REMEDIAL INVESTIGATION REPORT
AREA OF INTEREST 4

Philadelphia Energy Solutions Refining and Marketing LLC
Philadelphia Refining Complex
3144 Passyunk Avenue, Philadelphia, Pennsylvania
Sitewide PADEP Facility ID No. 780190
Area of Interest 4 PADEP Facility ID No. 770318

Stantec

Prepared for:

Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Prepared by:
Stantec Consulting Services Inc.

A Patel
Avani Naik Patel
Geologic Specialist

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
ANDREW DAVID KLINGBEIL
GEOLOGIST
No. PG005029

Andrew D. Klingbeil, P.G.
Pennsylvania Registered Geologist # PG005029

Reviewed by:

Jennifer Menges
Jennifer Menges
Principal Consultant, LRS

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Acronyms

API LDRM	American Petroleum Institute LNAPL Distribution and Recovery Model
ACGIH	American Conference of Governmental Industrial Hygienists
AOI	Area of Interest
ANT	Apparent NAPL Thickness
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
C	Celsius
CAP	Corrective Action Process
CCR	Current Conditions Report
CPT	cone penetration test (CPT)
CRP	Community Relations Plan
cm/s	centimeters per second
cm^3s/g	cubic centimeters second per gram
CO&A	Consent Order and Agreement
COC	Constituent of Concern
DLA	Defense Logistics Agency
DSCP	Defense Supply Center Philadelphia
EDB	1,2-Dibromoethane
EDC	1,2-Dichloroethane
EPA	United States Department of Environmental Protection
Evergreen	Philadelphia Refinery Operations, a series of Evergreen Resource Group, LLC
ft bgs	feet below ground surface
ft/d	feet per day
ft^2/d	square feet per day
ft/ft	feet per foot
GIS	Geographic Information System
gpm	gallons per minute
g/ml	grams per milliliter
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
IST	Integrated Science & Technology, Inc.
k	hydraulic conductivity
k_h	horizontal hydraulic conductivity
k_v	vertical hydraulic conductivity
LiDAR	Light Detection and Ranging
LNAPL	Light Non-Aqueous Phase Liquid
LCSM	LNAPL Conceptual Site Model
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
µg/l	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
MOA	Memorandum of Agreement
MSC	Medium Specific Concentration
MTBE	methyl tert butyl ether
NAPL	Non-Aqueous Phase Liquid
NAVD 88	North American Vertical Datum of 1988
NIOSH	National Institute for Occupational Safety and Health
NIR	Notice of Intent to Remediate
NOC	Notice of Contamination
NORR	Notice of Reportable Release
NOWData	National Weather Service Online Weather Data

NRDC	Non-Residential Direct Contact
OSHA	Occupational Safety and Health Administration
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PA FBC	Pennsylvania Fish and Boat Commission
PEL	Permissible Exposure Limit
PES	Philadelphia Energy Solutions Refining and Marketing LLC
PID	Photoionization Detector
PNDI	Pennsylvania Natural Diversity Inventory
PNSY	Philadelphia Naval Shipyard
ppm_v	parts per million by volume
PRCFM	Philadelphia Refining Complex Flow Model
PRM	Potomac-Raritan-Magothy aquifer system
Psi	Pounds per square inch
PWD	Philadelphia Water Department
RACR	Remedial Action Completion Report
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit
RIR	Remedial Investigation Report
RSL	Regional Screening Level
SCR	Site Characterization Report
SHS	Statewide Health Standard
SPT	Standard Penetration Test
SSS	Site-Specific Standard
Sunoco	Sunoco Inc. (R&M)
SPMT	Sunoco Partners Marketing and Terminals L.P.
SVIA-NR	Indoor Air Vapor Intrusion Screening Values – Non-Residential
SWMU	Solid Waste Management Unit
1,2,4-TMB	1,2,4-Trimethylbenzene
1,3,5-TMB	1,3,5-Trimethylbenzene
TDS	Total Dissolved Solids
TEL	Tetraethyl lead
TR	Target Risk
TLV	Threshold Limit Value
USGS	United States Geological Survey
VOC	Volatile Organic Compound

1.0 Introduction

This Remedial Investigation Report (RIR) has been prepared for Area of Interest (AOI) 4 (the site), also known as the No. 4 Tank Farm, at the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Philadelphia Refining Complex (Complex). Sunoco Inc. (R&M) transferred the Complex to PES on September 8, 2012. Sunoco retained the remediation liability prior to this date. The remediation liability was transferred to Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) on December 30, 2013. The remediation program is currently being performed under a Buyer-Seller Agreement signed by Sunoco, PES, and the Pennsylvania Department of Environmental Protection (PADEP) in September 2012.

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

1.1 DESCRIPTION OF THE COMPLEX

The PES Complex is located along the banks of the Schuylkill River in the City of Philadelphia, Philadelphia County, Pennsylvania (**Figure 1-1**). Portions of the PES Complex occupy both the eastern and western Schuylkill River banks. The PES Complex, which is located on industrial property, covers approximately 1,400 acres of land with access restricted by fencing and security measures. The area surrounding the PES Complex is characterized by a mixture of residential, commercial, and industrial properties. Current operations at the PES Complex consist of the production of fuels and basic petrochemicals for industry.

AOI 4 occupies approximately 106 acres of the PES Complex in the eastern portion of the Point Breeze Refinery South Yard (**Figure 1-2**). Surrounding the AOI are the following properties/features:

- North: AOIs 1 and 2 of the PES Complex, beyond which is located Belmont Terminal and Passyunk Avenue
- East: 26th Street borders the site except for a vacant parcel located at 3606 S 26th Street; on the east side of 26th Street are two non-residential parcels identified as 3401 S 26th Street and 2551 Penrose Avenue; a CSX Transportation (CSX) elevated railroad right-of-way parallels those properties, beyond which is located vacant lands associated with the former Passyunk Homes development
- South: Penrose Avenue borders the site as shown on **Figure 1-2**, beyond which are several non-residential properties including a scrap metal yard at 2600 Penrose Ferry Road and other apparent commercial properties
- West: AOI 3 of the PES Complex, beyond which is located the Schuylkill River and AOIs 5, 6 and 7 of the Girard Point Refinery

1.2 OPERATIONAL HISTORY AND CURRENT USE OF THE COMPLEX

The PES Complex has a long history of petroleum transportation, storage, and processing. The oldest portion of the PES Complex started petroleum related activities in the 1860's, when the Atlantic Refining Company was established as 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 PES Complex for a time. The PES Complex has operated continuously as a refining, product distribution, and storage facility. Use of the PES Complex has remained similar following transfer of ownership.

Currently, AOI 4 is comprised of primarily crude oil and gas oil tankage (No. 4 Tank Farm). Infrastructure mainly includes aboveground storage tanks (ASTs) and process equipment required for the blending and storage of gasoline and additives, including numerous aboveground and underground process lines. Use of the No. 4 Tank Farm has altered little over the course of the PES Complex's history with primary changes being various ASTs taken in and out of service. The only occupied building in AOI 4 is the 15 Pump House, located in the north central section of AOI 4 (**Figure 1-2**).

1.3 REGULATORY HISTORY/OVERVIEW

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

In October 2006, Sunoco submitted a notice of intent to remediate (NIR) to the PADEP entering the PES Complex into the Act 2 program. This NIR was later updated and submitted to the PADEP in November 2014 in order to revise the ownership identity to PES and the remediator identity to Evergreen. In November 2011, the PES Complex was formally entered into the PA One Cleanup Program with the United States Environmental Protection Agency (EPA) – Region III and PADEP. In November 2011, Sunoco submitted a Work Plan for Site Wide Approach Under the One Cleanup Program (Work Plan). As previously discussed, characterization and remediation work at the PES Complex is currently being performed under the September 2012 Buyer-Seller Agreement signed by Sunoco, PES, and the PADEP.

The following provides a timeline of major events and submissions for the PES Complex and relevant AOI 4 vicinity:

- 1987

- Potential source of hydrocarbon vapors within the 26th Street Intercepting Sewer (26th Street Sewer) was investigated. A pilot remedial system was tested and a report was completed (Engineering Enterprises, Inc., 1987).

- 1990
  - According to refinery personnel, the city sewer along 26th Street was cleaned and checked/sealed at connections.
- 1992
  - ENSR completed a Resource Conservation and Recovery Act (RCRA) facility investigation for the Point Breeze Refinery Solid Waste Management Units (SWMUs).
- 1993
  - A CO&A was established with the PADEP for the Point Breeze Refinery.
- 1996
  - Sunoco and the Defense Logistics Agency (DLA) entered into a CO&A with PADEP which required the two entities to collectively perform a series of tasks to address potential impacts to human health and the environment resulting from the presence of light non-aqueous phase liquid (LNAPL) at the former Defense Supply Center Philadelphia (DSCP) site.
- 1997
  - Dames & Moore Group (Dames & Moore) completed an LNAPL delineation to the south and east of the PES Complex and the DSCP facility (Dames & Moore, 1997a).
  - Malcolm Pirnie, Inc. (Malcolm Pirnie) prepared a final response to the LNAPL study prepared by Dames & Moore (Malcolm Pirnie, 1997).
  - Dames & Moore performed a subsurface assessment at the Steen Outdoor Advertising property (Steen) to evaluate the occurrence of free-phase hydrocarbons in the area between the PES Complex and DSCP facility (Dames & Moore, 1997b).
- 1998
  - Integrated Science & Technology, Inc. (IST) prepared a NAPL source study at the DSCP facility.
- 2002
  - Aquaterra Technologies, Inc. (Aquaterra) completed an investigation report for the Pollock Street Sewer (Langan, 2007).
- 2003
  - SECOR completed a RIR for the 26th Street border area.
  - A revised CO&A, which replaced the 1993 CO&A, was established with PADEP for the Point Breeze Refinery, Girard Point Refinery, Point Breeze West Yard, and the Schuylkill River Tank Farm.
- 2004
  - The PADEP and EPA signed an agreement entitled "One Cleanup Program Memorandum of Agreement (MOA or One Cleanup Program)," which clarifies how sites remediated under Pennsylvania's Voluntary Cleanup Program may satisfy RCRA corrective action requirements through characterization and attainment of remediation standards established under the Pennsylvania Land Recycling and Environmental Remediation Standards Act (Act 2).

- SECOR prepared a progress report for the 26th Street border area of AOI 1.
- Langan prepared the CCR for the Philadelphia Refining Complex and Belmont Terminal.

- 2005
  - PADEP, EPA, and Sunoco agreed that the One Cleanup Program would benefit the project by merging the remediation obligations under the various programs into one streamlined approach which would be conducted under the existing 2003 CO&A.
  - Langan completed a SCR/RIR for AOI 4 (Langan, 2005).
- 2006
  - Sunoco submitted a NIR to the PADEP for the Philadelphia Refinery including Schuylkill River Tank Farm, thereby entering the PES Complex, with the exception of Belmont Terminal, into the Act 2 program.
- 2009
  - Roux Associates, Inc. (Roux) submitted a Remedial Action Completion Report (RACR) for the former Ryder leasehold located at 3401 South 26th Street that was subsequently approved by the PADEP having demonstrated attainment of selected remediation standards for onsite soil and groundwater (Roux, 2009).
  - AQUI-VER, Inc. (AQUI-VER) prepared a data summary report that provided a comprehensive reporting of results related to LNAPL that included a portion of AOI 4 (AQUI-VER, 2009).
- 2011
  - In June and July, 2011, Aquaterra performed an investigation of the former ARCO property located at 3301-39 South 26th Street that included six soil borings, installation of four monitoring wells, and laboratory analysis of soil and groundwater samples (Aquaterra, 2011).
  - On November 8, 2011, the EPA provided an acknowledgment letter to Sunoco formally accepting the Sunoco Philadelphia Refinery into the One Cleanup Program.
  - Sunoco submitted the Work Plan to document the site-wide remedial approach extending beyond the requirements of the 2003 CO&A (Langan, 2011). PADEP and EPA reviewed and provided input to this report. Sunoco submitted a letter of commitment stating the Philadelphia Refinery would be remediated according to the Work Plan.
- 2012
  - Sunoco transferred the Philadelphia Refinery to PES and the facility was renamed the Philadelphia Refining Complex.
  - Sunoco, PES, and the PADEP signed the Buyer-Seller Agreement which established the environmental remediation and management obligations of Sunoco and PES following the sale of the PES Complex.
- 2013
  - The legacy remediation liability for environmental impacts existing prior to the conveyance of the Complex to PES was transferred from Sunoco to Evergreen.
  - Sunoco submitted a SCR/RIR for AOI 4 (Langan, 2013).
- 2014
  - Evergreen submitted an updated NIR to the PADEP for the PES Complex.
  - Evergreen submitted a NIR to PADEP exclusively for the Belmont Terminal which is a separate property owned by Sunoco Partners Marketing and Terminals L.P. (SPMT).

- 2015
  - Langan, on behalf of Evergreen, submitted a Human Health Risk Assessment (HHRA) Report to establish a site-specific standard (SSS) for lead in soil at the PES Complex, the Belmont Terminal, and the Marcus Hook Industrial Complex (Langan, 2015).
  - The HHRA was approved by the PADEP in a letter dated May 6, 2015 establishing a SSS of 2,240 milligrams per kilogram (mg/kg) for lead in soil.

On May 17, 2016, Evergreen and Stantec met with the PADEP to discuss proposed additional investigation activities at AOI 4. In accordance with the Work Plan for Site Wide Approach, Evergreen is submitting this RIR for AOI 4 to satisfy the requirements of Act 2 as specified in 25 PA Code §250.408. This RIR describes site characterization work conducted following the last submittal to PADEP regarding AOI 4 (SCR/RIR; Langan, 2013). Activities that have been performed in order to complete characterization within AOI 4 include:

- Additional characterization of surface soil (0-2 feet below ground surface [ft bgs] interval) and subsurface soil (2-15 ft bgs) including targeted soil investigations in potential contaminant source areas, such as historic product handling and storage locations, open storage tank incident areas, and known product releases;
- Horizontal and vertical delineation of impacts in soils;
- Installation of deep soil borings/monitoring wells in order to better understand hydrostratigraphy and address data gaps;
- Additional groundwater sampling from all monitoring wells not containing LNAPL;
- Evaluation of onsite and relevant offsite geology and hydrogeology;
- Delineation of LNAPL;
- Evaluation of LNAPL mobility;
- Investigation of the potential vapor intrusion to indoor air pathway at occupied buildings; and
- Qualitative evaluation of the potential fate and transport and future extent of dissolved contaminants, including a quantitative analysis for benzene at the Penrose Avenue site boundary.

As discussed with PADEP during a meeting conducted on September 28, 2015, Evergreen is in the process of developing a site-wide MODFLOW model to perform quantitative fate and transport modeling. Following the approval of this and other RIRs, Evergreen intends to submit a Cleanup Plan, pursuant to 25 PA Code §250.410, which will present remedies chosen to allow attainment of the selected remediation standards in soil and groundwater.

In accordance with Act 2, the required public and municipal notices for this report have been prepared and issued. **Appendix A** includes a copy of the original NIR, the updated NIR, as well as the report notices and their proof of receipt/publication for the PES Complex.

1.4 DSCP FACILITY

The DLA is the federal entity responsible for the former DSCP facility which is located approximately 550 feet to the east of the boundary of AOI 1 of the PES Complex (**Figure 1-2**). According to the NAPL Source Study at DSCP prepared by IST for Sunoco in March 1998, the federal government acquired an 87-acre parcel in 1917 and began construction of the DSCP facility. The function of the facility was to support the United States military by manufacturing, storing, and distributing supplies. Operations at the facility included printing, vehicle and locomotive repair, woolen fabric treatment and cleaning, painting, chemical laboratory operations, fuel dispensing, and fuel storage. Operations were at heightened levels during periods of conflict, including World War I, World War II, the Korean Conflict, the Vietnam Conflict, and Operation Desert Storm (IST, 1998). In 1999, the former DSCP was closed under the 1993 Base Realignment and Closure program, and has been subsequently redeveloped. In 2004, the Quartermaster Plaza shopping center was constructed on the northwestern section of the former DSCP property. South of the former DSCP was the former Passyunk Homes residential property. The residences were razed between 2002 and 2008, and a Philadelphia Housing Authority office and maintenance facility was constructed on the northern portion of the former Passyunk Homes property. The remainder of the property is currently being redeveloped into a residential neighborhood called Siena Place (**Figure 1-2**) (ARCADIS, 2014a).

Early environmental investigations began at the DSCP site in 1988 and centered primarily on historic fuel storage tank areas (IST, 1998). LNAPL was noted to be present in monitoring wells at DSCP (IST, 1998). A significant LNAPL plume has been in existence under the former DSCP property since at least the time of the IST report and has been investigated by teams from multiple interested parties, including Sunoco. In 1996, Sunoco and DLA entered into a CO&A with PADEP which required the two entities to collectively perform a series of tasks to address potential impacts to human health and the environment resulting from the presence of this LNAPL. Under the CO&A, Sunoco installed a sewer ventilation system on the Packer Avenue Sewer (which also serves the 26th Street and Pollock Street Sewers), and managed the design and construction of a LNAPL remediation system with financial contributions from DLA. On December 10, 1999, PADEP issued an Administrative Order which required DLA to address impacts related to the LNAPL plume located beneath the former DSCP property and former Passyunk Homes including assuming responsibility for operation of remediation systems. This Administrative Order presently requires that as much LNAPL be removed as is practicable. Currently, LNAPL is being removed via both fixed skimming and vacuum-enhanced skimming (VES) systems (ARCADIS, 2014a). According to ARCADIS (2017), the two fixed skimming systems commenced operation in March 1999 (one at the former DSCP property and the other at the former Passyunk Homes property), and the VES system became operational in March 2005.

In addition to LNAPL recovery, DLA is currently conducting characterization activities including soil and groundwater investigations at the former DSCP facility. DLA and Evergreen have conducted annual synoptic well gauging events since May 2014 that have included data from within AOI 4 and the immediate vicinity. Data from the three most recent annual gauging events, and available groundwater analytical data from 2007, and 2012 through 2016, were used in this RIR to evaluate groundwater flow paths and potential groundwater impacts in the water table and lower aquifers.

1.5 SELECTION OF CONSTITUENTS OF CONCERN

Lists of the constituents of concern (COCs) in soil and groundwater for AOI 4 are included as **Tables 1-1 and 1-2**. These tables are updated listings of the COCs identified in the Work Plan for Site Wide Approach for the PES Complex under Pennsylvania One Cleanup Program and will be referred to as the Evergreen Petroleum Short List (**Table 1-1**) and Evergreen Comprehensive List (**Table 1-2**).

1.6 SELECTION OF APPLICABLE STANDARDS AND SCREENING LEVELS

The media of concern for AOI 4 include soil and groundwater. The potential vapor intrusion into indoor air exposure pathway was also evaluated. The approach for attaining Act 2 remediation standards for the media of concern is described below. As the current and anticipated future use of the PES Complex is industrial, standards for non-residential properties were chosen for comparison.

1.6.1 Soil

All soil results were screened using a multi-step process as described in this section. Soil sample analytical results were first screened against the PADEP non-residential, used aquifer (total dissolved solids [TDS] less than or equal to 2,500 milligrams per liter [mg/l]) Statewide Health Standard (SHS). The following process was used to select the soil SHS for each COC:

- The highest value of either 100 times the groundwater medium specific concentration (MSC) or the generic value MSC was selected to represent the soil to groundwater numeric value.

- The selected used aquifer, non-residential soil to groundwater numeric value was then compared to the non-residential direct contact (NRDC) MSC (0-2 feet or 2-15 feet bgs, as applicable).

- The more stringent of the soil to groundwater numeric value and the direct contact value was selected as the SHS for initial comparison of soil sample results.

The SHS value is usually driven by the soil-to-groundwater MSC, and the soil-to-groundwater pathway will be addressed in the groundwater investigation presented in this RIR (**Section 4**) and through subsequent remedial measures which will be further described in future Act 2 deliverables. In order to further evaluate the risk posed by the concentrations of COCs which were detected above their respective SHS, the next step in the screening process is to compare all of the soil analytical results to the non-residential direct contact MSCs. Soil sample locations that will require further pathway evaluation or require a remedial measure in order to attain a standard under Act 2 were identified through comparison to the non-residential direct contact MSCs.

An exception to this soil screening process exists for lead. On February 24, 2015, Evergreen submitted a HHRA Report to PADEP which presented the development of a risk-based SSS for lead in soil (Langan, 2015). In a letter dated May 6, 2015, PADEP approved the report, and a non-residential direct contact site-specific numerical standard for lead of 2,240 mg/kg was established. This SSS is used in place of the default 0-2 ft bgs direct contact MSC for lead.

1.6.2 Groundwater

Groundwater sample analytical results were screened against the PADEP MSCs for non-residential properties overlying used aquifers with TDS less than or equal to 2,500 mg/l (SHS). Where constituent concentrations are above the SHS, Evergreen has evaluated application of the site-specific remediation standard using the pathway elimination option.

1.6.3 Potential Vapor Intrusion into Indoor Air

Indoor and ambient air sample results collected in AOI 4 were screened against the EPA Region 3 Regional Screening Levels (RSL) for Industrial Air Target Risk (TR)=1E-5, Target Hazard Quotient (THQ)=0.1 (updated May 2016; EPA-RSL, TR=1E-5). The EPA RSLs are used as the threshold values to determine if additional controls will be necessary to address vapor intrusion, and any such controls will be presented in the Cleanup Plan. The non-residential PADEP Indoor Air Site Specific Standard Vapor Intrusion Screening Values (SVIA-NR SHS), the non-residential PADEP Indoor Air Statewide Health Standard Vapor Intrusion Screening (SVIA-NR SSS), the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL); the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (REL) and the American Conference of Governmental Industrial Hygenists (ACGIH) Threshold Limit Values (TLV) are also provided for reference.

2.0 ENVIRONMENTAL SETTING

This section summarizes the geologic framework and general hydrogeologic properties of sedimentary deposits and bedrock underlying the south Philadelphia area, with emphasis near the PES Complex. A brief discussion of historical and present-day topography and hydrology is also included. This section provides a regional context from which sedimentary deposits observed beneath AOI 4 (discussed in **Section 5**) can be classified and characterized for the purposes of this RIR. Much of the information presented in this section was summarized during conceptualization of a site geologic model that is being used in the development of a numerical groundwater flow (MODFLOW) model.

In general, the groundwater resources and stratigraphic framework of the PES Complex area have been well-documented through a variety of data sources, including previous groundwater resource investigations dating back to the early 1900's, state and federal geologic mapping projects, groundwater modeling studies, and consultant site characterization and remedial investigation reports. Those data sources are summarized herein. In large part, available well and test boring logs from previous onsite and local subsurface investigations were the most valuable resource in evaluating the local subsurface stratigraphy. As such, subsurface information from approximately 750 well and test boring logs was considered in the evaluation of regional conditions. A database of stratigraphic "picks" on interpreted vertical lithologic unit boundaries (and, where possible, geologic formations) was also developed and includes identified records of boreholes completed to bedrock at and near the PES Complex. For the most part, these records include "deep" wells drilled at the PES Complex, the former DSCP property, and within the properties that exist between those two sites (e.g., CSX, former ARCO, and Steen properties). The purpose of developing a "picks" database was to begin archiving geologic interpretations of individual borehole lithologies to bedrock, so that stratigraphic profiles could be developed for use in this and future Act 2 submissions, and so the Schreffler lithologic model (Schreffler, 2001) being used as a basis for MODFLOW modeling could be refined and updated for site-specific use at the PES Complex. It is Evergreen's intention to update the site-specific geologic model as additional subsurface information is collected through remedial investigation activities under Act 2.

Three stratigraphic profiles are presented in this RIR to support evaluation of the lithologic character, geographic extent, and thickness of each geologic unit identified through correlation to published geologic formations. The first of the stratigraphic profiles is discussed in **Section 2.2.1.2** in support of a regional framework discussion. The two remaining profiles, developed specifically to support AOI 4 geologic and hydrogeologic interpretations, are presented in **Section 5** and utilized an updated version of the "picks" database. Database updates included the addition of subsurface information collected during the installation of new monitoring wells S-218D and S-39D as well as additional interpretations of strata from existing borehole records in the study area (to address data gaps where boreholes completed to bedrock are not available). The structure contour map of the bedrock surface originally presented in the AOI 1 RIR (Stantec, 2016) has also been updated and is used to support the discussion presented herein.

2.1 HYDROLOGY AND TOPOGRAPHY

The PES Complex occupies an area of approximately 2.2 square miles adjacent to the Schuylkill River near its confluence with the Delaware River. This region has a long history of human influence and disturbance, dating back to the early 17^{th} Century when European settlers first arrived. The following sections present a brief discussion of the significant land surface morphologic changes that are apparent when comparing modern environments and topography to that shown on historical maps. These changes are important to note in this RIR when considering natural hydrologic conditions, drainage, and the potential for preferential flow paths in the subsurface that may influence the fate and transport of contaminants.

2.1.1 Historical Topography and Natural Depositional Environments

The Philadelphia City Archives (City of Philadelphia, 2017) and several online archival resources, such as the Greater Philadelphia GeoHistory Network (The Athenaeum of Philadelphia, 2017) and the United States Geological Survey (USGS) National Map Viewer (USGS, 2016), have catalogued and provide free access to copies of historical maps and photographs of Philadelphia. Based on review of many of those maps, it is apparent that much of the land area occupied by the present-day PES Complex was formerly tidal marsh and lowlands that once fringed the Schuylkill River. **Figure 2-1** presents a geo-referenced USGS topographic map from 1898 (20-foot contour interval). The map indicates that several small tributary streams, digitized on-screen and shown as blue lines, formerly dissected that marshland and presumably would have exchanged water with the tidal Schuylkill River on a semi-diurnal basis. Several islands were also present throughout the lowlands, most notably League Island, which are interpreted as erosional remnants of uplands that formed sometime after deposition of the “Trenton gravel” sediments (discussed in detail below).

At that time, relatively higher topography was apparent north and west of the Schuylkill River, near Gibson’s Point. South and east of that general area, the Schuylkill River coursed through a distinctive meander around Point Breeze, and appeared to have formed an erosive cut bank along present-day AOI 2 where higher elevations were present (and favoring point bar deposition north of AOI 10). A southwest-northeast trending ridge of higher elevation was also present south of Point Breeze near AOI 4 (**Figure 2-1**), and between those two areas of higher elevation a stream was mapped to have been present. That stream appears to have originated in southern AOI 1 and flowed southwest through AOIs 3, 4, and 7, towards its confluence with the Schuylkill River. Numerous other small streams and ditches draining the lowlands surrounding Hollander Creek were also noted. Additional historic maps indicate that by 1900, an earthen dike had been constructed along the banks of the lower Schuylkill River, and sluices were present at each stream/ditch confluence. Other maps show wooden pilings in places along the Schuylkill River. In general, the construction of containment dikes, sluices, and shoreline hardening would have altered the natural tidal exchange between the Schuylkill River and these historic creeks, thereby limiting the natural accretion of sediment in the marshes that once fringed the river. Moreover, the modifications indicated on these maps would have altered the pre-existing tidal regime and dynamic equilibrium of the Schuylkill River.

2.1.2 Post-Industrialization

Figure 2-1 indicates that by 1898, storage of petroleum near Point Breeze and Gibson Point had already begun. According to City of Philadelphia archives (City of Philadelphia, 2017), much of the remaining tidal marsh and lowland environments nearby were reclaimed and routinely dewatered for farming practices around this same time period (mostly on the west side of the Schuylkill River). Industrialization warranted further land filling activity and shoreline hardening, including bulk-heading and filling of the tributary streams that modified and generally raised the antecedent topography into its present-day configuration. Farms were displaced in favor of industrial and commercial land uses. Although some clusters of residential property and open space have existed or still exist near the PES Complex, most land in south Philadelphia has been used for industrial and commercial purposes for over 100 years (IST, 1998).

Light Detection and Ranging (LiDAR) data obtained from the USGS (USGS, 2010) and topographic contours published in 2007 by the City of Philadelphia indicate that present-day topography is relatively flat near the PES Complex, and land surface elevations generally range from a few feet below the North American Vertical Datum of 1988 (NAVD 88) near Mingo Creek to approximately 30 feet near the eastern boundary of the PES Complex in AOIs 1, 4, and 8 (**Figure 2-2**). Although subtle, the high-resolution LiDAR model displays topographically low areas that based on location, likely correlate to the locations of former stream valleys (e.g., Franklin Delano Roosevelt Park). In addition to raising the land surface, much of the filled areas were either paved and/or rendered relatively impervious (**Figure 2-3**), which may have decreased rates of recharge to the water table and necessitated the construction of numerous sewers to convey stormwater runoff (combined with sewage) to the Schuylkill and Delaware Rivers, or deeper intercepting sewers. This further altered the natural hydrology of the area.

2.2 REGIONAL GEOLOGY AND HYDROGEOLOGIC CONDITIONS

The PES Complex occurs within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the “Fall Line,” where crystalline bedrock of the Appalachian foothills intersects the ground surface (outcrops) (**Figure 2-4**). The Atlantic Coastal Plain is a physiographic province that is defined as having relatively flat topography and as being underlain by a characteristic wedge of unconsolidated sediments that thicken in a southeasterly direction, away from sediment source areas in the Appalachian Mountains. These sediments were deposited atop a sloping bedrock surface in complex fluvial, estuarine, and marginal marine environments along the passive Atlantic margin. Overall, subsidence of the Piedmont land surface in conjunction with cyclical sea-level fluctuations have been the primary controlling mechanisms driving periods of deposition, non-deposition, and erosion in the Atlantic Coastal Plain (Trapp, 1992). In general, the resulting sedimentary record in the vicinity of the PES Complex is complicated, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity. A summary of those deposits is presented in succeeding sections.

2.2.1 Coastal Plain Deposits

2.2.1.1 Anthropogenic Fill

For reasons discussed, much of the PES Complex and surrounding area is underlain by historical fill material, which was placed for the purpose of reclaiming lowlands along the banks of the tidal Delaware and Schuylkill Rivers during industrialization. These fill materials are heterogeneous in nature and have been described on borehole logs by others as a mixture of compacted soil and anthropogenic debris, including sand, clay, silt, gravel, cinders, concrete, asphalt, crushed stone, ash, glass, brick fragments, and wood. Apparent fill thickness ranges from a veneer where antecedent topography was highest to greater than 50 feet where it was used as railroad ballast just east of the PES Complex. Within the locations of former stream valleys and marshes (**Figure 2-1**), the historical fill material is generally 20 feet or greater in thickness.

The fill materials may contain isolated lenses of groundwater (perched groundwater) where coarse or granular materials are separated from the underlying water table by low permeability sediments. The fill may also be saturated and/or in hydraulic connection with the water table along the axes of former stream channels, where the water-table appears to intersect the fill, or where the fill was placed on marshland. However, at most locations across the PES Complex, the fill layer occurs above the regional water-table under average hydraulic head conditions.

2.2.1.2 Quaternary Deposits

Quaternary sedimentary deposits are present beneath the PES Complex and are generally representative of geologically-recent cycles of deposition and erosion that occurred within the last 200,000 years. These cycles of sedimentation were the result of a series of glacial and interglacial periods, namely the Illinoian and Wisconsin glaciations, separated by an intervening interglacial period and followed by the present interglacial period through the Holocene (Sevon et al., 1999). Depositional environments through this period were primarily controlled by sea-level and the successive down-cutting and infilling of ancestral river valleys, primarily that of the Schuylkill and Delaware Rivers (Owens and Minard, 1979). Details of the Quaternary deposits present at the PES Complex are described below.

2.2.1.2.1 Recent (Holocene) Alluvium

Predominantly gray, muddy deposits with occasional sandy, gravelly, and organic-rich lenses comprise the most recent alluvium present at the PES Complex. These sediments were deposited in dynamic floodplain, channel, and marsh environments through the Holocene. As noted, the upper surface of alluvium, in most places covered by fill, defines the antecedent topography that pre-dated development under a large portion of the area of the PES Complex. This geologic unit is generally present below an elevation of approximately 20 feet NAVD 88. The alluvium ranges in thickness from a few feet at higher elevations, away from the present Schuylkill and Delaware River estuaries, to approximately 15 feet within the former floodplains of buried tributary streams. However, adjacent to and fringing these major river estuaries, apparent marsh deposits accreted in freshwater environments to as much as 60 feet thick (to elevations as low as approximately -60 feet NAVD 88) as sea-level transgressed and flooded the incised river valleys through the Holocene. **Figure 2-1** provides some estimation of how extensive the tidal marshes once were prior to development, existing generally along the Schuylkill River south of and surrounding Point Breeze. Stratigraphic profile C – C' demonstrates this interpretation and distribution of the most recent alluvial deposits across the PES Complex (**Figures 2-5** and **2-6**).

Similar to the fill described above, most recent alluvium at the PES Complex has limited water-bearing capacity due to its fine-grained texture. However, heterogeneities within the alluvium may allow for the presence of localized seasonal perched groundwater resulting from the percolation of recharge water. Within former marsh areas along the Schuylkill and Delaware River estuaries, the regional water-table occurs within the Holocene alluvium. At locations distal to the rivers and where the Schuylkill River appears to have eroded older alluvial deposits (e.g., along the western periphery of AOI 2), the Holocene alluvium occurs above the regional water-table and is unsaturated.

2.2.1.2.2 Pleistocene Alluvium ("Trenton Gravel")

Geologically-recent glacial outwash deposits, commonly referred to informally as the "Trenton gravel," have long been recognized in southeastern Pennsylvania along the Delaware River valley. Sevon and Braun (2000) provide a comprehensive map of glacial deposits in Pennsylvania, including the presence of sand and gravel outwash, interpreted as stratified drift, along the present Delaware River. Owens and Minard (1979) published a comprehensive summary of previous research into these deposits and subdivided the "Trenton gravel" into two distinct deposits (the Spring Lake and Van Sciver Lake beds) based on topographical position and lithology at those type sections. Low et al. (2002) indicate that in most places the "Trenton gravel" rests directly atop Cretaceous sediments and is overlain by younger alluvium of Holocene age near the Schuylkill River.

Based on literature review, Stantec interprets the "Trenton gravel" as a heterogeneous, stratified alluvial deposit of primarily sand and gravel, with occasional beds of clay and silt (the Van Sciver Lake beds), that resulted from glacial outwash through the Delaware River valley sometime after the Illinoian glacier receded. At the PES Complex, the "Trenton gravel" is commonly described on boring logs as a brown, reddish-brown or, where stained, black, fine to coarse sand with lenses of gravel. The gravel fraction is often multicolored and comprised of a mixture of sub-angular to sub-rounded, sedimentary and metamorphic rocks derived from the Appalachian Piedmont. The "Trenton gravel" generally ranges in thickness from a few feet up to approximately 30 feet near the PES Complex. It appears to be mostly laterally continuous and its thickness depends on the antecedent Cretaceous topography that it filled and on the degree of erosion from above. Along the Schuylkill River at the George C. Platt and Passyunk Avenue bridges, and in places beneath the Delaware River, Greenman et al. (1961) mapped the "Trenton gravel" to be present beneath thick sections of Holocene alluvium to elevations near -60 feet NAVD 88, and those interpretations have been adopted by Stantec in the geologic model for the PES Complex (**Figures 2-6, 2-7 and 2-8**).

The regional water-table at the PES Complex most often occurs within the "Trenton gravel," and, as a result of its stratigraphic position, this geologic unit comprises a large portion of the unconfined aquifer (along with the Potomac-Raritan-Magothy [PRM] aquifer system upper sand unit and localized areas of saturated alluvium and fill). Published well records indicate that the "Trenton gravel" can be a prolific aquifer (Paulachok, 1991). Nevertheless, due to lateral changes in "Trenton gravel" thickness and to its heterogeneous character, hydraulic properties and groundwater yields can vary widely. Stantec reviewed published data and available onsite aquifer testing data regarding the hydraulic properties of the unconfined aquifer and has summarized that data on **Figures 2-9** and **2-10**. It is noted that although most wells tested at the PES Complex and shown on **Figure 2-9** are predominantly screened through

"Trenton gravel" deposits, some test results may represent the hydraulic properties of other geologic units that locally comprise a portion of the unconfined aquifer, such as the PRM upper sand unit.

Of particular importance to this RIR are unconfined aquifer hydraulic property data resulting from a nearly 7-day groundwater extraction test conducted at recovery well RW-2 at the PES Complex (IST, 1998). During testing, RW-2 was pumped at a constant rate of 225 gallons per minute (gpm). Distance-drawdown data analyzed along transects of observation wells suggested that the area of influence extended approximately 1,680 feet from the pumping well under relatively isotropic conditions. Three of the observation well transects were at least partially in AOI 4. The horizontal hydraulic conductivity (k_h) was estimated to be greater than 400 feet per day (ft/d). More recently, a 24-hour pumping test was conducted at the former DSCP property at monitoring well DSCP-MW-65, a well that appears to be screened across the "Trenton gravel" and underlying sandy Cretaceous deposits (ARCADIS, 2013). Analysis of that data provided in the referenced report supports comparable aquifer properties at that site. However, it is noted that during the test, the "Trenton gravel" was reportedly dewatered and individual aquifer k values could not be calculated/resolved. Other, in-situ, single well instantaneous displacement tests and short-duration pumping tests for remedial system design suggest a lower k_h for the "Trenton gravel," on average, but test results vary widely, from less than 1 ft/d to over 600 ft/d. The observed wide range in k_h values over relatively short distances is consistent with the unconfined aquifer's lithologic heterogeneity which can be attributed in most part to the "Trenton gravel."

2.2.1.3 Cretaceous Deposits

Many studies of the Atlantic Coastal Plain near the PES Complex have identified the presence of Cretaceous age sediments in the subsurface. These are the oldest sedimentary deposits in the area and are configured in a southeasterly-thickening wedge, overlain by the much younger Quaternary deposits described above and underlain by Piedmont crystalline bedrock. Greenman et al. (1961) detailed the age, character, configuration, and hydraulic properties of these deposits in southeastern Pennsylvania. At the time of that publication, the Cretaceous deposits were assigned primarily to the Raritan Formation and noted to represent three distinct, fining-upward cycles of non-marine sedimentation. Similarities to lithologic sequences identified on borehole logs were correlated to previously-identified strata at their type locality in New Jersey, where the deposits are much thicker and more easily distinguished. Other similar, near time-equivalent geologic formations of Cretaceous age were elsewhere identified in Maryland and Delaware (Jordan, 1962), and more recently authors began wholly referring to the Cretaceous deposits in south Philadelphia as the PRM aquifer system.

In south Philadelphia, the PRM aquifer system is subdivided into six geologic units in order of increasing age (Schreffler, 2001):

- upper clay unit,
- upper sand unit,
- middle clay unit,
- middle sand unit,
- lower clay unit, and
- lower sand unit.

Near the PES Complex, it is generally true that these units thin, intercalate, and exhibit gradual facies changes that make separation of individual units difficult. The total thicknesses of PRM deposits at the PES Complex ranges from 0 feet, where Quaternary deposits are present atop bedrock, to more than 100 feet within paleochannels incised into bedrock. Details of the individual units and bedrock configuration based on boring log records and published descriptions are presented below.

2.2.1.3.1 Upper Clay Unit

The upper clay unit is a variegated clay/silt that is sometimes discernible from older clay units of the PRM where sandy and gravelly. In general, it is thin when compared to the other PRM clay units in south Philadelphia, and in places distal to the Delaware River, the upper clay may be entirely absent (Greenman et al., 1961). On the basis of geophysical log signature, others have mapped the upper clay to be at least 0.5 feet thick and up to 30 feet thick at the PES Complex, exhibiting its greatest thickness in northern portions of the area of the PES Complex while pinching out to the south (IST, 1998). At the PES Complex, Stantec has assigned the upper clay to first occurrences of light brown, tan, mauve, yellow, gray, and less-commonly, red sandy, silty clay beneath the Quaternary alluvium. However, overall stratigraphic correlation of the PRM across the PES Complex supports the upper clay unit pinching out or being truncated by younger deposits throughout most of the AOIs (**Figures 2-6, 2-7** and **2-8**).

The upper clay unit by nature acts as a confining or leaky confining bed. Where present, it can create hydraulic separation between the upper sand unit and water-table aquifer.

2.2.1.3.2 Upper Sand Unit

The upper sand unit is a varicolored but predominantly brown to gray sand with varying amounts of gravel, clay, and silt (Greenman et al., 1961). Nearer the PES Complex, it has been described as mostly silty and/or clayey fine to medium sand (IST, 1998). Where the upper clay is absent, the upper sand occurs directly beneath, and is typically discernable from, the overlying coarser, poorly-sorted, and more heterogeneous “Trenton gravel.” Stantec used color and lithologic changes, in addition to subtle changes in drilling conditions including Standard Penetration Test (SPT) blow counts, to make “picks” on upper sand occurrences where the upper clay is absent. In general, the upper sand appears most extensive beneath northern portions of the PES Complex (AOIs 1, 2, 3, 4, and 8) where it subcrops the “Trenton gravel”. The upper sand unit, where present, rarely exceeds 10 to 20 feet in total thickness.

The upper sand unit is an excellent aquifer where its thickness and extent are sufficient (Greenman et al., 1961). Aquifer testing of the upper sand unit in New Jersey has indicated that the aquifer has similar hydraulic properties to the middle and lower sand units where discrete (Navoy and Carleton, 1995). At the PES Complex, Stantec did not identify any existing testing data for wells discretely screened within the upper sand unit from which to infer sole hydraulic properties of that unit. The upper sand is fairly continuous along eastern areas of the PES Complex but generally occurs in pockets nearer the Schuylkill River where the middle clay unit is shallower. The upper sand unit comprises a portion of the unconfined aquifer. Most wells that fully penetrate the unconfined aquifer in northern areas of the PES Complex may intersect and be influenced by the hydraulic properties of the upper sand.

2.2.1.3.3 Middle Clay Unit

Whereas other clay units of the PRM are described as being sandy and gravelly in places, the middle clay unit is generally regarded as being a laterally extensive and uniformly massive confining bed of thick, red and white clay with very little sand (Greenman et al., 1961). Near the PES Complex, others have found the middle clay to be nearly continuous in the subsurface (IST, 1998). Based on boring log review and stratigraphic correlation, Stantec would agree with these previous findings and has mapped the middle clay unit of the PRM to be the most persistent of the clay units at the PES Complex. Thicknesses of the middle clay unit generally range from less than one foot to more than 20 feet. While the middle clay appears to be everywhere present, at least on the eastern side of the Schuylkill River, its characteristically muddy texture can vary and become finely-laminated/bedded and intercalated with muddy sand. West of the Schuylkill River and particularly under areas north of Point Breeze, the middle clay unit (in addition to most if not all of the PRM) appears to have been incised and completely removed by erosion. Downgradient, nearer AOI 9 and the George C. Platt Bridge, some pockets or thin lenses of middle and/or lower clay may be present under a thick section of Quaternary alluvium and upper sand. At other locations beneath the PES Complex, the middle and lower clay units appear to be in direct contact with each other (where the middle sand is absent).

The middle clay unit, in places resting directly on and combining with the lower clay unit, acts as a significant confining bed at the PES Complex. In a regional context, it creates hydraulic separation between the unconfined aquifer and deeper, semi-confined aquifer of the middle and/or lower sand units. However where it appears to be thin and sandy, most notably in the southeastern area of AOI 1, there may be more potential for vertical exchange between groundwater of the deeper aquifer and unconfined aquifer, the direction and magnitude of which would depend upon the vertical hydraulic gradients at the time.

2.2.1.3.4 Middle Sand Unit

The middle sand unit is a light-colored, stratified, fine to coarse sand with occasional gravel and clay that was generally deposited in lenticular masses along the axes of troughs carved into the lower clay unit (Greenman et al., 1961). As such, it is by nature discontinuous in the subsurface. Stantec has mapped the presence of middle sand at the PES Complex based on stratigraphic position and where present, is commonly described on boring logs as brown or orange sand and gravel. In some areas where the lower clay was entirely removed, it may be indistinguishable from and rest unconformably atop the lower sand unit. At those locations, Stantec used subtle changes in sample descriptions, including color, density, and/or texture, of the sequences of sand below the middle clay to infer the contact between those units. The middle sand unit, where discernable from the lower sand, has been observed at thicknesses up to approximately 30 feet beneath the PES Complex and is generally thickest in lenticular or tabular bodies.

Much like the other sand units of the PRM, the middle sand unit can be a prolific aquifer where it is laterally continuous and of sufficient thickness. Aquifer testing of the middle sand in New Jersey has indicated that the aquifer has similar hydraulic properties to the lower sand unit (Navoy and Carleton, 1995). At the PES Complex, Stantec did not identify any wells discretely screened within the middle sand unit from which to infer sole hydraulic properties. Deep refinery wells are screened in the lower sand, or potentially across the lower and middle sand units, where hydraulically connected.

2.2.1.3.5 Lower Clay Unit

Published descriptions of the lower clay unit indicate that it appears very similar to, and is sometimes inseparable from, the middle clay unit where the middle sand is absent. The lower clay is generally tough, red clay but is known from drilling records to contain softer zones of gray clay stratified with fine sand. The lower clay tends to exhibit its greatest thickness along the lateral margins of paleochannels in underlying bedrock, and can be thin to absent along the axes of paleochannels where eroded prior to deposition of the middle sand unit (Greenman et al., 1961). Of the PRM clay units, Stantec has interpreted the lower clay unit to be the least significant at the PES Complex in terms of both its lateral extent and vertical thickness. This is based on stratigraphic correlation and likely the result of erosion prior to deposition of the middle sand. Generally gray and red, commonly sandy clay and muddy sand zones were assigned to the lower clay if observed below and distinguishable from the middle clay. Where present, the lower clay was observed at thicknesses ranging from less than 1 foot to no greater than 10 feet. The lower clay appears to thicken and become more continuous to the south and east of the PES Complex.

Where physically connected, the lower and middle clay units combine to form a significant confining bed at the PES Complex. In a regional context, they create hydraulic separation between the unconfined aquifer and deeper, semi-confined aquifer of the lower sand unit. The lower clay can also create localized areas of hydraulic separation between the lower and middle sands, where discretely present.

2.2.1.3.6 Lower Sand Unit

The lower sand unit is a varicolored but predominantly white to yellow sand with gravel, usually fining upward to a cap of fine to medium sand with occasional yellow and gray clay lenses. As further described below, the lower sand unit is the oldest of the PRM deposits and rests unconformably atop bedrock. The lower sand is generally thickest (up to 87 feet thick) along the axial troughs of paleochannels carved into bedrock by discharge through former positions of the Schuylkill and Delaware Rivers (Greenman et al., 1961). At the PES Complex, Stantec recognizes the lower sand unit to be present as a nearly continuous deposit, with the exception of areas proximal to the Schuylkill River where it appears that the river entirely removed the PRM. Where present, the lower sand unit is observed to range in thickness from approximately 20 feet to a maximum of just over 50 feet, where it fills a bedrock paleochannel beneath a portion of AOI 1. Borehole logs from the PES Complex indicate that the lower sand unit is commonly yellow, white, and pale gray in color and predominantly medium to coarse sand with gravel, or gravel with sand. The lower sand's gravelly texture beneath the refinery has been well documented on drilling logs.

Of the PRM aquifer system and Quaternary deposits present, it can be argued that the lower sand unit was historically the most important groundwater resource in south Philadelphia. **Figures 2-10 and 2-11** summarize hydraulic information available for the lower sand unit (considered the lower aquifer at the PES Complex) based on estimates obtained from well testing at the PES Complex (see **Sections 4.5** and **5.2.3**) and published aquifer testing results. To date, the only known aquifer test data available for the lower aquifer at the PES Complex was collected from wells near the guard basin in AOI 3 in the early 1990s by ENSR. Proximal to the PES Complex at the Philadelphia Naval Shipyard (PNSY), a wealth of historical testing data is available providing estimates of hydraulic properties for the lower sand unit that can be reasonably applied to the lower aquifer at the PES Complex. This data indicates an average k value of approximately 134 ft/d. At the PES Complex, somewhat smaller k_h values have been estimated for the lower aquifer, ranging from approximately 3 to 85 ft/d and may include hydraulic properties of the middle sand and lower clay (where present) (**Figure 2-10**). Across the Delaware River in New Jersey, lower sand unit k_h values are documented to be slightly higher, on average.

2.2.2 Bedrock

Bedrock beneath the Coastal Plain near south Philadelphia has been inferred from surface outcroppings above the "Fall Line," and has been described in the subsurface where penetrated by past drilling activities. Bosbyshell (2008) has mapped schist of the Wissahickon Formation to occur in Philadelphia along the "Fall Line" (**Figure 2-4**). Relatively small bodies of granitic gneiss, resulting from igneous intrusions into the country rock during metamorphism, can also be present. Most boring log records of deep holes drilled at the PES Complex indicate that schist is present beneath the Coastal Plain, in agreement with published maps.

Available data pertaining to the bedrock surface beneath the PES Complex suggests that the surface generally dips to the southeast but contains local complexity. Greenman et al. (1961) recognized the presence of four paleochannels incised into bedrock and attributed those features to previous positions of the Schuylkill River. Two of those channels, referred to as the Schuylkill River and League Island Troughs by those authors, occur beneath parts of the PES Complex and influence the total thickness of the Coastal Plain sedimentary sequence above them (**Figure 2-12**). Through boring log review, Stantec has identified additional detail in the bedrock surface beneath the PES Complex, including two small bedrock paleochannels beneath the eastern portions of AOIs 1 and 4 that appear to be extensions of the League Island Trough, and a few localized bedrock surface highs (pinnacles).

In general, bedrock can store and transmit groundwater primarily through secondary porosity structures (e.g., fractures, joints). Bosbyshell (2008) indicates that the Wissahickon Formation can yield up to 20 gpm to wells in the mapped area above the "Fall Line." Balmer and Davis (1996) indicate that in Delaware County, Pennsylvania, the Wissahickon Formation is the most productive of the consolidated rock aquifers present in that county and can yield anywhere from 0 gpm to 300 gpm to wells (data from 127 wells). However, the wells included in their report were generally located above the "Fall Line" and were not screened below significant accumulations of Coastal Plain sediments. In general, when compared to the permeability and thickness of the Coastal Plain deposits, the water-bearing properties of the Wissahickon Formation beneath the PES Complex are considered de-minimis.

3.0 SOIL INVESTIGATION

The following sections summarize the soil investigation activities performed in AOI 4. Previous investigations are summarized in **Section 3.1**. The remainder of the soil investigation activities described were conducted for this RIR between 2013 and 2016 by Aquaterra, Langan, and Stantec, on behalf of Evergreen. The goal of the investigation was to characterize soil in potential source areas, including historic product handling and storage locations, open storage tank incident areas, and known product releases. In addition to collecting soil samples from borings advanced for the source-targeted soil investigations, soil samples were collected during monitoring well installation activities regardless of whether the area was expected to contain a source of petroleum compounds in soil. In addition, soil sample data collected as a part of PES investigations were evaluated and results included for investigations performed up to the time of this RIR.

All characterization fieldwork was performed in accordance with Evergreen's *Quality Assurance/Quality Control Plan and Field Procedures Manual (***Appendix B**). Soil borings were advanced using a variety of methods including hand auger, backhoe, split spoons in conjunction with hollow stem augers or mud rotary drilling, and split spoons driven using direct push methods. The general strategy for the RI was to characterize soil in the 0-2 ft bgs and greater than 2 ft bgs intervals (unsaturated soil). Generally, subsurface soil samples were collected at the depth exhibiting the highest photoionization detector (PID) response and/or above the water table. Delineation was performed to the highest of the SHS, the NRDC MSCs, and the numeric SSS (for lead). **Table 3-1** summarizes the soil boring rationale for the 2016 investigation activities, and soil boring logs are included in **Appendix C**. All soil analytical results are summarized on **Table 3-2**, which compares the results to the non-residential SHS (as defined in this report, the more stringent of the soil to groundwater numeric value and the direct contact value), and **Table 3-3**, which compares the results to the highest of the SHS, the NRDC MSC, and the numeric SSS (for lead) (Soil Screening Levels). Samples were analyzed for the Evergreen Comprehensive List or the Evergreen Petroleum Short List of compounds, unless a shorter list of analytes was appropriate in a specific situation (i.e. delineation of individual compound exceedences). Analysis of soil samples was conducted by either Pace Analytical Services, Inc., Accutest Laboratories, Eurofins Lancaster Laboratories, ESC Lab Sciences, and the Washington Group Environmental Laboratory. All laboratory analytical reports for investigation work conducted between 2013 and 2016 are included in **Appendix D**.

3.1 SUMMARY OF PREVIOUS SOIL ANALYTICAL RESULTS

As part of the site investigation program conducted in 2005, ten monitoring wells were completed under the supervision of Aquaterra (Langan, 2005). Associated soil sampling results collected as part of these activities are provided in **Tables 3-2** and **3-3**. These samples were collected from the 0-2 ft bgs interval, and analyzed for the Evergreen Petroleum Short List, with the exception of 1,2,4-TMB and 1,3,5-TMB, which were not on the PADEP petroleum short lists at the time. Twenty-two soil borings and fourteen monitoring wells were completed under site characterization activities in 2013 by Aquaterra and Langan, and are summarized in a combined SCR /RIR (Langan, 2013). Shallow (0-2 ft bgs) and deep (>2 ft bgs) samples collected from these locations were analyzed for the Evergreen Petroleum Short List, and the analytical results are presented on **Tables 3-2** and **3-3**.

SHS exceedances were observed in the following soil borings for lead: AOI4-BH-13-86, AOI4-BH-13-99, AOI4-BH-13-101, AOI4-BH-13-102, AOI4-BH-13-103, S-381, and S-408. SHS exceedances were observed in the following soil borings for benzene: AOI4-BH-13-104, S-369, S-373, and S-381. In addition, the SHS for 1,2,4-TMB was exceeded in AOI4-BH-13-104. Concentrations of COCs did not exceed the NRDC MSCs or the lead SSS in any samples, except for the following for lead: AOI4-BH-13-99, AOI4-BH-13-103, and S-381. Delineation of these exceedances were completed as part of RI activities in 2016, and are discussed in later sections.

As AOI 4 is mainly an aboveground storage tank farm, many soil samples have been collected for tank closures and tank related incidents regulated under 25 PA Code Chapter 245, in addition to characterization soil sampling that has been performed as part of the Act 2/One Cleanup program. Although the rationale and results of these soil sampling projects are not discussed in detail in this RIR, as they have been submitted to PADEP under 25 PA Code Chapter 245 reporting, they are relevant to the characterization of AOI 4 under Act 2. The analytical results for these tank related assessments are included on **Tables 3-2** and **3-3**, and the soil sample locations and results are presented on **Figure 3-1**. The investigation of select tank incidents was performed as part of the field effort for this RIR, and those results are discussed in the following sections.

