCL(4.3)by 8260(soil)			
Batch numbe	r: X101731AA			
	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6007699	98	102	102	83
6007700	101	107	96	82
Blank	101	93	91	91
LCS	103	97	99	96
LCSD	100	99	97	96
MS	101	102	98	94
Limits:	71-114	70-109	70-123	70-111
Analysis Na	me: PAH 8270 (microwave)			
	r: 10167SLF026			
	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6007699	88	97	80	
6007700	88	92	83	
6007701	85	95	84	
Blank	92	95	84	
LCS	92	95	87	
MS	86	96	89	
MSD	86	99	88	
Limits:	55-121	74-110	57-112	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

412	Lancaster Laboratories	
	Laboratories	•

Lancaster Laboratories) 132 g	iroup#		9å	Sar	nple #	600			- 70 ors (L-6 0.9-1.	O C	#	234	217	,
<u></u>					latrix		lespoi) An	alyse	Reque	sted	FS FS	Lab Use C: CR#:	e Only		_
Client: Aquate((a Technologia Inc.) Project Name/#: Sun Philly Retincy Project Manager: Tiffan: Doc((Sampler: TR Williams Name of state where samples were collected:	PWSID P.O.#: _ Quote #	#: <u>:</u>			F Botable Checkif	f Containors	=d(total)	Benzens, Chimpas, osorthune, Tothone, nett, Ibenzoua	zera, sylansitual)	tortials Entitlettest	enthiache	(6) theolasthanes	Pro H= N=	eservatio HCI HNO ₃	n Codes T=Thiosulfa B=NaOH O=Other	ate	of samples (9)
Sample identification	Date Collected	Time Callected	4	od H	Water	Other Total #1	7-070g	260 6-11-4-11-11-11-11-11-11-11-11-11-11-11-1	1,3,5 -Trim Etasleen	Methy!	180204. Benzols.	Benzanz Florocer Phriling		Remarks			Fempératur poor regalg
5-307-0-2 5-135-0-2 5-299-0-2	6110110		X X X	X X X		4 4	XXX	×			X X X		A	0I-2 0I-7 0I-2			
Turnaround Time Requested (TAT) (please of (Rush TAT is subject to Lancaster Laboratories appropriate results are needed:	oval and surcha			elinqui	21					-	1200	Received 5am P	ication	rdijo		£/11110	Time (9
Rush results requested by (please circle): Please circle P		E-mail G Complete	/ **	elinqui elinqui		1	// 7_	4				Received		ey		D-4-	lime P (OO) Time
Type I (validation/NJ Reg) Type II (Tier II) Type III (Reduced NJ) Type IV (CLP SOW) Type VI (Raw Data Only) TX TRRP-13 MA MCP CT II Site-specific QC (If yes, indicate QC sample and subtraction of the complete and subtr	MS/MSD/Dup)?	Yes No		elinqui elinqui			1			Date Date	Time	Received	<u> </u>		6151		Time Time



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	BMQL	Below Minimum Quantitation Level
N.D.	none detected	MPN	Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

X,Y,Z

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
Ε	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Defined in case narrative

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 02, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/13/2010 Group Number: 1202807 PO Number: PHILADELPHIA REFINERY State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-298_070810 Grab Water	6030815
S-299_070810 Grab Water	6030816
S-300_070810 Grab Water	6030817
S-301_070810 Grab Water	6030818
S-304_070810 Grab Water	6030819
S-309_070810 Grab Water	6030820
S-310_070810 Grab Water	6030821
S-312_070810 Grab Water	6030822
S-253_070910 Grab Water	6030823
S-302_070910 Grab Water	6030824
S-306_070910 Grab Water	6030825
S-314_070910 Grab Water	6030826
S-316_070910 Grab Water	6030827
S-317_070910 Grab Water	6030828
S-318_070910 Grab Water	6030829
S-251_071210 Grab Water	6030830
S-252_071210 Grab Water	6030831
S-139_071210 Grab Water	6030832
S-140_071210 Grab Water	6030833
S-141_071210 Grab Water	6030834
S-143_071210 Grab Water	6030835
S-303_071210 Grab Water	6030836
S-328_071210 Grab Water	6030837

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.



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ELECTRONIC Langan Attn: Dennis Webster

COPY TO

ELECTRONIC SUN: Aquaterra Tech. Attn: Megan Breen

COPY TO

ELECTRONIC SUN: Aquaterra Tech. Attn: Tiffani Doerr

COPY TO

ELECTRONIC LLI Attn: EDD Group

COPY TO

ELECTRONIC Langan Attn: Kristen Ward

COPY TO

Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Sarah M. Snyder Senior Specialist



As Received

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Page 1 of 2

Sample Description: S-298 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-298_070810

LLI Sample # WW 6030815 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 08:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2298

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	90	5	3	5
10943	1,2-Dichloroethane		107-06-2	< 5	5	3	5
10943	Ethylbenzene		100-41-4	68	5	3	5
10943	Isopropylbenzene		98-82-8	29	10	3	5
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 5	5	3	5
10943	Toluene		108-88-3	170	5	3	5
10943	1,2,4-Trimethylbenz	ene	95-63-6	620	10	3	5
10943	1,3,5-Trimethylbenz	ene	108-67-8	210	10	3	5
10943	Xylene (Total)		1330-20-7	520	5	3	5
	reporting limits for level of non-target (ds were raised (due to		
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 50	50	10	10
07805	Fluorene		86-73-7	< 50	50	10	10
07805	Naphthalene		91-20-3	190	50	10	10
07805	Phenanthrene		85-01-8	110	50	10	10
07805	Pyrene		129-00-0	55	50	10	10
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 17	:28 Anita M Dale	5
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 17	:28 Anita M Dale	5
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 04	:22 Linda M Hartenstine	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12	:05 Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 01	:18 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08	:45 Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 10	:55 Choon Y Tian	1



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Page 2 of 2

Sample Description: S-298 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-298 070810

LLI Sample # WW 6030815 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 08:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2298

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Page 1 of 2

Sample Description: S-299 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-299_070810

LLI Sample # WW 6030816 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2299

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	22	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	16	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	2	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the bunds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 14:16	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 14:16	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 05:12	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 02:17	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-299 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-299 070810

LLI Sample # WW 6030816 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2299

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 10:56	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050001	07/15/2010 19:45	Mirit S Shenouda	1



As Received

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Page 1 of 2

Sample Description: S-300 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-300 070810 LLI Sample # WW 6030817 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 14:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2300

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	14	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	29	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	81	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix vsis. Therefore, the bunds were raised.						
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 09:2	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 09:2	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 06:0	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:0	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 03:1	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:4	Edwin Ortiz	1



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Sample Description: S-300 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-300_070810

LLI Sample # WW 6030817 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 14:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2300

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:02	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Page 1 of 2

Sample Description: S-301 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-301_070810

LLI Sample # WW 6030818 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 13:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2301

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	9	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	41	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	4	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	9	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	4	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 500	500	100	10
07805	Fluorene		86-73-7	< 500	500	100	10
07805	Naphthalene		91-20-3	< 500	500	100	10
07805	Phenanthrene		85-01-8	< 500	500	100	10
07805	Pyrene		129-00-0	< 500	500	100	10
analy compo	to the sample matrix ysis. Therefore, the bunds were raised. to the nature of the ysis. The reporting	e reporting	ng limits for the atrix, a reduced a	GC/MS semivolat	ile		
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	a	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 1	10:53	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 1	10:53	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 0	6:50	Linda M	10
							Hartenstine	



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Page 2 of 2

Sample Description: S-301 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-301_070810

LLI Sample # WW 6030818 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 13:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2301

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tim	ne	Analyst	Dilution Factor
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010	12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	03:47	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	10:44	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-304 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-304_070810

LLI Sample # WW 6030819 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2304

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z101992AA	07/19/2010 07:23	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z101992AA	07/19/2010 07:23	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 07:40	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 04:16	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-304 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-304 070810

LLI Sample # WW 6030819 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2304

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:04	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-309 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-309_070810

LLI Sample # WW 6030820 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 10:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2309

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	17	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 11:38	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 11:38	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 08:29	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 05:45	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-309 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-309 070810

LLI Sample # WW 6030820 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 10:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2309

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:05	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-310 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-310_070810

LLI Sample # WW 6030821 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 11:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2310

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the bunds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.028	0.028	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 08:59	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 08:59	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 09:19	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 06:15	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-310 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-310 070810

LLI Sample # WW 6030821 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 11:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2310

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:07	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-312 070810 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-312_070810

LLI Sample # WW 6030822 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/08/2010 12:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2312

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	.e	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010	12:23	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010	12:23	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010	10:08	Linda M	1
							Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010	12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	06:45	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:09	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-253 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-253_070910

LLI Sample # WW 6030823 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 12:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2253

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	21	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	16	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 12:46	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 12:46	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 10:57	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 07:15	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-253 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-253_070910

LLI Sample # WW 6030823 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 12:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2253

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:11	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-302 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-302_070910

LLI Sample # WW 6030824 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 09:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2302

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	50	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	9	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	65	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.028	0.028	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 13:08	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 13:08	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 14:42	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 07:44	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 11:13	Choon Y Tian	1



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Sample Description: S-302 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-302_070910

LLI Sample # WW 6030824 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 09:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2302

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-306 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-306 070910

LLI Sample # WW 6030825 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2306

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles SW	-846 82	260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	740	10	5	10
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	490	10	5	10
10943	Isopropylbenzene		98-82-8	73	2	0.5	1
10943	Methyl Tertiary Butyl E	ther	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	52	1	0.5	1
10943	1,2,4-Trimethylbenzene		95-63-6	40	2	0.5	1
10943	1,3,5-Trimethylbenzene		108-67-8	52	2	0.5	1
10943	Xylene (Total)		1330-20-7	300	1	0.5	1
GC/MS	Semivolatiles SW	-846 82	270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 500	500	100	10
07805	Fluorene		86-73-7	< 500	500	100	10
07805	Naphthalene		91-20-3	670	500	100	10
07805	Phenanthrene		85-01-8	850	500	100	10
07805	Pyrene		129-00-0	< 500	500	100	10
Due	to the sample matrix an	initial o	dilution was ne	cessary to perfo	orm the		
anal	ysis. Therefore, the re	porting :	limits for the	GC/MS semivolati	ile		

the reporting limits for the GC/MS semivolatile compounds were raised.

Due to the nature of the sample matrix, a reduced aliquot was used for analysis. The reporting limits were raised accordingly.

GC Miscellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879 Ethylene dibromide		106-93-4	< 0.028	0.028	0.0094	1
Metals Dissolved	SW-846	6020	mg/l	mg/l	mg/l	

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 13:31	Anita M Dale	1
01163	GC/MS VOA Water Prep	SW-846 5030B	2	Z102011AA	07/20/2010 20:11	Ginelle L Feister	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 13:31	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102011AA	07/20/2010 20:11	Ginelle L Feister	10



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Sample Description: S-306 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-306_070910

LLI Sample # WW 6030825 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 08:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2306

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010	15:31	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010	12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	08:14	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:14	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-314 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-314 070910

LLI Sample # WW 6030826 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 11:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

08/17/2010 Discard:

A2314

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles SW-	-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	100	2	0.5	1
10943	Methyl Tertiary Butyl E	ther	1634-04-4	4	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenzene		95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenzene		108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	2	1	0.5	1
GC/MS	Semivolatiles SW-	-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 500	500	100	10
07805	Fluorene		86-73-7	870	500	100	10
07805	Naphthalene		91-20-3	< 500	500	100	10
07805	Phenanthrene		85-01-8	1,900	500	100	10
07805	Pyrene		129-00-0	< 500	500	100	10
	to the sample matrix an i						
			-				

compounds were raised.

Due to the nature of the sample matrix, a reduced aliquot was used for analysis. The reporting limits were raised accordingly.

GC Miscellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879 Ethylene dibromide		106-93-4	< 0.027	0.027	0.0089	1
Metals Dissolved	SW-846	6020	mg/l	mg/l	mg/l	

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 10:08	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 10:08	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 16:21	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1



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Sample Description: S-314 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-314_070910

LLI Sample # WW 6030826 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 11:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2314

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 08:	44 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:	45 Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 11:	16 Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010 19:	45 Mirit S Shenouda	1



As Received

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Sample Description: S-316 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-316_070910

LLI Sample # WW 6030827 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 10:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2316

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	5	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	36	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	2	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	3	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix vsis. Therefore, the bunds were raised.						
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.	Initially DID Italie	neemou	11141	Dacciiii	Date and Tim	ne	imarybe	Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010	15:02	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010	15:02	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010	17:10	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010	12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	09:14	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:18	Choon Y Tian	1



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Sample Description: S-316 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-316 070910

LLI Sample # WW 6030827 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 10:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2316

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-317 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-317_070910

LLI Sample # WW 6030828 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2317

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	84	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	9	1	0.5	1
10943	Toluene		108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	3	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 500	500	100	10
07805	Fluorene		86-73-7	< 500	500	100	10
07805	Naphthalene		91-20-3	< 500	500	100	10
07805	Phenanthrene		85-01-8	< 500	500	100	10
07805	Pyrene		129-00-0	< 500	500	100	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						

Due to the nature of the sample matrix, a reduced aliquot was used for analysis. The reporting limits were raised accordingly.

GC Miscellaneous 07879 Ethylene dibromide	SW-846	8011 106-93-4	ug/l < 0.028	ug/l 0.028	ug/1 0.0095	1
Metals Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035 Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010 15:24	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010 15:24	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 18:00	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1



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Sample Description: S-317 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-317_070910 LLI Sample # WW 6030828 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2317

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tim	me	Analyst	Dilution Factor
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	09:44	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:23	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-318 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-318 070910 LLI Sample # WW 6030829 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

As Received

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2318

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	51	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	20	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 48	48	10	10
07805	Fluorene		86-73-7	< 48	48	10	10
07805	Naphthalene		91-20-3	< 48	48	10	10
07805	Phenanthrene		85-01-8	< 48	48	10	10
07805	Pyrene		129-00-0	< 48	48	10	10
anal	to the sample matrix ysis. Therefore, the punds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	D101971AA	07/16/2010	16:10	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	D101971AA	07/16/2010	16:10	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010	18:49	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010	12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010	10:13	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:25	Choon Y Tian	1



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Sample Description: S-318 070910 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-318 070910

LLI Sample # WW 6030829 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/09/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2318

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-251 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-251_071210

LLI Sample # WW 6030830 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 09:50 by SS SUN: Aquaterra Tech.

PO Box 744

As Received

Submitted: 07/13/2010 15:10 West Chester PA 19381

Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2251

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	370	5	3	5
10943	1,2-Dichloroethane		107-06-2	< 5	5	3	5
10943	Ethylbenzene		100-41-4	120	5	3	5
10943	Isopropylbenzene		98-82-8	34	10	3	5
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	< 5	5	3	5
10943	Toluene		108-88-3	< 5	5	3	5
10943	1,2,4-Trimethylbenze	ene	95-63-6	68	10	3	5
10943	1,3,5-Trimethylbenze	ene	108-67-8	48	10	3	5
10943	Xylene (Total)		1330-20-7	33	5	3	5
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 04:19	Florida A Cimino	5
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 04:19	Florida A Cimino	5
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 19:38	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 11:43	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 11:27	Choon Y Tian	1



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Sample Description: S-251 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-251 071210

LLI Sample # WW 6030830 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 09:50 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2251

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-252 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-252_071210

LLI Sample # WW 6030831 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 09:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2252

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	1,300	10	5	10
10943	1,2-Dichloroethane		107-06-2	< 2	2	1	2
10943	Ethylbenzene		100-41-4	96	2	1	2
10943	Isopropylbenzene		98-82-8	13	4	1	2
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	5	2	1	2
10943	Toluene		108-88-3	9	2	1	2
10943	1,2,4-Trimethylbenze	ene	95-63-6	140	4	1	2
10943	1,3,5-Trimethylbenze	ene	108-67-8	42	4	1	2
10943	Xylene (Total)		1330-20-7	250	2	1	2
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
analy	to the sample matrix vsis. Therefore, the bunds were raised.						
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 04:48	Florida A Cimino	10
01163	GC/MS VOA Water Prep	SW-846 5030B	2	P102011AA	07/20/2010 19:53	Daniel H Heller	2
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 04:48	Florida A Cimino	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102011AA	07/20/2010 19:53	Daniel H Heller	2
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/29/2010 20:28	Matthew S Woods	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 12:13	James H Place	1



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Sample Description: S-252 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-252_071210

LLI Sample # WW 6030831 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 09:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2252

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010	08:45	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:29	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-139 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-139_071210

LLI Sample # WW 6030832 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2139

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 05:16	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 05:16	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/31/2010 04:40	Linda M Hartenstine	10
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 12:43	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-139 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-139 071210 LLI Sample # WW 6030832 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 13:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2139

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010	11:31	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050001	07/15/2010	19:45	Mirit S Shenouda	1



As Received

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Sample Description: S-140 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-140_071210

LLI Sample # WW 6030833 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2140

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	7	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 49	49	10	10
07805	Fluorene		86-73-7	< 49	49	10	10
07805	Naphthalene		91-20-3	< 49	49	10	10
07805	Phenanthrene		85-01-8	< 49	49	10	10
07805	Pyrene		129-00-0	< 49	49	10	10
analy	to the sample matrix ysis. Therefore, the bunds were raised.						
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 05:44	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 05:44	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/31/2010 05:29	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 13:13	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-140 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-140 071210

LLI Sample # WW 6030833 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2140

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 11:33	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050001	07/15/2010 19:4	Mirit S Shenouda	1



As Received

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Sample Description: S-141 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-141_071210

LLI Sample # WW 6030834 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 10:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2141

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	36	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	9	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 51	51	10	10
07805	Fluorene		86-73-7	91	51	10	10
07805	Naphthalene		91-20-3	< 51	51	10	10
07805	Phenanthrene		85-01-8	190	51	10	10
07805	Pyrene		129-00-0	61	51	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.028	0.028	0.0094	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010 06:12	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010 06:12	Florida A Cimino	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAA026	07/31/2010 06:19	Linda M	10
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10195WAA026	07/14/2010 12:05	Kelli M Barto	1
07879	EDB in Wastewater	SW-846 8011	1	101950014A	07/17/2010 13:42	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950014A	07/15/2010 08:45	Edwin Ortiz	1



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Sample Description: S-141 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-141_071210

LLI Sample # WW 6030834 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 10:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2141

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
06035	Lead	SW-846 6020	1	101966050001A	07/16/2010 11:34	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050001	07/15/2010 19:45	Mirit S Shenouda	1



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Sample Description: S-143 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-143_071210 LLI Sample # WW 6030835 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2143

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0095	1
Metals	: Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P101991AA	07/19/2010	07:08	Florida A Cimino	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P101991AA	07/19/2010	07:08	Florida A Cimino	1
07879	EDB in Wastewater	SW-846 8011	1	101950015A	07/17/2010	15:42	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950015A	07/15/2010	09:00	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050002A	07/16/2010	12:48	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050002	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-303 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-303_071210

LLI Sample # WW 6030836 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 11:40 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2303

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	4	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	38	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	1	1	0.5	1
10943	Toluene		108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	2	1	0.5	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.028	0.028	0.0095	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102014AA	07/20/2010	23:38	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102014AA	07/20/2010	23:38	Kelly E Keller	1
07879	EDB in Wastewater	SW-846 8011	1	101950015A	07/17/2010	17:41	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950015A	07/15/2010	09:00	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050002A	07/16/2010	12:50	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050002	07/15/2010	19:45	Mirit S Shenouda	1



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Sample Description: S-328 071210 Grab Water

Philadelphia Refinery AOI-2 COC: 237713 S-328_071210

LLI Sample # WW 6030837 LLI Group # 1202807 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/12/2010 12:50 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/13/2010 15:10 Reported: 08/02/2010 15:15

Discard: 08/17/2010

A2328

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	13	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	3	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	12	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102014AA	07/21/2010 00	:06 Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102014AA	07/21/2010 00	:06 Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10195WAJ026	07/23/2010 11	:45 Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10195WAJ026	07/15/2010 06	:15 Timothy J	1
						Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	101950015A	07/17/2010 18	:40 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101950015A	07/15/2010 09	:00 Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050002A	07/16/2010 12	:30 Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	101966050002	07/15/2010 19	:45 Mirit S Shenouda	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1202807

Reported: 08/02/10 at 03:15 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank <u>LOQ**</u>	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: D101971AA	Sample numl	ber(s): 6	030815-603	0818,6030820	0-60308	29			
Benzene	< 1	1.	0.5	uq/l	90	89	79-120	0	30
1,2-Dichloroethane	< 1	1.	0.5	uq/l	93	95	70-130	2	30
Ethylbenzene	< 1	1.	0.5	uq/l	101	100	79-120	2	30
Isopropylbenzene	< 2	2.	0.5	uq/l	104	104	77-120	1	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	uq/l	99	103	76-120	4	30
Toluene	< 1	1.	0.5	uq/l	100	99	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	111	111	74-120	0	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	109	109	75-120	1	30
Xylene (Total)	< 1	1.	0.5	ug/l	108	107	80-120	0	30
Batch number: P101991AA	Sample numl	ber(s): 6	030830-603	0835					
Benzene	< 1	1.	0.5	ug/l	109	110	79-120	1	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	87	89	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	84	85	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	80	83	77-120	4	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	107	109	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	91	94	79-120	3	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	81	84	74-120	3	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	82	86	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	85	87	80-120	2	30
Batch number: P102011AA	Sample numl	ber(s): 6	030831						
1,2-Dichloroethane	< 1	1.	0.5	ug/l	74	75	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	88	89	79-120	1	30
Isopropylbenzene	< 2	2.	0.5	ug/l	84	86	77-120	2	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	90	92	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	95	97	79-120	2	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	89	88	74-120	1	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	90	89	75-120	1	30
Xylene (Total)	< 1	1.	0.5	ug/l	89	90	80-120	2	30
Batch number: P102014AA	Sample numl								
Benzene	< 1	1.	0.5	ug/l	98	100	79-120	2	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	80	81	70-130	1	30
Ethylbenzene	< 1	1.	0.5	ug/l	90	90	79-120	0	30
Isopropylbenzene	< 2	2.	0.5	ug/l	89	90	77-120	1	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	103	100	76-120	2	30
Toluene	< 1	1.	0.5	ug/l	93	94	79-120	1	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	87	87	74-120	0	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	87	87	75-120	0	30
Xylene (Total)	< 1	1.	0.5	ug/l	92	91	80-120	0	30
Batch number: Z101992AA	Sample numl			-					
Benzene	< 1	1.	0.5	ug/l	95		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	90		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	97		79-120		

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1202807

Reported: 08/02/10 at 03:15 PM

Laboratory Compliance Quality Control

Analysis Name Isopropylbenzene Methyl Tertiary Butyl Ether Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	Blank Result < 2 < 1 < 1 < 2 < 1 < 1 < 2 < 1	Blank LOO** 2. 1. 2. 2. 1.	Blank MDL 0.5 0.5 0.5 0.5 0.5 0.5	Report Units ug/l ug/l ug/l ug/l ug/l ug/l ug/l ug/l	LCS %REC 97 97 98 98 96 99	LCSD %REC	LCS/LCSD <u>Limits</u> 77-120 76-120 79-120 74-120 75-120 80-120	<u>RPD</u>	RPD Max
Batch number: Z102011AA Benzene Ethylbenzene	Sample number 1 < 1	ber(s): 60 1. 1.	30825 0.5 0.5	ug/l ug/l	90 92		79-120 79-120		
Batch number: 10195WAA026 Chrysene Fluorene Naphthalene Phenanthrene Pyrene	Sample numl < 5 < 5 < 5 < 5 < 5 < 5 < 5	per(s): 60 5. 5. 5. 5. 5.	30815-603 1 1 1 1 1	0834 ug/l ug/l ug/l ug/l ug/l	97 111 93 102 107	97 113 91 100 107	82-112 82-113 77-107 83-112 80-115	0 1 2 2	30 30 30 30 30
Batch number: 10195WAJ026 Chrysene Fluorene Naphthalene Phenanthrene Pyrene	Sample numl < 5 < 5 < 5 < 5 < 5	ber(s): 60 5. 5. 5. 5. 5.	30837 1 1 1 1	ug/l ug/l ug/l ug/l ug/l	98 108 96 98 106	99 106 96 99 107	82-112 82-113 77-107 83-112 80-115	2 2 1 2	30 30 30 30 30
Batch number: 101950014A Ethylene dibromide	Sample numb	per(s): 60 0.030	30815-603 0.010	0834 ug/l	92	96	60-140	4	20
Batch number: 101950015A Ethylene dibromide	Sample number 0.030	ber(s): 60 0.030	30835-603 0.010	0837 ug/l	96	96	60-140	0	20
Batch number: 101966050001A Lead	<pre>Sample numl < 0.0010</pre>	ber(s): 60 0.0010	30815-603 0.00005 0	0834 mg/l	100		90-115		
Batch number: 101966050002A Lead	Sample numb < 0.0010	ber(s): 60 0.0010	30835-603 0.00005 0	0837 mg/l	99		90-115		

<u>Analysis Name</u>	MS <u>%REC</u>	MSD %REC	MS/MSD <u>Limits</u>	<u>RPD</u>	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP <u>RPD</u>	Dup RPD <u>Max</u>
Batch number: D101971AA Benzene 1,2-Dichloroethane Ethylbenzene	Sample 116 91 100	number(s)	: 6030815 80-126 66-141 71-134	-60308	18,6030	820-6030829	O UNSPK: 6	030817	
Isopropylbenzene Methyl Tertiary Butyl Ether	148* 228 (2)		75-128 72-126						

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1202807

Reported: 08/02/10 at 03:15 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name Toluene	MS %REC 101	MSD %REC	MS/MSD Limits 80-125	<u>RPD</u>	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD <u>Max</u>
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	106 104 105		72-130 72-131 79-125						
Batch number: P101991AA Benzene 1,2-Dichloroethane Ethylbenzene Isopropylbenzene Methyl Tertiary Butyl Ether	Sample 114 88 87 84 109	number(s)	: 6030830 80-126 66-141 71-134 75-128 72-126	-603083	5 UNSPR	C: P030840			
Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	96 82 84 88		80-125 72-130 72-131 79-125						
Batch number: P102011AA 1,2-Dichloroethane Ethylbenzene Isopropylbenzene Methyl Tertiary Butyl Ether Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	Sample 79 96 94 95 105 97 100	number(s)	: 6030831 66-141 71-134 75-128 72-126 80-125 72-130 72-131 79-125	UNSPK:	P03444	18			
Batch number: P102014AA Benzene 1,2-Dichloroethane Ethylbenzene Isopropylbenzene Methyl Tertiary Butyl Ether Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	Sample 108 85 100 98 107 104 95 95	number(s)	80-126 80-126 66-141 71-134 75-128 72-126 80-125 72-130 72-131 79-125	-603083	7 UNSPR	C: P030838			
Batch number: Z101992AA Benzene 1,2-Dichloroethane Ethylbenzene Isopropylbenzene Methyl Tertiary Butyl Ether Toluene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Xylene (Total)	Sample 102 93 104 105 98 104 103 102 105	number(s) 101 94 105 105 97 104 104 104 105	80-126 80-126 66-141 71-134 75-128 72-126 80-125 72-130 72-131 79-125	UNSPK: 1 0 1 0 1 0 1 0 1	P03235 30 30 30 30 30 30 30 30 30 30	57			
Batch number: Z102011AA Benzene Ethylbenzene	97 99	96 101	: 6030825 80-126 71-134	1 2	3 0 3 0				
Batch number: 101950014A	Sample	number(s)	: 6030815	-603083	4 UNSPR	K: 6030815	BKG: 603081	6	

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1202807

Reported: 08/02/10 at 03:15 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name Ethylene dibromide	MS <u>%REC</u> 87	MSD <u>%REC</u>	MS/MSD Limits 65-135	RPD	RPD <u>MAX</u>	BKG Conc < 0.029	DUP <u>Conc</u> < 0.029	DUP RPD 9 (1)	Dup RPD Max 30
Batch number: 101950015A Ethylene dibromide	Sample:	number(s)	: 6030835 65-135	-603083	7 UNSPE	<pre>C: 6030835 < 0.028</pre>	BKG: 6030836 < 0.028	0 (1)	30
Batch number: 101966050001A Lead	Sample:	number(s) 103	: 6030815 75-125		4 UNSPR 20	<pre>C: 6030818 < 0.0010</pre>	BKG: 6030818 < 0.0010	2 (1)	20
Batch number: 101966050002A Lead	Sample:	number(s)		-603083 7	7 UNSPE 20	X: P032079 < 0.0010	BKG: P032079 < 0.0010	3 (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water Batch number: D101971AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6030815	92	94	107	98
6030816	91	95	108	100
6030817	91	95	107	98
6030818	92	96	108	99
6030820	91	97	108	99
6030821	92	94	106	96
6030822	93	94	106	96
6030823	92	94	107	100
6030824	93	93	109	102
6030825	93	97	104	96
6030826	90	93	108	101
6030827	91	96	106	99
6030828	93	97	110	102
6030829	93	96	107	98
Blank	95	97	105	91
LCS	97	101	106	98
LCSD	94	102	106	98
MS	93	101	106	97
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water

er: P101991AA Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
99	104	93	95
98	103	93	95
100	103	92	96
97	103	92	96
100	105	92	95
	99 98 100 97	Dibromofluoromethane 1,2-Dichloroethane-d4 99 104 98 103 100 103 97 103	Dibromofluoromethane 1,2-Dichloroethane-d4 Toluene-d8 99 104 93 98 103 93 100 103 92 97 103 92

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 5 of 7

Quality Control Summary

	ame: SUN: Aquaterra : 08/02/10 at 03:15	DM	Group Number:	1202807
керогеса	.; 00/02/10 at 03:13		uality Control	
Blank	98	105	94	92
LCS	98	106	94	93
LCSD	97	106	95	93
MS	97	108	93	92
Limits:	80-116	77-113	80-113	78-113
Analysis N	ame: UST BTEX, MTBE in Wa er: P102011AA	ter		
Dateir Hall	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6030831	92	102	102	92
Blank	92	104	104	89
LCS	91	102	103	90
LCSD	91	103	104	92
MS	92	104	104	91
Limits:	80-116	77-113	80-113	78-113
	ame: UST BTEX, MTBE in Wa	ter		
Batch numb	er: P102014AA	1 0 Dishin - 13 3:	m-1 10	4. Danier 63
	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6030836	94	102	100	94
6030837	94	101	98	95
Blank	94	103	99	94
LCS	93	104	100	95
LCSD	95	106	98	93
MS	95	105	99	96
Limits:	80-116	77-113	80-113	78-113
	ame: UST BTEX, MTBE in Wa er: Z101992AA	ter		
Baccii IIana	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6030819	94	94	99	97
Blank	97	96	100	98
DIAIIK				
	96	98	100	98
	96 97	98 98	100 100	98 97
LCS				
LCS MS	97	98	100	97
LCS MS MSD Limits:	97 96 80-116 ame: UST BTEX, MTBE in Wa	98 97 77-113	100 100	97 98
LCS MS MSD Limits:	97 96 80-116 Tame: UST BTEX, MTBE in Wa er: Z102011AA	98 97 77-113 ter	100 100 80-113	97 98 78-113
LCS MS MSD Limits:	97 96 80-116 ame: UST BTEX, MTBE in Wa	98 97 77-113	100 100	97 98 78-113
LCS MS MSD Limits: Analysis N Batch numb	97 96 80-116 Fame: UST BTEX, MTBE in Wa er: Z102011AA Dibromofluoromethane	98 97 77-113 ter 1,2-Dichloroethane-d4	100 100 80-113 Toluene-d8	97 98 78-113 4-Bromofluorobenzene
LCS MS MSD Limits: Analysis N Batch numb	97 96 80-116 Tame: UST BTEX, MTBE in Wa er: Z102011AA Dibromofluoromethane	98 97 77-113 ter 1,2-Dichloroethane-d4	100 100 80-113 Toluene-d8	97 98 78-113 4-Bromofluorobenzene
LCS MS MSD Limits: Analysis N Batch numb Blank LCS MS	97 96 80-116 Same: UST BTEX, MTBE in Water: Z102011AA Dibromofluoromethane	98 97 77-113 ter 1,2-Dichloroethane-d4 92 95 95	100 100 80-113 Toluene-d8	97 98 78-113 4-Bromofluorobenzene 99 101 100
LCS MS MSD Limits: Analysis N Batch numb Blank LCS	97 96 80-116 Tame: UST BTEX, MTBE in Wa er: Z102011AA Dibromofluoromethane	98 97 77-113 ter 1,2-Dichloroethane-d4	100 100 80-113 Toluene-d8	97 98 78-113 4-Bromofluorobenzene

Terphenyl-d14

*- Outside of specification

Nitrobenzene-d5

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.