3.2 HISTORIC PRODUCT HANDLING/STORAGE AREAS

Thirteen former ASTs were identified and located within AOI 4 which had been historically closed. Of those thirteen ASTs, nine (PB 185, PB 186, PB 187, PB 188, PB 250, PB 254, PB 255, PB 256, and PB 260) have been confirmed to have been removed prior to 1989 (based on a 1971 as-built acquired from a review of facility records), and therefore, are not subject to 25 PA Code Chapter 245. For six of these tanks (PB 185, PB 186, PB 187, PB 188, PB 250, and PB 260), no additional investigation is required because there is no record of a release, no LNAPL is present in the subsurface in the vicinity of the tank footprint, and/or soil sampling has previously been conducted in the vicinity of the tank footprint. Due to presence or historic presence of LNAPL near ASTs PB 254, PB 255, and PB 256, one characterization soil boring was completed in the former tank footprint of each of these three tank (AOI4-BH-16-015 through AOI4-BH-16-017).

Records could not be identified to confirm that the four remaining ASTs (PB 189, PB 257, PB 258, and PB 820) had been removed prior to 1989. No record of site characterization or closure assessment was found for these former ASTs, and although no active PADEP incident numbers exist, one soil boring was completed within the footprint of each former AST (AOI4-BH-16-018 through AOI4-BH-16-021), biased to areas that exhibited visible signs of petroleum impacts.

Two samples (shallow and deep) were collected from each soil boring listed above, and analyzed for the Evergreen Comprehensive List. Concentrations of COCs did not exceed the SHS, the NRDC MSCs, or the lead SSS, with one exception. Benzene exceeded the SHS of 0.5 mg/kg in AOI4-BH-16-020; however, the concentration was below the NRDC MSC.

3.3 OPEN STORAGE TANK INCIDENTS

Evergreen has addressed all open AOI 4 storage tank incidents for which it is responsible through the 25 PA Code Chapter 245 CAP Program in a separate submittal (Stantec, 2017). Review of past activities indicated that eight incidents (6229, 6227, 35654, 37051, 37107, 38093, 38094, and 45998) did not require any additional characterization work; however, three incidents (45961, 6226 and 45966) required further characterization and delineation. A Site Characterization Report/Remedial Action Completion Report (SCR/RACR) was submitted for these incidents (Stantec, 2017). Open storage tank incidents are summarized on **Table 3-4**.

Soil characterization activities were conducted to further investigate three open storage tank incidents within AOI 4. For borings associated with storage tank incidents that involve releases within tank berms, soil analytical results are presented in this RIR for informational purposes only as they relate to overall AOI 4 soil characterization. These data were presented in a SCR/RACR for the identified open storage tank incidents, and submitted under separate cover to the PADEP in order to satisfy the requirements of 25 PA Code Chapter 245 (Stantec, 2017).

PB 823 (INCIDENT 45961)

According to historical documentation, approximately 630 gallons of hydrocracker gas oil were released to the tank dike area of PB 823 in March 1993, due to a leak near the base of the tank. Clean up was initiated at the time of release identification. No record of site characterization sampling was found; therefore, two soil borings (AOI4-BH-16-001 and AOI4-BH-16-002) were completed in the area of the release. Four soil samples were collected and analyzed for the Evergreen Comprehensive List. None of the samples exceeded the SHS, NRDC MSCs, or the lead SSS.

PB 842 (INCIDENT 6226)

According to the Notice of Reportable Release (NoRR) from October 10, 1996, holes were identified in the tank floor during removal from service of Tank PB 842, which formerly stored crude oil/water. No record of sampling to characterize this suspected release was found; therefore, two soil borings (AOI4-BH-16-003 and AOI4-BH-16-004) were completed in 2016 in the area of the former tank footprint. Two samples were collected from each soil boring and analyzed for the Evergreen Comprehensive List. None of the samples exceeded the SHS, NRDC MSCs, or the lead SSS.

PB 253 (INCIDENT 45966)

Approximately 5,040 gallons of diesel fuel were released to the tank dike area of PB 253 in August 1998 as the result of an overflow during filling. According to the NoRR, the overflow resulted from a high-level alarm failure and immediate corrective action was initiated, including the recovery of oil by vacuum truck. As no record was found for soil characterization at the time of the release, three soil borings (AOI4-BH-16-005, AOI4-BH-16-006, and AOI4-BH-16-007) were completed around the tank. Two samples were collected from each soil boring and analyzed for the Evergreen Petroleum Short List. None of the samples exceeded the SHS, NRDC MSCs or the lead SSS.

3.4 HISTORIC RELEASES

The following section discusses known historic releases that were investigated as part of the AOI 4 characterization activities. As part of the remedial investigation under Act 2, historic releases that could have created sources for hydrocarbons in soil were identified as reasonably practicable. In order to identify areas that would require further investigation, a review of internal facility files and meetings with facility operations staff were conducted in 2014. PADEP also reviewed its records and provided information on historic incidents. Based on information obtained, targeted soil investigations were performed as described below.

15 Pump House

Three different releases of crude oil have occurred historically at the 15 Pump House, based on a review of Sunoco's internal records. Due to multiple releases and known product handling, additional investigation in this area was conducted as part of the RI activities in June 2016. Two characterization soil borings (AOI4-BH-16-013 and AOI4-BH-16-014) were completed to the east and west of the 15 Pump House, biased to areas of visible surficial staining and/or access to the areas. At the time of the investigation activities, PES was conducting repairs on an underground pipeline. This area was avoided during Evergreen's sampling efforts. Concentrations of COCs did not exceed the SHS, NRDC MSC or the SSS for lead in any of the soil samples.

3.5 WELL INSTALLATION

During installation of monitoring wells, S-39D and S-218D, in 2016, shallow and deep soil samples were collected from each well and analyzed for the Evergreen Petroleum Short List. Shallow and deep samples were also collected during the installation of monitoring well, S-416, and analyzed for the Evergreen Comprehensive List. Results are included in **Tables 3-2 and 3-3**. Concentrations of COCs did not exceed the maximum of SHS, NRDC MSCs or the SSS for lead, in any of the soil samples.

3.6 DELINEATION OF DIRECT CONTACT MSC/SSS EXCEEDANCES

In order to characterize the horizontal and vertical extent of identified contamination in AOI 4 soil (up to the time of this RIR), areas exhibiting exceedances of the NRDC MSC and the lead SSS were delineated. These areas and associated investigations are described below.

- The concentration of lead detected in the sample from boring AOI4-BH-13-99 collected at 1.5-2 ft bgs exceeded the SSS. This exceedance is delineated vertically by the deep sample at that location; however, horizontal delineation was required in all directions. Three additional locations (AOI4-BH-16-008 through AOI4-BH-16-010) were completed for horizontal delineation, with one shallow sample (0-2 ft bgs) collected from each location and analyzed for lead only. The SHS for lead was exceeded for two of the three locations (AOI4-BH-16-008 and AOI4-BH-16-009), however all three samples were below the SSS for lead.

- A concentration of lead exceeding the SSS in the shallow soil sample (0-0.5 ft bgs) from boring S-381, is delineated vertically by the deep sample at that location and horizontally to the south, east, and northeast. One additional location (AOI4-BH-16-011) was completed as part of RI activities for horizontal delineation to the northwest. One shallow soil sample (0-2 ft bgs) was collected and analyzed for lead only.

  The concentration in delineation sample AOI4-BH-16-011 was also found to exceed the SSS for lead; therefore, one additional soil boring (AOI4-BH-16-022) was completed to northeast of AOI4-BH-16-011 location, with one shallow soil samples (0-2 ft bgs) collected and analyzed for lead only. The concentration of lead in AOI4-BH-16-22 exceeded the SHS, but was below the SSS.

- The exceedance of the lead SSS for the sample from boring AOI4-BH-13-103 collected at 0-1 ft bgs is delineated vertically by the deep sample at that location and horizontally to the northeast and northwest. One additional location (AOI4-BH-16-012) was completed to the south for horizontal delineation. One shallow soil sample (0-2 ft bgs) was collected and analyzed for lead only. The concentration of lead exceeded the SHS, but was below the SSS.

4.0 GROUNDWATER INVESTIGATION

4.1 HISTORIC GROUNDWATER INVESTIGATIONS

Many groundwater investigations have been conducted within AOI 4 and the surrounding offsite area evaluated in this RIR. From those investigations identified through historical document review, the oldest well logs indicate that the installation of monitoring wells occurred at the PES Complex as early as 1982. Other archived documents indicate that recovery wells were operational in this area as early as the late 1960s. Most of the investigations that span multiple properties appear to have been performed in response to suspected releases of petroleum substances to the subsurface based on the identification of petroleum odors in area sewers, observations of LNAPL in excavations, or operational losses. Previous consulting reports describe the purpose, methodologies, and present the results of historic groundwater sampling events performed in conjunction with the investigations. On behalf of Evergreen, Stantec identified and has collected and included as much of the historical subsurface information as was feasible in this RIR. That data includes well construction details and well logs, summarized on **Table 4-1** and included in **Appendix C,** and available analytical data collected from historic reports for wells located in AOI 4, which includes results dating back to 1985, in **Tables 4-2 and 4-3**.

To characterize historical groundwater conditions beneath AOI 4, groundwater analytical data summarized on the above-referenced tables include comprehensive sampling events conducted in 2005 and 2013 (included in previous SCRs/RIRs) and annual perimeter groundwater sampling events performed by Stantec. In general, groundwater analytical data collected as a part of these historic investigations indicate that concentrations of most constituents on the Evergreen COC lists have historically been detected above the SHS (as defined in this report) in groundwater (a detailed discussion of the aquifers present and relative conditions in each aquifer are discussed in **Sections 5 and 10**).

Review of available documents indicates offsite investigations of groundwater have occurred on up to six adjacent properties (see **Figure 1-2**), including the former DSCP, former Passyunk Homes, former Ryder Truck Rental, CSX, Steen property, and the former ARCO property (subsurface data is included in these RIR data tables, as Evergreen retains the environmental liability for that property). The investigations date back as early as the 1980s and like those performed at the PES Complex, were most often conducted to evaluate subsurface petroleum impacts that may be related to releases(s) from former storage tanks or piping in those areas. Relevant offsite data contained in those reports has been included in this RIR for the fate and transport assessment presented in **Section 10**.

4.2 WELL INSTALLATION ACTIVITIES

This section describes well installation activities that were performed as part of the AOI 4 remedial investigation. Activities are discussed by purpose in order to clarify characterization goals. All fieldwork was performed in accordance with the *Evergreen Field Procedures Manual* (**Appendix B**). Monitoring well locations are shown on **Figure 1-2**. Well logs, including both lithologic and well construction details, are included in **Appendix C**. Well construction details are also summarized on **Table 4-1**. The following sections discuss the well installation strategy/rationale, which is also summarized on **Table 3-1**.

4.2.1 Lower Aquifer Monitoring Well Installations

Two 4-inch polyvinyl chloride (PVC) monitoring wells (S-39D and S-218D) were installed in the lower aquifer in AOI 4 to aid in vertical delineation of dissolved impacts in groundwater and to refine the existing hydrogeologic model for the PES Complex presently under development. The locations for these wells were selected to address data gaps identified in the existing lower aquifer well network. Pilot soil borings performed prior to the well installations were advanced to bedrock in order to evaluate Coastal Plain hydrostratigraphy and identify appropriate well screen intervals. Screen intervals were subsequently selected in the lower aquifer and well screens were installed from 122 to 132 ft bgs for S-39D and from 86 to 96 ft bgs for S-218D.

Prior to the commencement of exploratory drilling, each location was cleared for subsurface utilities to a depth of 8 ft bgs using a backhoe. Utility clearing was performed by H.T. Sweeney & Son, Inc., of Brookhaven, Pennsylvania, under the oversight of Aquaterra. Advancement of soil borings and monitoring well installations were performed in January and February of 2016 by Parratt-Wolff, Inc. (Parratt-Wolff) of Lewisburg, Pennsylvania, under the oversight of Stantec. A combination of hollow stem auger and mud rotary drilling methods was utilized during borehole advancement for each monitoring well installed. Pilot boreholes utilized for subsurface characterization to bedrock were reamed with larger drilling tools to the selected well screen depths to allow for the 4-inch wells to be installed. Both wells were developed by Parratt-Wolff for approximately 4 to 6 hours utilizing several cycles of air lifting and surging. The wells were developed until groundwater produced was relatively free of turbidity. Groundwater and sediment generated during well development was contained in frac tanks. Frac tanks were emptied and cleaned by U.S. Environmental using a vacuum truck and the water was treated at the PES Complex's wastewater treatment plant.

During drilling, surface and subsurface soil samples were collected from the locations for laboratory analysis of the Evergreen Petroleum Short List. Continuous soil sampling was performed using a split spoon sampler. Soils were field screened with a PID, and lithologies were logged by a Stantec geologist. In addition, three Shelby tubes were collected within muddy strata of the apparent PRM aquifer system. The Shelby tube samples and some of the spoon samples were sent to GeoStructures in King of Prussia, Pennsylvania, for analysis of particle size, fraction organic carbon, and permeability. Results of the laboratory testing are discussed in **Section 5** and the laboratory report is included in **Appendix J**.

4.2.2 LNAPL Delineation Monitoring Well Installation

Water-table monitoring well S-416 was installed as a part of the remedial investigation. The well was installed as a replacement for destroyed well MW-4, in order to refine the LNAPL plume limits in the northwest portion of AOI 4. Prior to installation, the S-416 location was cleared for subsurface utilities to a depth of 8 ft bgs. Well installation activities were performed using hollow stem auger methods by Parratt-Wolff, Inc. of Lewisburg, Pennsylvania under the oversight of Aquaterra between June and July 2016. During borehole advancement, surface and subsurface soil samples were collected for laboratory analysis of the Evergreen Comprehensive List. Continuous soil sampling using a split spoon sampler was performed. An Aquaterra field technician screened soil with a PID and logged sample lithologies.

4.2.3 Offsite Monitoring Wells

As part of the AOI 4 characterization strategy discussed with the PADEP, installation of five offsite monitoring wells along the southeastern boundary of AOI 4 was proposed. The purpose of these monitoring wells was to aid in the delineation of AOI 4 groundwater contamination in the unconfined aquifer and to assess the potential for offsite contaminant migration. Negotiations with property owners for the installation of these wells have been unsuccessful to date. A fate and transport assessment has been presented in **Section 10.10** to preliminarily evaluate the potential extent of offsite groundwater contamination that may be related to migration from AOI 4. A more comprehensive groundwater model is under development and will be utilized to refine delineation in this area as described in **Section 10.11**.

4.3 GROUNDWATER SAMPLING EVENTS AND RESULTS

Two recent comprehensive rounds of groundwater sampling were conducted in August 2016 and October 2016 to characterize present conditions. All fieldwork was performed in accordance with the *Evergreen Field Procedures Manual* (**Appendix B**). Monitoring well locations are shown on **Figure 1-2**. The 2016 characterization groundwater samples were analyzed for the Evergreen Comprehensive List, although pre-2016 groundwater data may have included analysis of additional parameters. Groundwater sampling analytical results, including available historical results, are summarized on **Tables 4-2 and 4-3**. Along with conventional/low-flow sampling methodologies, the following wells were also chosen to sample using passive (no purge) sampling methodology: S-39D, S-218D, and S-245. These sample results are identified with "HS" in the sample ID. Sub-LNAPL groundwater samples were collected from the following wells to characterize COC concentrations beneath potential source areas: S-30, S-32, S-103, S-104, S-124, S-220, S-235, S-278, S-279, S-365, S-368, and S-373. These sample results are identified in the tables by an "SL" qualifier.

In summary, nearly all COCs on the Evergreen Comprehensive List were detected in AOI 4 groundwater during the 2016 sampling events. Concentrations of the following twenty compounds were detected in groundwater above the SHS during the 2016 sampling events: 1,2,4-TMB, 1,2-dibromoethane (EDB), 2-methylnaphthalene, anthracene, arsenic, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, ethylbenzene, lead, methyl tertiary butyl ether (MTBE), naphthalene, phenanthrene, pyrene, toluene, vanadium, and zinc. AOI 4 hydrostratigraphic units and groundwater sampling results by aquifer are discussed further in **Sections 5** and **10**, respectively.

4.4 WELL GAUGING ACTIVITIES AND GROUNDWATER MONITORING

Stantec presently conducts annual liquid level gauging of existing and accessible wells at the PES Complex (including some offsite wells along 26th Street). The PES Complex-wide annual well gauging event, which is typically conducted during the second quarter of each year, is used to identify the presence of LNAPL and estimate groundwater flow patterns. Liquid level measurements, groundwater elevation maps, and product thickness maps are submitted to PADEP with the Philadelphia Refinery Remediation Program Groundwater Remediation Status Reports for the first half of each year. **Table 4-4** presents liquid level measurements collected from AOI 4 and the surrounding area during the 2014 to 2016 annual gauging events. Groundwater elevation contours from the May 2014, May 2015, and May 2016 annual gauging events are discussed further in **Section 5**. In addition to the annual events, select wells in AOI 4 are gauged quarterly. These data are submitted to PADEP semi-annually in the Groundwater Remediation Status Reports.

For this RIR and general goals related to the overall characterization of groundwater conditions beneath the PES Complex, Stantec deployed several absolute pressure (data) loggers in selected wells in March 2016. Four of those monitoring wells, S-218, S-218D, S-39, and S-39D, are located in AOI 4. The data loggers were deployed on jacketed, braided steel cables and set to continuously record water depth at one to ten minute intervals. A barometric data logger was co-deployed in well S-218 to capture atmospheric pressure data at the same time interval. Data logger downloading and water-level gauging was performed periodically by Stantec throughout the course of monitoring. The S-39 and S-39D data loggers were removed after approximately one week. The S-218 and S-218D data loggers have been collecting near-continuous water depth data since that time. The methodology for logger data reduction and interpretation is presented in **Section 5**.

4.5 AQUIFER TESTING

During March 2016, a Stantec geologist and Parratt-Wolff conducted performance tests and short-duration constant rate pumping tests on wells S-218D and S-39D. The purpose of the testing was to acquire drawdown and recovery data that could be used to estimate lower aquifer properties at the PES Complex. The tests were performed using a three-inch submersible pump set approximately 75 feet below the top of casing on a one-inch discharge line that passed through a ball valve and flow meter (for flow rate adjustment and measurement). Pumped groundwater was conveyed through hoses to frac tanks for later disposal, as discussed above. Two check valves were installed above the pump in the discharge line to prevent backflow and allow for the collection of recovery data. During the tests, pumping rates were adjusted in two steps from approximately 15 to 25 gallons per minute (gpm). The second step was run for approximately 2-4 hours to maximize drawdown prior to capturing the recovery data.

In August 2016, Stantec returned to AOI 4 to perform slug tests on wells S-218D and S-39D. The purpose of the slug testing was to establish lower aquifer hydraulic conductivity estimates to compare to those estimated from the pumping and recovery tests. A pneumatic slug assembly was used to pressurize the well casings and initiate instantaneous water-level displacements from which the recovery data could be evaluated (rising-head tests). Both the pumping and slug tests were performed in general accordance with the *Evergreen Field Procedures Manual* (**Appendix B**). AQTESOLV Version 4.5 Professional was used to fit solutions to the normalized slug test and pumping test drawdown/recovery data. Both wells exhibited overdamped/non-oscillatory responses to the slug tests. Stantec applied either the Hvorslev (1951) or KGS Model (Hyder et al., 1994) to fit the data and estimate hydraulic conductivity. For the pumping tests, analysis of both drawdown and recovery or residual drawdown data was performed by applying the Theis (1935) solution. Results of the aquifer testing are discussed in **Section 5** and the data analyses are presented in **Appendix K**.

5.0 SITE-SPECIFIC HYDROGEOLOGIC CONDITIONS

In **Section 2**, details regarding Stantec's methodology and interpretation of regional geologic conditions were presented. The purpose of this discussion of site-specific conditions is to refine the regional hydrogeologic framework to summarize conditions observed beneath AOI 4, with an emphasis on groundwater occurrence, groundwater flow, and hydraulic head potentials. It is understood that although this RIR is designed to address subsurface conditions beneath AOI 4, PADEP has previously requested that investigations of individual AOIs at the PES Complex look beyond the boundary of the AOI being investigated. Further, PADEP has also requested that synoptic well gauging data collected by DLA for the former DSCP and Passyunk Homes properties be considered in the hydrogeological evaluation of data along adjacent portions of the PES Complex.

In consideration of those requests, Stantec has utilized well gauging and groundwater analytical data from perimeter wells in AOIs 1, 2, and 3 in this investigation of AOI 4. Moreover, available DLA gauging data for the former DSCP, Passyunk Homes, CSX, and/or Steen properties has been utilized herein for the years obtained through collaborative data exchanges. It is noted that wells on the Steen property were not available for two of the three gauging events (May 2014 and May 2015) presented in this report as that property was not accessible to the DLA's consultants. Boring/well logs reviewed for the characterization of AOI 4 are included in **Appendix C**. A well summary table, including construction details for AOI 4 wells where available, and well gauging data utilized in groundwater contouring and evaluation of recent hydraulic head conditions for AOIs 1, 2, 3, and 4, are included in **Tables 4-1** and **4-4**, respectively.

5.1 GEOLOGIC FORMATIONS AND UNITS OBSERVED

On the basis of available lithologic data from boring logs, the principle of stratigraphic position, results of past investigations, review of historical maps, review of archived sediment core samples from select monitoring wells, test drilling in support of this investigation, and attempted correlation of observed lithologies across the study area to a published geologic framework (e.g., Quaternary deposits and the PRM aquifer system), Stantec has interpreted the following stratigraphy in the subsurface beneath AOI 4. A generalized stratigraphic column adopted from Schreffler (2001) is included as **Table 5-1** and discussed further in **Section 5.2** in the context of interpreted hydrostratigraphy.

5.1.1 Anthropogenic Fill

Anthropogenic fill is present beneath the existing land surface at most locations in AOI 4 and has been identified to range in thickness from a thin veneer to a maximum of approximately 10 feet. The anthropogenic fill rarely exceeds a few feet in total thickness. It has been observed that the thickest area of fill generally correlates to and is reflective of the location of a former incised stream valley that once bisected AOI 4, as mentioned in **Section 2.1.1**. Stratigraphic Profile F – F' (**Figure 2-7**) cuts across that former valley and indicates that it was approximately 1,000 to 1,500 feet wide along the north-central to northwestern margin of AOI 4 (thalweg defined by AOI 3 well S-284D log on Profile F). This is the same former stream discussed by Stantec regarding AOI 1 (Stantec, 2016). Historic contoured topography (**Figure 2-1**) suggests that the stream valley was sourced offsite under 26th Street and the CSX Property to the east-northeast (upstream) of the PES Complex, and flowed southwest traversing through AOI 2 near Hartranft Street, AOI 4, AOI 3, and AOI 7 before reaching its confluence with the Schuylkill River. Borehole logs for wells S-284D, S-111, S-367, and S-416 indicate that the fill in this valley and elsewhere in AOI 4 is heterogeneous in nature, as previously described, and is composed of an admixture of sand and gravel, mud, and anthropogenic debris including bricks and construction debris. In places, the fill is saturated and supports a perched water table above finer-grained alluvium. Precipitation percolating through fill in the former stream channel could also create localized groundwater mounding on the water table, where the water table intersects the fill (e.g., at S-284D, present-day water table elevations intersect the base of the filled stream valley and would support groundwater discharge to fill). For this reason, it is important to evaluate the former stream as a preferential flow path (**Section 9.6**).

5.1.2 Recent (Holocene) Alluvium

Recent alluvial deposits that post-date the "Trenton gravel" are nearly everywhere present beneath filled areas or at existing land surface within AOI 4. In general, recent alluvium defines the antecedent topography that preceded industrialization at the PES Complex. In large part, recent alluvium within the study area is fine-grained, brown to brownish gray silt/clay with occasional lenses of sand and gravel that commonly grades with depth to include some sand. In places, decomposing organic material has also been observed in this deposit. Overall recent alluvium thickness has been observed to range from less than one foot to a maximum of approximately 17 feet in AOI 4. Within axial portions of the former stream valley identified in AOI 4, it appears that more-recent stream incision may have completely removed the older alluvial deposits, and may have at one time allowed for ground surface exposure of the underlying "Trenton gravel" deposits (e.g., monitoring well S-284D and S-365 on **Figure 2-7**). Because of its stratigraphic position and fine-grained texture, the recent alluvium is commonly mottled from the slow percolation of recharge from ground surface and generally is present above the seasonal high water table (i.e., does not support local artesian water-table conditions).

5.1.3 "Trenton Gravel"

The "Trenton gravel" is everywhere present beneath AOI 4 and ranges in thickness from approximately 10 to 15 feet. Its predominant lithology appears to be silty, clayey, poorly-sorted sand with gravel, but includes secondary sandy gravel and clay/silt lithologies in lenses. As described PES Complex-wide, the "Trenton gravel" is a heterogeneous unit that is reflective of its depositional environment. In AOI 4, the water table typically occurs in the "Trenton gravel". However, in the context of overall saturated thickness, the unconfined aquifer is mostly comprised of sediments correlated to the PRM upper sand unit, particularly in eastern portions of AOI 4.

5.1.4 Upper Clay Unit

The PRM upper clay unit is interpreted to be present beneath most of AOI 4 and was mapped as the first occurrence of reddish yellow, brown, and brownish yellow clay/silt (commonly sandy and laminated) beneath the "Trenton gravel". The upper clay was distinguished from the underlying middle and/or lower clay units where possible by stratigraphic position, color, consistency, and overall lithologic character. Where interpreted to be present, the upper clay generally ranges in thickness from less than one foot to approximately 5 feet and appears to fill channels cut into the upper sand. **Figure 2-7** supports this interpretation of the upper clay and as mapped, indicates that the upper clay is very thin and could be patchy along 26th Street. In the context of AOI 4 hydrostratigraphy, the upper clay unit is interpreted to be a part of the unconfined aquifer and where present, function as an aquitard limiting groundwater exchange between the "Trenton gravel" and upper sand unit.

5.1.5 Upper Sand Unit

The PRM upper sand unit is interpreted to be present beneath most of AOI 4 and ranges in thickness from approximately 5 to 30 feet. The upper sand unit appears to be thickest along the axial margin of the League Island Bedrock Trough where it forms a terrace near well S-39D. The upper sand unit is generally light gray to pale yellow, fine to medium-grained quartz sand with a trace to little silt, distinctly different from the heterogeneous "Trenton gravel". Muddy sand lenses are observed most often near the top of the unit where they sometimes grade up into the upper clay. In contrast, gravelly beds may be present near the bottom of the unit, generally along the margins of channel cuts into the underlying middle clay unit. The upper sand unit occurs beneath the water table under average conditions. However, in the context of hydrostratigraphy, the upper sand is interpreted to be part of the water-table aquifer beneath AOI 4 due to the discontinuous nature of the intervening upper clay unit aquitard in the area. Beneath the approximate eastern half of AOI 4, upper sand unit deposits comprise a greater portion of the unconfined aquifer than do the Pleistocene deposits (eg. S-39D, the unconfined aquifer is almost entirely composed of upper sand).

5.1.6 Middle Clay Unit

The PRM middle clay unit is mapped in this RIR as a continuous deposit of predominantly medium to high plasticity, gray, red, and white clay/silt beneath AOI 4. Where interpreted from boring logs, the thickness of the middle clay ranges from approximately 5 to 20 feet. Like AOI 1 (Stantec, 2016), the lithology of the interpreted middle clay is noted to vary beneath AOI 4, from red and white 'fat' clays to sandy gray clay and silt with fine sand laminations. Variability in middle clay lithology is plausible in this subcrop area near the "Fall Line," where the PRM aquifer system's "defined" lithologic units experience thinning and facies changes that can alter the primary lithologies from that of their down-dip type section, and make separation of each geologic unit difficult and interpretive. Lignite, noted by Greenman et al. (1961) to be oftentimes present at the base of the middle clay unit, has been observed on select borehole logs and was used in this RIR as a potential stratigraphic marker to help guide correlation of the base of the middle clay beneath AOI 4 (e.g., monitoring wells S-284D and S-218D). The middle clay unit generally represents an aquitard that separates the two mappable hydrostratigraphic units (i.e., the water-table and lower aquifers) beneath most of the PES Complex, but where thin and sandy could support limited recharge to the underlying lower aquifer through vertical leakage (leaky confining bed), depending on head potentials between those aquifers (discussed further in **Section 5.4**).

5.1.7 Middle Sand Unit

The PRM middle sand unit has been mapped in this RIR to be present beneath AOI 4 as a continuous deposit, primarily based on stratigraphic position. The middle sand is generally mapped where brown and reddish yellow, occasionally muddy and gravelly sand is present between the interpreted middle and lower clay units, where those units are distinct, or between the middle clay and lower sand (where the lower clay appears to have been eroded). Thickness generally ranges from approximately 10 to 30 feet. The middle sand pinches out to the east offsite where the middle and lower clays form a vertically continuous stratum (e.g., well PH-85 in **Figure 2-7**). To the west of AOI 4, the middle sand appears to have been truncated by erosion through the Schuylkill River valley, likely during the Pleistocene, and is in direct contact with the "Trenton gravel". In either scenario because of the discontinuous nature of the lower clay unit, the middle sand unit is interpreted to form a portion of the lower aquifer hydrostratigraphic unit.

5.1.8 Lower Clay Unit

The interpretation presented in this RIR suggests that the PRM lower clay unit is absent beneath most of AOI 4. If present, it may exist in small lenses as erosional remnants occupying troughs cut into the top of the lower sand. Where mapped to the east of AOI 4, the lower clay unit appears to be a discrete unit within portions of the League Island Bedrock Trough. The lower clay unit would most likely represent a leaky confining bed (aquitard) within the lower aquifer hydrostratigraphic unit if and where present.

5.1.9 Lower Sand Unit

Of the six published PRM geologic units, the lower sand unit appears to be the thickest and most laterally continuous beneath and near AOI 4. In general, the lower sand coarsens with depth, from a dense fine to medium pale gray, pale yellow, and white (commonly muddy) quartz sand to white and varicolored sandy gravel and gravelly sand. Scattered lenses of clayey sand and gravel within the overall sequence are common. Thickness of the lower sand generally ranges from approximately 25 feet to over 50 feet beneath AOI 4 and the surrounding area evaluated. Maximum thickness is observed beneath eastern AOI 4, where the lower sand unit fills a bedrock trough. Because of its predominantly sandy and gravelly lithology and large geographic extent, the lower sand is interpreted to form a large portion of the lower aquifer hydrostratigraphic unit.

5.1.10 Crystalline Bedrock

Bedrock has been observed beneath AOI 4 and, where encountered, has been described as moderately to highly-weathered mica schist. Where highly-weathered, the saprolite is generally a sandy, micaceous clay/silt. As shown on **Figure 2-12**, bedrock elevations beneath AOI 4 range from a maximum of approximately -70 feet NAVD 88, near the northern AOI 4 boundary, to a minimum of approximately -135 feet NAVD 88 near well S-39D. As refined by subsurface data collected for this AOI 4 investigation, it appears that the larger, more prominent League Island Bedrock Trough may have had extensions defined by smaller valleys oriented west-east that originated beneath AOI 1 and AOI 4 of the PES Complex. The bedrock surface (including saprolite) is interpreted to function as an aquitard representing the lower boundary of the lower aquifer.

5.2 AQUIFER HYDRAULIC PROPERTIES

Two aquifers have been established as mappable units beneath AOI 4 of the PES Complex. In general, these are the water-table (unconfined) and lower (semi-confined) aquifers (**Table 5-1**). For the purposes of this RIR, Stantec identified and has evaluated properties of those aquifers through review of approximately 200 well and soil boring records. The goal of the records review was to identify relatively distinct hydrostratigraphic units from well gauging data and where available, lithologic logs, soil physical properties, and well/aquifer testing data. Hydrostratigraphic units were assigned to wells where possible using the stratigraphic profiles developed for this RIR and nearby, deep boreholes as control points (**Table 4-1**). Overall, approximately 90% of existing monitoring wells used in AOI 4 are screened across the unconfined aquifer and were constructed to intersect the water table. The remaining 10% are screened in the lower aquifer, which may include portions of screened intervals that intersect lithologies correlated to the middle sand, lower clay, and/or lower sand units.

It is noted that where identified based on lithology and stratigraphic position, the PRM upper sand and middle sand geologic units appear to be hydraulically connected to portions of the two mappable aquifers identified above. Because of apparent discontinuities in the upper and lower clay units, they do not appear to represent discrete hydrostratigraphic units in this area. It is also noted that hydraulic head potentials between the unconfined and lower aquifers appear to vary across AOI 4 and the vicinity. These hydrogeologic conditions are discussed further below and are supported by **Figures 5-1** through **5-9**, which show groundwater elevation contours and groundwater monitoring data for both aquifers for calendar years 2014, 2015, and 2016.

5.2.1 Methodology for Evaluation of Hydraulic Data

For the purposes of evaluating present-day hydraulic head, groundwater flow patterns, magnitudes of groundwater flow (groundwater velocities), and any potential variability in those conditions through time for the aquifers identified in this RIR, Stantec reviewed and interpreted 2014, 2015, and 2016 water-levels from annual, site-wide well gauging data within AOI 4 and proximity (as described in **Section 4.4**). The analysis included gauging data from wells at the former DSCP property that are synoptically gauged by the DLA. For wells gauged by Stantec, depth-to-water measurements were collected with an optical oil/water interface probe and reported to the nearest hundredth of a foot. Water-table elevations were calculated using surveyed well top-of-casing elevations and, where necessary due to LNAPL accumulations, corrected using appropriate LNAPL density data (see **Table 4-4** for well gauging data).

It is noted that active remedial systems within the study area were shut down prior to annual well gauging for the 2014 and 2015 events (except for the 3 Separator System in 2015) and the results presented herein are interpreted to represent near-static conditions for those years. During the 2016 annual gauging event, all remediation systems at the PES Complex were operating (apart from historic systems labeled “inactive” on **Figure 1-2**). The integrity of DLA well gauging data for DSCP area wells was assumed to have been evaluated by the DLA, but Stantec also completed spot checking of DLA well gauging data and wells typically excluded by DLA’s consultant were also excluded from contouring in this study. Stantec understands that no significant remedial groundwater pumping is presently occurring at the former DSCP property and assumes that those data represent near-static conditions.

After well data evaluation, Golden Software's Surfer® 12 was used to interpolate the well data using block Kriging. Grid residuals were evaluated and the interpolated surfaces were subsequently contoured and imported into a geographic information system (GIS) for display and evaluation. Due to the high well density in areas of AOI 4 and the commonality of groundwater mounding in the subsurface, 2016 water-table elevation and lower sand potentiometric surface datasets were then refined through several iterations of gridding to remove anomalous data, where appropriate. For the unconfined aquifer, anomalous data points include those for wells screened within areas of apparent groundwater mounding where it is unclear whether those water-level elevations represent true water-table mounds under unconfined conditions, or areas of perched groundwater in fill or alluvium not at equilibrium with atmospheric pressure. Only one well was excluded from interpolation of the 2016 lower aquifer dataset. Both "unprocessed" and "processed" surfaces are presented and discussed in this RIR for 2016 unconfined aquifer data (unfiltered and filtered data). Well identifiers representing the filtered 2016 dataset were then used to select consistent 2014 and 2015 datasets, except for wells not gauged in 2016 but used in the AOI 1 RIR. Those wells were added to the queries for consistency between RIRs, pending gauging data availability for each annual event.

In addition to groundwater contouring of annual well gauging data, data logger monitoring data collected as described in **Section 4.4**, were processed and used to create a high-resolution water-level elevation plot for the wells monitored in AOI 4 (**Figure 5-9**). Water depths recorded by the absolute sensors were compensated for variability in atmospheric pressure using a linear correction to the synoptic barometric logger data. Manual depth to water measurements performed with a water-level meter were used to correct the data for sensor drift. Lastly, corrected depths were converted to elevations and plotted through time using the surveyed top of well casing elevations.

5.2.2 Unconfined (Water-Table) Aquifer

Beneath the study area, the unconfined aquifer is primarily composed of saturated portions of the "Trenton gravel" and PRM upper sand unit. Where present in mappable thickness, the unconfined aquifer also includes the intervening PRM upper clay unit and where saturated (mostly to the west of AOI 4), deeper portions of Holocene alluvium and fill. On average, the saturated thickness of the unconfined aquifer beneath AOI 4 is approximately 10 to 35 feet. As a part of this RIR, Stantec mined existing data and has identified estimations of horizontal hydraulic conductivity (k_h) for the AOI 4 unconfined aquifer from 2 in-situ aquifer (slug) tests and one regional pumping test (see **Figure 2-9**). From those tests and as previously discussed in **Section 2.2.1.2.2**, estimated values of unconfined aquifer k_h vary from approximately 12 ft/d to more than 450 ft/d in AOI 4. The wide range of estimated values of k_h is reflective of the heterogeneous nature of the "Trenton gravel" in AOI 4 and in some instances nearby anthropogenic fill (e.g., AOI 3 guard basin wells). Anomalously low values of k_h may be the result of poor well-aquifer hydraulic communication related to inadequate well development, or fouling of the well screen. It is noted that in general, estimated values of unconfined aquifer k_h are higher for pumping tests that were designed to estimate local to regional conditions, where the k_h has been estimated to range from approximately 434 to 452 ft/d beneath northwestern portions of AOI 4 (RW-2 test area of influence). It is noted herein that Stantec is presently evaluating reasonable values of reported unconfined aquifer k_h for AOI 4 and vicinity as a part of PES Complex-wide numerical model calibration and sensitivity analysis.

In addition to estimates of k_h, other estimates of unconfined aquifer properties were identified. Limited estimates of vertical hydraulic conductivity (k_v) are available for the unconfined aquifer near AOI 4. ENSR (1992) evaluated the vertical permeability of unconfined aquifer muddy lithologies near the guard basin in AOI 3 that can be reasonably applied to similar lithologies in AOI 4. Based on Stantec's subsurface interpretation and the consistency of the historical data with depth, muddy lenses within and alluvium overlying the unconfined aquifer may have a vertical permeability of approximately 10^{-8} centimeters per second (cm/s). Recent laboratory testing in AOI 4 (**Appendix J**) and other AOIs of the PES Complex indicates that the effective porosity of granular lithologies in the unconfined aquifer may range from approximately 7 % (well S-412, 12.6-13.4 ft bgs) to 28 % (well S-118DSRTF, 42-44 ft bgs). Within AOI 4, the fraction organic carbon in unconfined aquifer sand and gravel deposits may range from approximately 0.5-2% (well S-218D, 38-40 ft bgs; well S-39D, 26-28 ft bgs).

5.2.2.1 Hydraulic Heads and Groundwater Flow

As shown in **Figure 5-1**, water-table mounds and other anomalies are apparent near AOI 4 and tend to obscure the pattern of overall regional flow within the unconfined aquifer. The most significant, apparent groundwater mound in the study area is located adjacent to AOI 4 along the eastern bank of the guard basin as indicated by wells in parentheses: S-409, S-410, S-18, and S-21. Boring logs indicate that mounding in this area is the result of groundwater perching within significant fill deposits. Other areas of localized groundwater perching are apparent within a filled stream valley in northwestern AOI 4 as previously described in **Section 5.1.1**. In addition, groundwater mounding may also be the result of leaking infrastructure (such as fire suppression lines or sewers). Wells constructed with long but shallow screen intervals may intersect both perched water zones and the underlying water table, and where separated by a finer-grained, unsaturated stratum (e.g., Holocene alluvium) can contain unreliable water levels. Near the Penrose Avenue Remediation System (Penrose System), a groundwater capture zone is apparent surrounding that system's wells (both operational and sentinel wells). Evaluation of the persistence of groundwater mounding and groundwater losses from the unconfined aquifer are important components of this RIR because under these apparent conditions, horizontal hydraulic gradients, vertical flow potential, and groundwater velocities may be exaggerated or underestimated in AOI 4 and thus could influence scenarios of contaminant fate and transport.

Figures 5-2, **5-3**, and **5-4** display 2014 through 2016 water-table elevation contours after analysis and filtering of existing well data, as interpreted by Stantec. With localized areas of apparent groundwater mounding and/or anomalous data removed (including removal of actively pumping remediation wells in 2016 at the Penrose System), contours for all three years indicate that unconfined aquifer groundwater flows in a pattern that generally mirrors the historical topography shown on **Figure 2-1**. As such, a southwest-northeast trending groundwater divide is present in the southern half of AOI 4 beneath higher topography (well S-371 area). Around this divide, groundwater is indicated to flow in a radial pattern. North of that feature, flow appears to be southeast out of higher topography in AOI 2 and converge near the AOI 1/AOI 2 boundary near the location of the former stream. Horizontal hydraulic gradients generally range from approximately 0.001 to 0.004 feet per foot (ft/ft) in AOI 4. In contrast, horizontal hydraulic gradients steepen (up to 0.01 ft/ft) and groundwater flow beneath AOI 1, Steen, and the former DSCP property to the northeast of AOI 4 appears to converge along a depression, centered along the eastern PES Complex boundary at 26^{th} Street (Stantec, 2016). Beneath the former Passyunk Homes site, unconfined aquifer groundwater flows radially from another groundwater divide indicated at that property. Stantec discussed these flow patterns in detail and interpreted that the patterns of unconfined aquifer groundwater flow in that area are dominated by infiltration into the 26th Street Sewer, and potentially areas along the Pollock Street/Packer Avenue Sewer offsite (Stantec, 2016). The contours presented in this RIR indicate that within AOI 4, unconfined aquifer groundwater flow converges along the identified former stream valley that bisects a portion of the area, and in the northeastern corner may be influenced by offsite infiltration into the 26th Street Sewer.

5.2.3 Lower Aquifer

Beneath AOI 4, the lower aquifer is mapped in this RIR to be composed of nearly equal thicknesses of the middle and lower sand units as the lower clay unit appears to be absent in this area. On average, the saturated thickness of the lower aquifer beneath AOI 4 is approximately 50 to 90 feet and is thickest along 26th Street where a deep bedrock trough exists (e.g., S-39D). As noted in **Section 4** and on **Figure 2-11**, Stantec performed slug and pumping tests on lower aquifer deposits in AOI 4 using wells S-218D and S-39D. Well testing indicates that a representative hydraulic conductivity for the lower aquifer in AOI 4 may be approximately 65 to 85 ft/d (**Appendix K**). This encompasses lithologies that include silty sand to well-graded gravelly sand with a trace of silt (see sieve analyses in **Appendix J**). Older slug testing results for wells near the AOI 3 guard basin resulted in lower k_h values for the lower aquifer in that area, ranging from approximately 3 ft/d to 30 ft/d (eg. S-8 and S-22 on **Figure 2-8**). The data analysis appendix of ENSR (1992) was not available for review of test analysis methods; however, the results appear anomalous in the context of other testing and apparent lithologies present. Fraction organic carbon testing data included in **Appendix J** indicates that the AOI 4 lower aquifer deposits may contain approximately 1% organic carbon.

Lower aquifer k_h data can also be reasonably estimated from historical testing performed at the Philadelphia Naval Shipyard and as such has been summarized from offsite areas on **Figure 2-10**. From those tests, values of lower aquifer k_h are estimated to vary from approximately 123 ft/d to 151 ft/d. As noted for the unconfined aquifer, Stantec is presently evaluating potential values of AOI 4 aquifer k_h as a part of PES Complex-wide numerical model calibration and sensitivity analysis. No estimates of k_v are available for lithologies correlated to the lower aquifer beneath AOI 4.

5.2.3.1 Hydraulic Heads and Groundwater Flow

Groundwater flow within the lower aquifer beneath AOI 4 and proximity has been evaluated and contoured utilizing data from up to 20 wells, and the resultant potentiometric surfaces are shown on **Figures 5-5** through **5-7** for synoptic well gauging events conducted in May of 2014, 2015, and 2016. At the locations evaluated, the well gauging data indicates that the lower aquifer has artesian conditions or is at least semi-confined beneath AOI 4. In general, the datasets indicate an overall southerly groundwater flow direction beneath AOI 4 under a hydraulic gradient of approximately 0.0006 ft/ft. Like the pattern of flow in the unconfined aquifer, along the northeastern perimeter of AOI 4 and areas to the east, the lower aquifer potentiometric surface indicates that groundwater flow direction is to the southeast. Offsite beneath the former Passyunk Homes property, flow convergence is indicated in May 2016. Variability in patterns of lower aquifer groundwater flow in the area evaluated may be related to aquifer transmissivities through the referenced bedrock troughs, or as indicated by Stantec (2016) upward leakage into the 26th Street Sewer or offsite unconfined aquifer.

5.3 CLAY UNIT PROPERTIES

5.3.1 Upper Clay Unit

The PRM upper clay unit appears to be of limited thickness and lateral extent beneath AOI 4 and proximity. As such, the upper sand unit is interpreted as being hydraulically continuous with the overlying "Trenton gravel". However, where locally present in significant thickness, the upper clay unit aquitard could maintain hydraulic separation between the two formations/units and lead to localized areas of artesian pressure in the upper sand. Stantec collected one Shelby tube in the apparent upper clay unit at AOI 4 monitoring well location S-218D, and from that permeability test (depth of 30.1 to 30.5 ft bgs) it is estimated that the upper clay unit k_v may be approximately 2.16 x 10^{-7} cm/s (see **Appendix J**). At well S-39D, the upper clay was not encountered in sufficient thickness for Shelby tube sample collection but was observed to be of similar lithology to the upper clay at well S-218D.

5.3.2 Middle Clay Unit

The PRM middle clay unit is generally regarded as a regional confining unit in the study area. As presented in this RIR, the middle clay unit appears to be laterally continuous beneath AOI 4 and creates overall hydraulic separation between the unconfined and lower aquifers. For this RIR, Stantec collected two Shelby tubes in the apparent middle clay unit at AOI 4, one each from monitoring well locations S-218D (59.5 to 59.9 ft bgs) and S-39D (56.0 to 56.3 ft bgs). From those permeability tests it is estimated that the middle clay unit k_v may be approximately 6.0 x 10^{-7} to 7.21 x 10^{-9} cm/s (see **Appendix J**).

Offsite, Stantec is aware that DLA's consultants, the USGS, and others responsible for characterizing and remediating subsurface conditions at the former DSCP property have interpreted that a "breach" in the upper, middle, and/or lower clay units exists across a small area of that site. The interpreted "breach" area, as displayed by ARCADIS (2014a), is generally located beneath the Schuylkill Expressway, to the east of the CSX Property and west of Penrose Avenue. At that location, the current subsurface interpretation includes the lower sand unit mapped in direct hydraulic contact with the overlying "Trenton gravel" (e.g., well log for DSCP-MW-65). Using interpolation (inverse-distance weighted) software, Sloto (2012) modeled that "breach" as an approximately 25-acre area where the middle and lower sand units are hydraulically connected to the unconfined aquifer. The western limit of that "breach" area has not been delineated. However, no such area has been identified beneath AOI 4.

For the purposes of this RIR, Stantec reviewed the lithologic logs for 13 deep wells installed under the oversight of Tetra Tech, Inc. (Tetra Tech) in 2005 and 2007 at the former DSCP Property. Lithologic logs for deep wells DSCP-MW-20D and DSCP-MW-6D were also reviewed (logs for these wells can be found in IST [1998]). Those logs were interpreted and stratigraphic "picks" were made on the apparent formations/units and used in conjunction with well data at the PES Complex to create the stratigraphic profiles presented in this report. Of the well records reviewed, Stantec did not identify any logs exhibiting a complete hydraulic connection between the unconfined and lower aquifers in AOI 4. However, the cross sections developed for this RIR show that to the west of AOI 4 beneath AOIs 6 and 7, the middle clay was incised by erosion through the Schuylkill River valley and has been removed and replaced by Quaternary deposits. North and east of AOI 4 beneath the former Passyunk Homes property, the middle clay unit is interpreted to thin relatively rapidly over a short distance and may have been completely eroded prior to deposition of the upper sand unit near well PH-DW-10 (**Figure 2-8**). In this “breach” area as identified by others, it appears that the aquifers defined at AOI 4 may be hydraulically connected through muddy strata of the apparent middle sand unit.

5.4 AQUIFER CONDITIONS AND HEAD POTENTIALS BETWEEN AQUIFERS

Stantec evaluated the magnitude of vertical hydraulic head potentials for May 2016 between the unconfined and lower aquifers throughout the study area by identifying locations of well pairs in AOI 4 and by utilizing offsite well pair locations previously identified by Sloto (2012) and ARCADIS (2014a) for the former DSCP Property. **Figure 5-8** displays the results of that evaluation. The figure indicates that across most of the study area (including all well pairs in AOI 4), the hydraulic head potential between observed aquifers was positive (downward) in May 2016. However, an area of negative (upward) hydraulic head potential is indicated in southern AOI 1 and along 26th Street as supported by head observations at nested well pairs S-46/S-46D, S-214/S-392D, STEEN-PH-10/STEEN-DW-09, PH-MWS-1/PH-DW-10, EPH-PH-5/PH-DW-3, ARCO-1/ARCO-1D, and S-41/S-264D.

Outside of the area of indicated negative potential, a broad area of nearly equal hydraulic heads is indicated, generally along northeastern AOI 4 (eg., S-119/S-119D) and at the former DSCP Property near the “breach” area identified by others (eg., PH-DW-10/PH-MWS-1). Overall the positive hydraulic head potentials beneath AOI 4 support the existence of two aquifers and the continuity of the middle clay. Water-level monitoring data for AOI 4 well pairs shown on **Figure 5-9** indicate that the head potentials between the aquifers are consistent throughout the year. However, as concluded by Stantec (2016) the offsite pattern of flow potential continues to suggest that the 26th Street Sewer is receiving groundwater from the unconfined aquifer along an area of the sewer, and that groundwater losses are affecting heads in the lower aquifer through upward recharge/vertical leakage to the unconfined aquifer or direct losses to the sewer. The exact nature or cause of these losses is not currently known (i.e., breaks in the sewer, joint separation, construction anomaly, or other). Upward vertical leakage from the lower aquifer to the unconfined aquifer could be occurring in the offsite area to the east of AOI 4 where the middle clay unit may be absent.

6.0 LNAPL INVESTIGATION

To investigate LNAPL in AOI 4, a comprehensive LNAPL Conceptual Site Model (LCSM) was prepared and is included as **Appendix E** of this RIR. In general, the LCSM utilizes a technical approach to evaluate the potential mobility of LNAPL present at the site incorporating multiple lines of evidence, including observations of LNAPL distribution over time, an analysis of apparent NAPL thickness (ANT), physical and chemical laboratory analysis of LNAPL samples, and theoretical estimates of LNAPL mobility supported by field and laboratory measurements to understand whether AOI 4 LNAPL areas are residual (immobile), mobile (recoverable), and/or migrating. As defined in the LCSM, residual LNAPL represents LNAPL that is trapped in soil pores, mobile LNAPL is LNAPL that exceeds residual saturation, and migrating LNAPL is LNAPL that is observed to spread or expand. It is noted that although mobile LNAPL includes migrating LNAPL, not all LNAPL indicated to be mobile is migrating.

The following summarizes findings and conclusions of key elements of the LCSM utilizing data gathered from literature review, historical and recent field investigations, laboratory analyses, and remediation efforts. **Figure 6-1** is provided to support the summary.

- Numerous LNAPL characterization samples collected from the PES Complex by Stantec and others through time have identified the presence of several variably-weathered products and product mixtures in the subsurface at AOI 4. The variation in LNAPL characteristics is indicative of multiple product releases at different times with subsequent co-mingling of plumes. For the purposes of this and other RIRs for the PES Complex, AOI 4 laboratory-characterized LNAPL samples [i.e., qualitative analysis using chemical data of hydrocarbon distributions (gas chromatographic patterns) and comparison to reference product sample data] have been generalized by Stantec into the product groups (see LCSM for a description of the categories) listed below:
    - Light Distillate
    - Mixture of Light and Middle Distillate
    - Middle Distillate
- A mixture of light and middle distillate is the most common product type delineated in the subsurface beneath AOI 4. **Figure 6-1** displays the maximum observed LNAPL thickness for wells gauged during the time period 2013 – 2016 (Present). The maximum observed LNAPL thickness since 2013 was used conservatively (i.e., in some instances the maximum LNAPL thickness was observed in 2013) as a guide for delineation of the 6 general LNAPL plume areas shown. A few select wells that contained measurable LNAPL within this timeframe are not shown as plume areas due to insufficient spatial, temporal, and/or ANT data available to support that interpretation (e.g., well S-369).
- A review of ANT data through time suggests that in general, LNAPL plumes at AOI 4 are not migrating, mainly, because the vertical thickness of LNAPL as observed in AOI 4 monitoring wells has

not been increasing. However in the following wells, increasing trends in ANT have recently been observed indicating that LNAPL in these areas might be migrating:

- S-30 and S-31: located within the influence area of the inactive S-30 Remediation System (S-30 System).
- S-104 and S-368: these wells are located adjacent to the northern (center) AOI 4 border with AOIs 1 and 2 along Hartranft Street.
- S-221, S-240, S-241, and RW-701: these wells are located along or north of the northern leg of the Penrose System.
- S-220: located to the northwest of the Penrose System.

- Review of the aerial extent of apparent LNAPL through monitoring well observations suggests that overall, AOI 4 LNAPL plumes are not migrating because fluid level gauging through time indicates that LNAPL has not been identified in a downgradient portion of the monitoring well network that has historically lacked measurable LNAPL, with one exception: monitoring well S-368 has been gauged six times between 2013 and 2016. LNAPL was not detected until the most recent gauging events at monitoring well S-368, in May and November 2016, when it was observed at a maximum thickness of 2.25 ft. The recent LNAPL observation at well S-368 could also be the result of a new release, and not necessarily migration of existing LNAPL.

- At the Penrose System area along the southern AOI 4 boundary, use of ANT and aerial extent of LNAPL through time cannot completely demonstrate LNAPL delineation at the apparent downgradient boundary (point of compliance) as efforts by Evergreen to install offsite monitoring wells have been unsuccessful due to property access. Operation of the Penrose System wells is meant to mitigate the potential offsite migration of LNAPL in this area. ANT trends support continued operation of the Penrose System.

- Recent (post-2015) product releases are suspected to have occurred in the Penrose System area and may account for the ANT increases observed and discussed in the LCSM. During July/August 2016, product soaked soil was identified at the ground surface around pipes which are associated with Tank 253 but outside the emergency containment dike, located north of well S-241. The area around the lines was excavated and product removed by PES personnel. In addition, there is a product line that is suspected to have leaked which runs north-south along the access road leading to the Penrose system wells, approximately bisecting AOI 4. This line is being excavated and replaced in sections by PES. **Figure 6-1** contains an inset map that comparatively shows the ANT in May 2015 in this area versus the maximum thickness for the time period 2013 – 2016.

- Average LNAPL transmissivity for the Penrose system was calculated using monthly system operational data. Annual averages for the system were calculated to range from 0.5 ft^2/day in 2013 to 4.5 ft^2/day in 2016 with a significant increase in estimated transmissivity occurring in September 2016. The significant increase in Penrose system LNAPL transmissivity in 2016 is likely the result of new product releases in the area south of the system. These estimates are based on average extraction rates for the Penrose system as a whole. LNAPL transmissivity may be higher or lower at individual wells included in or near the system. For AOI 4, LNAPL baildown testing of system wells could be used to facilitate future optimization of the Penrose system.

- In February 2017, Stantec revisited the S-30 System area and collected one LNAPL sample from well S-30 to reevaluate LNAPL occurrence in that area. The sample was characterized as extremely-weathered middle distillate with a very similar density [0.8680 grams per milliliter (g/ml) versus 0.8681 g/ml] to what was collected and characterized as middle distillate in 2004 from that well. Potential mobility and recoverability of LNAPL at this well should be evaluated as a part of Cleanup Plan activities. Evergreen plans to resume operation of the idled remediation system following new equipment installation in 2017.

- A conservative value for the site-specific mobility term was calculated to be 1.92×10^{-4} $cm^3 s/g$ which is above the practical limit of mobility.

- The critical pore entry pressure was estimated for wells that had greater than 0.1 feet of apparent LNAPL thickness in 2016. The estimated critical pore entry pressure thickness ranged from 0.38 to 0.70 feet with an average of 0.45 feet. For 18 of the 20 wells evaluated, the observed LNAPL thickness was greater than the critical pore entry pressure indicating that the LNAPL observed at these wells is potentially mobile.

- ASTM suggests that LNAPL seepage velocities less than 1×10^{-6} cm/s are indicative of functionally immobile LNAPL. As a part of this LNAPL CSM, plume velocity calculations were updated for wells with greater than 0.1 feet of ANT in 2016. Model calculated plume velocities ranged from 5.2×10^{-7} cm/s to 2.5×10^{-4} cm/s with an average velocity of 1.3×10^{-4} cm/s, indicating that LNAPL is functionally mobile in some areas of AOI 4.

- The API LDRM model was run for wells with greater than 0.1 feet of ANT in 2016. The LDRM model indicates that LNAPL in 13 of the 20 wells evaluated was within the range of practicable recoverability, five wells are in the transitional range (S-29, S-31, S-278, RW-704, and S-373), and two wells (S-368 and S-104) have estimated LNAPL transmissivity values below the limit of practicable recoverability. LNAPL transmissivity testing completed at these wells could be used to further calibrate the LDRM model and in simulating recovery methods over time.

Site-specific values of LNAPL transmissivity based on groundwater recovery ratios indicate that overall, LNAPL at AOI 4 is below the lower limit of practicable recovery. However, pore entry pressure, mobility modeling, and LDRM evaluations indicate that areas of potentially mobile and practicably recoverable LNAPL are still present at and in some areas adjacent to AOI 4. In general, based upon the multiple lines of evidence presented above, LNAPL observed at AOI 4 appears to be stable or decreasing (not migrating) as a whole. Nonetheless, wells located in three distinct areas of AOI 4 indicate potentially mobile LNAPL: (1) S-30 System area (based on wells S-30 and S-31); (2) Penrose System area (based on S-221, S-240, S-241, and RW-701); and (3) in the vicinity of S-220 (between the S-30 System and Penrose System areas). Increasing ANT trends at S-104 and S-368 indicated potentially mobile LNAPL, however, the estimated plume velocity and/or LNAPL transmissivity indicate that the onsite edge of this plume is functionally immobile and not practically recoverable. In the Penrose System area, the apparent LNAPL mobility may be the result of recent (post-2015) product releases.

The results of this LNAPL mobility assessment may be used to focus additional testing and to facilitate recovery system optimization. As additional site-specific LNAPL data becomes available it may be used to update and calibrate the LNAPL mobility evaluations presented in the AOI 4 LCSM.

7.0 VAPOR INTRUSION

The vapor intrusion pathway in AOI 4 was evaluated for potential receptors of vapors originating from petroleum hydrocarbon source material, in accordance with the PADEP Land Recycling Program Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil under Act 2 (VI Guidance) (PADEP, 2017a). In accordance with the VI Guidance, an evaluation of the potential for a complete vapor intrusion pathway is required for each building based on size, construction, and use. Within AOI 4, the 15 Pump House building was identified as the only occupied building requiring further evaluation of the vapor intrusion pathway. An indoor air evaluation was selected as the method to investigate whether a complete pathway for hydrocarbon vapors exists within the 15 pump House, which is an approximately 4,000 square foot, single-story, slab on grade building typically occupied by 2 to 3 operators.

Potential offsite receptors are located greater than 30 feet from onsite sources in soil; therefore, volatilization from soil is not a concern. The proximity distances, established in the VI Guidance, for LNAPL are 30 horizontal feet and 15 vertical feet. As discussed in **Section 6,** LNAPL was not detected in wells at the AOI boundary in recent site-wide gauging events. Volatilization from dissolved-phase impacts are not a concern, as depth to groundwater in this area is greater than five feet, the vertical proximity distance established by the PADEP for dissolved-phase hydrocarbon constituents from any building foundations. The 26th Street and Penrose Avenue Sewers were identified as a potential preferential pathway for vapor intrusion to offsite receptors. These are submerged sewers in known areas of groundwater impacts. A vapor mitigation system is currently in operation to address vapors that could be migrating within the 26th Street Sewer which is connected to the Penrose Sewer. A summary of this remediation system is available in **Section 10.4.3**, and details are presented in **Appendix F**. Operational information regarding the system is currently reported to PADEP on a semi-annual basis as part of the Philadelphia Refining Groundwater Remediation Status Reports, and details regarding the plans to maintain this vapor mitigation system in the future will be included in future Act 2 deliverables. No other potential offsite receptors were identified within the specified proximity distances that warranted further vapor intrusion evaluation within AOI 4.

The following sections summarize the results of the vapor intrusion assessment performed in AOI 4, which was conducted in general accordance with the VI Guidance. The evaluation of indoor air was selected as the preferred investigation approach because indoor air data represent conditions that are as close to the receptor as possible and, therefore, provide the most accurate representation of concentrations at the point of exposure.

7.1 AMBIENT AND INDOOR AIR SAMPLING

Stantec completed an evaluation of VOCs in occupied buildings at the refinery, including in AOI 4 (Stantec, 2013). An initial site visit was conducted in September 2012, which identified the sample locations and specific number of samples to be collected. On October 24, 2012, three air samples were collected to evaluate the vapor intrusion pathway for the 15 Pump House and outdoor air located within AOI 4. Of the three samples collected for the AOI 4 vapor intrusion assessment, two were ambient air, and one was indoor air. Samples named AOI 4 Sample 21 and AOI 4 Sample 20, were collected from outside the 15 Pump House, under the equipment roof at grade and under the equipment roof approximately 8-10 ft below grade, respectively, and one blank was also collected on the day of sampling. The indoor air sample was collected from the breathing zone (3-6 feet above floor/ground level). All samples were collected using Summa© canisters with laboratory-provided regulators set to collect air over one continuous 4-hour period, which was determined to represent VOC concentrations during normal operating conditions at the PES Complex. The samples were packaged by Stantec field personnel and transported by FedEx to Columbia Analytical Services, Inc. under chain-of-custody documentation for analysis of VOCs including naphthalene on the Evergreen Petroleum Short List by EPA method TO-15.

In order to evaluate the potential for volatilization to outdoor air, an additional ambient air sample was collected above a LNAPL plume in 2016. A conservative approach was used to identify potential locations of concern using the vertical proximity distance, presented in the VI Guidance for volatilization to indoor air, of 15 ft for petroleum separate phase liquids. The S-104 area was identified as the only location in AOI 4 to have product at or less than 15 ft bgs. In June 2016, an ambient air sample (AOI4-AA-16-001) was collected at S-104, near the intersection of Hartranft Street and 10^{th} Avenues. The sample was collected by Aquaterra and analyzed by ESC, for analysis of VOCs by EPA method TO-15.

All sample locations are shown on **Figure 7-1**. Air samples were collected in general accordance with the *Evergreen Field Procedures Manual* as presented in **Appendix B**.

7.2 SAMPLE RESULTS

The analytical results of the indoor and ambient air sampling activity conducted in 2012 and 2016 are summarized below. Available analytical results for compounds on the Evergreen Comprehensive List are presented on **Table 7-1** and the laboratory analytical reports are included in **Appendix D**. Sample results were compared to six sets of screening values:

- EPA RSL, TR=1E-5, THQ=0.1
- SVIA-NR SHS
- SVIA-NR SSS
- OSHA PEL
- NIOSH REL
- ACGIH TLV

The VI Guidance establishes the EPA RSLs, TR=1E-5, THQ=0.1 as appropriate screening values when it can be demonstrated that vapor intrusion is the only complete exposure pathway for a receptor. Upon the completion of remediation activities, volatilization to the breathing zone will be the only potentially complete pathway for petroleum impacts in AOI 4. A calculated site specific standard is not being used, except for lead in soil, which is not a potential vapor intrusion concern. Results for 1,3,5-TMB were screened against the SVIA-NR SSS because there is not an established EPA RSL for this compound.

It should be noted that the laboratory reporting limits for 1,2-dibromoethane were above the EPA RSL in the 2012 samples. Options to address these compounds will be presented in the Cleanup Plan.

7.2.1 Ambient Air Results

A combination of several COCs were detected in all three ambient air samples collected within AOI 4. With the exception of 1,2,4-TMB in two samples, concentrations did not exceed the corresponding EPA RSLs. AOI4 Sample 21 and AOI4-AA-16-001 had 1,2,4-TMB concentrations in exceedance of the EPA RSL of 3.1 µg/m^3.

PADEP operates a network of air toxics monitoring stations that sample for VOCs. Note that several COCs are not included in PADEP's monitoring program. Detailed analytical results by year for each monitoring station are available on-line at Regional ambient air quality in the Philadelphia Refining Complex is best represented by data from the Marcus Hook monitoring station (latitude 39.8178, longitude - 75.4142) (PADEP, 2017b). **Table 7-2** presents the results for the ambient air samples with the air toxics monitoring data for 2012; data from 2016 was not made available at the time of this report. The concentrations of petroleum-related compounds in the outdoor air at the PES Complex were somewhat higher than regional mean background as represented by concentrations reported from PADEP's Marcus Hook monitoring location.

7.2.2 Indoor Air Results

Several COCs were detected in the indoor air sample collected from the 15 Pump House in AOI 4 in 2012. Concentrations of COCs did not exceed the EPA RSLs, with the exception of 1,2,4-TMB, which slightly exceeded the EPA RSL of 3.1 µg/m^3.

7.3 SUMMARY

The sampling events conducted in 2012 and 2016 represent ambient air and indoor air during the heating season when levels of VOCs inside buildings are expected to be higher than during warmer months.

- Indoor air sample, AOI4 Sample 19, and two of the outdoor air samples (AOI4 Sample 21 and AOI4-AA-16-001) exceeded the EPA RSLs for 1,2,4-TMB of 3.1 µg/m^3.
- With few exceptions, the concentrations of petroleum hydrocarbon-related VOCs were similar in both ambient and indoor air samples collected in 2012. There are multiple sources of petroleum-related VOCs at the Philadelphia Refining Complex and in the immediate proximity, such as traffic on major highways and other industries.
- PADEP operates a network of air toxics monitoring stations that sample for VOCs. Regional ambient air quality in the Philadelphia area where the PES Complex is located is best represented by data from the Marcus Hook monitoring station. As would be expected, the concentrations of petroleum-related compounds in the outdoor air at the PES Complex were somewhat higher than regional background as represented by concentrations reported from PADEP's Marcus Hook monitoring location.

Stantec plans to conduct an additional round of air sampling pursuant to the VI Guidance. In order to evaluate data trends, a minimum of one indoor air sample and one ambient air sample are planned for the 15 Pump House area, and one ambient air sample may be collected near the vicinity of well S-104. Samples will be collected for an 8-hour period during the heating season to represent the most conservative scenario. Exceedances of any EPA RSLs in air samples will be evaluated in the Cleanup Plan.

8.0 QUALITY ASSURANCE/ QUALITY CONTROL

Methods established by Evergreen to examine data quality are outlined in **Appendix B**, *Quality Assurance/Quality Control Plan and Field Procedures Manual*. All fieldwork conducted as part of the site characterization activities was performed in accordance with the procedures outlined in the *Evergreen Field Procedures Manual*, **Appendix B**. An assessment of analytical data collected as part of this investigation under the *Quality Assurance/Quality Control Plan* is included in **Appendix G**. The following sections describe specific aspects of quality assurance/quality control procedures that pertain to the activities outlined in this report.

8.1 EQUIPMENT DECONTAMINATION

All sampling equipment was either dedicated or decontaminated in accordance with the field sampling procedures to prevent cross-contamination. Prior to sampling, the equipment was decontaminated with successive rinses of detergent, potable water, and distilled water.

8.2 EQUIPMENT CALIBRATION

Air quality monitors used for both air monitoring and soil screening were calibrated prior to use. Both a zero calibration and a span calibration using gases of known concentration as recommended by the manufacturer (i.e. 100 parts per million by volume (ppm_v) isobutylene for the photoionization sensor) were performed.

8.3 SAMPLE PRESERVATION

Samples were placed directly into chemically preserved and/or non-preserved glassware provided by the analytical laboratory, as appropriate. All samples were preserved and shipped at a temperature of approximately 4° Celsius (C) or less by application of ice prior to shipment to the analytical laboratory. This temperature was maintained during shipment by placing ice in zip-top bags above, around, and below the sample containers.

8.4 DOCUMENTATION

Chain-of-custody forms were maintained throughout the sampling program to document sample acquisition, possession, and analysis. Chain-of-custody documentation accompanied all samples from the field to the laboratory. Each sample was assigned a unique identifier that was recorded in the field notes as well as on the chain-of-custody document.

9.0 CONCEPTUAL SITE MODEL

Through comprehensive file review and characterization activities performed as a part of this RIR, Stantec's conceptual understanding of the present conditions identified at AOI 4 and nearby proximity is summarized as follows.

9.1 DESCRIPTION AND SITE USE

- The PES Complex is located along the banks of the Schuylkill River in the City of Philadelphia, Philadelphia County, Pennsylvania (**Figure 1-1**). The PES Complex, which is located on industrial property, covers approximately 1,400 acres of land with access restricted by fencing and security measures. Current operations at the PES Complex consist of the production of fuels and basic petrochemicals for the chemical industry.

- The area surrounding the PES Complex is characterized by a mixture of residential, commercial, and industrial properties, including property formerly occupied by the DSCP discussed in this RIR.

- AOI 4 occupies approximately 106 acres of the PES Complex in the southeast portion of the Point Breeze Refinery South Yard (**Figure 1-2**).

- AOI 4 is comprised of primarily light-end hydrocarbon tankage (Tank Farm No. 4). Infrastructure mainly includes ASTs and process equipment required for the blending and storage of gasoline and additives, included numerous aboveground and underground process lines. Use of the Tank Farm No. 4 has altered little over the course of history at the PES Complex with primary changes being various ASTs taken in and out of service. The only occupied building in AOI 4 is the 15 Pump House, which is located in the northcentral section of AOI 4.

9.2 GEOLOGY AND HYDROGEOLOGY

9.2.1 Geologic Framework

- The PES Complex occurs within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the "Fall Line" (**Figures 2-1 and 2-2**). Historical maps indicate that AOI 4 topography was generally low-lying prior to industrialization and contained subtle topographic highs surrounded by lowlands and streams. Present-day topography has been significantly altered by humans and in most places is capped by low permeability materials (**Figure 2-3**).

- Published geologic information indicates that the Coastal Plain sedimentary record beneath, and in the vicinity of, AOI 4 is complex, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity. Total Coastal Plain thickness above bedrock (predominantly variably weathered mica schist) ranges from approximately 80 to 150 feet near AOI 4 (**Figure 2-12**).

- Beneath AOI 4 and the area evaluated, the following Coastal Plain deposits may be present, in order of increasing depth/age: anthropogenic fill, Quaternary alluvium [including Holocene (recent) and Pleistocene ("Trenton gravel") deposits], and the Cretaceous Potomac-Raritan-Magothy (PRM) aquifer system, including the upper clay, upper sand, middle clay, middle sand, lower clay, and lower sand units. These deposits are identified and described in this RIR based on correlation to published geologic formations/units using lithology and stratigraphic principles (**Figures 2-5** through **2-8**).

- Within the Coastal Plain, thicknesses of fill and each individual geologic formation/unit vary across the PES Complex. Along the northern AOI 4 margin, recent alluvium appears to have been truncated by erosion through a presently-buried stream valley. To the west of AOI 4, the PRM upper clay, upper sand, middle sand, and middle clay are interpreted to have been cut by the ancestral Schuylkill River or laterally "pinch" out (**Figures 2-5** through **2-8**) as they approach the "fall line." Beneath AOI 4, the PRM units appear to follow a similar depositional pattern that mirrors the bedrock surface (a vertical sequence of cut and fill deposits). In large part, the PRM lower clay unit is not present beneath AOI 4. Overall Coastal Plain thickness is greatest along the eastern boundary of AOI 4 and offsite, where a bedrock trough is present (**Figure 2-12**).

- Hydrostratigraphic units (aquifers and aquitards/confining beds) were defined from the geologic units to identify water-bearing strata on a mappable scale applicable to AOI 4 (**Table 5-1**).

9.2.2 Unconfined (Water-Table) Aquifer

- Beneath AOI 4, the unconfined aquifer is primarily composed of saturated portions of unconsolidated materials that are interpreted as the "Trenton gravel" and underlying PRM upper sand unit. The intervening PRM upper clay unit aquitard, where present, is also included in this aquifer.

- On average, the saturated thickness of the unconfined aquifer beneath AOI 4 is approximately 10 to 35 feet.

- Estimated values of unconfined aquifer k_h vary from approximately 12 ft/d to more than 450 ft/d in AOI 4 (**Figure 2-9**). Permeability (k_v) of muddy strata found within the unconfined aquifer may range from approximately 10^{-7} to 10^{-8} cm/s (Trenton gravel and PRM upper clay unit), the fraction organic carbon may range from approximately 0.5% to more than 1.5%; and effective porosity may range from approximately 7% to 28%.

- Numerous groundwater mounds are apparent beneath and near AOI 4 that may be the result of saturated fill areas or leaking underground infrastructure (**Figure 5-1**). Many of the mounds present appear to behave independently of water-table trends and are likely indicative of perched water that is supported by an underlying layer of lower permeability, recent alluvium.

- Recent (2014-2016) patterns of AOI 4 unconfined aquifer groundwater flow appear relatively consistent through time. Near-continuous water-level monitoring data suggest that seasonal variability is limited to approximately 1 foot (2016 data) (**Figure 5-9**). An earth tide and/or river tide signal is superimposed on the unconfined aquifer data on a semidiurnal timescale. The amplitude of the tidal signal is approximately 0.05 feet (well S-218 data).

- Unconfined aquifer groundwater flows radially under a gentle hydraulic gradient (0.001 to 0.004 ft/ft) beneath most of AOI 4 and appears to subtly mirror natural surface topography (see **Figures 5-2** through **5-4**) that creates a southwest-northeast trending groundwater divide. North of that feature, flow appears to be southeast out of higher topography in AOI 2 and converges with northerly flow out of AOI 4 near the AOI 1/AOI 2/AOI 4 boundary along the location of a former stream. The pattern of unconfined aquifer groundwater flow north and east of AOI 4 suggests that infiltration into the 26th Street Sewer, and potentially the Pollock Street/Packer Avenue Sewer, is occurring. Regardless of the cause(s), groundwater convergence along 26th Street influences flow in the northeastern portion of AOI 4.

- Offsite to the east of AOI 4 and 26th Street, unconfined aquifer groundwater flow appears to be further influenced by factors in addition to potential infiltration into the large, deep sewers present. Geologic mapping suggests that these factors may include enhanced vertical groundwater exchange/leakage to/from the lower aquifer where a regional confining unit, the PRM middle clay, is mapped to thin, become sandy (reworked), and in a small area may be missing (eroded) entirely.

- A filled, former stream valley identified to have historically flowed south out of AOI 1 and into AOI4 before turning west, appears to remain an influence on groundwater flow patterns in the unconfined aquifer beneath AOI 4. The buried stream valley appears to contain perched water in places where perching is supported by stratigraphy.

9.2.3 Lower Aquifer

- Beneath AOI 4, the lower aquifer is primarily composed of saturated portions of the PRM lower and middle sand units. The lower clay unit aquitard appears to be largely absent.

- On average, the saturated thickness of the lower aquifer beneath AOI 4 is approximately 50 to 90 feet.

- Lower aquifer k_h is estimated to vary from approximately 65 ft/d to 85 ft/d (**Figure 2-10** and **Appendix K**) where the lithology is silty sand to well-graded gravelly sand with a trace of silt. In vicinity to AOI 4 the k_h may be as high as approximately 123 ft/d to 151 ft/d (**Figure 2-11**). The fraction organic carbon is estimated at approximately 1%.

- Well gauging data indicates that the lower aquifer exhibits artesian conditions and is at least semi-confined beneath AOI 4. Near-continuous monitoring of the lower aquifer potentiometric surface (2016) indicates that seasonal variability is limited to approximately 1 foot (**Figure 5-9**). An earth tide and/or river tide signal is superimposed on the lower aquifer data on a semidiurnal timescale. The amplitude of the tidal signal is approximately 0.3 feet (well S-218D data).

- Lower aquifer groundwater flows to the south beneath most of AOI 4 under a hydraulic gradient of approximately 0.006 ft/ft (see **Figures 5-5** and **5-7**). Within the overall southerly groundwater flow regime present across the study area, the lower aquifer potentiometric surface may appear non-uniform and flow can converge towards an offsite depression along a portion of 26th Street and the former Passyunk Homes property. Along the northeastern perimeter of AOI 4 and areas to the east the lower aquifer potentiometric surface indicates that the groundwater flow direction is to the southeast. Variability in patterns of lower aquifer groundwater flow in the area evaluated may be related to aquifer transmissivities through the referenced bedrock troughs, or as indicated in Stantec (2016) upward leakage into the 26th Street Sewer or offsite unconfined aquifer.

9.2.4 Vertical Head Potentials

- Across most of the study area (including all well pairs in AOI 4), the hydraulic head potential between observed aquifers was positive (downward) in May 2016 (**Figure 5-8**). However, an area of negative (upward) hydraulic head potential is indicated in southern AOI 1 and along 26th Street. A broad zone of nearly equal hydraulic heads is indicated between these areas, generally along northeastern AOI-4 and at the former DSCP Property near the "breach" area identified by others. Overall the positive hydraulic head potentials beneath AOI 4 support the existence of two aquifers and the continuity of the middle clay unit aquitard. Water-level monitoring data for AOI 4 well pairs shown on **Figure 5-11** indicate that the head potentials between the aquifers are consistent throughout the year.

9.3 COMPOUNDS OF CONCERN

9.3.1 Soil

- AOI 4 soil delineations were performed to the highest concentration in soil of the SHS, the NRDC MSC, and the lead SSS for the Evergreen Comprehensive List, unless a shorter list of analytes was appropriate for a specific situation, and as described in **section 3.6** (**Figure 3-1**).

- Lead was identified in AOI 4 surface soil samples at concentrations in excess of the SSS for lead (**Tables 3-2** and **3-3**).

- Where identified in surface soil to exceed the referenced standards, lead has been delineated both horizontally and vertically through characterization activities and review of existing soil sample analytical data. It is noted that Stantec has observed some correlation between the locations of lead exceedances in surface soil and the occurrence of (presumably smelter) slag and cinders in areas of anthropogenic fill.

- No exceedances of the NRDC MSCs for compounds listed on the Evergreen Petroleum Short List were identified in subsurface soil in AOI 4.

9.3.2 Groundwater

- Two comprehensive rounds of characterization groundwater sampling were completed in 2016 as a part of this RIR and groundwater samples were analyzed for the Evergreen Comprehensive List.

- For the unconfined aquifer, concentrations of the following compounds were detected above the SHS in groundwater during the 2016 groundwater sampling events: 1,2,4-TMB, EDB, 2-methylnaphthalene, anthracene, arsenic, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, ethylbenzene, MTBE, naphthalene, phenanthrene, pyrene, toluene, vanadium, and zinc. (**Table 4-2**). Prior to 2016, available historical groundwater data shows the following compounds detected above the SHS: 1,2,4-TMB, EDB, arsenic, benzene, benzo(a)pyrene, benzo(b)flouranthene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chromium, chrysene, cobalt, ethylbenzene, indeno(1,2,3-c,d)pyrene, lead, MTBE, naphthalene, toluene, and total xylenes.

- For the lower aquifer, concentrations of the following COCs were detected above the SHS in groundwater during the 2016 groundwater sampling events: benzene, MTBE, and lead (**Table 4-3**). Prior to 2016, available historical groundwater data shows the following compounds detected above the SHS: arsenic, cobalt, benzene, and lead.

9.3.3 Indoor/Ambient Air

The sampling events conducted in 2012 and 2016 represent ambient air and indoor air during the heating season when levels of VOCs inside buildings are expected to be higher than during warmer months.

- Indoor air sample, AOI4 Sample 19, and two of the outdoor air samples (AOI4 Sample 21 and AOI4-AA-16-001) exceeded the EPA RSLs for 1,2,4-TMB of 3.1 $\mu g/m^3$.

- With few exceptions, the concentrations of petroleum hydrocarbon-related VOCs were similar in both ambient and indoor air samples collected in 2012. There are multiple sources of petroleum-related VOCs at the PES Complex and in the immediate proximity, such as traffic on major highways and other industries.

- PADEP operates a network of air toxics monitoring stations that sample for VOCs. Regional ambient air quality in the Philadelphia area where the PES Complex is located is best represented by data from the Marcus Hook monitoring station. As would be expected, the concentrations of petroleum-related compounds in the outdoor air at the PES Complex were somewhat higher than regional background as represented by concentrations reported from PADEP's Marcus Hook monitoring location.

9.4 LNAPL DISTRIBUTION AND MOBILITY

- A comprehensive LCSM was prepared and is included as **Appendix E** of this RIR.

- LNAPL samples collected from site monitoring wells through time have identified the presence of several variably-weathered products and mixtures of products refined from crude oil in the subsurface at AOI 4 (**Figure 6-1**).

- Variability in LNAPL characteristics observed at AOI 4 is indicative of multiple product releases at different times with subsequent co-mingling of plumes. Several areas of LNAPL are identified within AOI 4 (**Figure 6-1**).

- A review of apparent LNAPL thickness data and the aerial LNAPL extent through time suggest that overall LNAPL plumes are not migrating. However, LNAPL plumes at the site may be migrating in the following areas: (1) S-30 System area (based on S-30 and S-31); (2) Penrose System (based on S-221, S-240, S-241, and RW-701); (3) in the vicinity of S-220 (between the S-30 System and Penrose System areas); and (4) northern AOI 4 boundary (based on S-104 and S-368).

- The PES Complex remains an active refinery and as such, may be impacted by additional petroleum releases through time. Recent product releases are suspected to have occurred near the Penrose System area and may account for the ANT increases observed and discussed in the LCSM. Observations of LNAPL migration are made difficult for this reason.

- The API LDRM model was run for wells with greater than 0.1 feet of apparent LNAPL thickness in 2016. The LDRM model indicates that LNAPL in 13 of the 20 wells evaluated was within the range of practicable recoverability, five wells are in the transitional range (S-29, S-31, S-278, RW-704, and S-373), and two wells (S-368 and S-104) have estimated LNAPL transmissivity values below the limit of practicable recoverability.

- Estimates of critical pore entry pressure and seepage velocities indicate that LNAPL is functionally mobile at a majority of wells included in the calculations in AOI 4.

- LNAPL observed at AOI 4 appears to be stable or decreasing (not migrating) as a whole and immobile at most locations. LNAPL areas are continually monitored through well gauging. LNAPL recovery is ongoing at the Penrose System, and anticipated in 2017 for the inactive S-30 System once it has been rehabilitated.

9.5 QUALITATIVE FATE AND TRANSPORT OF SELECTED COMPOUNDS

- A soil to groundwater model to evaluate the soil to groundwater pathway was not developed for the qualitative fate and transport assessment presented in this RIR. Rather, a qualitative-level assessment of groundwater data has been completed (**Section 10**).

- Of the COCs identified to be present in groundwater beneath AOI 4, benzene and MTBE were chosen for the qualitative assessment of fate and transport presented in this RIR because of their higher water solubility and potential mobility when compared to other Evergreen List COCs, and/or due to their general persistence in groundwater at the PES Complex. Other COCs identified in groundwater are discussed in the context of benzene and MTBE distributions.

- Comprehensive rounds of groundwater data from three timeframes for AOI 4 and adjacent AOIs 1, 2, and 3 conducted in 2004-2005, 2012- 2013, and 2014-2016 are presented on **Figures 10-1 through 10-6**. Data from offsite wells at the Steen, ARCO, and DSCP properties were incorporated to better characterize dissolved COC plumes across AOI 4 boundaries. Offsite datasets from the 2004-2005 timeframe did not include key wells, therefore, a 2007 dataset was supplemented. Golden Software's Surfer® 13 was used to interpolate the well data using point Kriging. Grid residuals were evaluated and the interpolated surfaces were subsequently contoured and imported into a geographic information system (GIS) for display and evaluation. For co-located wells, the maximum concentration was considered for kriging.

- Historical (2004-2005 and 2012-2013) benzene distribution in the unconfined aquifer beneath AOI 4 shows a continuous plume core of SHS exceedences that generally encompasses the central and western portion of AOI 4 (**Figures 10-1** and **10-2**).

- Recent (2014-2016) benzene concentrations in unconfined aquifer groundwater beneath AOI 4 show three general areas of benzene SHS exceedences: in the northeast corner of AOI 4 generally delineated by wells S-369, S-40, S-119, S-368, and AOI 1 well S-95; in the western and central portion of AOI 4, centered around wells S-415 and S-218 and generally delineated by wells within AOI 4; and in the south-central portion of AOI 4 near the PES Complex boundary, generally delineated by AOI 4 well data (**Figure 10-3**).

- Except for a few isolated occurrences, historical (2004-2005) MTBE concentrations in exceedance of the SHS are limited in time and extent to the Penrose System area (south central AOI 4 in association with the benzene plume) during the recent (2014-2016) timeframe (**Figures 10-4** through **10-6**).

- Recent (2014-2016) distributions of dissolved-phase benzene and MTBE in unconfined aquifer groundwater appear to in-part reflect groundwater movement along current hydraulic head gradients identified at AOI 4. Additional distribution of these substances may have been influenced by the operation of recovery wells (Penrose System area), or have resulted from gradients induced by historical pumping at the site (S-30 System and S-36 Remediation System).

- Recent (2014-2016) distributions of dissolved-phase 1,2,4-TMB, ethylbenzene, and toluene in unconfined aquifer groundwater generally resemble that identified for benzene at AOI 4, and have demonstrated the highest number of exceedances following benzene. The distribution of these substances in groundwater also suggests that they were released in the same areas as benzene and were likely components of the same petroleum hydrocarbon products (e.g., light and/or middle distillate). As such, benzene is used as a qualitative-level proxy for the fate and transport assessment of these substances in this report. Where these substances are present as co-contaminants along the AOI 4 property boundary and may pose potential risk to offsite receptors, they will be further evaluated during quantitative fate and transport model simulations and documented under future Act 2 submission(s).

- MTBE, naphthalene, and bis(2-ethylhexyl)phthalate demonstrated the highest number of exceedances in AOI 4 in recent years (2014- 2016), following benzene, 1,2,4-TMB, ethylbenzene, and toluene. The remaining COCs identified at concentrations above the MSC in unconfined aquifer groundwater during 2014-2016 sampling were generally only observed in a few AOI 4 well samples.

Within AOI 4, no significant spatial distribution of these constituents was observed. Most of these compounds are generally less soluble in groundwater than benzene or MTBE. Where these substances are present as co-contaminants along the AOI 4 property boundary and may pose potential risk to offsite receptors, they will be further evaluated during quantitative fate and transport model simulations and documented under future Act 2 submission(s).

- The most elevated concentrations of benzene and MTBE in unconfined aquifer groundwater generally correlate to locations beneath free-phase LNAPL or presumed areas of residual LNAPL that is trapped within a "smear zone" beneath AOI 4.

- Concentration trends generally support that dissolved benzene and MTBE in groundwater have stabilized onsite, except for observations from a portion of wells in the Penrose System that indicate a stable to increasing trend. Recent product releases have occurred in this area and may be complicating the apparent benzene trend. Recent observations of significant MTBE concentrations in groundwater at the Penrose System where not previously observed may be attributable to a historic, onsite source that may have been mobilized in association with recent (post-2015) pipeline excavations and repair in the area.

- MSC exceedances of lead in unconfined aquifer groundwater over the period of record have been very limited, and show no pattern of spatial distribution. In 2016, lead was only detected in three wells; S-218D, S-39D, and S-97.

- Concentrations of benzene and MTBE in lower aquifer groundwater generally do not indicate the presence of any significant, onsite source areas in that aquifer (**Figure 10-7**).

- The PRM lower sand unit was historically developed and heavily pumped for water supply in southeastern Philadelphia. Published water-level/historical well gauging data and aquifer heads modeled by others indicate that heavy groundwater production from the lower sand in the region, primarily during the late 1940s and early 1950s, significantly lowered heads in that (lower) aquifer. Those relic hydraulic conditions may have been the mechanism responsible for present-day COC distributions observed in AOI 4 aquifer groundwater as the regional lowering of heads may have facilitated the downward migration of contaminants.

- Quantitative fate and transport analysis of selected dissolved-phase COCs in, and potentially across, AOI 4 aquifers, including benzene and MTBE, will be performed utilizing a 3-dimensional, steady-state, numerical groundwater flow (MODFLOW) model presently under development.

9.6 FATE AND TRANSPORT OF BENZENE NEAR THE PENROSE SYSTEM

- A predictive analysis of the potential fate and transport of dissolved benzene in unconfined aquifer groundwater near the Penrose System was performed using QD. The "worst case" analysis utilized conservative and site-specific input parameters to evaluate plume lengths and potential offsite impacts. The analysis indicates that dissolved benzene in unconfined aquifer groundwater near the southern AOI 4 boundary has the potential to migrate and/or have migrated offsite. This is based on recent benzene data and analysis of historical benzene contamination trends, and on the assumptions inherent to the QD model (**Appendix L**).

9.7 POTENTIAL MIGRATION PATHWAYS AND SITE RECEPTORS

- AOI 4 occupies approximately 106 acres in the southeast portion of the Point Breeze Refinery South Yard, and access is restricted by fencing and security measures.
- PES is responsible for overall security and oversight of contractor safety, and PES implements PPE and work plan/permitting protocols that mitigate the potential for worker exposure to impacted soil, groundwater, and/or LNAPL through the direct contact pathway.
- AOI 4 areas with identified surface soil exceedances of the SSS for lead have been delineated and remedies will be addressed in future Act 2 submissions, including a Cleanup Plan.
- Concentrations of Evergreen Petroleum Short List COCs identified through indoor and ambient air sampling were below the EPA RSLs with the exception of 1,2,4-TMB in three samples.
- Infiltration of groundwater into underground utilities has the potential to generate vapors along subsurface corridors, or direct vapor migration into the vadose zone. The 26th Street and Penrose Avenue sewers were identified as potential vapor migration (external preferential) pathways for petroleum hydrocarbon sources identified in AOI 4 because they either do not meet the 30 foot horizontal proximity distance from AOI 4 identified groundwater impacts, or are submerged beneath the water table in areas of potential groundwater impacts (do not meet the vertical separation distance). A vapor mitigation system (Point Breeze Biofilter System) is currently in operation in AOI 1 to remove and treat potential vapors from the 26th Street Sewer.
- Other potential vapor receptors were not identified within the proximity distances specified in the PADEP Technical Guidance Manual (PADEP, 2017) that warranted further vapor intrusion evaluation. This includes the potential offsite benzene plume area predicted by conservative QD modeling.
- Areas of potentially mobile LNAPL may be present in AOI 4 and could impact offsite receptors if they were to migrate beyond the AOI 4 boundary. LNAPL areas are continually monitored through well gauging. Operation of the Penrose System is meant to mitigate the potential offsite migration of LNAPL along that boundary. ANT trends support continued operation of the Penrose System.
- Dissolved-phase Evergreen Petroleum Short List COCs, including benzene and MTBE, are present in unconfined aquifer groundwater at concentrations above their respective MSCs within, and in places directly adjacent to AOI 4.
- 2015 vertical head potentials (**Figure 5-8**) between the unconfined and lower aquifers adjacent to AOI 4 indicate that limited groundwater exchange may occur between those aquifers through leakage

or, where the potential for connection or penetration along the 26th Street Sewer exists (**Figure 10-1**), direct connection between the aquifers.

- Surface water bodies that intersect the water table are not present in, or directly adjacent to, AOI 4. According to a 2016 well search, the unconfined aquifer is not utilized for municipal or nearby communal, potable water supply in south Philadelphia (**Appendix N**).

- Selected geologic units of the PRM are utilized for water supply in New Jersey. The potential for migration of dissolved-phase Evergreen Petroleum Short List COCs from AOI 4 into, and along, the lower aquifer will be evaluated through use of a PES Complex-wide, 3-dimensional, steady-state, numerical groundwater flow (MODFLOW) model presently under development and will be presented in a separate Act 2 submission to PADEP.

- The 26th Street Sewer, under normal flow conditions or when not at capacity, captures flow from the shallower Packer Avenue/Pollock Street and Penrose Avenue Sewers through intercepting chambers located near AOI 4. All three sewers are constructed of reinforced concrete. The 26th Street Sewer appears to intercept groundwater from the unconfined, and potentially the lower, aquifer(s) to the northeast of AOI 4, based on water-level data (**Figures 5-2** through **5-4**).

- Dissolved-phase Evergreen Petroleum Short List COCs present in groundwater along the AOI 4 boundary, or present in the Penrose Avenue Sewer and the 26th Street Sewer, have the potential to migrate offsite through preferential flow into, or along, the sewer interceptor at locations identified in this report (**Section 10.4.2**). The 26th Street Sewer conveys wastewater to the City of Philadelphia's Southwest Wastewater Treatment Plant and is maintained by PWD. The potential for offsite migration of dissolved-phase COCs from AOI 4 to the PWD sewer interceptor system will be evaluated through interim remedial actions, including the MODFLOW model under development, and will be discussed in a Cleanup Plan or other future submission to PADEP under Act 2.

10.0 FATE AND TRANSPORT ASSESSMENT

This RIR presents a fate and transport assessment that contains both qualitative and quantitative components. The qualitative portion is presented with the goal of broadly identifying subsurface impacts in AOI 4 and vicinity, and was designed in accordance with a September 30, 2015, meeting during which Evergreen's team of consultants and the PADEP collaboratively decided that individual AOI RIR submissions for the PES Complex would include qualitative assessments of contaminant fate and transport. These assessments were to include an evaluation of plume stability, COC trends, and potential impacts to receptors, including surface water. Findings and conclusions of the AOI specific, qualitative assessments of fate and transport will ultimately be used to construct and refine a calibrated, steady-state MODFLOW and transport model (e.g., MT3DMS model) to comprehensively quantify contaminant fate and transport at the PES Complex, including predictive simulations that will address cumulative mass loading to potential receptors.

The following discussion qualitatively summarizes factors that may influence contaminant fate and transport at AOI 4 of the PES Complex, utilizing qualitative assessments of benzene and MTBE as proxies for future quantitative modeling. Additionally, an analytical groundwater fate and transport model is included to estimate the potential fate and transport of dissolved benzene from a source area near the Penrose Avenue Remediation System (**Section 10.10; Appendix L**).

10.1 GEOLOGIC FRAMEWORK

As discussed in detail in **Sections 2** and **5** of this report, the geologic framework present beneath and in close proximity to AOI 4 can be summarized as follows:

- The PES Complex occurs within the up-dip limits of the Atlantic Coastal Plain, generally within two miles of the "Fall Line," where crystalline bedrock of the Appalachian foothills intersects the ground surface (outcrops) (**see Figure 2-1**). The Atlantic Coastal Plain is defined as having relatively flat topography and as being underlain by a characteristic wedge of unconsolidated sediments that thicken in a southeasterly direction atop a sloping bedrock surface.

- Depositional environments for the strata present were complex fluvial, estuarine, and marginal marine environments along the passive Atlantic margin. The resulting sedimentary record is complicated, largely incomplete, and under-represented by only Cretaceous and Quaternary deposits, separated by a regional disconformity (see **Figures 2-5** through **2-8**).

- Coastal Plain deposits observed beneath AOI 4 and in close proximity have been interpreted to include, with increasing depth and age, the following (note geologic unit correlations to observed lithologies have been included for reference purposes only):

  1. *Anthropogenic Fill* (discussed further in **Section 10.4**)
  2. *Recent (Holocene) alluvium*: fine-grained, brown to brownish gray silt/clay with occasional lenses of sand and gravel that commonly grades with depth to include some sand; in places

includes decomposing organic material; thickness ranges from a few feet to a maximum of approximately 17 feet.

3. *Pleistocene "Trenton gravel":* brown and reddish brown silty, clayey, poorly-sorted sand with gravel, including secondary sandy gravel and clay/silt lithologies in lenses; very heterogeneous unit; thickness ranges from approximately 10 to 15 feet.
4. *Cretaceous PRM upper clay unit:* reddish yellow, brown, and brownish yellow clay/silt (commonly sandy and laminated); approximately 1 to 5 feet thick where present beneath AOI 4.
5. *Cretaceous PRM upper sand unit:* light gray to pale yellow, fine to medium-grained quartz sand with a trace to little silt but including muddy lenses; ranges in thickness from approximately 5 to 30 feet.
6. *Cretaceous PRM middle clay unit:* medium to high plasticity gray, red, and white clay/silt with intercalating lenses of muddy sand; may contain lignite; thickness ranges from approximately 5 to 20 feet.
7. *Cretaceous PRM middle sand unit:* brown and reddish yellow, silty, occasionally gravelly sand; ranges in thickness from approximately 10 to 30 feet.
8. *Cretaceous PRM lower clay unit:* generally absent beneath AOI 4; if present could occupy troughs in the lower sand unit as lenses of gray or red/white clay/silt.
9. *Cretaceous PRM lower sand unit:* pale gray, pale yellow, and white quartz sand coarsening with depth to white and varicolored sandy gravel and gravelly sand; common lenses of clayey sand and gravel; thickness ranges from approximately 25 feet to over 50 feet.

- Bedrock is present beneath the Coastal Plain deposits in AOI 4 and consists predominantly of variably-weathered mica schist. The bedrock surface is irregular and contains troughs. Beneath AOI 4, bedrock elevations range from approximately -70 feet NAVD 88 to -135 feet NAVD 88 (see **Figure 2-12**).

10.2 HYDROGEOLOGY

As summarized above and discussed in detail in **Section 5** of this report, the geologic framework present beneath and in close proximity to AOI 4 supports the following hydrogeologic conditions:

- Two aquifers have been identified beneath AOI 4 at the PES Complex. In general, these are the water-table (unconfined) and a lower (semi-confined) aquifer (see **Table 5-1**). Their properties are as follows:

    1. *Unconfined aquifer:* primarily composed of saturated portions of the "Trenton gravel" and PRM upper sand unit; includes the upper clay unit aquitard where present; on average, the saturated thickness of the unconfined aquifer is approximately 10 to 35 feet; k_h may vary from approximately 12 ft/d to more than 450 ft/d (see **Figure 2-9**); k_v may approximate 10^{-8} cm/s; the fraction organic carbon may range from approximately 0.5% to nearly 2%; estimates of effective porosity range from approximately 7% to 28%.
    2. *Lower aquifer:* semi-confined, artesian aquifer primarily composed of the lower sand but as mapped also includes the middle sand unit and where present, the lower clay unit aquitard;

on average, the saturated thickness of the lower aquifer is approximately 50 to 90 feet; k_h is estimated to vary from approximately 65 ft/d to 85 ft/d (see **Figure 2-10** and **Appendix K**); the fraction organic carbon is estimated at approximately 1%.

- Unconfined aquifer groundwater flows radially under a gentle hydraulic gradient (0.001 to 0.004 ft/ft) beneath most of AOI 4 and appears to subtly mirror natural surface topography (see **Figures 5-2** through **5-4**) that creates a southwest-northeast trending groundwater divide. North of that feature, flow appears to be southeast out of higher topography in AOI 2 and converge near the AOI 1/AOI 2 boundary, and in northern AOI 4, along the location of a former stream. The pattern of unconfined aquifer groundwater flow north and east of AOI 4 suggests that infiltration into the 26th Street Sewer, and potentially the Pollock Street/Packer Avenue Sewer, is occurring and influences flow in the northeastern portion of AOI 4.

- Lower aquifer groundwater flows to the south beneath most of AOI 4 under a hydraulic gradient of approximately 0.006 ft/ft (see **Figures 5-5** and **5-7**). Within the overall southerly groundwater flow regime present across the study area, the lower aquifer potentiometric surface can appear non-uniform and flow may be concentric towards an offsite depression along a portion of 26th Street and the former Passyunk Homes property. Along the northeastern perimeter of AOI 4 and areas to the east the lower aquifer potentiometric surface indicates that groundwater flow direction is to the southeast. Variability in patterns of lower aquifer groundwater flow in the area evaluated may be related to aquifer transmissivities through the referenced bedrock troughs, or, as indicated in Stantec (2016), upward leakage into the 26th Street Sewer or offsite unconfined aquifer.

- Near-continuous water-level monitoring data suggest that seasonal aquifer water-level variability (both aquifers) may be limited to approximately 1 foot (2016 data) (**Figure 5-9**). An earth tide and/or river tide signal is superimposed on both aquifer datasets on a semidiurnal timescale. The amplitude of the tidal signal is approximately 0.05 feet in the unconfined aquifer (well S-218 data) and approximately 0.3 feet in the lower aquifer (well S-218D data).

- The middle clay unit appears to be laterally continuous beneath AOI 4 and create overall hydraulic separation between the unconfined and lower aquifers with a k_v of approximately 6.0×10^{-7} to 7.21×10^{-9} cm/s. The upper clay unit is interpreted to pinch out or have been truncated by erosion beneath areas of AOI 4 and is present primarily in troughs incised into the upper sand. As interpreted the lower clay unit is not mappable beneath AOI 4.

- West of AOI 4 beneath AOIs 6 and 7, the middle clay was incised by erosion through the Schuylkill River valley and has been removed and replaced by Quaternary deposits. North and east of AOI 4 beneath the former Passyunk Homes property, the middle clay unit is interpreted to thin relatively rapidly over a short distance and may have been completely eroded prior to deposition of the upper sand unit near well PH-DW-10 (**Figure 2-8**).

- Across most of the study area (including all well pairs in AOI 4), the hydraulic head potential between observed aquifers was positive (downward) in May 2016 (**Figure 5-8**). However, an area of negative (upward) hydraulic head potential is indicated in southern AOI 1 and along 26th Street. A broad zone of nearly equal hydraulic heads is indicated between these areas, generally along northeastern AOI 4 and at the former DSCP Property near the "breach" area identified by others. Overall the positive hydraulic head potentials beneath AOI 4 support the existence of two aquifers and the continuity of the middle clay. Water-level monitoring data for AOI 4 well pairs shown on **Figure 5-9** indicate that the head potentials between the aquifers are consistent throughout the year.

10.3 HYDROLOGY AND TOPOGRAPHY

- LiDAR data collected in 2010 indicates that present-day topography is relatively flat within AOI 4 and proximity, where land surface elevations generally range from approximately 7 feet to 30 feet NAVD 88 (see **Figure 2-2**). Elevations are lowest where historical maps indicate that a stream once bisected the area. Elevations as high as approximately 60 feet NAVD 88 exist just offsite at the CSX property, where fill was placed to elevate the rail lines and spurs present.

- Within AOI 4, much of the surface area present is impervious or assumed to be of limited permeability (see **Figure 2-3**). Note that some inaccuracies are inherent to the regional land surface model shown on **Figure 2-3**.

- No surface water bodies are present within AOI 4. Just west of AOI 4 in AOI 3, two surface water bodies are present and collectively referred to as the Guard Basin. These two basins collect stormwater conveyance from tank containment areas and appear to have no connection to the water table.

- National Weather Service Online Weather Data (NOWData) for Philadelphia, Pennsylvania, indicates that since 1872, mean annual precipitation is approximately 42 inches (ranging from approximately 29 to 64 inches).

- Stormwater runoff within AOI 4 is managed by a PES Complex storm sewer system, assumed to tie into the deeper PWD sewers that bisect or exist adjacent to the site.

- Natural recharge of the unconfined aquifer beneath AOI 4 and proximity is assumed to be spatially variable but limited in overall capacity because of the high percentage of impervious surface coverage present and the fine-grained nature and geographic extent of recent alluvial deposits that exist in most places above the water table. Water-level monitoring data collected through 2016 in AOI 4 supports that recharge to the water table is limited and results in minimal seasonal variability (see **Figure 5-9**).

10.4 ANTHROPOGENIC FEATURES

10.4.1 Historic Fill

Anthropogenic fill is present beneath the existing land surface at most locations in AOI 4 and has been identified to range in thickness from a thin veneer to a maximum of approximately 10 feet. The thickest fill generally correlates with and is reflective of the location of a former incised stream valley that once bisected AOI 4. The fill is generally heterogeneous in nature and is composed of an admixture of sand and gravel, mud, and anthropogenic debris including bricks and other construction debris.

10.4.2 Sewers

Numerous storm sewers exist beneath AOI 4. The primary function of the existing PES Complex storm sewer system is to collect and convey surface runoff derived from precipitation. A portion of storm water is collected from within tank berm areas and managed onsite in sediment ponds (AOI 3). The remainder of surface runoff is presumed to ultimately sheet flow offsite, or drain through shallow sewer conveyance to the Pollock Street, Penrose Avenue, and/or 26th Street Sewers, or the Schuylkill River by means of the Pollock Street and Penrose Avenue Sewers.

Additional details of the deeper sewers adjacent to AOI 4 are provided below. Because these sewers collect stormwater from shallower onsite (and offsite) sewers and generally intersect or are submerged beneath the water table, they are evaluated as potential contaminant migration pathways in this report.

10.4.2.1 Penrose Avenue Sewer

Stantec obtained the following two drawings from the PWD through a Pennsylvania One Call in 2017:

- Sewers, Intercepting Chamber and Appurtenant Work in Penrose Avenue, Railroad Property and City Property from 725' +/- W. of W.H.L. of 26th Street to Pattison Ave., and in Pattison Ave. from Penrose Ave. to 20th St., City of Philadelphia Water Department Return Plan, Work No. S-2810-A, Sheet 1 of 3, dated 2/18/1964
- Penrose Avenue Sewer, Sheet No. 2 of 2 (undated plan)

Stantec has concluded the following regarding the Penrose Avenue Sewer based on review of the referenced as-built drawings:

- The portion of the sewer adjacent to AOI 4 was constructed in 1962.
- The sewer is generally located beneath the southern right-of-way of Penrose Avenue. Currently, the sewer extends west from Pattison Avenue and continues to the Schuylkill River.
- The sewer's construction varies from Pattison Avenue west where it begins as twin reinforced concrete box culverts that are 7 feet by 7.5 feet (V-Bottom). These tie into a concrete flare that connects them to a 10.5 foot diameter concrete sewer (constructed in a tunnel) that passes beneath the elevated railroad over Penrose Avenue. On the west side of the railroad overpass, the sewer ties into a flared end that connects it to another section of twin 7 foot by 7.5 foot reinforced concrete box culverts (V-Bottom). These continue west and enter an Intercepting Chamber on the southwest corner of Penrose Avenue and 26th Street, and exit out of the chamber as dual 7 foot by 9 foot and 7 foot by 6 foot reinforced concrete culverts (flat bottom) that continue west until approximately Lanier Avenue, where only the 7 foot by 9 foot culvert continues west toward the Schuylkill River.
- The sewer was designed to flow west along a grade of approximately 0.05 feet per 100 feet of pipe.
- Inverts indicate that sewer bottom elevations range from approximately -5 feet to -7 feet (undisclosed elevation datum). These elevations generally correspond to present depths below ground surface of greater than approximately 15 feet (for details see discussion in **Appendix L**).

- The concrete sewer appears to have been constructed in open excavations and formed/cured in-place except for the section beneath the elevated rail line, indicated to have been tunneled.
- The sewer connects to the beginning of the 26th Street Sewer through the Intercepting Chamber at 26th Street and Penrose Avenue. The chamber contains a tide dam.

10.4.2.2 26th Street Intercepting Sewer

Stantec obtained the following drawing from the PWD through a Pennsylvania One Call in 2017:

- Intercepting Sewer in 26th Street from Penrose Ave. Sta. 141+90.95 North to Sta. 122+55.50, Lower Schuylkill East Side Intercepting System, City of Philadelphia Water Department, Work No. SD-273-SW, signed 11/18/1965

Stantec (2016) included additional drawings of the 26th Street Sewer (sewer) and has concluded the following based on review of past consultant reports, internet-based concrete pipe information, and the referenced as-built drawings:

- The sewer was constructed circa 1963.
- The sewer is located along the western side of 26th Street, approximately 3 feet to 40 feet east of the AOI 1 boundary/fence line (distance varies along centerline of pipe run).
- The sewer is constructed of vacuum-processed (a process by which excess water and air is removed from the surface of wet concrete by vacuum for the purpose of compacting the concrete, increasing its strength, lowering its permeability and increasing resistance to high-velocity liquid flow), reinforced concrete pipe that increases in diameter from 3 feet to 4 feet along the AOI 4 boundary, from just south of Hartranft Street to former Shunk Street.
- The sewer flows to the north along a grade of 0.195 feet per 100 feet of pipe in the AOI 4 area. The sewer begins at Penrose Avenue where it drops from an Intercepting Chamber in the Penrose Avenue Sewer that allows the sewer to capture gravity flow when not at capacity.
- The sewer appears to have been constructed in both tunnels and open cut excavations.
- Inverts indicate that sewer elevations range from -8.57 feet at the northwest corner of Penrose Avenue and 26th Street to -12.29 feet just south of Hartranft Street (assumed to be referenced to the National Geodetic Vertical Datum of 1929).
- Individual sewer pipe segments are approximately 8 feet to 10 feet long (based on the plan scale). It is assumed that the pipe joints consist of bell ends that were slipped together in the tunnel. The annular space surrounding the sewer pipe was then backfilled with concrete grout (plan indicated 1,500 pounds per square inch [psi]; one-part cement to three parts sand) placed under pressure.
- Test boring data provided on the plan set along AOI 1 is stratigraphically consistent with the framework presented in the AOI 1 RIR and includes: a surficial layer of apparent fill that is thickest within a filled stream valley; muddy, recent alluvial deposits; stratified alluvium consisting of brown sand and gravel/cobbles/boulders with clayey lenses (“Trenton gravel”); hardpans; and red to brown, fine sand, gravel, and sandy silt of the apparent PRM aquifer system (Stantec, 2016).