2-Fluorobiphenyl

(2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1202807

Reported: 08/02/10 at 03:15 PM

Surrogate Quality Control

6030815	99	99	69	
6030816	66	69	52	
6030817	77	66	40*	
6030818	91	102	67	
6030819	88	104	73	
6030820	92	98	72	
6030821	79	88	46*	
6030822	83	102	89	
6030823	81	95	77	
6030824	83	99	68	
6030825	87	84	54	
6030826	91	87	57	
6030827	81	90	67	
6030828	98	101	71	
6030829	98	100	70	
6030830	82	79	53	
6030831	80	88	54	
6030832	84	106	74	
6030833	76	85	51	
6030834	89	85	62	
Blank	94	109	88	
LCS	92	103	95	
LCSD	91	103	93	
Limits:	64-121	63-114	47-114	
	V	V3 111	** ***	

Analysis Name: PAHs by 8270 Batch number: 10195WAJ026

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6030837	85	94	82	
Blank	90	92	84	
LCS	92	95	82	
LCSD	90	93	83	
Limits	64-121	63-114	47-114	

Analysis Name: EDB in Wastewater Batch number: 101950014A 1,1,2,2-

Tetrachloroethane

6030815	118
6030816	106
6030817	88
6030818	109
6030819	100
6030820	136
6030821	93
6030822	93
6030823	96
6030824	133
6030825	139*
6030826	150*
6030827	153*
6030828	136
6030829	109

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 7 of 7

Quality Control Summary

	me: SUN: Aquaterra 08/02/10 at 03:15			G	roup Number:	1202807
Reported:	00/02/10 at 03:15	PM	Surrogate	Ouality	Control	
6030830	104		Darrogaco	guarroj	00110101	
6030831	114					
6030832	119					
6030833	123					
6030834	159*					
Blank	100					
DUP	105					
LCS	104					
LCSD	102					
MS	135					
Limits:	46-136					
Analysis Na	me: EDB in Wastewater					
	r: 101950015A					
Darotti Itambo	1,1,2,2-					
	Tetrachloroethane					
6030835	124					
6030836	115					
6030837	108					
Blank	115					
DUP	107					
LCS	110					
LCSD	104					
MS	130					
Limits:	46-136					

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



For Lancaster Laboratories use only

Acct. # 10132 Group# 1303807 Sample # 6030815-37

COC # 237713

1)		·								(5) Aı	alys	es R	eque	sted		For Lab L	ise Only		_	
Client: SUN-AQUATERRA	Acct. #:			_		latrix	_(4) L		la	Pre	serva	tion	Code	es	<u>-</u>	SCR#:				_
Project Name/#: PHILA REF/AOI Project Manager: T. DOERR	<u>-2</u> PWSID	#:		-		Check if Applicable	\prod	^ 	Ive ()	ethy/loce	98	ما	J-1.vareng				Preservat H=HCl N=HNO ₃	tion Codes T=Thios B=NaOl	ulfate	6	
Sampler: S.SYKES Name of state where samples were collected:	Quote #			-		☐ Potable☐ NPDES		Containers	Carsolved	brockhoig 15 Trim	Cerment for the E	Tolve ne	() [[\ e, \]	res &			S=H ₂ SO ₄	O =Other	i .	of samples f requested)	
2 Sample Identification	Date Collected	Time Collected	Grab (2)	유니	Soil	Water	Other	Total # of	Lea3	1,2-0-5,1	Breche, Etherhan	MTB (E)	Chrysene Nachtha	Photomby			Remarl	ks		Temperature o	
5-298_070810	7/8/10	845	X			X		8	X	X	X	X	X	X					0.9	-2.6	}
5-299-070810	7/8/10		X		-	X		8	$\langle \rangle$	\propto	X		\times	X		<u> </u>					
S-300-070810 S-301-070810	7/8/16		$\hat{\chi}$		\dashv	\hat{X}	4	8	$\stackrel{\wedge}{\times}$	Δ	X	X	X	X		-					
5-304-070810	7/8/16	1330	X			X		Ž.	X	X	X	X	X	X							
81868200810	118/102	100	2			-	2	#	2				-			Zen	4				l
5-309-070810	7/8/10	1045	X	, 		X		8	X	X	X	X	X	X	-	-					
5-310-070810	7/8/10	1125	X	,		X		8	\angle	$\stackrel{X}{X}$	X	\overline{X}	$\frac{}{\times}$	Ŷ		+-				 	
Turnaround Time Requested (TAT) (please c		_		Calin		hed t						Date	<u> </u>	Firm a	Receiv	ad by			Date	Time (
Rush TAT is subject to Lancaster Laboratories appre			ľ	Teiiii	iquis 	$\overline{}$	-	la		/AG	П		- 1	760	Receiv	-	rite		1	1700	~
Date results are needed: Rush results requested by (please circle):			ļ	Relin	y quis	hed b						Dat		Γime	Receiv		iady		Date	Time	
Phone #: Fax #: E-mail address:			Į.	Relin	iquis	hed b	у. оу:					// ን / Dat	e /	Time	Receiv				(<i>V() f(</i> Date	Time	1
Pata Package Options (please circle if required) Type I (validation/NJ Reg) TX TRRP-13 Type II (Tier II) Type III (Reduced NJ) Site-specific QC (N	RCP Y	Complete' No	-	Relin	quis	shed t	برطر oy:	<u>e</u>			•	Date			Receiv	red by	:		Date	Time	
Type IV (CLP SOW) Type VI (Raw Data Only) Gille 3 pec office QC Service and sub- linternal COC Req	t triplicate volume (\cup	F	Relin	quis	hed b	by:		/			Dat	e	Гime	Receiv	red by	;	7	1 Date	Time S C	



For Lancaster Laboratories use only Acct. # 10132 Group# 1202807 Sample #6030815-37

COC # 242743

Please print. Instructions on reverse side correspond with circled numbers

1		. ,					T		(5) A	nalyse	s Re	eques	sted	For Lab Us	se Only			
Client: SUN- AQUATERRA	Acct. #:					atrix	4			Pre	servat	ion (Code	es	SCR#:			_	
Project Name/#: PHILA REF AOI Project Manager: T. DOERR	P.O.#:Quote #	#:	3	posite	: : :	er Dotable Check if	# of Containers	10	1 4 C 1	seare, comerc	TBE To here	Xylones	ysone, Fluorene on Hodese, Pheroothere	Pyrene	Preservati H=HCI N=HNO ₃ S=H ₂ SO ₄	on Codes T=Thiosulf B=NaOH O=Other	ate	erature of samples (
Sample Identification	Collected	Collected	Grab	Com	Soil	Water	Tota	-	7,7	3	3 5	×,	ें≷		Remark	s		remp	
5-253-070910 5-302-070910 5-306-070910 5-314-070910 5-316-070910 5-317-070910 5-318-070910	7/9/10 7/9/10 7/9/10 7/9/10 7/9/10 7/9/10	1245 915 830 1135 1025 1100 945	× × × × × × × × × × × × × ×			X X X X X X	2 2 3 3 3 3 3 3 3 3 4 2	XXXX	××××××××××××××××××××××××××××××××××××××	X X X X X X	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	XXXXXX	XXXXXX	X X X X X			6.	9-2.6	٥
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Type VI (Raw Data Only) Internal COC Req	•	·		,0111	.4013		•				Jac			22	<u>.</u>	7/13	(0	Islo	



For Lancaster Laboratories use only _Group# <u>1202807</u> Sample #<u>6030815~37</u>

COC#

232893

1) Client: SUN-AQUATERR	A next #		Matrix (4)		inalyses Requested	For Lab Use Only FSC: SCR#:
Project Name/#: PHILA REF AOI: Project Manager: T. DOERR Sampler: S. SYICES Name of state where samples were collected:	-2_PWSID#: P.O.#: Quote #:		Professional Checker	- Orchloroethane	Jan 18 E Mars (tota) Man Holan Man Holan	Preservation Codes H=HCI T=Thiosulfate N=HNO ₃ B=NaOH S=H ₂ SO ₄ O=Other 6 Preservation Codes General Codes For a code code code code code code code code
Sample Identification S-251_071210	Collected Collecte 7/12/10 950	X	X		TXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	Remarks () () () () () () () () () (
5-252 071210 5-139 - 071210 5-140-071210	1331	X	X	3		
5-14] 071210 5-143 07/210	1400	1/2	X	3 /		<i>y</i>
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Date results are needed: Rush results requested by (please circle): Phone #: E-mail address:		_ \$	ipquished by: inquished by:		Date Time Received by Date Time Received by	seldy 1/3/0104
Data Package Options (please circle if required) Type I (validation/NJ Reg) TX TRRP-13 Type II (Tier II) MA MCP CT	Yes No		inquished by:	7	Date Time Received by	r: Date Time
Type IV (CLP SOW) till yes, indicate QC sample and sult	MS/MSD/Dup)? Yes No and triplicate volume.) quired? Yes / No	Reli	inquished by:		Date Time Received by	7/13/10 (Sto



For Lancaster Laboratories use only

Acct. # 10132 Group# 1202807 Sample # 6030815-37

COC#

232894

	Please print	. Instructions	s on reverse sid	ie correspo	nd with circle	ed numbers.			
1) 51/1-4-1-3-1-4			Matrix		17 1 1 2 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1	nalyses Reque	H (88.00.000.000.000.000.000.000.000.000.0	For Lab Use Only FSC: SCR#:	
Client: SUN-AQUATERRA Project Name/#: PHILA REF ACT: Project Manager: T. DOERR Sampler: S. SYKES Name of state where samples were collected:	P.O.#:		Potable Check II NPDES Applicable	of Containers (A)	dicherochore	MTBE Xylenex (Mp)		Preservation Codes H=HCl T=Thiosulf N=HNO ₃ B=NaOH S=H ₂ SO ₄ O=Other	ate 6 in the state of the state
2 Sample Identification	Date Time	1000	Solf	Total#	1,2-1 12,4 Briggs	EDB/ Tolvene, Chrysere,	S	Remarks	Temperati upon rece
S-303 - 071210 S-328 - 071210	7/12/16 1140		X	8 X	1 X X	XXX	*		0.9-2.6
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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 02, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/14/2010 Group Number: 1203025 PO Number: PHILADELPHIA REFINERY State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-132_071310 Grab Water	6031955
S-133_071310 Grab Water	6031956
S-137_071310 Grab Water	6031957
S-307_071310 Grab Water	6031958

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO		
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Dorothy M. Love Group Leader

Doutty M. Love



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Page 1 of 1

Sample Description: S-132 071310 Grab Water

Philadelphia Refinery AOI-2 COC: 232895 S-132_071310

LLI Sample # WW 6031955 LLI Group # 1203025 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/13/2010 14:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/14/2010 17:07 Reported: 08/02/2010 10:38

Discard: 08/17/2010

S-132

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	31	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0095	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102002AA	07/19/2010 18:20	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102002AA	07/19/2010 18:20	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10196WAD026	07/28/2010 21:2	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10196WAD026	07/16/2010 01:29	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	101960019A	07/18/2010 05:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101960019A	07/16/2010 08:4	Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050003A	07/20/2010 10:00	Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050003	07/15/2010 19:4	Mirit S Shenouda	1



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Sample Description: S-133 071310 Grab Water

Philadelphia Refinery AOI-2 COC: 232895 S-133_071310

LLI Sample # WW 6031956 LLI Group # 1203025 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/13/2010 12:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/14/2010 17:07 Reported: 08/02/2010 10:38

Discard: 08/17/2010

S-133

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102002AA	07/19/2010 18:	18 Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102002AA	07/19/2010 18:	18 Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10196WAD026	07/28/2010 21:	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10196WAD026	07/16/2010 01:	25 Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	101960019A	07/18/2010 05:	36 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101960019A	07/16/2010 08:	15 Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050003A	07/20/2010 09:	56 Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050003	07/15/2010 19:	45 Mirit S Shenouda	1



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Sample Description: S-137 071310 Grab Water

Philadelphia Refinery AOI-2 COC: 232895 S-137_071310

LLI Sample # WW 6031957 LLI Group # 1203025 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/13/2010 13:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/14/2010 17:07 Reported: 08/02/2010 10:38

Discard: 08/17/2010

S-136

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	11	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102002AA	07/19/2010 19:	16 Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102002AA	07/19/2010 19:	16 Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10196WAD026	07/28/2010 22:	17 Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10196WAD026	07/16/2010 01:	25 Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	101960019A	07/18/2010 06:	05 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101960019A	07/16/2010 08:	45 Edwin Ortiz	1
06035	Lead	SW-846 6020	1	101966050003A	07/20/2010 10:	08 Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050003	07/15/2010 19:	45 Mirit S Shenouda	1



As Received

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Sample Description: S-307 071310 Grab Water

Philadelphia Refinery AOI-2 COC: 232895 S-307_071310 LLI Sample # WW 6031958 LLI Group # 1203025 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/13/2010 11:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/14/2010 17:07 Reported: 08/02/2010 10:38

Discard: 08/17/2010

S-307

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
semi hold	ogate recoveries are volatile analysis. The time and the surrogated is from the initial control of the control	The analys	sis was repeated on eries are within th	utside of the rene ne limits. The	equired		
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102002AA	07/19/2010 19:45	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102002AA	07/19/2010 19:45	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10196WAD026	07/28/2010 22:42	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10196WAD026	07/16/2010 01:25	Roman Kuropatkin	1
07879	EDB in Wastewater	SW-846 8011	1	101960019A	07/18/2010 06:35	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101960019A	07/16/2010 08:45	Edwin Ortiz	1



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Sample Description: S-307 071310 Grab Water

Philadelphia Refinery AOI-2 COC: 232895 S-307_071310

LLI Sample # WW 6031958 LLI Group # 1203025 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/13/2010 11:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/14/2010 17:07 Reported: 08/02/2010 10:38

Discard: 08/17/2010

S-307

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	101966050003A	07/20/2010	10:13	Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	101966050003	07/15/2010	19:45	Mirit S Shenouda	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203025

Reported: 08/02/10 at 10:38 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: P102002AA	Sample numi	ber(s): 60	31955-603	1958					
Benzene	< 1	1.	0.5	ug/l	103	95	79-120	8	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	82	80	70-130	3	30
Ethylbenzene	< 1	1.	0.5	ug/l	95	89	79-120	6	30
Isopropylbenzene	< 2	2.	0.5	ug/l	93	88	77-120	6	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	104	99	76-120	5	30
Toluene	< 1	1.	0.5	ug/l	100	94	79-120	6	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92	88	74-120	5	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	93	88	75-120	6	30
Xylene (Total)	< 1	1.	0.5	ug/l	96	91	80-120	5	30
Batch number: 10196WAD026	Sample num	ber(s): 60	31955-603	1958					
Chrysene	< 5	5.	1	ug/l	93	94	82-112	1	30
Fluorene	< 5	5.	1	ug/l	97	94	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	94	94	77-107	0	30
Phenanthrene	< 5	5.	1	ug/l	96	95	83-112	1	30
Pyrene	< 5	5.	1	ug/l	102	96	80-115	6	30
Batch number: 101960019A	Sample num	ber(s): 60	31955-603	1958					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	117	108	60-140	7	20
Batch number: 101966050003A Lead	<pre>Sample num < 0.0010</pre>	ber(s): 60 0.0010	31955-603 0.00005 0	1958 mg/l	101		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	<u>RPD</u>	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP <u>RPD</u>	Dup RPD <u>Max</u>
Batch number: P102002AA	Sample	number(s)	: 6031955	-603195	8 UNSP	K: P031921			
Benzene	103		80-126						
1,2-Dichloroethane	80		66-141						
Ethylbenzene	95		71-134						
Isopropylbenzene	95		75-128						
Methyl Tertiary Butyl Ether	98		72-126						
Toluene	100		80-125						
1,2,4-Trimethylbenzene	92		72-130						
1,3,5-Trimethylbenzene	92		72-131						
Xylene (Total)	96		79-125						

- *- Outside of specification
- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203025

Reported: 08/02/10 at 10:38 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DOP	Dup RPD
<u>Analysis Name</u>	%REC	%REC	<u>Limits</u>	RPD	MAX	Conc	Conc	RPD	Max
Batch number: 101960019A	Sample	number(s)	: 6031955	-60319	58 UNSPI	K: P031713			
Ethylene dibromide	91	96	65-135	5	20				
Batch number: 101966050003A	Sample	number(s)			58 UNSPI	K: 6031956	BKG: 6031956		
Lead	105	101	75-125	4	20	< 0.0010	< 0.0010	200* (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102002AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6031955	95	102	100	97
6031956	94	101	100	95
6031957	94	101	98	97
6031958	93	102	99	93
Blank	93	101	100	93
LCS	93	103	99	93
LCSD	94	104	100	93
MS	93	105	99	92
T.imita.	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270 Batch number: 10196WAD026 Nitrobenzene-d5

	Nitropenzene-d5	2-Fluorobiphenyl	Terpneny1-d14	
6031955	101	96	89	
6031956	108	99	90	
6031957	102	101	90	
6031958	96	77	46*	
Blank	106	107	94	
LCS	102	99	91	
LCSD	99	99	87	
Limits:	64-121	63-114	47-114	

Analysis Name: EDB in Wastewater

Batch number: 101960019A

1,1,2,2-

Tetrachloroethane

6031955	88
6031956	108
6031957	106
6031958	95
Blank	99

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 08/02/10 at 10:38 AM Group Number: 1203025

Surrogate Quality Control

LCS LCSD 108 104 MS 81 MSD 90

Limits: 46-136

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



For Lancaster Laboratories use only Acct. # 10132 Group# 120309 5 Sample # G031955 - 58

COC#

232895

Please print. Instructions on reverse side correspond with circled numbers. For Lab Use Only Analyses Requested FSC: Client: SUN-AQUATERRA >> Preservation Codes SCR# Acct. #: Preservation Codes Project Name/#: PHILA REF AOI-9 PWSID #: ____ H=HCL T=Thiosulfate Project Manager: TOPERR P.O.#: N=HNO₃ B=NaOH S=H₂SO₄ **O**=Other Sampler: S-SYICES Naph then len a Quote #: Name of state where samples were collected: 国に国 Time Sample Identification Collected Collected Remarks 132-071310 1.8-2.8 7/13/10 1430 7/13/10 1245 33 - 07/3/0 * ID 15 S-137 1320 7/13/10 rollected at 1320 1120 Der T.D. 9007/15/10 Turnaround Time Requested (TAT) (please circle): Normal Rush Relinquished by: Date Time Received by: Date Time (9 (Rush TAT is subject to Lancaster Laboratories approval and surcharge.) 7/10/8 7/17/0 1630 1630 Date results are needed: Time Received by Date Time Rush results requested by (please circle): Phone Fax Phone #: Relinguished by: E-mail address: SDG Complete? Data Package Options (please circle if required) Type I (validation/NJ Reg) TX TRRP-13 Relinquished by: Date Time Received by: Date Time Type II (Tier II) MA MCP CT RCP Site-specific QC (MS/MSD/Dup)? Yes Type III (Reduced NJ) Relinquished by: Type IV (CLP SOW) Date Time Received by: Date Time (If yes, indicate QC sample and submit triplicate volume.) Type VI (Raw Data Only) Internal COC Required? Yes / No 1707



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	E	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

July 26, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/15/2010 Group Number: 1203257 PO Number: PHILADELPHIA REFINERY State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
C-HEADER_071410 Grab Water	6033030
S-134_071410 Grab Water	6033031
S-305_071410 Grab Water	6033032
S-165_071410 Grab Water	6033033
S-166_071410 Grab Water	6033034
S-177_071410 Grab Water	6033035
S-48_071410 Grab Water	6033036

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO		
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Robin C. Runkle Senior Specialist



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Page 1 of 2

Sample Description: C-HEADER 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 C-HEADER 071410 LLI Sample # WW 6033030 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 11:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

CHEAD

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010 18:34	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010 18:34	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 01:16	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 16:49	Michele D Hamilton	1 1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08:45	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010 07:52	Deborah A Krady	1



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Page 2 of 2

Sample Description: C-HEADER_071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 C-HEADER 071410

LLI Group # 1203257 Account # 10132

LLI Sample # WW 6033030

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 11:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

CHEAD

Laboratory Sample Analysis Record

 CAT
 Analysis Name
 Method
 Trial#
 Batch#
 Analysis
 Analyst
 Dilution

 No.
 06050
 ICP/MS SW-846 Water Digest
 SW-846 3010A
 1
 102006050001
 07/20/2010
 09:42
 Denise K Conners
 1



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Page 1 of 2

Sample Description: S-134 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-134 071410 LLI Sample # WW 6033031 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 12:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-134

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	2	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010 19:02	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010 19:02	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 01:42	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 17:19	Michele D Hamiltor	1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08:45	Deborah M	1
						Zimmerman	
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010 07:54	Deborah A Krady	1



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Sample Description: S-134 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-134 071410 LLI Sample # WW 6033031 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 12:25 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-134

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102006050001	07/20/2010	09:42	Denise K Conners	1



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Sample Description: S-305 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-305_071410

LLI Sample # WW 6033032 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 08:40 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-305

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 2	2	1	2
10943	1,2-Dichloroethane		107-06-2	< 2	2	1	2
10943	Ethylbenzene		100-41-4	< 2	2	1	2
10943	Isopropylbenzene		98-82-8	58	4	1	2
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	2	2	1	2
10943	Toluene		108-88-3	< 2	2	1	2
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 4	4	1	2
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 4	4	1	2
10943	Xylene (Total)		1330-20-7	< 2	2	1	2
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 50	50	10	1
07805	Fluorene		86-73-7	< 50	50	10	1
07805	Naphthalene		91-20-3	< 50	50	10	1
07805	Phenanthrene		85-01-8	66	50	10	1
07805	Pyrene		129-00-0	< 50	50	10	1
	to the nature of the ysis. The reporting				for		
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010 19	30 Anita M Dale	2
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010 19	30 Anita M Dale	2
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 02	08 Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09	45 Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 17	48 Michele D Hamilton	1 1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08	45 Deborah M Zimmerman	1



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Sample Description: S-305 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-305_071410

LLI Sample # WW 6033032 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 08:40 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-305

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010	07:56	Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102006050001	07/20/2010	09:42	Denise K Conners	1



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Page 1 of 2

Sample Description: S-165 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-165_071410 LLI Sample # WW 6033033 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-165

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	88	2	1	2
10943	1,2-Dichloroethane		107-06-2	< 2	2	1	2
10943	Ethylbenzene		100-41-4	2	2	1	2
10943	Isopropylbenzene		98-82-8	4	4	1	2
10943	Methyl Tertiary But	yl Ether	1634-04-4	71	2	1	2
10943	Toluene		108-88-3	10	2	1	2
10943	1,2,4-Trimethylbenz	ene	95-63-6	4	4	1	2
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 4	4	1	2
10943	Xylene (Total)		1330-20-7	18	2	1	2
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	7	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010 20:27	Anita M Dale	2
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010 20:27	Anita M Dale	2
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 02:34	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 18:18	Michele D Hamiltor	1 1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08:45	Deborah M	1
						Zimmerman	
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010 07:58	Deborah A Krady	1



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Page 2 of 2

Sample Description: S-165 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-165_071410

LLI Sample # WW 6033033 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 09:45 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-165

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102006050001	07/20/2010	09:42	Denise K Conners	1



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Sample Description: S-166 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-166_071410

LLI Sample # WW 6033034 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 10:10 by SS SUN: Aquaterra Tech.

PO Box 744

Submitted: 07/15/2010 17:10 West Chester PA 19381

Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-166

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	7	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	10	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	3	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 50	50	10	1
07805	Fluorene		86-73-7	< 50	50	10	1
07805	Naphthalene		91-20-3	< 50	50	10	1
07805	Phenanthrene		85-01-8	< 50	50	10	1
07805	Pyrene		129-00-0	< 50	50	10	1
	to the nature of the ysis. The reporting				for		
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010 21:23	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010 21:23	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 02:59	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 18:48	Michele D Hamilton	. 1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08:45	Deborah M Zimmerman	1



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Sample Description: S-166 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-166_071410

LLI Sample # WW 6033034 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 10:10 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-166

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010	07:59	Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102006050001	07/20/2010	09:42	Denise K Conners	1



As Received

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Page 1 of 2

Sample Description: S-177 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-177_071410 LLI Sample # WW 6033035 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 11:05 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-177

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	5	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 50	50	10	1
07805	Fluorene		86-73-7	< 50	50	10	1
07805	Naphthalene		91-20-3	< 50	50	10	1
07805	Phenanthrene		85-01-8	< 50	50	10	1
07805	Pyrene		129-00-0	< 50	50	10	1
	to the nature of the ysis. The reporting				for		
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tim	ne	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102001AA	07/19/2010	22:20	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102001AA	07/19/2010	22:20	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010	03:25	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010	09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010	19:18	Michele D Hamilton	. 1
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010	08:45	Deborah M Zimmerman	1



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Sample Description: S-177 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-177_071410

LLI Sample # WW 6033035 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 11:05 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S-177

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	102006050001A	07/21/2010	08:01	Deborah A Krady	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102006050001	07/20/2010	09:42	Denise K Conners	1



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Page 1 of 2

Sample Description: S-48 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-48_071410

LLI Sample # WW 6033036 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 09:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S--48

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	48	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	8	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	75	50	10	1
07805	Fluorene		86-73-7	690	50	10	1
07805	Naphthalene		91-20-3	< 50	50	10	1
07805	Phenanthrene		85-01-8	1,900	500	100	10
07805	Pyrene		129-00-0	340	50	10	1
	to the nature of the ysis. The reporting				for		
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102043AA	07/24/2010 07:31	Kelly E Keller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102043AA	07/24/2010 07:31	Kelly E Keller	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/24/2010 03:51	Barton C Conner	1
07805	PAHs by 8270	SW-846 8270C	1	10198WAC026	07/25/2010 04:34	Brian K Graham	10
07807	BNA Water Extraction	SW-846 3510C	1	10198WAC026	07/19/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980008A	07/20/2010 19:48	Michele D Hamiltor	ı 1



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Sample Description: S-48 071410 Grab Water

Philadelphia Refinery AOI-2 COC: 232896 S-48_071410

LLI Sample # WW 6033036 LLI Group # 1203257 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/14/2010 09:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/15/2010 17:10 Reported: 07/26/2010 18:27

Discard: 08/10/2010

S--48

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07786	EDB Extraction	SW-846 8011	1	101980008A	07/19/2010 08:4	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 11:3	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010 08:5	5 Denise K Conners	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203257

Reported: 07/26/10 at 06:27 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: P102001AA	Sample numb	ber(s): 60	33030-603	3035					
Benzene	< 1	1.	0.5	uq/l	92	95	79-120	3	30
1,2-Dichloroethane	< 1	1.	0.5	ug/l	75	75	70-130	0	30
Ethylbenzene	< 1	1.	0.5	ug/l	89	91	79-120	2	30
Isopropylbenzene	< 2	2.	0.5	ug/l	85	88	77-120	4	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	93	93	76-120	0	30
Toluene	< 1	1.	0.5	ug/l	96	100	79-120	4	30
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	91	93	74-120	2	30
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91	94	75-120	4	30
Xylene (Total)	< 1	1.	0.5	ug/l	90	93	80-120	3	30
Batch number: P102043AA	Sample numb	ber(s): 60	33036						
Benzene	< 1	1.	0.5	ug/l	97		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	77		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	89		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	85		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	95		76-120		
Toluene	< 1	1.	0.5	ug/l	98		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	90		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	91		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	90		80-120		
Batch number: 10198WAC026	Sample numb		33030-603	3036					
Chrysene	< 5	5.	1	ug/l	90	89	82-112	1	30
Fluorene	< 5	5.	1	ug/l	99	97	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	93	92	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	93	94	83-112	0	30
Pyrene	< 5	5.	1	ug/l	93	92	80-115	1	30
Batch number: 101980008A	Sample numb			3036					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	104	104	60-140	0	20
Batch number: 102006050001A	Sample numb								
Lead	< 0.0010	0.0010	0.00005 0	mg/l	101		90-115		
Batch number: 102016050003A Lead	Sample numb	ber(s): 60	0.00005	mg/l	102		90-115		
			0						

Sample Matrix Quality Control

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203257

Reported: 07/26/10 at 06:27 PM

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: P102001AA	Sample	number(s)	: 6033030	-603303	5 UNSPK	C: P032950			
Benzene	97	, , ,	80-126						
1,2-Dichloroethane	78		66-141						
Ethylbenzene	91		71-134						
Isopropylbenzene	89		75-128						
Methyl Tertiary Butyl Ether	99		72-126						
Toluene	99		80-125						
1,2,4-Trimethylbenzene	91		72-130						
1,3,5-Trimethylbenzene	92		72-131						
Xylene (Total)	91		79-125						
Batch number: P102043AA	Sample	number(s)	: 6033036	UNSPK:	P03824	.3			
Benzene	94	102	80-126	7	30				
1,2-Dichloroethane	75	81	66-141	7	30				
Ethylbenzene	89	95	71-134	7	30				
Isopropylbenzene	86	92	75-128	7	30				
Methyl Tertiary Butyl Ether	91	98	72-126	7	30				
Toluene	96	104	80-125	8	30				
1,2,4-Trimethylbenzene	88	95	72-130	7	30				
1,3,5-Trimethylbenzene	89	96	72-131	7	30				
Xylene (Total)	88	95	79-125	7	30				
Batch number: 101980008A	Sample	number(s)	: 6033030	-603303	6 UNSPK	: P033025	BKG: P033026		
Ethylene dibromide	96		65-135			< 0.029	< 0.030	0 (1)	30
Batch number: 102006050001A	Sample	number(s)	: 6033030	-603303	5 UNSPK	: P033985	BKG: P033985	5	
Lead	100	102	75-125	1	20	< 0.0010	< 0.0010	200* (1)	20
Batch number: 102016050003A	Sample	number(s)	: 6033036	UNSPK:	603303	6 BKG: 603	3036		
Lead	103	104	75-125	1	20	< 0.0010	< 0.0010	41* (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102001AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6033030	92	102	103	91
6033031	92	100	103	89
6033032	92	102	101	90
6033033	92	101	102	92
6033034	91	103	102	94
6033035	92	105	103	90
Blank	91	101	102	89
LCS	91	104	103	90
LCSD	90	102	103	90
MS	93	105	104	90

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



78-113

93

92

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77-113

102

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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203257

Reported: 07/26/10 at 06:27 PM

80-116

Limits:

MS

MSD

Surrogate Quality Control

80-113

104

104

	Jame: UST BTEX, MTBE in Wa Der: P102043AA	ter		
	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6033036	91	103	101	96
Blank	92	101	104	92
T CC	0.0	1 0 2	102	0.2

77-113 Limits: 80-116 80-113 78-113

Analysis Name: PAHs by 8270

	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6033030	97	96	91	
6033031	92	93	86	
6033032	99	95	71	
6033033	105	72	67	
6033034	93	90	79	
6033035	93	81	54	
6033036	108	90	92	
Blank	94	98	82	
LCS	95	97	85	
LCSD	93	94	84	
T 2 2 to	C4 101	62 114	AD 114	

63-114 47-114 Limits: 64-121

Analysis Name: EDB in Wastewater

Batch number: 101980008A

1,1,2,2-

Tetrachloroethane

6033030	113			
6033031	97			
6033032	123			
6033033	106			
6033034	93			
6033035	129			
6033036	108			
Blank	100			
DUP	88			
LCS	104			
LCSD	98			
MS	82			
Limits:	46-136		 	

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories For Lancaster Laboratories use only

Acct. # 10132 Group# 1203257 Sample # 6033030-36

COC#

232896

'U' Laboratories	P	lease print. Ins	tructio	ns on re	everse s	ide con	respor	nd with	circle	d numl	bers.	Coc	ler H	enu.	0.9-	2.60°C		
1							10					eque			For Lab Us FSC:	e Only		_
Client: SUN - AQUATERRA	Acct. #:		_	_	Hatrix	(4)			Pres	serva	tion	Code	s	_	SCR#:			
Project Name/#: PHILA REF AOT -2	PWSID	#:			128	Ť		2			<u>}</u> کټ				Preservation	on Codes T=Thiosulf		
Project Manager:				57723	88	2	_	1 4	ED 63	(F)	غ ره ٰ		1		H=HCi N=HNO3	B=NaOH	ate	(6)
Sampler: S. SYKES		:		4469	量图	ı	, tank	Part C	(1) (2)	لَّهُوْ ا	Flyorene				S=H ₂ SO ₄	O =Other		- # F
Name of state where samples were collected:			2	8	2 5 D D	100 J	7.58	horsthane	100	Tolvené Pres Chobal	立る	Bva			J.			mbeu ji)
2) Sample Identification	Date Collected	Time Collected	Grab (Compos Soil	Water	Officer Total # o	Lens (1,2 - 310	Bencene,	MTBE X	Ch. 32, 20				Remarks	.		Temperature upon receipt
C-HEADER _ 071410	7/14/10	1135	\checkmark		\times	8	X	X	X	X	X	X						
	7/14/10	1225	X	•	X	8	X	X	X	X	X	X				····		
5-305-071410	7/14/10	840	X		X	8	X	X	X	X	X	X				~-	-	
5-165-071410	7/14/10	945	X		X	8	X	X	X	X	X	X					,	
<u> </u>	7/14/10	1010	X		X	8	X	X	X	X	X	[X]						
	7/14/10	1105	X		X	8	X	X	X	X	7	X						
5-48-071410	7/14/10	915	χ		X	8	\forall	X	X	X	X	X						
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(Rush TAT is subject to Lancaster Laboratories approv	-				12/	-	- /	46T	_	1 ,		1630		-	ridge		7/14/10	
Date results are needed: Rush results requested by (please circle): Pho	one For	E-mail	F		ished b	-				Dat			Receive					
Phone #:Fax #:					11/1					7/5/	10 0	A45	\mathcal{L}	Ku	dely		7/5/	0 79
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Data Package Options (please circle if required)	į.	G Complete	<u> </u>		29		4			T - 1		1710		egthinspace = egt				
Type I (validation/NJ Reg) TX TRRP-13 Type II (Tier II) MA MCP CT Re	CP	es No		Refinau	ished t	y:				Dát	e	Time	Receive	ed by:	_		Date	Time
Type III (Reduced NJ) Site-specific QC (MS Type IV (CLP SOW) All yes, indicate QC sample and submitted	• •	Yes No		Relina	ished b					Dat	<u>_</u>	Time	Receive	ed hv	 		Øate	Time .
Type VI (Raw Data Only) Internal COC Requ		l		Jonniqu		٠٠,٠					.~	, IIIIQ	3	2 -		7/13	10	ואלכו



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 04, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/16/2010 Group Number: 1203492 PO Number: PHILA REFINERY AOI-2 State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-294_071510 Grab Water	6034565
S-295_071510 Grab Water	6034566
PZ-101_071510 Grab Water	6034567
S-136_071510 Grab Water	6034568
S-71_071510 Grab Water	6034569
S-72_071510 Grab Water	6034570

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC	Langan	Attn: Dennis Webster
COPY TO ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO ELECTRONIC	LLI	Attn: EDD Group
COPY TO ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO	Zungun	Tituli Itilistell Wald



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Sarah M. Snyder Senior Specialist



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Page 1 of 2

Sample Description: S-294 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-294_071510

LLI Sample # WW 6034565 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 09:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-294

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	130	10	5	10
10943	1,2-Dichloroethane		107-06-2	< 10	10	5	10
10943	Ethylbenzene		100-41-4	470	10	5	10
10943	Isopropylbenzene		98-82-8	110	20	5	10
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 10	10	5	10
10943	Toluene		108-88-3	< 10	10	5	10
10943	1,2,4-Trimethylbenz	ene	95-63-6	410	20	5	10
10943	1,3,5-Trimethylbenz	ene	108-67-8	130	20	5	10
10943	Xylene (Total)		1330-20-7	720	10	5	10
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	140	47	9	10
07805	Fluorene		86-73-7	480	47	9	10
07805	Naphthalene		91-20-3	8,500	470	95	100
07805	Phenanthrene		85-01-8	1,000	47	9	10
07805	Pyrene		129-00-0	380	47	9	10
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	e	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 2	20:36	Daniel H Heller	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 2	20:36	Daniel H Heller	10
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010	14:27	Ryan P Byrne	10
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	08/01/2010	18:59	Florida A Cimino	100
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010	09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010	01:46	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010	08:45	Deborah M	1
							Zimmerman	
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010	12:02	David K Beck	1



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Page 2 of 2

Sample Description: S-294 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-294 071510 LLI Sample # WW 6034565 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 09:20 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-294

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010	08:55	Denise K Conners	1



As Received

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Page 1 of 2

Sample Description: S-295 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-295_071510

LLI Sample # WW 6034566 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 09:55 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-295

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846 8	260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	1,900	50	25	50
10943	1,2-Dichloroethane		107-06-2	< 5	5	3	5
10943	Ethylbenzene		100-41-4	140	5	3	5
	Isopropylbenzene		98-82-8	71	10	3	5
10943	Methyl Tertiary Buty	l Ether	1634-04-4	< 5	5	3	5
10943	Toluene		108-88-3	560	5	3	5
10943	1,2,4-Trimethylbenze	ne	95-63-6	360	10	3	5
10943	1,3,5-Trimethylbenze	ne	108-67-8	130	10	3	5
10943	Xylene (Total)		1330-20-7	1,200	5	3	5
labor	ne volatile nature of ratory to adjust the sample was pH = 4.	pH at the t	cime of sample r			ug/1	
•		SW-846 8			- -	-	
07805	Chrysene Fluorene		218-01-9 86-73-7	< 50	50	10	1
	Naphthalene		91-20-3	< 50 740	50 50	10 10	1 1
	Naphthalene Phenanthrene		91-20-3 85-01-8	740 97	50	10	1
07805			129-00-0	< 50	50	10	1
Surro semin hold repor	ogate recoveries are volatile analysis. The time and the surrogated is from the init to the nature of the vsis. The reporting	he analysis te recover: ial extract	QC limits for to so was repeated codes are within to tion of the samp	he initial GC/MS utside of the re he limits. The le.	equired data		
GC Mis	scellaneous	SW-846 8	011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846 6	020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	1.04	0.0050	0.00025	5

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.