10.4.3 Active Remediation Systems

Within AOI 4, the Penrose Avenue Remediation System (Penrose System) is the only active remediation system at the time of this RIR (**Figure 1-2**). **Appendix F** provides a detailed discussion of the Penrose System. System design, operation, and totalized fluid recovery can be summarized as follows:

<u>Penrose Avenue Remediation System</u>

- The Penrose Avenue Remediation System is a total fluids remediation system that was originally designed to provide hydraulic control of hydrocarbon impacts resulting from historic petroleum refining operations. The system is located at the southeast AOI 4 boundary.
- Construction of the Penrose System began in December 2011 with the installation of 18 recovery wells (RW-700 through RW-717). Two wells were not piped into the remediation system, RW-707 and RW-710. The operation of the system started on March 20, 2013 and the system is currently active.
- Currently, RW-700, RW-701, RW-702, RW-703, RW-704, RW-708 and RW-714 are pumping. The remaining recovery wells have been disabled due to a lack of recoverable LNAPL at those locations.
- Total fluids (groundwater and LNAPL) are extracted from the recovery wells by top loading pneumatic submersible pumps supplied by compressed air from the PES Complex.
- Total fluids are conveyed through underground piping to avoid seasonal temperature issues and are processed through an oil/water separator and a settling tank within the treatment trailer. Water is discharged to the Philadelphia Water Department sanitary sewer. Recovered LNAPL is stored in a holding tank that is periodically pumped out and recycled by the PES Complex. A biofilter and carbon vessels are used to control odors and vapor emissions.
- Since its inception, the Penrose System has recovered approximately 16 million gallons of groundwater and approximately 2,900 gallons of LNAPL (through March 2017).

10.4.4 Inactive Remediation Systems

In AOI 4, there are 2 inactive remediation systems: S-30 Remediation System (S-30 System) and the S-36 Remediation System (S-36 System). **Appendix F** provides a description of each system. System design, operation, and totalized fluid recovery can be summarized as follows:

<u>S-30 Remediation System</u>

- The system, which was designed to recover LNAPL, was started on January 15, 1996.
- The system consisted of a LNAPL recovery pump installed in monitoring well S-30.
- The system operation ceased on December 30, 2010.
- During its lifetime, the S-30 System recovered approximately 39,650 gallons of LNAPL.
- Due to accumulation of LNAPL in S-30, a new pump, probe, and control panel are planned for installation in 2017.

<u>S-36 Remediation System</u>

- The system, which was designed to recover LNAPL, was started on September 15, 2004.

- The system originally consisted of a LNAPL recovery pump installed in monitoring well S-36. In October 2007, LNAPL recovery pumps were added in monitoring wells S-34 and S-35.
- The system was taken off-line July 28, 2010 due to the absence of recoverable LNAPL.
- The lifetime recovery totals for the system were 1,025 gallons of LNAPL.

10.5 GROUNDWATER CONSTITUENTS OF CONCERN

10.5.1 Unconfined (Water-Table) Aquifer

Concentrations of the following Evergreen Comprehensive List COCs were detected above the MSC in unconfined aquifer groundwater during the 2016 characterization sampling events (see **Table 4-2**): 1,2,4-TMB, EDB, 2-methylnaphthalene, anthracene, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, ethylbenzene, MTBE, naphthalene, phenanthrene, pyrene, toluene, vanadium, and zinc.

Available historical analytical data from previous groundwater sampling events were reviewed by Stantec. That data indicates the following additional Evergreen Comprehensive List COCs were identified at concentrations in excess of the current SHS during past AOI 4 unconfined aquifer groundwater sampling: benzo(b)flouranthene, cobalt, indeno(1,2,3-c,d)pyrene, lead, and total xylenes. It should be noted that exceedances of arsenic and chromium, which are not part of the Evergreen Comprehensive List, have been observed over the period of record.

10.5.2 Lower Aquifer

Concentrations of the following COCs were detected above the SHS in lower aquifer groundwater during 2016 characterization sampling events (see **Table 4-3**): benzene, MTBE, and lead.

Available historical analytical data from previous groundwater sampling events was reviewed by Stantec. That data indicates that no additional Evergreen Comprehensive List COCs were identified at concentrations in excess of the current SHS during past AOI 4 lower aquifer groundwater sampling; however, historical arsenic exceedances were noted.

10.6 BENZENE AND MTBE GROUNDWATER PLUME LOCATIONS

For purposes of the qualitative component of AOI 4 contaminant fate and transport, Stantec evaluated available analytical data from Evergreen's electronic database for the three most comprehensive groundwater analytical data sets, assembled from events conducted in 2004/2005, 2012/2013, and 2014/2016 to identify the general locations of areas where elevated COC concentrations (plumes) may be present in unconfined aquifer groundwater. Data from offsite wells at the Steen, ARCO, and former DSCP properties were incorporated to better characterize dissolved COC plumes across AOI 4 boundaries. Offsite datasets from the 2004-2005 timeframe did not include key wells, therefore, a 2007 dataset was supplemented. Of the Evergreen List COCs identified to be present in groundwater in both aquifers beneath AOI 4, benzene and MTBE were chosen as the primary COCs for this discussion. These two COCs were chosen as qualitative-level proxies for other contaminants evaluated because of their higher water solubility and potential to be mobile or migrate in the aquifers, and/or due to their general persistence in groundwater at and near the PES Complex. Other COCs identified in groundwater are discussed below (**Section 10-8**) in the context of benzene and MTBE distributions.

Figures 10-1 through **10-6** present benzene and MTBE concentration plots for the referenced sampling events in the unconfined aquifer. To create the contoured data plots, Stantec selected the maximum concentration (where data for more than one groundwater sample was available per stated time period) of each of the COCs for AOIs 1, 2, 3, and 4. That concentration data was interpolated using the point Kriging gridding method, contoured using a logarithmic scale, and cropped to the extents shown with the overall goal of identifying AOI 4-specific groundwater source areas while utilizing peripheral data (AOIs 1, 2, 3, and offsite) where available. Grid classifications were normalized for all plots (see color scales), with the exception of the lower concentration limit where the MSC was used for each COC (i.e., 5 μg/L for benzene and 20 μg/L for MTBE).

Based on available data, the following dissolved plumes were identified in recent years (2014-2016):

- Three general areas of elevated benzene concentration (dissolved plume cores) have been characterized: in the northeast corner of AOI 4 generally delineated by wells S-369, S-40, S-119, S-368, and AOI 1 well S-95; in the western and central portion of AOI 4, centered around wells S-415 and S-218 and generally delineated by wells within AOI 4; and in the south-central portion of AOI 4 near the PES Complex boundary, generally delineated by AOI 4 well data.
- Except for a few isolated exceedances, elevated MTBE concentrations are limited in time and extent to the Penrose System area (south central AOI 4 in association with the benzene plume) during the recent (2014-2016) timeframe.

Figure 10-7 displays available historic groundwater analytical data for the lower aquifer wells, including benzene and MTBE (interpolation was not warranted due to limited spatial data availability for that aquifer). Although no discernible plume areas are apparent in the lower aquifer data, slightly elevated concentrations of benzene, MTBE, and lead are indicated to be present or have historically been present at times beneath AOI 4.

10.7 BENZENE AND MTBE GROUNDWATER PLUME STABILITY ASSESSMENT

To qualitatively assess the stability of the identified unconfined aquifer groundwater plumes, Stantec utilized the referenced concentration plots to evaluate overall plume size and COC concentration trends through the last decade. In addition, COC concentration trend plots were created for selected wells with historical data that are located near plumes (to evaluate trends), and at locations downgradient of the plume cores (to evaluate potential mobility of dissolved-phase plumes with emphasis near the property boundary) (see **Figures 10-8** through **10-12**).

The following conclusions can be made based on this qualitative assessment of benzene and MTBE.

<u>Eastern AOI 4 Boundary</u>

- Benzene concentrations along the eastern AOI 4 boundary (S-38, S-39, S-40, S-120, and S-122) have been decreasing or non-detect over the period of record (**Figure 10-8**). An exception to this is the area in the northeast corner of AOI 4 near well S-369. Data availability is limited for this well however an increasing trend may be concluded. Based on present-day groundwater flow patterns, the apparent trend may be attributable to migration from AOI 4, AOI 1, and or offsite source (convergent flow).

- MTBE has not been detected along the eastern AOI 4 boundary over the period of record.

<u>Central Portion of AOI 4</u>

- Very limited groundwater analytical data is available for wells located in the western portion of AOI 4. However, for wells with more than two data points over the period of record (such as S-225, S-216, S-218, S-219, S-97, S-28), stable and/or decreasing trends are discernable for benzene and MTBE (**Figure 10-9**). This is indicative of a decaying source from past historic releases in this area.

<u>Penrose System Area</u>

- Benzene concentrations in the recovery wells of the Penrose System show variability based on their location: recovery wells (RWs) located along the northern leg of the system show a slightly increasing trend (RW-700 through 704); whereas, RWs located on the southern leg of the system (RW-705 through 717, except for RW-706 and RW-708) generally show a stable or decreasing trend (**Figures 10-10 and 10-11).** MTBE distribution is similar to benzene distribution, where detections (and MSC exceedances) are limited to RWs 700 through 704. However, MTBE data in this area is only available for the 2010 and 2016 years, and therefore, long term trend analysis is not possible for MTBE. Although a detailed MTBE analysis is not feasible at this time, it is noted that significant increases in MTBE concentration are apparent near the northern leg of actively pumping remediation wells.
- Limited groundwater data for the wells downgradient of the northern leg of the Penrose System (S-124 and S-235) are available over the period of record; however, an increasing trend similar to the northern RWs can be discerned. Benzene concentrations in the downgradient wells of the southern leg of the Penrose System (S-222, S-223, S-224, S-239, and S-243) indicate a generally stable to decreasing trend since 2004 (**Figure 10-12**). MTBE has been non-detect in these wells over the period of record.
- Benzene and MTBE concentrations in the periphery wells of the Penrose System (S-329, S-242, S-245, S-246) are mainly from the 2016 characterization sampling rounds, and therefore, a long-term trend analysis is not feasible at this time.
- No data is available from various upgradient wells in the Penrose System (such as S-240, S-241, S-236, and S-221) due to the historical presence of NAPL in these wells.

10.8 OTHER GROUNDWATER CONSTITUENTS OF CONCERN

Additional Evergreen COCs (co-contaminants) present above the MSCs in AOI 4 groundwater were generally found to be distributed in patterns that mirror or are localized to the benzene and/or MTBE plumes, or have no discernable pattern based on the monitoring well network available (a few scattered well exceedances). As summarized in **Section 9.5** of this report, the following can be qualitatively stated regarding groundwater COCs in AOI 4:

- Recent (2014-2016) distributions of dissolved-phase 1,2,4-TMB, ethylbenzene, and toluene in unconfined aquifer groundwater generally resemble that identified for benzene at AOI 4, and have demonstrated the highest number of exceedances following benzene. The distribution of these substances in groundwater also suggests that they were released in the same areas as benzene and were likely components of the same petroleum hydrocarbon products (e.g., light and middle distillates). As such, benzene is used as a qualitative-level proxy for the fate and transport assessment of these substances in this report. Where these substances are present as co-contaminants along the AOI 4 property boundary and may pose potential risk to offsite receptors, they will be further evaluated during quantitative fate and transport model simulations and documented under future Act 2 submission(s).

- MTBE, naphthalene, and bis(2-ethylhexyl)phthalate demonstrated the highest number of exceedances in AOI 4 in recent years (2014- 2016), following benzene, 1,2,4-TMB, ethylbenzene, and toluene. The remaining COCs identified at concentrations above the MSC in unconfined aquifer groundwater during 2014-2016 sampling were generally only observed in a few AOI 4 well samples. Within AOI 4, no significant spatial distribution of these constituents was observed. Most of these compounds are generally less soluble in groundwater than benzene or MTBE. Where these substances are present as co-contaminants along the AOI 4 property boundary and may pose potential risk to offsite receptors, they will be further evaluated during quantitative fate and transport model simulations and documented under future Act 2 submission(s).

- MSC exceedances of lead in unconfined aquifer groundwater over the period of record have been very limited, and show no pattern of spatial distribution. In 2016, lead was only detected in groundwater sampled from three wells; S-218D (lower aquifer), S-39D (lower aquifer), and S-97 (unconfined aquifer).

10.9 POTENTIAL ONSITE AND OFFSITE RECEPTORS

Based on the identified impacts to groundwater at AOI 4, Stantec has evaluated the following as potential receptors.

- Vapor intrusion effecting potential occupants of buildings in AOI 4 located above groundwater plumes and/or areas of LNAPL was evaluated. The only occupied building in AOI 4 based on communication with PES is the 15 Pump House Building. Indoor air and ambient air were sampled as a part of site characterization activities and identified concentrations of Evergreen Petroleum Short List COCs below the EPA RSLs, with the exception of 1,2,4-TMB.
- Infiltration of groundwater into underground utilities has the potential to generate vapors along subsurface corridors, or direct vapor migration into the vadose zone. The 26th Street and Penrose Avenue sewers were identified as potential vapor migration (external preferential) pathways for petroleum hydrocarbon sources identified in AOI 4 because they either do not meet the 30 foot horizontal proximity distance from AOI 4 identified groundwater impacts, or are submerged beneath the water table in areas of potential groundwater impacts (do not meet the vertical separation distance). A vapor mitigation system (Point Breeze Biofilter System) is currently in operation in AOI 1 to remove and treat potential vapors from the 26th Street Sewer.

- Other potential vapor receptors were not identified within the proximity distances specified in the PADEP Technical Guidance Manual (PADEP, 2017) that warranted further vapor intrusion evaluation. This includes the potential offsite benzene plume area predicted by conservative QD modeling (see below).
- Unconfined and lower aquifer groundwater appears to be infiltrating the 26th Street Sewer. There is no available data that demonstrates groundwater infiltration into the Penrose Avenue Sewer. When capacity exists (dry-season flow), the 26th Street Sewer is designed to intercept flow from the Penrose Avenue Sewer and Pollock Street/Packer Avenue Sewer and convey the combined sewage to the PWD's Southwest Regional Treatment Plant.
- The Schuylkill River is distal to AOI 4 but could receive AOI 4 impacted groundwater by way of infiltration to sewers that collect AOI 4 drainage, particularly during storm flows when the 26th Street Sewer is at or near capacity and sewer flows are directed towards the river (e.g., Penrose Avenue Sewer).
- A Complex-wide (including a one-mile buffer) well search of PaGWIS records was performed by Langan in 2016 (**Appendix N**). A subset of those records, located within one mile of the AOI 4 boundary, was selected by Stantec and is presented on **Table 10-1**. The data indicates that no known potable water supply wells exist at or in close proximity to AOI 4 (one domestic well was identified in the Grays Ferry area, up-gradient of AOI 4). Most identified records are for monitoring or recovery wells at the PES Complex, or monitoring wells installed by others for nearby PADEP facilities (some previously abandoned).
- The PRM aquifer system is utilized for water supply in New Jersey. The aquifers of that system, chiefly the lower sand unit, can receive recharge via vertical leakage through confining units and direct recharge from younger deposits along their subcrop area in south Philadelphia. Groundwater COCs, such as benzene and MTBE, present in the lower aquifer beneath AOI 4 have the potential to migrate offsite.

10.10 FATE AND TRANSPORT ANALYSIS FOR BENZENE USING QD

An analysis of the potential fate and transport of benzene in unconfined aquifer groundwater near the Penrose System is presented in **Appendix L**. The analysis was performed using the Quick Domenico (QD) groundwater fate and transport model spreadsheet developed by the PADEP, in general accordance with the User's Manual for the Quick Domenico Groundwater Fate and Transport Model (PADEP, 2014) and Pennsylvania's Land Recycling Program Technical Guidance Manual Section IV.A.2 (Fate and Transport Analysis) (PADEP, 2002). Goals of the analysis are as follows: to utilize an analytical groundwater model and recent characterization data to build upon previous findings by Langan (2013) and the qualitative fate and transport assessment presented in this RIR; to address PADEP comments provided in response to the Langan (2013) QD models in a letter dated January 16, 2014 (Report Comments); and to apply a conservative analytical modeling approach to reasonably predict a "worst case" dissolved benzene plume length so that the possible extent of offsite impacts in the Penrose System area can be delineated. Results of the QD modeling, discussed in **Section 9.6** and **Section 13.2.1,** indicate that benzene has the potential to migrate and/or have migrated offsite. The possible extent of offsite benzene migration in groundwater is predicted to impact offsite properties, and those properties are identified.

10.11 PLANS FOR COMPREHENSIVE FATE AND TRANSPORT ANALYSIS

Stantec is presently developing a groundwater flow model, using the USGS MODFLOW2000 computer code and Groundwater Vistas software. The MT3DMS contaminant transport module will be utilized to comprehensively simulate predictive scenarios of the fate and transport of selected COCs in groundwater. The modeling is being performed to assist in the process of attainment of a remediation standard under Act 2, Pennsylvania's Land Recycling Program. Under Act 2 and in consideration of the One Cleanup Program, an analysis of the fate and transport of petroleum-related constituents is needed, in general, to assess risk to potential receptors, assess plume stability, assist in selection of remedial alternatives, and estimate time to project closure.

The model will focus on groundwater movement within the Coastal Plain of south Philadelphia, Pennsylvania, near the PES Complex. The model domain was adopted from an earlier USGS model developed by Schreffler (2001), later updated by Sloto (2012), and has been updated by Stantec to more-closely simulate site-specific groundwater flow conditions beneath the PES Complex. Updates to the Schreffler (2001) model have included model layer refinement, grid discretization, updates to the model layer hydraulic properties using site-specific testing data, and the inclusion of drains to simulate water withdrawals near the PES Complex. It is anticipated that updates to the model will be completed by the summer of 2017, and that the model and preliminary fate and transport modeling results will be presented to the PADEP. Evergreen also anticipates that a fate and transport assessment based on the numerical modeling results will be submitted to PADEP under a separate Act 2 submission.

11.0 ECOLOGICAL ASSESSMENT

The majority of AOI 4 is covered with soil, gravel, and impervious surfaces. The soil and gravel-covered portions of AOI 4 are not likely to serve as a breeding area, migratory stopover, or primary habitat for wildlife. On October 31, 2016, a survey of endangered, threatened, and special concern wildlife and habitat was conducted by submitting a search request through the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Tool. The results of the PNDI search identified no known impacts by the Pennsylvania Game Commission and the U.S. Fish and Wildlife Service.

The PNDI search identified potential endangered species impacts that required further review by the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) and the Pennsylvania Fish and Boat Commission (PA FBC). No effect letter requests were submitted to PA DCNR and PA FBC on October 31, 2016. A response was received from the PA DCNR on November 8, 2016, and from the PA FBC on November 28, 2016 indicating that no impact is anticipated to the species of special concern. All ecological assessment documentation is included in **Appendix H**.

12.0 COMMUNITY RELATIONS ACTIVITIES

A Community Relation Plan (CRP) that includes public involvement with local residents to inform them of the anticipated investigations and remediation activities was completed as part of the original NIR submittal in 2006. A revised NIR was submitted in 2014. The purpose of the CRP is to provide a mechanism for the community, government officials, and other interested or affected citizens to be informed of onsite activities related to the investigation activities at the Site. This plan incorporates aspects of public involvement under both PADEP's Act 2 program and EPA's RCRA Corrective Action program. This report and future Act 2 reports will include the appropriate municipal and public notices in accordance with the provisions of Act 2. Notices will be published in the Pennsylvania Bulletin and a summary of the notice will appear in a local newspaper. As part of the CRP, Sunoco held an initial public meeting in the City of Philadelphia to present the strategy and give status updates of the project at the CRP meeting on an as requested basis. A copy of the original NIR, the 2014 NIR, and the Act 2 report notifications for this RIR are included in **Appendix A**.

13.0 CONCLUSIONS AND RECOMMENDATIONS

Stantec has prepared this RIR for AOI 4 of the PES Complex to satisfy the requirements under Act 2, as specified under 25 PA Code §250.408 (Remedial Investigation Report). The documented investigation activities were performed in general accordance with a 2011 revised Work Plan for Site Wide Approach, and were conducted in support of Evergreen's commitment to remediate legacy environmental impacts that existed at the PES Complex prior to its conveyance to PES in 2012 (Buyer-Seller Agreement). In support of those stated objectives, this RIR has described a comprehensive evaluation of available historical data pertaining to AOI 4, and has documented a remedial investigation strategy that included the collection of a significant amount of additional subsurface information in the time since previous AOI 4 Act 2 deliverables were submitted to the PADEP. Investigations performed as a part of this report also considered and where relevant, sought to address PADEP comments directed towards previous RIR submissions for the overall PES Complex.

The following summarizes Stantec's conclusions and recommendations regarding AOI 4.

13.1 SOIL

Lead was identified in AOI 4 surface soil samples at concentrations higher than the SSS for lead. Where identified in surface soil to exceed the SSS, lead has been delineated both horizontally and vertically through characterization activities and review of existing soil sample analytical data. Concentrations of COCs in all other collected soil samples (including subsurface soil) were below the highest of the SHS, the non-residential direct contact MSC, or the numeric lead SSS.

Soil from locations with lead SSS exceedances will require further pathway evaluation or a remedial measure in order to attain a standard under Act 2. It is noted that although preliminary, Stantec has observed some correlation between the locations of lead exceedances in surface soil and the occurrence of (presumably smelter) slag and cinders in areas of historic fill onsite. Metals contained within those fill materials are commonly encountered in the Philadelphia area and are generally presumed to be chemically inert under average geochemical conditions.

13.2 GROUNDWATER

13.2.1 Unconfined (Water-Table) Aquifer

Concentrations of the following Evergreen Comprehensive List COCs were detected above the MSC in unconfined aquifer groundwater during the 2016 characterization sampling events: 1,2,4-TMB, EDB, 2-methylnaphthalene, anthracene, arsenic, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, ethylbenzene, MTBE, naphthalene, phenanthrene, pyrene, toluene, vanadium, and zinc. Historical data indicates that in addition to those substances, arsenic, benzo(b)flouranthene, chromium, cobalt, indeno(1,2,3-c,d)pyrene, lead, and total xylenes have also previously exceeded the current MSC in that aquifer beneath AOI 4.

The unconfined aquifer beneath AOI 4 includes the "Trenton gravel," PRM upper clay unit aquitard (where present) and PRM upper sand unit. Unconfined aquifer groundwater flows radially under a gentle hydraulic gradient (0.001 to 0.004 ft/ft) beneath most of AOI 4 and appears to subtly mirror natural surface topography that creates a southwest-northeast trending groundwater divide. North of that feature, flow appears to be southeast out of higher topography in AOI 2 and converge near the AOI 1/AOI 2/AOI 4 boundary along the location of a former stream. The pattern of unconfined aquifer groundwater flow north and east of AOI 4 suggests that infiltration into the 26th Street Sewer, and potentially the Pollock Street/Packer Avenue Sewer, is occurring and influences flow in the northeastern portion of AOI 4.

A qualitative assessment of the potential fate and transport of benzene and MTBE in AOI 4 unconfined aquifer groundwater was performed as a proxy for future quantitative analyses of those and potentially other compounds. The qualitative assessment has indicated the following.

- Three general areas of elevated benzene concentration (dissolved plume cores) have been characterized: in the northeast corner of AOI 4 generally delineated by wells S-369, S-40, S-119, S-368, and AOI 1 well S-95; in the western and central portion of AOI 4, centered around wells S-415 and S-218 and generally delineated by wells within AOI 4; and in the south-central portion of AOI 4 at the Penrose System, generally delineated by AOI 4 well data.
- Except for a few isolated exceedances, elevated MTBE concentrations are limited in time and extent to the Penrose System area (south central AOI 4 in association with the benzene plume) in recent (2014-2016) times.
- Except for the Penrose System area plume identified, AOI 4 groundwater plume areas for benzene exhibit stable to decreasing trends based on historical data from as much as 13 years where available.
- Dissolved benzene located in central and western portions of AOI 4 may be correlated to overlying LNAPL plumes delineated in those areas in this RIR. Dissolved benzene in the northeastern corner of AOI 4 does not appear to be associated with an overlying or nearby, significant LNAPL source.
- Recent observations of significant MTBE concentrations in groundwater at the Penrose System were evaluated and may be attributable to a historic, onsite source that may have been mobilized in association with recent (post-2015) pipeline excavations and repair in the area.
- Recent (post-2015) product releases in the Penrose System area may be the causal factor for the increasing benzene concentration trend on the northern (upgradient) side of the Penrose System wells. Groundwater extraction at the Penrose System since 2013 may be partly responsible for the decreasing benzene trend observed at the southern AOI 4 boundary.
- Elevated benzene concentrations are present along the northeastern AOI 4 boundary near Hartranft Street. Based on proximity to the property boundary and nearby influence of the 26th Street Sewer, dissolved benzene may be migrating offsite by means of the sewer.
- Offsite benzene and MTBE contamination present to the northeast of AOI 4 beyond 26th Street may be the result of historical LNAPL or dissolved-phase migration from AOI 1/AOI 4 or other, nearby sites with documented or undocumented releases of petroleum hydrocarbons.

A predictive analysis of the potential fate and transport of dissolved benzene in unconfined aquifer groundwater near the Penrose System was performed using QD. The "worst case" analysis utilized conservative and site-specific input parameters to evaluate benzene plume lengths and delineate potential offsite impacts in that area where efforts to install delineation wells have been unsuccessful. The analysis indicates that dissolved benzene in unconfined aquifer groundwater near the southern AOI 4 boundary has the potential to migrate and/or have migrated offsite. This is based on recent benzene data and analysis of historical benzene concentrations in the area, and on the assumptions inherent to the QD model. Offsite properties within the modeled benzene plume area have been identified, and the Penrose sewer has been identified as a potential receptor of impacted groundwater, although available groundwater data does not suggest that the Penrose sewer may be leaking (infiltrating groundwater).

Evergreen COCs in addition to benzene and MTBE are present in AOI 4 unconfined aquifer groundwater at concentrations above the SHS. Most of these COCs (e.g., dissolved-phase 1,2,4-TMB, ethylbenzene, and toluene) appear to be spatially-associated with the locations of benzene and/or MTBE and were likely released in the same general area(s) as components of the same petroleum hydrocarbon products, such as leaded gasoline. Other COCs, such as naphthalene and bis(2-ethylhexyl)phthalate exhibit no significant spatial distribution in unconfined aquifer groundwater at concentrations above the MSCs. In general, most of these compounds are less soluble in groundwater than benzene or MTBE. Other related compounds (e.g., lead alkyls) or COCs (e.g., EDB and EDC) have a tendency to biodegrade or degrade into less soluble end products that adsorb to soil. As such, these additional dissolved-phase constituents are considered delineated to the extent of the benzene and MTBE plumes presented in this report. Where present at the AOI 4 property boundary, these COCs may be further evaluated during future quantitative fate and transport model simulations and documented under Act 2 submission, particularly where benzene and/or MTBE are found to pose potential risk to offsite receptors such as the 26th Street and Penrose Avenue Sewers.

Stantec recommends continued operation of the Penrose System to mitigate the potential for offsite migration of dissolved-phase COCs along the AOI 4 boundary in that area, in addition to continued groundwater and LNAPL monitoring at the AOI 4 points of compliance. As a part of Cleanup Plan activities, the Penrose System should be evaluated for performance improvements and capture zone delineation. Alternative remedial technology screening and LNAPL mobility/recoverability testing should also be considered. Offsite unconfined aquifer groundwater along the northeastern AOI 4 boundary (former ARCO Property) should be continually monitored for potential migration of COCs beyond the 26th Street Sewer through the analysis of contaminant trend data. It is noted that existing, offsite groundwater contamination in the unconfined aquifer in this area may be the result of other, nearby sites with documented or undocumented releases of petroleum hydrocarbons. The groundwater contamination may have been distributed by means of past aquifer hydraulic conditions/flow patterns created by regional groundwater pumping.

A comprehensive evaluation of the fate and transport of selected COCs dissolved in groundwater at the PES Complex is being performed using a numerical groundwater flow (MODFLOW) model that is more well-suited to the geologically (and anthropogenically) complex environment beneath AOI 4 and proximity. Evergreen anticipates that the model will also be used to aid in optimization of the Penrose and other remediation systems during Cleanup Plan Activities. It is anticipated that Stantec and Evergreen will present the numerical model to the PADEP in the summer of 2017.

13.2.2 Lower Aquifer

Benzene, MTBE, arsenic, and lead were identified in AOI 4 lower aquifer groundwater at concentrations in excess of the MSCs over the period of record. Historical data indicates that no other Evergreen COCs have previously exceeded the current MSCs in that aquifer beneath AOI 4.

The lower aquifer beneath AOI 4 is primarily composed of nearly equal thicknesses of the middle and lower sand units as the lower clay unit appears to be absent in this area. Groundwater flows to the south beneath most of AOI 4 under a hydraulic gradient of approximately 0.006 ft/ft. Within the overall southerly groundwater flow regime present across the area evaluated in this RIR, the lower aquifer potentiometric surface can appear non-uniform and flow may be convergent towards an offsite depression along a portion of 26th Street and the former Passyunk Homes property. Along the northeastern perimeter of AOI 4 and areas to the east the lower aquifer potentiometric surface indicates that groundwater flow direction is to the southeast. Variability in patterns of lower aquifer groundwater flow in the area evaluated may be related to aquifer transmissivities through the referenced bedrock troughs. As indicated in Stantec (2016), these observed patterns of lower aquifer groundwater flow may also be related to upward leakage into the 26th Street Sewer, or into the unconfined aquifer through an offsite hydraulic connection.

A qualitative assessment of the fate and transport of previously detected COCs in AOI 4 lower aquifer groundwater was performed as a proxy for future quantitative analyses. Although detailed analyses were not performed based on lack of spatial and historical data availability in this aquifer, no discernible plume areas are apparent. However, when compared to the SHS, slightly elevated concentrations of benzene, MTBE, and lead are indicated to be present or have historically been present beneath AOI 4. It is noted that the present hydraulic regime at AOI 4 does not support an AOI 4 source for the contamination observed in the lower aquifer and does not support that AOI 4 lower aquifer contamination is presently a source for nearby offsite contamination observed to the north and east. There are other documented sources for petroleum hydrocarbons in the area. It is likely that regional groundwater production from the lower aquifer and possibly construction dewatering for the 26th Street Sewer historically lowered hydraulic heads near AOI 4 and were the mechanism that may have allowed for the downward migration of contamination from the unconfined aquifer into the lower aquifer. This concept would be particularly applicable to areas outside of AOI 4 where the middle clay is absent, or where the middle clay may have been excavated during construction of the 26th Street Sewer interceptor. As such, the Evergreen Petroleum Short List COCs present above the SHS in the lower aquifer beneath AOI 4 are considered characterized for the purposes of this RIR.

The PRM aquifer system is utilized for water supply in New Jersey. The aquifers of that system, chiefly the lower sand unit, can receive recharge via vertical leakage through confining units and direct recharge from younger deposits along their subcrop in the south Philadelphia area. Groundwater COCs, such as benzene and MTBE, present in the lower aquifer beneath AOI 4 have the potential to migrate offsite. As indicated previously for the unconfined aquifer, a MODFLOW model will be utilized during quantitative fate and transport analyses to evaluate that potential based on the COC source areas identified in this and other RIRs at the PES Complex.

13.2.3 Aquifer Discussion

Stantec supports the following conclusions regarding the presence or absence of a hydraulic connection between the unconfined and lower aquifers beneath AOI 4 and proximity.

- The middle clay unit appears to be the sole “clay” unit of the PRM that is laterally continuous beneath AOI 4, and supports overall hydraulic separation between the unconfined and lower aquifers.
- To the west of AOI 4 beneath AOIs 6 and 7, the middle clay was incised by erosion through the Schuylkill River valley and has been removed and replaced by Quaternary deposits. North and east of AOI 4 beneath the former Passyunk Homes property, the middle clay unit is interpreted to thin relatively rapidly over a short distance and may have been completely eroded prior to deposition of the upper sand unit. In this “breach” area as identified by others, it appears that the aquifers defined at AOI 4 may be hydraulically connected through muddy strata of the apparent middle sand unit.
- Across most of the study area, the hydraulic head potential between observed AOI 4 aquifers was positive (downward) in May 2016. However, an area of negative (upward) hydraulic head potential is indicated in southern AOI 1 and along 26th Street. A broad zone of nearly equal hydraulic heads is indicated between these areas, generally along northeastern AOI 4 and at the former DSCP Property near the “breach” area identified by others.
- Overall the positive hydraulic head potentials beneath AOI 4 support the existence of two aquifers and the continuity of the middle clay unit aquitard. Water-level monitoring data for AOI 4 well pairs indicate that the head potentials between the aquifers are consistent throughout the year.
- Direct losses from the lower aquifer to the 26th Street Sewer are possible where sewer excavations appear to have encountered PRM deposits near the elevation of the middle clay unit along an area where the middle clay is interpreted to be relatively thin. For this reason, it is possible that a connection between Quaternary alluvium and the PRM middle/lower sand (i.e., the water-table and lower aquifers) was established through construction of the 26th Street Sewer. Data presented in this RIR suggest that the present-day lower aquifer is semi-confined in the area evaluated and that a direct hydraulic connection between aquifers is not present onsite but may exist nearby (i.e., either along the 26th Street Interceptor or offsite “breach” area).

13.3 VAPOR INTRUSION

Concentrations of COCs in indoor and ambient air were evaluated in and near the only occupied building in AOI 4 (15 Pump House). Observed COC concentrations were below the EPA RSLs, with the exception of 1,2,4-TMB in three samples. Upon the completion of remediation activities, it is assumed that volatilization to the breathing zone will be the only potentially complete pathway for legacy petroleum impacts in AOI 4. As such, these screening values are applicable. It is noted that this conclusion is dependent upon the remainder of the exposure pathways being eliminated through other remedial activities and controls.

Evergreen will continue to operate the sewer ventilation system present for the 26th Street and Pollock Street/Packer Avenue Sewers (Point Breeze Biofilter System) and report performance information in semi-annual Philadelphia Refinery Groundwater Remediation Status Reports. Details regarding plans to maintain this vapor mitigation system will be included in future Act 2 deliverables for AOI 4. Stantec plans to conduct an additional round of air sampling pursuant to the VI Guidance. In order to evaluate data trends, a minimum of one indoor air sample and one ambient air sample are planned for the 15 Pump House area, and one ambient air sample may be collected near the vicinity of well S-104. Samples will be collected for an 8-hour period during the heating season to represent the most conservative scenario. Exceedances of any EPA RSLs in air samples will be evaluated in the Cleanup Plan.

13.4 LNAPL

LNAPL present in the subsurface beneath and directly adjacent to AOI 4 has been delineated and characterized into 6 general plume areas. The majority of LNAPL sampled though time has been characterized as a mixture of light and middle distillates and is indicative of multiple product releases at different times with subsequent co-mingling of plumes in the subsurface.

Data evaluated in this RIR indicates that the majority of LNAPL at AOI 4 is the result of relatively old petroleum hydrocarbon releases and is residual. In general, based upon the multiple lines of evidence presented above, LNAPL observed at AOI 4 appears to be stable or decreasing (not migrating) as a whole. However, wells located in three distinct areas of AOI 4 indicate potentially mobile LNAPL: (1) S-30 System area (based on wells S-30 and S-31); (2) Penrose System area (based on S-221, S-240, S-241, and RW-701); and (3) in the vicinity of S-220 (between the S-30 System and Penrose System areas).

Based on LDRM evaluations, areas of potentially mobile and practically recoverable LNAPL are still present in AOI 4, particularly in the currently active Penrose System area. LNAPL in this and other areas of AOI 4 are continually monitored through well gauging. LNAPL recovery is ongoing at the Penrose System, and is anticipated to resume in 2017 for the inactive S-30 System once it has been rehabilitated. It is noted that the PES Complex remains an active refinery and as such, may be impacted by additional petroleum releases through time.

14.0 SIGNATURES

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

Tiffani L. Doerr, P.G.
Project Manager
Evergreen Resources Management Operations

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

15.0 REFERENCES

NOTE: ELECTRONIC COPIES OF REFERENCED REPORTS ARE INCLUDED IN **APPENDIX I** AS A COMPACT DISK ATTACHMENT.

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Table 1-1
Constituents of Concern
Evergreen Petroleum Short List
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Volatile Organic Compounds	CAS No.
Benzene	71-43-2
Cumene	98-82-8
Dichloroethane, 1,2-	107-06-2
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Methyl tert butyl ether	1634-04-4
Toluene	108-88-3
Trimethylbenzene, 1,2,4-	95-63-6
Trimethylbenzene, 1,3,5-	108-67-8
Xylenes	1330-20-7
Semi Volatile Organic Compounds	**CAS No.**
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluroranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Chrysene	218-01-9
Fluorene	86-73-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0
Metals	**CAS No.**
Lead	7439-92-1

Constituents are from Pennsylvania Department of Environmental Protection Short List of Petroleum Products (leaded and unleaded gasoline and No. 1, 2, 4, 5, 6 fuel oils) published as Table IV-9 in Chapter IV, Section E of the Land Recycling Program Technical Guidance Manual (Document Number 253-0300-100) effective June 8, 2002 and revised March 18, 2008.

Table 1-2
Constituents of Concern (COCs)
Evergreen Comprehensive List
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Volatile Organic Compounds	CAS No.
Benzene	71-43-2
Butylbenzene, sec-	135-98-8
Butylbenzene, tert-	98-06-6
Cumene	98-82-8
Cyclohexane	110-82-7
Dichloroethane, 1,2-	107-06-2
Ethylbenzene	100-41-4
Ethylene Dibromide	106-93-4
Hexane	110-54-3
Methyl tert-butyl ether	1634-04-4
Toluene	108-88-3
Trimethylbenzene, 1,2,4-	95-63-6
Trimethylbenzene, 1,3,5-	108-67-8
Xylenes	1330-20-7
Metals	**CAS No.**
Cobalt	7440-48-4
Lead	7439-92-1
Nickel	7440-02-0
Vanadium	7440-62-2
Zinc	7440-66-6

Semi-Volatile Organic Compounds	CAS No.
Acenaphthene	83-32-9
Anthracene	120-12-7
Benzo(a)anthracene	56-55-3
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(g,h,i)perylene	191-24-2
Benzo(k)fluoranthene	207-08-9
Biphenyl, 1,1-	92-52-4
Bis(2-ethylhexyl) phthalate	117-81-7
Chrysene	218-01-9
Cresol, m- (3-methylphenol)	108-39-4
Cresol, o- (2-methylphenol)	95-48-7
Cresol, p- (4-methylphenol)	106-44-5
Dibenz(a,h)anthracene	53-70-3
Diethyl phthalate	84-66-2
Dimethylphenol, 2,4-	105-67-9
Dibutyl phthalate, n-	84-74-2
Dinitrophenol, 2,4-	51-28-5
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-cd)pyrene	193-39-5
Methylnaphthalene, 2-	91-57-6
Naphthalene	91-20-3
Nitrophenol, 4-	100-02-7
Phenanthrene	85-01-8
Phenol	108-95-2
Pyrene	129-00-0
Pyridine	110-86-1
Quinoline	91-22-5

This list is generated from the Pennsylvania Deparment of Environmental Protection Southeast Regional Office Crude Oil Parameters for Corrective Action (CDB|SERO|PADEP|9 Aug 2013) combined with PADEP Short List of Petroleum Products (leaded and unleaded gasoline and No. 1, 2, 4, 5, 6 Fuel Oils).

Table 3-1
Remdial Investigation Activities Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Location ID	General Descripton of Physical Location	Location Rationale	Product Type	Soil Sample Depths (ft bgs)	Analyte List
AOI4-BH-16-001	PB 823, biased toward low points, surface staining if observed	Characterize soil in area of historic open incident at PB 823	hydrocracker gas oil	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-002	PB 823, biased toward low points, surface staining if observed	Characterize soil in area of historic open incident at PB 823	hydrocracker gas oil	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-003	PB 842, within footprint of former tank	Characterize soil in area of historic open incident at PB 842	crude oil/water	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-004	PB 842, within footprint of former tank	Characterize soil in area of historic open incident at PB 842	crude oil/water	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-005	PB 253, biased toward low points, surface staining if observed	Characterize soil in area of historic open incident at PB 253	diesel fuel	0-2, 2-15[1]	Evergreen Petroleum Short List
AOI4-BH-16-006	PB 253, biased toward low points, surface staining if observed	Characterize soil in area of historic open incident at PB 253	diesel fuel	0-2, 2-15[1]	Evergreen Petroleum Short List
AOI4-BH-16-007	PB 253, biased toward low points, surface staining if observed	Characterize soil in area of historic open incident at PB 253	diesel fuel	0-2, 2-15[1]	Evergreen Petroleum Short List
AOI4-BH-16-008	Within PB 848 tank berm	Characterize lead exceedence in shallow soils around PB 848 tank berm	crude oil	0-2	Lead
AOI4-BH-16-009	Within PB 848 tank berm	Characterize lead exceedence in shallow soils around PB 848 tank berm	crude oil	0-2	Lead
AOI4-BH-16-010	Within PB 848 tank berm	Characterize lead exceedence in shallow soils around PB 848 tank berm	crude oil	0-2	Lead
AOI4-BH-16-011	Northwest corner of PB 252 tank berm	Characterize lead exceedence in shallow soils around PB 252	#2 fuel oil	0-2	Lead
AOI4-BH-16-012	Southwest corner of PB 252 tank berm	Characterize lead exceedence in shallow soils around PB 252	#2 fuel oil	0-2	Lead
AOI4-BH-16-013	15 Pump House, biased toward surface staining if observed and /or former release areas	Characterize soil in area of historic releases from 15 Pump House	crude oil	0-2	Evergreen Comprehensive List

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Table 3-1
Remdial Investigation Activities Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Location ID	General Descripton of Physical Location	Location Rationale	Product Type	Soil Sample Depths (ft bgs)	Analyte List
AOI4-BH-16-014	15 Pump House, biased toward surface staining if observed and /or former release areas	Characterize soil in area of historic releases from 15 Pump House	crude oil	0-2	Evergreen Comprehensive List
AOI4-BH-16-015	PB 254, within footprint of former tank	Characterize soil in area of historically removed tank PB 254	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-016	PB 255, within footprint of former tank	Characterize soil in area of historically removed tank PB 255	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-017	PB 256, within footprint of former tank	Characterize soil in area of historically removed tank PB 256	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-018	PB 189, within footprint of former tank	Characterize soil in area of historically removed tank PB 189	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-019	PB 257, within footprint of former tank	Characterize soil in area of historically removed tank PB 257	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-020	PB 258, within footprint of former tank	Characterize soil in area of historically removed tank PB 258	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-021	PB 820, within footprint of former tank	Characterize soil in area of historically removed tank PB 820	unknown	0-2, 2-15[1]	Evergreen Comprehensive List
AOI4-BH-16-022	Northwest corner of PB 252 tank berm	Characterize lead exceedance in shallow soils near AOI4-BH-16-011	#2 fuel oil	0-2	Lead
S-39D	Along roadway northeast of tank PB 885	Vertical delineation of groundwater impacts, and obtain hydrostratigraphic information	NA	0-2, 2-15[1]	Evergreen Petroleum Short List
S-218D	Northwest corner of PB 848 tank berm	Vertical delineation of groundwater impacts, and obtain hydrostratigraphic information	NA	0-2, 2-15[1]	Evergreen Petroleum Short List
S-416	Northeast corner of PB 845 tank berm	Replacement well for former MW-4; delineation of LNAPL plume in northwest portion of AOI	NA	0-2, 2-15[1]	Evergreen Comprehensive List

Notes:
1. 2'-15' samples collected from the interval exhibiting the highest PID response (above the water table)
NA - Not applicable

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Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**AOI4_BH-13-81**	**AOI4_BH-13-90**	**AOI4_BH-13-94**		**AOI4-BH-13-82**	**AOI4-BH-13-84**	**AOI4-BH-13-85**	**AOI4-BH-13-86**		**AOI4-BH-13-88**			**AOI4-BH-13-89**	**AOI4-BH-13-91**		**AOI4-BH-13-92**	**AOI4-BH-13-93**	**AOI4-BH-13-95**	**AOI4-BH-13-96**
Sample Date			20-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	18-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	14-Mar-13	14-Mar-13	14-Mar-13	19-Mar-13	14-Mar-13	14-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	14-Mar-13
Sample ID			AOI-4_BH-13-81_8-10'	AOI-4_BH-13-90_8-10'_031513	AOI-4_BH-13-94_0-2_031513	AOI-4_BH-13-94_8-10_031513	AOI4-BH-13-82_6.5-7_031813	AOI4-BH-13-84_5.5-6_031513	AOI4-BH-13-85_5.5-6_031513	AOI4-BH-13-86_2-2.5_031513	AOI4-BH-13-86_5.5-6_031513	AOI4-BH-13-88_1.5-2_31413	AOI4-BH-13-88_3.5-4_031413	AOI4-BH-13-88_5.5-6_031413	AOI4-BH-13-89_5.5-6_031913	AOI4-BH-13-91_0-2'_031413	AOI4-BH-13-91_8-10'_031413	AOI4-BH-13-92_8-10'	AOI4-BH-13-93_8-10'	AOI4-BH-13-95_8-10'	AOI4-BH-13-96_8-9_31413
Sample Depth			8 - 10 ft	8 - 10 ft	0 - 2 ft	8 - 10 ft	6.5 - 7 ft	5.5 - 6 ft	5.5 - 6 ft	2 - 2.5 ft	5.5 - 6 ft	1.5 - 2 ft	3.5 - 4 ft	5.5 - 6 ft	5.5 - 6 ft	0 - 2 ft	8 - 10 ft	8 - 10 ft	8 - 10 ft	8 - 10 ft	8 - 9 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	UNKNOWN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order		**SHS-PA**	JB31919	JB31583	JB31583	JB31583	JB31733	JB31583	JB31583	JB31583	JB31583	JB31413	JB31413	JB31413	JB31794	JB31413	JB31413	JB31733	JB31733	JB31733	JB31413
Laboratory Sample ID	**Units**		JB31919-1	JB31583-3	JB31583-1	JB31583-2	JB31733-9	JB31583-11	JB31583-10	JB31583-8	JB31583-9	JB31413-6	JB31413-7	JB31413-8	JB31794-1	JB31413-9	JB31413-10	JB31733-13	JB31733-12	JB31733-14	JB31413-1
Volatile Organic Compounds																					
BENZENE	mg/kg	0.5^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	*ND (0.013)*	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	*ND (0.014)*	*ND (0.013)*	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	*ND (0.011)*
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	0.186	ND (0.00088)	ND (0.00088)	0.0206	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.0535 J
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.129 J	ND (0.0044)	ND (0.0044)	0.0143	ND (0.0044)	0.694	0.993	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.143 J
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.0472 J
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.362 J	ND (0.0044)	ND (0.0044)	0.0437	ND (0.0044)	13.6	6.95	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.145 J
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.147 J	ND (0.0044)	ND (0.0044)	0.0169	ND (0.0044)	ND (0.55)	ND (0.50)	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.189 J
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	0.339	ND (0.00088)	ND (0.00088)	0.0109	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.260
Volatile Organic Compounds (SW8011)																					
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																					
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0692 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.036)	ND (0.12)	0.0442 J	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0431 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.036)	ND (0.12)	0.150	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.122	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	0.130	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0634 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.181
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	2.53	0.894	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.107 J	0.622	0.393	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.282
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.036)	ND (0.12)	0.0604 J	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.147	0.0608 J	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.0538 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																					
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	2.5	8.6	43.8	6.2	13.3	6.6	6.9	7.8	**_2140_**^{B}	10.0	7.1	6.2	6.7	60.8	7.3	11.6	10.7	5.5	26.2
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location	Units	SHS-PA	AOI4-BH-13-97		AOI4-BH-13-98		AOI4-BH-13-99		AOI4-BH-13-100		AOI4-BH-13-101	
Sample Date			14-Mar-13	14-Mar-13	14-Mar-13	14-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13
Sample ID			AOI4-BH-13-97.0-1_31413	AOI4-BH-13-97-8.5-9.5_31413	AOI4-BH-13-98-1-2_31413	AOI4-BH-13-98_6-7_31413	AOI4-BH-13-99_1.5-2_031813	AOI4-BH-13-99_2.5-3_031813	AOI4-BH-13-100_0-1_31813	AOI4-BH-13-100_5-6_31813	AOI4-BH-13-101_0-1_31813	AOI4-BH-13-101_7-8_31813
Sample Depth			0 - 1 ft	8.5 - 9.5 ft	1 - 2 ft	6 - 7 ft	1.5 - 2 ft	2.5 - 3 ft	0 - 1 ft	5 - 6 ft	0 - 1 ft	7 - 8 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order		SHS-PA	JB31413	JB31413	JB31413	JB31413	JB31733	JB31733	JB31733	JB31733	JB31733	JB31733
Laboratory Sample ID	Units		JB31413-2	JB31413-3	JB31413-4	JB31413-5	JB31733-10	JB31733-11	JB31733-7	JB31733-8	JB31733-5	JB31733-6
Volatile Organic Compounds												
BENZENE	mg/kg	0.5[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	0.127	0.00024 J	0.245	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
CYCLOHEXANE	mg/kg	6900[AB]	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.018)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.15)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
ETHYLBENZENE	mg/kg	70[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	0.581	ND (0.0012)	0.110 J	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500[AB]	ND (0.0047)	ND (0.0050)	ND (0.0051)	0.0150	0.00071 J	0.122 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
METHYL TERTIARY BUTYL ETHER	mg/kg	2[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.15)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
HEXANE	mg/kg	5600[AB]	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25[AB]	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800[AB]	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200[AB]	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	0.702	ND (0.0012)	0.182	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
1,2,4-TRIMETHYLBENZENE	mg/kg	35[AB]	ND (0.0047)	ND (0.0050)	ND (0.0051)	1.15	ND (0.0059)	0.169 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
1,3,5-TRIMETHYLBENZENE	mg/kg	210[AB]	ND (0.0047)	ND (0.0050)	ND (0.0051)	0.0948	ND (0.0059)	0.0611 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000[AB]	ND (0.00095)	ND (0.0010)	ND (0.0010)	2.42	ND (0.0012)	0.671	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005[AB]	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds												
ACENAPHTHENE	mg/kg	4700[AB]	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350[AB]	ND (0.12)	ND (0.10)	ND (0.12)	ND (0.12)	0.0675	ND (0.037)	ND (0.038)	ND (0.037)	0.0182 J	ND (0.040)
BENZO(A)ANTHRACENE	mg/kg	130[A] 430[B]	ND (0.12)	ND (0.10)	0.105 J	ND (0.12)	0.111	0.0652	0.0231 J	ND (0.037)	0.0559	ND (0.040)
BENZO(A)PYRENE	mg/kg	12[A] 46[B]	ND (0.12)	ND (0.10)	0.0823 J	ND (0.12)	0.157	0.0875	0.0243 J	ND (0.037)	0.0449	ND (0.040)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 170[B]	ND (0.12)	ND (0.10)	0.189	ND (0.12)	0.109	0.0954	0.0303 J	ND (0.037)	0.0544	ND (0.040)
BENZO(G,H,I)PERYLENE	mg/kg	180[AB]	ND (0.12)	ND (0.10)	0.0753 J	ND (0.12)	0.215	0.109	0.0274 J	ND (0.037)	0.0408	ND (0.040)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 610[B]	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190[AB]	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130[AB]	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900[AB]	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230[AB]	ND (0.12)	ND (0.10)	0.112 J	ND (0.12)	0.145	0.114	0.0263 J	ND (0.037)	0.0787	ND (0.040)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 270[B]	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300[AB]	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230[AB]	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23[AB]	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200[AB]	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800[AB]	ND (0.12)	ND (0.10)	ND (0.12)	ND (0.12)	ND (0.039)	0.191	ND (0.038)	ND (0.037)	ND (0.037)	ND (0.040)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 22000[B]	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900[AB]	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}[A] 58_{s2}[B]	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580[AB]	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25[AB]	ND (0.12)	ND (0.10)	ND (0.12)	ND (0.12)	0.0334 J	0.0933	ND (0.038)	ND (0.037)	ND (0.037)	ND (0.040)
4-NITROPHENOL	mg/kg	6[AB]	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000[AB]	ND (0.12)	ND (0.10)	0.0619 J	ND (0.12)	0.237	0.380	0.0235 J	ND (0.037)	0.104	ND (0.040)
PHENOL	mg/kg	200[AB]	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200[AB]	ND (0.12)	ND (0.10)	0.201	ND (0.12)	0.196	0.140	0.0297 J	ND (0.037)	0.120	ND (0.040)
PYRIDINE	mg/kg	12[AB]	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37[AB]	-	-	-	-	-	-	-	-	-	-
Metals												
COBALT	mg/kg	160[AB]	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450[AB]	81.5	2.9	136	8.0	***11600***[A]	***1870***[B]	399	12.8	***494***[A]	10.2
NICKEL	mg/kg	650[AB]	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220[A] 820[B]	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000[AB]	-	-	-	-	-	-	-	-	-	-