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Sample Description: S-295 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-295_071510

LLI Sample # WW 6034566 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 09:55 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-295

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010	21:02	Daniel H Heller	5
01163	GC/MS VOA Water Prep	SW-846 5030B	2	Z102071AA	07/26/2010	21:27	Daniel H Heller	50
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010	21:02	Daniel H Heller	5
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010	21:27	Daniel H Heller	50
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010	09:33	Florida A Cimino	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010	09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/24/2010	02:00	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010	08:45	Deborah M Zimmerman	1
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010	12:36	David K Beck	5
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010	08:55	Denise K Conners	1



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Sample Description: PZ-101 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 PZ-101_071510

LLI Sample # WW 6034567 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 13:05 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

PZ101

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 21:5	3 Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 21:5	3 Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 15:1	6 Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 09:3	0 Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 02:4	5 James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 08:4	5 Deborah M	1
						Zimmerman	
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 12:0	5 David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102016050003	07/21/2010 08:5	5 Denise K Conners	1



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Sample Description: S-136 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-136_071510

LLI Sample # WW 6034568 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 12:40 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S136-

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	zene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	zene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	12	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
The	Ethylene dibromide surrogate data is ou lems evident in the			< 0.029 unresolvable mat	0.029 trix	0.0097	1
-		-		mg/l	mg/l	mg/l	
	s Dissolved	SW-846		•	-	- ·	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	e	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 2	22:18	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 2	22:18	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 1	15:40	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 0	09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 0	03:16	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 0	08:45	Deborah M	1
							Zimmerman	
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 1	12:07	David K Beck	1



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Page 2 of 2

Sample Description: S-136 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-136 071510 LLI Sample # WW 6034568 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 12:40 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S136-

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102016050003	07/21/2010	08:55	Denise K Conners	1



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Sample Description: S-71 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-71_071510

LLI Sample # WW 6034569 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 11:30 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-71-

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	2	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	6	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	440	1	0.5	1
10943	Toluene		108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	3	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 22	2:43	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 22	2:43	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 16	6:04	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 09	9:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 04	4:45	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 08	8:45	Deborah M	1
							Zimmerman	
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 12	2:09	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102016050003	07/21/2010 08	8:55	Denise K Conners	1



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Page 1 of 1

Sample Description: S-72 071510 Grab Water

Philadelphia Refinery AOI-2 COC: 232900 S-72_071510

LLI Sample # WW 6034570 LLI Group # 1203492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/15/2010 10:35 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/16/2010 17:20 Reported: 08/04/2010 11:26

Discard: 08/19/2010

S-72-

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	35	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	2	1	0.5	1
10943	1,2,4-Trimethylbenz		95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	4	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	14	5	1	1
07805	Fluorene		86-73-7	13	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	10	5	1	1
07805	Pyrene		129-00-0	20	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	Z102071AA	07/26/2010 23:08	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	Z102071AA	07/26/2010 23:08	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10200WAJ026	07/31/2010 16:28	Ryan P Byrne	1
07807	BNA Water Extraction	SW-846 3510C	1	10200WAJ026	07/20/2010 09:30	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	101980012A	07/21/2010 05:15	James H Place	1
07786	EDB Extraction	SW-846 8011	1	101980012A	07/19/2010 08:45	Deborah M	1
						Zimmerman	
06035	Lead	SW-846 6020	1	102016050003A	07/22/2010 12:14	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102016050003	07/21/2010 08:55	Denise K Conners	1



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Page 1 of 3

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203492

Reported: 08/04/10 at 11:26 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: Z102071AA	Sample numi	ber(s): 60	34565-603	4570					
Benzene	< 1	1.	0.5	ug/l	88		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	84		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	90		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	90		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	95		76-120		
Toluene	< 1	1.	0.5	ug/l	90		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	96		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	uq/l	96		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	91		80-120		
Batch number: 10200WAJ026	Sample num	ber(s): 60	34565-603	4570					
Chrysene	< 5	5.	1	uq/l	96	96	82-112	0	30
Fluorene	< 5	5.	1	ug/l	99	100	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	87	86	77-107	1	30
Phenanthrene	< 5	5.	1	ug/l	94	96	83-112	2	30
Pyrene	< 5	5.	1	ug/l	97	95	80-115	2	30
Batch number: 101980012A	Sample num	ber(s): 60	34565-603	4570					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	121	121	60-140	0	20
Batch number: 102016050003A	Sample num	ber(s): 60	34565-603	4570					
Lead	< 0.0010	0.0010	0.00005	mg/l	102		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD <u>Limits</u>	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD Max
Batch number: Z102071AA	Sample	number(s)	: 6034565	-60345	70 UNSP	K: P034028			
Benzene	96	95	80-126	1	30				
1,2-Dichloroethane	88	87	66-141	1	30				
Ethylbenzene	99	97	71-134	1	30				
Isopropylbenzene	99	98	75-128	1	30				
Methyl Tertiary Butyl Ether	100	97	72-126	3	30				
Toluene	98	96	80-125	2	30				
1,2,4-Trimethylbenzene	102	102	72-130	0	30				
1,3,5-Trimethylbenzene	103	101	72-131	2	30				
Xylene (Total)	99	97	79-125	1	30				

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 2 of 3

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1203492

Reported: 08/04/10 at 11:26 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DUP	Dup RPD
Analysis Name	%REC	%REC	<u>Limits</u>	RPD	MAX	Conc	Conc	RPD	Max
Batch number: 101980012A	Sample	number(s)	: 6034565-	-6034570	UNSPK	: P034561	BKG: P034562		
Ethylene dibromide	104		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 102016050003A	Sample	number(s)	: 6034565-	-6034570	UNSPK	: P033036	BKG: P033036		
Lead	103	104	75-125	1	20	< 0.0010	< 0.0010	41* (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6034565	94	93	100	101
6034566	94	93	101	103
6034567	94	93	100	100
6034568	93	93	101	104
6034569	94	92	100	101
6034570	94	93	100	104
Blank	95	94	99	99
LCS	95	96	99	100
MS	95	96	100	100
MSD	95	95	100	101
Limits:	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270 Batch number: 10200WAJ026

Datoli IIani	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6034565	77	86	78	
6034566	128*	80	51	
6034567	88	93	78	
6034568	93	67	82	
6034569	90	89	81	
6034570	106	90	75	
Blank	91	93	89	
LCS	89	88	89	
LCSD	86	88	86	
Limits:	64-121	63-114	47-114	

Analysis Name: EDB in Wastewater

Batch number: 101980012A

1,1,2,2-

Tetrachloroethane

6034565 275*

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 08/04/10 at 11:26 AM Group Number: 1203492

Surrogate Quality Control

6034566	72
6034567	88
6034568	0*
6034569	109
6034570	184
Blank	94
DUP	77
LCS	99
LCSD	98
MS	62

Limits: 46-136

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1203492 Sample # 6034565-70

COC#

232900

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Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 05, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/23/2010 Group Number: 1204492 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-246_072210 Grab Water	6040998
S-247_072210 Grab Water	6040999
S-248_072210 Grab Water	6041000
S-249_072210 Grab Water	6041001

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO	CIDY 4	
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Barbara F. Reedy Senior Specialist



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Sample Description: S-246 072210 Grab Water

Philadelphia Refinery AOI-2 COC: 229916 S-246_072210

LLI Sample # WW 6040998 LLI Group # 1204492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/22/2010 14:35 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/23/2010 16:15 Reported: 08/05/2010 11:06

Discard: 08/20/2010

S-246

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time		Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 13	:46	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 13	:46	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 02	:37	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14	:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 11	:23	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 18	:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 07	:18	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102086050002	07/27/2010 21	:00	Mirit S Shenouda	1



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Sample Description: S-247 072210 Grab Water

Philadelphia Refinery AOI-2 COC: 229916 S-247_072210

LLI Sample # WW 6040999 LLI Group # 1204492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/22/2010 14:50 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/23/2010 16:15 Reported: 08/05/2010 11:06

Discard: 08/20/2010

S-247

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.030	0.030	0.0099	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	e	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F102082AA	07/27/2010 1	14:07	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	F102082AA	07/27/2010 1	14:07	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 0	03:00	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 1	14:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010 1	11:53	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010 1	18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010 0	07:20	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102086050002	07/27/2010 2	21:00	Mirit S Shenouda	1



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Sample Description: S-248 072210 Grab Water

Philadelphia Refinery AOI-2 COC: 229916 S-248_072210

LLI Sample # WW 6041000 LLI Group # 1204492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/22/2010 14:10 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/23/2010 16:15 Reported: 08/05/2010 11:06

Discard: 08/20/2010

S-248

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	2	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	7	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	9	5	1	1
07805	Pyrene		129-00-0	7	5	1	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0096	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102092AA	07/28/2010	18:14	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102092AA	07/28/2010	18:14	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010	03:24	Matthew S Woods	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010	14:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010	12:23	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010	18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010	07:22	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102086050002	07/27/2010	21:00	Mirit S Shenouda	1



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Sample Description: S-249 072210 Grab Water

Philadelphia Refinery AOI-2 COC: 229916 S-249 072210

LLI Sample # WW 6041001 LLI Group # 1204492 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/22/2010 15:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/23/2010 16:15 Reported: 08/05/2010 11:06

Discard: 08/20/2010

S-249

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	.me	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102092AA	07/28/2010	18:43	Anita M Dale	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102092AA	07/28/2010	18:43	Anita M Dale	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010	06:19	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010	14:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102080003A	07/30/2010	12:52	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102080003A	07/27/2010	18:00	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102086050002A	07/29/2010	07:27	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102086050002	07/27/2010	21:00	Mirit S Shenouda	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204492

Reported: 08/05/10 at 11:06 AM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: F102082AA	Sample numl	per(s): 60	40998-604	0999					
Benzene	< 1	1.	0.5	uq/l	92		79-120		
1,2-Dichloroethane	< 1	1.	0.5	uq/1	92		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	95		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	95		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	uq/l	90		76-120		
Toluene	< 1	1.	0.5	ug/l	96		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	uq/l	92		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	uq/l	91		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	95		80-120		
Batch number: P102092AA	Sample numl	ber(s): 60							
Benzene	< 1	1.	0.5	ug/l	102		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	84		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	97		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	95		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	102		76-120		
Toluene	< 1	1.	0.5	ug/l	101		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	95		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	ug/l	95		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	96		80-120		
Batch number: 10208WAB026	Sample numl								
Chrysene	< 5	5.	1	ug/l	88	92	82-112	5	30
Fluorene	< 5	5.	1	ug/l	94	97	82-113	3	30
Naphthalene	< 5	5.	1	ug/l	88	94	77-107	6	30
Phenanthrene	< 5	5.	1	ug/l	95	98	83-112	2	30
Pyrene	< 5	5.	1	ug/l	97	100	80-115	3	30
Batch number: 102080003A	Sample numl	ber(s): 60	40998-604	1001					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	100	96	60-140	4	20
Batch number: 102086050002A Lead	Sample numl < 0.0010	ber(s): 60 0.0010	0.00005	1001 mg/l	99		90-115		
			0						

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DUP	Dup RPD
<u>Analysis Name</u>	%REC	%REC	<u>Limits</u>	RPD	<u>MAX</u>	Conc	Conc	RPD	Max

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204492

Reported: 08/05/10 at 11:06 AM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DUP	Dup RPD
<u>Analysis Name</u>	%REC	%REC	<u>Limits</u>	RPD	MAX	Conc	Conc	RPD	Max
Batch number: F102082AA	Sample	number(s)	: 6040998	-604099	99 UNSP	K: P039238			
Benzene	94	95	80-126	1	30				
1,2-Dichloroethane	91	92	66-141	1	30				
Ethylbenzene	100	99	71-134	1	30				
Isopropylbenzene	101	100	75-128	2	30				
Methyl Tertiary Butyl Ether	89	87	72-126	2	30				
Toluene	100	99	80-125	1	30				
1,2,4-Trimethylbenzene	95	95	72-130	0	30				
1,3,5-Trimethylbenzene	93	94	72-131	1	30				
Xylene (Total)	99	98	79-125	1	30				
Batch number: P102092AA	Sample	number(s)	: 6041000	-604100)1 UNSP	K: P039442			
Benzene	371 (2)			1	30				
1,2-Dichloroethane	88	85	66-141	3	30				
Ethylbenzene	214 (2)	204 (2)	71-134	1	30				
Isopropylbenzene	107	104	75-128	2	30				
Methyl Tertiary Butyl Ether	144 (2)	133 (2)	72-126	2	30				
Toluene	337 (2)	320 (2)	80-125	0	30				
1,2,4-Trimethylbenzene	174 (2)	170 (2)	72-130	1	30				
1,3,5-Trimethylbenzene	123	122	72-131	0	30				
Xylene (Total)	280 (2)	271 (2)	79-125	1	30				
Batch number: 102080003A	Sample	number(s)	: 6040998	-604100)1 UNSP	K: P040989	BKG: P040990	1	
Ethylene dibromide	43*	, ,	65-135			< 0.030	< 0.029	0 (1)	30
Batch number: 102086050002A	Sample	number(s)	: 6040998	-604100	1 UNSP	K: P042035	BKG: P042035		
Lead	98	103	75-125	4	20	0.0078	0.0081	5	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed $\bar{\mathbf{Q}}$ unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: F102082AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzen
6040998	95	98	102	94
6040999	94	97	101	94
Blank	96	98	102	93
LCS	93	98	101	97
MS	94	99	103	98
MSD	94	99	102	96
Limits:	80-116	77-113	80-113	78-113

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102092AA

Dibromofluoromethane 1,2-Dichloroethane-d4 Toluene-d8 4-Bromofluorobenzene

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

	Jame: SUN: Aquaterra		Group Numb	er: 1204492
Reported	l: 08/05/10 at 11:06	5 AM		
		Surrog	ate Quality Control	
6041000	94	102	99	97
6041001	95	102	99	94
Blank	93	100	102	96
LCS	94	101	102	97
MS	92	102	106	96
MSD	92	100	103	97
Limits:	80-116	77-113	80-113	78-113
	Jame: PAHs by 8270			
Batch numb	per: 10208WAB026			
	Nitrobenzene-d5	2-Fluorobipheny	1 Terphenyl-d14	
6040998	86	99	92	
6040999	82	94	91	
6041000	82	88	88	
6041001	100	95	88	
Blank	94	97	94	
LCS	88	95	89	
LCSD	92	97	89	
Limits:	64-121	63-114	47-114	
	Jame: EDB in Wastewater			
Batch numb	per: 102080003A			
	1,1,2,2-			
	Tetrachloroethane			
6040998	51			
6040999	48			
6041000	88			
6041001	81			
Blank	109			
DUP	58			
LCS	105			
LCSD	96			
MS	64			
Limits:	46-136			

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only Acct. # 1013 & Group# 1204497 Sample # 6040998-1001 COC #

229916

Please print, Instructions on reverse side correspond with circled numbers For Lab Use Only 5 Analyses Requested Matrix Client: Aquatoria Tochnologies Acct. #: Preservation Codes Preservation Codes Project Name/#: Rhilly Refiner AUI-2 PWSID#:

Project Manager: Tiffuni Doci P.O.#: H=HCL T=Thiosulfate N=HNO₃ B=NaOH S=H₂SQ₄ **O**=Other Sampler: 3R Williams Quote #: lab to filter Sumples Time # S S Collected Sample Identification Collected Remarks temp 0.7-2.60 5-246_072210 7/22/10 1435 5-247 - 072210 7/22/19 1450 X 5-248 _ 072210 7/22/10 1410 7/22/10 5-249 - 0722/0 1515 Turnaround Time Requested (TAT) (please circle): Normal Rush |Time (9 Time | Received by Date Date (Rush TAT is subject to Lancaster Laboratories approval and surcharge.) 429 700 Date results are needed: Time Received by Relinguished by: Date Date Time Rush results requested by (please circle): Phone Fax F-mail 723/10 4600 ULS 1027 721 Phone #: Fax #: Date Time Received by: E-mail address: Date Time 7/22/10 0600 Sample Flidge 7/22/5 400 Data Package Options (please circle if required) SDG Complete? TX TRRP-13 Type I (validation/NJ Reg) Yes No. Relinguished by: Time Received by: Date MA MCP CT RCP. Type II (Tier II) Type III (Reduced NJ) Site-specific QC (MS/MSD/Dup)? Yes No Relinquished by: Time Received by: Type IV (CLP SOW) Date (If yes, indicate QC sample and submit triplicate volume.) Type VI (Raw Data Only) Internal COC Required? Yes / No



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	BMQL	Below Minimum Quantitation Level
N.D.	none detected	MPN	Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- **J** estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

X,Y,Z

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
Ε	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Defined in case narrative

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by: Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 10, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/26/2010 Group Number: 1204675 PO Number: PHILADELPHIA State of Sample Origin: PA

Client Sample Description	Lancaster Labs (LLI) #
S-72D_072310 Grab Water	6042079
SD-1_072310 Grab Water	6042080
RW-600_072310 Grab Water	6042081
S-108_072310 Grab Water	6042082
S-110_072310 Grab Water	6042083
S-153_072310 Grab Water	6042084
S-154_072310 Grab Water	6042085
S-294D_072310 Grab Water	6042086

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC COPY TO	LLI	Attn: EDD Group
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Robin C. Runkle Senior Specialist



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Page 1 of 1

Sample Description: S-72D 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-72D_072310

LLI Sample # WW 6042079 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 13:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-72D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tim	ne	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010	17:48	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010	17:48	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010	07:29	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010	14:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010	07:44	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010	14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010	07:46	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102096050001	07/28/2010	20:30	Mirit S Shenouda	1



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Page 1 of 2

Sample Description: SD-1 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 SD-1_072310

LLI Sample # WW 6042080 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 10:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

SD-1-

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	370	10	5	10
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	1	1	0.5	1
10943	Isopropylbenzene		98-82-8	2	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	22	1	0.5	1
10943	Toluene		108-88-3	11	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	4	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	3	2	0.5	1
10943	Xylene (Total)		1330-20-7	15	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 48	48	10	10
07805	Fluorene		86-73-7	< 48	48	10	10
07805	Naphthalene		91-20-3	< 48	48	10	10
07805	Phenanthrene		85-01-8	< 48	48	10	10
07805	Pyrene		129-00-0	< 48	48	10	10
anal	to the sample matrix ysis. Therefore, the ounds were raised.						
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 18:16	Daniel H Heller	1
01163	GC/MS VOA Water Prep	SW-846 5030B	2	P102122AA	07/31/2010 11:34	Kelly E Keller	10
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 18:16	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102122AA	07/31/2010 11:34	Kelly E Keller	10
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 07:53	Brian K Graham	10
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:45	Timothy J Attenberger	1



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Page 2 of 2

Sample Description: SD-1 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 SD-1_072310

LLI Sample # WW 6042080 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 10:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

SD-1-

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Tir	me	Analyst	Dilution Factor
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010	09:43	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010	14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010	07:48	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010	20:30	Mirit S Shenouda	1



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Sample Description: RW-600 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 RW-600_072310

LLI Sample # WW 6042081 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 09:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

RW600

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	4	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	2	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Ti	me	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010	18:44	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010	18:44	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010	08:16	Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010	14:45	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010	10:13	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010	14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010	07:54	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102096050001	07/28/2010	20:30	Mirit S Shenouda	1



As Received

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Sample Description: S-108 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-108_072310

LLI Sample # WW 6042082 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 09:00 by JRW SUN: Aquaterra Tech.

PO Box 744

As Received

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-108

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	54	50	10	10
07805	Fluorene		86-73-7	< 50	50	10	10
07805	Naphthalene		91-20-3	< 50	50	10	10
07805	Phenanthrene		85-01-8	< 50	50	10	10
07805	Pyrene		129-00-0	110	50	10	10
analy	to the sample matrix vsis. Therefore, the bunds were raised.						
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 19:1	2 Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 19:1	2 Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 08:4	0 Brian K Graham	10
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:4	5 Timothy J Attenberger	1
07879 07786	EDB in Wastewater EDB Extraction	SW-846 8011 SW-846 8011	_	102150023A 102150023A	08/05/2010 10:2 08/03/2010 21:0		1 1



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Page 2 of 2

Sample Description: S-108 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-108 072310

LLI Sample # WW 6042082 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 09:00 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-108

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010	07:56	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010	20:30	Mirit S Shenouda	1



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Page 1 of 1

Sample Description: S-110 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-110 072310

LLI Sample # WW 6042083 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 10:15 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-110

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	3	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	0.0011	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 19:	40 Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 19:	40 Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAB026	08/04/2010 09:	03 Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAB026	07/27/2010 14:	45 Timothy J	1
						Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102150023A	08/05/2010 10:	54 James H Place	1
07786	EDB Extraction	SW-846 8011	2	102150023A	08/03/2010 21:	00 JoElla L Rice	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 07:	35 Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102096050001	07/28/2010 20:	30 Mirit S Shenouda	1



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Sample Description: S-153 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-153 072310 LLI Sample # WW 6042084 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 09:20 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-153

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	7	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	13	2	0.5	1
10943	Methyl Tertiary Buty	/l Ether	1634-04-4	4	1	0.5	1
10943	Toluene		108-88-3	2	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	7	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	8	5	0.9	1
07805	Fluorene		86-73-7	12	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	29	5	0.9	1
07805	Pyrene		129-00-0	25	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT	Analysis Name	Method	Trial#	Batch#	Analysis	Analyst	Dilution
No.					Date and Time		Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 20:09	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 20:09	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	07/31/2010 02:18	Barton C Conner	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAF026	07/28/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010 11:42	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010 14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 07:58	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010 20:30	Mirit S Shenouda	1



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Sample Description: S-154 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-154_072310

LLI Sample # WW 6042085 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 09:30 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S-154

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	12	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	4	1	0.5	1
10943	Isopropylbenzene		98-82-8	7	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	31	1	0.5	1
10943	Toluene		108-88-3	11	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	4	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	40	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 20:3	7 Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 20:3	7 Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	08/02/2010 04:3	7 Brian K Graham	1
07807	BNA Water Extraction	SW-846 3510C	1	10208WAF026	07/28/2010 09:4	5 Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010 12:1	2 James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010 14:4	5 Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 07:5	9 Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102096050001	07/28/2010 20:3	Mirit S Shenouda	1



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Sample Description: S-294D 072310 Grab Water

Philadelphia Refinery AOI-2 COC: 230373 S-294D_072310

LLI Sample # WW 6042086 LLI Group # 1204675 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/23/2010 11:40 by JRW SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/26/2010 16:00 Reported: 08/10/2010 15:57

Discard: 08/25/2010

S294D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	17	1	0.5	1
10943	Isopropylbenzene		98-82-8	3	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenz		95-63-6	15	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	6	2	0.5	1
10943	Xylene (Total)		1330-20-7	19	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	6	5	0.9	1
07805	Naphthalene		91-20-3	140	24	5	5
07805	Phenanthrene		85-01-8	8	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	cellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102112AA	07/30/2010 21:04	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102112AA	07/30/2010 21:04	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	07/31/2010 03:10	Barton C Conner	1
07805	PAHs by 8270	SW-846 8270C	1	10208WAF026	08/02/2010 05:03	Brian K Graham	5
07807	BNA Water Extraction	SW-846 3510C	1	10208WAF026	07/28/2010 09:45	Kerrie A Freeburn	1
07879	EDB in Wastewater	SW-846 8011	1	102090006A	07/31/2010 12:42	James H Place	1
07786	EDB Extraction	SW-846 8011	1	102090006A	07/28/2010 14:45	Olivia I Santiago	1
06035	Lead	SW-846 6020	1	102096050001A	07/30/2010 08:01	Choon Y Tian	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A	1	102096050001	07/28/2010 20:30	Mirit S Shenouda	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204675

Reported: 08/10/10 at 03:57 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: P102112AA	Sample numb	her(s): 60	42079-604	2086					
Benzene	< 1	1.	0.5	uq/1	97		79-120		
1,2-Dichloroethane	< 1	1.	0.5	uq/1	81		70-130		
Ethylbenzene	< 1	1.	0.5	ug/1	94		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	93		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	uq/l	100		76-120		
Toluene	< 1	1.	0.5	ug/l	98		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	92		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	uq/l	92		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	95		80-120		
Batch number: P102122AA	Sample numb	ber(s): 60	42080						
Benzene	< 1	1.	0.5	ug/l	99	99	79-120	0	30
Batch number: 10208WAB026	Sample numb	ber(s): 60	42079-604	2083					
Chrysene	< 5	5.	1	uq/l	88	92	82-112	5	30
Fluorene	< 5	5.	1	ug/l	94	97	82-113	3	30
Naphthalene	< 5	5.	1	uq/l	88	94	77-107	6	30
Phenanthrene	< 5	5.	1	ug/l	95	98	83-112	2	30
Pyrene	< 5	5.	1	ug/l	97	100	80-115	3	30
Batch number: 10208WAF026	Sample numb	ber(s): 60	42084-604	2086					
Chrysene	< 5	5.	1	ug/l	97	96	82-112	1	30
Fluorene	< 5	5.	1	ug/l	97	89	82-113	8	30
Naphthalene	< 5	5.	1	ug/l	88	91	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	95	97	83-112	2	30
Pyrene	< 5	5.	1	ug/l	102	102	80-115	0	30
Batch number: 102090006A	Sample numb	ber(s): 60	42079-604	2081,6042084	1-60420	86			
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	88	60-140	9	20
Batch number: 102150023A	Sample numb	ber(s): 60	42082-604	2083					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 102096050001A	Sample numb								
Lead	< 0.0010	0.0010	0.00005 0	mg/l	98		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

MS	MSD	MS/MSD	RPD	BKG	DUP	DUP	Dup RPD

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^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204675

Reported: 08/10/10 at 03:57 PM

Analysis Name	%REC	%REC	<u>Limits</u>	RPD	<u>MAX</u>	Conc	Conc	RPD	<u>Max</u>
Batch number: P102112AA	Sample	number(s)	: 6042079	-604208	6 UNSPI	K: P040460			
Benzene	109	108	80-126	1	30				
1,2-Dichloroethane	87	86	66-141	2	30				
Ethylbenzene	102	103	71-134	1	30				
Isopropylbenzene	101	100	75-128	1	30				
Methyl Tertiary Butyl Ether	104	103	72-126	1	30				
Toluene	108	109	80-125	1	30				
1,2,4-Trimethylbenzene	93	88	72-130	1	30				
1,3,5-Trimethylbenzene	103	101	72-131	1	30				
Xylene (Total)	102	99	79-125	3	30				
Batch number: P102122AA	Sample	number(s)	: 6042080	UNSPK:	P04040	07			
Benzene	101		80-126						
Batch number: 102090006A	Sample	number(s)	: 6042079	-604208	31,60420	084-6042086	UNSPK: 6042	079 BKG: P	041787
Ethylene dibromide	57*		65-135		•	< 0.029	< 0.030	0 (1)	30
Batch number: 102150023A	Sample	number(s)	: 6042082	-604208	3 UNSPI	K: P045867 I	3KG: P045868	,	
Ethylene dibromide	78	, , ,	65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 102096050001A	Sample	number(s)	: 6042079	-604208	86 UNSPI	K: 6042083 I	3KG: 6042083		
Lead	102	99	75-125	4	20	0.0011	0.0011	0 (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102112AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzer
6042079	93	100	109	94
6042080	93	99	103	96
6042081	94	101	103	96
6042082	93	99	101	98
6042083	94	102	102	95
6042084	94	99	103	99
6042085	93	100	101	97
6042086	94	102	102	99
Blank	92	99	105	95
LCS	92	103	102	97
MS	93	104	102	96
MSD	94	101	106	97
Limits:	80-116	77-113	80-113	78-113
	80-116		80-113	/8-113

Analysis Name: UST BTEX, MTBE in Water

Batch nur	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene	
Blank	93	102	103	95	
LCS	93	102	102	97	
LCSD	93	104	102	86	
MS	94	103	101	96	

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 08/10/10 at 03:57 PM Group Number: 1204675

Surrogate Quality Control

Limits:	80-116	77-113	80-113	78-113
	Jame: PAHs by 8270 Der: 10208WAB026			
Daceir Hama	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6042079	106	98	87	
6042080	84	67	64	
6042081	101	95	89	
6042082	94	67	63	
6042083	94	90	89	
Blank	94	97	94	
LCS	88	95	89	
LCSD	92	97	89	
Limits:	64-121	63-114	47-114	
Analysis N	Jame: PAHs by 8270 Der: 10208WAF026			
Datell Hullik	Nitrobenzene-d5	2-Fluorobiphenyl	Terphenyl-d14	
6042084	104	72	53	
6042085	98	98	75	
6042086	105	97	96	
Blank	105	100	87	
LCS	96	94	92	
LCSD	97	96	92	
Limits:	64-121	63-114	47-114	
	Jame: EDB in Wastewater Der: 102090006A 1,1,2,2- Tetrachloroethane			
6042079	93			
6042079	60			
6042081	51			
6042084	65			
6042085	91			
6042086	73			
Blank	105			
DUP	123			
LCS	104			
LCSD	97			
MS	59			
Limits:	46-136			
Analysis N Batch numb	Name: EDB in Wastewater Der: 102150023A			
	1,1,2,2- Tetrachloroethane			
6042082	91			·····
6042083	96			
Blank	101			

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 08/10/10 at 03:57 PM Group Number: 1204675

Surrogate Quality Control

DUP 111 103 LCS LCSD 102 MS 70

Limits: 46-136

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental



For Lancaster Laboratories use only

Group# 1204675 Sample # 6042079-86 COC # Acct. # 10127

230373

50-1-0723/0 1/25/10 1000 X X X X X X X X	
Client: Act. #:	
Client: Rquatc(sa Technologies Inc Acct. #: Project Name/#: Sun Philly Refine (s. NoT-2) Project Manager: Tiffan; Doe((P.O.#: Sampler: JR Wiffam'S Quote #: Name of state where samples were collected: 2 Sampler: Samples were collected: Apple Samples Samples Samples	建源资料 等
Project Name/#: <u>Sun Philly Refine(s A07-2</u> PWSID #: Project Manager: <u>Tiffan</u> ; <u>Dae((P.O.#: Sampler: TR Wiffiam S Quote #: Sampler: TR Wiffiam S Quote #: Samples were collected: 3 11 12 12 13 13 14 14 15 14 15 14 15 15</u>	
Project Manager: $Tlffan$, $Doe(l$ P.O.#: Sampler: TR Wiffiam S Quote #: Name of state where samples were collected: 2 Iab	
Sampler: IR Williams Quote #: Name of state where samples were collected: 2 Samples Remarks $S-720-0723/0$ $1/23/0$	
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5-152 077310 //2010 0120 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1/10_
6-154 0723/0 1/25/10 0/30 1 V V V V X X X	
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Date Time Received by:	Time (
Turner aund Time Requested (TAT) (please circle): Normal Rush Relinquistica by	10/6/
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)	Time
	14 1
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E-mail address: T/26/s 1600	
Voc No I Deliberationed by	Time
Type I (validation/NJ Reg) MA MCP CT RCP	
Type III (Reduced NJ) Site-specific QC (MS/MSD/Dup)? Yes No Relinquished by: Date Time Received by:	Time
Type IV (CLP SOW) Type VI (Raw Data Only)	Time



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL N.D.	Reporting Limit none detected	BMQL MPN	Below Minimum Quantitation Level Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- > greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion
- **Dry weight basis**Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

	Organic Qualifiers		inorganic Qualifiers
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
E	Concentration exceeds the calibration range of the instrument	S	Method of standard additions (MSA) used for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995
X,Y,Z	Defined in case narrative		

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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ANALYTICAL RESULTS

Prepared by:

Prepared for:

Lancaster Laboratories 2425 New Holland Pike Lancaster, PA 17605-2425 SUN: Aquaterra Tech. PO Box 744 West Chester PA 19381

August 10, 2010

Project: SUN: Philadelphia Refinery AOI-2

Submittal Date: 07/27/2010 Group Number: 1204825 PO Number: PHILADELPHIA REFINERY State of Sample Origin: PA

Client Sample Description	<u>Lancaster Labs (LLI) #</u>
S-305D_072610 Grab Water	6043277
S-302D_072610 Grab Water	6043278
S-303_072610 Grab Water	6043279
S-143_072610 Grab Water	6043280

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO	Langan	Attn: Dennis Webster
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Megan Breen
COPY TO ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO	Solv. Aquateria Teen.	Attil. Hilliam Doen
ELECTRONIC	LLI	Attn: EDD Group
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		



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Questions? Contact your Client Services Representative Jessica A Oknefski at (717) 656-2300 Ext. 1815

Respectfully Submitted,

Tracy A. Cole Tracy A. Cole Senior Specialist



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Page 1 of 2

Sample Description: S-305D 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-305D 072610

LLI Sample # WW 6043277 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S305D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	5	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	1	1
07805	Fluorene		86-73-7	< 5	5	1	1
07805	Naphthalene		91-20-3	< 5	5	1	1
07805	Phenanthrene		85-01-8	< 5	5	1	1
07805	Pyrene		129-00-0	< 5	5	1	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	s Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102101AA	07/29/2010 20:25	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102101AA	07/29/2010 20:25	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10209WAA026	08/01/2010 04:07	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10209WAA026	07/28/2010 14:30	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102150023A	08/05/2010 11:53	James H Place	1
07786	EDB Extraction	SW-846 8011	2	102150023A	08/03/2010 21:00	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102106050002A	08/02/2010 17:50	David K Beck	1



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Page 2 of 2

Sample Description: S-305D 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-305D 072610 LLI Sample # WW 6043277 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 14:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S305D

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102106050002	07/29/2010	20:30	Mirit S Shenouda	1



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Page 1 of 2

Sample Description: S-302D 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-302D_072610

LLI Sample # WW 6043278 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S302D

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 5	5	0.9	1
07805	Fluorene		86-73-7	< 5	5	0.9	1
07805	Naphthalene		91-20-3	< 5	5	0.9	1
07805	Phenanthrene		85-01-8	< 5	5	0.9	1
07805	Pyrene		129-00-0	< 5	5	0.9	1
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0098	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102101AA	07/29/2010 20:	16 Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102101AA	07/29/2010 20:	16 Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10209WAA026	08/01/2010 04:	56 Linda M	1
						Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10209WAA026	07/28/2010 14:	30 Timothy J	1
						Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102150023A	08/05/2010 13:	23 James H Place	1
07786	EDB Extraction	SW-846 8011	2	102150023A	08/03/2010 21:	00 JoElla L Rice	1
06035	Lead	SW-846 6020	1	102106050002A	08/02/2010 17:	51 David K Beck	1



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Page 2 of 2

Sample Description: S-302D 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-302D_072610

LLI Sample # WW 6043278 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 11:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S302D

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102106050002	07/29/2010	20:30	Mirit S Shenouda	1



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Page 1 of 2

Sample Description: S-303 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-303_072610

LLI Sample # WW 6043279 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 11:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S-303

CAT No.	Analysis Name		CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	6	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	13	2	0.5	1
10943	Methyl Tertiary But	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	1	1	0.5	1
10943	1,2,4-Trimethylbenz	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenz	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	2	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 24	24	5	5
07805	Fluorene		86-73-7	28	24	5	5
07805	Naphthalene		91-20-3	48	24	5	5
07805	Phenanthrene		85-01-8	54	24	5	5
07805	Pyrene		129-00-0	< 24	24	5	5
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	B Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11

This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	e	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102101AA	07/29/2010 2	21:07	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102101AA	07/29/2010 2	21:07	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10209WAA026	08/02/2010 2	22:29	Linda M	5
							Hartenstine	
07807	BNA Water Extraction	SW-846 3510C	1	10209WAA026	07/28/2010 1	14:30	Timothy J	1
							Attenberger	
07879	EDB in Wastewater	SW-846 8011	1	102150023A	08/05/2010 1	13:53	James H Place	1
07786	EDB Extraction	SW-846 8011	2	102150023A	08/03/2010 2	21:00	JoElla L Rice	1
06035	Lead	SW-846 6020	1	102106050002A	08/02/2010 1	17:57	David K Beck	1



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Sample Description: S-303 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-303 072610

LLI Sample # WW 6043279 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 11:15 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S-303

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102106050002	07/29/2010	20:30	Mirit S Shenouda	1



As Received

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Page 1 of 2

Sample Description: S-143 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-143_072610

LLI Sample # WW 6043280 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 12:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

As Received

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S-143

CAT No.	Analysis Name		CAS Number	As Received Result	Limit of Quantitation*	Method Detection Limit	Dilution Factor
GC/MS	Volatiles	SW-846	8260B	ug/l	ug/l	ug/l	
10943	Benzene		71-43-2	< 1	1	0.5	1
10943	1,2-Dichloroethane		107-06-2	< 1	1	0.5	1
10943	Ethylbenzene		100-41-4	< 1	1	0.5	1
10943	Isopropylbenzene		98-82-8	< 2	2	0.5	1
10943	Methyl Tertiary Buty	yl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene		108-88-3	< 1	1	0.5	1
10943	1,2,4-Trimethylbenze	ene	95-63-6	< 2	2	0.5	1
10943	1,3,5-Trimethylbenze	ene	108-67-8	< 2	2	0.5	1
10943	Xylene (Total)		1330-20-7	< 1	1	0.5	1
GC/MS	Semivolatiles	SW-846	8270C	ug/l	ug/l	ug/l	
07805	Chrysene		218-01-9	< 50	50	10	1
07805	Fluorene		86-73-7	54	50	10	1
07805	Naphthalene		91-20-3	< 50	50	10	1
07805	Phenanthrene		85-01-8	< 50	50	10	1
07805	Pyrene		129-00-0	< 50	50	10	1
	to the nature of the ysis. The reporting				for		
GC Mis	scellaneous	SW-846	8011	ug/l	ug/l	ug/l	
07879	Ethylene dibromide		106-93-4	< 0.029	0.029	0.0097	1
Metals	Dissolved	SW-846	6020	mg/l	mg/l	mg/l	
06035	Lead		7439-92-1	< 0.0010	0.0010	0.000050	1

General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/11 This sample was filtered in the lab for dissolved metals.