Sample Location	AOI4-BH-13-102		AOI4-BH-13-103		AOI4-BH-13-104		AOI4-BH-15-1	AOI4-BH-16-001	
Sample Date	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	15-Mar-13	15-Mar-13	9-Oct-15	21-Jun-16	15-Jul-16
Sample ID	AOI4-BH-13-102_0-1_31813	AOI4-BH-13-102_6-7_31813	AOI4-BH-13-103_0-1_31813	AOI4-BH-13-103_2-3_31813	AOI4-BH-13-104_0-.5_31513	AOI4-BH-13-104_6-7_31513	AOI4_BH-15-1_0-2_100915	AOI4-BH-16-001-0-2-20160621	AOI4-BH-16-001-14-16-20160715
Sample Depth	0 - 1 ft	6 - 7 ft	0 - 1 ft	2 - 3 ft	0 - 0.5 ft	6 - 7 ft	0 - 2 ft	0 - 2 ft	14 - 16 ft
Sampling Company	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ESC	ESC
Laboratory Work Order	JB31733	JB31733	JB31733	JB31733	JB31583	JB31583	JC5896	L843252	L847944
Laboratory Sample ID	JB31733-3	JB31733-4	JB31733-1	JB31733-2	JB31583-5	JB31583-4	JC5896-1	L843252-06	L847944-01
Volatile Organic Compounds									
BENZENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	***1.96***[B]	ND (0.00057)	ND (0.00124)	ND (0.00115)
CYCLOHEXANE	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)
1,2-DIBROMOETHANE (EDB)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.035)	-	ND (0.00124)	ND (0.00115)
1,2-DICHLOROETHANE (EDC)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.27)	ND (0.0011)	ND (0.00124)	ND (0.00115)
ETHYLBENZENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	29.5	ND (0.0011)	ND (0.00124)	ND (0.00115)
ISOPROPYLBENZENE (CUMENE)	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	7.31	ND (0.0023)	ND (0.0124)	ND (0.0115)
METHYL TERTIARY BUTYL ETHER	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.27)	ND (0.0011)	ND (0.00124)	ND (0.00115)
HEXANE	-	-	-	-	-	-	-	ND (0.0124)	ND (0.0115)
NAPHTHALENE	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)
TOLUENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	6.55	ND (0.0011)	ND (0.00618)	ND (0.00575)
1,2,4-TRIMETHYLBENZENE	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	***75.4***[B]	ND (0.0023)	ND (0.00124)	ND (0.00115)
1,3,5-TRIMETHYLBENZENE	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	27.3	ND (0.0023)	ND (0.00124)	ND (0.00115)
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	65.6	ND (0.0011)	ND (0.00371)	ND (0.00345)
Volatile Organic Compounds (SW8011)									
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	ND (0.0029)	-	-
Semi-Volatile Organic Compounds									
ACENAPHTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
ANTHRACENE	ND (0.036)	ND (0.037)	0.0731	ND (0.040)	ND (0.12)	2.56	ND (0.039)	ND (0.0408)	ND (0.190)
BENZO(A)ANTHRACENE	0.0292 J	ND (0.037)	0.0807	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)
BENZO(A)PYRENE	ND (0.036)	ND (0.037)	0.0794	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)
BENZO(B)FLUORANTHENE	ND (0.036)	ND (0.037)	0.0607	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)
BENZO(G,H,I)PERYLENE	ND (0.036)	ND (0.037)	0.111	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
1,1'-BIPHENYL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
CHRYSENE	0.0338 J	ND (0.037)	0.122	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
DIETHYL PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
2,4-DINITROPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
FLUORANTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
FLUORENE	ND (0.036)	ND (0.037)	ND (0.038)	ND (0.040)	ND (0.12)	6.14	ND (0.039)	ND (0.0408)	ND (0.190)
INDENO(1,2,3-C,D)PYRENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
NAPHTHALENE	ND (0.036)	ND (0.037)	0.0654	ND (0.040)	ND (0.12)	21.2	ND (0.039)	ND (0.0408)	ND (0.190)
4-NITROPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
PHENANTHRENE	0.0401	ND (0.037)	0.285	0.0341 J	ND (0.12)	21.7	ND (0.039)	ND (0.0408)	ND (0.190)
PHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
PYRENE	0.0476	ND (0.037)	0.261	ND (0.040)	ND (0.12)	0.697	ND (0.039)	ND (0.0408)	ND (0.190)
PYRIDINE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)
QUINOLINE	-	-	-	-	-	-	-	ND (0.0709)	ND (0.330)
Metals									
COBALT	-	-	-	-	-	-	-	9.57	2.74
LEAD	***1620***[A]	9.2	***3020***[A]	34.0	7.0	7.9	9.7	11.2	2.73
NICKEL	-	-	-	-	-	-	-	12.5	6.39
VANADIUM	-	-	-	-	-	-	-	36.8	5.91
ZINC	-	-	-	-	-	-	-	34.6	21.0

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			AOI4-BH-16-002		AOI4-BH-16-003		AOI4-BH-16-004		AOI4-BH-16-005		AOI4-BH-16-006		AOI4-BH-16-007		AOI4-BH-16-008	AOI4-BH-16-009	AOI4-BH-16-010	AOI4-BH-16-011		AOI4-BH-16-012	AOI4-BH-16-013	
Sample Date			21-Jun-16	18-Jul-16	24-Aug-16	24-Aug-16	24-Aug-16	24-Aug-16	23-Jun-16	23-Jun-16	23-Jun-16	23-Jun-16	27-Jun-16	27-Jun-16	14-Jun-16	14-Jun-16	14-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	30-Jun-16	30-Jun-16
Sample ID			AOI4-BH-16-002-0-2-20160621	AOI4-BH-16-002-14-16-20160718	AOI4-BH-16-003-0-2-20160824	AOI4-BH-16-003-14-15-20160824	AOI4-BH-16-004-0-2-20160824	AOI4-BH-16-004-14-15-20160824	AOI4-BH-16-005-0-2-20160623	AOI4-BH-16-005-14-15-20160623	AOI4-BH-16-006-0-2-20160623	AOI4-BH-16-006-14-15-20160623	AOI4-BH-16-007-0-2-20160627	AOI4-BH-16-007-14-15-20160627	AOI4-BH-16-008-0-2-20160614	AOI4-BH-16-009-0-2-20160614	AOI4-BH-16-010-0-2-20160614	AOI4-BH-16-011-0-2-20160613	AOI4-BH-16-011-0-2-20160613	AOI4-BH-16-012-0-2-20160613	AOI4-BH-16-013-0-2-20160630	AOI4-BH-16-013-13-14-20160630
Sample Depth			0 - 2 ft	14 - 16 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	13 - 14 ft
Sampling Company			AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order		**SHS-PA**	L843252	L847944	L855702	L855702	L855702	L855702	L843656	L843656	L843656	L843656	L844277	L844277	L841529	L841529	L841529	L841529	L842738	L841529	L844813	L844813
Laboratory Sample ID	**Units**		L843252-05	L847944-02	L855702-03	L855702-04	L855702-01	L855702-02	L843656-05	L843656-06	L843656-03	L843656-04	L844277-05	L844277-06	L841529-01	L841529-02	L841529-03	L841529-04	L842738-01	L841529-05	L844813-03	L844813-04
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	0.00122	ND (0.00121)	0.00135	ND (0.00118)	ND (0.00125)	ND (0.00123)	0.0237	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	0.00349	ND (0.0528)
CYCLOHEXANE	mg/kg	6900[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	0.0291	ND (0.00121)	0.00201	-	-	-	-	-	-	-	-	-	-	-	-	0.0443	0.306
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	*ND (0.0149)*	-	-	-	-	-	-	ND (0.00118)	*ND (0.0181)*
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	ND (0.00118)	ND (0.0528)
ETHYLBENZENE	mg/kg	70[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.271	-	-	-	-	-	-	ND (0.00118)	ND (0.0528)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500[AB]	ND (0.0127)	ND (0.0120)	ND (0.0126)	ND (0.0110)	ND (0.0121)	ND (0.0120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	0.00284	ND (0.00129)	0.120	-	-	-	-	-	-	0.0415	ND (0.528)
METHYL TERTIARY BUTYL ETHER	mg/kg	2[AB]	ND (0.00127)	ND (0.00120)	0.00155	0.0177	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	0.0452	0.205
HEXANE	mg/kg	5600[AB]	ND (0.0127)	ND (0.0120)	ND (0.0126)	ND (0.0110)	ND (0.0121)	ND (0.0120)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0118)	ND (0.528)
NAPHTHALENE	mg/kg	25[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	-	-	-	-	-	-	-	-	-	-	-	-	0.0208	0.405
BUTYLBENZENE, TERT-	mg/kg	2200[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	-	-	-	-	-	-	-	-	-	-	-	-	0.00214	0.131
TOLUENE	mg/kg	100[AB]	ND (0.00633)	ND (0.00602)	ND (0.00629)	ND (0.00550)	ND (0.00604)	ND (0.00602)	ND (0.00590)	ND (0.00625)	ND (0.00616)	ND (0.00615)	ND (0.00645)	ND (0.218)	-	-	-	-	-	-	ND (0.00589)	ND (0.264)
1,2,4-TRIMETHYLBENZENE	mg/kg	35[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.731	-	-	-	-	-	-	ND (0.00118)	0.327
1,3,5-TRIMETHYLBENZENE	mg/kg	210[AB]	ND (0.00127)	ND (0.00120)	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.332	-	-	-	-	-	-	ND (0.00118)	0.0551
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000[AB]	ND (0.00380)	ND (0.00361)	ND (0.00377)	ND (0.00330)	ND (0.00362)	ND (0.00361)	ND (0.00354)	ND (0.00375)	ND (0.00369)	ND (0.00369)	ND (0.00387)	0.290	-	-	-	-	-	-	ND (0.00353)	ND (0.159)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)
ANTHRACENE	mg/kg	350[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.131	-	-	-	-	-	-	ND (0.194)	ND (0.210)
BENZO(A)ANTHRACENE	mg/kg	130[A] 430[B]	ND (0.0418) I	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)
BENZO(A)PYRENE	mg/kg	12[A] 46[B]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 170[B]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)
BENZO(G,H,I)PERYLENE	mg/kg	180[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 610[B]	ND (0.0418) OE I	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)
1,1'-BIPHENYL	mg/kg	190[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
DI-N-BUTYL PHTHALATE	mg/kg	4900[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
CHRYSENE	mg/kg	230[AB]	ND (0.0418) I	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 270[B]	ND (0.0418) OE	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)
DIETHYL PHTHALATE	mg/kg	9300[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
2,4-DIMETHYLPHENOL	mg/kg	230[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
2,4-DINITROPHENOL	mg/kg	23[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
FLUORANTHENE	mg/kg	3200[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	0.330	ND (0.210)
FLUORENE	mg/kg	3800[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.205	-	-	-	-	-	-	ND (0.194)	ND (0.210)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 22000[B]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)
2-METHYLNAPHTHALENE	mg/kg	1900[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58$_{s2}$[A] 58$_{s2}$[B]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580[AB]	ND (0.422) OE	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
NAPHTHALENE	mg/kg	25[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.0236)	ND (0.0250)	ND (0.0246)	ND (0.0246)	ND (0.0258)	0.0407	-	-	-	-	-	-	ND (0.194)	ND (0.210)
4-NITROPHENOL	mg/kg	6[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
PHENANTHRENE	mg/kg	10000[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.421	-	-	-	-	-	-	0.262	0.303
PHENOL	mg/kg	200[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
PYRENE	mg/kg	2200[AB]	ND (0.0418)	ND (0.0397)	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	0.00752	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.0452	-	-	-	-	-	-	0.292	ND (0.210)
PYRIDINE	mg/kg	12[AB]	ND (0.422)	ND (0.401)	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)
QUINOLINE	mg/kg	0.37[AB]	ND (0.0727)	ND (0.0691)	ND (0.0722) OE	ND (0.366) OE	ND (0.0693) OE	ND (0.0691) OE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.338)	ND (0.365)
Metals																						
COBALT	mg/kg	160[AB]	8.43	4.45	9.05	7.02	8.42	9.13	-	-	-	-	-	-	-	-	-	-	-	-	10.2	7.43
LEAD	mg/kg	450[AB]	6.60	3.99	8.18	6.69	12.2	10.8	14.4	8.22	8.07	5.88	7.79	7.25	***1760 J*** [A]	***1490 J*** [A]	160 J	***4380 J*** [A]	***6000*** [A]	***1080 J*** [A]	255	65.1
NICKEL	mg/kg	650[AB]	13.8	7.63	11.6	11.3	12.0	6.20	-	-	-	-	-	-	-	-	-	-	-	-	18.6	12.1
VANADIUM	mg/kg	220[A] 820[B]	27.7	8.20	25.9	22.1	39.0	21.9	-	-	-	-	-	-	-	-	-	-	-	-	38.2	30.1
ZINC	mg/kg	12000[AB]	42.2	29.4	29.9	29.0	46.2	17.9	-	-	-	-	-	-	-	-	-	-	-	-	102	113

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**AOI4-BH-16-014**		**AOI4-BH-16-015**		**AOI4-BH-16-016**		**AOI4-BH-16-017**		**AOI4-BH-16-018**		**AOI4-BH-16-019**		**AOI4-BH-16-020**		**AOI4-BH-16-021**		**AOI4-BH-16-022**	**AST-845-LINE-1**	**AST-845-LINE-2**	**AST-845-LINE-3**
Sample Date			29-Jun-16	29-Jun-16	22-Jun-16	22-Jun-16	20-Jun-16	21-Jun-16	21-Jun-16	21-Jun-16	28-Jun-16	28-Jun-16	27-Jun-16	27-Jun-16	24-Jun-16	24-Jun-16	22-Jun-16	22-Jun-16	23-Jun-16	14-Mar-07	14-Mar-07	14-Mar-07
Sample ID			AOI4-BH-16-014-0-2-20160629	AOI4-BH-16-014-13-14-20160629	AOI4-BH-16-015-0-2-20160622	AOI4-BH-16-015-13-15-20160622	AOI4-BH-16-016-0-2-20160620	AOI4-BH-16-016-14-16-20160621	AOI4-BH-16-017-0-2-20160621	AOI4-BH-16-017-12-14-20160621	AOI4-BH-16-018-0-2-20160628	AOI4-BH-16-018-14-15-20160628	AOI4-BH-16-019-0-2-20160627	AOI4-BH-16-019-13-15-20160627	AOI4-BH-16-020-0-2-20160624	AOI4-BH-16-020-13-15-20160624	AOI4-BH-16-021-0-2-20160622	AOI4-BH-16-021-14-15-20160622	AOI4-BH-16-022-0-2-20160623	AST-845-LINE-1	AST-845-LINE-2	AST-845-LINE-3
Sample Depth			0 - 2 ft	13 - 14 ft	0 - 2 ft	13 - 15 ft	0 - 2 ft	14 - 16 ft	0 - 2 ft	12 - 14 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	13 - 15 ft	0 - 2 ft	13 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	SECOR	SECOR	SECOR
Laboratory			ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	PIP	PIP	PIP
Laboratory Work Order		**SHS-PA**	L844813	L844813	L843252	L843252	L842835	L842835	L842835	L842835	L844277	L844277	L844277	L844277	L845360	L845360	L843252	L843252	L843656	072076	072076	072076
Laboratory Sample ID	**Units**		L844813-01	L844813-02	L843252-01	L843252-02	L842835-01	L842835-02	L842835-04	L842835-05	L844277-01	L844277-02	L844277-03	L844277-04	L845360-01	L845360-02	L843252-03	L843252-04	L843656-07	0703-3404	0703-3405	0703-3406
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	0.0626	ND (0.122)	0.00230	ND (0.00107)	0.00973	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	***0.896*** A	0.00142	ND (0.00127)	ND (0.00111)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D
CYCLOHEXANE	mg/kg	6900^{AB}	0.00987	ND (0.122)	0.00525	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	8.10	ND (0.00125)	ND (0.00114)	4.10	0.0146	ND (0.00127)	ND (0.00111)	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	ND (0.00114)	*ND (0.0419)*	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	*ND (0.0692)*	ND (0.00125)	ND (0.00114)	*ND (0.0735)*	ND (0.00118)	ND (0.00127)	ND (0.00111)	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	ND (0.00114)	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	ND (0.214) OE	ND (0.00118) OE	ND (0.00127)	ND (0.00111)	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	0.00835	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	11.2	0.0224	ND (0.00127)	ND (0.00111)	-	ND (0.097) D	0.068 J D	ND (0.100) D
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.0114)	ND (1.22)	ND (0.0120)	ND (0.0107)	ND (0.0122)	ND (0.0127)	ND (0.0126)	ND (0.0120)	ND (0.0129)	7.88	ND (0.0125)	ND (0.0114)	5.19	0.0137	ND (0.0127)	ND (0.0111)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	0.00170	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	ND (0.214)	ND (0.00118)	ND (0.00127)	ND (0.00111)	-	-	-	-
HEXANE	mg/kg	5600^{AB}	ND (0.0114)	ND (1.22)	ND (0.0120)	ND (0.0107)	ND (0.0122)	ND (0.0127)	ND (0.0126)	ND (0.0120)	ND (0.0129)	ND (2.02)	ND (0.0125)	ND (0.0114)	ND (2.14)	ND (0.0118)	ND (0.0127)	ND (0.0111)	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.097) D	ND (0.120) D	ND (0.100) D
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	ND (0.00114)	0.837	0.00291	ND (0.00107)	ND (0.00122)	0.00564	ND (0.00126)	ND (0.00120)	ND (0.00129)	17.5	0.00274	0.00266	9.76	0.0347	ND (0.00127)	ND (0.00111)	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	ND (0.00114)	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	1.06	ND (0.00125)	ND (0.00114)	0.603	0.00133	ND (0.00127)	ND (0.00111)	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.00568)	ND (0.611)	ND (0.00601)	ND (0.00533)	ND (0.00609)	ND (0.00635)	ND (0.00628)	ND (0.00598)	ND (0.00646)	ND (1.01)	ND (0.00627)	ND (0.00571)	ND (1.07)	ND (0.00591)	ND (0.00634)	ND (0.00555)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	ND (0.00114)	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	33.9	0.0973	ND (0.00127)	ND (0.00111)	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	ND (0.00114)	ND (0.122)	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)	ND (0.00125)	ND (0.00114)	10.5	0.0312	ND (0.00127)	ND (0.00111)	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	ND (0.00341)	ND (0.366)	ND (0.00361)	ND (0.00320)	ND (0.00366)	ND (0.00381)	ND (0.00377)	ND (0.00359)	ND (0.00388)	ND (0.605)	ND (0.00376)	ND (0.00343)	13.1	0.0229	ND (0.00380)	ND (0.00333)	-	ND (0.097) D	0.077 J D	ND (0.100) D
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	0.0777	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.272	ND (0.0414)	ND (0.0377)	1.88	0.167	ND (0.0418)	ND (0.0366)	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	0.444	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394) B	ND (0.422)	ND (0.370)	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.450	ND (0.390)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	0.218	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	0.103	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.426	ND (0.0414)	ND (0.0377)	2.37	0.203	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	23.6	1.52	ND (0.0418)	ND (0.0366)	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	6.15	0.278	ND (0.0418)	ND (0.0366)	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	0.0446	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.760	ND (0.0414)	ND (0.0377)	5.70	0.476	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.640	ND (0.390)
PHENOL	mg/kg	200^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.375)	ND (0.0403)	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)	ND (0.0414)	ND (0.0377)	0.565	0.0417	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.640	0.450
PYRIDINE	mg/kg	12^{AB}	ND (3.78)	ND (0.407)	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	*ND (0.652)*	ND (0.0701)	ND (0.345)	ND (0.355)	ND (0.0700)	ND (0.0729)	ND (0.0721)	ND (0.0687)	ND (0.0742)	ND (0.0681)	ND (0.0720)	ND (0.0656)	*ND (0.380)*	ND (0.0678)	ND (0.0728)	ND (0.370)	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	8.37	8.32	9.36	4.92	7.93	4.73	5.49	3.22	8.76	5.96	6.08	4.32	3.75	4.45	5.72	19.8	-	-	-	-
LEAD	mg/kg	450^{AB}	57.6	13.9	310	17.9	370	13.6	9.54	2.22	6.97	5.91	7.89	7.56	12.4	11.4	7.70	7.21	***644*** A	-	-	-
NICKEL	mg/kg	650^{AB}	14.6	13.4	29.4	11.6	17.5	13.9	14.0	6.09	12.8	10.2	11.4	14.1	11.7	12.7	11.5	10.6	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	47.5	37.1	206	10.3	34.8	27.4	35.9	8.20	27.3	14.9	31.6	14.0	28.9	30.2	30.8	19.8	-	-	-	-
ZINC	mg/kg	12000^{AB}	80.2	37.6	696	38.3	112	35.8	42.6	16.1	30.7	29.4	31.8	36.3	36.8	58.7	32.1 B	27.1 B	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			AST-845-LINE-4	AST-845-LINE-5	GP-1		GP-2		GP-3		GP-4		GP-5		GP-6		GP-7			GP-8		
Sample Date			14-Mar-07	14-Mar-07	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03
Sample ID			AST-845-LINE-4	AST-845-LINE-5	GP-1(1.5-2)	GP-1(15-15.5)	GP-2(1.5-2)	GP-2(15-15.5)	GP-3(0-2)	GP-3(15-15.5)	GP-4(1.5-2)	GP-4(15-15.5)	GP-5(1.5-2)	GP-5(15-15.5)	GP-6(1.5-2)	GP-6(15.5-16)	GP-7(1.5-2)	GP-7(6.5-7)	GP-7(15.5-16)	GP-8(1.5-2)	GP-8(7.5-8)	GP-8(15-15.5)
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	0 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15.5 - 16 ft	1.5 - 2 ft	6.5 - 7 ft	15.5 - 16 ft	1.5 - 2 ft	7.5 - 8 ft	15 - 15.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			PIP	PIP	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL
Laboratory Work Order		SHS-PA	072076	072076	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559
Laboratory Sample ID	Units		0703-3407	0703-3408	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	ND (0.120) D	ND (0.130) D	ND (0.25)	0.11 J	ND (0.23)	ND (0.26)	ND (0.31)	ND (0.25)	ND (0.24)	ND (0.25)	ND (0.31)	0.14 J	ND (0.27)	ND (0.26)	ND (0.26)	0.16 J	0.34 J	ND (0.28)	ND (0.26)	ND (0.24)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.120) D	ND (0.130) D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.120) D	ND (0.130) D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.120) D	ND (0.130) D	0.20 J	3.7	0.72	2.2	ND (0.31)	0.42	ND (0.24)	0.24 J	ND (0.31)	0.37	0.13 J	ND (0.26)	ND (0.26)	9.4	25	***40^{A} D***	0.91	ND (0.24)
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.120) D	ND (0.130) D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	0.090 J D	ND (0.130) D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.400)	ND (0.370)	0.50	ND (0.36)	ND (1.8)	ND (0.36)	0.31 J	ND (0.36)	1.9 J	ND (0.37)	0.61 J	ND (0.37)	1.3	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	0.50 J	ND (0.37)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.400)	0.490	2.0	ND (0.36)	5.0	ND (0.36)	1.6	ND (0.36)	4.1	ND (0.37)	2.1	ND (0.37)	2.7	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.400)	ND (0.370)	2.2	ND (0.36)	4.8	ND (0.36)	1.4	ND (0.36)	3.5	ND (0.37)	2.3	ND (0.37)	2.3	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	0.470	0.530	1.8	ND (0.36)	3.8	ND (0.36)	1.1	ND (0.36)	3.2	ND (0.37)	1.8	ND (0.37)	2.0	ND (0.42)	1.3 J	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.400)	ND (0.370)	0.67	ND (0.36)	1.7 J	ND (0.36)	0.41 J	ND (0.36)	1.2 J	ND (0.37)	0.88 J	ND (0.37)	0.77 J	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.400)	0.490	1.8	ND (0.36)	4.4	ND (0.36)	1.4	ND (0.36)	4.0	ND (0.37)	2.0	ND (0.37)	2.4	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	0.63 J	ND (0.37)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.400)	ND (0.370)	ND (0.40)	0.40	ND (1.8)	0.20 J	ND (0.42)	ND (0.36)	ND (0.19)	0.27 J	ND (0.95)	0.25 J	0.50 J	ND (0.42)	ND (2.0)	17	2.2 J	7.6 J	0.82	ND (0.37)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.400)	ND (0.370)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.400)	0.660	1.7	0.99	2.1	0.48	1.1	0.35 J	10	0.69	1.9	0.66	4.7	ND (0.42)	ND (2.0)	49	5.0	22	3.4	0.38
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	0.620	1.0	1.8	ND (0.36)	5.4	ND (0.36)	2.0	ND (0.36)	7.3	ND (0.37)	2.4	ND (0.37)	3.6	ND (0.42)	ND (2.0)	10	ND (3.7)	4.1 J	1.3	ND (0.37)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			GP-9	MW-1		MW-2	MW-3		MW-4	
Sample Date			29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03
Sample ID			GP-9(Surface)	MW-1(1.5-2)	MW-1(11.5-12)	MW-2(0-2)	MW-3(1.5-2)	MW-3(15.5-16)	MW-4(1.5-2)	MW-4(11.5-12)
Sample Depth				1.5 - 2 ft	11.5 - 12 ft	0 - 2 ft	1.5 - 2 ft	15.5 - 16 ft	1.5 - 2 ft	11.5 - 12 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL
Laboratory Work Order		SHS-PA	75559	75559	75559	75559	75559	75559	75559	75559
Laboratory Sample ID	Units		UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Volatile Organic Compounds										
BENZENE	mg/kg	0.5^{AB}	0.054 J	ND (0.24)	ND (0.26)	0.087 J	ND (0.25)	0.065 J	0.054 J	ND (0.25)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	-	-	-	-	-	-	-	-
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	0.46	ND (0.24)	ND (0.26)	0.055 J	ND (0.25)	3.4	0.075 J	ND (0.25)
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	-	-	-	-	-	-	-	-
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)										
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds										
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (57)	0.88	ND (0.36)	0.29 J	0.35 J	ND (0.36)	0.33 J	ND (0.41)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (57)	2.1	ND (0.36)	0.73	2.7	ND (0.36)	0.93	ND (0.41)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	*ND (57)*	1.9	ND (0.36)	0.80	5.0 D	ND (0.36)	1.1	ND (0.41)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (57)	2.0	ND (0.36)	0.69	3.9	ND (0.36)	0.98	ND (0.41)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (57)	0.71	ND (0.36)	0.37 J	1.8	ND (0.36)	0.50	ND (0.41)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (57)	2.1	ND (0.36)	0.73	2.5	ND (0.36)	0.91	ND (0.41)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (57)	0.39	ND (0.36)	ND (0.39)	ND (0.37)	0.60	ND (0.39)	ND (0.41)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	230	3.1	ND (0.36)	1.1	0.86	1.4	1.2	ND (0.41)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	37 J	3.2	ND (0.36)	1.2	1.8	ND (0.36)	1.1	0.26 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-
Metals										
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-

Sample Location			PB-252-LINE-1	PB-252-LINE-2	PB-252-LINE-3	PB-252-LINE-4	PB-252-LINE-5	PB-252-LINE-6	PB-252-PER-1	PB-252-PER-2	PB-252-PER-3	PB-252-PER-4	PB-252-PER-5	PB-252-PER-6
Sample Date			30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07
Sample ID			PB-252-LINE-1	PB-252-LINE-2	PB-252-LINE-3	PB-252-LINE-4	PB-252-LINE-5	PB-252-LINE-6	PB-252-PER-1	PB-252-PER-2	PB-252-PER-3	PB-252-PER-4	PB-252-PER-5	PB-252-PER-6
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	6 - 6.5 ft	6 - 6.5 ft	6 - 6.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order		SHS-PA	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139
Laboratory Sample ID	Units		0706-0440	0706-0441	0706-0442	0706-0437	0706-0438	0706-0439	0706-0428	0706-0429	0706-0430	0706-0431	0706-0432	0706-0433
Volatile Organic Compounds														
BENZENE	mg/kg	0.5^{AB}	ND (0.280) D	ND (0.210) D	ND (0.220) D	**22^{B} D**	**1.6^{B} D**	**0.710^{B} D**	**10^{B} D**	**2.2^{B} D**	**0.720^{B} D**	**1.7^{B} D**	**2.1^{B} D**	**4.7^{B} D**
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	0.150 J D	ND (0.210) D	ND (0.220) D	**73^{B} D**	63 D	6.7 D	37 D	35 D	23 D	18 D	6.4 D	9.3 D
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.280) D	ND (0.210) D	ND (0.220) D	11 D	9.9 D	14 D	7.5 D	12 D	11 D	6.4 D	2.7 D	2.3 D
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.280) D	0.170 J D	0.190 J D	**49^{B} D**	**43^{B} D**	7.9 D	**29^{B} D**	4.8 D	**29^{B} D**	12 D	**26^{B} D**	3.8 D
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	B	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.280) D	ND (0.210) D	ND (0.220) D	94 D	51 D	0.450 D	7.5 D	0.420 D	0.590 D	0.720 D	0.300 D	2.7 D
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds														
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.360)	ND (0.360)	ND (0.370)	1.6	2.6	2.1	ND (0.400)	ND (0.380)	ND (0.420)	ND (0.420)	4.2	0.420
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.360)	0.550	0.910	2.5	4.4	4.1	7.9 D	0.480	0.230 J	3.9	14 D	1.0
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
Metals														
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**PB-252-SUB-1**	**PB-252-SUB-2**	**PB-252-SUB-3**	**PB-826-1**	**PB-826-2**	**PB-826-3**	**PB-826-4**	**PB-826-5**	**PB-826-6**	**PB-826-7**	**PB-826-8**	**PB-826-9**	**PB-843 LINE 1**	**PB-843 LINE 2**	**PB-843 LINE 3**	**PB-843 LINE 4**	**PB-843 LINE 5**	**PB-843 LINE 6**	**PB-843 LINE 7**	**PB-843 LINE 8**
Sample Date			**30-May-07**	**30-May-07**	**30-May-07**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**7-Sep-04**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**	**23-Aug-06**
Sample ID			**PB-252-SUB-1**	**PB-252-SUB-2**	**PB-252-SUB-3**	**826-1**	**826-2**	**826-3**	**826-4**	**826-5**	**826-6**	**826-7**	**826-8**	**826-9**	**843 Line 1**	**843 Line 2**	**843 Line 3**	**843 Line 4**	**843 Line 5**	**843 Line 6**	**843 Line 7**	**843 Line 8**
Sample Depth			**5 - 5.5 ft**	**5 - 5.5 ft**	**5 - 5.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**5.5 - 6 ft**	**5.5 - 6 ft**	**5.5 - 6 ft**	**5.5 - 6 ft**	**5.5 - 6 ft**	**5.5 - 6 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**
Sampling Company			**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**
Laboratory			**PIP**	**PIP**	**PIP**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**
Laboratory Work Order		**SHS-PA**	**074139**	**074139**	**074139**	**911205**	**911205**	**911205**	**911205**	**911205**	**911205**	**911205**	**911205**	**911205**	**1003265**	**1003265**	**1003265**	**1003265**	**1003265**	**1003265**	**1003265**	**1003265**
Laboratory Sample ID	**Units**		**0706-0434**	**0706-0435**	**0706-0436**	**4347770**	**4347771**	**4347772**	**4347773**	**4347774**	**4347775**	**4347776**	**4347777**	**4347778**	**4851923**	**4851924**	**4851925**	**4851926**	**4851927**	**4851928**	**4851929**	**4851930**
Volatile Organic Compounds																							
BENZENE	mg/kg	0.5^{AB}	ND (0.260) D	**4.7^B D**	ND (0.300) D	ND (0.0019)	ND (0.0020)	ND (0.0019)	ND (0.0020)	ND (0.0019)	ND (0.0021)	ND (0.0021)	ND (0.0021)	ND (0.0020)	ND (0.028)	ND (0.028)	ND (0.026)	ND (0.025)	ND (0.027)	ND (0.029)	ND (0.025)	ND (0.027)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.260) D	44 D	ND (0.300) D	ND (0.0019)	0.0025 J	0.0022 J	ND (0.0020)	ND (0.0019)	ND (0.0021)	ND (0.0021)	0.0048 J	ND (0.0020)	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	ND (0.057)	ND (0.049)	ND (0.055)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.260) D	11 D	ND (0.300) D	ND (0.0047)	ND (0.0049)	ND (0.0048)	ND (0.0050)	ND (0.0049)	ND (0.0052)	ND (0.0052)	ND (0.0052)	ND (0.0050)	0.110 J	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	1.4	ND (0.049)	ND (0.055)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	0.260 J D	24 D	ND (0.300) D	ND (0.0095)	0.016 J	0.015 J	ND (0.010)	ND (0.0097)	ND (0.010)	ND (0.010)	ND (0.010)	ND (0.0099)	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	0.067 J	ND (0.049)	ND (0.055)
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.260) D	5.2 D	ND (0.300) D	0.0027 J	0.0054	0.0043 J	ND (0.0020)	0.0027 J	ND (0.0021)	ND (0.0021)	0.0081	0.0036 J	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	ND (0.057)	ND (0.049)	ND (0.055)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	-	-	-	0.068	0.230	0.023 J	0.016	0.0056 J	0.00085 J	ND (0.00071)	0.023 J	0.025	0.140 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	ND (0.037)	ND (0.180)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	-	-	-	0.240	0.880	0.110	0.083	0.027	0.0056 J	0.0041 J	0.110	0.048	0.120 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.130 J	0.310	0.340 J
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	-	-	-	0.250	0.800	0.160	0.100	0.032	0.0085 J	0.0061 J	0.110	0.047	0.067 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.100 J	0.340	0.400 J
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	-	-	-	0.210	0.710	0.130	0.086	0.027	0.0069 J	0.0048 J	0.110	0.047	0.086 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.100 J	0.490	0.620 J
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	-	-	-	0.420	1.0	0.280	0.170	0.052	0.013 J	0.011 J	0.170	0.068	ND (0.038)	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	0.280	0.570 J
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	-	-	-	0.230	0.820	0.130	0.089	0.028	0.0064 J	0.0053 J	0.098	0.074	0.100 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.230 J	0.410	0.470 J
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.380)	ND (0.410)	ND (0.430)	0.033 J	0.110 J	ND (0.023)	0.012 J	ND (0.0046)	ND (0.0047)	ND (0.0047)	ND (0.023)	0.021 J	0.390	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	1.0	ND (0.037)	ND (0.180)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	0.097	0.500	0.071 J	0.046	0.024	0.0040 J	ND (0.0039)	0.060 J	0.020	ND (0.038)	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	0.300	0.400 J
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.380)	ND (0.410)	ND (0.430)	0.390	1.5	0.150	0.120	0.031	0.0059 J	0.0051 J	0.130	0.180	0.800	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	2.2	0.140 J	0.260 J
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	-	-	-	0.780	2.4	0.440	0.250	0.076	0.017 J	0.014 J	0.280	0.170	0.310	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.370 J	0.490	0.530 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-843 LINE 9	PB-843 PERIMETER 1	PB-843 PERIMETER 2	PB-843 PERIMETER 3	PB-843 PERIMETER 4	PB-843 PERIMETER 5	PB-843 PERIMETER 6	PB-843 SUB 1	PB-843 SUB 2	PB-843 SUB 3	PB-844 LINE 1	PB-844 LINE 2	PB-844 LINE 3	PB-844 LINE 4	PB-844 LINE 5	PB-844 LINE 6	PB-844 LINE 7	PB-844 LINE 8	PB-844 LINE 9	PB-844 LINE 10
Sample Date			23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06
Sample ID			843 Line 9	843 Perimeter 1	843 Perimeter 2	843 Perimeter 3	843 Perimeter 4	843 Perimeter 5	843 Perimeter 6	843 Sub 1	843 Sub 2	843 Sub 3	844 Line 1	844 Line 2	844 Line 3	844 Line 4	844 Line 5	844 Line 6	844 Line 7	844 Line 8	844 Line 9	844 Line 10
Sample Depth			0 - 0.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268
Laboratory Sample ID	Units		4851931	4851917	4851918	4851919	4851920	4851921	4851922	4851932	4851933	4851934	4851944	4851945	4851946	4851947	4851948	4851949	4851950	4851951	4851952	4851953
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	0.035 J	ND (0.031)	0.037 J	ND (0.026)	ND (0.024)	ND (0.024)	ND (0.024)	ND (0.023)	ND (0.024)	ND (0.023)	ND (0.027)	ND (0.026)	ND (0.029)	ND (0.030)	0.034 J	ND (0.030)	ND (0.029)	0.067 J	0.035 J	**2.4** ^{B}
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)	ND (0.061)	ND (0.058)	ND (0.054)	0.220 J	8.3
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)	ND (0.061)	ND (0.058)	ND (0.054)	0.340	4.2
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)	ND (0.061)	ND (0.058)	ND (0.054)	0.950	12
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)	ND (0.061)	ND (0.058)	ND (0.054)	ND (0.054)	ND (0.190)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.037)	ND (0.040)	0.600	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.078 J	ND (0.041)	ND (0.040)	ND (0.040)	ND (0.041)	4.0
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	0.087 J	ND (0.040)	0.860	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.310	ND (0.041)	0.057 J	0.110 J	0.170 J	0.540
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	0.065 J	ND (0.040)	0.510	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.310	ND (0.041)	0.054 J	0.110 J	0.200	0.100 J
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	0.099 J	ND (0.040)	0.640	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.320	ND (0.041)	0.054 J	0.130 J	0.190 J	0.066 J
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	0.085 J	ND (0.040)	0.230	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.170 J	ND (0.041)	ND (0.040)	0.082 J	0.150 J	ND (0.036)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	0.110 J	ND (0.040)	0.770	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.270	ND (0.041)	0.056 J	0.120 J	0.450	0.560
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.037)	ND (0.040)	0.300	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	ND (0.041)	ND (0.041)	ND (0.040)	ND (0.040)	0.970	2.2
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	0.054 J	ND (0.040)	0.280	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.160 J	ND (0.041)	ND (0.040)	0.073 J	0.140 J	0.038 J
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	0.160 J	ND (0.040)	2.1	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.230	ND (0.041)	0.056 J	0.076 J	1.9	4.1
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	0.170 J	ND (0.040)	1.5	ND (0.038)	ND (0.036)	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.290	ND (0.041)	0.069 J	0.140 J	0.320	0.430
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-844 PERIMETER 1	PB-844 PERIMETER 2	PB-844 PERIMETER 3	PB-844 PERIMETER 4	PB-844 PERIMETER 5	PB-844 PERIMETER 6	PB-844 SUB 1	PB-844 SUB 2	PB-844 SUB 3	PB-845 PERIMETER 1	PB-845 PERIMETER 2	PB-845 PERIMETER 3	PB-845 PERIMETER 4	PB-845 PERIMETER 5	PB-845 SUB 1	PB-845 SUB 2	PB-845 SUB 3	PB-845-PER-6	PB-846 LINE 1	PB-846 LINE 2
Sample Date			23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	12-Feb-08	24-Aug-06	24-Aug-06
Sample ID			844 Perimeter 1	844 Perimeter 2	844 Perimeter 3	844 Perimeter 4	844 Perimeter 5	844 Perimeter 6	844 Sub 1	844 Sub 2	844 Sub 3	845 Perimeter 1	845 Perimeter 2	845 Perimeter 3	845 Perimeter 4	845 Perimeter 5	845 Sub 1	845 Sub 2	845 Sub 3	PB-845-PER-6	846 Line 1	846 Line 2
Sample Depth			3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	3 - 3.5 ft	5.5 - 6 ft	5.5 - 6 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003270	1003270	1003270	1003270	1003270	1003270	1003270	1003270	1077642	1003269	1003269
Laboratory Sample ID	Units		4851938	4851939	4851940	4851941	4851942	4851943	4851954	4851955	4851956	4851973	4851974	4851975	4851976	4851977	4851978	4851979	4851980	5280668	4851963	4851964
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	ND (0.026)	ND (0.029)	ND (0.026)	0.380	ND (0.027)	ND (0.027)	0.031 J	ND (0.028)	0.095 J	ND (0.028)	ND (0.026)	ND (0.029)	ND (0.028)	ND (0.029)	ND (0.028)	ND (0.029)	ND (0.027)	ND (0.025)	ND (0.026)	ND (0.027)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.052)	ND (0.058)	ND (0.053)	0.320	ND (0.053)	ND (0.054)	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	ND (0.057)	ND (0.055)	ND (0.058)	ND (0.054)	ND (0.050)	ND (0.051)	ND (0.054)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.052)	ND (0.058)	ND (0.053)	ND (0.061)	0.073 J	ND (0.054)	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	0.180 J	ND (0.055)	ND (0.058)	ND (0.054)	ND (0.050)	ND (0.051)	ND (0.054)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.052)	ND (0.058)	ND (0.053)	0.130 J	ND (0.053)	ND (0.054)	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	0.120 J	ND (0.057)	ND (0.056)	1.2	0.067 J	0.310	0.450	0.074 J	0.140 J	ND (0.054)
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.052)	ND (0.058)	ND (0.053)	0.520	ND (0.053)	ND (0.054)	ND (0.052)	ND (0.056)	0.078 J	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	ND (0.057)	ND (0.055)	ND (0.058)	ND (0.054)	ND (0.050)	ND (0.051)	ND (0.054)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	0.170 J	0.250	0.150 J	0.920	0.480	0.320	0.140 J	ND (0.040)	0.078 J	ND (0.040)	1.2	0.430	0.240	ND (0.200)	0.400	0.110 J	0.590	ND (0.036)	0.038 J	ND (0.036)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	0.570	0.640	0.530	2.3	0.110 J	0.780	0.210	ND (0.040)	0.110 J	ND (0.040)	2.8	1.5	0.750	0.590 J	1.2	0.110 J	0.640	ND (0.036)	0.066 J	ND (0.036)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	0.680	0.510	0.500	1.8	0.068 J	0.690	0.140 J	ND (0.040)	0.089 J	0.044 J	2.3	1.4	0.680	0.650 J	0.860	0.085 J	0.440	0.052 J	0.050 J	ND (0.036)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	0.720	0.560	0.530	2.1	0.093 J	0.870	0.150 J	ND (0.040)	0.097 J	0.050 J	2.8	1.6	0.880	1.2	1.2	0.120 J	0.650	0.064 J	0.063 J	ND (0.036)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	0.440	0.320	0.280	1.0	ND (0.039)	0.420	0.073 J	ND (0.040)	0.130 J	0.056 J	1.4	0.840	0.460	0.720 J	0.480	0.051 J	0.250	0.074 J	ND (0.035)	ND (0.036)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	0.520	0.600	0.490	1.9	0.120 J	0.740	0.200	ND (0.040)	0.150 J	0.068 J	2.8	1.5	0.740	3.1	1.2	0.140 J	0.660	0.064 J	0.067 J	ND (0.036)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	0.075 J	0.100 J	0.075 J	0.420	1.2	0.150 J	0.067 J	ND (0.040)	ND (0.039)	ND (0.040)	0.510	0.180 J	0.130 J	0.590 J	0.190 J	0.190 J	0.520	ND (0.036)	ND (0.035)	ND (0.036)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	0.540	0.350	0.320	1.2	0.048 J	0.490	0.087 J	ND (0.040)	0.088 J	ND (0.040)	1.4	0.810	0.430	0.480 J	0.530	0.061 J	0.270	0.039 J	ND (0.035)	ND (0.036)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	0.550	0.710	0.600	3.0	3.4	1.0	0.520	ND (0.040)	0.180 J	ND (0.040)	4.3	2.0	0.970	1.8	1.7	0.620	1.9	ND (0.036)	0.120 J	ND (0.036)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	0.620	0.900	0.660	3.0	0.380	1.1	0.370	ND (0.040)	0.170 J	0.057 J	4.4	2.6	1.3	2.0	2.2	0.280	1.3	0.046 J	0.120 J	0.045 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-846 LINE 3	PB-846 LINE 4	PB-846 LINE 5	PB-846 LINE 6	PB-846 LINE 7	PB-846 PERIMETER 1	PB-846 PERIMETER 2	PB-846 PERIMETER 3	PB-846 PERIMETER 4	PB-846 PERIMETER 5	PB-846 PERIMETER 6	PB-846 SUB 1	PB-846 SUB 2	PB-846 SUB 3	PB-847-1	PB-847-2	PB-847-3	PB-847-4	PB-847-5	PB-847-6
Sample Date			24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	16-Oct-06	16-Oct-06	16-Oct-06	16-Oct-06	16-Oct-06	16-Oct-06
Sample ID			846 Line 3	846 Line 4	846 Line 5	846 Line 6	846 Line 7	846 Perimeter 1	846 Perimeter 2	846 Perimeter 3	846 Perimeter 4	846 Perimeter 5	846 Perimeter 6	846 Sub 1	846 Sub 2	846 Sub 3	AST-847-1/0-0.5	AST-847-2/0-0.5	AST-847-3/0-0.5	AST-847-4/0-0.5	AST-847-5/0-0.5	AST-847-6/0-0.5
Sample Depth			5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1010396	1010396	1010396	1010396	1010396	1010396
Laboratory Sample ID	Units		4851965	4851966	4851967	4851968	4851972	4851957	4851958	4851959	4851960	4851961	4851962	4851969	4851970	4851971	4892823	4892824	4892825	4892826	4892827	4892828
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	ND (0.028)	0.037 J	0.220 J	0.120 J	0.029 J	5^{B}	0.039 J	ND (0.027)	ND (0.028)	ND (0.026)	0.120 J	ND (0.025)	ND (0.025)	0.027 J	ND (0.028)	ND (0.028)	ND (0.027)	ND (0.028)	ND (0.028)	ND (0.028)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.055)	ND (0.059)	0.620	ND (0.052)	ND (0.056)	1.8	ND (0.052)	ND (0.054)	ND (0.057)	ND (0.052)	0.063 J	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)	ND (0.057)	ND (0.055)	ND (0.056)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.055)	0.160 J	0.290	ND (0.052)	ND (0.056)	6.5	ND (0.052)	ND (0.054)	ND (0.057)	ND (0.052)	0.063 J	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)	ND (0.057)	ND (0.055)	ND (0.056)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.055)	0.140 J	0.760	0.062 J	0.100 J	2.3	0.095 J	0.160 J	ND (0.057)	ND (0.052)	1.1	ND (0.049)	ND (0.050)	0.160 J	ND (0.056)	ND (0.057)	ND (0.054)	ND (0.057)	ND (0.055)	0.063 J
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.055)	ND (0.059)	0.120 J	0.100 J	ND (0.056)	0.280	ND (0.052)	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.052)	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)	ND (0.057)	ND (0.055)	ND (0.056)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.056)	ND (0.057)	ND (0.054)	ND (0.057)	ND (0.055)	ND (0.056)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.039)	0.120 J	0.160 J	0.240	0.220	2.0	0.086 J	1.5	0.190 J	ND (0.039)	2.0	ND (0.038)	ND (0.036)	1.6	ND (0.036)	0.061 J	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.039)	0.100 J	0.380	0.370	0.580	3.4	0.170 J	3.9	1.3	ND (0.039)	3.5	ND (0.038)	ND (0.036)	3.8	ND (0.036)	0.170 J	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.039)	0.038 J	0.320	0.200	0.490	2.6	0.160 J	3.3	1.4	ND (0.039)	2.4	ND (0.038)	ND (0.036)	2.9	ND (0.036)	0.180 J	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.039)	0.061 J	0.430	0.300	0.650	3.1	0.260	4.4	1.8	ND (0.039)	3.2	ND (0.038)	ND (0.036)	3.6	0.046 J	0.160 J	ND (0.038)	ND (0.039)	0.043 J	ND (0.039)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.039)	ND (0.036)	0.210	0.120 J	0.340	1.4	0.200	1.8	0.630	ND (0.039)	1.4	ND (0.038)	ND (0.036)	2.0	ND (0.036)	0.091 J	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.039)	0.290	0.510	0.850	0.550	4.0	0.280	3.6	1.1	ND (0.039)	3.4	ND (0.038)	ND (0.036)	3.7	0.079 J	0.130 J	ND (0.038)	ND (0.039)	0.048 J	ND (0.039)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.039)	0.730	0.380	0.550	0.140 J	4.2	0.090 J	0.570	0.110 J	ND (0.039)	1.7	ND (0.038)	ND (0.036)	1.1	ND (0.036)	ND (0.038)	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.039)	ND (0.036)	0.200	0.096 J	0.330	1.4	0.130 J	1.9	0.730	ND (0.039)	1.4	ND (0.038)	ND (0.036)	1.8	ND (0.036)	0.091 J	ND (0.038)	ND (0.039)	ND (0.038)	ND (0.039)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.039)	1.9	1.6	1.4	0.730	9.3	0.300	4.9	0.690	ND (0.039)	9.1	ND (0.038)	ND (0.036)	6.2	0.043 J	0.300	ND (0.038)	ND (0.039)	0.081 J	ND (0.039)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.039)	0.300	0.680	0.880	1.0	4.1	0.350	6.3	1.1	ND (0.039)	7.2	ND (0.038)	ND (0.036)	6.4	0.050 J	0.310	ND (0.038)	ND (0.039)	0.085 J	ND (0.039)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	268	185	177	35.1	154	15.8
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-848 LINE 1	PB-848 LINE 2	PB-848 LINE 3	PB-848 LINE 6	PB-848 LINE 7	PB-848 PERIMETER 1	PB-848 PERIMETER 2	PB-848 PERIMETER 3	PB-848 PERIMETER 6
Sample Date			24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06
Sample ID			848 Line 1	848 Line 2	848 Line 3	848 Line 6	848 Line 7	848 Perimeter 1	848 Perimeter 2	848 Perimeter 3	848 Perimeter 6
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	1003263	1003263	1003263	1003263	1003263	1003263	1003263	1003263	1003263
Laboratory Sample ID	Units		4851888	4851889	4851890	4851891	4851892	4851884	4851885	4851886	4851887
Volatile Organic Compounds											
BENZENE	mg/kg	0.5^{AB}	ND (0.025)	ND (0.028)	ND (0.027)	ND (0.028)	0.100 J	ND (0.028)	ND (0.027)	ND (0.027)	ND (0.028)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.050)	ND (0.055)	ND (0.054)	ND (0.055)	0.260 J	ND (0.055)	ND (0.053)	ND (0.053)	ND (0.057)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.050)	ND (0.055)	ND (0.054)	0.810	4.6	ND (0.055)	ND (0.053)	0.150 J	ND (0.057)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.050)	ND (0.055)	0.071 J	ND (0.055)	ND (0.055)	ND (0.055)	ND (0.053)	0.059 J	ND (0.057)
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.050)	ND (0.055)	ND (0.054)	ND (0.055)	ND (0.055)	ND (0.055)	ND (0.053)	ND (0.053)	ND (0.057)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.180)	ND (0.037)	ND (0.039)	0.110 J	0.350	ND (0.040)	ND (0.040)	0.060 J	ND (0.039)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.180)	0.075 J	ND (0.039)	0.071 J	0.160 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	0.230 J	0.058 J	ND (0.039)	ND (0.041)	0.140 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.180)	0.067 J	ND (0.039)	ND (0.041)	0.120 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.180)	0.059 J	ND (0.039)	ND (0.041)	0.067 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	0.360 J	0.083 J	ND (0.039)	0.160 J	0.530	ND (0.040)	ND (0.040)	0.150 J	ND (0.039)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.180)	ND (0.037)	ND (0.039)	0.510	1.3	ND (0.040)	ND (0.040)	0.590	ND (0.039)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.180)	0.044 J	ND (0.039)	ND (0.041)	0.059 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.180)	0.048 J	ND (0.039)	0.870	3.1	ND (0.040)	ND (0.040)	0.880	ND (0.039)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.180)	0.100 J	0.042 J	0.150 J	0.440	ND (0.040)	ND (0.040)	0.120 J	ND (0.039)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-
Metals											
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-