Trip blank vials were not received by the laboratory for this sample group.

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
01163	GC/MS VOA Water Prep	SW-846 5030B	1	P102101AA	07/29/2010 21:28	Daniel H Heller	1
10943	BTEX/MTBE/Cumene/EDC/TMBs	SW-846 8260B	1	P102101AA	07/29/2010 21:28	Daniel H Heller	1
07805	PAHs by 8270	SW-846 8270C	1	10209WAA026	08/02/2010 23:17	Linda M Hartenstine	1
07807	BNA Water Extraction	SW-846 3510C	1	10209WAA026	07/28/2010 14:30	Timothy J Attenberger	1
07879	EDB in Wastewater	SW-846 8011	1	102150023A	08/05/2010 14:23	James H Place	1
07786	EDB Extraction	SW-846 8011	2	102150023A	08/03/2010 21:00	JoElla L Rice	1



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Sample Description: S-143 072610 Grab Water

Philadelphia Refinery AOI-2 COC: 242401 S-143_072610

LLI Sample # WW 6043280 LLI Group # 1204825 Account # 10132

Project Name: SUN: Philadelphia Refinery AOI-2

Collected: 07/26/2010 12:00 by SS SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 07/27/2010 16:20 Reported: 08/10/2010 15:59

Discard: 08/25/2010

S-143

Laboratory Sample Analysis Record

CAT	Analysis Name	Method	Trial#	Batch#	Analysis		Analyst	Dilution
No.					Date and Ti	me		Factor
06035	Lead	SW-846 6020	1	102106050002A	08/02/2010	17:59	David K Beck	1
06050	ICP/MS SW-846 Water Digest	SW-846 3010A modified	1	102106050002	07/29/2010	20:30	Mirit S Shenouda	1



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Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204825

Reported: 08/10/10 at 03:59 PM

Matrix QC may not be reported if site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

Laboratory Compliance Quality Control

Analysis Name	Blank <u>Result</u>	Blank LOQ**	Blank <u>MDL</u>	Report <u>Units</u>	LCS %REC	LCSD %REC	LCS/LCSD <u>Limits</u>	RPD	RPD Max
Batch number: P102101AA	Sample numl	ber(s): 60	43277-604	3280					
Benzene	< 1	1.	0.5	ug/l	95		79-120		
1,2-Dichloroethane	< 1	1.	0.5	ug/l	78		70-130		
Ethylbenzene	< 1	1.	0.5	ug/l	85		79-120		
Isopropylbenzene	< 2	2.	0.5	ug/l	81		77-120		
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	93		76-120		
Toluene	< 1	1.	0.5	ug/l	92		79-120		
1,2,4-Trimethylbenzene	< 2	2.	0.5	ug/l	84		74-120		
1,3,5-Trimethylbenzene	< 2	2.	0.5	uq/l	85		75-120		
Xylene (Total)	< 1	1.	0.5	ug/l	85		80-120		
Batch number: 10209WAA026	Sample numl	ber(s): 60	43277-604	3280					
Chrysene	< 5	5.	1	uq/l	92	94	82-112	2	30
Fluorene	< 5	5.	1	ug/l	104	102	82-113	2	30
Naphthalene	< 5	5.	1	ug/l	85	83	77-107	3	30
Phenanthrene	< 5	5.	1	ug/l	93	95	83-112	1	30
Pyrene	< 5	5.	1	ug/l	94	94	80-115	1	30
Batch number: 102150023A	Sample numl	ber(s): 60	43277-604	3280					
Ethylene dibromide	< 0.030	0.030	0.010	ug/l	96	96	60-140	0	20
Batch number: 102106050002A	Sample numl	ber(s): 60	43277-604	3280					
Lead	< 0.0010	0.0010	0.00005	mg/1	99		90-115		

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

Analysis Name	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD <u>MAX</u>	BKG Conc	DUP Conc	DUP RPD	Dup RPD <u>Max</u>
Batch number: P102101AA	Sample	number(s): 6043277	-60432	80 UNSP	K: P040514			
Benzene	110	110	80-126	0	30				
1,2-Dichloroethane	88	87	66-141	1	30				
Ethylbenzene	88	89	71-134	1	30				
Isopropylbenzene	76	78	75-128	3	30				
Methyl Tertiary Butyl Ether	105	105	72-126	0	30				
Toluene	103	104	80-125	0	30				
1,2,4-Trimethylbenzene	78	78	72-130	0	30				
1,3,5-Trimethylbenzene	77	77	72-131	1	30				
Xylene (Total)	87	89	79-125	1	30				

^{*-} Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 2 of 3

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Group Number: 1204825

Reported: 08/10/10 at 03:59 PM

Sample Matrix Quality Control

Unspiked (UNSPK) = the sample used in conjunction with the matrix spike Background (BKG) = the sample used in conjunction with the duplicate

	MS	MSD	MS/MSD		RPD	BKG	DUP	DUP	Dup RPD
Analysis Name	%REC	%REC	<u>Limits</u>	RPD	MAX	Conc	Conc	RPD	Max
Batch number: 102150023A	Sample	number(s)	: 6043277	-6043280	UNSPK	: P045867	BKG: P045868		
Ethylene dibromide	78		65-135			< 0.029	< 0.029	0 (1)	30
Batch number: 102106050002A	Sample	number(s)	: 6043277	-6043280	UNSPK	: P042439	BKG: P042439		
Lead	102	100	75-125	3	20	< 0.0010	< 0.0010	0 (1)	20

Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: P102101AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
6043277	93	103	99	95
6043278	94	102	101	89
6043279	92	101	100	98
6043280	93	101	101	94
Blank	93	102	102	92
LCS	92	105	102	94
MS	93	104	100	91
MSD	93	103	102	95
T.imita.	80-116	77-113	80-113	78-113

Analysis Name: PAHs by 8270 Batch number: 10209WAA026 Nitrobenzene-d5

	Nitrobenzene-d5	2-Fluoropiphenyl	Terpneny1-d14	
6043277	87	104	81	
6043278	84	102	80	
6043279	84	97	71	
6043280	91	105	58	
Blank	86	98	81	
LCS	85	98	81	
LCSD	84	97	82	
Limits:	64-121	63-114	47-114	

Analysis Name: EDB in Wastewater

Batch number: 102150023A

1,1,2,2-

Tetrachloroethane

6043277	0*
6043278	97
6043279	96
6043280	97
Blank	101

*- Outside of specification

- **-This limit was used in the evaluation of the final result for the blank
- (1) The result for one or both determinations was less than five times the LOQ.
- (2) The unspiked result was more than four times the spike added.



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Page 3 of 3

Quality Control Summary

Client Name: SUN: Aquaterra Tech. Reported: 08/10/10 at 03:59 PM Group Number: 1204825

Surrogate Quality Control

DUP 111 103 LCS LCSD 102 MS 70

Limits: 46-136

^{*-} Outside of specification

^{**-}This limit was used in the evaluation of the final result for the blank

⁽¹⁾ The result for one or both determinations was less than five times the LOQ.

⁽²⁾ The unspiked result was more than four times the spike added.

Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1204825 Sample # 6043217-80

COC # 242401

	- F	Please print. In	structio	ons on	reverse	e side	corr	espon	nd with	circle	d nun	nbers.						
									(5) A	naly	ses R	eque	sted		For Lab Us	e Only	
Client: SVN- AQUATERRA	Acct. #:			_	Matri					Pre	serv	ation	Cod	es		SCR#:		
Project Name/#: PHILA REF/Act Project Manager: TOOERR Sampler: S. SY K & S Name of state where samples were collected:	P.O.#:Quote #	#: t:		-	Potable Check if NPDES Applicable		Containers	(Larsova)	Tomoth Remon	ر مسمد المساور المساور	(Xylens Crotal)	Florene	rae, Pyrane			Preservation H=HC N=HNO ₃ S=H ₂ SO ₄	T=Thiosulfate B=NaOH	(6) seldus
2 Sample Identification	Date Collected	Time Collected	Grab (2)	Composite	Water	1	Total # of C	Lead (1 5 %	Seneral Phillips	ATISE, X	Gensenas Negl	Pherothiene			Remarks	ı	Temperature of samples
S-305D -072610 S-302 D -072610 S-303 -072610 S-143 -072610	7/26/10	1906 1100 1115 1200	× × ×		メ		8888	X X X	XXXX	XXX	XXXX	x x x x	*************************************).9-1.4 \ \ \ \
Turnaround Time Requested (TAT) (please of Rush TAT is subject to Lancaster Laboratories appropriate results are needed:	SDO Ye RCP Is/MSD/Dup)?	E-mail G Complete? s No Yes No	Ri Ri	elinqu elinqu elinqu	ished is a second	by:	۰ <u>> /</u>	/A	QT	_	Date フォ Date	10 16 To 10 16	ime ime ime 2° me	Recei Recei	ved by:	eddye	Dai	e Time Time Time

c., 2425 New Holland Pike, Lancaster, PA 17601 (717) 656-2300 Fax: (147) 656-6766 Copies: White and yellow should accompany samples to Lancaster Laboratories. The pink copy should be retained by the client.

Issued by Dept. 6042 Management 2102.05



Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	BMQL	Below Minimum Quantitation Level
N.D.	none detected	MPN	Most Probable Number
TNTC	Too Numerous To Count	CP Units	cobalt-chloroplatinate units
IU	International Units	NTU	nephelometric turbidity units
umhos/cm	micromhos/cm	ng	nanogram(s)
С	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	I	liter(s)
m3	cubic meter(s)	ul	microliter(s)

- < less than The number following the sign is the <u>limit of quantitation</u>, the smallest amount of analyte which can be reliably determined using this specific test.
- greater than
- J estimated value The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).
- ppm parts per million One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.
- ppb parts per billion

Dry weight basis

X,Y,Z

Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

Inorganic Qualifiers

U.S. EPA CLP Data Qualifiers:

	•		•
Α	TIC is a possible aldol-condensation product	В	Value is <crdl, but="" th="" ≥idl<=""></crdl,>
В	Analyte was also detected in the blank	Ε	Estimated due to interference
С	Pesticide result confirmed by GC/MS	M	Duplicate injection precision not met
D	Compound quantitated on a diluted sample	N	Spike sample not within control limits
Ε	Concentration exceeds the calibration range of	S	Method of standard additions (MSA) used
	the instrument		for calculation
N	Presumptive evidence of a compound (TICs only)	U	Compound was not detected
Р	Concentration difference between primary and	W	Post digestion spike out of control limits
	confirmation columns >25%	*	Duplicate analysis not within control limits
U	Compound was not detected	+	Correlation coefficient for MSA < 0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

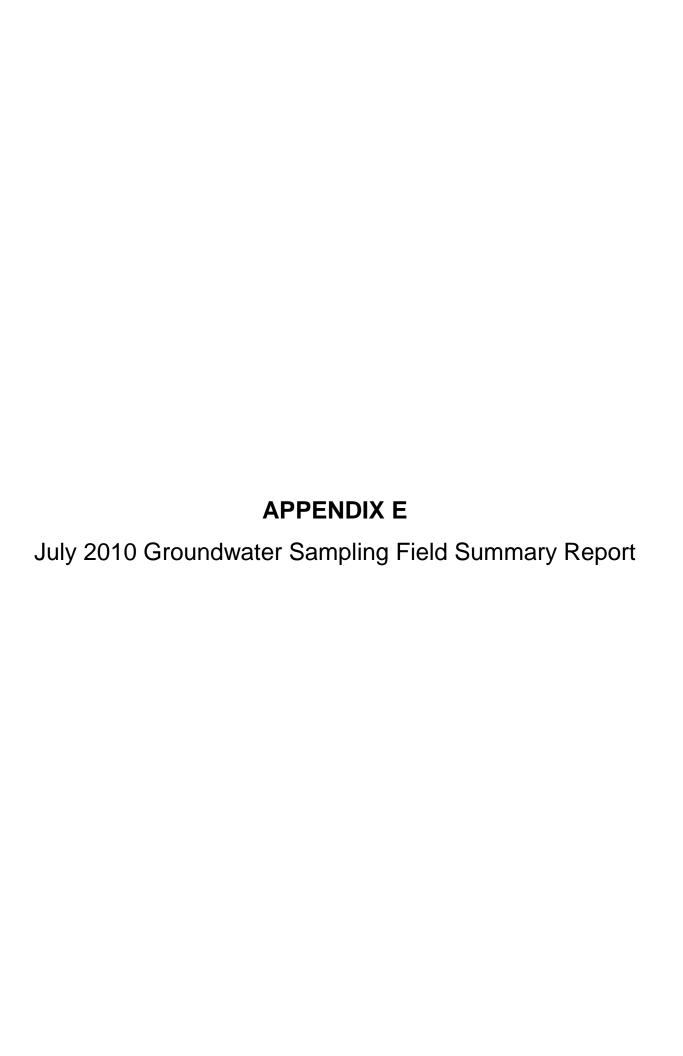
Measurement uncertainty values, as applicable, are available upon request.

Defined in case narrative

Organic Qualifiers

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Appendix E July 2010 Groundwater Sampling Field Summary AOI 2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

		WELL INFO					FIELD READIN	IGS (pre-purg	je)				FIE	ELD READING	S (post-purge	.)			FIELD REA (sampl	
Location ID	Depth to Bottom (ft bgs)	Depth to Water (ft btic) ⁽¹⁾	Depth to Product (ft btic)	Product Thickness (ft)	Purge Start	Temp. (°C)	DO (mg/L)	ORP (mv)	рН	Conductivity (mS/cm)	Purge Complete	Approx. Purge Rate (gpm) ⁽²⁾	Volume Purged (gal)	Temp. (°C)	DO (mg/L)	ORP (mv)	рН	Conductivity (mS/cm)	Date Sampled	Sample Time
C-Header	NM	13.16	NP	NP	1130	24.76	6.29	-28.0	7.06	0.377	1135	Hand	3	24.63	5.98	-14.5	6.87	0.362	7/14/2010	1135
PZ-100	24.67	16.04	15.82	0.22	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
PZ-101	24.49	15.53	NP	NP	1300	19.94	11.22	14.4	7.57	0.176	1305	Hand	1	19.64	2.32	10.6	7.42	0.156	7/15/2010	1305
RW-100	NM	25.88	NP	NP	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-101	NM	19.93	19.86	0.07	NS-P	NS-P NS-P	NS-P NS-P	NS-P	NS-P NS-P	NS-P	NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P
RW-102 RW-103	NM NM	26.38 27.02	23.18 27.02	3.20 <0.01	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	NS-P NS	pump in well	NS-P NS
RW-103	20.03	13.20	13.20	<0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS NS	NS	NS	NS	NS	NS NS	pump in well	NS
RW-105	17.67	17.90	17.90	<0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-106	15.03	17.93	17.93	<0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-107	20.28	10.85	NP	NP	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-108	20.24	8.18	NP	NP	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-109	20.32	8.10	NP	NP	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	pump in well	NS
RW-600	NM	4.34	NP	NP	0900	25.42	2.83	32.5	7.30	1.236	0915	1.5	23	24.52	2.08	23.7	7.11	1.242	7/23/2010	0915
RW-601 RW-602	23.90 24.34	Blocked at 8' Could not locate	NP NP	NP NP	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
S-105	11.83	11.90	NP	NP	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry
S-106	13.72	10.37	NP	NP	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry
S-107	NM	10.38	10.37	0.01	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-108	16.77	7.70	NP	NP	0850	24.77	3.44	-6.7	7.52	1.189	0900	Hand	4.5	23.32	1.92	8.3	7.29	1.202	7/23/2010	0900
S-110	24.02	14.70	NP	NP	1000	24.95	2.55	-41.2	6.84	1.111	1015	Hand	4.5	24.03	2.14	-42	6.94	1.132	7/23/2010	1015
S-130	19.66	19.75	NP	NP	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry
S-131	NM	17.15	15.46	1.69	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-132	29.59	18.75	NP	NP	1415	16.23	7.45	15.5	6.77	0.631	1430	1.5	21	15.86	1.74	-13.3	6.47	0.573	7/13/2010	1430
S-133	31.16	19.01	NP NP	NP NP	1230	17.1	5.39	-10.1	7.12	1.234	1245	1.5	24 20.5	17.13	1.58	-34.4	6.40	1.497	7/13/2010	1245
S-134 S-135	30.24 NM	19.84 22.38	21.17	1.21	1210 NS-P	16.65 NS-P	4.94 NS-P	-37.3 NS-P	6.86 NS-P	0.524 NS-P	1225 NS-P	1.5 NS-P	NS-P	16.85 NS-P	2.53 NS-P	-3.6 NS-P	6.31 NS-P	0.528 NS-P	7/14/2010 NS-P	1225 NS-P
S-136	NM	18.32	NP	NP	1225	18.1	4.87	-18.3	7.83	0.434	1240	1.5	19	18.62	3.2	-14.7	7.22	0.498	7/15/2010	1240
S-137	28.06	17.78	NP	NP	1300	20.5	8.07	3.6	6.57	0.649	1320	1.5	19.5	20.38	2.18	-17.6	6.33	0.618	7/13/2010	1320
S-139	30.14	19.40	19.40	<0.01	1315	20.41	6.29	4.6	6.62	0.957	1330	1.5	21	19.95	4.21	-2.1	6.51	0.942	7/12/2010	1330
S-140	31.02	20.02	20.02	< 0.01	1045	20.51	2.34	-17.8	6.84	0.924	1100	1.5	21.5	19.88	4.72	-28.9	6.64	0.882	7/12/2010	1100
S-141	28.37	20.11	NP	NP	1010	18.47	5.31	-5.7	6.75	1.037	1020	1.5	16	18.22	2.94	-19.4	6.49	1.016	7/12/2010	1020
S-142	NM	18.62	17.58	1.04	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-143	26.61	20.08	NP	NP	1350	19.49	1.75	-46.7	7.30	0.586	1400	1.5	13	20.11	1.23	-42.7	6.65	0.600	7/26/2010	1400
S-147 S-149	12.96 11.54	Could not locate Could not locate	NP NP	NP NP	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
S-143	NM	18.05	17.90	0.15	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-153	11.11	9.75	NP	NP	0915	22.59	1.84	2	7.31	0.971	0920	Hand	2.5	27.04	2.26	18.9	7.19	1.150	7/23/2010	0920
S-154	22.96	11.06	NP	NP	0920	25.21	2.81	28.8	6.74	2.672	0930	1.5	23	22.45	2.01	-20.9	6.69	3.010	7/23/2010	0930
S-156	NM	18.63	18.56	0.07	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-159	18.75	17.39	17.25	0.14	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-165	19.15	16.42	NP	NP	0940	21.19	6.82	7.4	6.25	1.418	0945	Hand	1.5	20.77	3.49	-14.7	6.39	1.258	7/14/2010	0945
S-166	19.02	15.35	NP	NP	1005	21.63	4.54	-18.9	7.17	0.518	1010	Hand	2	20.73	1.54	-3.1	6.65	0.504	7/14/2010	1010
S-167 S-174	24.14 NM	Could not locate 12.32	NP 10.90	NP 1.42	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P	NS NS-P
S-174	NM	18.88	17.49	1.39	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-177	21.47	17.67	NP	NP	1100	22.17	2.22	17.9	6.87	1.321	1105	Hand	2	21.45	1.24	16.9	6.64	1.307	7/14/2010	1105
S-178	NM	17.65	17.64	0.01	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-246A	15.11	11.82	NP	NP	1420	27.44	5.3	-0.7	7.25	0.477	1435	1.5	6	27.44	8.17	-4	7.14	0.458	7/22/2010	1435
S-247	21.04	12.48	NP	NP	1440	28.18	7.47	25.4	7.07	0.511	1450	1.5	16	28.76	1.1	0.9	6.96	0.510	7/22/2010	1450
S-248	16.39	10.81	NP	NP	1400	30.05	10.81	85.6	6.12	1.215	1410	1.5	10	27.65	6.38	6.6	6.52	0.827	7/22/2010	1410
S-249	21.49	14.90	NP 10.04	NP	1505	27.89	8.23	5.6	7.34	0.484	1515 NC P	1.5	12 NC D	24.74	4.12	0.8	7.08	0.482	7/22/2010	1515 NC P
S-250	NM	21.12	19.04	2.08	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P

Appendix E July 2010 Groundwater Sampling Field Summary AOI 2 Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Location ID	Depth to Bottom (ft bgs)	Depth to Water (ft btic) ⁽¹⁾	Depth to Product (ft btic)	Product Thickness (ft)	Purge Start	Temp. (°C)	DO (mg/L)	ORP (mv)	pH	Conductivity (mS/cm)	Purge Complete	Approx. Purge Rate (gpm) ⁽²⁾	Volume Purged (gal)	Temp. (°C)	DO (mg/L)	ORP (mv)	рН	Conductivity (mS/cm)	Date Sampled	Sample Time
S-251	31.35	22.71	NP	NP	0940	16.59	6.53	-17.2	6.38	1.304	950	1.5	16.5	16.51	2.55	-35.4	6.20	1.307	7/12/2010	0950
S-252	31.11	22.70	NP	NP	0850	16.63	6.94	-126.6	7.84	1.161	900	1.5	16.5	16.55	2.89	-97	6.88	1.169	7/12/2010	0900
S-253	35.38	23.08	NP	NP	1230	16.7	4.64	-11.7	6.49	1.161	1245	1.5	24	16.45	0.79	-58	6.35	1.099	7/9/2010	1245
S-254	34.27	22.73	22.71	0.02	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-48	25.29	18.98	NP	NP	0910	18.31	2.94	12.6	6.24	1.284	915	1.5	3	17.88	1.43	3.7	6.13	1.290	7/14/2010	0915
S-53	NM	19.47	19.32	0.15	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-54	NM	21.90	21.55	0.35	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-61 S-62	NM	16.65	16.60 19.93	0.05 0.04	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P	NS-P NS-P
S-62 S-63	NM NM	19.97 22.89	20.54	2.35	NS-P	NS-P	NS-P	NS-P NS-P	NS-P	NS-P	NS-P	NS-P	NS-P NS-P	NS-P	NS-P	NS-P	NS-P	NS-P NS-P	NS-P	NS-P
S-64	NM	10.97	10.90	0.07	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-65	NM	12.21	12.20	0.01	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-70	14.40	14.45	NP	NP	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry
S-71	35.96	20.82	NP	NP	1115	21.09	4.02	25.4	7.08	1.988	1040	Hand	2	21.57	3.6	-25.7	7.12	1.982	7/15/2010	1130
S-72	30.00	26.47	NP	NP	1030	19.13	2.6	-44.3	8.22	0.316	1035	Hand	2	18.87	2	-21.2	6.29	1.572	7/15/2010	1035
S-72D	>100	33.31	NP	NP	1240	19.03	2.77	-39.3	7.38	1.038	1300	1.5	30	18.16	0.66	-58.4	6.58	1.047	7/23/2010	1300
S-91	NM	20.31	20.29	0.02	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-92	NM	13.05	12.78	0.27	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-93	NM	22.21	21.72	0.49	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
SD-1	NM	8.34	NP NP	NP NP	0950	25.48	1.2	-19.1	6.90	0.990	1000	Hand	5	25.2	0.86	-24.9	6.72	1.062	7/23/2010	1300
S-292 S-294	20.00 40.00	19.66 29.58	NP NP	NP NP	NS-Dry 0905	NS-Dry 17.6	NS-Dry 2.52	NS-Dry 52.5	NS-Dry 5.86	NS-Dry 2.831	NS-Dry 0920	NS-Dry 1.5	NS-Dry 20	NS-Dry 17.45	NS-Dry 1.3	NS-Dry 7.4	NS-Dry 5.97	NS-Dry 2.621	NS-Dry 7/15/2010	NS-Dry 0920
S-294D	99.00	32.33	NP	NP	1120	17.6	6.31	-29.1	7.68	0.893	1140	1.5	135	16.99	2.13	-57.5	8.22	1.056	7/23/2010	1140
S-295	24.00	23.21	NP	NP	950	20.01	3.45	4.7	6.49	1.900	0955	1.5	5	18.89	2.27	3.6	6.56	1.357	7/15/2010	0955
S-297	36.00	26.50	26.05	0.45	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-298	20.00	20.06	NP	NP	835	21.71	2.31	-89.4	7.27	1.277	0843	1.5	3	21.94	2.06	-94.8	7.14	1.275	7/8/2010	0845
S-299	25.00	21.11	NP	NP	930	19.27	1.24	-101.1	7.28	1.738	0942	1.5	11.5	19.26	0.9	-101.4	6.61	1.823	7/8/2010	0945
S-300	30.00	21.76	NP	NP	1410	17.04	1.77	-37.9	6.14	0.958	1420	1.5	15	18.7	0.98	-41.5	6.09	1.054	7/8/2010	1420
S-301	28.00	19.85	NP	NP	1245	17.89	0.48	4.5	6.72	1.318	1300	1.5	20	18.8	1.55	-2.3	6.12	1.336	7/8/2010	1300
S-302	30.00	21.96	NP	NP	905	16.74	1.49	-39.4	6.60	0.822	0915	1.5	15.5	16.64	0.83	-44.3	6.25	0.836	7/9/2010	0915
S-302D	92.00	24.60	NP	NP	1005	17.8	6.23	-27.1	7.46	0.995	1100	1.5	131.5	17.65	4.21	-22.3	7.39	1.012	7/23/2010	1100
S-303	26.00	24.38	NP NP	NP NP	1135	17.44	8.41	15.8	6.59	0.848 0.867	1140	1.5	3	17.06	4.11 0.36	4.8	6.37	0.850 0.885	7/26/2010	1140
S-304 S-305	18.00 29.00	12.90 18.20	NP NP	NP NP	1318 825	18.93 16.91	2.12 6.55	-6.5 -104.5	6.36 7.77	0.867	1325 0840	1.5 1.5	10 21	19.29 16.95	2.98	-79.5 -66.9	6.33 6.72	0.885	7/8/2010 7/14/2010	1330 0840
S-305D	82.00	19.66	NP NP	NP NP	1245	17.9	3.21	-104.5	7.77	0.886	1400	1.5	122	17.67	2.98	-00.9	7.19	0.911	7/26/2010	1400
S-306	30.00	22.73	NP	NP	820	19.84	1.91	-25.7	6.83	1.045	0830	1.5	14	19.76	1.15	-15.2	6.40	0.999	7/9/2010	0830
S-307	26.00	19.86	NP	NP	1110	19.21	9.21	-30.4	7.60	0.908	1120	1.5	14	19.62	3.22	-51	6.94	0.911	7/13/2010	1120
S-308	20.00	24.42	NP	NP	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry
S-309	20.00	17.92	NP	NP	1034	18.12	1.78	-64.4	6.70	1.296	1045	1.5	4	19.54	0.95	-74.6	6.31	1.342	7/8/2010	1045
S-310	20.00	12.23	NP	NP	1110	18.75	1.43	26.9	6.45	1.637	1125	1.5	15	19.57	0.89	-52.4	6.25	1.562	7/8/2010	1125
S-311	33.00	24.93	24.92	0.01	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-312	20.00	8.91	NP	NP	1145	22.07	1.96	21.4	7.29	0.692	1200	1.5	22	23.01	1.79	22.9	7.01	0.782	7/8/2010	1200
S-313	30.00	22.09	21.97	0.12	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P	NS-P
S-314	30.00	22.73	NP 21.00	NP 2.20	1125	16.16	1.18	-1.3	6.53	1.147	1135	1.5	14 NC D	16.06	0.78	-8.9	6.20	1.084	7/9/2010	1135
S-315 S-316	30.00 30.00	24.27 21.87	21.98 NP	2.29 NP	NS-P 1015	NS-P 21.6	NS-P 0.92	NS-P -32.6	NS-P 6.34	NS-P 1.211	NS-P 1025	NS-P 1.5	NS-P 16	NS-P 21.38	NS-P 0.52	NS-P -84	NS-P 6.44	NS-P 1.227	NS-P 7/9/2010	NS-P 1025
S-316 S-317	30.00	21.87	NP NP	NP NP	1015	16.24	2.01	-32.b -18	6.73	0.612	1100	1.5	16	16.23	0.52	-84 -12.1	6.25	0.773	7/9/2010	1100
S-317	30.00	21.89	NP	NP	0935	16.55	1.31	5.5	6.29	0.898	0945	1.5	16	16.23	0.79	-7.1	6.17	0.773	7/9/2010	0945
S-328	26.00	19.43	NP	NP	1240	24.59	2.55	-19.8	6.80	1.190	1250	1.5	13	24.4	1.22	-50.2	6.53	1.184	7/12/2010	1250

Notes:
(1) - Measured prior to purging

(2) - Wells purged with whale pump unless otherwise noted

Groundwater quality readings collected using a YSI meter

Blocked - Well was blocked, unable to lower pump

A minimum of 3 well volumes were purged at each well location, unless well went dry during purging

All wells were sampled using poly bailers

Hand - Well purged using bailer

ft btic - Feet below top of inner casing

ft bgs - Feet below ground surface

mg/L - Milligrams per Liter

^oC - Degrees celsius mV - Millivolts mS/cm - Millisiemens per centimeter

NM - Not measured

NP - No measurable product (>0.01 ft)

NS-P - Not sampled due to measurable product (>0.01 ft)

NS-Dry - Not sampled, well was dry

gpm - Gallons per minute
NM - Total depth of well not measured due to the presence of light non aqueous phase liquid (LNAPL)

APPENDIX F

Fate and Transport Analysis

APPENDIX F

FATE AND TRANSPORT MODELING PROCEDURES AOI 2: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA, PENNSYLVNIA

QUICK DOMENICO MODELING

F.1 INTRODUCTION

Fate and transport calculations were completed for groundwater in Area of Interest (AOI) 2 to evaluate potential migration pathways/potential impacts to receptors. Eighteen shallow/intermediate wells (S-108, S-153, S-154, S-165, S-251, S-252, S-294, S-295, S-298, S-300, S-301, S-303, S-306, S-314, S-48, S-71, S-72, and SD-1) and one deep well (S-294D) in AOI 2 exhibited concentrations of groundwater compounds of concern (COCs) above their respective groundwater MSCs. The COCs that were above the groundwater MSCs in these wells were modeled using the analytical results from the July 2010 groundwater sampling event, and the Quick Domenico Version 2 (QD) spreadsheet model developed by Pennsylvania Department of Environmental Protection (PADEP). Site-specific data was used to complete the fate and transport calculations, when available.

F.2 MODEL OVERVIEW

The QD Model is a Microsoft Excel spreadsheet application based on the analytical contaminant transport equation developed by P.A. Domenico in "An Analytical Model For Multidimensional Transport of a Decaying Contaminant Species," Journal of Hydrology, 91 (1987), pp. 49-58. The QD model calculates contaminant concentrations at any down-gradient location after a specified interval of time. The model incorporates the processes of advection, first order decay, retardation, and dispersion to describe fate and transport of compounds. In addition, the QD model displays the results as a two dimensional chart to facilitate interpretation of the results.

F.3 MODEL LIMITATIONS

Limitations of the QD model include:

- Groundwater flow is assumed to be steady state, and one-dimensional;
- Aquifer properties are assumed to be reasonably uniform;

- Applicable only to unconsolidated aguifers;
- Intended for use primarily with dissolved organic compounds;
- Does not account for the transformation of parent compounds into daughter products as the result of biodegradation;
- Compounds are considered individually, and are assumed to not react with each other; and
- The contaminant source is limited to a single and continuous source concentration.

F.4 MODEL INPUT PARAMTERS

In preparation of this report, input values for the QD model were compiled from available site-specific data. When no site-specific data was available, estimated input values from the PADEP spreadsheet "Number Please!," which is based on PA Code, Chapter 250, Appendix A, Table 5, or other acceptable literature sources, were utilized. The input parameters are discussed in detail in the following sections, and are summarized in the input/output tables F.1 through F.19 in this appendix. An Excel spreadsheet interface was used to construct the QD simulations. This interface allowed the simulation of all relevant compounds at each well location to be constructed and saved in a single electronic file.

F.4.1 Source Concentration

Results of the July 2010 groundwater sampling indicated that eight organic compounds (1,2,4-trimethylbenzene (1,2,4-TMB), 1,3,5-trimethylbenzene (1,3,5-TMB), benzene, methyl tertiary butyl ether (MTBE), chrysene, naphthalene, phenanthrene and pyrene) and lead were detected above their respective groundwater MSCs in shallow/intermediate monitoring wells (S-108, S-153, S-154, S-165, S-251, S-252, S-294, S-295, S-298, S-300, S-301, S-303, S-306, S-314, S-48, S-71, S-72, and SD-1). Groundwater sample results also indicated that one organic compound (naphthalene) was detected above its respective groundwater MSC in one deep monitoring well (S-294D). The potential for these compounds to migrate offsite was evaluated through the use of the QD model. Based on groundwater flow direction, the concentrations in S-108, S-153, S-154, S-251, S-252, S-295, S-298, S-300, S-301, S-303, S-306, S-314, S-71, S-72, SD-1, S-295 and S-294D were evaluated in relation to AOI 2's western boundary (Schuylkill River) and the concentrations in S-165, S-48, and S-294 were evaluated in relation to AOI 2's eastern boundary (AOI 1).