Sample Location	PB-848 SUB 1	PB-848 SUB 2	PB-848 SUB 3	PB-848-LINE-4	PB-848-LINE-5	PB-848-LINE-8	PB-848-LINE-9	PB-848-LINE-10	PB-848-LINE-11	PB-848-LINE-12	PB-848-LINE-13
Sample Date	24-Aug-06	24-Aug-06	24-Aug-06	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07
Sample ID	848 Sub 1	848 Sub 2	848 Sub 3	PB-848-LINE-4	PB-848-LINE-5	PB-848-LINE-8	PB-848-LINE-9	PB-848-LINE-10	PB-848-LINE-11	PB-848-LINE-12	PB-848-LINE-13
Sample Depth	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft
Sampling Company	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	LL	LL	LL	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order	1003263	1003263	1003263	074146	074146	074146	074146	074146	074146	074146	074146
Laboratory Sample ID	4851893	4851894	4851895	0706-0480	0706-0479	0706-0481	0706-0482	0706-0483	0706-0486	0706-0485	0706-0484
Volatile Organic Compounds											
BENZENE	ND (0.030)	ND (0.027)	**20^{B}**	ND (0.190) D	ND (0.300) D	ND (0.270) D	ND (0.180) D	ND (0.150) D	ND (0.160) D	ND (0.330) D	0.130 J D
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	ND (0.059)	ND (0.055)	46	ND (0.190) D	ND (0.300) D	1.7 D	0.200 D	0.690 D	0.084 J D	0.240 J D	0.160 J D
ISOPROPYLBENZENE (CUMENE)	ND (0.059)	ND (0.055)	8.9	8.5 D	0.940 D	8.6 D	0.900 D	2.5 D	ND (0.160) D	0.410 D	ND (0.210) D
METHYL TERTIARY BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-
HEXANE	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	ND (0.059)	ND (0.055)	4.9	ND (0.190) D	ND (0.300) D	0.330 D	0.900 D	0.280 D	0.300 D	1.9 D	ND (0.210) D
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	ND (0.059)	ND (0.055)	1.5	ND (0.190) D	ND (0.300) D	ND (0.270) D	0.140 J D	ND (0.150) D	0.100 J D	ND (0.330) D	ND (0.210) D
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	ND (0.040)	ND (0.041)	0.210	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
BENZO(A)ANTHRACENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
BENZO(A)PYRENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
BENZO(B)FLUORANTHENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
BENZO(G,H,I)PERYLENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	ND (0.040)	ND (0.041)	2.2	0.750	ND (0.430)	0.830	0.480	0.660	0.380 J	ND (0.420)	ND (0.390)
INDENO(1,2,3-C,D)PYRENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	ND (0.040)	ND (0.041)	1.9	1.7	ND (0.430)	1.5	0.790	1.5	ND (0.400)	ND (0.420)	ND (0.390)
PHENOL	-	-	-	-	-	-	-	-	-	-	-
PYRENE	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)	ND (0.420)	ND (0.390)
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-
Metals											
COBALT	-	-	-	-	-	-	-	-	-	-	-
LEAD	-	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-848-PER-4	PB-848-PER-5	PB-849-LINE-1	PB-849-LINE-2	PB-849-LINE-3	PB-849-LINE-4	PB-849-PER1	PB-849-PER2	PB-849-PER3	PB-849-PER4	PB-849-PER5	PB-849-SUB1	PB-880-1	PB-880-2	PB-880-3	PB-880-4	PB-880-5	PB-880-6	PB-880-7	PB-880-8
Sample Date			30-May-07	30-May-07	4-Sep-07	4-Sep-07	4-Sep-07	4-Sep-07	25-May-07	25-May-07	25-May-07	25-May-07	25-May-07	25-May-07	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04
Sample ID			PB-848-PER-4	PB-848-PER-5	PB-849-LINE-1	PB-849-LINE-2	PB-849-LINE-3	PB-849-LINE-4	PB-849-PER1	PB-849-PER2	PB-849-PER3	PB-849-PER4	PB-849-PER5	PB-849-SUB1	880-1	880-2	880-3	880-4	880-5	880-6	880-7	880-8
Sample Depth			3 - 3.5 ft	3 - 3.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	074146	074146	076851	076851	076851	076851	074095	074095	074095	074095	074095	074095	891702	891702	891702	891702	891702	891702	891702	891702
Laboratory Sample ID	Units		0706-0487	0706-0488	0709-0937	0709-0938	0709-0939	0709-0940	0705-4528	0705-4529	0705-4530	0705-4531	0705-4532	0705-4533	4252250	4252251	4252252	4252253	4252254	4252255	4252256	4252257
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	***0.930^{B} D***	ND (0.180) D	ND (0.0056)	ND (0.0061)	0.0046 J	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D	ND (0.160) D	ND (0.150) D	ND (0.310) D	0.420	ND (0.012)	ND (0.013)	0.140	0.220	ND (0.012)	0.018 J	***0.58^{A}***
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	0.270 D	ND (0.180) D	ND (0.0056)	ND (0.0061)	ND (0.0061)	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D	ND (0.160) D	ND (0.150) D	ND (0.310) D	1.0	ND (0.023)	ND (0.027)	0.660	1.3	ND (0.025)	ND (0.024)	1.2
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	0.630 D	ND (0.180) D	ND (0.0056)	ND (0.0061)	ND (0.0061)	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D	ND (0.160) D	ND (0.150) D	ND (0.310) D	0.350	ND (0.023)	ND (0.027)	0.270	0.490	ND (0.025)	ND (0.024)	0.390
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.180) D	ND (0.180) D	0.0039 J	0.0020 J	0.0036 J	0.0020 J	ND (0.180) D	ND (0.160) D	ND (0.290) D	ND (0.160) D	ND (0.150) D	ND (0.310) D	2.0	ND (0.023)	ND (0.027)	1.1	2.1	ND (0.025)	0.038 J	1.4
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.180) D	ND (0.180) D	ND (0.0056)	ND (0.0061)	0.0047 J	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D	ND (0.160) D	ND (0.150) D	ND (0.310) D	2.7	ND (0.023)	ND (0.027)	1.3	2.4	0.034 J	0.030 J	3.2
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.220 J	ND (0.040)	ND (0.390)	0.740 J
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.160 J	ND (0.040)	ND (0.390)	0.520 J
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.170 J	ND (0.040)	ND (0.390)	0.590 J
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.200 J	ND (0.040)	ND (0.390)	0.680 J
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.100 J	ND (0.040)	ND (0.390)	ND (0.440)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.200 J	ND (0.040)	ND (0.390)	1.0 J
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	10 D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	0.460 J	ND (0.039)	ND (0.410)	0.340 J	0.570	ND (0.040)	ND (0.390)	1.9 J
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.100 J	ND (0.040)	ND (0.390)	ND (0.440)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	13 D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	0.860 J	ND (0.039)	ND (0.410)	0.590 J	1.2	ND (0.040)	ND (0.390)	4.1 J
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)	ND (0.370)	ND (0.400)	ND (0.420)	0.200 J	ND (0.039)	ND (0.410)	ND (0.200)	0.360 J	ND (0.040)	ND (0.390)	1.3 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-880-9	PB-880-10	PB-880-11	PB-880-12	PB-880-13	PB-880-14	PB-880-SURFACE	PB-881-1_2004	PB-881-2_2004	PB-881-3_2004	PB-881-4_2004	PB-881-5_2004	PB-881-6_2004	PB-881-7_2004	PB-884-SS-1	PB-884-SS-2	PB-885-CS-1	PB-885-CS-2	PB-885-CS-3	PB-885-CS-4
Sample Date			24-Apr-04	24-Apr-04	24-Apr-04	24-Apr-04	24-Apr-04	7-Sep-04	8-Apr-04	22-Jul-04	22-Jul-04	22-Jul-04	22-Jul-04	22-Jul-04	22-Jul-04	22-Jul-04	30-Nov-06	30-Nov-06	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07
Sample ID			880-9	880-10	880-11	880-12	880-13	880-14	880-Surface	881-1	881-2	881-3	881-4	881-5	881-6	881-7	AST-884-SS-1	AST-884-SS-2	AST-885-CS-1	AST-885-CS-2	AST-885-CS-3	AST-885-CS-4
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	9999 - 9999 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	PIP	PIP	PIP	PIP
Laboratory Work Order		SHS-PA	893279	893279	893279	893279	893279	911206	891702	904975	904975	904975	904975	904975	904975	904975	1016430	1016430	072076	072076	072076	072076
Laboratory Sample ID	Units		4259682	4259683	4259684	4259685	4259686	4347780	4252259	4316677	4316678	4316679	4316680	4316681	4316682	4316683	4929240	4929241	0703-3400	0703-3399	0703-3397	0703-3396
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	***3.1***^{A}	0.330	***1.1***^{A}	0.034 J	***8***^{A}	0.014	***36***^{A}	ND (0.0012)	0.011	ND (0.020)	ND (0.0011)	ND (0.180)	ND (0.320)	ND (0.200)	ND (0.031)	0.055 J	ND (0.096) D	***0.550***^{A} ***D***	0.065 J D	0.190 D
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	13	0.720	6.3	0.150 J	3.3	ND (0.024)	41	ND (0.0012)	0.023	0.300	ND (0.0011)	ND (0.180)	ND (0.320)	ND (0.500)	0.740	ND (0.059)	0.110 D	1.6 D	0.440 D	1.7 D
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	4.6	0.300	2.7	0.069 J	1.6	0.031	13	ND (0.0031)	0.084	0.850	ND (0.0028)	5.8	ND (0.810)	2.9	0.490	ND (0.059)	0.054 J D	0.440 D	0.480 D	1.1 D
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	22	1.3	13	0.410	10	0.220	***52***^{A}	ND (0.0061)	ND (1.2)	3.4	0.013	***31***^{A}	20	18	2.7	ND (0.059)	0.520 D	1.4 D	4.1 D	4.6 D
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	29	1.7	12	0.260 J	24	0.037	***140***^{A}	0.0024 J	0.032	0.250	0.0027 J	1.7	ND (0.320)	0.330 J	0.120 J	ND (0.059)	ND (0.096) D	1.1 D	0.610 D	3.4 D
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.4	ND (0.059)	2.1 D	7.9 D	18 D	21 D
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.021 J	3.6 J	0.019	0.057	0.170 J	ND (0.035)	0.890	0.360 J	0.240 J	0.045 J	ND (0.040)	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.063	ND (0.360)	0.077	0.018 J	ND (0.073)	0.078 J	ND (0.140)	ND (0.140)	ND (0.069)	0.073 J	0.140 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.099	ND (0.360)	0.091	0.021 J	ND (0.110)	ND (0.120)	ND (0.220)	ND (0.210)	ND (0.100)	0.081 J	0.140 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.085	0.880 J	0.067	0.019 J	ND (0.150)	ND (0.150)	ND (0.290)	ND (0.290)	ND (0.140)	0.088 J	0.150 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.100	ND (0.360)	0.120	ND (0.016)	ND (0.150)	ND (0.150)	ND (0.290)	ND (0.290)	ND (0.140)	0.058 J	0.096 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.085	2.1 J	0.075	0.065 J	ND (0.740)	ND (0.120)	ND (0.220)	ND (0.210)	ND (0.100)	0.100 J	0.150 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (2.0)	1.4 J	2.8 J	ND (2.0)	ND (2.0)	0.026 J	12	0.0057 J	0.069 J	0.240 J	ND (0.230)	1.8 J	ND (0.430)	0.490 J	0.390	ND (0.040)	ND (0.390)	0.490	3.3	ND (0.380)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (0.020)	ND (0.360)	0.043	ND (0.020)	ND (0.180)	ND (0.190)	ND (0.360)	ND (0.360)	ND (0.170)	0.047 J	0.100 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	4.1 J	3.3 J	5.9 J	ND (2.0)	2.0 J	0.160	28	0.096	0.250	0.610 J	ND (0.120)	4.2	0.660 J	1.1	0.660	0.170 J	0.600	0.610	3.9	ND (0.380)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.190	3.1 J	0.210	0.120 J	0.390 J	ND (0.270)	1.6 J	0.920 J	0.540 J	0.110 J	0.240	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-885-CS-5	PB-885-CS-6	PB-885-CS-7	PB-885-CS-8	PB-885-CS-9	PB-885-CS-10	PB-885-CS-11	PB-885-CS-12	PB-885-CS-13	PB-885-CS-14	PB-885-CS-15	PB-885-SS-1	PB-885-SS-2	PB-885-SS-3	PB-885-SS-4	PB-885-SS-5	PB-885-SS-6	PB-885-SS-7	PB-885-SS-8	PB-885-SS-9
Sample Date			14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06
Sample ID			AST-885-CS-5	AST-885-CS-6	AST-885-CS-7	AST-885-CS-8	AST-885-CS-9	AST-885-CS-10	AST-885-CS-11	AST-885-CS-12	AST-885-CS-13	AST-885-CS-14	AST-885-CS-15	AST-885-SS-1	AST-885-SS-2	AST-885-SS-3	AST-885-SS-4	AST-885-SS-5	AST-885-SS-6	AST-885-SS-7	AST-885-SS-8	AST-885-SS-9
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order		SHS-PA	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	1016432	1016432	1016432	1016432	1016432	1016432	1016432	1016432	1016432
Laboratory Sample ID	Units		0703-3395	0703-3394	0703-3393	0703-3392	0703-3391	0703-3390	0703-3389	0703-3388	0703-3398	0703-3402	0703-3403	4929243	4929244	4929245	4929246	4929247	4929248	4929249	4929250	4929251
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	0.110 D	ND (0.092) D	ND (0.100) D	ND (0.110) D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D	ND (0.028)	0.100 J	ND (0.033)	0.068 J	0.350	**2.6** ^{A}	0.160 J	ND (0.035)	ND (0.029)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	70^{AB}	1.8 D	ND (0.092) D	0.510 D	0.340 D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D	ND (0.057)	2.1	ND (0.065)	ND (0.052)	3.4	13	2.4	ND (0.069)	ND (0.059)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	1.1 D	ND (0.092) D	0.350 D	0.250 D	0.110 J D	0.099 D	0.089 J D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D	ND (0.057)	1.2	ND (0.065)	ND (0.052)	1.7	5.4	2.9	ND (0.069)	0.110 J
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	4.3 D	0.190 D	1.2 D	0.740 D	0.210 D	0.100 D	ND (0.095) D	0.160 D	0.480 D	ND (0.089) D	ND (0.096) D	ND (0.057)	4.8	ND (0.065)	0.110 J	5.6	15	11	ND (0.069)	0.550
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	3.3 D	ND (0.092) D	0.230 D	0.100 J D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	0.050 J D	ND (0.089) D	ND (0.096) D	ND (0.057)	1.6	ND (0.065)	0.100 J	3.3	26	3.4	ND (0.069)	ND (0.059)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	22 D	0.810 D	7.3 D	3.1 D	1.0 D	0.150 D	ND (0.095) D	ND (0.094) D	1.9 D	ND (0.089) D	ND (0.096) D	ND (0.057)	21	ND (0.065)	4.4	27	97	66	ND (0.069)	1.8
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.450	ND (0.180)	ND (0.200)	ND (0.038)	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.200 J
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.760	ND (0.180)	ND (0.200)	0.076 J	ND (0.180)	ND (0.200)	ND (0.200)	0.220 J	ND (0.200)	0.490 J
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.460	ND (0.180)	ND (0.200)	0.069 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.220 J	0.360 J
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.680	ND (0.180)	ND (0.200)	0.075 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.240 J	0.460 J
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)	ND (0.180)	ND (0.200)	0.046 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.260 J
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.560	ND (0.180)	ND (0.200)	0.077 J	ND (0.180)	ND (0.200)	ND (0.200)	0.220 J	ND (0.200)	0.550 J
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)	ND (0.180)	ND (0.200)	ND (0.038)	ND (0.180)	ND (0.200)	1.2	1.2	ND (0.200)	0.470 J
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)	ND (0.180)	ND (0.200)	0.046 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.300 J
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	2.5	0.720	ND (0.410)	1.9	1.2	ND (0.400)	ND (0.410)	0.500	1.2	ND (0.430)	1.6	ND (0.180)	0.880 J	0.120 J	0.500 J	1.5	2.0	2.3	ND (0.200)	1.4
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	1.1	0.180 J	ND (0.200)	0.092 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.240 J	0.820 J
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**PB-885-SS-10**	**PB-881-1_2005**	**PB-881-2_2005**	**PB-881-3_2005**	**PB-881-4_2005**	**PB-881-5_2005**	**PB-881-6_2005**	**S-39D**		**S-119D**	**S-216**	**S-217**	**S-218D**		**S-219**	**S-220**	**S-221**	**S-222**	**S-223**	**S-224**
Sample Date			**30-Nov-06**	**26-Oct-05**	**26-Oct-05**	**26-Oct-05**	**26-Oct-05**	**26-Oct-05**	**26-Oct-05**	**21-Jan-16**	**8-Feb-16**	**1-Apr-05**	**25-Mar-05**	**1-Apr-05**	**14-Jan-16**	**5-Feb-16**	**25-Mar-05**	**1-Apr-05**	**25-Mar-05**	**4-Aug-05**	**4-Aug-05**	**4-Aug-05**
Sample ID			**AST-885-SS-10**	**881-1**	**881-2**	**881-3**	**881-4**	**881-5**	**881-6**	**AOI4-S-39D-1.5-2-20160121**	**AOI4-S39D-7.5-8.0-20160208**	**BHS119D-040105-1-1.5**	**BH-S216-032505-1-1.5**	**BH-S217-040105-1-1.5**	**AOI4-S218D-6-6.5-20160114**	**AOI4-S218D-0.5-1.0-20160205**	**BH-S219-032505-1-1.5**	**BH-S220-040105-1-1.5**	**BH-S221-032505-1.5-2**	**BH-S222-080405-1-1.5**	**BH-S223-080405-1.5-2**	**BH-S224-080405-1-1.5**
Sample Depth			**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**0 - 0.5 ft**	**1.5 - 2 ft**	**7.5 - 8 ft**	**1 - 1.5 ft**	**1 - 1.5 ft**	**1 - 1.5 ft**	**6 - 6.5 ft**	**0.5 - 1 ft**	**1 - 1.5 ft**	**1 - 1.5 ft**	**1.5 - 2 ft**	**1 - 1.5 ft**	**1.5 - 2 ft**	**1 - 1.5 ft**
Sampling Company			**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**SECOR**	**STANTEC**	**STANTEC**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**STANTEC**	**STANTEC**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**LANGAN**	**LANGAN**	**LANGAN**
Laboratory			**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**	**ACCUTEST**	**ACCUTEST**	**LL**	**LL**	**LL**	**ACCUTEST**	**ACCUTEST**	**LL**	**LL**	**LL**	**LL**	**LL**	**LL**
Laboratory Work Order		**SHS-PA**	**1016432**	**965084**	**965084**	**965084**	**965084**	**965084**	**965084**	**JC13070**	**JC14123**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**JC12759**	**JC14123**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**954311**	**954311**	**954311**
Laboratory Sample ID	**Units**		**4929252**	**4634610**	**4634611**	**4634612**	**4634613**	**4634614**	**4634615**	**JC13070-1**	**JC14123-2**	**4495328**	**4491372**	**4495326**	**JC12759-2**	**JC14123-1**	**4491369**	**4495327**	**4491370**	**4578229**	**4578230**	**4578231**
Volatile Organic Compounds																						
BENZENE	mg/kg	0.5^{AB}	0.110 J	ND (0.023)	ND (0.028)	ND (0.025)	ND (0.027)	ND (0.027)	ND (0.024)	ND (0.00065)	ND (0.00068)	ND (0.005)	ND (0.005)	ND (0.005)	0.0114	ND (0.00055)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	ND (0.0013)	-	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0011)	-	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.001)	ND (0.005)
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	-	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0011)	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
ETHYLBENZENE	mg/kg	70^{AB}	2.2	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)	ND (0.005)	0.207	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	1.2	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0026)	ND (0.0027)	ND (0.005)	ND (0.005)	ND (0.005)	0.0880	ND (0.0022)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	-	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.0011)	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	6.5	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0065)	ND (0.0068)	-	-	-	0.195 J	ND (0.0055)	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	0.850	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)	ND (0.005)	0.0234	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	-	-	-	-	-	-	ND (0.0026)	ND (0.0027)	-	-	-	1.17	ND (0.0022)	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	-	-	-	-	-	-	ND (0.0026)	ND (0.0027)	-	-	-	0.434	ND (0.0022)	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	17	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)	ND (0.005)	0.418	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.210)	ND (0.037)	ND (0.039)	ND (0.039)	ND (0.041)	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.0207 J	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.210)	0.200	0.046 J	ND (0.039)	0.058 J	ND (0.041)	0.044 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.0748	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.490
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.210)	ND (0.037)	0.060 J	ND (0.039)	0.049 J	0.050 J	0.058 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.0952	ND (0.400)	ND (0.410)	0.460	ND (0.190)	ND (0.230)	0.550
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.210)	ND (0.037)	0.042 J	ND (0.039)	0.047 J	0.061 J	0.057 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.106	ND (0.400)	ND (0.410)	0.560	ND (0.190)	ND (0.230)	0.700
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.210)	ND (0.037)	0.065 J	0.057 J	ND (0.041)	0.053 J	0.078 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.0794	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.430
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.210)	0.150 J	0.140 J	ND (0.039)	0.087 J	0.051 J	0.064 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	ND (0.038)	0.0966	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.490
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	1.2	0.069 J	ND (0.039)	ND (0.039)	ND (0.041)	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	0.231	ND (0.039)	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	ND (0.210)	ND (0.037)	ND (0.039)	0.052 J	ND (0.041)	ND (0.041)	0.042 J	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	2.44	0.0317 J	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	2.0	0.130 J	0.058 J	ND (0.039)	0.059 J	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	0.371	0.110	ND (0.400)	0.460	0.390	ND (0.190)	ND (0.230)	0.300
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.210)	0.110 J	0.100 J	0.054 J	0.098 J	0.081 J	0.082 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)	ND (0.400)	0.0220 J	0.127	ND (0.400)	ND (0.410)	0.530	ND (0.190)	ND (0.230)	0.900
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	-	-	-	-	-	-	-	49.5	5.2	24.9	60.8	10.2	13.3	**500^{A}**	8.99	7.58	102	143	18.2	192
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			S-229	S-282	S-364			S-365			S-366			S-367			S-368		
Sample Date			25-Mar-05	27-Apr-10	4-Mar-13	4-Mar-13	19-Mar-13	4-Mar-13	4-Mar-13	18-Mar-13	5-Mar-13	5-Mar-13	15-Mar-13	5-Mar-13	13-Mar-13	13-Mar-13	5-Mar-13	5-Mar-13	14-Mar-13
Sample ID			BH-S229-032505-1.5-2	S-282_1-2	AOI4_S-364_.5-1_30413	AOI4_S-364_4-5_30413	S-364 @ 19'_031913	S-365_0-2'	S-365_4-6'	S-365 @ 12'-14'_031813	AOI4_S-366_0-1_30513	AOI4_S-366_4.5-5.5_30513	S-366@14-16_031513	S-367_0-2'	S-367_031313@6'	S-367@14'_031313	AOI4_S-368_0-1_30513	AOI4_S-368_6-7_30513	S-368@14'_031413
Sample Depth			1.5 - 2 ft	1 - 2 ft	0.5 - 1 ft	4 - 5 ft	18.5 - 19 ft	0 - 2 ft	4 - 6 ft	12 - 14 ft	0 - 1 ft	4.5 - 5.5 ft	14 - 16 ft	0 - 2 ft	5.5 - 6 ft	13.5 - 14 ft	0 - 1 ft	6 - 7 ft	13.5 - 14 ft
Sampling Company			UNKNOWN	UNKNOWN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			LL	LL	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order		SHS-PA	UNKNOWN	1192441	JB30309	JB30309	JB31794	JB30306	JB30306	JB31733	JB30425	JB30425	JB31583	JB30425	JB31583	JB31583	JB30425	JB30425	JB31583
Laboratory Sample ID	Units		4491371	5966981	JB30309-1	JB30309-2	JB31794-5	JB30306-4	JB30306-5	JB31733-15	JB30425-4	JB30425-5	JB31583-12	JB30425-1	JB31583-13	JB31583-14	JB30425-6	JB30425-7	JB31583-15
Volatile Organic Compounds																			
BENZENE	mg/kg	0.5^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	0.189 J	0.241	ND (0.00055)	0.0269	0.00040 J	ND (0.00090)	ND (0.0011)	0.00041 J	ND (0.00055)	ND (0.095)	0.00054 J	ND (0.0010)	ND (0.11)	ND (0.0011)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	*ND (0.026)*	*ND (0.10)*	ND (0.00055)	ND (0.00057)	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	ND (0.00055)	*ND (0.012)*	ND (0.0012)	ND (0.0010)	*ND (0.013)*	ND (0.0011)
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	ND (0.00057)	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	ND (0.00055)	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	1.43	0.140	ND (0.00055)	0.0085	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	0.00081	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	0.0059
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.005)	ND (0.004)	ND (0.0037)	0.755 J	2.36	ND (0.0028)	0.0063	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)	0.0135	0.431 J	0.0170	ND (0.0052)	ND (0.53)	0.0026 J
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	0.014	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	0.00024 J	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	ND (0.00055)	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	0.0025	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	0.00067	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	-	ND (0.004)	ND (0.0037)	4.30	ND (0.50)	ND (0.0028)	0.0025 J	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)	0.00059 J	ND (0.47)	ND (0.0058)	ND (0.0052)	ND (0.53)	0.0767
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	-	ND (0.004)	ND (0.0037)	1.88	ND (0.50)	ND (0.0028)	0.0027 J	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)	0.00027 J	ND (0.47)	ND (0.0058)	ND (0.0052)	ND (0.53)	0.0316
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	ND (0.005)	ND (0.004)	ND (0.00074)	2.25	0.222	ND (0.00055)	0.0098	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)	0.0050	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	0.0075
Volatile Organic Compounds (SW8011)																			
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																			
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	ND (0.033)	0.356	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)	0.209	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0200 J	0.841	ND (0.034)	0.0154 J	ND (0.040)	ND (0.10)	0.468	ND (0.11)	ND (0.10)	0.0324 J	ND (0.073)	ND (0.12)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0242 J	0.825	ND (0.034)	0.0169 J	ND (0.040)	ND (0.10)	0.402	ND (0.11)	ND (0.10)	0.0368	ND (0.073)	ND (0.12)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0350	0.802	ND (0.034)	0.0177 J	ND (0.040)	ND (0.10)	0.409	ND (0.11)	ND (0.10)	0.0379	ND (0.073)	ND (0.12)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0292 J	0.545	ND (0.034)	0.0212 J	ND (0.040)	ND (0.10)	0.346	ND (0.11)	ND (0.10)	0.0288 J	ND (0.073)	ND (0.12)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0279 J	0.983	ND (0.034)	0.0139 J	ND (0.040)	ND (0.10)	0.729	ND (0.11)	ND (0.10)	0.0358 J	ND (0.073)	ND (0.12)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	0.0934	ND (0.033)	0.386	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)	0.394	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	ND (0.033)	0.314	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)	ND (0.036)	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.370)	ND (0.200)	ND (0.035)	0.0402 J	0.172	ND (0.033)	2.18	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)	0.839	ND (0.11)	ND (0.10)	0.0205 J	ND (0.073)	ND (0.12)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	ND (0.370)	ND (0.200)	0.0237 J	0.0243 J	0.0583	0.0295 J	1.97	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)	1.04	ND (0.11)	ND (0.10)	0.0401	ND (0.073)	ND (0.12)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																			
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	16.7	87.3	13.0	15.2	18.5	79.1	222	4.2	14.2	10.9	4.3	258	6.3	2.6	44.3	64.0	5.5
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			S-369					S-370			S-371				S-373	S-379		
Sample Date			4-Mar-13	4-Mar-13	4-Mar-13	2-Apr-13	2-Apr-13	1-Mar-13	1-Mar-13	22-Apr-13	4-Mar-13	4-Mar-13	4-Mar-13	1-Apr-13	19-Mar-13	28-Feb-13	28-Feb-13	28-Feb-13
Sample ID			S-369_0-2'	S-369_6-8'	S-369_8-10'	S-369@11'_04022013	S-369@32'_04022013	S-370-0-2	S-370-8-10	S-370 @ 14'_04222013	AOI4_S-371_1-1.5_30413	AOI4_S-371_2-3_30413	AOI4_S-371_7.5-8.5_30413	S-371_18-20_40113	AOI4-S-373_4-6'	S-379_0-2'	S-379_4-5'	S-379_8-9'
Sample Depth			0 - 2 ft	6 - 8 ft	8 - 10 ft	10.5 - 11 ft	31.5 - 32 ft	0 - 2 ft	8 - 10 ft	13.5 - 14 ft	1 - 1.5 ft	2 - 3 ft	7.5 - 8.5 ft	18 - 20 ft	4 - 6 ft	0 - 2 ft	4 - 5 ft	8 - 9 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	UNKNOWN	LANGAN	LANGAN	LANGAN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order		SHS-PA	JB30306	JB30306	JB30306	JB33050	JB33050	JB30169	JB30169	JB35091	JB30309	JB30309	JB30309	JB32976	JB31794	JB30168	JB30168	JB30168
Laboratory Sample ID	Units		JB30306-1	JB30306-2	JB30306-3	JB33050-1	JB33050-2	JB30169-9	JB30169-10	JB35091-1	JB30309-3	JB30309-4	JB30309-5	JB32976-1	JB31794-4	JB30168-1	JB30168-2	JB30168-3
Volatile Organic Compounds																		
BENZENE	mg/kg	0.5^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	**4.4^{B}**	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	**1.25^{B}**	ND (0.00088)	0.00024 J	ND (0.00045)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	*ND (0.013)*	ND (0.0011)	*ND (0.0073)*	-	ND (0.0010)	ND (0.00091)	ND (0.0011)	*ND (0.014)*	*ND (0.11)*	ND (0.00088)	ND (0.00089)	ND (0.00045)
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	ND (0.10)	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	ND (0.11)	ND (0.00088)	ND (0.00089)	ND (0.00045)
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	1.25	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	2.12	ND (0.00088)	ND (0.00089)	ND (0.00045)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	3.29	ND (0.0056)	0.950	0.558	ND (0.0050)	ND (0.0046)	ND (0.0055)	0.393 J	0.718	ND (0.0044)	ND (0.0044)	ND (0.0022)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	ND (0.10)	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	ND (0.11)	ND (0.00088)	ND (0.00089)	ND (0.00045)
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	100^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	0.165	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	0.339	ND (0.00088)	ND (0.00089)	ND (0.00045)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	0.445 J	ND (0.0056)	0.0314 J	0.0887 J	ND (0.0050)	ND (0.0046)	ND (0.0055)	ND (0.57)	2.56	ND (0.0044)	ND (0.0044)	ND (0.0022)
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	0.800	ND (0.0056)	ND (0.29)	ND (0.53)	ND (0.0050)	ND (0.0046)	ND (0.0055)	ND (0.57)	2.88	ND (0.0044)	ND (0.0044)	ND (0.0022)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	0.617	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	3.76	ND (0.00088)	ND (0.00089)	ND (0.00045)
Volatile Organic Compounds (SW8011)																		
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	-	-	-	ND (0.0029)	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																		
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	350^{AB}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.0934	ND (0.041)	ND (0.036)	0.145	ND (0.037)	ND (0.039)	ND (0.039)	0.0676	ND (0.039)	ND (0.035)	0.0977	ND (0.041)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	0.0178 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0356	ND (0.041)	ND (0.036)	ND (0.12)	0.0313 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.035)	0.223	ND (0.041)
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0353 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.035)	0.194	ND (0.041)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0326 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.035)	0.225	ND (0.041)
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0655	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.035)	0.120	ND (0.041)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	230^{AB}	0.0182 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0477	ND (0.041)	ND (0.036)	ND (0.12)	0.0390	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.035)	0.229	ND (0.041)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	3800^{AB}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.402	ND (0.041)	1.23	0.548	ND (0.037)	ND (0.039)	ND (0.039)	0.831	0.221	ND (0.035)	0.0430	ND (0.041)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	25^{AB}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	2.04	ND (0.041)	ND (0.036)	0.295	ND (0.037)	ND (0.039)	ND (0.039)	ND (0.039)	0.362	ND (0.035)	0.0194 J	ND (0.041)
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.720	ND (0.041)	2.21	1.20	0.0298 J	ND (0.039)	ND (0.039)	0.901	0.590	ND (0.035)	0.296	ND (0.041)
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	2200^{AB}	0.0260 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0898	ND (0.041)	0.201	0.107 J	0.0404	ND (0.039)	ND (0.039)	0.0273 J	ND (0.039)	ND (0.035)	0.351	ND (0.041)
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																		
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	450^{AB}	10.5	9.5	22.2	10.7	4.4	9.9	9.9	14.7	102	103	8.4	2.6	8.5	1.5 J	206	10
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**S-380**		**S-381**				**S-408**		**S-415**		**S-416**	
Sample Date			1-Mar-13	1-Mar-13	15-Mar-13	15-Mar-13	24-Apr-13	24-Apr-13	9-Oct-15	23-Oct-15	12-Oct-15	12-Oct-15	20-Jun-16	11-Jul-16
Sample ID			S-380_0-2'	S-380_8-10	AOI4-S-381_0-.5_31513	AOI4-S-381_2-3_31513	S-381 @ 12'_04242013	S-381 @ 24'_04252013	AOI4_S-408_0-2_100915	AOI4_S-408_14-16_102315	AOI4_S-415_0-2_101215	AOI4_S-415_16-18_101215	AOI4-S-416-0-2-20160620	AOI4-S-416-14-15-20160711
Sample Depth			0 - 2 ft	8 - 10 ft	0 - 0.5 ft	2 - 3 ft	11.5 - 12 ft	23.5 - 24 ft	0 - 2 ft	14 - 16 ft	0 - 2 ft	16 - 18 ft	0 - 2 ft	14 - 15 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ESC	ESC
Laboratory Work Order		**SHS-PA**	JB30169	JB30169	JB31583	JB31583	JB35319	JB35319	JC5896	JC7021	JC6121	JC6121	L842835	L846805
Laboratory Sample ID	**Units**		JB30169-11	JB30169-12	JB31583-6	JB31583-7	JB35319-1	JB35319-2	JC5896-2	JC7021-1	JC6121-1	JC6121-2	L842835-03	L846805-03
Volatile Organic Compounds														
BENZENE	mg/kg	0.5^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	0.242 J	0.0403	***1.11*** ^{B}	0.00051	0.0016	0.0013	ND (0.25)	0.00315	ND (0.00112)
CYCLOHEXANE	mg/kg	6900^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	0.00791
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	*ND (0.075)*	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
1,2-DICHLOROETHANE (EDC)	mg/kg	0.5^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	ND (0.080)	ND (0.00089)	ND (0.50)	ND (0.00099)	ND (0.00091)	ND (0.0010)	ND (0.068)	ND (0.00118)	ND (0.00112)
ETHYLBENZENE	mg/kg	70^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	5.54	0.0021	0.439 J	0.00037 J	0.00032 J	ND (0.0010)	ND (0.51)	ND (0.00118)	ND (0.00112)
ISOPROPYLBENZENE (CUMENE)	mg/kg	2500^{AB}	ND (0.0045)	ND (0.0030)	ND (0.0051)	1.97 J	0.0033 J	11.7	0.00022 J	ND (0.0018)	ND (0.0021)	5.65	ND (0.0118)	ND (0.0112)
METHYL TERTIARY BUTYL ETHER	mg/kg	2^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	ND (0.59)	ND (0.00089)	ND (0.50)	ND (0.00099)	ND (0.00091)	ND (0.0010)	ND (0.51)	ND (0.00118)	ND (0.00112)
HEXANE	mg/kg	5600^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.0118)	ND (0.0112)
NAPHTHALENE	mg/kg	25^{AB}	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	2800^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
BUTYLBENZENE, TERT-	mg/kg	2200^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
TOLUENE	mg/kg	100^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	0.419 J	0.0076	0.200 J	0.00045 J	0.00067 J	0.00035 J	ND (0.51)	ND (0.00591)	ND (0.00562)
1,2,4-TRIMETHYLBENZENE	mg/kg	35^{AB}	ND (0.0045)	ND (0.0030)	ND (0.0051)	29.9	0.0032 J	0.518 J	0.0016 J	0.00036 J	ND (0.0021)	ND (1.0)	ND (0.00118)	ND (0.00112)
1,3,5-TRIMETHYLBENZENE	mg/kg	210^{AB}	ND (0.0045)	ND (0.0030)	ND (0.0051)	11.9	ND (0.0045)	0.543 J	0.00039 J	ND (0.0018)	ND (0.0021)	ND (1.0)	`	ND (0.00112)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	1000^{AB}	ND (0.00090)	ND (0.00060)	ND (0.0010)	17.7	0.0056	1.01	0.0026	0.0020	0.00070 J	ND (0.51)	ND (0.00355)	ND (0.00337)
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	mg/kg	0.005^{AB}	-	-	-	-	ND (0.0029)	ND (0.0029)	ND (0.0029)	ND (0.0029)	ND (0.0028)	ND (0.0026)	-	-
Semi-Volatile Organic Compounds														
ACENAPHTHENE	mg/kg	4700^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
ANTHRACENE	mg/kg	350^{AB}	ND (0.035)	ND (0.041)	0.0439 J	ND (0.12)	ND (0.11)	1.79	0.0486	ND (0.036)	0.0698	0.156	ND (0.0390)	0.0505
BENZO(A)ANTHRACENE	mg/kg	130^{A} 430^{B}	ND (0.035)	ND (0.041)	0.143	ND (0.12)	ND (0.11)	ND (0.12)	0.0951	ND (0.036)	0.249	0.0595	ND (0.0390)	0.137
BENZO(A)PYRENE	mg/kg	12^{A} 46^{B}	ND (0.035)	ND (0.041)	0.0854 J	ND (0.12)	ND (0.11)	ND (0.12)	0.0836	ND (0.036)	0.316	0.0379	ND (0.0390)	0.104
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 170^{B}	ND (0.035)	ND (0.041)	0.143	ND (0.12)	ND (0.11)	ND (0.12)	0.123	ND (0.036)	0.395	0.0258 J	0.0446	0.130
BENZO(G,H,I)PERYLENE	mg/kg	180^{AB}	ND (0.035)	ND (0.041)	0.0814 J	ND (0.12)	ND (0.11)	ND (0.12)	0.0966	ND (0.036)	0.228	0.0143 J	ND (0.0390)	0.0548
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 610^{B}	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	0.0489
1,1'-BIPHENYL	mg/kg	190^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	130^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
DI-N-BUTYL PHTHALATE	mg/kg	4900^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
CHRYSENE	mg/kg	230^{AB}	ND (0.035)	ND (0.041)	0.158	ND (0.12)	ND (0.11)	0.0624 J	0.138	ND (0.036)	0.245	0.0736	ND (0.0390)	0.118
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 270^{B}	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
DIETHYL PHTHALATE	mg/kg	9300^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
2,4-DIMETHYLPHENOL	mg/kg	230^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
2,4-DINITROPHENOL	mg/kg	23^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
FLUORANTHENE	mg/kg	3200^{AB}	-	-	-	-	-	-	-	-	-	-	0.0419	0.252 OE
FLUORENE	mg/kg	3800^{AB}	ND (0.035)	ND (0.041)	ND (0.12)	ND (0.12)	ND (0.11)	5.02	ND (0.038)	ND (0.036)	0.0196 J	0.536	ND (0.0390)	ND (0.0371)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 22000^{B}	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	0.0516
2-METHYLNAPHTHALENE	mg/kg	1900^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	58_{s2}^{A} 58_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
CRESOL, O- (2-METHYLPHENOL)	mg/kg	580^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
NAPHTHALENE	mg/kg	25^{AB}	ND (0.035)	ND (0.041)	ND (0.12)	1.18	ND (0.11)	5.48	0.0766	ND (0.036)	0.0651	ND (0.035)	ND (0.0390)	ND (0.0371)
4-NITROPHENOL	mg/kg	6^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
PHENANTHRENE	mg/kg	10000^{AB}	ND (0.035)	ND (0.041)	0.598	ND (0.12)	ND (0.11)	13.0	0.246	ND (0.036)	0.254	1.04	ND (0.0390)	0.164
PHENOL	mg/kg	200^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
PYRENE	mg/kg	2200^{AB}	ND (0.035)	ND (0.041)	0.381	ND (0.12)	ND (0.11)	1.11	0.234	ND (0.036)	0.329	0.143	ND (0.0390)	0.219
PYRIDINE	mg/kg	12^{AB}	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
QUINOLINE	mg/kg	0.37^{AB}	-	-	-	-	-	-	-	-	-	-	*ND (0.394)*	*ND (0.374) OE*
Metals														
COBALT	mg/kg	160^{AB}	-	-	-	-	-	-	-	-	-	-	6.02	5.04
LEAD	mg/kg	450^{AB}	24.3	8.1	***25800*** ^{A}	***2650*** ^{B}	8.5	5.6	***1560*** ^{A}	6.8	241	3.9	86.2	63.5
NICKEL	mg/kg	650^{AB}	-	-	-	-	-	-	-	-	-	-	20.9	11.3
VANADIUM	mg/kg	220^{A} 820^{B}	-	-	-	-	-	-	-	-	-	-	46.4	26.3
ZINC	mg/kg	12000^{AB}	-	-	-	-	-	-	-	-	-	-	175	60.7

See notes on last page

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Table 3-2
Soil Analytical Results Summary - Statewide Health Standards
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Notes:

SHS-PA	Pennsylvania Department of Environmental Protection - Statewide Health Standards
A	PADEP Non-Residential Statewide Health Standards (0-2 ft bgs) (Unsaturated Soil)
B	PADEP Non-Residential Statewide Health Standards (>2 ft bgs) (Unsaturated Soil)
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Indicates the laboratory method detection limit (if available) was above the applicable standard. The reporting limit is shown if the laboratory method detection limit is not available.
ND (0.03)	Indicates concentration not detected above the laboratory reporting limit (in parentheses) except when the reporting limit is greater than the standard in which case the method detection limit is listed in parentheses.
-	Parameter not analyzed / not available.
s2	Cresol, m&p (3-Methylphenol & 4-Methylphenol) co-elute and are reported as the summation of the co-eluting compounds. Standards shown are the stricter of the two.
B	Indicates the analyte is detected in the associated blank as well as in the sample.
D	Indicates an identified compound in an analysis that has been diluted. This flag alerts the data user to any differences between the concentrations reported in the two analyses.
I	Matrix Interference.
J	Indicates an estimated value.
OE	The associated batch QC was outside the established quality control range for precision/accuracy.
ft	Feet
bgs	Below ground surface
mg/kg	milligrams per kilogram
LL	Eurofins Lancaster Laboratories Environmental
PIP	Pace Analytical Services, Inc.
WGEL	The Washington Group Enviornmental Laboratory
ESC	Environmental Sciences Corporation

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			AOI4_BH-13-81	AOI4_BH-13-90	AOI4_BH-13-94		AOI4-BH-13-82	AOI4-BH-13-84	AOI4-BH-13-85	AOI4-BH-13-86		AOI4-BH-13-88			AOI4-BH-13-89	AOI4-BH-13-91		AOI4-BH-13-92	AOI4-BH-13-93	AOI4-BH-13-95	AOI4-BH-13-96	AOI4-BH-13-97	
Sample Date			20-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	18-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	15-Mar-13	14-Mar-13	14-Mar-13	14-Mar-13	19-Mar-13	14-Mar-13	14-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	14-Mar-13	14-Mar-13	14-Mar-13
Sample ID			AOI-4_BH-13-81_8-10'	AOI-4_BH-13-90_8-10'_031513	AOI-4_BH-13-94_0-2_031513	AOI-4_BH-13-94_8-10_031513	AOI4-BH-13-82_6.5-7_031813	AOI4-BH-13-84_5.5-6_031513	AOI4-BH-13-85_5.5-6_031513	AOI4-BH-13-86_2-2.5_031513	AOI4-BH-13-86_5.5-6_031513	AOI4-BH-13-88_1.5-2_31413	AOI4-BH-13-88_3.5-4_031413	AOI4-BH-13-88_5.5-6_031413	AOI4-BH-13-89_5.5-6_031913	AOI4-BH-13-91_0-2'_031413	AOI4-BH-13-91_8-10'_031413	AOI4-BH-13-92_8-10'	AOI4-BH-13-93_8-10'	AOI4-BH-13-95_8-10'	AOI4-BH-13-96_8-9_31413	AOI4-BH-13-97.0-1_31413	AOI4-BH-13-97-8.5-9.5_31413
Sample Depth			8 - 10 ft	8 - 10 ft	0 - 2 ft	8 - 10 ft	6.5 - 7 ft	5.5 - 6 ft	5.5 - 6 ft	2 - 2.5 ft	5.5 - 6 ft	1.5 - 2 ft	3.5 - 4 ft	5.5 - 6 ft	5.5 - 6 ft	0 - 2 ft	8 - 10 ft	8 - 10 ft	8 - 10 ft	8 - 10 ft	8 - 9 ft	0 - 1 ft	8.5 - 9.5 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	UNKNOWN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order			JB31919	JB31583	JB31583	JB31583	JB31733	JB31583	JB31583	JB31583	JB31583	JB31413	JB31413	JB31413	JB31794	JB31413	JB31413	JB31733	JB31733	JB31733	JB31413	JB31413	JB31413
Laboratory Sample ID	**Units**	**MSC-PA**	JB31919-1	JB31583-3	JB31583-1	JB31583-2	JB31733-9	JB31583-11	JB31583-10	JB31583-8	JB31583-9	JB31413-6	JB31413-7	JB31413-8	JB31794-1	JB31413-9	JB31413-10	JB31733-13	JB31733-12	JB31733-14	JB31413-1	JB31413-2	JB31413-3
Volatile Organic Compounds																							
BENZENE	mg/kg	290[A] 330[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)	ND (0.00095)	ND (0.0010)
CYCLOHEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)	ND (0.00095)	ND (0.0010)
1,2-DICHLOROETHANE (EDC)	mg/kg	86[A] 98[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)	ND (0.00095)	ND (0.0010)
ETHYLBENZENE	mg/kg	890[A] 1000[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	0.186	ND (0.00088)	ND (0.00088)	0.0206	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.0535 J	ND (0.00095)	ND (0.0010)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[AB]	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.129 J	ND (0.0044)	ND (0.0044)	0.0143	ND (0.0044)	0.694	0.993	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.143 J	ND (0.0047)	ND (0.0050)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A] 9900[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	ND (0.083)	ND (0.00095)	ND (0.0010)
HEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000[AB]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	ND (0.099)	ND (0.00088)	ND (0.00088)	ND (0.00085)	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.0472 J	ND (0.00095)	ND (0.0010)
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A] 640[B]	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.362 J	ND (0.0044)	ND (0.0044)	0.0437	ND (0.0044)	13.6	6.95	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.145 J	ND (0.0047)	ND (0.0050)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[AB]	ND (0.0046)	ND (0.0058)	ND (0.0051)	ND (0.0055)	0.147 J	ND (0.0044)	ND (0.0044)	0.0169	ND (0.0044)	ND (0.55)	ND (0.50)	ND (0.0051)	ND (0.0045)	ND (0.0044)	ND (0.0043)	ND (0.0045)	ND (0.0038)	ND (0.0045)	0.189 J	ND (0.0047)	ND (0.0050)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A] 9100[B]	ND (0.00091)	ND (0.0012)	ND (0.0010)	ND (0.0011)	0.339	ND (0.00088)	ND (0.00088)	0.0109	ND (0.00088)	ND (0.11)	ND (0.10)	ND (0.0010)	ND (0.00089)	ND (0.00088)	ND (0.00085)	ND (0.00089)	ND (0.00077)	ND (0.00090)	0.260	ND (0.00095)	ND (0.0010)
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000[AB]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
BENZO(A)ANTHRACENE	mg/kg	130[A] 190000[B]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0692 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
BENZO(A)PYRENE	mg/kg	12[A] 190000[B]	ND (0.036)	ND (0.12)	0.0442 J	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0431 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 190000[B]	ND (0.036)	ND (0.12)	0.150	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.122	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	0.130	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
BENZO(G,H,I)PERYLENE	mg/kg	190000[AB]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760[A] 190000[B]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.0634 J	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000[A] 190000[B]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.181	ND (0.12)	ND (0.10)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000$_{s2}$[A] 10000$_{s2}$[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	ND (0.11)	2.53	0.894	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	ND (0.11)	ND (0.12)	ND (0.10)
4-NITROPHENOL	mg/kg	26000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000[AB]	ND (0.036)	ND (0.12)	ND (0.11)	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.107 J	0.622	0.393	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.282	ND (0.12)	ND (0.10)
PHENOL	mg/kg	16000[A] 18000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000[A] 190000[B]	ND (0.036)	ND (0.12)	0.0604 J	ND (0.12)	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.12)	0.147	0.0608 J	ND (0.12)	ND (0.12)	ND (0.037)	ND (0.11)	ND (0.11)	ND (0.071)	ND (0.036)	ND (0.033)	0.0538 J	ND (0.12)	ND (0.10)
PYRIDINE	mg/kg	3200[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	960[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240[A] 190000[B]	2.5	8.6	43.8	6.2	13.3	6.6	6.9	7.8	2140	10.0	7.1	6.2	6.7	60.8	7.3	11.6	10.7	5.5	26.2	81.5	2.9
NICKEL	mg/kg	64000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			**AOI4-BH-13-98**		**AOI4-BH-13-99**		**AOI4-BH-13-100**		**AOI4-BH-13-101**	
Sample Date			14-Mar-13	14-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13
Sample ID			AOI4-BH-13-98-1-2_31413	AOI4-BH-13-98_6-7_31413	AOI4-BH-13-99_1.5-2_031813	AOI4-BH-13-99_2.5-3_031813	AOI4-BH-13-100_0-1_31813	AOI4-BH-13-100_5-6_31813	AOI4-BH-13-101_0-1_31813	AOI4-BH-13-101_7-8_31813
Sample Depth			1 - 2 ft	6 - 7 ft	1.5 - 2 ft	2.5 - 3 ft	0 - 1 ft	5 - 6 ft	0 - 1 ft	7 - 8 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order			JB31413	JB31413	JB31733	JB31733	JB31733	JB31733	JB31733	JB31733
Laboratory Sample ID	**Units**	**MSC-PA**	JB31413-4	JB31413-5	JB31733-10	JB31733-11	JB31733-7	JB31733-8	JB31733-5	JB31733-6
Volatile Organic Compounds										
BENZENE	mg/kg	290[A] 330[B]	ND (0.0010)	0.127	0.00024 J	0.245	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
CYCLOHEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.15)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
1,2-DICHLOROETHANE (EDC)	mg/kg	86[A] 98[B]	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.15)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
ETHYLBENZENE	mg/kg	890[A] 1000[B]	ND (0.0010)	0.581	ND (0.0012)	0.110 J	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[AB]	ND (0.0051)	0.0150	0.00071 J	0.122 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A] 9900[B]	ND (0.0010)	ND (0.00096)	ND (0.0012)	ND (0.15)	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
HEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000[AB]	ND (0.0010)	0.702	ND (0.0012)	0.182	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A] 640[B]	ND (0.0051)	1.15	ND (0.0059)	0.169 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[AB]	ND (0.0051)	0.0948	ND (0.0059)	0.0611 J	ND (0.0044)	ND (0.0057)	ND (0.0051)	ND (0.0063)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A] 9100[B]	ND (0.0010)	2.42	ND (0.0012)	0.671	ND (0.00088)	ND (0.0011)	ND (0.0010)	ND (0.0013)
Volatile Organic Compounds (SW8011)										
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds										
ACENAPHTHENE	mg/kg	190000[AB]	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000[AB]	ND (0.12)	ND (0.12)	0.0675	ND (0.037)	ND (0.038)	ND (0.037)	0.0182 J	ND (0.040)
BENZO(A)ANTHRACENE	mg/kg	130[A] 190000[B]	0.105 J	ND (0.12)	0.111	0.0652	0.0231 J	ND (0.037)	0.0559	ND (0.040)
BENZO(A)PYRENE	mg/kg	12[A] 190000[B]	0.0823 J	ND (0.12)	0.157	0.0875	0.0243 J	ND (0.037)	0.0449	ND (0.040)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 190000[B]	0.189	ND (0.12)	0.109	0.0954	0.0303 J	ND (0.037)	0.0544	ND (0.040)
BENZO(G,H,I)PERYLENE	mg/kg	190000[AB]	0.0753 J	ND (0.12)	0.215	0.109	0.0274 J	ND (0.037)	0.0408	ND (0.040)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 190000[B]	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000[A] 190000[B]	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500[A] 10000[B]	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760[A] 190000[B]	0.112 J	ND (0.12)	0.145	0.114	0.0263 J	ND (0.037)	0.0787	ND (0.040)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 190000[B]	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000[AB]	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400[A] 190000[B]	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000[A] 190000[B]	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000[A] 190000[B]	ND (0.12)	ND (0.12)	ND (0.039)	0.191	ND (0.038)	ND (0.037)	ND (0.037)	ND (0.040)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 190000[B]	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000[A] 190000[B]	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000$_{s2}$[A] 10000$_{s2}$[B]	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000[A] 190000[B]	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	ND (0.12)	ND (0.12)	0.0334 J	0.0933	ND (0.038)	ND (0.037)	ND (0.037)	ND (0.040)
4-NITROPHENOL	mg/kg	26000[A] 190000[B]	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000[AB]	0.0619 J	ND (0.12)	0.237	0.380	0.0235 J	ND (0.037)	0.104	ND (0.040)
PHENOL	mg/kg	16000[A] 18000[B]	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000[A] 190000[B]	0.201	ND (0.12)	0.196	0.140	0.0297 J	ND (0.037)	0.120	ND (0.040)
PYRIDINE	mg/kg	3200[A] 10000[B]	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30[A] 10000[B]	-	-	-	-	-	-	-	-
Metals										
COBALT	mg/kg	960[A] 190000[B]	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240[A] 190000[B]	136	8.0	***11600*** [A]	1870	399	12.8	494	10.2
NICKEL	mg/kg	64000[A] 190000[B]	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220[A] 190000[B]	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000[AB]	-	-	-	-	-	-	-	-

Sample Location	**AOI4-BH-13-102**		**AOI4-BH-13-103**		**AOI4-BH-13-104**		**AOI4-BH-15-1**	**AOI4-BH-16-001**		**AOI4-BH-16-002**	
Sample Date	18-Mar-13	18-Mar-13	18-Mar-13	18-Mar-13	15-Mar-13	15-Mar-13	9-Oct-15	21-Jun-16	15-Jul-16	21-Jun-16	18-Jul-16
Sample ID	AOI4-BH-13-102_0-1_31813	AOI4-BH-13-102_6-7_31813	AOI4-BH-13-103_0-1_31813	AOI4-BH-13-103_2-3_31813	AOI4-BH-13-104_0-.5_31513	AOI4-BH-13-104_6-7_31513	AOI4_BH-15-1_0-2_100915	AOI4-BH-16-001-0-2-20160621	AOI4-BH-16-001-14-16-20160715	AOI4-BH-16-002-0-2-20160621	AOI4-BH-16-002-14-16-20160718
Sample Depth	0 - 1 ft	6 - 7 ft	0 - 1 ft	2 - 3 ft	0 - 0.5 ft	6 - 7 ft	0 - 2 ft	0 - 2 ft	14 - 16 ft	0 - 2 ft	14 - 16 ft
Sampling Company	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ESC	ESC	ESC	ESC
Laboratory Work Order	JB31733	JB31733	JB31733	JB31733	JB31583	JB31583	JC5896	L843252	L847944	L843252	L847944
Laboratory Sample ID	JB31733-3	JB31733-4	JB31733-1	JB31733-2	JB31583-5	JB31583-4	JC5896-1	L843252-06	L847944-01	L843252-05	L847944-02
Volatile Organic Compounds											
BENZENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	1.96	ND (0.00057)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
CYCLOHEXANE	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
1,2-DIBROMOETHANE (EDB)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.27)	-	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
1,2-DICHLOROETHANE (EDC)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.27)	ND (0.0011)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
ETHYLBENZENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	29.5	ND (0.0011)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
ISOPROPYLBENZENE (CUMENE)	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	7.31	ND (0.0023)	ND (0.0124)	ND (0.0115)	ND (0.0127)	ND (0.0120)
METHYL TERTIARY BUTYL ETHER	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	ND (0.27)	ND (0.0011)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
HEXANE	-	-	-	-	-	-	-	ND (0.0124)	ND (0.0115)	ND (0.0127)	ND (0.0120)
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
TOLUENE	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	6.55	ND (0.0011)	ND (0.00618)	ND (0.00575)	ND (0.00633)	ND (0.00602)
1,2,4-TRIMETHYLBENZENE	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	75.4	ND (0.0023)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
1,3,5-TRIMETHYLBENZENE	ND (0.0056)	ND (0.0050)	ND (0.0076)	ND (0.0055)	ND (0.0050)	27.3	ND (0.0023)	ND (0.00124)	ND (0.00115)	ND (0.00127)	ND (0.00120)
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (0.0011)	ND (0.0010)	ND (0.0015)	ND (0.0011)	ND (0.0010)	65.6	ND (0.0011)	ND (0.00371)	ND (0.00345)	ND (0.00380)	ND (0.00361)
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	ND (0.0029)	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
ANTHRACENE	ND (0.036)	ND (0.037)	0.0731	ND (0.040)	ND (0.12)	2.56	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
BENZO(A)ANTHRACENE	0.0292 J	ND (0.037)	0.0807	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418) I	ND (0.0397)
BENZO(A)PYRENE	ND (0.036)	ND (0.037)	0.0794	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
BENZO(B)FLUORANTHENE	ND (0.036)	ND (0.037)	0.0607	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
BENZO(G,H,I)PERYLENE	ND (0.036)	ND (0.037)	0.111	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418) OE I	ND (0.0397)
1,1'-BIPHENYL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
CHRYSENE	0.0338 J	ND (0.037)	0.122	ND (0.040)	ND (0.12)	ND (0.12)	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418) I	ND (0.0397)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418) OE	ND (0.0397)
DIETHYL PHTHALATE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
2,4-DINITROPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
FLUORANTHENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
FLUORENE	ND (0.036)	ND (0.037)	ND (0.038)	ND (0.040)	ND (0.12)	6.14	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
INDENO(1,2,3-C,D)PYRENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422) OE	ND (0.401)
NAPHTHALENE	ND (0.036)	ND (0.037)	0.0654	ND (0.040)	ND (0.12)	21.2	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
4-NITROPHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
PHENANTHRENE	0.0401	ND (0.037)	0.285	0.0341 J	ND (0.12)	21.7	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
PHENOL	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
PYRENE	0.0476	ND (0.037)	0.261	ND (0.040)	ND (0.12)	0.697	ND (0.039)	ND (0.0408)	ND (0.190)	ND (0.0418)	ND (0.0397)
PYRIDINE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
QUINOLINE	-	-	-	-	-	-	-	ND (0.411)	ND (1.91)	ND (0.422)	ND (0.401)
Metals											
COBALT	-	-	-	-	-	-	-	9.57	2.74	8.43	4.45
LEAD	1620	9.2	***3020*** [A]	34.0	7.0	7.9	9.7	11.2	2.73	6.60	3.99
NICKEL	-	-	-	-	-	-	-	12.5	6.39	13.8	7.63
VANADIUM	-	-	-	-	-	-	-	36.8	5.91	27.7	8.20
ZINC	-	-	-	-	-	-	-	34.6	21.0	42.2	29.4

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			AOI4-BH-16-003		AOI4-BH-16-004		AOI4-BH-16-005		AOI4-BH-16-006		AOI4-BH-16-007		AOI4-BH-16-008	AOI4-BH-16-009	AOI4-BH-16-010	AOI4-BH-16-011		AOI4-BH-16-012	AOI4-BH-16-013		AOI4-BH-16-014	
Sample Date			24-Aug-16	24-Aug-16	24-Aug-16	24-Aug-16	23-Jun-16	23-Jun-16	23-Jun-16	23-Jun-16	27-Jun-16	27-Jun-16	14-Jun-16	14-Jun-16	14-Jun-16	13-Jun-16	13-Jun-16	13-Jun-16	30-Jun-16	30-Jun-16	29-Jun-16	29-Jun-16
Sample ID			AOI4-BH-16-003-0-2-20160824	AOI4-BH-16-003-14-15-20160824	AOI4-BH-16-004-0-2-20160824	AOI4-BH-16-004-14-15-20160824	AOI4-BH-16-005-0-2-20160623	AOI4-BH-16-005-14-15-20160623	AOI4-BH-16-006-0-2-20160623	AOI4-BH-16-006-14-15-20160623	AOI4-BH-16-007-0-2-20160627	AOI4-BH-16-007-14-15-20160627	AOI4-BH-16-008-0-2-20160614	AOI4-BH-16-009-0-2-20160614	AOI4-BH-16-010-0-2-20160614	AOI4-BH-16-011-0-2-20160613	AOI4-BH-16-011-0-2-20160613	AOI4-BH-16-012-0-2-20160613	AOI4-BH-16-013-0-2-20160630	AOI4-BH-16-013-13-14-20160630	AOI4-BH-16-014-0-2-20160629	AOI4-BH-16-014-13-14-20160629
Sample Depth			0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	0 - 2 ft	13 - 14 ft	0 - 2 ft	13 - 14 ft
Sampling Company			AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order			L855702	L855702	L855702	L855702	L843656	L843656	L843656	L843656	L844277	L844277	L841529	L841529	L841529	L841529	L842738	L841529	L844813	L844813	L844813	L844813
Laboratory Sample ID	**Units**	**MSC-PA**	L855702-03	L855702-04	L855702-01	L855702-02	L843656-05	L843656-06	L843656-03	L843656-04	L844277-05	L844277-06	L841529-01	L841529-02	L841529-03	L841529-04	L842738-01	L841529-05	L844813-03	L844813-04	L844813-01	L844813-02
Volatile Organic Compounds																						
BENZENE	mg/kg	290[A] 330[B]	ND (0.00126)	0.00122	ND (0.00121)	0.00135	ND (0.00118)	ND (0.00125)	ND (0.00123)	0.0237	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	0.00349	ND (0.0528)	0.0626	ND (0.122)
CYCLOHEXANE	mg/kg	10000[AB]	ND (0.00126)	0.0291	ND (0.00121)	0.00201	-	-	-	-	-	-	-	-	-	-	-	-	0.0443	0.306	0.00987	ND (0.122)
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	ND (0.00118)	ND (0.0528)	ND (0.00114)	ND (0.122)
1,2-DICHLOROETHANE (EDC)	mg/kg	86[A] 98[B]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	ND (0.00118)	ND (0.0528)	ND (0.00114)	ND (0.122)
ETHYLBENZENE	mg/kg	890[A] 1000[B]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.271	-	-	-	-	-	-	ND (0.00118)	ND (0.0528)	0.00835	ND (0.122)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[AB]	ND (0.0126)	ND (0.0110)	ND (0.0121)	ND (0.0120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	0.00284	ND (0.00129)	0.120	-	-	-	-	-	-	0.0415	ND (0.528)	ND (0.0114)	ND (1.22)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A] 9900[B]	0.00155	0.0177	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	ND (0.0437)	-	-	-	-	-	-	0.0452	0.205	0.00170	ND (0.122)
HEXANE	mg/kg	10000[AB]	ND (0.0126)	ND (0.0110)	ND (0.0121)	ND (0.0120)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0118)	ND (0.528)	ND (0.0114)	ND (1.22)
NAPHTHALENE	mg/kg	760[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000[AB]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	-	-	-	-	-	-	-	-	-	-	-	-	0.0208	0.405	ND (0.00114)	0.837
BUTYLBENZENE, TERT-	mg/kg	10000[AB]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	-	-	-	-	-	-	-	-	-	-	-	-	0.00214	0.131	ND (0.00114)	ND (0.122)
TOLUENE	mg/kg	10000[AB]	ND (0.00629)	ND (0.00550)	ND (0.00604)	ND (0.00602)	ND (0.00590)	ND (0.00625)	ND (0.00616)	ND (0.00615)	ND (0.00645)	ND (0.218)	-	-	-	-	-	-	ND (0.00589)	ND (0.264)	ND (0.00568)	ND (0.611)
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A] 640[B]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.731	-	-	-	-	-	-	ND (0.00118)	0.327	ND (0.00114)	ND (0.122)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[AB]	ND (0.00126)	ND (0.00110)	ND (0.00121)	ND (0.00120)	ND (0.00118)	ND (0.00125)	ND (0.00123)	ND (0.00123)	ND (0.00129)	0.332	-	-	-	-	-	-	ND (0.00118)	0.0551	ND (0.00114)	ND (0.122)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A] 9100[B]	ND (0.00377)	ND (0.00330)	ND (0.00362)	ND (0.00361)	ND (0.00354)	ND (0.00375)	ND (0.00369)	ND (0.00369)	ND (0.00387)	0.290	-	-	-	-	-	-	ND (0.00353)	ND (0.159)	ND (0.00341)	ND (0.366)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	190000[AB]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
ANTHRACENE	mg/kg	190000[AB]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.131	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
BENZO(A)ANTHRACENE	mg/kg	130[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
BENZO(A)PYRENE	mg/kg	12[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
BENZO(G,H,I)PERYLENE	mg/kg	190000[AB]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
1,1'-BIPHENYL	mg/kg	11000[A] 190000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500[A] 10000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
DI-N-BUTYL PHTHALATE	mg/kg	10000[AB]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
CHRYSENE	mg/kg	760[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	ND (0.00694)	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
DIETHYL PHTHALATE	mg/kg	10000[AB]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
2,4-DIMETHYLPHENOL	mg/kg	10000[AB]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
2,4-DINITROPHENOL	mg/kg	6400[A] 190000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
FLUORANTHENE	mg/kg	130000[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	0.330	ND (0.210)	ND (0.375)	ND (0.0403)
FLUORENE	mg/kg	130000[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.205	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
2-METHYLNAPHTHALENE	mg/kg	13000[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000$_{s2}$[A] 10000$_{s2}$[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000[A] 190000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
NAPHTHALENE	mg/kg	760[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.0236)	ND (0.0250)	ND (0.0246)	ND (0.0246)	ND (0.0258)	0.0407	-	-	-	-	-	-	ND (0.194)	ND (0.210)	ND (0.375)	ND (0.0403)
4-NITROPHENOL	mg/kg	26000[A] 190000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
PHENANTHRENE	mg/kg	190000[AB]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	ND (0.00708)	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.421	-	-	-	-	-	-	0.262	0.303	ND (0.375)	ND (0.0403)
PHENOL	mg/kg	16000[A] 18000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
PYRENE	mg/kg	96000[A] 190000[B]	ND (0.0415)	ND (0.0363)	ND (0.0398)	ND (0.0397)	0.00752	ND (0.00749)	ND (0.00739)	ND (0.00738)	ND (0.00774)	0.0452	-	-	-	-	-	-	0.292	ND (0.210)	ND (0.375)	ND (0.0403)
PYRIDINE	mg/kg	3200[A] 10000[B]	ND (0.419)	ND (0.366)	ND (0.402)	ND (0.401)	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
QUINOLINE	mg/kg	30[A] 10000[B]	ND (0.419) OE	ND (0.366) OE	ND (0.402) OE	ND (0.401) OE	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.96)	ND (2.12)	ND (3.78)	ND (0.407)
Metals																						
COBALT	mg/kg	960[A] 190000[B]	9.05	7.02	8.42	9.13	-	-	-	-	-	-	-	-	-	-	-	-	10.2	7.43	8.37	8.32
LEAD	mg/kg	2240[A] 190000[B]	8.18	6.69	12.2	10.8	14.4	8.22	8.07	5.88	7.79	7.25	1760 J	1490 J	160 J	***4380 J***[A]	***6000***[A]	1080 J	255	65.1	57.6	13.9
NICKEL	mg/kg	64000[A] 190000[B]	11.6	11.3	12.0	6.20	-	-	-	-	-	-	-	-	-	-	-	-	18.6	12.1	14.6	13.4
VANADIUM	mg/kg	220[A] 190000[B]	25.9	22.1	39.0	21.9	-	-	-	-	-	-	-	-	-	-	-	-	38.2	30.1	47.5	37.1
ZINC	mg/kg	190000[AB]	29.9	29.0	46.2	17.9	-	-	-	-	-	-	-	-	-	-	-	-	102	113	80.2	37.6

See notes on last page

Stantec

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			AOI4-BH-16-015		AOI4-BH-16-016		AOI4-BH-16-017		AOI4-BH-16-018	
Sample Date			22-Jun-16	22-Jun-16	20-Jun-16	21-Jun-16	21-Jun-16	21-Jun-16	28-Jun-16	28-Jun-16
Sample ID			AOI4-BH-16-015-0-2-20160622	AOI4-BH-16-015-13-15-20160622	AOI4-BH-16-016-0-2-20160620	AOI4-BH-16-016-14-16-20160621	AOI4-BH-16-017-0-2-20160621	AOI4-BH-16-017-12-14-20160621	AOI4-BH-16-018-0-2-20160628	AOI4-BH-16-018-14-15-20160628
Sample Depth			0 - 2 ft	13 - 15 ft	0 - 2 ft	14 - 16 ft	0 - 2 ft	12 - 14 ft	0 - 2 ft	14 - 15 ft
Sampling Company			AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ESC	ESC	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order			L843252	L843252	L842835	L842835	L842835	L842835	L844277	L844277
Laboratory Sample ID	Units	MSC-PA	L843252-01	L843252-02	L842835-01	L842835-02	L842835-04	L842835-05	L844277-01	L844277-02
Volatile Organic Compounds										
BENZENE	mg/kg	290^{A} 330^{B}	0.00230	ND (0.00107)	0.00973	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
CYCLOHEXANE	mg/kg	10000^{AB}	0.00525	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	8.10
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.0120)	ND (0.0107)	ND (0.0122)	ND (0.0127)	ND (0.0126)	ND (0.0120)	ND (0.0129)	7.88
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
HEXANE	mg/kg	10000^{AB}	ND (0.0120)	ND (0.0107)	ND (0.0122)	ND (0.0127)	ND (0.0126)	ND (0.0120)	ND (0.0129)	ND (2.02)
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	0.00291	ND (0.00107)	ND (0.00122)	0.00564	ND (0.00126)	ND (0.00120)	ND (0.00129)	17.5
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	1.06
TOLUENE	mg/kg	10000^{AB}	ND (0.00601)	ND (0.00533)	ND (0.00609)	ND (0.00635)	ND (0.00628)	ND (0.00598)	ND (0.00646)	ND (1.01)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	ND (0.00120)	ND (0.00107)	ND (0.00122)	ND (0.00127)	ND (0.00126)	ND (0.00120)	ND (0.00129)	ND (0.202)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	ND (0.00361)	ND (0.00320)	ND (0.00366)	ND (0.00381)	ND (0.00377)	ND (0.00359)	ND (0.00388)	ND (0.605)
Volatile Organic Compounds (SW8011)										
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds										
ACENAPHTHENE	mg/kg	190000^{AB}	ND (0.198)	ND (0.0352)	ND (0.0402)	0.0777	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.272
ANTHRACENE	mg/kg	190000^{AB}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
CHRYSENE	mg/kg	760^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
DIETHYL PHTHALATE	mg/kg	10000^{AB}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	0.103	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.426
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.198)	ND (0.0352)	ND (0.0402)	0.0446	ND (0.0415)	ND (0.0395)	ND (0.0426)	0.760
PHENOL	mg/kg	16000^{A} 18000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
PYRENE	mg/kg	96000^{A} 190000^{B}	ND (0.198)	ND (0.0352)	ND (0.0402)	ND (0.0419)	ND (0.0415)	ND (0.0395)	ND (0.0426)	ND (0.0392)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
QUINOLINE	mg/kg	30^{A} 10000^{B}	ND (2.00)	ND (0.355)	ND (0.406)	ND (0.423)	ND (0.418)	ND (0.398)	ND (0.430)	ND (0.395)
Metals										
COBALT	mg/kg	960^{A} 190000^{B}	9.36	4.92	7.93	4.73	5.49	3.22	8.76	5.96
LEAD	mg/kg	2240^{A} 190000^{B}	310	17.9	370	13.6	9.54	2.22	6.97	5.91
NICKEL	mg/kg	64000^{A} 190000^{B}	29.4	11.6	17.5	13.9	14.0	6.09	12.8	10.2
VANADIUM	mg/kg	220^{A} 190000^{B}	206	10.3	34.8	27.4	35.9	8.20	27.3	14.9
ZINC	mg/kg	190000^{AB}	696	38.3	112	35.8	42.6	16.1	30.7	29.4

Sample Location	AOI4-BH-16-019		AOI4-BH-16-020		AOI4-BH-16-021		AOI4-BH-16-022	AST-845-LINE-1	AST-845-LINE-2	AST-845-LINE-3	AST-845-LINE-4	AST-845-LINE-5
Sample Date	27-Jun-16	27-Jun-16	24-Jun-16	24-Jun-16	22-Jun-16	22-Jun-16	23-Jun-16	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07
Sample ID	AOI4-BH-16-019-0-2-20160627	AOI4-BH-16-019-13-15-20160627	AOI4-BH-16-020-0-2-20160624	AOI4-BH-16-020-13-15-20160624	AOI4-BH-16-021-0-2-20160622	AOI4-BH-16-021-14-15-20160622	AOI4-BH-16-022-0-2-20160623	AST-845-LINE-1	AST-845-LINE-2	AST-845-LINE-3	AST-845-LINE-4	AST-845-LINE-5
Sample Depth	0 - 2 ft	13 - 15 ft	0 - 2 ft	13 - 15 ft	0 - 2 ft	14 - 15 ft	0 - 2 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	ESC	ESC	ESC	ESC	ESC	ESC	ESC	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order	L844277	L844277	L845360	L845360	L843252	L843252	L843656	072076	072076	072076	072076	072076
Laboratory Sample ID	L844277-03	L844277-04	L845360-01	L845360-02	L843252-03	L843252-04	L843656-07	0703-3404	0703-3405	0703-3406	0703-3407	0703-3408
Volatile Organic Compounds												
BENZENE	ND (0.00125)	ND (0.00114)	0.896	0.00142	ND (0.00127)	ND (0.00111)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D	ND (0.120) D	ND (0.130) D
CYCLOHEXANE	ND (0.00125)	ND (0.00114)	4.10	0.0146	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	ND (0.00125)	ND (0.00114)	ND (0.214)	ND (0.00118)	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	ND (0.00125)	ND (0.00114)	ND (0.214) OE	ND (0.00118) OE	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
ETHYLBENZENE	ND (0.00125)	ND (0.00114)	11.2	0.0224	ND (0.00127)	ND (0.00111)	-	ND (0.097) D	0.068 J D	ND (0.100) D	ND (0.120) D	ND (0.130) D
ISOPROPYLBENZENE (CUMENE)	ND (0.0125)	ND (0.0114)	5.19	0.0137	ND (0.0127)	ND (0.0111)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D	ND (0.120) D	ND (0.130) D
METHYL TERTIARY BUTYL ETHER	ND (0.00125)	ND (0.00114)	ND (0.214)	ND (0.00118)	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
HEXANE	ND (0.0125)	ND (0.0114)	ND (2.14)	ND (0.0118)	ND (0.0127)	ND (0.0111)	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	ND (0.097) D	ND (0.120) D	ND (0.100) D	ND (0.120) D	ND (0.130) D
BUTYLBENZENE, SEC-	0.00274	0.00266	9.76	0.0347	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
BUTYLBENZENE, TERT-	ND (0.00125)	ND (0.00114)	0.603	0.00133	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
TOLUENE	ND (0.00627)	ND (0.00571)	ND (1.07)	ND (0.00591)	ND (0.00634)	ND (0.00555)	-	ND (0.097) D	ND (0.120) D	ND (0.100) D	ND (0.120) D	ND (0.130) D
1,2,4-TRIMETHYLBENZENE	ND (0.00125)	ND (0.00114)	33.9	0.0973	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	ND (0.00125)	ND (0.00114)	10.5	0.0312	ND (0.00127)	ND (0.00111)	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (0.00376)	ND (0.00343)	13.1	0.0229	ND (0.00380)	ND (0.00333)	-	ND (0.097) D	0.077 J D	ND (0.100) D	0.090 J D	ND (0.130) D
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds												
ACENAPHTHENE	ND (0.0414)	ND (0.0377)	1.88	0.167	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
ANTHRACENE	ND (0.0414)	ND (0.0377)	0.444	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	ND (0.370)
BENZO(A)ANTHRACENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	0.490
BENZO(A)PYRENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	ND (0.370)
BENZO(B)FLUORANTHENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	0.470	0.530
BENZO(G,H,I)PERYLENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	ND (0.370)
BENZO(K)FLUORANTHENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
1,1'-BIPHENYL	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394) B	ND (0.422)	ND (0.370)	-	-	-	-	-	-
CHRYSENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.450	ND (0.390)	ND (0.400)	0.490
DIBENZ(A,H)ANTHRACENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
DIETHYL PHTHALATE	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
2,4-DINITROPHENOL	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
FLUORANTHENE	ND (0.0414)	ND (0.0377)	0.218	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
FLUORENE	ND (0.0414)	ND (0.0377)	2.37	0.203	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	ND (0.370)
INDENO(1,2,3-C,D)PYRENE	ND (0.0414)	ND (0.0377)	ND (0.218)	ND (0.0390)	ND (0.0418)	ND (0.0366)	-	ND (0.420)	ND (0.410)	ND (0.390)	ND (0.400)	ND (0.370)
2-METHYLNAPHTHALENE	ND (0.0414)	ND (0.0377)	23.6	1.52	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
NAPHTHALENE	ND (0.0414)	ND (0.0377)	6.15	0.278	ND (0.0418)	ND (0.0366)	-	-	-	-	-	-
4-NITROPHENOL	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
PHENANTHRENE	ND (0.0414)	ND (0.0377)	5.70	0.476	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.640	ND (0.390)	ND (0.400)	0.660
PHENOL	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
PYRENE	ND (0.0414)	ND (0.0377)	0.565	0.0417	ND (0.0418)	ND (0.0366)	-	ND (0.420)	0.640	0.450	0.620	1.0
PYRIDINE	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
QUINOLINE	ND (0.418)	ND (0.380)	ND (2.20)	ND (0.394)	ND (0.422)	ND (0.370)	-	-	-	-	-	-
Metals												
COBALT	6.08	4.32	3.75	4.45	5.72	19.8	-	-	-	-	-	-
LEAD	7.89	7.56	12.4	11.4	7.70	7.21	644	-	-	-	-	-
NICKEL	11.4	14.1	11.7	12.7	11.5	10.6	-	-	-	-	-	-
VANADIUM	31.6	14.0	28.9	30.2	30.8	19.8	-	-	-	-	-	-
ZINC	31.8	36.3	36.8	58.7	32.1 B	27.1 B	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			GP-1		GP-2		GP-3		GP-4		GP-5		GP-6		GP-7			GP-8			GP-9	MW-1	
Sample Date			28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	28-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	29-May-03
Sample ID			GP-1(1.5-2)	GP-1(15-15.5)	GP-2(1.5-2)	GP-2(15-15.5)	GP-3(0-2)	GP-3(15-15.5)	GP-4(1.5-2)	GP-4(15-15.5)	GP-5(1.5-2)	GP-5(15-15.5)	GP-6(1.5-2)	GP-6(15.5-16)	GP-7(1.5-2)	GP-7(6.5-7)	GP-7(15.5-16)	GP-8(1.5-2)	GP-8(7.5-8)	GP-8(15-15.5)	GP-9(Surface)	MW-1(1.5-2)	MW-1(11.5-12)
Sample Depth			1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	0 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15 - 15.5 ft	1.5 - 2 ft	15.5 - 16 ft	1.5 - 2 ft	6.5 - 7 ft	15.5 - 16 ft	1.5 - 2 ft	7.5 - 8 ft	15 - 15.5 ft		1.5 - 2 ft	11.5 - 12 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL	WGEL
Laboratory Work Order			75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559	75559
Laboratory Sample ID	Units	MSC-PA	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Volatile Organic Compounds																							
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.25)	0.11 J	ND (0.23)	ND (0.26)	ND (0.31)	ND (0.25)	ND (0.24)	ND (0.25)	ND (0.31)	0.14 J	ND (0.27)	ND (0.26)	ND (0.26)	0.16 J	0.34 J	ND (0.28)	ND (0.26)	ND (0.24)	0.054 J	ND (0.24)	ND (0.26)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	0.20 J	3.7	0.72	2.2	ND (0.31)	0.42	ND (0.24)	0.24 J	ND (0.31)	0.37	0.13 J	ND (0.26)	ND (0.26)	9.4	25	40 D	0.91	ND (0.24)	0.46	ND (0.24)	ND (0.26)
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	0.50	ND (0.36)	ND (1.8)	ND (0.36)	0.31 J	ND (0.36)	1.9 J	ND (0.37)	0.61 J	ND (0.37)	1.3	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	0.50 J	ND (0.37)	ND (57)	0.88	ND (0.36)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	2.0	ND (0.36)	5.0	ND (0.36)	1.6	ND (0.36)	4.1	ND (0.37)	2.1	ND (0.37)	2.7	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)	ND (57)	2.1	ND (0.36)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	2.2	ND (0.36)	4.8	ND (0.36)	1.4	ND (0.36)	3.5	ND (0.37)	2.3	ND (0.37)	2.3	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)	*ND (57)*	1.9	ND (0.36)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	1.8	ND (0.36)	3.8	ND (0.36)	1.1	ND (0.36)	3.2	ND (0.37)	1.8	ND (0.37)	2.0	ND (0.42)	1.3 J	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)	ND (57)	2.0	ND (0.36)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	0.67	ND (0.36)	1.7 J	ND (0.36)	0.41 J	ND (0.36)	1.2 J	ND (0.37)	0.88 J	ND (0.37)	0.77 J	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	ND (0.76)	ND (0.37)	ND (57)	0.71	ND (0.36)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	1.8	ND (0.36)	4.4	ND (0.36)	1.4	ND (0.36)	4.0	ND (0.37)	2.0	ND (0.37)	2.4	ND (0.42)	ND (2.0)	ND (4.7)	ND (3.7)	ND (8.1)	0.63 J	ND (0.37)	ND (57)	2.1	ND (0.36)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.40)	0.40	ND (1.8)	0.20 J	ND (0.42)	ND (0.36)	ND (0.19)	0.27 J	ND (0.95)	0.25 J	0.50 J	ND (0.42)	ND (2.0)	17	2.2 J	7.6 J	0.82	ND (0.37)	ND (57)	0.39	ND (0.36)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	1.7	0.99	2.1	0.48	1.1	0.35 J	10	0.69	1.9	0.66	4.7	ND (0.42)	ND (2.0)	49	5.0	22	3.4	0.38	230	3.1	ND (0.36)
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	1.8	ND (0.36)	5.4	ND (0.36)	2.0	ND (0.36)	7.3	ND (0.37)	2.4	ND (0.37)	3.6	ND (0.42)	ND (2.0)	10	ND (3.7)	4.1 J	1.3	ND (0.37)	37 J	3.2	ND (0.36)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			MW-2	MW-3		MW-4		PB-252-LINE-1	PB-252-LINE-2	PB-252-LINE-3	PB-252-LINE-4	PB-252-LINE-5	PB-252-LINE-6	PB-252-PER-1	PB-252-PER-2	PB-252-PER-3	PB-252-PER-4	PB-252-PER-5	PB-252-PER-6	PB-252-SUB-1	PB-252-SUB-2	PB-252-SUB-3	PB-826-1
Sample Date			29-May-03	29-May-03	29-May-03	29-May-03	29-May-03	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	7-Sep-04
Sample ID			MW-2(0-2)	MW-3(1.5-2)	MW-3(15.5-16)	MW-4(1.5-2)	MW-4(11.5-12)	PB-252-LINE-1	PB-252-LINE-2	PB-252-LINE-3	PB-252-LINE-4	PB-252-LINE-5	PB-252-LINE-6	PB-252-PER-1	PB-252-PER-2	PB-252-PER-3	PB-252-PER-4	PB-252-PER-5	PB-252-PER-6	PB-252-SUB-1	PB-252-SUB-2	PB-252-SUB-3	826-1
Sample Depth			0 - 2 ft	1.5 - 2 ft	15.5 - 16 ft	1.5 - 2 ft	11.5 - 12 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	6 - 6.5 ft	6 - 6.5 ft	6 - 6.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			WGEL	WGEL	WGEL	WGEL	WGEL	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	LL
Laboratory Work Order			75559	75559	75559	75559	75559	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	074139	911205
Laboratory Sample ID	Units	MSC-PA	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	0706-0440	0706-0441	0706-0442	0706-0437	0706-0438	0706-0439	0706-0428	0706-0429	0706-0430	0706-0431	0706-0432	0706-0433	0706-0434	0706-0435	0706-0436	4347770
Volatile Organic Compounds																							
BENZENE	mg/kg	$290^{A}\ 330^{B}$	0.087 J	ND (0.25)	0.065 J	0.054 J	ND (0.25)	ND (0.280) D	ND (0.210) D	ND (0.220) D	22 D	1.6 D	0.710 D	10 D	2.2 D	0.720 D	1.7 D	2.1 D	4.7 D	ND (0.260) D	4.7 D	ND (0.300) D	ND (0.0019)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	$3.7^{A}\ 4.3^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	$86^{A}\ 98^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	$890^{A}\ 1000^{B}$	-	-	-	-	-	0.150 J D	ND (0.210) D	ND (0.220) D	73 D	63 D	6.7 D	37 D	35 D	23 D	18 D	6.4 D	9.3 D	ND (0.260) D	44 D	ND (0.300) D	ND (0.0019)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	-	-	-	-	-	ND (0.280) D	ND (0.210) D	ND (0.220) D	11 D	9.9 D	14 D	7.5 D	12 D	11 D	6.4 D	2.7 D	2.3 D	ND (0.260) D	11 D	ND (0.300) D	ND (0.0047)
METHYL TERTIARY BUTYL ETHER	mg/kg	$8600^{A}\ 9900^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	$760^{A}\ 190000^{B}$	0.055 J	ND (0.25)	3.4	0.075 J	ND (0.25)	ND (0.280) D	0.170 J D	0.190 J D	49 D	43 D	7.9 D	29 D	4.8 D	29 D	12 D	26 D	3.8 D	0.260 J D	24 D	ND (0.300) D	ND (0.0095)
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	-	-	-	-	-	ND (0.280) D	ND (0.210) D	ND (0.220) D	94 D	51 D	0.450 D	7.5 D	0.420 D	0.590 D	0.720 D	0.300 D	2.7 D	ND (0.260) D	5.2 D	ND (0.300) D	0.0027 J
1,2,4-TRIMETHYLBENZENE	mg/kg	$560^{A}\ 640^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	$8000^{A}\ 9100^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	$3.7^{A}\ 4.3^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	0.29 J	0.35 J	ND (0.36)	0.33 J	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.068
BENZO(A)ANTHRACENE	mg/kg	$130^{A}\ 190000^{B}$	0.73	2.7	ND (0.36)	0.93	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.240
BENZO(A)PYRENE	mg/kg	$12^{A}\ 190000^{B}$	0.80	5.0 D	ND (0.36)	1.1	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.250
BENZO(B)FLUORANTHENE	mg/kg	$76^{A}\ 190000^{B}$	0.69	3.9	ND (0.36)	0.98	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.210
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	0.37 J	1.8	ND (0.36)	0.50	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.420
BENZO(K)FLUORANTHENE	mg/kg	$76^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	$11000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	$6500^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	$760^{A}\ 190000^{B}$	0.73	2.5	ND (0.36)	0.91	ND (0.41)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.230
DIBENZ(A,H)ANTHRACENE	mg/kg	$22^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	$6400^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	$130000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	$130000^{A}\ 190000^{B}$	ND (0.39)	ND (0.37)	0.60	ND (0.39)	ND (0.41)	ND (0.360)	ND (0.360)	ND (0.370)	1.6	2.6	2.1	ND (0.400)	ND (0.380)	ND (0.420)	ND (0.420)	4.2	0.420	ND (0.380)	ND (0.410)	ND (0.430)	0.033 J
INDENO(1,2,3-C,D)PYRENE	mg/kg	$76^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.097
2-METHYLNAPHTHALENE	mg/kg	$13000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	$10000_{s2}^{A}\ 10000_{s2}^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	$160000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	$760^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	$26000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	1.1	0.86	1.4	1.2	ND (0.41)	ND (0.360)	0.550	0.910	2.5	4.4	4.1	7.9 D	0.480	0.230 J	3.9	14 D	1.0	ND (0.380)	ND (0.410)	ND (0.430)	0.390
PHENOL	mg/kg	$16000^{A}\ 18000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	$96000^{A}\ 190000^{B}$	1.2	1.8	ND (0.36)	1.1	0.26 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.780
PYRIDINE	mg/kg	$3200^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	$30^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	$960^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	$2240^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	$64000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	$220^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-826-2	PB-826-3	PB-826-4	PB-826-5	PB-826-6	PB-826-7	PB-826-8	PB-826-9	PB-843 LINE 1	PB-843 LINE 2	PB-843 LINE 3	PB-843 LINE 4	PB-843 LINE 5	PB-843 LINE 6	PB-843 LINE 7	PB-843 LINE 8	PB-843 LINE 9	PB-843 PERIMETER 1	PB-843 PERIMETER 2	PB-843 PERIMETER 3	PB-843 PERIMETER 4
Sample Date			7-Sep-04	7-Sep-04	7-Sep-04	7-Sep-04	7-Sep-04	7-Sep-04	7-Sep-04	7-Sep-04	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06
Sample ID			826-2	826-3	826-4	826-5	826-6	826-7	826-8	826-9	843 Line 1	843 Line 2	843 Line 3	843 Line 4	843 Line 5	843 Line 6	843 Line 7	843 Line 8	843 Line 9	843 Perimeter 1	843 Perimeter 2	843 Perimeter 3	843 Perimeter 4
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order			911205	911205	911205	911205	911205	911205	911205	911205	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265	1003265
Laboratory Sample ID	Units	MSC-PA	4347771	4347772	4347773	4347774	4347775	4347776	4347777	4347778	4851923	4851924	4851925	4851926	4851927	4851928	4851929	4851930	4851931	4851917	4851918	4851919	4851920
Volatile Organic Compounds																							
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.0020)	ND (0.0019)	ND (0.0020)	ND (0.0019)	ND (0.0021)	ND (0.0021)	ND (0.0021)	ND (0.0020)	ND (0.028)	ND (0.028)	ND (0.026)	ND (0.025)	ND (0.027)	ND (0.029)	ND (0.025)	ND (0.027)	0.035 J	ND (0.031)	0.037 J	ND (0.026)	ND (0.024)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	0.0025 J	0.0022 J	ND (0.0020)	ND (0.0019)	ND (0.0021)	ND (0.0021)	0.0048 J	ND (0.0020)	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	ND (0.057)	ND (0.049)	ND (0.055)	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.0049)	ND (0.0048)	ND (0.0050)	ND (0.0049)	ND (0.0052)	ND (0.0052)	ND (0.0052)	ND (0.0050)	0.110 J	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	1.4	ND (0.049)	ND (0.055)	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	0.016 J	0.015 J	ND (0.010)	ND (0.0097)	ND (0.010)	ND (0.010)	ND (0.010)	ND (0.0099)	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	0.067 J	ND (0.049)	ND (0.055)	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	0.0054	0.0043 J	ND (0.0020)	0.0027 J	ND (0.0021)	ND (0.0021)	0.0081	0.0036 J	ND (0.056)	ND (0.055)	ND (0.052)	ND (0.050)	ND (0.055)	ND (0.057)	ND (0.049)	ND (0.055)	ND (0.052)	ND (0.063)	ND (0.055)	ND (0.053)	ND (0.049)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	0.230	0.023 J	0.016	0.0056 J	0.00085 J	ND (0.00071)	0.023 J	0.025	0.140 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	ND (0.037)	ND (0.180)	ND (0.037)	ND (0.040)	0.600	ND (0.038)	ND (0.036)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	0.880	0.110	0.083	0.027	0.0056 J	0.0041 J	0.110	0.048	0.120 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.130 J	0.310	0.340 J	0.087 J	ND (0.040)	0.860	ND (0.038)	ND (0.036)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	0.800	0.160	0.100	0.032	0.0085 J	0.0061 J	0.110	0.047	0.067 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.100 J	0.340	0.400 J	0.065 J	ND (0.040)	0.510	ND (0.038)	ND (0.036)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	0.710	0.130	0.086	0.027	0.0069 J	0.0048 J	0.110	0.047	0.086 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.100 J	0.490	0.620 J	0.099 J	ND (0.040)	0.640	ND (0.038)	ND (0.036)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	1.0	0.280	0.170	0.052	0.013 J	0.011 J	0.170	0.068	ND (0.038)	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	0.280	0.570 J	0.085 J	ND (0.040)	0.230	ND (0.038)	ND (0.036)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	0.820	0.130	0.089	0.028	0.0064 J	0.0053 J	0.098	0.074	0.100 J	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.230 J	0.410	0.470 J	0.110 J	ND (0.040)	0.770	ND (0.038)	ND (0.036)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	0.110 J	ND (0.023)	0.012 J	ND (0.0046)	ND (0.0047)	ND (0.0047)	ND (0.023)	0.021 J	0.390	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	1.0	ND (0.037)	ND (0.180)	ND (0.037)	ND (0.040)	0.300	ND (0.038)	ND (0.036)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	0.500	0.071 J	0.046	0.024	0.0040 J	ND (0.0039)	0.060 J	0.020	ND (0.038)	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	ND (0.078)	0.300	0.400 J	0.054 J	ND (0.040)	0.280	ND (0.038)	ND (0.036)
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	1.5	0.150	0.120	0.031	0.0059 J	0.0051 J	0.130	0.180	0.800	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	2.2	0.140 J	0.260 J	0.160 J	ND (0.040)	2.1	ND (0.038)	ND (0.036)
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	2.4	0.440	0.250	0.076	0.017 J	0.014 J	0.280	0.170	0.310	ND (0.040)	ND (0.040)	ND (0.039)	ND (0.039)	0.370 J	0.490	0.530 J	0.170 J	ND (0.040)	1.5	ND (0.038)	ND (0.036)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-843 PERIMETER 5	PB-843 PERIMETER 6	PB-843 SUB 1	PB-843 SUB 2	PB-843 SUB 3	PB-844 LINE 1	PB-844 LINE 2	PB-844 LINE 3	PB-844 LINE 4	PB-844 LINE 5
Sample Date			23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06
Sample ID			843 Perimeter 5	843 Perimeter 6	843 Sub 1	843 Sub 2	843 Sub 3	844 Line 1	844 Line 2	844 Line 3	844 Line 4	844 Line 5
Sample Depth			3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order			1003265	1003265	1003265	1003265	1003265	1003268	1003268	1003268	1003268	1003268
Laboratory Sample ID	Units	MSC-PA	4851921	4851922	4851932	4851933	4851934	4851944	4851945	4851946	4851947	4851948
Volatile Organic Compounds												
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.024)	ND (0.024)	ND (0.023)	ND (0.024)	ND (0.023)	ND (0.027)	ND (0.026)	ND (0.029)	ND (0.030)	0.034 J
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	ND (0.047)	ND (0.048)	ND (0.045)	ND (0.048)	ND (0.047)	ND (0.055)	ND (0.053)	ND (0.057)	ND (0.060)	ND (0.058)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds												
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.078 J
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.310
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.310
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.320
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.170 J
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.270
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	ND (0.041)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.160 J
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000$_{s2}$^{A} 10000$_{s2}$^{B}	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.230
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	ND (0.036)	ND (0.038)	ND (0.035)	ND (0.037)	ND (0.037)	ND (0.041)	ND (0.037)	ND (0.041)	ND (0.041)	0.290
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
Metals												
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-

Sample Location	PB-844 LINE 6	PB-844 LINE 7	PB-844 LINE 8	PB-844 LINE 9	PB-844 LINE 10	PB-844 PERIMETER 1	PB-844 PERIMETER 2	PB-844 PERIMETER 3	PB-844 PERIMETER 4	PB-844 PERIMETER 5	PB-844 PERIMETER 6
Sample Date	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06	23-Aug-06
Sample ID	844 Line 6	844 Line 7	844 Line 8	844 Line 9	844 Line 10	844 Perimeter 1	844 Perimeter 2	844 Perimeter 3	844 Perimeter 4	844 Perimeter 5	844 Perimeter 6
Sample Depth	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268	1003268
Laboratory Sample ID	4851949	4851950	4851951	4851952	4851953	4851938	4851939	4851940	4851941	4851942	4851943
Volatile Organic Compounds											
BENZENE	ND (0.030)	ND (0.029)	0.067 J	0.035 J	2.4	ND (0.026)	ND (0.029)	ND (0.026)	0.380	ND (0.027)	ND (0.027)
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	ND (0.061)	ND (0.058)	ND (0.054)	0.220 J	8.3	ND (0.052)	ND (0.058)	ND (0.053)	0.320	ND (0.053)	ND (0.054)
ISOPROPYLBENZENE (CUMENE)	ND (0.061)	ND (0.058)	ND (0.054)	0.340	4.2	ND (0.052)	ND (0.058)	ND (0.053)	ND (0.061)	0.073 J	ND (0.054)
METHYL TERTIARY BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-
HEXANE	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	ND (0.061)	ND (0.058)	ND (0.054)	0.950	12	ND (0.052)	ND (0.058)	ND (0.053)	0.130 J	ND (0.053)	ND (0.054)
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	ND (0.061)	ND (0.058)	ND (0.054)	ND (0.054)	ND (0.190)	ND (0.052)	ND (0.058)	ND (0.053)	0.520	ND (0.053)	ND (0.054)
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	ND (0.041)	ND (0.040)	ND (0.040)	ND (0.041)	4.0	0.170 J	0.250	0.150 J	0.920	0.480	0.320
BENZO(A)ANTHRACENE	ND (0.041)	0.057 J	0.110 J	0.170 J	0.540	0.570	0.640	0.530	2.3	0.110 J	0.780
BENZO(A)PYRENE	ND (0.041)	0.054 J	0.110 J	0.200	0.100 J	0.680	0.510	0.500	1.8	0.068 J	0.690
BENZO(B)FLUORANTHENE	ND (0.041)	0.054 J	0.130 J	0.190 J	0.066 J	0.720	0.560	0.530	2.1	0.093 J	0.870
BENZO(G,H,I)PERYLENE	ND (0.041)	ND (0.040)	0.082 J	0.150 J	ND (0.036)	0.440	0.320	0.280	1.0	ND (0.039)	0.420
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	ND (0.041)	0.056 J	0.120 J	0.450	0.560	0.520	0.600	0.490	1.9	0.120 J	0.740
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	ND (0.041)	ND (0.040)	ND (0.040)	0.970	2.2	0.075 J	0.100 J	0.075 J	0.420	1.2	0.150 J
INDENO(1,2,3-C,D)PYRENE	ND (0.041)	ND (0.040)	0.073 J	0.140 J	0.038 J	0.540	0.350	0.320	1.2	0.048 J	0.490
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	ND (0.041)	0.056 J	0.076 J	1.9	4.1	0.550	0.710	0.600	3.0	3.4	1.0
PHENOL	-	-	-	-	-	-	-	-	-	-	-
PYRENE	ND (0.041)	0.069 J	0.140 J	0.320	0.430	0.620	0.900	0.660	3.0	0.380	1.1
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-
Metals											
COBALT	-	-	-	-	-	-	-	-	-	-	-
LEAD	-	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-844 SUB 1	PB-844 SUB 2	PB-844 SUB 3	PB-845 PERIMETER 1	PB-845 PERIMETER 2	PB-845 PERIMETER 3	PB-845 PERIMETER 4	PB-845 PERIMETER 5	PB-845 SUB 1	PB-845 SUB 2	PB-845 SUB 3
Sample Date			23-Aug-06	23-Aug-06	23-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06
Sample ID			844 Sub 1	844 Sub 2	844 Sub 3	845 Perimeter 1	845 Perimeter 2	845 Perimeter 3	845 Perimeter 4	845 Perimeter 5	845 Sub 1	845 Sub 2	845 Sub 3
Sample Depth			5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order			1003268	1003268	1003268	1003270	1003270	1003270	1003270	1003270	1003270	1003270	1003270
Laboratory Sample ID	Units	MSC-PA	4851954	4851955	4851956	4851973	4851974	4851975	4851976	4851977	4851978	4851979	4851980
Volatile Organic Compounds													
BENZENE	mg/kg	290^{A} 330^{B}	0.031 J	ND (0.028)	0.095 J	ND (0.028)	ND (0.026)	ND (0.029)	ND (0.028)	ND (0.029)	ND (0.028)	ND (0.029)	ND (0.027)
CYCLOHEXANE	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	ND (0.057)	ND (0.055)	ND (0.058)	ND (0.054)
ISOPROPYLBENZENE (CUMENE)	mg/kg	$10000^{A,B}$	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	0.180 J	ND (0.055)	ND (0.058)	ND (0.054)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.052)	ND (0.056)	ND (0.054)	ND (0.057)	0.120 J	ND (0.057)	ND (0.056)	1.2	0.067 J	0.310	0.450
BUTYLBENZENE, SEC-	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	$10000^{A,B}$	ND (0.052)	ND (0.056)	0.078 J	ND (0.057)	ND (0.052)	ND (0.057)	ND (0.056)	ND (0.057)	ND (0.055)	ND (0.058)	ND (0.054)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)													
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds													
ACENAPHTHENE	mg/kg	$190000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	$190000^{A,B}$	0.140 J	ND (0.040)	0.078 J	ND (0.040)	1.2	0.430	0.240	ND (0.200)	0.400	0.110 J	0.590
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	0.210	ND (0.040)	0.110 J	ND (0.040)	2.8	1.5	0.750	0.590 J	1.2	0.110 J	0.640
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	0.140 J	ND (0.040)	0.089 J	0.044 J	2.3	1.4	0.680	0.650 J	0.860	0.085 J	0.440
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	0.150 J	ND (0.040)	0.097 J	0.050 J	2.8	1.6	0.880	1.2	1.2	0.120 J	0.650
BENZO(G,H,I)PERYLENE	mg/kg	$190000^{A,B}$	0.073 J	ND (0.040)	0.130 J	0.056 J	1.4	0.840	0.460	0.720 J	0.480	0.051 J	0.250
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	0.200	ND (0.040)	0.150 J	0.068 J	2.8	1.5	0.740	3.1	1.2	0.140 J	0.660
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	$10000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	0.067 J	ND (0.040)	ND (0.039)	ND (0.040)	0.510	0.180 J	0.130 J	0.590 J	0.190 J	0.190 J	0.520
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	0.087 J	ND (0.040)	0.088 J	ND (0.040)	1.4	0.810	0.430	0.480 J	0.530	0.061 J	0.270
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{12}^{A} 10000_{12}	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	$190000^{A,B}$	0.520	ND (0.040)	0.180 J	ND (0.040)	4.3	2.0	0.970	1.8	1.7	0.620	1.9
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	0.370	ND (0.040)	0.170 J	0.057 J	4.4	2.6	1.3	2.0	2.2	0.280	1.3
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-
Metals													
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	$190000^{A,B}$	-	-	-	-	-	-	-	-	-	-	-

Sample Location	PB-845-PER-6	PB-846 LINE 1	PB-846 LINE 2	PB-846 LINE 3	PB-846 LINE 4	PB-846 LINE 5	PB-846 LINE 6	PB-846 LINE 7	PB-846 PERIMETER 1	PB-846 PERIMETER 2
Sample Date	12-Feb-08	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06
Sample ID	PB-845-PER-6	846 Line 1	846 Line 2	846 Line 3	846 Line 4	846 Line 5	846 Line 6	846 Line 7	846 Perimeter 1	846 Perimeter 2
Sample Depth	3 - 3.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order	1077642	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269	1003269
Laboratory Sample ID	5280668	4851963	4851964	4851965	4851966	4851967	4851968	4851972	4851957	4851958
Volatile Organic Compounds										
BENZENE	ND (0.025)	ND (0.026)	ND (0.027)	ND (0.028)	0.037 J	0.220 J	0.120 J	0.029 J	5.0	0.039 J
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	ND (0.050)	ND (0.051)	ND (0.054)	ND (0.055)	ND (0.059)	0.620	ND (0.052)	ND (0.056)	1.8	ND (0.052)
ISOPROPYLBENZENE (CUMENE)	ND (0.050)	ND (0.051)	ND (0.054)	ND (0.055)	0.160 J	0.290	ND (0.052)	ND (0.056)	6.5	ND (0.052)
METHYL TERTIARY BUTYL ETHER	-	-	-	-	-	-	-	-	-	-
HEXANE	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	0.074 J	0.140 J	ND (0.054)	ND (0.055)	0.140 J	0.760	0.062 J	0.100 J	2.3	0.095 J
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-
TOLUENE	ND (0.050)	ND (0.051)	ND (0.054)	ND (0.055)	ND (0.059)	0.120 J	0.100 J	ND (0.056)	0.280	ND (0.052)
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)										
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds										
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	ND (0.036)	0.038 J	ND (0.036)	ND (0.039)	0.120 J	0.160 J	0.240	0.220	2.0	0.086 J
BENZO(A)ANTHRACENE	ND (0.036)	0.066 J	ND (0.036)	ND (0.039)	0.100 J	0.380	0.370	0.580	3.4	0.170 J
BENZO(A)PYRENE	0.052 J	0.050 J	ND (0.036)	ND (0.039)	0.038 J	0.320	0.200	0.490	2.6	0.160 J
BENZO(B)FLUORANTHENE	0.064 J	0.063 J	ND (0.036)	ND (0.039)	0.061 J	0.430	0.300	0.650	3.1	0.260
BENZO(G,H,I)PERYLENE	0.074 J	ND (0.035)	ND (0.036)	ND (0.039)	ND (0.036)	0.210	0.120 J	0.340	1.4	0.200
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-
CHRYSENE	0.064 J	0.067 J	ND (0.036)	ND (0.039)	0.290	0.510	0.850	0.550	4.0	0.280
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-
FLUORENE	ND (0.036)	ND (0.035)	ND (0.036)	ND (0.039)	0.730	0.380	0.550	0.140 J	4.2	0.090 J
INDENO(1,2,3-C,D)PYRENE	0.039 J	ND (0.035)	ND (0.036)	ND (0.039)	ND (0.036)	0.200	0.096 J	0.330	1.4	0.130 J
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	ND (0.036)	0.120 J	ND (0.036)	ND (0.039)	1.9	1.6	1.4	0.730	9.3	0.300
PHENOL	-	-	-	-	-	-	-	-	-	-
PYRENE	0.046 J	0.120 J	0.045 J	ND (0.039)	0.300	0.680	0.880	1.0	4.1	0.350
PYRIDINE	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-
Metals										
COBALT	-	-	-	-	-	-	-	-	-	-
LEAD	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-846 PERIMETER 3	PB-846 PERIMETER 4	PB-846 PERIMETER 5	PB-846 PERIMETER 6	PB-846 SUB 1	PB-846 SUB 2	PB-846 SUB 3	PB-847-1	PB-847-2	PB-847-3
Sample Date			24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	16-Oct-06	16-Oct-06	16-Oct-06
Sample ID			846 Perimeter 3	846 Perimeter 4	846 Perimeter 5	846 Perimeter 6	846 Sub 1	846 Sub 2	846 Sub 3	AST-847-1/0-0.5	AST-847-2/0-0.5	AST-847-3/0-0.5
Sample Depth			3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order			1003269	1003269	1003269	1003269	1003269	1003269	1003269	1010396	1010396	1010396
Laboratory Sample ID	Units	MSC-PA	4851959	4851960	4851961	4851962	4851969	4851970	4851971	4892823	4892824	4892825
Volatile Organic Compounds												
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.027)	ND (0.028)	ND (0.026)	0.120 J	ND (0.025)	ND (0.025)	0.027 J	ND (0.028)	ND (0.028)	ND (0.027)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.054)	ND (0.057)	ND (0.052)	0.063 J	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.054)	ND (0.057)	ND (0.052)	0.063 J	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	0.160 J	ND (0.057)	ND (0.052)	1.1	ND (0.049)	ND (0.050)	0.160 J	ND (0.056)	ND (0.057)	ND (0.054)
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	ND (0.054)	ND (0.057)	ND (0.052)	ND (0.052)	ND (0.049)	ND (0.050)	ND (0.053)	ND (0.056)	ND (0.057)	ND (0.054)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	-	-	-	ND (0.056)	ND (0.057)	ND (0.054)
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds												
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	1.5	0.190 J	ND (0.039)	2.0	ND (0.038)	ND (0.036)	1.6	ND (0.036)	0.061 J	ND (0.038)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	3.9	1.3	ND (0.039)	3.5	ND (0.038)	ND (0.036)	3.8	ND (0.036)	0.170 J	ND (0.038)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	3.3	1.4	ND (0.039)	2.4	ND (0.038)	ND (0.036)	2.9	ND (0.036)	0.180 J	ND (0.038)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	4.4	1.8	ND (0.039)	3.2	ND (0.038)	ND (0.036)	3.6	0.046 J	0.160 J	ND (0.038)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	1.8	0.630	ND (0.039)	1.4	ND (0.038)	ND (0.036)	2.0	ND (0.036)	0.091 J	ND (0.038)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	3.6	1.1	ND (0.039)	3.4	ND (0.038)	ND (0.036)	3.7	0.079 J	0.130 J	ND (0.038)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	0.570	0.110 J	ND (0.039)	1.7	ND (0.038)	ND (0.036)	1.1	ND (0.036)	ND (0.038)	ND (0.038)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	1.9	0.730	ND (0.039)	1.4	ND (0.038)	ND (0.036)	1.8	ND (0.036)	0.091 J	ND (0.038)
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	4.9	0.690	ND (0.039)	9.1	ND (0.038)	ND (0.036)	6.2	0.043 J	0.300	ND (0.038)
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	6.3	1.1	ND (0.039)	7.2	ND (0.038)	ND (0.036)	6.4	0.050 J	0.310	ND (0.038)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-
Metals												
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	268	185	177
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-

Sample Location	PB-847-4	PB-847-5	PB-847-6	PB-848 LINE 1	PB-848 LINE 2	PB-848 LINE 3	PB-848 LINE 6	PB-848 LINE 7	PB-848 PERIMETER 1	PB-848 PERIMETER 2	PB-848 PERIMETER 3
Sample Date	16-Oct-06	16-Oct-06	16-Oct-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06
Sample ID	AST-847-4/0-0.5	AST-847-5/0-0.5	AST-847-6/0-0.5	848 Line 1	848 Line 2	848 Line 3	848 Line 6	848 Line 7	848 Perimeter 1	848 Perimeter 2	848 Perimeter 3
Sample Depth	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order	1010396	1010396	1010396	1003263	1003263	1003263	1003263	1003263	1003263	1003263	1003263
Laboratory Sample ID	4892826	4892827	4892828	4851888	4851889	4851890	4851891	4851892	4851884	4851885	4851886
Volatile Organic Compounds											
BENZENE	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.025)	ND (0.028)	ND (0.027)	ND (0.028)	0.100 J	ND (0.028)	ND (0.027)	ND (0.027)
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	ND (0.057)	ND (0.055)	ND (0.056)	ND (0.050)	ND (0.055)	ND (0.054)	ND (0.055)	0.260 J	ND (0.055)	ND (0.053)	ND (0.053)
ISOPROPYLBENZENE (CUMENE)	ND (0.057)	ND (0.055)	ND (0.056)	ND (0.050)	ND (0.055)	ND (0.054)	0.810	4.6	ND (0.055)	ND (0.053)	0.150 J
METHYL TERTIARY BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-
HEXANE	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	ND (0.057)	ND (0.055)	0.063 J	ND (0.050)	ND (0.055)	0.071 J	ND (0.055)	ND (0.055)	ND (0.055)	ND (0.053)	0.059 J
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	ND (0.057)	ND (0.055)	ND (0.056)	ND (0.050)	ND (0.055)	ND (0.054)	ND (0.055)	ND (0.055)	ND (0.055)	ND (0.053)	ND (0.053)
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (0.057)	ND (0.055)	ND (0.056)	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	ND (0.039)	ND (0.038)	ND (0.039)	ND (0.180)	ND (0.037)	ND (0.039)	0.110 J	0.350	ND (0.040)	ND (0.040)	0.060 J
BENZO(A)ANTHRACENE	ND (0.039)	ND (0.038)	ND (0.039)	ND (0.180)	0.075 J	ND (0.039)	0.071 J	0.160 J	ND (0.040)	ND (0.040)	ND (0.039)
BENZO(A)PYRENE	ND (0.039)	ND (0.038)	ND (0.039)	0.230 J	0.058 J	ND (0.039)	ND (0.041)	0.140 J	ND (0.040)	ND (0.040)	ND (0.039)
BENZO(B)FLUORANTHENE	ND (0.039)	0.043 J	ND (0.039)	ND (0.180)	0.067 J	ND (0.039)	ND (0.041)	0.120 J	ND (0.040)	ND (0.040)	ND (0.039)
BENZO(G,H,I)PERYLENE	ND (0.039)	ND (0.038)	ND (0.039)	ND (0.180)	0.059 J	ND (0.039)	ND (0.041)	0.067 J	ND (0.040)	ND (0.040)	ND (0.039)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	ND (0.039)	0.048 J	ND (0.039)	0.360 J	0.083 J	ND (0.039)	0.160 J	0.530	ND (0.040)	ND (0.040)	0.150 J
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	ND (0.039)	ND (0.038)	ND (0.039)	ND (0.180)	ND (0.037)	ND (0.039)	0.510	1.3	ND (0.040)	ND (0.040)	0.590
INDENO(1,2,3-C,D)PYRENE	ND (0.039)	ND (0.038)	ND (0.039)	ND (0.180)	0.044 J	ND (0.039)	ND (0.041)	0.059 J	ND (0.040)	ND (0.040)	ND (0.039)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	ND (0.039)	0.081 J	ND (0.039)	ND (0.180)	0.048 J	ND (0.039)	0.870	3.1	ND (0.040)	ND (0.040)	0.880
PHENOL	-	-	-	-	-	-	-	-	-	-	-
PYRENE	ND (0.039)	0.085 J	ND (0.039)	ND (0.180)	0.100 J	0.042 J	0.150 J	0.440	ND (0.040)	ND (0.040)	0.120 J
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-
Metals											
COBALT	-	-	-	-	-	-	-	-	-	-	-
LEAD	35.1	154	15.8	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-848 PERIMETER 6	PB-848 SUB 1	PB-848 SUB 2	PB-848 SUB 3	PB-848-LINE-4	PB-848-LINE-5	PB-848-LINE-8	PB-848-LINE-9	PB-848-LINE-10	PB-848-LINE-11
Sample Date			24-Aug-06	24-Aug-06	24-Aug-06	24-Aug-06	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07	30-May-07
Sample ID			848 Perimeter 6	848 Sub 1	848 Sub 2	848 Sub 3	PB-848-LINE-4	PB-848-LINE-5	PB-848-LINE-8	PB-848-LINE-9	PB-848-LINE-10	PB-848-LINE-11
Sample Depth			3 - 3.5 ft	5 - 5.5 ft	5 - 5.5 ft	5 - 5.5 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft	5.5 - 6 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	PIP	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order			1003263	1003263	1003263	1003263	074146	074146	074146	074146	074146	074146
Laboratory Sample ID	Units	MSC-PA	4851887	4851893	4851894	4851895	0706-0480	0706-0479	0706-0481	0706-0482	0706-0483	0706-0486
Volatile Organic Compounds												
BENZENE	mg/kg	290^A 330^B	ND (0.028)	ND (0.030)	ND (0.027)	20	ND (0.190) D	ND (0.300) D	ND (0.270) D	ND (0.180) D	ND (0.150) D	ND (0.160) D
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^A 4.3^B	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^A 98^B	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^A 1000^B	ND (0.057)	ND (0.059)	ND (0.055)	46	ND (0.190) D	ND (0.300) D	1.7 D	0.200 D	0.690 D	0.084 J D
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.057)	ND (0.059)	ND (0.055)	8.9	8.5 D	0.940 D	8.6 D	0.900 D	2.5 D	ND (0.160) D
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^A 9900^B	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^A 190000^B	ND (0.057)	ND (0.059)	ND (0.055)	4.9	ND (0.190) D	ND (0.300) D	0.330 D	0.900 D	0.280 D	0.300 D
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	ND (0.057)	ND (0.059)	ND (0.055)	1.5	ND (0.190) D	ND (0.300) D	ND (0.270) D	0.140 J D	ND (0.150) D	0.100 J D
1,2,4-TRIMETHYLBENZENE	mg/kg	560^A 640^B	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^A 9100^B	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^A 4.3^B	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds												
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	ND (0.039)	ND (0.040)	ND (0.041)	0.210	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
BENZO(A)ANTHRACENE	mg/kg	130^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
BENZO(A)PYRENE	mg/kg	12^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
BENZO(B)FLUORANTHENE	mg/kg	76^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
BENZO(K)FLUORANTHENE	mg/kg	76^A 190000^B	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^A 190000^B	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^A 10000^B	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^A 190000^B	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^A 190000^B	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^A 190000^B	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	2.2	0.750	ND (0.430)	0.830	0.480	0.660	0.380 J
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
2-METHYLNAPHTHALENE	mg/kg	13000^A 190000^B	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^A 10000_{s2}^B	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^A 190000^B	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^A 190000^B	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^A 190000^B	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.039)	ND (0.040)	ND (0.041)	1.9	1.7	ND (0.430)	1.5	0.790	1.5	ND (0.400)
PHENOL	mg/kg	16000^A 18000^B	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^A 190000^B	ND (0.039)	ND (0.040)	ND (0.041)	ND (0.039)	ND (0.430)	ND (0.430)	ND (0.410)	ND (0.420)	ND (0.430)	ND (0.400)
PYRIDINE	mg/kg	3200^A 10000^B	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^A 10000^B	-	-	-	-	-	-	-	-	-	-
Metals												
COBALT	mg/kg	960^A 190000^B	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^A 190000^B	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^A 190000^B	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^A 190000^B	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-