F.4.2 Distance to Location of Concern (x)

Distance to the Location of Concern (distance) for the current simulations is the distance required for each COCs concentration to fall below its respective MSC under steady-state plume conditions. The distance is iteratively entered in the QD model until the location where the COC concentration reaches the MSC is identified. This step is performed using a large simulation time of 1×10^{99} days to ensure that the plume has reached steady-state.

F.4.3 Dispersivity

Dispersivity is the tendency of a dissolved plume to "spread out" as it moves downgradient.

- Longitudinal dispersivity (A_x) occurs in the direction parallel to groundwater flow;
- Transverse dispersivity (A_Y) occurs in the same plane as longitudinal dispersivity but perpendicular to the direction of groundwater flow; and
- Vertical dispersivity (A_Z) occurs in the upward direction, normal to the plane
 in which longitudinal and transverse dispersivity occur (Vertical dispersivity
 is usually negligible and is typically omitted from most QD analyses).

Dispersivity estimates are difficult to quantify and are commonly estimated from the following relationships:

- 1. $A_X = X/10$ (where, X is the distance a contaminant has traveled by advective transport)
- 2. $A_y = A_x/10$
- 3. $A_Z = A_X/20$ to $A_X/100$ (generally, it is recommended that A_Z be a very small number (0.001) unless vertical monitoring can reliably justify a larger number. Additionally, a value of 0.0001 is suggested for uncalibrated or conceptual applications).

As stated above the value for A_{γ} was estimated to be 10 percent of A_{χ} . A value of 0.001 was used as a value for A_{Z} .

F.4.4 Lambda

Lambda is the first order decay constant. It is determined by dividing 0.693 by the half-life of the compound. The value can typically be estimated for shrinking plumes by evaluating at concentrations versus time or distance. Lambda can also sometimes be estimated for stable plumes by evaluating concentration versus time using the methodology outlined in Buscheck and Alcantar (1995). Important considerations to estimating Lambda from site data include:

- 1. Are the measured concentrations along the centerline of the plume?
- 2. Are the measured concentrations the result of the single source area?
- 3. Are there no remedial systems and/or activities that effected the migration of the plume during the time interval of evaluation?

If the answer is yes to these questions, then the methodologies outlined in Buscheck and Alcantar may be utilized to estimate a site-specific lambda from site data.

Based on review of the available site data, the criteria necessary to calculate a site-specific lambda could not be met; therefore, a default value for lambda (when appropriate and available) was obtained from the PADEP spreadsheet "Number Please!" which is based on PA Code, Chapter 250, Appendix A, Table 5. The "Number Please!" spreadsheet does not include biodegradation rates for 1, 2, 4–TMB or 1, 3, 5–TMB. A brief internet search also did not produce any lambda estimates for 1, 2, 4-TMB or 1, 3, 5-TMB. Based on the previous modeling performed for the site, it was assumed that a representative lambda for these compounds would be very small, and therefore a value of 0.01 year-1 (2.74 x 10-5 day-1) was used.

F.4.5 Source Dimensions

Source width is the maximum width of the area measured perpendicular to the direction of groundwater flow. Source thickness is the thickness of the contaminated soils below the water table that contribute contamination to groundwater. In addition to the saturated zone, fluctuation in groundwater elevation may create a smear zone in the unsaturated portion of an aquifer. As an estimate of the thickness of the smear zone, average fluctuation can be used. Since no plumes have been delineated, a source width of 100 ft was used. The source thicknesses used was 15 feet (ft), which is the average thickness of the upper unconfined aquifer.

F.4.6 Hydraulic Conductivity (k)

The hydraulic conductivity of a geologic material is a measure of its ability to transmit water. A hydraulic conductivity of 24 ft/d was used in the AOI 2 QD simulations. This value is the hydraulic conductivity of the Trenton gravel at the site, obtained from the recovery data recorded at RW-406 (located in AOI 1). This value is representative of the geometric mean of hydraulic conductivity values calculated using aquifer testing recovery data in Well RW-406 by SECOR in 2003 (SECOR, 2003), and appears to be most representative of the Trenton Gravel in the vicinity of AOIs 1, 2, and 3. Since the composition of the Trenton Gravel in AOI 2 was consistent with AOI 1, this value of hydraulic conductivity was chosen as representative for conditions in AOI 2.

F.4.7 Hydraulic Gradient

Hydraulic gradient is the change in hydraulic head relative to the distance between head measurement locations. The hydraulic gradient is measured parallel to the direction of ground water flow assuming horizontal flow and a uniform gradient. Using the groundwater elevations collected in July 2010, the hydraulic gradient value was estimated between the well with exceedance and the downgradient wells within the same aquifer. The average value of the hydraulic gradient in the fill/alluvium/Trenton gravel ranged from 0.001 to 0.097 with an average of 0.018. A hydraulic gradient of 0.0013 was used for the wells screened in the Lower Sand, as measured between S-294D/S-72D from the July 2010 gauging event. Using the groundwater elevations collected in July 2010, the hydraulic gradient values used in the QD simulations were estimated between the wells with concentrations exceeding the MSC and its nearest downgradient well.

F.4.8 Porosity (n)

Porosity is measured as the ratio of the volume of void space in a geologic material to the total volume of material. Porosity values used in the fate and transport modeling for AOI 2 were based on historical geotechnical analysis.

F.4.9 Soil Bulk Density (ρb)

Soil bulk density is the dry weight of a sample divided by the total volume of the sample in an undisturbed state. Soil bulk density can either be determined by a laboratory or by the equation

$$\rho_b = 2.65 * (1- n).$$

Soil bulk density values used in the fate and transport modeling were based on historical geotechnical analysis.

F.4.10 Organic Carbon Partition Coefficient (KOC)

The organic carbon partition coefficient is chemical specific and is provided in the PADEP EP spreadsheet "Number Please!" which is based on PA Code, Chapter 250, Appendix A, Table 5. These values were used in the fate and transport modeling.

F.4.11 Fraction Organic Carbon (foc)

The fraction of organic carbon is the organic carbon content of a soil. A laboratory using ASTM methods can determine this value. Samples for organic carbon are taken from the same soil horizon in which the contaminant occurs, but outside of the impacted area. Since no site specific fraction of organic carbon data was available for the site, the fate and transport modeling used the model-recommended default concentration of 0.005, which is a conservative value based on the description of site soils.

F.4.12 Plume Coordinates ('y' and 'z')

The plume coordinates, 'y' and 'z,' define the horizontal and vertical extent of the impacted area, respectfully. For a solution on the centerline of the plume down gradient from the source, 'y' was set equal to zero. Additionally, to yield the highest concentration, which is located at the water table, 'z' was also set equal to zero.

F.4.13 Time (t)

'Time zero' is the point at which contamination was introduced into the aquifer. Time since 'time zero' is measured in days. The final simulation time of 1×10^{99} days was used to ensure that a steady-state plume was simulated.

F.4.14 Grid Dimensions

The grid dimensions form the window through which the plume is viewed and the locations where concentrations are calculated. The grid is determined by user specified length and width measurements from the source of the plume.

F.5 QD OUTPUT DATA AND RESULTS

A spreadsheet for each well for which a QD simulation was performed is included at the end of this appendix. The QD simulations prepared for the shallow/intermediate (fill/alluvium and Trenton Gravel) are summarized in Tables F.1 through F.18 and for deep well in Table F.19. A comparison between the model-predicted downgradient transport distance and the distance to the nearest property boundary and/or surface water receptor is also included in these tables. The following summaries the results of the QD simulations:

- The modeling results indicate that concentrations above the groundwater MSCs in eleven shallow/intermediate wells S-153, S-154, S-251, S-252, S-300, S-301, S-303, S-306, S-314, S-48 and S-72 and in one deep well S-294D are not predicted to migrate beyond the AOI 2 boundary. The distance from wells (S-153, S-154, S-300, S-301, S-303, S-314, S-48 and S-72, S-294D) to the AOI 2 boundary is larger than the distance predicted to meet groundwater MSCs. Wells S-251 and S-252 are within the capture zone of the remediation system recovery well RW-100. S-306 is within the groundwater capture zone of RW-105/106.
- The modeling results indicate that one monitoring well (S-165) contains concentrations of benzene and one monitoring well (S-294) contain concentrations of 1,2,4-TMB, 1,3,5-TMB and benzene that have the potential to reach the AOI 2 boundary and migrate into AOI 1. Based on the QD simulations, groundwater concentrations in exceedance of the groundwater MSCs will not reach the Refinery boundary, located along the eastern boundary of AOI 1.

- The modeling results for benzene in SD-1 were predicted not to attenuate to a concentration below their groundwater MSCs by the time they reach the AOI 2 western boundary (Schuylkill River). The QD forward model run predicts a benzene concentration adjacent to the Schuylkill River, 120 feet away from SD-1 to be 251 ug/L (Tables F.20), which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L. Therefore, a surface water screening concentration (waste load allocation) for benzene was calculated for SD-1 using the PENTOXSD modeling, and is presented in the next section. The modeling results indicate that one monitoring well (S-298) contains concentrations of benzene, 1,2,4-TMB and 1,3,5-TMB that have the potential to reach the western boundary (Schuylkill River) at concentrations above their groundwater MSCs. Chapter 25 PA Code Aquatic Life Criteria for Toxic Substances did not derive screening criteria for 1,2,4-TMB and 1,3,5-TMB, and therefore the VOC with the lowest aquatic life criteria from the COCs list, benzene, was used as a surrogate compound. The QD forward model run predicts benzene, 1,2,4-TMB and 1,3,5-TMB concentrations adjacent to the Schuylkill River, 500 feet away from S-298 to be 12 ug/L, 129 ug/L and 81 ug/L (Table F.21), which are below both the benzene acute and chronic fish criterion of 640 ug/L, and 130 ug/L, respectively.
- The modeling results for chrysene in S-108 predict that it will not attenuate to a concentration below its groundwater MSCs by the time it reaches the AOI 2 western boundary (Schuylkill River). Chapter 25 PA Code Aquatic Life Criteria for Toxic Substances did not derive a screening criteria for chrysene, and therefore and therefore the SVOC with the lowest aquatic life criteria from the COCs list, phenanthrene, was used as a surrogate compound. The QD forward model run predicts a chrysene concentration adjacent to the Schuylkill River, 25 feet away from S-108, to be 4.17 ug/L (Table F.22), which is below the phenanthrene acute fish criterion of 5 ug/L, but above the chronic fish criterion of 1 ug/L. Therefore, a surface water screening concentration (waste load allocation) for chrysene was calculated for S-108 using the PENTOXSD modeling, and is presented in the next section.
- The modeling results for MTBE in S-71 were predicted not to attenuate to a concentration below their groundwater MSCs by the time they reach the AOI 2 western boundary (Schuylkill River). Chapter 25 PA Code Aquatic Life Criteria for Toxic Substances did not derive screening criteria for MTBE, and therefore the VOC with the lowest aquatic life criteria from the COCs list, benzene, was used as a surrogate compound. The QD forward model run predicts MTBE concentrations adjacent to the Schuylkill River, 215 feet away from S-71 to be 170 ug/L (Table F.23), which is below the benzene acute fish criterion of 640 ug/L, but above the chronic fish criterion of 130 ug/L.

- Therefore, a surface water screening concentration (waste load allocation) for MTBE was calculated for S-71 using the PENTOXSD modeling, and is presented in the next section.
- The modeling results indicate that one monitoring well (S-295) contains concentrations of benzene and lead that have the potential to reach the western AOI 2 boundary (Schuylkill River). The QD forward model run predicts a benzene concentration adjacent to the Schuylkill River, 984 feet away from S-295, to be 40 ug/L (Tables F.24), which is below both the benzene acute and chronic fish criterion of 640 ug/L, and 130 ug/L, respectively. The QD forward model run predicts a lead concentration from S-295, to be 338 ug/L (Table F.24), which is above the lead acute (65 ug/L) and chronic fish criterion (2.5 ug/L). Therefore, a surface water screening concentration (waste load allocation) for lead was calculated for S-295 using the PENTOXSD modeling, and is presented in the next section.

A summary of the QD simulation results can be found in Table F.25.

F.6 PENTOX Evaluation

The Pennsylvania Single Discharge Waste load Allocation Program for Toxics Version 2.0 (PENTOX) was used to calculate site-specific, groundwater screening concentrations (also called wasteload allocations) protective of surface water. Wasteload allocations generated through PENTOX take into account the dilution of groundwater as it diffuses into flowing surface water and represent the groundwater concentration at which the Pennsylvania Code Chapter 93 Water Quality Criteria (WQC) for Toxic Substances (PA WQC) has the potential to be exceeded. As a result of the QD screening of benzene at SD-1, MTBE at S-71, chrysene at S-108 and lead at S-295, it was predicted that concentrations would not attenuate below their groundwater MSCs before reaching the Schuylkill River. PENTOX was then used to assess the potential impact of benzene on the Schuylkill River.

F.7 PENTOX Input Data

PENTOX model input values were derived from reports by Langan, previous consultants and government agencies. The variables used in PENTOX to model groundwater discharge to the Schuylkill River are summarized in Tables F.26 through F.41 along with their source(s).

7.1 Compound of Interest

The July 2010 groundwater analytical data indicated that benzene, MTBE, chrysene, and lead were detected in SD-1, S-71, S-108 and S-295 at concentrations of 370 ug/L, 440 ug/L, 54 ug/L and 1,040 ug/L, respectively. These concentrations exceed the PADEP

non-residential groundwater MSC screening values of 5 ug/L, 20 ug/L, 1.9 ug/L and 5 ug/L, respectively. Because groundwater near SD-1, S-71, S-108 and S-295 have the potential to discharge to the Schuylkill River, the effect on surface water quality standards must be addressed.

For benzene the PA GWQ continuous (chronic) and maximum (acute) fish and aquatic life criteria are 130 ug/L and 640 ug/L respectively. The predicted benzene concentration at the Schuylkill River is 251 ug/L. The benzene concentration from SD-1 does not exceed the acute but does exceed the chronic surface water criteria. Therefore PENTOX was used to generate a groundwater to surface water screening criteria to evaluate the groundwater concentration of benzene.

For MTBE Chapter 25 PA Code Aquatic Life Criteria for Toxic Substances did not derive a screening level, and therefore, the VOC with the lowest aquatic life criteria from the COCs list, benzene, was used as a surrogate compound. The predicted MTBE concentration at the Schuylkill River is 170 ug/L. The MTBE concentration from S-71 does not exceed the acute (640 ug/L) but does exceed the chronic (130 ug/L) surface water criteria for benzene. Therefore PENTOX was used to generate a groundwater to surface water screening criteria to evaluate the groundwater concentration of benzene.

For chrysene Chapter 25 PA Code Aquatic Life Criteria for Toxic Substances did not derive a screening level, and therefore, the SVOC with the lowest aquatic life criteria from the COCs list, phenanthrene, was used as a surrogate compound. For phenanthrene, the PA GWQ continuous (chronic) and maximum (acute) fish and aquatic life criteria are 1 ug/L and 5 ug/L, respectively. The predicted chrysene concentration at the Schuylkill River is 4.17 ug/L. The chrysene concentration from S-108 does not exceed the acute (5 ug/L) but does exceed the chronic (1 ug/L) surface water criteria. Therefore PENTOX was used to generate a groundwater to surface water screening criteria to evaluate the groundwater concentration of benzene.

For lead the PA GWQ continuous (chronic) and maximum (acute) fish and aquatic life criteria are 2.5 ug/L and 65 ug/L, respectively. The predicted lead concentration at the Schuylkill River is 338 ug/L. The lead concentration from S-295 exceeds both the acute (65 ug/L) and the chronic (2.5 ug/L) surface water criteria. Therefore PENTOX was used to generate a groundwater to surface water screening criteria to evaluate the groundwater concentration of lead.

7.2 Aquifer Parameters and Groundwater Flux

Aquifer parameters were entered into the groundwater flow equation to calculate the volumetric aquifer discharge to the Schuylkill River (Tables F.26, F.28, F.34 and F.38)). The hydraulic conductivity, hydraulic gradient and cross sectional area was taken directly from the SD-1, S-71, S-108, and S-295 QD simulations (Tables F.22, F.23 and F.24).

7.3 Stream Parameters

Stream parameters were selected to represent the discharge point and the confluence of the Schuylkill River with The Delaware River. Stream parameters were derived from USGS topographic maps (river mile index and river width). River low flow conditions (ten-year – consecutive seven-day low-flow (Q7-10) were accessed on the Low-Flow Statistics for Pennsylvania Streams developed by the USGS and PADEP. The gauging stations used are located at the Penrose Avenue and Chestnut Street bridges. Drainage areas for the AOI 2 point of discharge and river confluence are from the same USGS/PADEP website. Since the estimated point of discharge to surface water in AOI 2 lies between the two gauging stations the average flow conditions and drainage area were used. River stage at the potential discharge point in AOI 2 and at the confluence of the Schuylkill and Delaware Rivers were drawn from Schreffler, 2001. All other parameters required by PENTOX such as flow at the confluence of the Schuylkill and Delaware Rivers as well as their depths at those locations were calculated by PENTOX. Stream parameter input values are summarized in Tables F.258, F.32, F.36 and F.40.

F.8 PENTOX Model Results

The PENTOX derived groundwater to surface water screening standard (wasteload allocation) for benzene is 12,412 ug/L, MTBE is 122,599 ug/L, chrysene is 114 ug/L and lead is 18,726 ug/L.

The predicted benzene, MTBE, chrysene, and lead concentrations at the Schuylkill River are 251 ug/L, 170 ug/L, 4.17 ug/L and 338 ug/L which are below the calculated surface water screening concentrations, and therefore benzene in groundwater at SD-1, MTBE at S-71, chrysene at S-108 and lead at S-295 do not pose a significant risk to surface water quality in the Schuylkill River.

PENTOXSD input and output files are presented in Tables F.26 through F.41.

Table F.1 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gen	eric Input Param	eters	<u> </u>	Data Source
Source Identification (or Well ID)			S-108	
Sample Date			7/23/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient		ft/ft	0.097	S-108 July 2010/River Stage (0.6 ft)
Porosity		decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Cher	Chemical Specific Input Parameters								
Sim 1									
Contaminant			Chrysene						
Source Concentration (mg/L)		mg/L	0.0540	July 2010 Sampling					
Lambda (per day)		day ⁻¹	3.452E-04	PA DEP Number Please! Spreadsheet					
кос			490000	PA DEP Number Please! Spreadsheet					

Output (Distance	Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)								
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)					
Sim 1 - Chrysene	0.0540	0.0019	0.00190	33					

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.2 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	eric Input Parar	neters		Data Source
Source Identification (or Well ID)			S-153	
Sample Date			7/23/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A_y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.025	S-153/S-150 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Specific Input Para	meters		Data Source		
Sim 1						
Contaminant			Benzene			
Source Concentration (mg/L)		mg/L	0.0070	July 2010 Sampling		
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet		
KOC			58	PA DEP Number Please! Spreadsheet		
Sim 2						
Contaminant			Chrysene			
Source Concentration (mg/L)		mg/L	0.0080	July 2010 Sampling		
Lambda (per day)		day ⁻¹	3.4521E-04	PA DEP Number Please! Spreadsheet		
KOC			490000	PA DEP Number Please! Spreadsheet		

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)									
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)					
Sim 1 - Benzene	0.0070	0.0050	0.005	129					
Sim 2 - Chrysene	0.0080	0.002	0.002	7					

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.3 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	eric Input Parar	neters		Data Source
Source Identification (or Well ID)			S-154	
Sample Date			7/23/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A_y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.029	S-154/S-150
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	pecific Input Parameter	s		Data Source		
Sim 1						
Contaminant			Benzene			
Source Concentration (mg/L)	mç	g/L	0.0120	July 2010 Sampling		
Lambda (per day)	da	y ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet		
KOC COC			58	PA DEP Number Please! Spreadsheet		
Sim 2						
Contaminant			MTBE			
Source Concentration (mg/L)	mç	g/L	0.0310	July 2010 Sampling		
_ambda (per day)	da	y ⁻¹	1.8986E-03	PA DEP Number Please! Spreadsheet		
⟨OC			12	PA DEP Number Please! Spreadsheet		

Output (Dist	Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)									
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)						
Sim 1 - Benzene	0.0120	0.0050	0.0050	340						
Sim 2 - MTBE	0.0310	0.020	0.020	157						

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.4 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	eric Input Para	meters	•	Data Source
Source Identification (or Well ID)			S-165	
Sample Date			7/14/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26t Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00099	S-165/S-305 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemica	Data Source		
Sim 1			
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.0880	July 2010 Sampling
Lambda (per day)	day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC		58	PA DEP Number Please! Spreadsheet
Sim 2			
Contaminant		MTBE	
Source Concentration (mg/L)	mg/L	0.0710	July 2010 Sampling
Lambda (per day)	day ⁻¹	1.8986E-03	PA DEP Number Please! Spreadsheet
KOC		12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)	
Sim 1 - Benzene	0.0880	0.005	0.005	144	
Sim 2 - MTBE	0.0710	0.02	0.02	64	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.5 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery

Project Prepared by Date Prepared Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-251	
Sample Date			7/12/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A_y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0031	S-251/S-252 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical	Chemical Specific Input Parameters				
Sim 1					
Contaminant		1,2,4-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.0680	July 2010 Sampling		
Lambda (per day)	day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet		
KOC		2200	PA DEP Number Please! Spreadsheet		
Sim 2					
Contaminant		1,3,5-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.0480	July 2010 Sampling		
Lambda (per day)	day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet		
KOC		660	PA DEP Number Please! Spreadsheet		
Sim 3	<u> </u>				
Contaminant		Benzene			
Source Concentration (mg/L)	mg/L	0.3700	July 2010 Sampling		
Lambda (per day)	day ⁻¹	0.001	PA DEP Number Please! Spreadsheet		
KOC		58	PA DEP Number Please! Spreadsheet		

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)*	
Sim 1 - 1,2,4-Trimethylbenzene	0.0680	0.035	0.035	99	
Sim 2 - 1,3,5-Trimethylbenzene	0.0480	0.035	0.035	99	
Sim 3 - Benzene	0.3700	0.005	0.005	468	

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

* Towards recovery well RW-100 which is 50 ft away.

Table F.6 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Project Prepared by Date Prepared

Gene	Data Source			
Source Identification (or Well ID)			S-252	
Sample Date			7/12/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.004	S-252/S-306 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f_{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Chemical Specific Input Parameters				
Sim 1					
Contaminant		1,2,4-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.1400	July 2010 Sampling		
_ambda (per day)	day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet		
KOC		2200	PA DEP Number Please! Spreadsheet		
Sim 2	<u> </u>				
Contaminant		1,3,5-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.0420	July 2010 Sampling		
_ambda (per day)	day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet		
KOC		660	PA DEP Number Please! Spreadsheet		
Sim 3	l .				
Contaminant		Benzene			
Source Concentration (mg/L)	mg/L	1.3000	July 2010 Sampling		
_ambda (per day)	day ⁻¹	0.001	PA DEP Number Please! Spreadsheet		
KOC		58	PA DEP Number Please! Spreadsheet		

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)*	
Sim 1 - 1,2,4-Trimethylbenzene	0.1400	0.035	0.035	232	
Sim 2 - 1,3,5-Trimethylbenzene	0.0420	0.035	0.035	73	
Sim 3 - Benzene	1.3000	0.005	0.005	745	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500. Recovery well RW-100 is approximately 85 ft away.

Table F.7 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Project Prepared by Date Prepared 2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gen	Data Source			
Source Identification (or Well ID)			S-294	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A_z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00996	S-295/S-294 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	foc	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Data Source		
Sim 1			
Contaminant		1,2,4-Trimethylbenzene	
Source Concentration (mg/L)	mg/L	0.4100	July 2010 Sampling
Lambda (per day)	day -1	2.740E-05	PA DEP Number Please! Spreadsheet
кос		2200	PA DEP Number Please! Spreadsheet
Sim 2			
Contaminant		1,3,5-Trimethylbenzene	
Source Concentration (mg/L)	mg/L	0.1300	July 2010 Sampling
Lambda (per day)	day -1	2.7397E-05	PA DEP Number Please! Spreadsheet
кос		660	PA DEP Number Please! Spreadsheet
Sim 3			
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.1300	July 2010 Sampling
Lambda (per day)	day -1	0.001	PA DEP Number Please! Spreadsheet
кос		58	PA DEP Number Please! Spreadsheet
Sim 4	l.		
Contaminant		Chrysene	
Source Concentration (mg/L)	mg/L	0.1400	July 2010 Sampling
Lambda (per day)	day -1	0.0003	PA DEP Number Please! Spreadsheet
KOC		490000	PA DEP Number Please! Spreadsheet
Sim 5			
Contaminant		Naphthalene	
Source Concentration (mg/L)	mg/L	8.500000	July 2010 Sampling
Lambda (per day)	day ⁻¹	2.685E-03	PA DEP Number Please! Spreadsheet
кос		950	PA DEP Number Please! Spreadsheet
Sim 6			
Contaminant		Pyrene	
Source Concentration (mg/L)	mg/L	0.3800	July 2010 Sampling
Lambda (per day)	day ⁻¹	0.000	PA DEP Number Please! Spreadsheet
KOC		68000	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)						
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)		
Sim 1 - 1,2,4-Trimethylbenzene	0.41	0.035	0.035	795		
Sim 2 - 1,3,5-Trimethylbenzene	0.13	0.035	0.035	732		
Sim 3 - Benzene	0.13	0.005	0.005	806		
Sim 4 - Chrysene	0.14	0.002	0.002	12		
Sim 5 - Naphthalene	8.5	0.1	0.1	122		
Sim 6 - Pyrene	0.38	0.13	0.13	12		

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.8 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-295	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26t Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0100	S-295/S-294 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Chemical Specific Input Parameters				
Sim 1					
Contaminant		1,2,4-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.3600	July 2010 Sampling		
Lambda (per day)	day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet		
кос		2200	PA DEP Number Please! Spreadsheet		
Sim 2					
Contaminant		1,3,5-Trimethylbenzene			
Source Concentration (mg/L)	mg/L	0.1300	July 2010 Sampling		
Lambda (per day)	day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet		
кос		660	PA DEP Number Please! Spreadsheet		
Sim 3		l .			
Contaminant		_			
Source Concentration (mg/L)	mg/L	Benzene 1.9000	July 2010 Sampling		
Lambda (per day)	day ⁻¹	0.001	PA DEP Number Please! Spreadsheet		
KOC		58	PA DEP Number Please! Spreadsheet		
Sim 4					
Contaminant					
Source Concentration (mg/L)	mg/L	Naphthalene 0.7400	July 2010 Sampling		
Lambda (per day)	day ⁻¹	0.003	PA DEP Number Please! Spreadsheet		
KOC	uay	950	PA DEP Number Please! Spreadsheet		
Sim 5		550			
Contaminant					
		Lead			
Source Concentration (mg/L)	mg/L	1.040000	July 2010 Sampling		
Lambda (per day)	day ⁻¹	2.740E-08	PA DEP Number Please! Spreadsheet		
Kd		890	PA DEP Number Please! Spreadsheet		

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)	
Sim 1 - 1,2,4-Trimethylbenzene	0.3600	0.035	0.035	745	
Sim 2 - 1,3,5-Trimethylbenzene	0.1300	0.035	0.035	732	
Sim 3 - Benzene	1.9000	0.005	0.005	1,595	
Sim 4 - Naphthalene	0.7400	0.100	0.101	56	
Sim 5 - Lead	1.0400	0.005	0.005	17,100	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.9 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-298	
Sample Date			7/8/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A_y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.011	S-298/S-71 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical	Chemical Specific Input Parameters					
Sim 1						
Contaminant		1,2,4-Trimethylbenzene				
Source Concentration (mg/L)	mg/L	0.6200	July 2010 Sampling			
Lambda (per day)	day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet			
KOC		2200	PA DEP Number Please! Spreadsheet			
Sim 2	L					
Contaminant		1,3,5-Trimethylbenzene				
Source Concentration (mg/L)	mg/L	0.2100	July 2010 Sampling			
Lambda (per day)	day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet			
KOC		660	PA DEP Number Please! Spreadsheet			
Sim 3	L					
Contaminant		Benzene				
Source Concentration (mg/L)	mg/L	0.0900	July 2010 Sampling			
Lambda (per day)	day ⁻¹	0.001	PA DEP Number Please! Spreadsheet			
KOC		58	PA DEP Number Please! Spreadsheet			
Sim 4	L					
Contaminant		Naphthalene				
Source Concentration (mg/L)	mg/L	0.1900	July 2010 Sampling			
Lambda (per day)	day ⁻¹	0.003	PA DEP Number Please! Spreadsheet			
кос		950	PA DEP Number Please! Spreadsheet			

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)	
Sim 1 - 1,2,4-Trimethylbenzene	0.6200	0.035	0.035	1,035	
Sim 2 - 1,3,5-Trimethylbenzene	0.2100	0.035	0.035	1,217	
Sim 3 - Benzene	0.0900	0.005	0.005	755	
Sim 4 - Naphthalene	0.1900	0.1	0.1	19	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.10 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-300	
Sample Date			7/8/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26t Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0062	S-295/S-300 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	рь	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemica	Data Source		
Sim 1			
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.0140	July 2010 Sampling
Lambda (per day)	day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC		58	PA DEP Number Please! Spreadsheet
Sim 2			
Contaminant		MTBE	
Source Concentration (mg/L)	mg/L	0.0810	July 2010 Sampling
Lambda (per day)	day -1	1.8986E-03	PA DEP Number Please! Spreadsheet
KOC		12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Benzene	0.0140	0.005	0.005	173
Sim 2 - MTBE	0.0810	0.02	0.02	221

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.11 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-301	
Sample Date			7/8/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26t Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.021	S-304/S-301 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	foc	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

(Data Source		
Sim 1			
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.0090	July 2010 Sampling
Lambda (per day)	day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC		58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Benzene	0.0090	0.005	0.005	195

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.12 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-303	
Sample Date			7/26/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.035	S-139/S-303 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.0060	July 2010 Sampling
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant Starting Concentration (mg/L) Starting Concentration (mg/L) Starting Concentration (mg/L) Starting Concentration (mg/L) GW MSC ¹ Non-Residential (mg/L) Predicted Concentration (mg/L) Predicted Concentration (mg/L) MSC (Rounded to the Nearest foot)					
Sim 1 - Benzene	0.0060	0.005	0.005	87	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.13 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gene	Data Source			
Source Identification (or Well ID)			S-306	
Sample Date			7/9/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A_z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.007	S-63/S-306 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Data Source		
Sim 1			
Contaminant		1,2,4-Trimethylbenzene	
Source Concentration (mg/L)	mg/L	0.0400	July 2010 Sampling
Lambda (per day)	day ⁻¹	2.740E-05	PA DEP Number Please! Spreadsheet
KOC		2200	PA DEP Number Please! Spreadsheet
Sim 2	l		
Contaminant		1,3,5-Trimethylbenzene	
Source Concentration (mg/L)	mg/L	0.0520	July 2010 Sampling
Lambda (per day)	day ⁻¹	2.7397E-05	PA DEP Number Please! Spreadsheet
KOC		660	PA DEP Number Please! Spreadsheet
Sim 3	l .		
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.7400	July 2010 Sampling
Lambda (per day)	day ⁻¹	0.001	PA DEP Number Please! Spreadsheet
KOC		58	PA DEP Number Please! Spreadsheet
Sim 4	I		
Contaminant		Naphthalene	
Source Concentration (mg/L)	mg/L	0.6700	July 2010 Sampling
Lambda (per day)	day ⁻¹	0.003	PA DEP Number Please! Spreadsheet
кос		950	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)	
Sim 1 - 1,2,4-Trimethylbenzene	0.0400	0.035	0.035	44	
Sim 2 - 1,3,5-Trimethylbenzene	0.0520	0.035	0.035	165	
Sim 3 - Benzene	0.7400	0.005	0.005	1,026	
Sim 4 - Naphthalene	0.6700	0.1	0.1	45	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.14 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Gen	Data Source			
Source Identification (or Well ID)			S-314	
Sample Date			7/9/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.019	S-314/S-251 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical Specific Input Parameters				Data Source
Sim 1				
Contaminant			Phenanthrene	
Source Concentration (mg/L)		mg/L	1.9000	July 2010 Sampling
Lambda (per day)		day ⁻¹	1.726E-03	PA DEP Number Please! Spreadsheet
кос			38000	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant Starting Concentration (mg/L) Concentration (mg/L) GW MSC¹ Non-Residential (mg/L) Predicted Concentration (mg/L) Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)					
Sim 1 - Phenanthrene	1.9	1.1	1.1	4	

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.15 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Project Prepared by Date Prepared

Ger	Data Source			
Source Identification (or Well ID)			S-48	
Sample Date			7/14/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A_z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0014	S-48/S-305 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemical S	Specific Input Parameters		Data Source
Sim 1			
Contaminant		Chrysene	
Source Concentration (mg/L)	mg/L	0.0750	July 2010 Sampling
Lambda (per day)	day ⁻¹	3.452E-04	PA DEP Number Please! Spreadsheet
кос		490000	PA DEP Number Please! Spreadsheet
Sim 2			
Contaminant		Phenanthrene	
Source Concentration (mg/L)	mg/L	1.9000	July 2010 Sampling
Lambda (per day)	day ⁻¹	1.7260E-03	PA DEP Number Please! Spreadsheet
KOC		38000	PA DEP Number Please! Spreadsheet
Sim 3	-	-	
Contaminant		Pyrene	
Source Concentration (mg/L)	mg/L	0.3400	July 2010 Sampling
Lambda (per day)	day -1	0.000	PA DEP Number Please! Spreadsheet
KOC		68000	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC
Sim 1 - Chrysene	0.075	0.002	0.002	4.0
Sim 2 - Phenanthrene	1.9	1.1	1.1	1.0
Sim 3 - Pyrene	0.34	0.13	0.13	3.9

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.16 **Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Project Prepared by Date Prepared

Gene	Data Source			
Source Identification (or Well ID)			S-71	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A_y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A_z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.011	S-71/S-105 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	P _b	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chem	Data Source		
Sim 1			
Contaminant		MTBE	
Source Concentration (mg/L)	mg/L	0.4400	July 2010 Sampling
Lambda (per day)	day ⁻¹	1.899E-03	PA DEP Number Please! Spreadsheet
KOC		12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - MTBE	0.4400	0.02	0.02	780

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.17 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Project 2574601 - Sunoco Philadelphia Refinery

Prepared by Terrance Stanley
Date Prepared 9/17/2010

Generic Input Parameters Data Source Source Identification (or Well ID) S-72 Sample Date 7/15/2010 100 Delineated LNAPL (100' default if no plume is Source Width ft present) Source Thickness Estimated from USGS cross-section B-B' ft 15 Perpendicular Distance to Location of Concern 0 Set equal to zero to focus on centerline of ft simulated plume Set equal to zero to focus on centerline of Vertical Axis Perpendicular to x and y Z ft 0 simulated plume Estimate based on knowledge of site geology and Longitudinal Dispersivity 50 A_{x} ft contaminants present Transverse Dispersivity ft 5.0 Quick Domenico User's Manual A_{y} 0.0001 Quick Domenico User's Manual Vertical Dispersivity A_z ft Recovery data recorded at RW-406 (based on 26th Hydraulic Conductivty ft/day 24 Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003) Hydraulic Gradient ft/ft 0.009 S-295/S-72 July 2010 0.35 Porosity decimal Site soil analyses fraction Soil Bulk Density 1.7225 ACT 2 TGM Default g/cm3 p_{b} Fraction of Organic Carbon 0.005 ACT 2 TGM Default decimal f_{OC} fraction Time days 1.00E+99 Steady-State Conditions

Chemi	Data Source		
Sim 1			
Contaminant		Chrysene	
Source Concentration (mg/L)	mg/L	0.0140	July 2010 Sampling
Lambda (per day)	day ⁻¹	3.452E-04	PA DEP Number Please! Spreadsheet
KOC		490000	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Chrysene	0.0140	0.0019	0.0019	6

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.18 Quick Domenico Fate and Transport Model Input and Output AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/3/2010

Project Prepared by Date Prepared

Gene	Data Source			
Source Identification (or Well ID)			SD-1	
Sample Date			7/23/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0164	S-150 July 2010/River Stage (0.6 ft)
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Рь	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{oc}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chemica	Data Source					
Sim 1	Sim 1					
Contaminant			Benzene			
Source Concentration (mg/L)		mg/L	0.3700	July 2010 Sampling		
Lambda (per day)		day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet		
кос			58	PA DEP Number Please! Spreadsheet		
Sim 2						
Contaminant			MTBE			
Source Concentration (mg/L)		mg/L	0.0220	July 2010 Sampling		
Lambda (per day)		day ⁻¹	1.8986E-03	PA DEP Number Please! Spreadsheet		
KOC			12	PA DEP Number Please! Spreadsheet		

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)
Sim 1 - Benzene	0.3700	0.005	0.005	1,650
Sim 2 - MTBE	0.0220	0.02	0.02	33

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.19 Quick Domenico Fate and Transport Model Input and Output AOI-2 Deep (Lower Sand) Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/3/2010

Project Prepared by Date Prepared

Gene	Data Source			
Source Identification (or Well ID)			S-294D	
Sample Date			7/23/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	25	Estimated from USGS cross-section B-B'
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.00126	Measured hydraulic gradient between S-294D and S-72D from July 2010 gauging
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Рь	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

	Data Source		
Sim 1			
Contaminant		Naphthalene	
Source Concentration (mg/L)	mg/L	0.1400	July 2010 Sampling
Lambda (per day)	day ⁻¹	2.685E-03	PA DEP Number Please! Spreadsheet
KOC		950	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Predicted Distance to Meet Non-Residential GW MSC (Rounded to the Nearest foot)	
Sim 1 - Naphthalene	0.1400	0.1	0.1	3	

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.20 Quick Domenico SD-1 Forward Simulation for Benzene AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Project 2574601 - Sunoco Philadelphia Refinery

Prepared by Terrance Stanley
Date Prepared 9/17/2010

Gen	Generic Input Parameters							
Source Identification (or Well ID)			SD-1					
Sample Date			7/23/2010					
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)				
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)				
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume				
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume				
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present				
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual				
Vertical Dispersivity	A_z	ft	0.0001	Quick Domenico User's Manual				
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)				
Hydraulic Gradient	i	ft/ft	0.0164	S-150 July 2010/River Stage (0.6 ft)				
Porosity	n	decimal fraction	0.35	Site soil analyses				
Soil Bulk Density	p_b	g/cm3	1.7225	ACT 2 TGM Default				
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default				
Time		days	1.00E+99	Steady-State Conditions				

Chemic	Data Source		
Sim 1			
Contaminant		Benzene	
Source Concentration (mg/L)	mg/L	0.3700	July 2010 Sampling
Lambda (per day)	day ⁻¹	9.589E-04	PA DEP Number Please! Spreadsheet
KOC		58	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)					
Contaminant Starting Concentration (mg/L) Starting (mg/L) GW MSC ¹ Non-Residential (mg/L) Predicted Concentration (mg/L) Distance from SD-1 to the Schuylkill River (mg/L)					
Sim 1 - Benzene	0.3700	0.005	0.251	120	

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.21 **Quick Domenico** S-298 Forward Simulation for Benzene AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/17/2010

Project Prepared by Date Prepared

Ger	Generic Input Parameters						
Source Identification (or Well ID)			S-298				
Sample Date			7/8/2010				
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)			
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)			
Perpendicular Distance to Location of Concern	у	ft	0	Set equal to zero to focus on centerline of simulated plume			
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume			
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present			
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual			
Vertical Dispersivity	Az	ft	0.0001	Quick Domenico User's Manual			
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)			
Hydraulic Gradient	i	ft/ft	0.011	S-298/S-71 July 2010			
Porosity	n	decimal fraction	0.35	Site soil analyses			
Soil Bulk Density	р _ь	g/cm3	1.7225	ACT 2 TGM Default			
Fraction of Organic Carbon	foc	decimal fraction	0.005	ACT 2 TGM Default			
Time		days	1.00E+99	Steady-State Conditions			

C	Data Source			
Sim 1				
Contaminant			Benzene	
Source Concentration (mg/L)		mg/L	0.0900	July 2010 Sampling
Lambda (per day)		day ⁻¹	0.001	PA DEP Number Please! Spreadsheet
KOC			58	PA DEP Number Please! Spreadsheet
Output (D	Distance from Source Who	ere Concentration	on Equals Respective Grou	und Water MSC)
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Distance from S-298 to the Schuylkill River (Rounded to the Nearest foot)
Sim 1 - Benzene	0.0900	0.005	0.012	500

¹ ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.22 Quick Domenico S-108 Forward Simulation for Chrysene AOI-2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Project 2574601 - Sunoco Philadelphia Refinery
Prepared by Terrance Stanley

Date Prepared 9/28/2010

Time

Generic Input Parameters Data Source Source Identification (or Well ID) S-108 Sample Date 7/23/2010 Delineated LNAPL (100' default if no plume is Source Width 100 ft present)
URS, 2002 (average thickness of the UUA) Source Thickness ft 15 Perpendicular Distance to Location of Concern 0 Set equal to zero to focus on centerline of ft simulated plume Set equal to zero to focus on centerline of Vertical Axis Perpendicular to x and y ft 0 simulated plume Longitudinal Dispersivity Estimate based on knowledge of site geology and A_{x} ft 50 contaminants present

Quick Domenico User's Manual Transverse Dispersivity A_y ft 5.0 Vertical Dispersivity A_z 0.0001 Quick Domenico User's Manual Recovery data recorded at RW-406 (based on 26t Street Vicinity Pt. Breeze Processing Area RIR, Hydraulic Conductivty ft/day 24 Secor 2003) S-108 July 2010/River Stage (0.6 ft) Hydraulic Gradient ft/ft 0.097 Site soil analyses Soil Bulk Density 1.7225 ACT 2 TGM Default рb g/cm3 ACT 2 TGM Default raction of Organic Carbon f_{OC} decimal 0.005 fraction

Chemi	Data Source		
Sim 1			
Contaminant		Chrysene	
Source Concentration (mg/L)	mg/L	0.0540	July 2010 Sampling
Lambda (per day)	day ⁻¹	3.452E-04	PA DEP Number Please! Spreadsheet
кос		490000	PA DEP Number Please! Spreadsheet

1.00E+99

Steady-State Conditions

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Distance from S-108 to the Schuylkill River (Rounded to the Nearest foot)
Sim 1 - Chrysene	0.0540	0.0019	0.00417	25

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500

Table F.23 Quick Domenico S-71 Forward Simulation for MTBE **AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/28/2010

Project Prepared by Date Prepared

Gene	Data Source			
Source Identification (or Well ID)			S-71	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A _x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.011	S-71/S-105 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Che	Data Source		
Sim 1			
Contaminant		MTBE	
Source Concentration (mg/L)	mg/L	0.4400	July 2010 Sampling
Lambda (per day)	day ⁻¹	1.899E-03	PA DEP Number Please! Spreadsheet
KOC		12	PA DEP Number Please! Spreadsheet

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)				
Contaminant	Starting Concentration (mg/L)	GW MSC ¹ Non-Residential (mg/L)	Predicted Concentration (mg/L)	Distance from S-71 to the Schuylkill River (Rounded to the Nearest foot)
Sim 1 - MTBE	0.4400	0.02	0.17	215

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.24 Quick Domenico S-295 Forward Simulation for Benzen and Lead **AOI-2 Shallow Groundwater** Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

2574601 - Sunoco Philadelphia Refinery Terrance Stanley 9/28/2010

Project Prepared by Date Prepared

Gene	ric Input Parar	neters		Data Source
Source Identification (or Well ID)			S-295	
Sample Date			7/15/2010	
Source Width		ft	100	Delineated LNAPL (100' default if no plume is present)
Source Thickness		ft	15	URS, 2002 (average thickness of the UUA)
Perpendicular Distance to Location of Concern	У	ft	0	Set equal to zero to focus on centerline of simulated plume
Vertical Axis Perpendicular to x and y	Z	ft	0	Set equal to zero to focus on centerline of simulated plume
Longitudinal Dispersivity	A_x	ft	50	Estimate based on knowledge of site geology and contaminants present
Transverse Dispersivity	A _y	ft	5.0	Quick Domenico User's Manual
Vertical Dispersivity	A _z	ft	0.0001	Quick Domenico User's Manual
Hydraulic Conductivty	k	ft/day	24	Recovery data recorded at RW-406 (based on 26th Street Vicinity Pt. Breeze Processing Area RIR, Secor 2003)
Hydraulic Gradient	i	ft/ft	0.0100	S-295/S-294 July 2010
Porosity	n	decimal fraction	0.35	Site soil analyses
Soil Bulk Density	Pb	g/cm3	1.7225	ACT 2 TGM Default
Fraction of Organic Carbon	f _{OC}	decimal fraction	0.005	ACT 2 TGM Default
Time		days	1.00E+99	Steady-State Conditions

Chem	Chemical Specific Input Parameters								
Sim 3									
Contaminant			Benzene						
Source Concentration (mg/L)		mg/L	1.9000	July 2010 Sampling					
Lambda (per day)		day ⁻¹	0.001	PA DEP Number Please! Spreadsheet					
кос			58	PA DEP Number Please! Spreadsheet					
Sim 5	· I								
Contaminant			Lead						
Source Concentration (mg/L)		mg/L	1.040000	July 2010 Sampling					
Lambda (per day)		day ⁻¹	2.740E-08	PA DEP Number Please! Spreadsheet					
Kd			890	PA DEP Number Please! Spreadsheet					

Output (Distance from Source Where Concentration Equals Respective Ground Water MSC)										
Contaminant Starting Concentration (mg/L) Concentration (mg/L) Starting Concentration (mg/L) One-Residential (mg/L) Predicted Concentration (mg/L) Distance from S-295 to the Schuylkill River (Rounded to the Nearest foot)										
Sim 3 - Benzene	1.9000	0.005	0.040	984						
Sim 5 - Lead	1.0400	0.005	0.338	984						

ACT 2 TGM, Appendix A, Table 1 MSC for a Non-residential Used Aquifer with Total Dissolved Solids less than or equal to 2500.

Table F.25

Fate and Transport Screening Results for Groundwater Predicted Distance to Achieve Groundwater Screening Standard AOI-2 Wells Sunoco, Philadelphia Refinery Philadelphia, Pennsylvania

	Location	S-108	S-153	S-154	S-165	S-251 ⁽¹⁾	S-252 ⁽¹⁾	S-294	S-295	S-298	S-300
Chemical Name	Sample ID	S-108_072310	S-153_072310	S-154_072310	S-165_071410	S-251_071210	S-252_071210	S-294_071510	S-295_071510	S-298_070810	S-300_070810
Chemical Name	Sample Date	7/23/2010	7/23/2010	7/23/2010	7/14/2010	7/12/2010	7/12/2010	7/15/2010	7/15/2010	7/8/2010	7/8/2010
	Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds	Units	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	ft					99	232	<i>795</i>	745	1,035	
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	ft					99	73	732	732	1,217	
BENZENE	ft		129	340	144	468	745	806	1,595	755	173
TERT-BUTYL METHYL ETHER (MTBE)	ft			157	64						221
Semi-volatile Organic Compounds											
CHRYSENE	ft	33	7				-	12	-		
NAPHTHALENE	ft						-	122	56	19	
PHENANTHRENE	ft						-			-	
PYRENE	ft							12			
Metals											
LEAD	ft								17,100	-	

Notes:

PADEP - Pennsylvania Department of Environmental Protection

- Detected concentration (if any) is below PADEP MSC for groundwater therefore it was not inluded in the Quick Domenico anaylsis.

All predicted distances rounded to the nearest foot.

(1) S-251 and S-252 are within the groundwater capture zone of RW-100.

(2) S-306 is within the groundwater capture zone of RW-105/106.

=Predicted distance to attenuate to PADEP MSC is greater than distance to Schuylkill River (bulkhead may mitigate connection to river).

= Predicted distance to attenuate to PADEP MSC is greater than distance to AOI boundary.

Table F.25

Fate and Transport Screening Results for Groundwater Predicted Distance to Achieve Groundwater Screening Standard AOI-2 Wells Sunoco, Philadelphia Refinery Philadelphia, Pennsylvania

	Location	S-301	S-303	S-306 ⁽²⁾	S-314	S-48	S-71	S-72	SD-1	S-294D
Chamical Name	Sample ID	S-301_070810	S-303_072610	S-306_070910	S-314_070910	S-48_071410	S-71_071510	S-72_071510	SD-1_072310	S-294D_072310
Chemical Name	Sample Date	7/8/2010	7/26/2010	7/9/2010	7/9/2010	7/14/2010	7/15/2010	7/15/2010	7/23/2010	7/23/2010
	Sample Matrix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Volatile Organic Compounds	Units	Result	Result	Result	Result	Result	Result	Result	Result	Result
1,2,4-TRIMETHYLBENZENE	ft			44				_	-	-
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	ft			165					-	-
BENZENE	ft	195	87	1,026					1,650	-
TERT-BUTYL METHYL ETHER (MTBE)	ft						780		33	-
Semi-volatile Organic Compounds										
CHRYSENE	ft			-		4		6	-	_
NAPHTHALENE	ft			45					_	3
PHENANTHRENE	ft				4	<1			_	-
PYRENE	ft					4				_
Metals										
LEAD	ft								-	_

Notes:

PADEP - Pennsylvania Department of Environmental Protection

- Detected concentration (if any) is below PADEP MSC for grounded and predicted distances rounded to the nearest foot.
- (1) S-251 and S-252 are within the groundwater capture zone of (2) S-306 is within the groundwater capture zone of RW-105/10
- **26** = Predicted distance to attenuate to PADEP MSC is gr
- **26** = Predicted distance to attenuate to PADEP MSC is g

Table F.26 SD-1 PENTOXSD Input Data AOI 2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (at discharge point)	mile	3.3	USGS Philadelphia Quadrangle Map
River Stage Elevation (at discharge point)	ft	1.0	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,905.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	101.5	USGS-PADEP Low-Flow Statistics Website.
Q ₇₋₁₀ Reach Width	ft	530	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
Q _h Stream Flow	ft ³ /s	809.00	USGS-PADEP Low-Flow Statistics Website.
Q _h Reach Width	ft	530.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
River Mile Index (at confluence)	mile	0.001	USGS Philadelphia Quadrangle Map
River Stage Elevation (at confluence)	ft	0.50	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,912.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q ₇₋₁₀ Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	NA
Q _h Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q _h Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	NA
Diffuse Groundwater Flow	million gallons per day	0.0304	Calculated ⁽²⁾
Hydraulic Conductivity (K)	ft/d	24.0	SD-1 Quick Domenico Simulation (In this Appendix)
Hydraulic Gradient (i)	ft/ft	0.11300	Calculated between SD-1 and Schuylkill River (stage = 0.6 ft-msl)
Area of groundwater flux (A)	ft ²	1,500.00	SD-1 Quick Domenico Simulation (In this Appendix)

NOTES:

NA = Not Applicable.

⁽¹⁾ Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia Couunty, Pennsylvania.

⁽²⁾ Diffuse Groundwater Flow (in Million Gallons per Day) = ((Hydraulic Conductivity x Hydraulic Gradient x Area of Groundwater Flux) x 7.481) / (1,000,000)

PENTOXSD

Modeling Input Data

Strea Cod		Elevatio (ft)	Are	ea	Slope	PWS (mg			A	oply FC				
186	33 3.30	1	(sq 1		0.00000		0.00			✓	_			
							Stream Da	ata						
	LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>n</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)		(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	101.5	0	530	0	0	0	100	7	0	0	0	0
Qh		0	809	0	530	0	0	0	100	7	0	0	0	0
						C	ischarge D	Data						
	Name	Permi Numb		c c	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
<u> </u>	-2 SD-1 Ben	25746	(mg 01 0.030		(mgd) 0	(mgd)	0	0	0	0	0	(mg/L) 100	7	_
AOI	-2 3D-1 Dell	23740	0.030	743	U				U	U	U	100	7	
	Parameter	Namo		Disc	Trib	P Dis	arameter D c Disc		n Stream	Fate	FOS	Crit	Max	
	raidillelei	ivame		Conc µg/L)	Conc (µg/L)	Daily C\	y Hourl		: CV	Coe		Mod		
BENZE	NE			251	0	0.	5 0.5		0	0	0	1	0	
Strea Cod		Elevatio (ft)	n Drain Are (sq 1	ea	Slope	PWS (mg				pply FC				
186	33 0.00	0			0.00000		0.00			✓	_			
							Stream Da	ata						
	LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>n</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)		(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	0	0	1050	0	0	0	100	7	0	0	0	0
Qh		0	0	0	1050	0	0	0	100	7	0	0	0	0
						С	ischarge D							
	Name	Permi Numb		c c	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
_			(mg	d) ((mgd)	(mgd)						(mg/L)		_
			0		0	0	0	0	0	0	0	100	7	
						Р	arameter D							
	Parameter	Name		Disc Conc	Trib Conc	Dis Dail C\	y Hourl	y Cond	: CV	Fate Coe		Crit Mod	Conc	
BENZE	:NE		(μg/L) 0	(μg/L) 0		E 0.5	(μg/L		0	0	1	(μg/L)	
DEINZE	.INC			U	U	0.	5 0.5	U	0	U	0	ı	0	

Hydrodynamics

<u>s</u>	SWP Basin Stream Code:						Stream	n Name	_		
	06B		18	633							
RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope	Depth (ft)	Width (ft)	WD Ratio	Velocity (fps)	Reach Trav Time (days)	CMT (min)
			Q7-10 Hydrodynamics								
3.300	101.5	0	101.5	0.04707	3E-05	0.4952	530	1070.4	0.3869	0.5210	1000+
0.001	102.2	0	102.2	NA	0	0	0	0	0	0	NA
			Qh Hydrodynamics								
3.300	809	0	809	0.04707	3E-05	1.2337	530	429.59	1.2373	0.1629	1000+
0.001	811.54	0	811.54	NA	0	0	0	0	0	0	NA

Wasteload Allocations

RMI	Name P	ermit N	umber						
3.30	AOI-2 SD-1 Ben	25746	601						
				A	AFC				
Q7-	10: CCT (min)	15	PMF	0.008	Analysis	pH 7	Analysis	Hardness	100
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
			(µg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	BENZENE		0	0	0	0	640	640	12412.41
				C	FC				
Q7-10:	CCT (min)	720	PMF	0.059	Analysis	pH 7	oH 7 Analysis Hardness		
	Parameter		Stream Conc.	Stream CV	Trib Conc.	Fate Coef	WQC	WQ Obj	WLA
			(µg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	BENZENE		0	0	0	0	130	130	16697.21
				Т	НН				
Q7-10:	CCT (min)	720	PMF	NA	Analysis	spH NA	Analysi	NA	
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
			(µg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	BENZENE		0	0	0	0	NA	NA	NA
				c	CRL				
Qh:	CCT (min)	720	PMF	0.117					
	Parameter		Stream	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
-			(µg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	BENZENE		0	0	0	0	1.2	1.2	2417.499

Table F.30 S-71 PENTOXSD Input Data AOI 2 Shallow Groundwater Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (at discharge point)	mile	3.3	USGS Philadelphia Quadrangle Map
River Stage Elevation (at discharge point)	ft	1.0	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,905.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	101.5	USGS-PADEP Low-Flow Statistics Website.
Q ₇₋₁₀ Reach Width	ft	530	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
Q _h Stream Flow	ft ³ /s	809.00	USGS-PADEP Low-Flow Statistics Website.
O _h Reach Width	ft	530.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
River Mile Index (at confluence)	mile	0.001	USGS Philadelphia Quadrangle Map
River Stage Elevation (at confluence)	ft	0.50	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,912.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q ₇₋₁₀ Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	NA
O _h Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q _h Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	NA
Diffuse Groundwater Flow	million gallons per day	0.0029	Calculated ⁽²⁾
Hydraulic Conductivity (K)	ft/d	24.0	S-71 Quick Domenico Simulation (In this Appendix)
Hydraulic Gradient (i)	ft/ft	0.01090	Calculated between S-71 and Schuylkill River (stage = 0.6 ft-msl)
Area of groundwater flux (A)	ft ²	1,500.00	S-71 Quick Domenico Simulation (In this Appendix)

NOTES:

NA = Not Applicable.

⁽¹⁾ Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia Couunty, Pennsylvania.

⁽²⁾ Diffuse Groundwater Flow (in Million Gallons per Day) = ((Hydraulic Conductivity x Hydraulic Gradient x Area of Groundwater Flux) x 7.481) / (1,000,000)

PENTOXSD

Modeling Input Data

Strea Cod		Elevati (ft)	A	inage Area	Slope	PWS (m	With	put Duta	Α	pply FC				
186	33 3.3	0		q mi) 1905.00	0.00000		0.00			✓	=			
							Stream Da	ata						
	LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>n</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	Time (days)	(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	101.5	0	530	0	0	0	100	7	0	0	0	0
Qh		0	809	0	530	0	0	0	100	7	0	0	0	0
							Discharge D	Data						
	Name	Pern Num	ber D	isc	ermitted Disc Flow	Design Disc Flow	Reserve Factor		CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
AOI-	2 S-71 MTB	E 2574		ngd) (0294	(mgd) 0	(mgd)	0	0	0	0	0	(mg/L)	7	_
						. В	arameter D	loto			-			
	Paramete	r Name		Disc Conc (μg/L)	Trib Conc (μg/L)	Dis Dail C\	c Disc	Steam	CV	Fate Coe		Crit Mod	Max Disc Conc (µg/L)	
BENZE	NE			170	0	0.	.5 0.5		0	0	0	1	0	
Strea Cod		Elevati (ft)		inage Area (1 mi)	Slope	PWS (m				pply FC				
186	33 0.0	0			0.00000		0.00			✓	_			
							Stream Da	ata						
	LFY	Trib Flow	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>n</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	(days)	(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	0	0	1050	0	0	0	100	7	0	0	0	0
Qh		0	0	0	1050	0	0	0	100	7	0	0	0	0
							Discharge D	Data						
	Name	Pern Num	ber D	isc	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
_					(mgd)	(mgd)						(mg/L)		_
				0	0	0	0	0	0	0	0	100	7	
	_						arameter D			_				
	Paramete	r Name		Disc Conc	Trib Conc	C	y Hourl	y Cond	c CV	Fate Coe		Crit Mod	d Disc Conc	
DENIZE	NE			(μg/L)	(μg/L)		E 0.5	(μg/L		^		4	(μg/L)	
BENZE	INE			0	0	0.	.5 0.5	0	0	0	0	1	0	

Hydrodynamics

<u>s</u>	SWP Basin Stream Code:					Stream Name:						
	06B		18	633								
RMI	Stream Flow	PWS With	Net Stream Flow	Disc Analysis Flow	Reach Slope	Depth	Width	WD Ratio	Velocity	Reach Trav Time	CMT	
	(cfs)	(cfs)	(cfs)	(cfs)		(ft)	(ft)		(fps)	(days)	(min)	
			Q7-10 Hydrodynamics									
3.300	101.5	0	101.5	0.00454	3E-05	0.4951	530	1070.6	0.3869	0.5211	1000+	
0.001	102.2	0	102.2	NA	0	0	0	0	0	0	NA	
			Qh Hydrodynamics									
3.300	809	0	809	0.00454	3E-05	1.234	530	429.51	1.2370	0.163	1000+	
0.001	811.54	0	811.54	NA	0	0	0	0	0	0	NA	

Wasteload Allocations

RMI	Name	Permit N	lumber						
3.30	AOI-2 S-71 MTBE	2574	601						
				,	AFC				
Q7	-10: CCT (mi	n) 15	PMF	0.008	Analysis	pH 7	Analysis	Hardness	100
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (μg/L)	Fate Coef	WQC	WQ Obj (µg/L)	WLA (ug/L)
					(μg/L)		(μg/L)		(μg/L)
	BENZENE		0	0	0	0	640	640	122598.5
				c	FC				
Q7-10:	CCT (min	720	PMF	0.059	Analysis	pH 7	Analysi	s Hardness	100
	Parameter		Stream Conc.	Stream CV	Trib Conc.	Fate Coef	WQC	WQ Obj	WLA
			(μg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	BENZENE		0	0	0	0	130	130	171761.1
				т	НН				
Q7-10:	CCT (min	720	PMF	NA	Analysi	spH NA	Analysi	s Hardness	NA
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
-			(μg/L)		(µg/L)		(μg/L)	(µg/L)	(μg/L)
	BENZENE		0	0	0	0	NA	NA	NA
				(CRL				
Qh:	CCT (min) 72	0 PMF	0.117					
	Parameter		Stream Conc (µg/L)	Stream CV	Trib Conc (μg/L)	Fate Coef	WQC (μg/L)	WQ Obj (µg/L)	WLA (μg/L)
-	DENZENE								
	BENZENE		0	0	0	0	1.2	1.2	25049.36

Table F.34
S-108 PENTOXSD Input Data
AOI 2 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (at discharge point)	mile	3.3	USGS Philadelphia Quadrangle Map
River Stage Elevation (at discharge point)	ft	1.0	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,905.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	101.5	USGS-PADEP Low-Flow Statistics Website.
Q ₇₋₁₀ Reach Width	ft	530	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
Q _h Stream Flow	ft ³ /s	809.00	USGS-PADEP Low-Flow Statistics Website.
Q _h Reach Width	ft	530.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
River Mile Index (at confluence)	mile	0.001	USGS Philadelphia Quadrangle Map
River Stage Elevation (<u>at confluence</u>)	ft	0.50	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,912.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q ₇₋₁₀ Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	NA
Q _h Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q _h Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	NA
Diffuse Groundwater Flow	million gallons per day	0.0256	Calculated ⁽²⁾
Hydraulic Conductivity (K)	ft/d	24.0	S-108 Quick Domenico Simulation (In this Appendix)
Hydraulic Gradient (i)	ft/ft	0.09500	Calculated between S-108 and Schuylkill River (stage = 0.6 ft-msl)
Area of groundwater flux (A)	ft ²	1,500.00	S-108 Quick Domenico Simulation (In this Appendix)

NOTES:

NA = Not Applicable.

⁽¹⁾ Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia Couunty, Pennsylvania.

⁽²⁾ Diffuse Groundwater Flow (in Million Gallons per Day) = ((Hydraulic Conductivity x Hydraulic Gradient x Area of Groundwater Flux) x 7.481) / (1,000,000)

PENTOXSD

Modeling Input Data

Strea Cod		Elevatio (ft)	Are	a	Slope	PWS (m			Α	pply FC				
186	33 3.30	1.	(sq n .00 190		0.00000		0.00			✓	-			
							Stream Da	ata						
	LFY	Trib Flow		WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>1</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	Time (days)	(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	101.5	0	530	0	0	0	100	7	0	0	0	0
Qh		0	809	0	530	0	0	0	100	7	0	0	0	0
							Discharge D	Data						
	Name	Permi Numbe		-	ermitted Disc Flow	Design Disc Flow	Reserve Factor		CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
AOI	-2 S-108 Chr	257460	(mgd		(mgd) 0	(mgd)	0	0	0	0	0	(mg/L)	7	_
7.01	2 0 100 0111	207 100	0.020	•	Ü			-	Ü	Ü	Ü	100	,	
	Parameter	Name	C	Disc Conc g/L)	Trib Conc (μg/L)	Dis Dail C\	y Hourl	Steam y Cond	CV	Fate Coe		Crit Mod	Max Disc Conc (µg/L)	
PHENA	ANTHRENE			4.17	(μg/L)	0.	.5 0.5		0	0	0	1	0	
Strea Cod		Elevatio (ft)	n Draina Area (sq n	ă	Slope	PWS (m				pply FC				
186	33 0.00	0.			0.00000		0.00			✓	=			
							Stream Da	ata						
	LFY	Trib Flow		WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Strean</u> Hard	<u>1</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(cfs)	(cfs)		(ft)	(ft)	(fps)	(days)	(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.1	0	0	0	1050	0	0	0	100	7	0	0	0	0
Qh		0	0	0	1050	0	0	0	100	7	0	0	0	0
							Discharge D							
	Name	Permi Numbe		-	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
_			(mgd)	(mgd)	(mgd)						(mg/L)		_
			0		0	0	0	0	0	0	0	100	7	
							arameter D							
	Parameter	Name	C	Disc Conc	Trib Conc	C	y Hourl	y Cond	CV	Fate Coe		Crit Mod	d Disc Conc	
DUENI	ANTHRENE		(µ	.g/L) 0	(μg/L) 0	0.	.5 0.5	(μg/L 5 0		0	0	1	(μg/L) 0	
I I I E INF	ANTINENE			U	U	U.	.5 0.5	, 0	0	U	U	1	U	

Hydrodynamics

<u>s</u>	WP Basir	<u>1</u>	Strean	1 Code:			Stream	n Name:	<u>:</u>		
	06B		18	633			BENN	YS RUN			
RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope	Depth (ft)	Width (ft)	WD Ratio	Velocity (fps)	Reach Trav Time (days)	CMT (min)
			Q7-10 Hydrodynamics								
3.300	101.5	0	101.5	0.0396	3E-05	0.4951	530	1070.4	0.3869	0.5210	1000+
0.001	102.2	0	102.2	NA	0	0	0	0	0	0	NA
					Q	h Hydr	odynan	nics			
3.300	809	0	809	0.0396	3E-05	1.2338	530	429.58	1.2373	0.1629	1000+
0.001	811.54	0	811.54	NA	0	0	0	0	0	0	NA

Wasteload Allocations

RMI	Name	Permit N	lumber						
3.30	AOI-2 S-108 Chr	2574	601						
				ı	AFC				
Q7	7-10: CCT (mir	1) 15	PMF	0.008	Analysis	pH 7	Analysis	Hardness	100
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
			(μg/L)		(µg/L)		(μg/L)	(μg/L)	(μg/L)
	PHENANTHRENE		0	0	0	0	5	5	114.325
				c	FC				
Q7-10:	CCT (min	720	PMF	0.059	Analysis	pH 7	Analysi	s Hardness	100
	Parameter		Stream Conc.	Stream CV	Trib Conc.	Fate Coef	WQC	WQ Obj	WLA
			(μg/L)		(μg/L)		(μg/L)	(μg/L)	(µg/L)
	PHENANTHRENE		0	0	0	0	1	1	152.485
				т	НН				
Q7-10:	CCT (min	720	PMF	NA	Analysis	spH NA	Analysi	s Hardness	NA
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
			(µg/L)		(µg/L)		(μg/L)	(μg/L)	(μg/L)
	PHENANTHRENE		0	0	0	0	NA	NA	NA
				C	CRL				
Qh:	CCT (min) 72	0 PMF	0.117					
	Parameter		Stream Conc	Stream CV	Trib Conc	Fate Coef	WQC	WQ Obj	WLA
			(µg/L)		(μg/L)		(μg/L)	(μg/L)	(µg/L)
	PHENANTHRENE		0	0	0	0	NA	NA	NA

Table F.38
S-295 PENTOXSD Input Data
AOI 2 Shallow Groundwater
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Parameter	Unit	Value	Source
River Mile Index (at discharge point)	mile	3.3	USGS Philadelphia Quadrangle Map
River Stage Elevation (at discharge point)	ft	1.0	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,905.00	Pennsylvania Gazetteer of Streams PADEP/USGS
Q ₇₋₁₀ Stream Flow	ft ³ /s	101.5	USGS-PADEP Low-Flow Statistics Website.
O ₇₋₁₀ Reach Width	ft	530	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
Q _h Stream Flow	ft ³ /s	809.00	USGS-PADEP Low-Flow Statistics Website.
Q _h Reach Width	ft	530.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	Calculated by PENTOX
River Mile Index (<u>at confluence</u>)	mile	0.001	USGS Philadelphia Quadrangle Map
River Stage Elevation (at confluence)	ft	0.50	Water-Resources Investigations Report 01-4218 ⁽¹⁾
Drainage Area	mi ²	1,912.00	Pennsylvania Gazetteer of Streams PADEP/USGS
O ₇₋₁₀ Stream Flow	ft ³ /s	Calculated by PENTOX	NA
O ₇₋₁₀ Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q ₇₋₁₀ Reach Depth	ft	Calculated by PENTOX	NA
O _h Stream Flow	ft ³ /s	Calculated by PENTOX	NA
Q _h Reach Width	ft	1,050.00	USGS Philadelphia Quadrangle Map
Q _h Reach Depth	ft	Calculated by PENTOX	NA
Diffuse Groundwater Flow	million gallons per day	0.0025	Calculated ⁽²⁾
Hydraulic Conductivity (K)	ft/d	24.0	S-295 Quick Domenico Simulation (In this Appendix)
Hydraulic Gradient (i)	ft/ft	0.00910	Calculated between S-295 and Schuylkill River (stage = 0.6 ft-msl)
Area of groundwater flux (A)	ft ²	1,500.00	S-295 Quick Domenico Simulation (In this Appendix)

NOTES:

NA = Not Applicable.

⁽¹⁾ Simulation of Ground-Water Flow in the Potomac-Raritan-Magothy Aquifer System Near the Defense Supply Center Philadelphia, and the Point Breeze Refinery, Southern Philadelphia Couunty, Pennsylvania.

⁽²⁾ Diffuse Groundwater Flow (in Million Gallons per Day) = ((Hydraulic Conductivity x Hydraulic Gradient x Area of Groundwater Flux) x 7.481) / (1,000,000)

PENTOXSD

Modeling Input Data

Strea Cod		E	levatior (ft)	Α	nage rea (mi)	Slope	PWS (mg				pply FC				
186	33 3.	30	1.0			0.00000		0.00			✓	_			
								Stream Da	nta						
	LFY		rib S low	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Stream</u> Hard	<u>1</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(0	cfs)	(cfs)		(ft)	(ft)	(fps)		(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.	1	0	101.5	0	530	0	0	0	100	7	0	0	0	0
Qh			0	809	0	530	0	0	0	100	7	0	0	0	0
							D	ischarge D	ata						
	Name		Permit Numbe	r Di	sc	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
_						(mgd)	(mgd)						(mg/L)		_
AOI	-2 S-295 P	b	257460	1 0.00	0245	0	0	0	0	0	0	0	100	7	
								arameter D							
	Paramete	er Nan	ne		Disc Conc (μg/L)	Trib Conc (μg/L)	Dise Daily C\	/ Hourly	Stean y Cond (µg/L	c CV	Fate Coe		Crit Mod	Max I Disc Conc (μg/L)	
LEAD					338	0	0.	5 0.5		0	0	0	1	0	
Strea Cod		E	levatior (ft)	Α	nage rea mi)	Slope	PWS (mg				pply FC				
186	33 0.	00	0.4			0.00000		0.00			✓	_			
								Stream Da	ıta						
	LFY		rib S low	Stream Flow	WD Ratio	Rch Width	Rch Depth	Rch Velocity	Rch Trav Time	<u>Tributa</u> Hard	<u>ry</u> pH	<u>Stream</u> Hard	<u>1</u> pH	<u>Analysi</u> Hard	<u>s</u> pH
	(cfsm)	(0	cfs)	(cfs)		(ft)	(ft)	(fps)	(days)	(mg/L)		(mg/L)		(mg/L)	
Q7-10	0.	1	0	0	0	1050	0	0	0	100	7	0	0	0	0
Qh			0	0	0	1050	0	0	0	100	7	0	0	0	0
							D	ischarge D	ata						
	Name		Permit Numbe	r Di	sc	ermitted Disc Flow	Design Disc Flow	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard	Disc pH	
_						(mgd)	(mgd)						(mg/L)		_
				(0	0	0	0	0	0	0	0	100	7	
								arameter D							
	Paramete	er Nan	ne		Disc Conc	Trib Conc	Dise Daily CV	/ Hourly	,	CV	Fate Coe		Crit Mod	Conc	
					(μg/L)	(μg/L)		- o-	(μg/L					(μg/L)	
LEAD					0	0	0.	5 0.5	0	0	0	0	1	0	

Hydrodynamics

<u>s</u>	WP Basir	<u>1</u>	Stream	n Code:			Stream	n Name	_		
	06B		18	633			BENN	YS RUN			
RMI	Stream Flow	PWS With	Net Stream Flow	Disc Analysis Flow	Reach Slope	Depth	Width	WD Ratio	Velocity	Reach Trav Time	CMT
-	(cfs)	(cfs)	(cfs)	(cfs)		(ft)	(ft)		(fps)	(days)	(min)
					Q7-	-10 Hyd	Irodyna	mics			
3.300	101.5	0	101.5	0.00379	3E-05	0.4951	530	1070.6	0.3869	0.5211	1000+
0.001	102.2	0	102.2	NA	0	0	0	0	0	0	NA
					Q	h Hydr	odynan	nics			
3.300	809	0	809	0.00379	3E-05	1.234	530	429.51	1.2370	0.163	1000+
0.001	811.54	0	811.54	NA	0	0	0	0	0	0	NA

Wasteload Allocations

RMI	Name F	Permit Number						
3.30	AOI-2 S-295 Pb	2574601	_					
				AFC				
Q7-	-10: CCT (min)	15 PM	F 0.008	Analysis	pH 7	Analysis	Hardness	100
	Parameter	Strea Con (µg/L	c CV	Trib Conc (μg/L)	Fate Coef	WQC (μg/L)	WQ Obj (μg/L)	WLA (μg/L)
	LEAD	0	0	0	0	64.581	81.645	18726.02
		Dissolv	ed WQC. D	issolved W0	QC. Chem	ical translate	or of 0.791 ap	plied.
			(CFC				
Q7-10:	CCT (min)	720 PI	VF 0.059	Analysis	pH 7	Analysis	s Hardness	100
	Parameter	Strean Conc	CV	Conc.	Fate Coef	WQC	WQ Obj	WLA
		(μg/L)		(μg/L)		(μg/L)	(μg/L)	(μg/L)
	LEAD	0	0	0	0	2.517	3.182	5036.83
		Cnemic	al translator: -	•	рпеа.			
				ТНН				
Q7-10:	CCT (min)	720 PN	IF NA	Analysis	pH NA	Analysis	s Hardness	NA
	Parameter	Strean Conc (μg/L)	CV	Trib Conc (µg/L)	Fate Coef	WQC (μg/L)	WQ Obj (μg/L)	WLA (μg/L)
-	LEAD	0	0	0	0	NA	NA	NA
				CRL				
Qh:	CCT (min)	720 PI	VIF 0.117					
	Parameter	Strea Con	CV	Conc	Fate Coef	WQC	WQ Obj	WLA
		(μg/L	-)	(µg/L)		(µg/L)	(μg/L)	(µg/L)
	LEAD	0	0	0	0	NA	NA	NA

APPENDIX G

Development of Site-Specific Standards and Risk Assessment

APPENDIX G DEVELOPMENT OF SITE-SPECIFIC STANDARDS AOI 2: SUNOCO PHILADELPHIA REFINERY PHILADELPHIA, PENNSYLVANIA

Based on the current and future intended non-residential site use, an exposure assessment was conducted for all compounds in surficial soil which exceeded the non-residential statewide health standards in AOI 2. Potential human health exposures for the Refinery are for an industrial worker scenario.

Direct contact exposure pathways to surface soil, groundwater, and LNAPL is for the industrial scenario because of Sunoco's established excavation procedures, PPE requirements and soil handling procedures, as they are described in Appendix K of the 2004 Current Conditions Report (CCR). However, because direct contact to surface soils could occur outside of excavation activities, shallow soil samples were collected in AOI 2 to further evaluate this pathway under a non-residential (on-site worker) scenario.

Based on the recent characterization data collected, concentrations of benzene and lead were detected above the non-residential soil MSCs in surficial soil (0-2 feet). In accordance with Section IV of the PADEP's Technical Guidance Manual (TGM) (dated June 8, 2002), to reduce the list of compounds carried through the risk assessment, the COCs listed above were further screened against the EPA Region III Risk-Based Concentrations RBCs (aka, EPA Regional Screening Levels) for industrial soil; however, from the above listed compounds, only lead also exceeded the Region III's RBCs.

For both compounds that exceed both the non-residential statewide health standards, site-specific standards were calculated using PADEP default intake parameters for an on-site worker and, for benzene, a risk level of 10⁻⁴. For calculating a site-specific standard for on-site workers exposed to lead, Sunoco used the Society of Environmental Geochemistry and Health (SEGH) model used by PADEP to develop the non-residential MSC. The input parameters used to develop the site-specific standards for benzene and lead are provided in Tables G-1 and G-2, respectively.

The site-specific standards for the organic compounds (calculated in Tables G-1 and G-2) are as follows:

	Calculated Site-Specific
Compound	Standard
	(mg/kg)
Benzene	2,160
Lead	3,140

The site-specific screening level for benzene was calculated for inhalation, based on the calculations specified in 25 Pa. Code § 250.306(b)(1). Based on these calculations and PADEP's default parameters, PADEP's non-residential direct contact MSC default value for benzene in surface soil is 21,522 mg/kg. To develop a site-specific criteria for benzene, the target risk level used by the PADEP was updated in consideration of site-specific conditions, from 1E-5 to 1E-4. As presented in Table G-1, based on the revised target risk level, the derived site-specific standard for benzene in soil is 2,160 mg/kg (rounded) for an onsite worker, and is consistent with the values used in the previous SCR/RIR prepared for AOIs 1, 4, 6, 5, 8 and 9.

Concentrations of benzene detected in the surface soil samples collected in AOI 2 are below the site-specific standards and, therefore, risk to an on-site worker due to exposure is considered to be within the acceptable ACT 2 range.

The site-specific screening level for lead was calculated for ingestion. As presented in 25 Pa. Code § 250.306(e), Appendix A, Table 7, the non-residential soil screening value for lead is based on the method presented in the report 'The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil' (Wixson, 1991). The model used by the PADEP and developed by SEGH was also used to calculate the site specific criterion for the refinery. Based on the SEGH model and PADEP's default parameters, PADEP's non-residential direct contact MSC default value for lead in surface soil is 1,000 mg/kg. To develop a site-specific criteria for lead, some of the parameters used by the PADEP were updated in consideration of site-specific conditions and updated lead data collected from recent studies. These parameters are discussed in

the following paragraphs.

Target blood lead concentration (T) – The default target blood lead concentration used by the PADEP to develop the non-residential MSC is 20 ug/dL; however, the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) recommends that worker blood lead levels be maintained below 40 ug/dL (OSHA, 29 CFR 1910.1025) to prevent adverse health effects for most workers from exposure to lead throughout a working lifetime. To minimize adverse reproductive health effects, OSHA further recommends that the blood lead levels of workers (both male and female) who intend to have children should be maintained below 30 ug/dL. Based on the action levels provided by OSHA the value used for T in the site specific calculation has been revised to 30 ug/dL.

Geometric mean background blood lead concentration (B) – B is the background blood lead concentration in the target population from sources other than soil and dust. The PADEP's default value for B is 4 ug/dL and, as summarized in PADEPs reference document (Wixson, 1991), is based on data gathered in the United Kingdom from young children. The US Center for Disease Control and Prevention (CDC) in Atlanta, GA has monitored blood lead levels in US children and adults since 1976 and, based on the most recent results published by the National Center for Environmental Health of the CDC (NCEH, 2005), the mean blood lead concentration for an adult 20 years of age or older is 1.56 ug/dL. Based on the more recent study by the US CDC, the value used for B in the site specific calculation has been revised to 1.56 ug/dL.

Slope of blood lead to soil lead (δ) – The PADEP's default value for δ is 7.5 ug/dL blood per ug/g soil; however, based on recommendations by the United Kingdom's Department for Environment, Food, and Rural Affairs (DEFRA, 2002) the reasonable range of δ values is between 2 and 5 ug/dL blood per ug/g soil and should be selected based on site-specific information. Based on the DEFRA's guidance, low values of δ relate primarily to groups of older children, well maintained (dense) vegetative cover, low bioavailability, heavier textured soils, and good personal

grooming habits. Higher values of δ tend to be found in groups of children between the ages of 18 and 24 months, sparse vegetation, soluble lead salts, light textured or soils with low organic matter, and poor personal grooming habits. Based on the suggested range for δ by the DEFRA and because access to the refinery is restricted and PPE is required we believe a value of 7.5 ug/dL is too conservative. Because the soils at the refinery are sandy with low organic matter we selected the highest value within the range suggested by the SEGH, 5.0 ug/dL.

As presented in Table G-2, based on the revised parameters, the derived site-specific standard for lead in soil is 3,140 mg/kg for a refinery worker, and is consistent with the value calculated in the SCR/RIR prepared for AOI 9. Concentrations of lead detected in the surface soil samples collected in AOI 2 are below the site-specific standard, with the exception of one sample (S-318_1-2). With the exception to this sample, risk to an on-site worker due to exposure is considered minimal. Potential lead exposure within the areas of S-318_1-2 will be addressed by Sunoco through implementation of a remedy which will either remediate the lead concentration in shallow soil or eliminate the potential pathway to on-site workers.

In addition to calculating the site-specific standards for benzene and lead, the cumulative risk of exposure was also calculated. Lead exposure is dependent on the blood/lead concentration and not risk based; therefore, lead could not be incorporated into the cumulative risk calculation.

The cumulative hazard index is the combined index for exposure to non-carcinogenic compounds, and it cannot exceed 1. For AOI 2 none of the non-carcinogenic compounds exceeded the state-wide health standard in soil and, therefore, a cumulative hazard index was not calculated.

The total cumulative risk is the combined risk of exposure to the concentrations of carcinogenic compounds which for AOI 2 is benzene. In accordance with the TGM, the total cumulative risk cannot exceed 10⁻⁴. As presented in Table G-3, the total cumulative risk of exposure to the carcinogenic compounds in AOI 2 is 1.17E-07, and therefore, no remedies are required for AOI 2 to address direct contact to benzene.

References

DEFRA. (2002). Soil Guideline Values for Lead Contamination. Bristol, UK: R&D Publication SGV 10 Environment Agency.

NCEH. (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences. Atlanta, Georgia. NCEH. Pub. No. 05-0570.

Wixson, B.G., (1991). The Society of Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. Trace Substances in Environmental Health. 11-20.

Table G-1 Derivation of Site-Specific Soil Value for Benzene¹

AOI 2 Site Characterization/Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Parameter	Abbreviation	Assumption	Units	Source
Transport Factor	TF	13100	mg/kg / mg/m ³	25 Pa. Code § 250, Appendix A Table 5
Absorption	Abs	1	unitless	25 Pa. Code § 250.307(d)
Exposure Time	ET	8	hr/day	25 Pa. Code § 250.307(d)
Exposure Frequency	EF	180	d/yr	25 Pa. Code § 250.307(d)
Target Risk ²	TR	0.0001	mg/kg	
Inhalation Cancer Slope Factor	CSF _I	0.027	mg/kg-day ⁻¹	25 Pa. Code § 250, Appendix A Table 5
Averaging Time for Carcinogens	AT _C	70	yr	25 Pa. Code § 250.307(d)
Inhalation Factor	IF _{ADJ}	0.4	unitless	25 Pa. Code § 250.307(d)

Site-Specific, Non-Residential (Onsite Worker) Screening Value

2,160 mg/kg 2,160,000 ug/kg

Notes:

1. The site specific screening value was calculated for inhalation based on the calculation specified in 25 Pa. Code 250.307(b)(1)

 $MSC (mg/kg) = \frac{TR \times AT_C \times 365 \text{ days/year } \times TF}{CSF_1 \times Abs \times ET \times EF \times IF_{ADJ}}$

2. The target risk level was modified from PADEP's default (1E-5) to 1E-4.

Table G-2 Derivation of Site-Specific Soil Value

for Lead1

AOI 2 Site Characterization/Remedial Investigation Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

Parameter	Abbreviation	Assumption	Units	Source
Blood lead target concentration	Т	30	ug/dL	OSHA 29CFR1910.1025 App A
Geometric standard deviation of the blood lead distribution	G	1.4	unitless	25 Pa. Code § 250, Appendix A Table 7
Geometric mean background blood lead concentration from sources other than soil or dust (for ages > 20 years old)	В	1.56	ug/dL	NCEH Pub. No. 05-0570 (NCEH, 2005)
Number of standard deviations corresponding to the degree of protection required for the population at risk	n	1.645	unitless	25 Pa. Code § 250, Appendix A Table 7
Response of the blood lead versus soil lead relationship	δ	5	ug/dL blood / ug/g soil	DEFRA, 2002

Site-Specific, Non-Residential (Onsite Worker) Screening Value

3,140 ug/g (mg/kg) 3,140,000 ug/kg

Notes

1. The site specific screening value for Lead was calculated for ingestion based on the SEGH model as specified by 25 Pa. Code 250.306(e)

$$MSC (mg/kg) = \underbrace{[(T/G^n) - B] \times 1000}_{S}$$

DEFRA. (2002). Soil Guideline values for Lead Contamination. Bristol, UK: R&D Publication SGV 10 Environment Agency.

NCEH. (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Laboratory Sciences.

Atlanta, Georgia. NCEH. Pub. No. 05-0570.

Table G-3 Summary of Site Specific Cumulative Risk Evaluation AOI 2 Site Characterization Report Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

				Benzer	ne (71-43-2)	Le	ead (7439-92-1)
Location ID	Sample ID*	Sample Interval	Sample Date	Reported Result (ug/kg)	Calculated Risk	Reported Result (ug/kg)	Calculated Blood Lead Concentration⁴ (ug/dL)
			Region III RBC ⁵	5,400		800	
AOI-2	C-137_1-2	1-2	5/27/2010	ND		251	3
AOI-2	S-135_0-2	0-2	6/10/2010	ND		4	3
AOI-2	S-297_0-2	0-2	5/4/2010	ND		59	3
AOI-2	S-298_1-2	1-2	5/25/2010	1,200	5.58E-08	96	3
AOI-2	S-299_0-2	0-2	6/8/2010	ND		12	3
AOI-2	S-300_0-2	0-2	5/19/2010	130	6.04E-09	168	3
AOI-2	S-302S_1-2	1-2	5/12/2010	ND		48	3
AOI-2	S-303_0-2	0-2	5/21/2010	140	6.51E-09	121	3
AOI-2	S-305S_0-2	0-2	5/19/2010	ND		161	3
AOI-2	S-306_0-2	0-2	5/20/2010	160	7.43E-09	145	3
AOI-2	S-307_0-2	0-2	6/10/2010	ND		48	3
AOI-2	S-308_1-2	1-2	4/30/2010	ND		19	3
AOI-2	S-309_1-2	1-2	4/29/2010	24	1.12E-09	65	3
AOI-2	S-310_1-2	1-2	4/29/2010	ND		41	3
AOI-2	S-311_1-2	1-2	4/29/2010	52	2.42E-09	166	3
AOI-2	S-312_1-2	1-2	4/28/2010	ND		54	3
AOI-2	S-313_0-2	0-2	5/6/2010	620	2.88E-08	335	3
AOI-2	S-314_1-2	1-2	5/11/2010	ND		227	3
AOI-2	S-315_1-2	1-2	5/11/2010	190	8.83E-09	80	3
AOI-2	S-316_1-2	1-2	5/10/2010	ND		384	3
AOI-2	S-317_0-2	0-2	5/7/2010	ND		20	3
AOI-2	S-318_1-2	1-2	5/12/2010	6	2.79E-10	860	3
			Cumulative Total 1:		1.17E-07		

Total Cumulative Risk for Carcinogens²: 1.17E-07

< 1 in 10,000

Notes:

ND - Not Detected

BOLD - Indicates locations with concentrations exceeding PADEP's Non-Residential Soil MSC.

¹ Cumulative total of detected concentrations greater than the PADEP Non-Residential Soil MSC.

² Total cumulative risk of detected concentrations of carcinogenic compunds (benzene) greater than the PADEP Non-Residential Soil MSC

³ Total Hazard Index of detected concentrations of non-carcinogenic compunds greater than the PADEP Non-Residential Soil MSC.

⁴ Calculated based on site specific parameters provided in Table F-6. OSHA, 29CFR1910.1025, Appendix A, recommends that blood lead levels be maintained below 30 ug/dL.

⁵ http://www.epa.gov/reg3hscd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2010.pdf

^{*}All soil samples collected and analyzed were unsaturated.

APPENDIX H

LNAPL Characterization Data

Appendix H Table 1

AOI 2 LNAPL Characterization Summary Table Sunoco Philadelphia Refinery Philadelphia, Pennsylvania

	Interpreta	tion of Product Types	Proportions, and Weathering				Similarities to Other Samp	les in Study
			Characterization Resu	Its Compiled for C	CR (TGI Job No. 040	46 - Analyzed in March 20	04)	
Well ID	Density g/cc (60°F)	LNAPL Type(s)	Torkelson LNAPL Type(s)	Proportion (%)	Weathering	Quite Similar To	Fairly Similar To	Somewhat Similar To
			?Gasoline	Trace			S-33, S-56, & S-79	All other gasoline in study
S-64/N-48	0.9049	Lube Oil	Lube Oil	50	Extreme	A-47, N-48, & S-68	A-13	All other lube oils in study
			Middle Distillate	50				All other middle distillates in study
			Kerosene	50				
S-109 ¹	NA	Kerosene	Residual Oil	30	NA	NA	NA	NA
			Naphtha	20				
			Naphtha	50				
S-110 ¹	NA	Naphtha	Gasoline	30	NA	NA	NA	NA
			Kerosene	20				
S-130	0.8623	Condensate	Condensate	100	Extreme			BF-106
S-138	0.8957	Lube Oil	Lube Oil	90	Extreme		B-39, B-129, S-59, S-78, & S-117	All other gasoline in study
5-138	0.8957	Lube Oil	?Gasoline	10	Extreme	Unique		
S-142	NA	Residual Oil	Residual Oil	100	Extreme	N-78	S-21, S-92, & S-158	All other residual oils in study except A-13
C 1E0	0.0003	Danielus I Oil	Residual Oil	90	Evetra no a			
S-158	0.8692	Residual Oil	?Naphtha	10	Extreme	S-21 & S-92	N-78 & S-142	All other residual oils in study except A-13
		ı	Characterization Results Com	piled for AOI 2 Wo	rk Plan (TGI Job No.	09177 - Analyzed in Dece	mber 2009)	
S-142	0.8790	Residual Oil	Heavier Material	90	Extreme	NA	NA	NA
3-142	0.8790	nesiduai Oii	Gasoline	10	Extreme	IVA	IVA	INA .
		Charact	erization Results Compiled fo	r AOI 2 Site Charac	terization Activities	s (TGI Job No. 10099 - Ana	lyzed in July 2010)	
			Middle Distillate	75	Extreme		S-282	
S-297	0.8229	Middle Distillate	Aviation Gasoline	15	Severe			C-143
			Heavier Material	10	Extreme			All other heavier materials in study
			Middle Distillate	60				S-315
S-313	0.8694	Middle Distillate	Unknown Lt. Material	20	Extreme	Unique		
			Heavier Material	20				All other heavier materials in study
			Middle Distillate	50				S-313
S-315	0.8552	Middle Distillate	Unknown Lt. Material	30	Extreme			S-282
			Heavier Material	20				All other heavier materials in study

Notes:

Heavier material could either be crude oil or residual oil.

g/cc - Grams per cubic centimeter

TGI - Torkelson Geochemistry, Inc.

NA - Not Applicable

? - Tentative identification

CCR - 2004 Sunoco Current Conditions Report

LNAPL - Light Non Aqueous Phase Liquid

All LNAPL results (except for S-109 & S-110) reported were analyzed by TGI.

Product interpretations were provided by TGI.

1. LNAPL results for S-109 and S-110 were obtained from Handex 1996.



Torkelson Geochemistry, Inc.

2528 S. Columbia Place Tulsa, OK 74114-3233

Phone: 918-749-8441 e-mail: BTorkelson@torkelsongeochemistry.com Fax: 918-749-6005

CHAIN-OF-CUSTODY RECORD

Page __1__of ___1___

Project: Sunoco, Inc. Philadelphia Refinery

Location: 3144 Passyunk Avenue, Philadlephia, PA 19145

Proj. No.: AOis 2, 3, & 7 SCRs/RIRs P.O.: Sampled By: Tim Delk

Report/Bill To: Langan Engineering & Env'i Services Address: P.O. Box 1669

Additional Instructions

Samples to be analyzed for Fingerprint (GC Characterization) and Density. Include a "Brief Description/Interpretation" of LNAPL, to be consistent with existing LNAPL types for Sunoco Philadelphia. Wust have data results no later than July 30, 2010.

Requested Turn-Around Time: Data needed by July 30th

Г											
	REMARKS	include a "Brief Description/Interpretation" of LNAPL, to be	consistent with existing LNAPL types for Sunoco Philadelphia.		Times 5-282-080	5-285-1115	0011-162-5	5-313-1035	0-01-512-S	C-143-1130	
						·					
亞											
REQUESTED	Marine										
	Lead Sulfur										
ANALYSES	NAPL Surface Tension NAPL/Water Interfac. Tens.									•	
NALY	Water Surface Tension										
¥	Viscosity	*					~ <				
20	Fingerprint-GC Cheracterization	>					≫				
PRESERVATIVES		-			·					-	
ERV											
PRES	Эгио	X					X				
	Total # OF Vals	*		1	-	-					
	ON BAJ										
	MATRIX	Accd					PPP				
	DATE	PI/SI/C	ا , لا ا		-	^	0/2//2	, ,			
	SAMPLE DESCRIPTION	S-282	S-245	5-297	5-313	5-315	c-143				
	ITEM NO.	*	2	3	4	5	8	7	8	6	9
		701-8-	/ C.	子グアー	AULZ-	AU2-	AUE.7-				

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TIME

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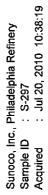
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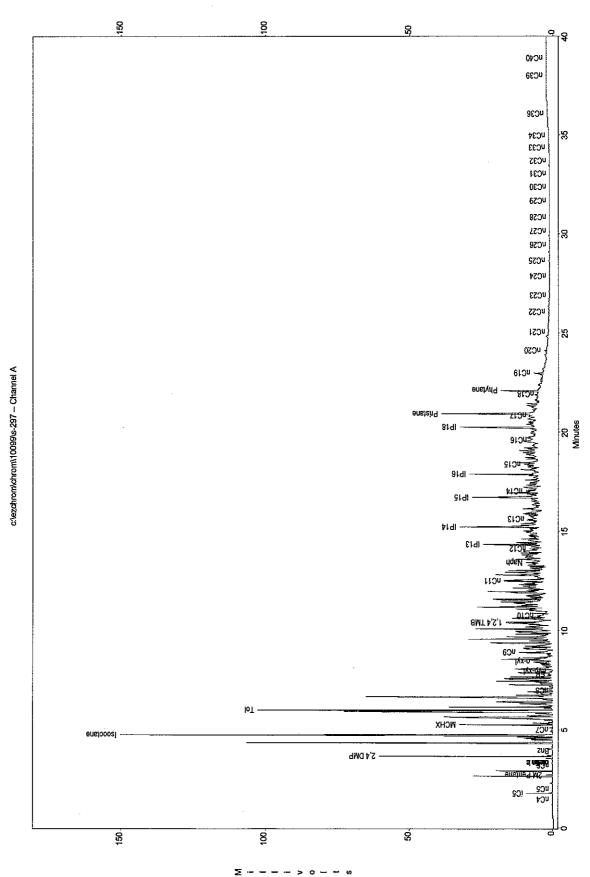
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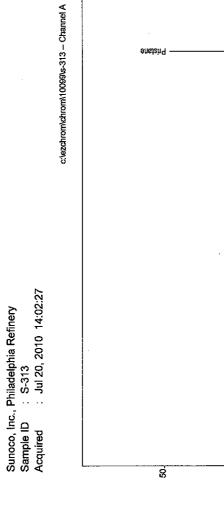
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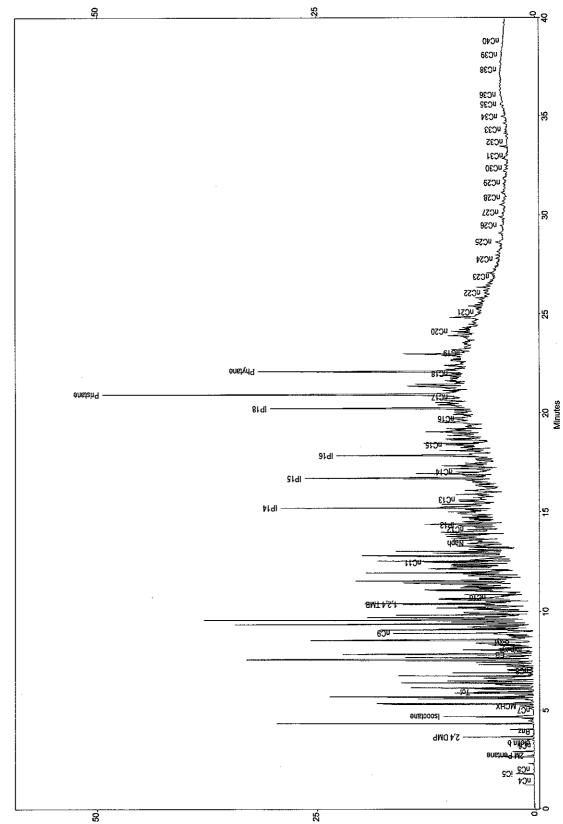
Torkelson Geochemistry, Inc.



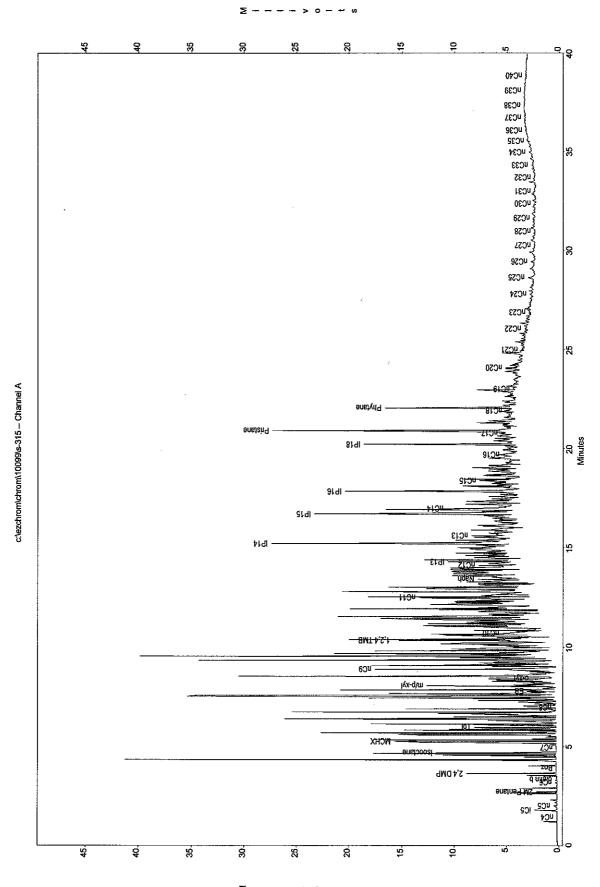


Torkelson Geochemistry, Inc.



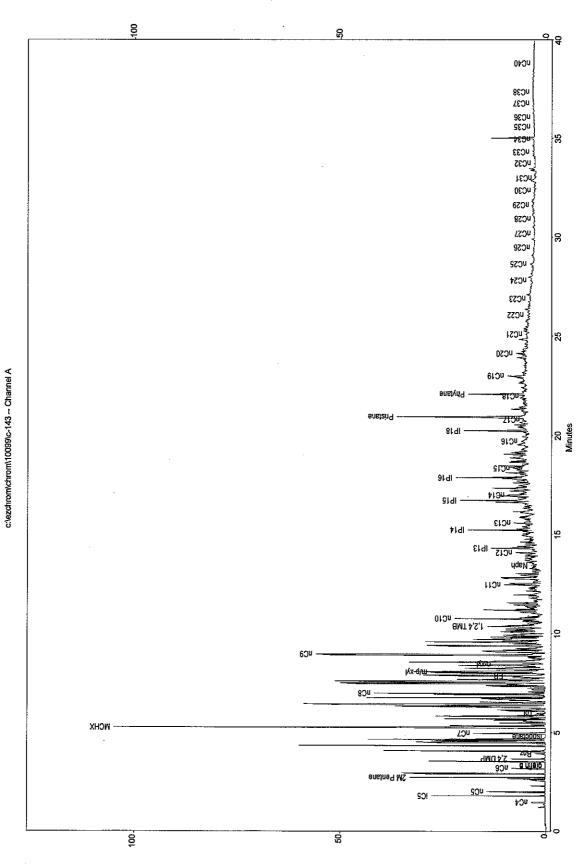


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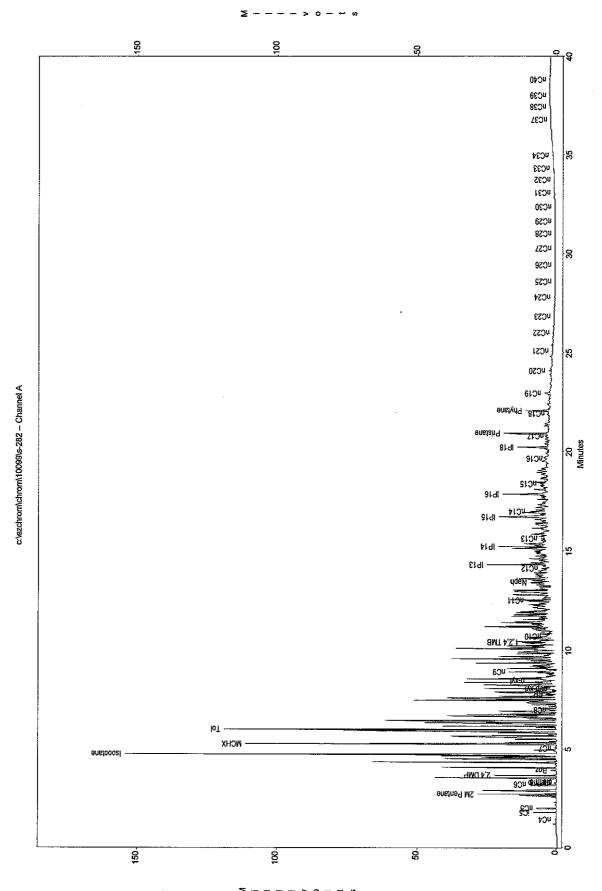


Torkelson Geochemistry, Inc.



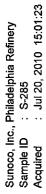


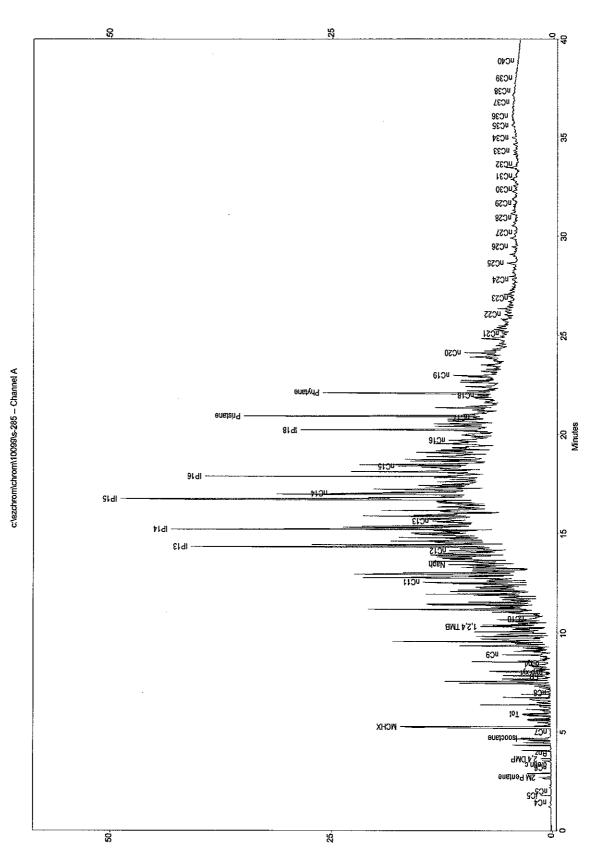
Sunoco, Inc., Philadelphia Refinery Sample ID : S-282 Acquired : Jul 20, 2010 12:19:51



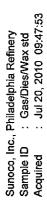
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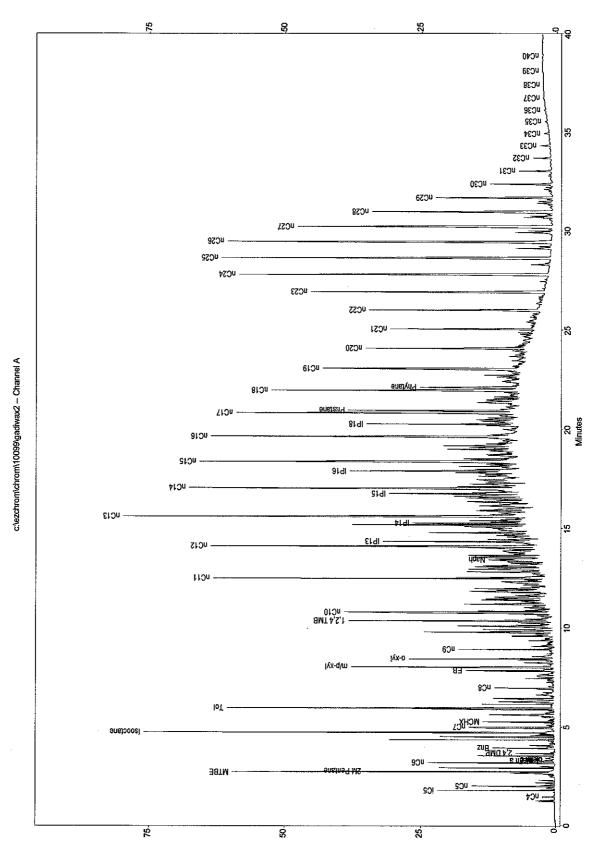


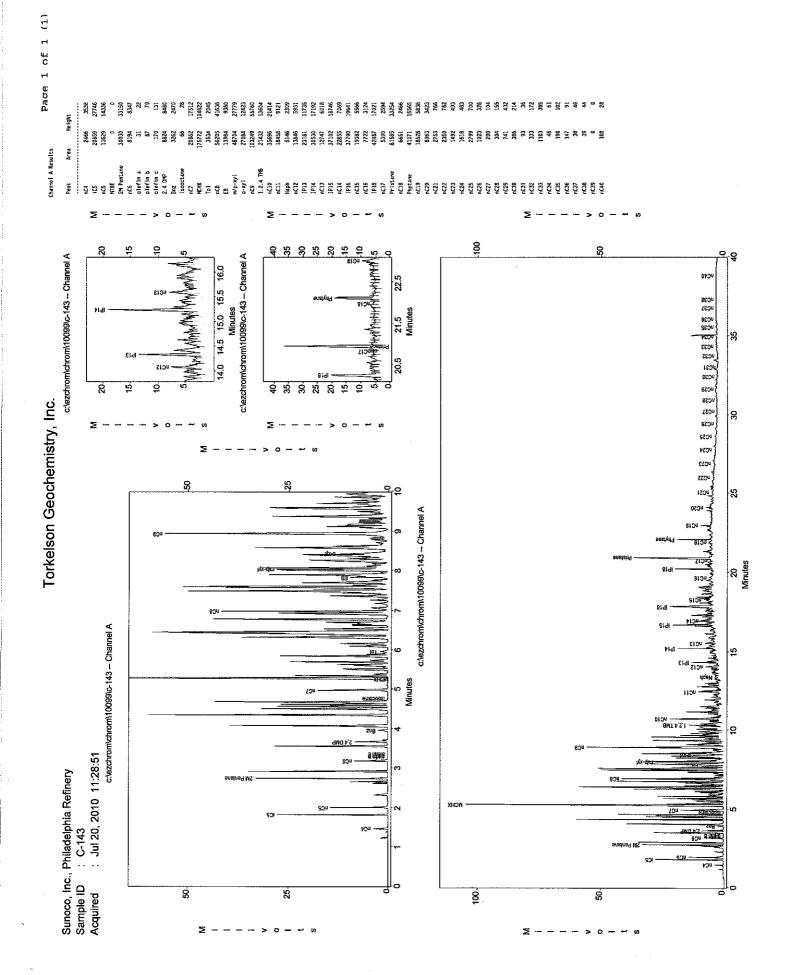


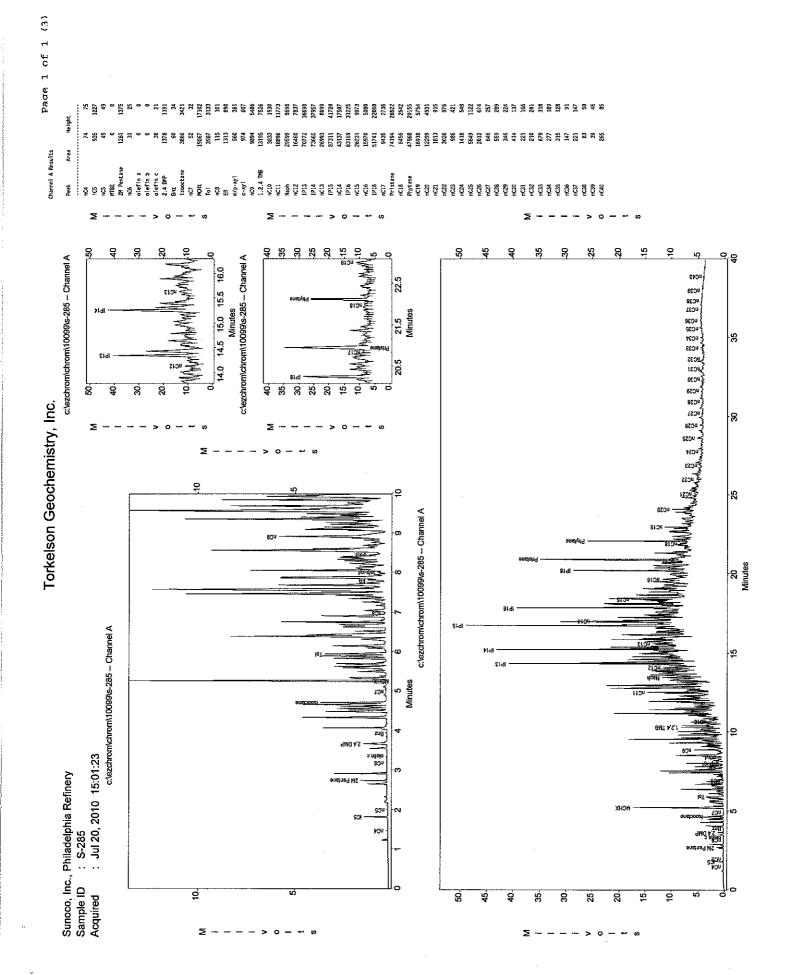


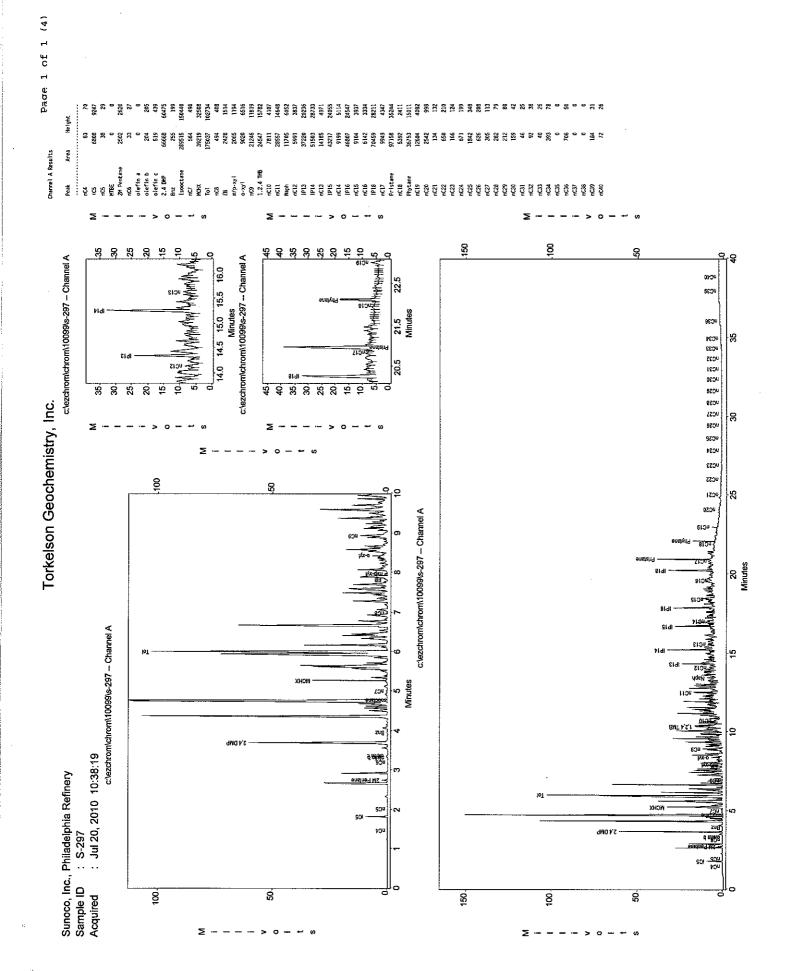
Torkelson Geochemistry, Inc.









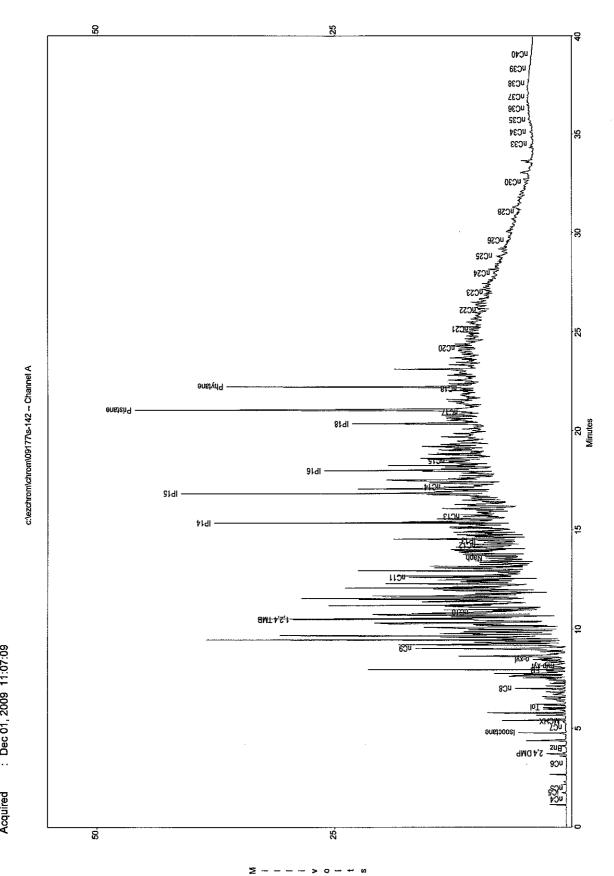


	Torkelso	Torkelson Geochemistry, Inc.		
Density Measurements				
Paar DMA 512 / DMA 60		ASTM Me	ASTM Method 4052	
Sample	Density gm/ml	Temp. of Measurement	Job Number	Date
C-143	0.8676	60F	10099	7/20/10
S-282	0.8104	60F	66001	7/20/10
S-285	0.8921	409	66001	7/20/10
S-297	0.8229	409	66001	7/20/10
S-313	0.8694	60F	66001	7/20/10
S-315	0.8552	409	10099	7/20/10

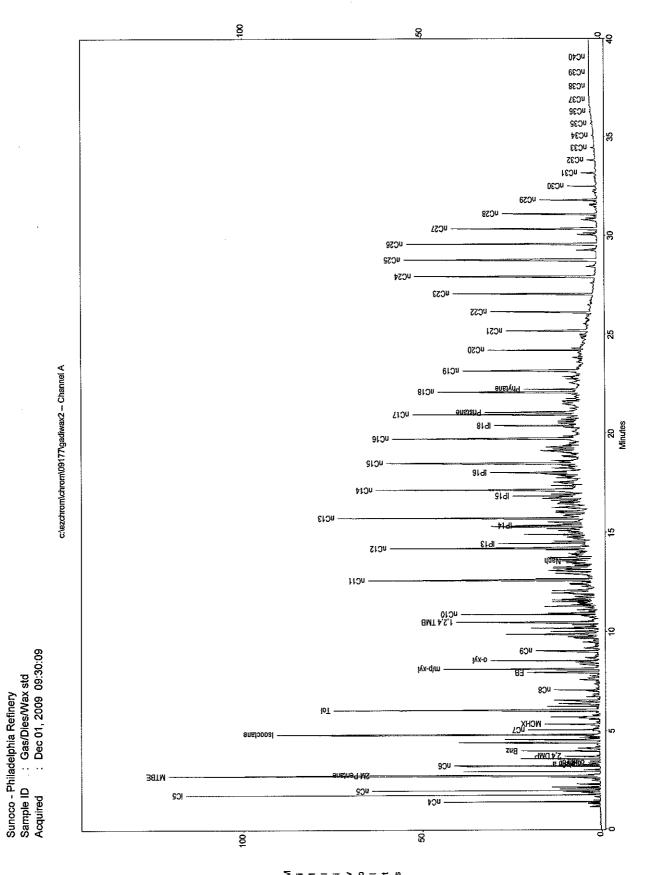
TANTEC CONSULTING CORP CHAIN-OF-MATION MATION PROJECT INFORMATION MATION PROJECT INFORMATION MATION PROJECT WAS 13402024 Task: ENV'L SVCS Project Name TORKELSON GIED CHEMISTRY MINISTRY MORE STANDED Detect Matheway Stander Detect Matheway Stander Matheway 1300 OT C-HOM. NOME 6 X X X MINISTRY MISTERIAL CONTINUES MISTRAND 1300 OT C-HOM. NOME 6 X X X MINISTRY MATION MATION MATION MATION PROJECT MATHEMATICS AND CHEMISTRY MATHON MATHON MATHON MATHON PROJECT MATHON MATHON MATHON MATHON PROJECT MATHON MATHON MATHON MATHON MATHON PROJECT MATHON MA	# 2002 Fage	ANALYSES / WETHOD REMARKS/ REQUEST PRECAUTIONS	3dms33d	7 147 96 F	MV.	 	×	IS NOTANOPHON, PLEMSE	DISKEGARD AND COMPLETE	OTHER ANALYSES AS INDICATED					Disposal by Lab.	Airbill Number:	Company Date Time	CV. 18181111	<u> </u>			
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STANTEC CC FORMATION Property Company Letter 115/2009 CREANER COM Language Languag	ONSULTING CORP (PROJECT INFORMATION	NOCO - PHILADELPHA REP Noct Manager Leaving Medices	boratory:	OPKELSON SIED CHEMISTRY	-Matrix 8 Size **	OT C-40ML			•					ð :	Shipment Method:	Print Name	<u></u>	M			
	STANTEC CC	MATION	olangan. bom] ENV'L SVKS	+	۱ 1∶	ΝĖ	1.							:	nable 🔲 Skin imlant	7	Signature		John			

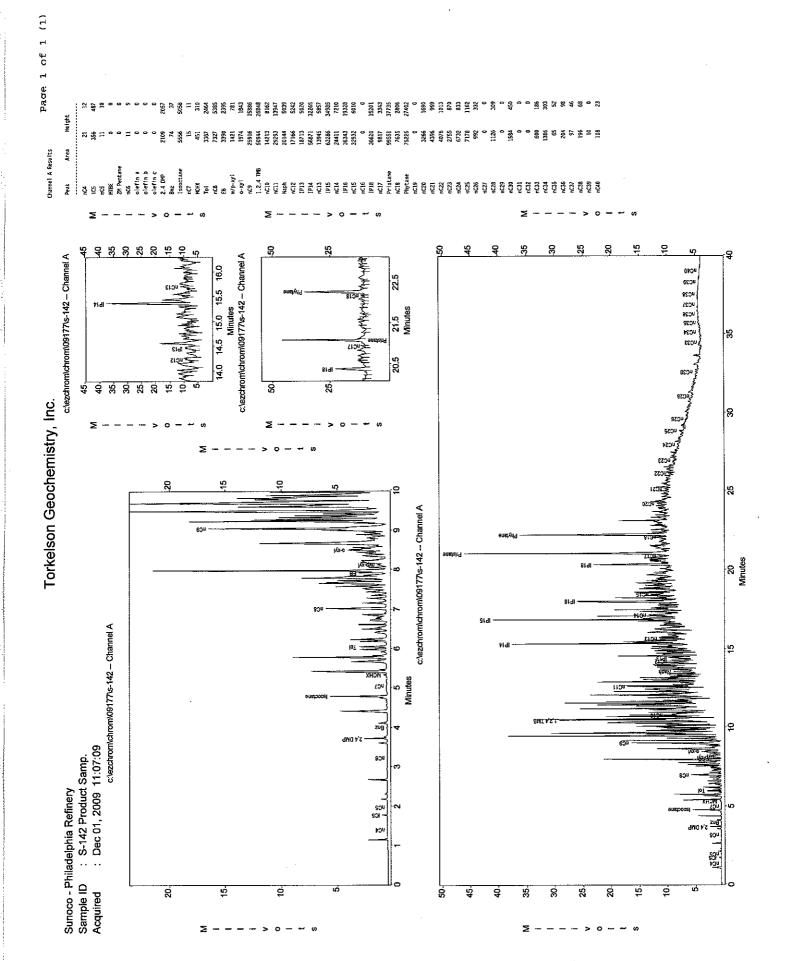
Torkelson Geochemistry, Inc.

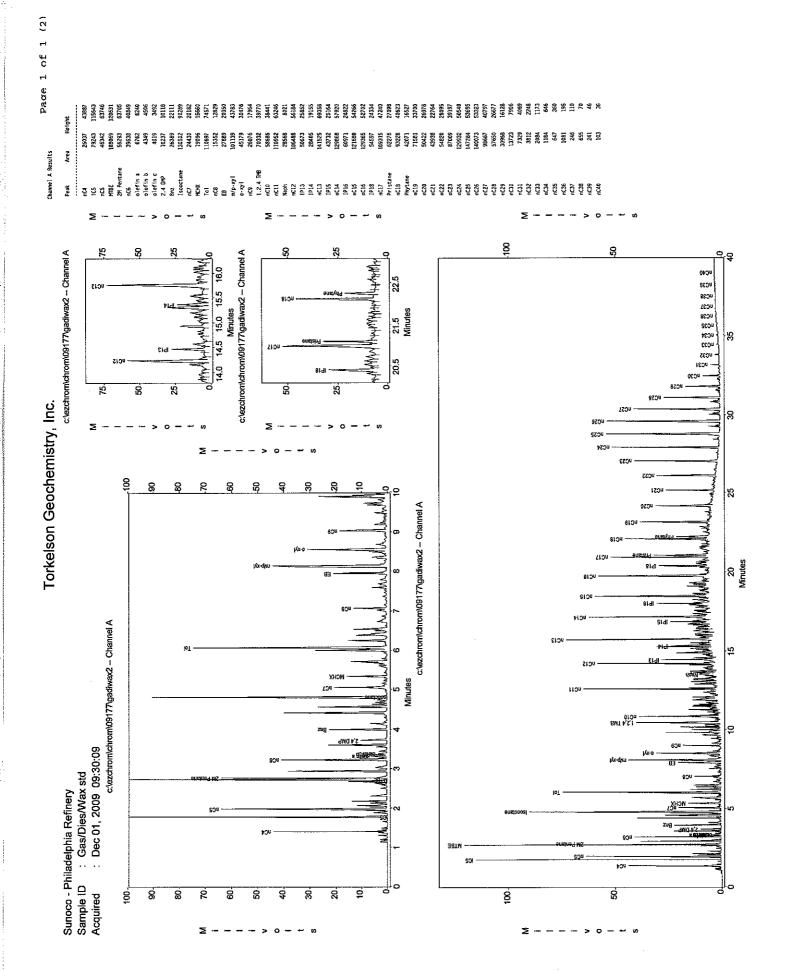
Sunoco - Philadelphia Refinery Sample ID : S-142 Product Samp. Acquired : Dec 01, 2009 11:07:09



Torkelson Geochemistry, Inc.







			Torkelsor	Forkelson Geochemistry, Inc.	, Inc.		
		立	ysical Pro	Physical Properties Measurements	rements		
Sample	TGI Job Number	Density (gm/ml)	Viscosity (centipoise)	Surface Tension Air/Water	Surface Tension Interfacial Tension Surface Tension Air/Water Air/NAPL Advince/cm) Advince/cm) Advince/cm)	Surface Tension Air/NAPL (dynes/cm)	Temperature of Measurements
S-142 Product Sample 09177	09177	0.8790	17.10 NA	4	NA	NA	60F

NA = Not Analyzed



Torkelson Geochemistry, Inc.

2528 S. Columbia Place Tulsa, OK 74114-3233

Phone: 918-749-8441 Fax: 918-749-6005 Report/Bill To: Colleen Costell0

Sun- Philadelphia Refinery COA

Project:

Location: Philadelphia, PA

Address:

Phone: 215.884.0840 215.884.0671

e-mail: Fax:

Sampled By: M. Brad Spancake & Tim Delk

Proj. No.:

P.O.

e-mail: BTorkelson@aol.com

CHAIN-OF-CUSTODY RECORD

				Requested Tum-Around Time:	
30 South 17th St, Suite 1500	Philadelphia, PA 19103	34.0840	34.0671		

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RELINQUISHED BY	ACCEPTED BY	DATE	TIME
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X	Brue Labbo	3204	1705

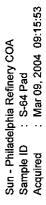
Sarbent Rod Sample

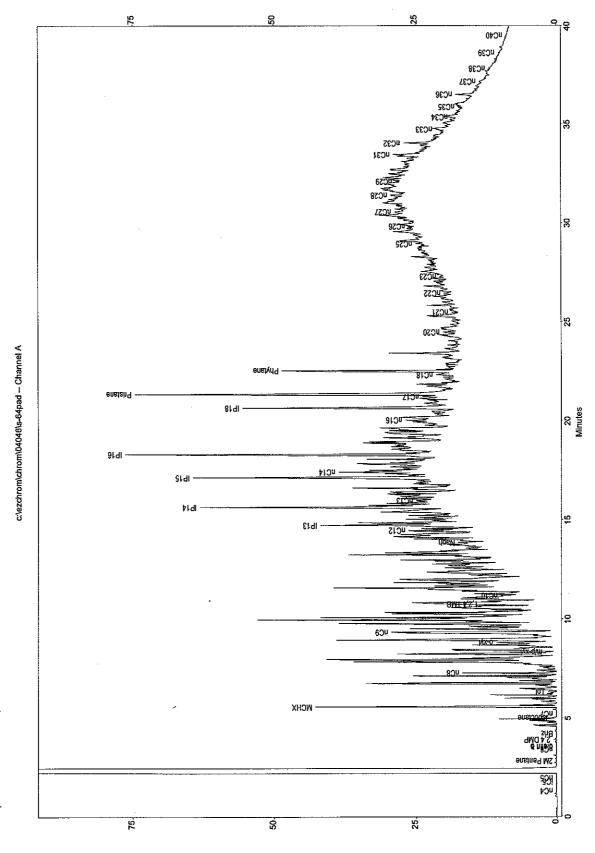
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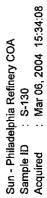
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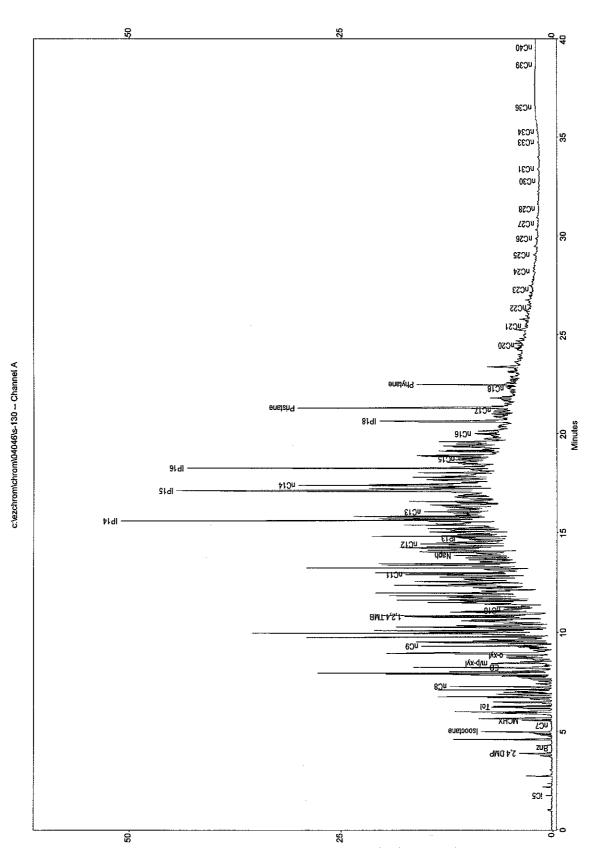
5-162 28-8

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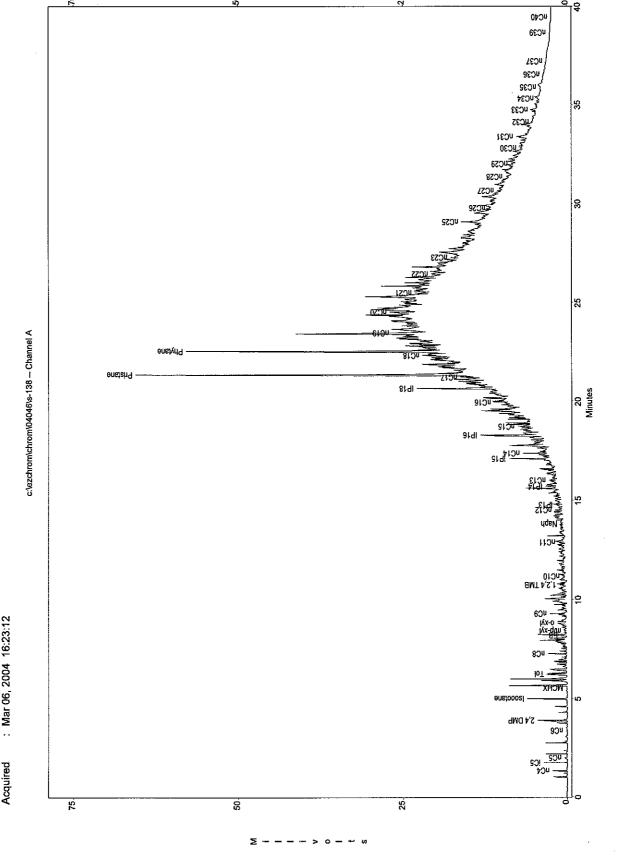




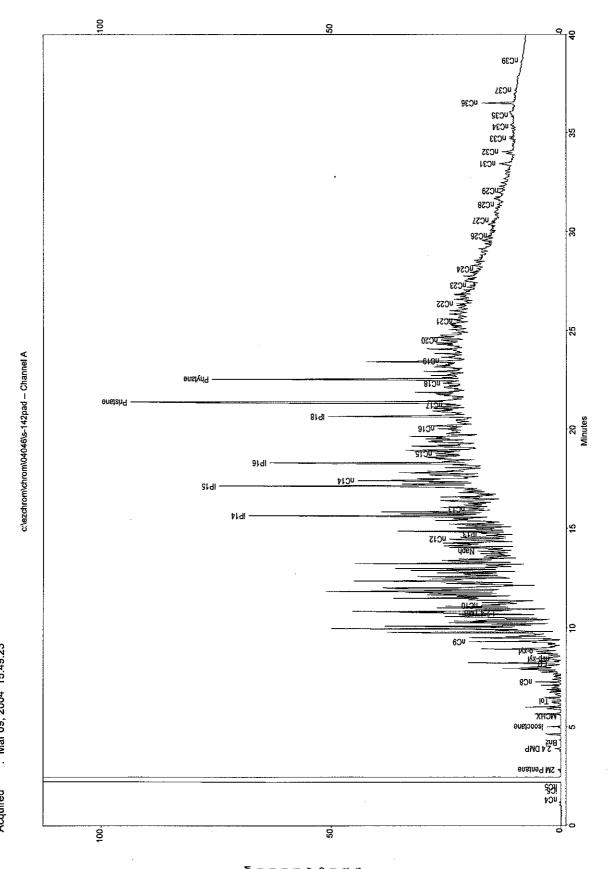


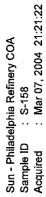


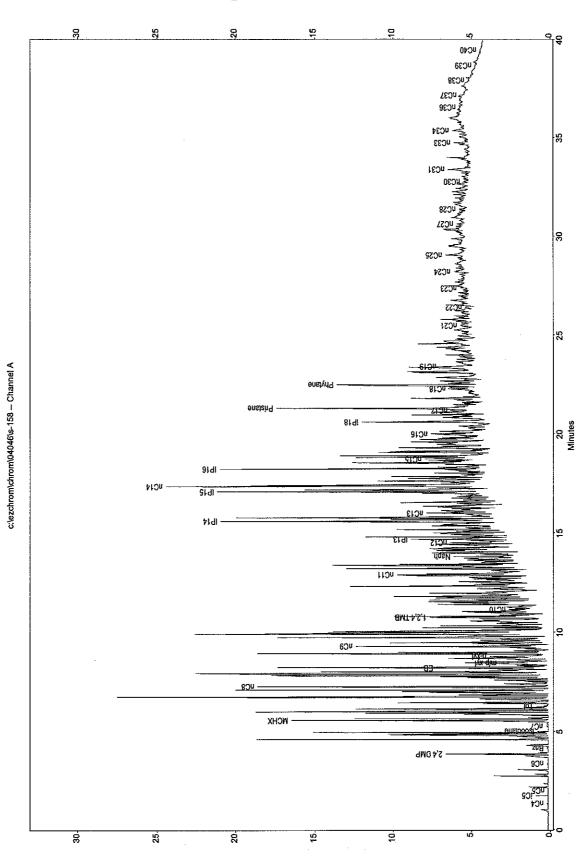
Sun - Philadelphia Refinery COA Sample ID : S-138 Acquired : Mar 06, 2004 16:23:12



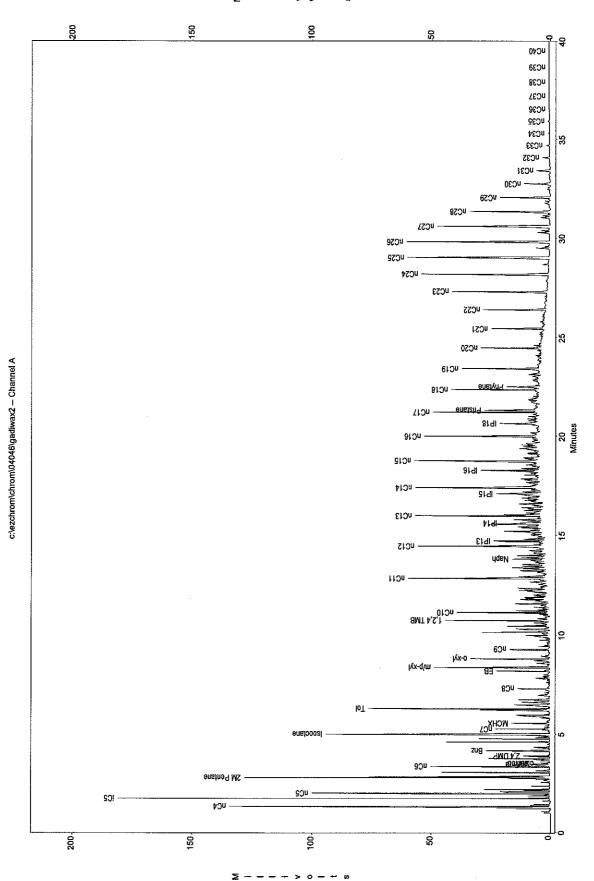
Sun - Philadelphia Refinery COA Sample ID : S-142 Pad Acquired : Mar 09, 2004 15:49:23



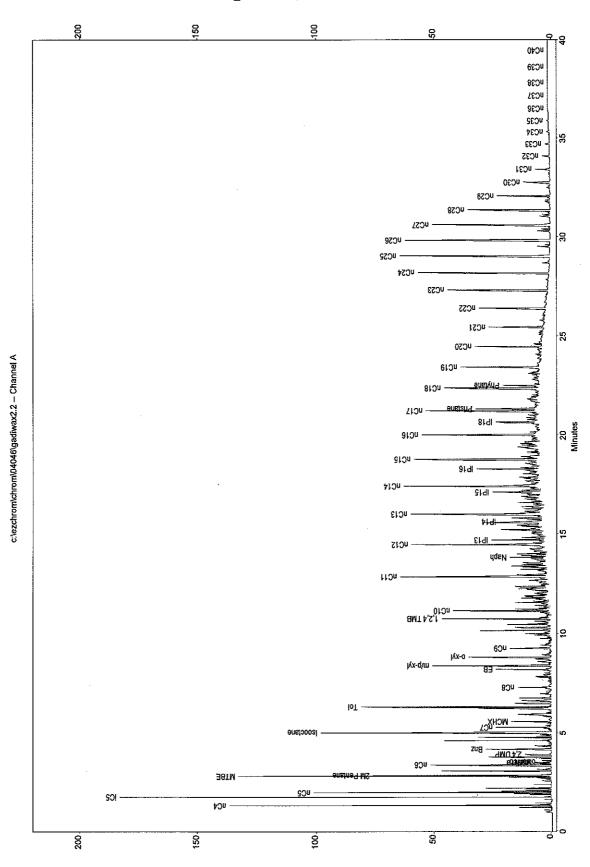




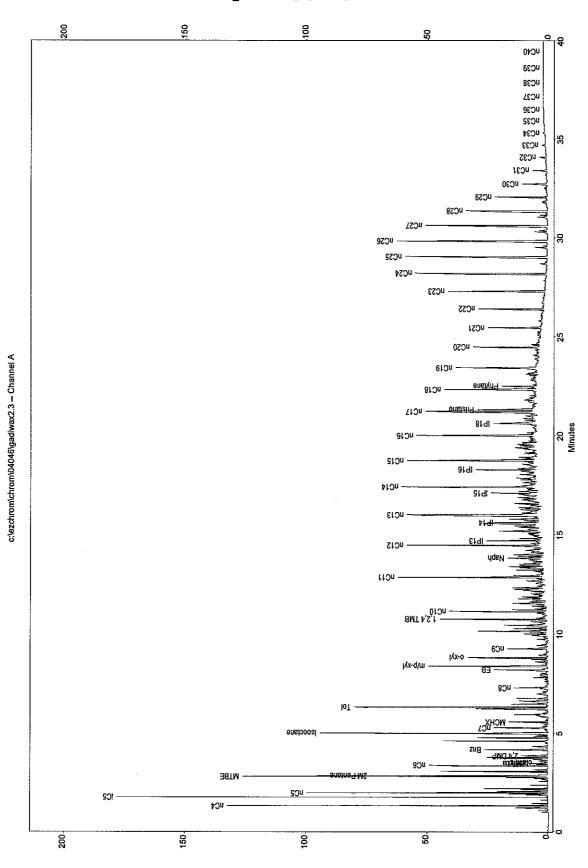
Sun - Philadelphia Refinery COA Sample ID : Gas/Dies/Wax std Acquired : Mar 05, 2004 10:14:50



Sun - Philadelphia Refinery COA Sample ID : Gas/Dies/Wax std Acquired : Mar 06, 2004 11:29:07



Sun - Philadelphia Refinery COA Sample ID : Gas/Dies/Wax std Acquired : Mar 07, 2004 16:27:47



Paar DMA 512 / DMA 6	30	ASTM Method	4052
Sample	Density gm/ml @ 60F	Job Number	Da
A-13	0.9015	04046	
A-14	0.9143	04046	
A-22	0.9356	04046	
A-47	0.8926	04046	
A-133	qns	04046	
B-39	0.8734	04046	
B-43	0.9161	04046	
B-129	0.8645	04046	
B-130	0.9306	04046	
B-144	0.8654	04046	
BF-106	0.8199	04046	
BF-107	0.8671	04046	
C-65	0.9162	04046	
C-106	0.9306	04046	
C-107	0.9371	04046	
N-14	0.9299	04046	
N-25	0.0402	04046	
N-35	0.9205	04046	
N-48	0.9049	04046	
N-52	0.8613	04046	
N-68	0.9211	04046	
N-79	0.8169	04046	
PZ-204	0.9016	04046	
PZ-502	0.9155	04046	
S-21	0.9281	04046	
S-29	0.8550	04046	
S-32	0.8665	04046	
S-33	0.8578	04046	
S-50	0.7508	04046	
S-56	0.8684	04046	
S-59	0.8039	04046	
S-60	0.7898	04046	
S-76	0.7851	04046	
S-79	0.8406	04046	
S-81	0.7948	04046	
S-89	0.8523	04046	
S-92	0.9156	04046	
S-97	0.8653	04046	
S-100	0.7930	04046	
S-103	0.7978	04046	
S-104	0.8787	04046	
S-117	0.8236	04046	
S-124	0.8223	04046	
S-130	0.8623	04046	
S-138	0.8957	04046	
S-158	0.8692	04046	
S-162	0.7498	04046	
SRTF MW-1	0.7705	04046	
West Yard W8	0.7703	04046	

WP 9-2 0.8114 04046 3/9/04