Sample Location	PB-848-LINE-12	PB-848-LINE-13	PB-848-PER-4	PB-848-PER-5	PB-849-LINE-1	PB-849-LINE-2	PB-849-LINE-3	PB-849-LINE-4	PB-849-PER1	PB-849-PER2	PB-849-PER3
Sample Date	30-May-07	30-May-07	30-May-07	30-May-07	4-Sep-07	4-Sep-07	4-Sep-07	4-Sep-07	25-May-07	25-May-07	25-May-07
Sample ID	PB-848-LINE-12	PB-848-LINE-13	PB-848-PER-4	PB-848-PER-5	PB-849-LINE-1	PB-849-LINE-2	PB-849-LINE-3	PB-849-LINE-4	PB-849-PER1	PB-849-PER2	PB-849-PER3
Sample Depth	5.5 - 6 ft	5.5 - 6 ft	3 - 3.5 ft	3 - 3.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	3 - 3.5 ft	3 - 3.5 ft	3 - 3.5 ft
Sampling Company	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order	074146	074146	074146	074146	076851	076851	076851	076851	074095	074095	074095
Laboratory Sample ID	0706-0485	0706-0484	0706-0487	0706-0488	0709-0937	0709-0938	0709-0939	0709-0940	0705-4528	0705-4529	0705-4530
Volatile Organic Compounds											
BENZENE	ND (0.330) D	0.130 J D	0.930 D	ND (0.180) D	ND (0.0056)	ND (0.0061)	0.0046 J	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	0.240 J D	0.160 J D	0.270 D	ND (0.180) D	ND (0.0056)	ND (0.0061)	ND (0.0061)	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D
ISOPROPYLBENZENE (CUMENE)	0.410 D	ND (0.210) D	0.630 D	ND (0.180) D	ND (0.0056)	ND (0.0061)	ND (0.0061)	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D
METHYL TERTIARY BUTYL ETHER	-	-	-	-	-	-	-	-	-	-	-
HEXANE	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	1.9 D	ND (0.210) D	ND (0.180) D	ND (0.180) D	0.0039 J	0.0020 J	0.0036 J	0.0020 J	ND (0.180) D	ND (0.160) D	ND (0.290) D
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	ND (0.330) D	ND (0.210) D	ND (0.180) D	ND (0.180) D	ND (0.0056)	ND (0.0061)	0.0047 J	ND (0.0058)	ND (0.180) D	ND (0.160) D	ND (0.290) D
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)											
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds											
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
BENZO(A)ANTHRACENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
BENZO(A)PYRENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
BENZO(B)FLUORANTHENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
BENZO(G,H,I)PERYLENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	ND (0.420)	ND (0.390)	10 D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
INDENO(1,2,3-C,D)PYRENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	ND (0.420)	ND (0.390)	13 D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
PHENOL	-	-	-	-	-	-	-	-	-	-	-
PYRENE	ND (0.420)	ND (0.390)	ND (2.3) D	ND (0.370)	ND (3.7) D	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.400)	ND (0.400)	ND (0.400)
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-
Metals											
COBALT	-	-	-	-	-	-	-	-	-	-	-
LEAD	-	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-849-PER4	PB-849-PER5	PB-849-SUB1	PB-880-1	PB-880-2	PB-880-3	PB-880-4	PB-880-5	PB-880-6	PB-880-7	PB-880-8	PB-880-9	PB-880-10	PB-880-11	PB-880-12	PB-880-13	PB-880-14	PB-880-SURFACE	PB-881-1_2004	PB-881-2_2004	PB-881-3_2004
Sample Date			25-May-07	25-May-07	25-May-07	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	8-Apr-04	24-Apr-04	24-Apr-04	24-Apr-04	24-Apr-04	24-Apr-04	7-Sep-04	8-Apr-04	22-Jul-04	22-Jul-04	22-Jul-04
Sample ID			PB-849-PER4	PB-849-PER5	PB-849-SUB1	880-1	880-2	880-3	880-4	880-5	880-6	880-7	880-8	880-9	880-10	880-11	880-12	880-13	880-14	880-Surface	881-1	881-2	881-3
Sample Depth			3 - 3.5 ft	3 - 3.5 ft	5 - 5.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	9999 - 9999 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			PIP	PIP	PIP	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL
Laboratory Work Order			074095	074095	074095	891702	891702	891702	891702	891702	891702	891702	891702	893279	893279	893279	893279	893279	911206	891702	904975	904975	904975
Laboratory Sample ID	Units	MSC-PA	0705-4531	0705-4532	0705-4533	4252250	4252251	4252252	4252253	4252254	4252255	4252256	4252257	4259682	4259683	4259684	4259685	4259686	4347780	4252259	4316677	4316678	4316679
Volatile Organic Compounds																							
BENZENE	mg/kg	290[A] 330[B]	ND (0.160) D	ND (0.150) D	ND (0.310) D	0.420	ND (0.012)	ND (0.013)	0.140	0.220	ND (0.012)	0.018 J	0.580	3.1	0.330	1.1	0.034 J	8.0	0.014	36	ND (0.0012)	0.011	ND (0.020)
CYCLOHEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86[A] 98[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890[A] 1000[B]	ND (0.160) D	ND (0.150) D	ND (0.310) D	1.0	ND (0.023)	ND (0.027)	0.660	1.3	ND (0.025)	ND (0.024)	1.2	13	0.720	6.3	0.150 J	3.3	ND (0.024)	41	ND (0.0012)	0.023	0.300
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000[AB]	ND (0.160) D	ND (0.150) D	ND (0.310) D	0.350	ND (0.023)	ND (0.027)	0.270	0.490	ND (0.025)	ND (0.024)	0.390	4.6	0.300	2.7	0.069 J	1.6	0.031	13	ND (0.0031)	0.084	0.850
METHYL TERTIARY BUTYL ETHER	mg/kg	8600[A] 9900[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	ND (0.160) D	ND (0.150) D	ND (0.310) D	2.0	ND (0.023)	ND (0.027)	1.1	2.1	ND (0.025)	0.038 J	1.4	22	1.3	13	0.410	10	0.220	52	ND (0.0061)	ND (1.2)	3.4
BUTYLBENZENE, SEC-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000[AB]	ND (0.160) D	ND (0.150) D	ND (0.310) D	2.7	ND (0.023)	ND (0.027)	1.3	2.4	0.034 J	0.030 J	3.2	29	1.7	12	0.260 J	24	0.037	140	0.0024 J	0.032	0.250
1,2,4-TRIMETHYLBENZENE	mg/kg	560[A] 640[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000[A] 9100[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7[A] 4.3[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000[AB]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.220 J	ND (0.040)	ND (0.390)	0.740 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.021 J	3.6 J	0.019	0.057	0.170 J
BENZO(A)ANTHRACENE	mg/kg	130[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.160 J	ND (0.040)	ND (0.390)	0.520 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.063	ND (0.360)	0.077	0.018 J	ND (0.073)
BENZO(A)PYRENE	mg/kg	12[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.170 J	ND (0.040)	ND (0.390)	0.590 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.099	ND (0.360)	0.091	0.021 J	ND (0.110)
BENZO(B)FLUORANTHENE	mg/kg	76[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.200 J	ND (0.040)	ND (0.390)	0.680 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.085	0.880 J	0.067	0.019 J	ND (0.150)
BENZO(G,H,I)PERYLENE	mg/kg	190000[AB]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.100 J	ND (0.040)	ND (0.390)	ND (0.440)	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.100	ND (0.360)	0.120	ND (0.016)	ND (0.150)
BENZO(K)FLUORANTHENE	mg/kg	76[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.200 J	ND (0.040)	ND (0.390)	1.0 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.085	2.1 J	0.075	0.065 J	ND (0.740)
DIBENZ(A,H)ANTHRACENE	mg/kg	22[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	0.460 J	ND (0.039)	ND (0.410)	0.340 J	0.570	ND (0.040)	ND (0.390)	1.9 J	ND (2.0)	1.4 J	2.8 J	ND (2.0)	ND (2.0)	0.026 J	12	0.0057 J	0.069 J	0.240 J
INDENO(1,2,3-C,D)PYRENE	mg/kg	76[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	ND (0.190)	ND (0.039)	ND (0.410)	ND (0.200)	0.100 J	ND (0.040)	ND (0.390)	ND (0.440)	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (0.020)	ND (0.360)	0.043	ND (0.020)	ND (0.180)
2-METHYLNAPHTHALENE	mg/kg	13000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}[A] 10000_{s2}[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000[AB]	ND (0.370)	ND (0.400)	ND (0.420)	0.860 J	ND (0.039)	ND (0.410)	0.590 J	1.2	ND (0.040)	ND (0.390)	4.1 J	4.1 J	3.3 J	5.9 J	ND (2.0)	2.0 J	0.160	28	0.096	0.250	0.610 J
PHENOL	mg/kg	16000[A] 18000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000[A] 190000[B]	ND (0.370)	ND (0.400)	ND (0.420)	0.200 J	ND (0.039)	ND (0.410)	ND (0.200)	0.360 J	ND (0.040)	ND (0.390)	1.3 J	ND (2.0)	ND (1.0)	ND (2.0)	ND (2.0)	ND (2.0)	0.190	3.1 J	0.210	0.120 J	0.390 J
PYRIDINE	mg/kg	3200[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30[A] 10000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	960[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220[A] 190000[B]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000[AB]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-881-4_2004	PB-881-5_2004	PB-881-6_2004	PB-881-7_2004	PB-884-SS-1	PB-884-SS-2	PB-885-CS-1	PB-885-CS-2	PB-885-CS-3	PB-885-CS-4	PB-885-CS-5	PB-885-CS-6	PB-885-CS-7	PB-885-CS-8	PB-885-CS-9	PB-885-CS-10	PB-885-CS-11	PB-885-CS-12	PB-885-CS-13	PB-885-CS-14	PB-885-CS-15
Sample Date			22-Jul-04	22-Jul-04	22-Jul-04	22-Jul-04	30-Nov-06	30-Nov-06	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07	14-Mar-07
Sample ID			881-4	881-5	881-6	881-7	AST-884-SS-1	AST-884-SS-2	AST-885-CS-1	AST-885-CS-2	AST-885-CS-3	AST-885-CS-4	AST-885-CS-5	AST-885-CS-6	AST-885-CS-7	AST-885-CS-8	AST-885-CS-9	AST-885-CS-10	AST-885-CS-11	AST-885-CS-12	AST-885-CS-13	AST-885-CS-14	AST-885-CS-15
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR
Laboratory			LL	LL	LL	LL	LL	LL	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP	PIP
Laboratory Work Order			904975	904975	904975	904975	1016430	1016430	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076	072076
Laboratory Sample ID	**Units**	**MSC-PA**	4316680	4316681	4316682	4316683	4929240	4929241	0703-3400	0703-3399	0703-3397	0703-3396	0703-3395	0703-3394	0703-3393	0703-3392	0703-3391	0703-3390	0703-3389	0703-3388	0703-3398	0703-3402	0703-3403
Volatile Organic Compounds																							
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.0011)	ND (0.180)	ND (0.320)	ND (0.200)	ND (0.031)	0.055 J	ND (0.096) D	0.550 D	0.065 J D	0.190 D	0.110 D	ND (0.092) D	ND (0.100) D	ND (0.110) D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.0011)	ND (0.180)	ND (0.320)	ND (0.500)	0.740	ND (0.059)	0.110 D	1.6 D	0.440 D	1.7 D	1.8 D	ND (0.092) D	0.510 D	0.340 D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.0028)	5.8	ND (0.810)	2.9	0.490	ND (0.059)	0.054 J D	0.440 D	0.480 D	1.1 D	1.1 D	ND (0.092) D	0.350 D	0.250 D	0.110 J D	0.099 D	0.089 J D	ND (0.094) D	ND (0.094) D	ND (0.089) D	ND (0.096) D
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	0.013	31	20	18	2.7	ND (0.059)	0.520 D	1.4 D	4.1 D	4.6 D	4.3 D	0.190 D	1.2 D	0.740 D	0.210 D	0.100 D	ND (0.095) D	0.160 D	0.480 D	ND (0.089) D	ND (0.096) D
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	0.0027 J	1.7	ND (0.320)	0.330 J	0.120 J	ND (0.059)	ND (0.096) D	1.1 D	0.610 D	3.4 D	3.3 D	ND (0.092) D	0.230 D	0.100 J D	ND (0.110) D	ND (0.090) D	ND (0.095) D	ND (0.094) D	0.050 J D	ND (0.089) D	ND (0.096) D
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	-	-	-	-	6.4	ND (0.059)	2.1 D	7.9 D	18 D	21 D	22 D	0.810 D	7.3 D	3.1 D	1.0 D	0.150 D	ND (0.095) D	ND (0.094) D	1.9 D	ND (0.089) D	ND (0.096) D
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	ND (0.035)	0.890	0.360 J	0.240 J	0.045 J	ND (0.040)	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.450
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	0.078 J	ND (0.140)	ND (0.140)	ND (0.069)	0.073 J	0.140 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.760
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	ND (0.120)	ND (0.220)	ND (0.210)	ND (0.100)	0.081 J	0.140 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.460
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.150)	ND (0.290)	ND (0.290)	ND (0.140)	0.088 J	0.150 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.680
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.150)	ND (0.290)	ND (0.290)	ND (0.140)	0.058 J	0.096 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	ND (0.120)	ND (0.220)	ND (0.210)	ND (0.100)	0.100 J	0.150 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	0.560
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.230)	1.8 J	ND (0.430)	0.490 J	0.390	ND (0.040)	ND (0.390)	0.490	3.3	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	ND (0.190)	ND (0.360)	ND (0.360)	ND (0.170)	0.047 J	0.100 J	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	ND (0.400)
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.120)	4.2	0.660 J	1.1	0.660	0.170 J	0.600	0.610	3.9	ND (0.380)	2.5	0.720	ND (0.410)	1.9	1.2	ND (0.400)	ND (0.410)	0.500	1.2	ND (0.430)	1.6
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	ND (0.270)	1.6 J	0.920 J	0.540 J	0.110 J	0.240	ND (0.390)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.380)	ND (0.420)	ND (0.410)	ND (0.450)	ND (0.450)	ND (0.400)	ND (0.410)	ND (0.380)	ND (0.380)	ND (0.430)	1.1
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																							
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			PB-885-SS-1	PB-885-SS-2	PB-885-SS-3	PB-885-SS-4	PB-885-SS-5	PB-885-SS-6	PB-885-SS-7	PB-885-SS-8	PB-885-SS-9	PB-885-SS-10	PB-881-1_2005	PB-881-2_2005	PB-881-3_2005	PB-881-4_2005	PB-881-5_2005	PB-881-6_2005	S-39D		S-119D	S-216
Sample Date			30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	30-Nov-06	26-Oct-05	26-Oct-05	26-Oct-05	26-Oct-05	26-Oct-05	26-Oct-05	21-Jan-16	8-Feb-16	1-Apr-05	25-Mar-05
Sample ID			AST-885-SS-1	AST-885-SS-2	AST-885-SS-3	AST-885-SS-4	AST-885-SS-5	AST-885-SS-6	AST-885-SS-7	AST-885-SS-8	AST-885-SS-9	AST-885-SS-10	881-1	881-2	881-3	881-4	881-5	881-6	AOI4-S-39D-1.5-2-20160121	AOI4-S39D-7.5-8.0-20160208	BHS119D-040105-1-1.5	BH-S216-032505-1-1.5
Sample Depth			0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	0 - 0.5 ft	1.5 - 2 ft	7.5 - 8 ft	1 - 1.5 ft	1 - 1.5 ft
Sampling Company			SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	SECOR	STANTEC	STANTEC	UNKNOWN	UNKNOWN
Laboratory			LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	LL	LL
Laboratory Work Order			1016432	1016432	1016432	1016432	1016432	1016432	1016432	1016432	1016432	1016432	965084	965084	965084	965084	965084	965084	JC13070	JC14123	UNKNOWN	UNKNOWN
Laboratory Sample ID	Units	MSC-PA	4929243	4929244	4929245	4929246	4929247	4929248	4929249	4929250	4929251	4929252	4634610	4634611	4634612	4634613	4634614	4634615	JC13070-1	JC14123-2	4495328	4491372
Volatile Organic Compounds																						
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.028)	0.100 J	ND (0.033)	0.068 J	0.350	2.6	0.160 J	ND (0.035)	ND (0.029)	0.110 J	ND (0.023)	ND (0.028)	ND (0.025)	ND (0.027)	ND (0.027)	ND (0.024)	ND (0.00065)	ND (0.00068)	ND (0.005)	ND (0.005)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0013)	-	ND (0.005)	ND (0.005)
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.057)	2.1	ND (0.065)	ND (0.052)	3.4	13	2.4	ND (0.069)	ND (0.059)	2.2	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.057)	1.2	ND (0.065)	ND (0.052)	1.7	5.4	2.9	ND (0.069)	0.110 J	1.2	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0026)	ND (0.0027)	ND (0.005)	ND (0.005)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.057)	4.8	ND (0.065)	0.110 J	5.6	15	11	ND (0.069)	0.550	6.5	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0065)	ND (0.0068)	-	-
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	ND (0.057)	1.6	ND (0.065)	0.100 J	3.3	26	3.4	ND (0.069)	ND (0.059)	0.850	ND (0.045)	ND (0.056)	ND (0.051)	ND (0.053)	ND (0.054)	ND (0.047)	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0026)	ND (0.0027)	-	-
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0026)	ND (0.0027)	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	ND (0.057)	21	ND (0.065)	4.4	27	97	66	ND (0.069)	1.8	17	-	-	-	-	-	-	ND (0.0013)	ND (0.0014)	ND (0.005)	ND (0.005)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	ND (0.180)	ND (0.200)	ND (0.038)	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.200 J	ND (0.210)	ND (0.037)	ND (0.039)	ND (0.039)	ND (0.041)	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	ND (0.180)	ND (0.200)	0.076 J	ND (0.180)	ND (0.200)	ND (0.200)	0.220 J	ND (0.200)	0.490 J	ND (0.210)	0.200	0.046 J	ND (0.039)	0.058 J	ND (0.041)	0.044 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	ND (0.180)	ND (0.200)	0.069 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.220 J	0.360 J	ND (0.210)	ND (0.037)	0.060 J	ND (0.039)	0.049 J	0.050 J	0.058 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.180)	ND (0.200)	0.075 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.240 J	0.460 J	ND (0.210)	ND (0.037)	0.042 J	ND (0.039)	0.047 J	0.061 J	0.057 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.180)	ND (0.200)	0.046 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.260 J	ND (0.210)	ND (0.037)	0.065 J	0.057 J	ND (0.041)	0.053 J	0.078 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	ND (0.180)	ND (0.200)	0.077 J	ND (0.180)	ND (0.200)	ND (0.200)	0.220 J	ND (0.200)	0.550 J	ND (0.210)	0.150 J	0.140 J	ND (0.039)	0.087 J	0.051 J	0.064 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.180)	ND (0.200)	ND (0.038)	ND (0.180)	ND (0.200)	1.2	1.2	ND (0.200)	0.470 J	1.2	0.069 J	ND (0.039)	ND (0.039)	ND (0.041)	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	ND (0.180)	ND (0.200)	0.046 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	ND (0.200)	0.300 J	ND (0.210)	ND (0.037)	ND (0.039)	0.052 J	ND (0.041)	ND (0.041)	0.042 J	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.180)	0.880 J	0.120 J	0.500 J	1.5	2.0	2.3	ND (0.200)	1.4	2.0	0.130 J	0.058 J	ND (0.039)	0.059 J	ND (0.041)	ND (0.039)	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	0.180 J	ND (0.200)	0.092 J	ND (0.180)	ND (0.200)	ND (0.200)	ND (0.200)	0.240 J	0.820 J	ND (0.210)	0.110 J	0.100 J	0.054 J	0.098 J	0.081 J	0.082 J	ND (0.035)	ND (0.034)	ND (0.380)	ND (0.380)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49.5	5.2	24.9	60.8
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

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Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			S-217	S-218D		S-219	S-220	S-221	S-222	S-223	S-224	S-229	S-282	S-364			S-365			S-366		
Sample Date			1-Apr-05	14-Jan-16	5-Feb-16	25-Mar-05	1-Apr-05	25-Mar-05	4-Aug-05	4-Aug-05	4-Aug-05	25-Mar-05	27-Apr-10	4-Mar-13	4-Mar-13	19-Mar-13	4-Mar-13	4-Mar-13	18-Mar-13	5-Mar-13	5-Mar-13	15-Mar-13
Sample ID			BH-S217-040105-1-1.5	AOI4-S218D-6-6.5-20160114	AOI4-S218D-0.5-1.0-20160205	BH-S219-032505-1-1.5	BH-S220-040105-1-1.5	BH-S221-032505-1.5-2	BH-S222-080405-1-1.5	BH-S223-080405-1.5-2	BH-S224-080405-1-1.5	BH-S229-032505-1.5-2	S-282_1-2	AOI4_S-364_.5-1_30413	AOI4_S-364_4-5_30413	S-364 @ 19'_031913	S-365_0-2'	S-365_4-6'	S-365 @ 12'-14'_031813	AOI4_S-366_0-1_30513	AOI4_S-366_4.5-5.5_30513	S-366@14-16_031513
Sample Depth			1 - 1.5 ft	6 - 6.5 ft	0.5 - 1 ft	1 - 1.5 ft	1 - 1.5 ft	1.5 - 2 ft	1 - 1.5 ft	1.5 - 2 ft	1 - 1.5 ft	1.5 - 2 ft	1 - 2 ft	0.5 - 1 ft	4 - 5 ft	18.5 - 19 ft	0 - 2 ft	4 - 6 ft	12 - 14 ft	0 - 1 ft	4.5 - 5.5 ft	14 - 16 ft
Sampling Company			UNKNOWN	STANTEC	STANTEC	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	LANGAN	LANGAN	UNKNOWN	UNKNOWN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN
Laboratory			LL	ACCUTEST	ACCUTEST	LL	LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order			UNKNOWN	JC12759	JC14123	UNKNOWN	UNKNOWN	UNKNOWN	954311	954311	954311	UNKNOWN	1192441	JB30309	JB30309	JB31794	JB30306	JB30306	JB31733	JB30425	JB30425	JB31583
Laboratory Sample ID	Units	MSC-PA	4495326	JC12759-2	JC14123-1	4491369	4495327	4491370	4578229	4578230	4578231	4491371	5966981	JB30309-1	JB30309-2	JB31794-5	JB30306-4	JB30306-5	JB31733-15	JB30425-4	JB30425-5	JB31583-12
Volatile Organic Compounds																						
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.005)	0.0114	ND (0.00055)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	0.189 J	0.241	ND (0.00055)	0.0269	0.00040 J	ND (0.00090)	ND (0.0011)	0.00041 J
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	ND (0.005)	ND (0.0011)	-	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	ND (0.00057)	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	ND (0.005)	ND (0.0011)	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	ND (0.00057)	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	ND (0.005)	0.207	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	1.43	0.140	ND (0.00055)	0.0085	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.005)	0.0880	ND (0.0022)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.0037)	0.755 J	2.36	ND (0.0028)	0.0063	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	ND (0.005)	ND (0.0011)	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	0.014	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	0.00024 J	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	0.195 J	ND (0.0055)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	ND (0.005)	0.0234	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	ND (0.21)	ND (0.10)	ND (0.00055)	0.0025	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	-	1.17	ND (0.0022)	-	-	-	-	-	-	-	ND (0.004)	ND (0.0037)	4.30	ND (0.50)	ND (0.0028)	0.0025 J	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	-	0.434	ND (0.0022)	-	-	-	-	-	-	-	ND (0.004)	ND (0.0037)	1.88	ND (0.50)	ND (0.0028)	0.0027 J	ND (0.0053)	ND (0.0045)	ND (0.0053)	ND (0.0056)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	ND (0.005)	0.418	ND (0.0011)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.006)	ND (0.005)	ND (0.005)	ND (0.004)	ND (0.00074)	2.25	0.222	ND (0.00055)	0.0098	ND (0.0011)	ND (0.00090)	ND (0.0011)	ND (0.0011)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	ND (0.400)	ND (0.038)	0.0207 J	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	ND (0.033)	0.356	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	ND (0.400)	ND (0.038)	0.0748	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.490	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0200 J	0.841	ND (0.034)	0.0154 J	ND (0.040)	ND (0.10)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	ND (0.400)	ND (0.038)	0.0952	ND (0.400)	ND (0.410)	0.460	ND (0.190)	ND (0.230)	0.550	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0242 J	0.825	ND (0.034)	0.0169 J	ND (0.040)	ND (0.10)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	ND (0.400)	ND (0.038)	0.106	ND (0.400)	ND (0.410)	0.560	ND (0.190)	ND (0.230)	0.700	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0350	0.802	ND (0.034)	0.0177 J	ND (0.040)	ND (0.10)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.400)	ND (0.038)	0.0794	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.430	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0292 J	0.545	ND (0.034)	0.0212 J	ND (0.040)	ND (0.10)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	ND (0.400)	ND (0.038)	0.0966	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	0.490	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	0.0279 J	0.983	ND (0.034)	0.0139 J	ND (0.040)	ND (0.10)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	ND (0.400)	0.231	ND (0.039)	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	0.0934	ND (0.033)	0.386	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000_{s2}^{A} 10000_{s2}^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.400)	2.44	0.0317 J	ND (0.400)	ND (0.410)	ND (0.390)	ND (0.190)	ND (0.230)	ND (0.190)	ND (0.370)	ND (0.200)	ND (0.035)	ND (0.041)	ND (0.039)	ND (0.033)	0.314	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.400)	0.371	0.110	ND (0.400)	0.460	0.390	ND (0.190)	ND (0.230)	0.300	ND (0.370)	ND (0.200)	ND (0.035)	0.0402 J	0.172	ND (0.033)	2.18	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	ND (0.400)	0.0220 J	0.127	ND (0.400)	ND (0.410)	0.530	ND (0.190)	ND (0.230)	0.900	ND (0.370)	ND (0.200)	0.0237 J	0.0243 J	0.0583	0.0295 J	1.97	ND (0.034)	ND (0.035)	ND (0.040)	ND (0.10)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																						
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	10.2	13.3	500	8.99	7.58	102	143	18.2	192	16.7	87.3	13.0	15.2	18.5	79.1	222	4.2	14.2	10.9	4.3
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			S-367			S-368			S-369					S-370			S-371				S-373
Sample Date			5-Mar-13	13-Mar-13	13-Mar-13	5-Mar-13	5-Mar-13	14-Mar-13	4-Mar-13	4-Mar-13	4-Mar-13	2-Apr-13	2-Apr-13	1-Mar-13	1-Mar-13	22-Apr-13	4-Mar-13	4-Mar-13	4-Mar-13	1-Apr-13	19-Mar-13
Sample ID			S-367_0-2'	S-367_031313@6'	S-367@14'_031313	AOI4_S-368_0-1_30513	AOI4_S-368_6-7_30513	S-368@14'_031413	S-369_0-2'	S-369_6-8'	S-369_8-10'	S-369@11'_04022013	S-369@32'_04022013	S-370-0-2	S-370-8-10	S-370 @ 14'_04222013	AOI4_S-371_1-1.5_30413	AOI4_S-371_2-3_30413	AOI4_S-371_7.5-8.5_30413	S-371_18-20_40113	AOI4-S-373_4-6'
Sample Depth			0 - 2 ft	5.5 - 6 ft	13.5 - 14 ft	0 - 1 ft	6 - 7 ft	13.5 - 14 ft	0 - 2 ft	6 - 8 ft	8 - 10 ft	10.5 - 11 ft	31.5 - 32 ft	0 - 2 ft	8 - 10 ft	13.5 - 14 ft	1 - 1.5 ft	2 - 3 ft	7.5 - 8.5 ft	18 - 20 ft	4 - 6 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	UNKNOWN
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST
Laboratory Work Order			JB30425	JB31583	JB31583	JB30425	JB30425	JB31583	JB30306	JB30306	JB30306	JB33050	JB33050	JB30169	JB30169	JB35091	JB30309	JB30309	JB30309	JB32976	JB31794
Laboratory Sample ID	Units	MSC-PA	JB30425-1	JB31583-13	JB31583-14	JB30425-6	JB30425-7	JB31583-15	JB30306-1	JB30306-2	JB30306-3	JB33050-1	JB33050-2	JB30169-9	JB30169-10	JB35091-1	JB30309-3	JB30309-4	JB30309-5	JB32976-1	JB31794-4
Volatile Organic Compounds																					
BENZENE	mg/kg	290^{A} 330^{B}	ND (0.00055)	ND (0.095)	0.00054 J	ND (0.0010)	ND (0.11)	ND (0.0011)	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	4.40	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	1.25
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	ND (0.00055)	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	ND (0.10)	ND (0.0011)	ND (0.058)	-	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	ND (0.11)
1,2-DICHLOROETHANE (EDC)	mg/kg	86^{A} 98^{B}	ND (0.00055)	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	ND (0.10)	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	ND (0.11)
ETHYLBENZENE	mg/kg	890^{A} 1000^{B}	0.00081	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	0.0059	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	1.25	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	2.12
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	0.0135	0.431 J	0.0170	ND (0.0052)	ND (0.53)	0.0026 J	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	3.29	ND (0.0056)	0.950	0.558	ND (0.0050)	ND (0.0046)	ND (0.0055)	0.393 J	0.718
METHYL TERTIARY BUTYL ETHER	mg/kg	8600^{A} 9900^{B}	ND (0.00055)	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	ND (0.10)	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	ND (0.11)
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	mg/kg	10000^{AB}	0.00067	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	ND (0.0011)	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	0.165	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	0.339
1,2,4-TRIMETHYLBENZENE	mg/kg	560^{A} 640^{B}	0.00059 J	ND (0.47)	ND (0.0058)	ND (0.0052)	ND (0.53)	0.0767	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	0.445 J	ND (0.0056)	0.0314 J	0.0887 J	ND (0.0050)	ND (0.0046)	ND (0.0055)	ND (0.57)	2.56
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	0.00027 J	ND (0.47)	ND (0.0058)	ND (0.0052)	ND (0.53)	0.0316	ND (0.0031)	ND (0.0025)	ND (0.0033)	ND (0.0048)	0.800	ND (0.0056)	ND (0.29)	ND (0.53)	ND (0.0050)	ND (0.0046)	ND (0.0055)	ND (0.57)	2.88
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	8000^{A} 9100^{B}	0.0050	ND (0.095)	ND (0.0012)	ND (0.0010)	ND (0.11)	0.0075	ND (0.00062)	ND (0.00050)	ND (0.00065)	ND (0.00095)	0.617	ND (0.0011)	ND (0.058)	ND (0.11)	ND (0.0010)	ND (0.00091)	ND (0.0011)	ND (0.11)	3.76
Volatile Organic Compounds (SW8011)																					
1,2-DIBROMOETHANE (EDB)	mg/kg	3.7^{A} 4.3^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0029)	-	-	-	-	-
Semi-Volatile Organic Compounds																					
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	mg/kg	190000^{AB}	0.209	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.0934	ND (0.041)	ND (0.036)	0.145	ND (0.037)	ND (0.039)	ND (0.039)	0.0676	ND (0.039)
BENZO(A)ANTHRACENE	mg/kg	130^{A} 190000^{B}	0.468	ND (0.11)	ND (0.10)	0.0324 J	ND (0.073)	ND (0.12)	0.0178 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0356	ND (0.041)	ND (0.036)	ND (0.12)	0.0313 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)
BENZO(A)PYRENE	mg/kg	12^{A} 190000^{B}	0.402	ND (0.11)	ND (0.10)	0.0368	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0353 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)
BENZO(B)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	0.409	ND (0.11)	ND (0.10)	0.0379	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0326 J	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	0.346	ND (0.11)	ND (0.10)	0.0288 J	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	ND (0.035)	ND (0.041)	ND (0.036)	ND (0.12)	0.0655	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)
BENZO(K)FLUORANTHENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	mg/kg	11000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	6500^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	mg/kg	760^{A} 190000^{B}	0.729	ND (0.11)	ND (0.10)	0.0358 J	ND (0.073)	ND (0.12)	0.0182 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0477	ND (0.041)	ND (0.036)	ND (0.12)	0.0390	ND (0.039)	ND (0.039)	ND (0.039)	ND (0.039)
DIBENZ(A,H)ANTHRACENE	mg/kg	22^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	mg/kg	6400^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	mg/kg	130000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	mg/kg	130000^{A} 190000^{B}	0.394	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.402	ND (0.041)	1.23	0.548	ND (0.037)	ND (0.039)	ND (0.039)	0.831	0.221
INDENO(1,2,3-C,D)PYRENE	mg/kg	76^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	mg/kg	13000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	10000$_{s2}^{A}$ 10000$_{s2}^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	mg/kg	160000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	mg/kg	760^{A} 190000^{B}	ND (0.036)	ND (0.11)	ND (0.10)	ND (0.036)	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	2.04	ND (0.041)	ND (0.036)	0.295	ND (0.037)	ND (0.039)	ND (0.039)	ND (0.039)	0.362
4-NITROPHENOL	mg/kg	26000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	mg/kg	190000^{AB}	0.839	ND (0.11)	ND (0.10)	0.0205 J	ND (0.073)	ND (0.12)	ND (0.037)	ND (0.037)	ND (0.037)	ND (0.040)	0.720	ND (0.041)	2.21	1.20	0.0298 J	ND (0.039)	ND (0.039)	0.901	0.590
PHENOL	mg/kg	16000^{A} 18000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	mg/kg	96000^{A} 190000^{B}	1.04	ND (0.11)	ND (0.10)	0.0401	ND (0.073)	ND (0.12)	0.0260 J	ND (0.037)	ND (0.037)	ND (0.040)	0.0898	ND (0.041)	0.201	0.107 J	0.0404	ND (0.039)	ND (0.039)	0.0273 J	ND (0.039)
PYRIDINE	mg/kg	3200^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	mg/kg	30^{A} 10000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals																					
COBALT	mg/kg	960^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	mg/kg	2240^{A} 190000^{B}	258	6.3	2.6	44.3	64.0	5.5	10.5	9.5	22.2	10.7	4.4	9.9	9.9	14.7	102	103	8.4	2.6	8.5
NICKEL	mg/kg	64000^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	mg/kg	220^{A} 190000^{B}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location			S-379			S-380		S-381				S-408		S-415		S-416	
Sample Date			28-Feb-13	28-Feb-13	28-Feb-13	1-Mar-13	1-Mar-13	15-Mar-13	15-Mar-13	24-Apr-13	24-Apr-13	9-Oct-15	23-Oct-15	12-Oct-15	12-Oct-15	20-Jun-16	11-Jul-16
Sample ID			S-379_0-2'	S-379_4-5'	S-379_8-9'	S-380_0-2'	S-380_8-10	AOI4-S-381_0-.5_31513	AOI4-S-381_2-3_31513	S-381 @ 12'_04242013	S-381 @ 24'_04252013	AOI4_S-408_0-2_100915	AOI4_S-408_14-16_102315	AOI4_S-415_0-2_101215	AOI4_S-415_16-18_101215	AOI4-S-416-0-2-20160620	AOI4-S-416-14-15-20160711
Sample Depth			0 - 2 ft	4 - 5 ft	8 - 9 ft	0 - 2 ft	8 - 10 ft	0 - 0.5 ft	2 - 3 ft	11.5 - 12 ft	23.5 - 24 ft	0 - 2 ft	14 - 16 ft	0 - 2 ft	16 - 18 ft	0 - 2 ft	14 - 15 ft
Sampling Company			LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ESC	ESC
Laboratory Work Order			JB30168	JB30168	JB30168	JB30169	JB30169	JB31583	JB31583	JB35319	JB35319	JC5896	JC7021	JC6121	JC6121	L842835	L846805
Laboratory Sample ID	Units	MSC-PA	JB30168-1	JB30168-2	JB30168-3	JB30169-11	JB30169-12	JB31583-6	JB31583-7	JB35319-1	JB35319-2	JC5896-2	JC7021-1	JC6121-1	JC6121-2	L842835-03	L846805-03
Volatile Organic Compounds																	
BENZENE	mg/kg	$290^{A}\ 330^{B}$	ND (0.00088)	0.00024 J	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	0.242 J	0.0403	1.11	0.00051	0.0016	0.0013	ND (0.25)	0.00315	ND (0.00112)
CYCLOHEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	0.00791
1,2-DIBROMOETHANE (EDB)	mg/kg	$3.7^{A}\ 4.3^{B}$	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	ND (0.59)	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
1,2-DICHLOROETHANE (EDC)	mg/kg	$86^{A}\ 98^{B}$	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	ND (0.59)	ND (0.00089)	ND (0.50)	ND (0.00099)	ND (0.00091)	ND (0.0010)	ND (0.51)	ND (0.00118)	ND (0.00112)
ETHYLBENZENE	mg/kg	$890^{A}\ 1000^{B}$	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	5.54	0.0021	0.439 J	0.00037 J	0.00032 J	ND (0.0010)	ND (0.51)	ND (0.00118)	ND (0.00112)
ISOPROPYLBENZENE (CUMENE)	mg/kg	10000^{AB}	ND (0.0044)	ND (0.0044)	ND (0.0022)	ND (0.0045)	ND (0.0030)	ND (0.0051)	1.97 J	0.0033 J	11.7	0.00022 J	ND (0.0018)	ND (0.0021)	5.65	ND (0.0118)	ND (0.0112)
METHYL TERTIARY BUTYL ETHER	mg/kg	$8600^{A}\ 9900^{B}$	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	ND (0.59)	ND (0.00089)	ND (0.50)	ND (0.00099)	ND (0.00091)	ND (0.0010)	ND (0.51)	ND (0.00118)	ND (0.00112)
HEXANE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0118)	ND (0.0112)
NAPHTHALENE	mg/kg	$760^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
BUTYLBENZENE, TERT-	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.00118)	ND (0.00112)
TOLUENE	mg/kg	10000^{AB}	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	0.419 J	0.0076	0.200 J	0.00045 J	0.00067 J	0.00035 J	ND (0.51)	ND (0.00591)	ND (0.00562)
1,2,4-TRIMETHYLBENZENE	mg/kg	$560^{A}\ 640^{B}$	ND (0.0044)	ND (0.0044)	ND (0.0022)	ND (0.0045)	ND (0.0030)	ND (0.0051)	29.9	0.0032 J	0.518 J	0.0016 J	0.00036 J	ND (0.0021)	ND (1.0)	ND (0.00118)	ND (0.00112)
1,3,5-TRIMETHYLBENZENE	mg/kg	10000^{AB}	ND (0.0044)	ND (0.0044)	ND (0.0022)	ND (0.0045)	ND (0.0030)	ND (0.0051)	11.9	ND (0.0045)	0.543 J	0.00039 J	ND (0.0018)	ND (0.0021)	ND (1.0)	`	ND (0.00112)
XYLENES, TOTAL (DIMETHYLBENZENE)	mg/kg	$8000^{A}\ 9100^{B}$	ND (0.00088)	ND (0.00089)	ND (0.00045)	ND (0.00090)	ND (0.00060)	ND (0.0010)	17.7	0.0056	1.01	0.0026	0.0020	0.00070 J	ND (0.51)	ND (0.00355)	ND (0.00337)
Volatile Organic Compounds (SW8011)																	
1,2-DIBROMOETHANE (EDB)	mg/kg	$3.7^{A}\ 4.3^{B}$	-	-	-	-	-	-	-	ND (0.0029)	ND (0.0029)	ND (0.0029)	ND (0.0029)	ND (0.0028)	ND (0.0026)	-	-
Semi-Volatile Organic Compounds																	
ACENAPHTHENE	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
ANTHRACENE	mg/kg	190000^{AB}	ND (0.035)	0.0977	ND (0.041)	ND (0.035)	ND (0.041)	0.0439 J	ND (0.12)	ND (0.11)	1.79	0.0486	ND (0.036)	0.0698	0.156	ND (0.0390)	0.0505
BENZO(A)ANTHRACENE	mg/kg	$130^{A}\ 190000^{B}$	ND (0.035)	0.223	ND (0.041)	ND (0.035)	ND (0.041)	0.143	ND (0.12)	ND (0.11)	ND (0.12)	0.0951	ND (0.036)	0.249	0.0595	ND (0.0390)	0.137
BENZO(A)PYRENE	mg/kg	$12^{A}\ 190000^{B}$	ND (0.035)	0.194	ND (0.041)	ND (0.035)	ND (0.041)	0.0854 J	ND (0.12)	ND (0.11)	ND (0.12)	0.0836	ND (0.036)	0.316	0.0379	ND (0.0390)	0.104
BENZO(B)FLUORANTHENE	mg/kg	$76^{A}\ 190000^{B}$	ND (0.035)	0.225	ND (0.041)	ND (0.035)	ND (0.041)	0.143	ND (0.12)	ND (0.11)	ND (0.12)	0.123	ND (0.036)	0.395	0.0258 J	0.0446	0.130
BENZO(G,H,I)PERYLENE	mg/kg	190000^{AB}	ND (0.035)	0.120	ND (0.041)	ND (0.035)	ND (0.041)	0.0814 J	ND (0.12)	ND (0.11)	ND (0.12)	0.0966	ND (0.036)	0.228	0.0143 J	ND (0.0390)	0.0548
BENZO(K)FLUORANTHENE	mg/kg	$76^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	0.0489
1,1'-BIPHENYL	mg/kg	$11000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
BIS(2-ETHYLHEXYL) PHTHALATE	mg/kg	$6500^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
DI-N-BUTYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
CHRYSENE	mg/kg	$760^{A}\ 190000^{B}$	ND (0.035)	0.229	ND (0.041)	ND (0.035)	ND (0.041)	0.158	ND (0.12)	ND (0.11)	0.0624 J	0.138	ND (0.036)	0.245	0.0736	ND (0.0390)	0.118
DIBENZ(A,H)ANTHRACENE	mg/kg	$22^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
DIETHYL PHTHALATE	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
2,4-DIMETHYLPHENOL	mg/kg	10000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
2,4-DINITROPHENOL	mg/kg	$6400^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
FLUORANTHENE	mg/kg	$130000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0419	0.252 OE
FLUORENE	mg/kg	$130000^{A}\ 190000^{B}$	ND (0.035)	0.0430	ND (0.041)	ND (0.035)	ND (0.041)	ND (0.12)	ND (0.12)	ND (0.11)	5.02	ND (0.038)	ND (0.036)	0.0196 J	0.536	ND (0.0390)	ND (0.0371)
INDENO(1,2,3-C,D)PYRENE	mg/kg	$76^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	0.0516
2-METHYLNAPHTHALENE	mg/kg	$13000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0390)	ND (0.0371)
CRESOL, M,P- (3&4-METHYLPHENOL)	mg/kg	$10000_{s2}^{A}\ 10000_{s2}^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
CRESOL, O- (2-METHYLPHENOL)	mg/kg	$160000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
NAPHTHALENE	mg/kg	$760^{A}\ 190000^{B}$	ND (0.035)	0.0194 J	ND (0.041)	ND (0.035)	ND (0.041)	ND (0.12)	1.18	ND (0.11)	5.48	0.0766	ND (0.036)	0.0651	ND (0.035)	ND (0.0390)	ND (0.0371)
4-NITROPHENOL	mg/kg	$26000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
PHENANTHRENE	mg/kg	190000^{AB}	ND (0.035)	0.296	ND (0.041)	ND (0.035)	ND (0.041)	0.598	ND (0.12)	ND (0.11)	13.0	0.246	ND (0.036)	0.254	1.04	ND (0.0390)	0.164
PHENOL	mg/kg	$16000^{A}\ 18000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
PYRENE	mg/kg	$96000^{A}\ 190000^{B}$	ND (0.035)	0.351	ND (0.041)	ND (0.035)	ND (0.041)	0.381	ND (0.12)	ND (0.11)	1.11	0.234	ND (0.036)	0.329	0.143	ND (0.0390)	0.219
PYRIDINE	mg/kg	$3200^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374)
QUINOLINE	mg/kg	$30^{A}\ 10000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.394)	ND (0.374) OE
Metals																	
COBALT	mg/kg	$960^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	6.02	5.04
LEAD	mg/kg	$2240^{A}\ 190000^{B}$	1.5 J	206	10	24.3	8.1	***25800*** ^{A}	2650	8.5	5.6	1560	6.8	241	3.9	86.2	63.5
NICKEL	mg/kg	$64000^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	20.9	11.3
VANADIUM	mg/kg	$220^{A}\ 190000^{B}$	-	-	-	-	-	-	-	-	-	-	-	-	-	46.4	26.3
ZINC	mg/kg	190000^{AB}	-	-	-	-	-	-	-	-	-	-	-	-	-	175	60.7

See notes on last page

Table 3-3
Soil Analytical Results Summary - Direct Contact MSCs
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Notes:

MSC-PA	Pennsylvania Department of Environmental Protection- Medium-Specific Concentration (MSC)
A	MSCs Direct Contact - Non-Residential Surface Soil (0-2 ft). Lead value is the site-specific standard.
B	MSCs Direct Contact - Non-Residential Subsurface Soil (2-15 ft)
6.5 [A]	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Indicates the laboratory method detection limit (if available) was above the applicable standard. The reporting limit is shown if the laboratory method detection limit is not available.
ND (0.03)	Indicates concentration not detected above the laboratory reporting limit (in parentheses) except when the reporting limit is greater than the standard in which case the method detection limit is listed in parentheses.
-	Parameter not analyzed / not available.
s2	Cresol, m&p (3-Methylphenol & 4-Methylphenol) co-elute and are reported as the summation of the co-eluting compounds. Standards shown are the stricter of the two.
B	Indicates the analyte is detected in the associated blank as well as in the sample.
D	Indicates an identified compound in an analysis that has been diluted. This flag alerts the data user to any differences between the concentrations reported in the two analyses.
I	Matrix Interference.
J	Indicates an estimated value.
OE	The associated batch QC was outside the established quality control range for precision/accuracy.
ft	Feet
bgs	Below ground surface
mg/kg	milligrams per kilogram
LL	Eurofins Lancaster Laboratories Environmental
PIP	Pace Analytical Services, Inc.
WGEL	The Washington Group Enviornmental Laboratory

Table 3-4
Summary of PADEP Open Storage Tank Incidents
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Release/ Incident Date	PADEP Incident ID	Sunoco Tank Number or Release Location	PADEP Tank Number	PADEP Tank Number Under PES	Quantity Released (gallons)	Product Description	Incident Status
3/16/2000	6229	PB 843	111A	NA	Unknown	Crude Oil/Water	Additional characterization work not required. SCR/RACR submitted.
5/29/2002	6227	PB 846	114A	NA	3600	Recovered Oil	Additional characterization work not required. SCR/RACR submitted.
9/3/2005	35654	PB 881	120A	011A	252	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
9/3/2006	37051	PB 847	115A	055A	42	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
10/15/2006	37107	PB 885	124A	059A	239,274	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
6/25/2007	38093	PB 848	116A	NA	Unknown[1]	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
6/28/2007	38094	PB 252	055A	NA	Unknown[1]	#2 Fuel Oil	Additional characterization work not required. SCR/RACR submitted.
1/7/2008	45998	PB 844	112A	NA	Unknown[1]	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
3/26/1993	45961	PB 823	097A	047A	630	Hydrocracker Gas Oil	Additional characterization work not required. SCR/RACR submitted.
10/10/1996	6226	PB 842	110A	NA	Unknown[2]	Crude Oil	Additional characterization work not required. SCR/RACR submitted.
8/27/1998	45966	PB 253	056A	042A	5040	Diesel Feul	Additional characterization work not required. SCR/RACR submitted.

Notes:
1. The incident ID was assigned due to a Statewide Health Standard exceedance during tank closure assessment.
2. The incident was assigned due to deficiency in the tank integrity noted during tank removal.
NA = not available / not applicable

Table 4-1
Existing Well Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Former Well ID[2]	Well Status/ Description	Northing[3]	Easting[3]	Well Type[4]	Hydrostratigraphic Unit[5]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[1]							
											Well Completion Depth (ft bgs)[6]	Well Diameter (in)[7]	Top of Inner Casing Elevation (ft NAVD88)[8]	Ground Surface Elevation (ft NAVD88)[8]	Top of Screen Elevation (ft NAVD88)[8]	Bottom of Screen Elevation (ft NAVD88)[8]	Depth to Screen (ft bgs)[6]	Screen Length (ft)[9]
AOI 4	AS-9			NA	NA	Piezometer	unconfined	Y	Y	15-Feb-82	33.25	3	19.51	NA	NA	NA	23.25	10
AOI 4	MW-1			220715.37	2684313.64	MW	unconfined	N	Y	29-May-03	20	NA	16.38	13.68	11.18	-3.82	2.5	15
AOI 4	MW-3		Destroyed	220543.28	2684079.10	Temporary Well Point	NA	N	Y	29-May-03	20	NA	16.9	14.94	11.94	-3.06	3	15
AOI 4	MW-4		Destroyed	220728.90	2684127.40	Temporary Well Point	NA	N	Y	29-May-03	16	NA	14.87	14.11	7.11	-2.89	7	10
AOI 4	PH-66		Destroyed	NA	NA	MW	NA	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
AOI 4	PH-67		Destroyed	NA	NA	MW	NA	N	N	NA	NA	NA	NA	NA	NA	NA	NA	NA
AOI 4	RW-700			218992.45	2684981.92	RW	unconfined	Y	Y	27-Aug-10	38	4	18.0079	19.248	6.248	-13.752	13	20
AOI 4	RW-701			218971.72	2684953.13	RW	unconfined	Y	Y	25-Aug-10	37	4	18.2698	19.338	12.338	-12.662	7	25
AOI 4	RW-702			218950.61	2684925.93	RW	unconfined	Y	Y	25-Aug-10	39	4	20.955	21.24	7.24	-12.76	14	20
AOI 4	RW-703			218926.35	2684901.74	RW	unconfined	Y	Y	24-Aug-10	34	4	20.6167	21.613	12.613	-7.387	9	20
AOI 4	RW-704			218911.61	2684874.65	RW	unconfined	Y	Y	25-Aug-10	26	4	20.2297	22.131	16.131	-3.869	6	20
AOI 4	RW-705			218913.48	2685079.75	RW	unconfined	Y	Y	5-Oct-10	38	4	15.9171	16.91	8.91	-16.09	8	25
AOI 4	RW-706			218860.52	2685031.83	RW	unconfined	Y	Y	4-Oct-10	39.5	4	15.8917	16.813	7.313	-17.687	9.5	25
AOI 4	RW-707			218852.31	2685021.12	RW	unconfined	Y	Y	31-Aug-10	36.5	4	16.2939	16.828	5.328	-14.672	11.5	20
AOI 4	RW-708			218831.23	2685001.28	RW	unconfined	Y	Y	2-Sep-10	38	4	15.487	16.765	3.765	-16.235	13	20
AOI 4	RW-709			218811.61	2684982.04	RW	unconfined	Y	Y	2-Sep-10	38	4	15.3001	16.522	3.522	-16.478	13	20
AOI 4	RW-710			218789.95	2684962.50	RW	unconfined	Y	Y	7-Sep-10	37	4	15.8815	16.711	4.711	-15.289	12	20
AOI 4	RW-711			218781.92	2684954.78	RW	unconfined	Y	Y	21-Sep-10	41	4	15.4917	16.715	5.715	-19.285	11	25
AOI 4	RW-712			218762.11	2684935.88	RW	unconfined	Y	Y	21-Sep-10	39	4	15.5572	16.676	7.676	-17.324	9	25
AOI 4	RW-713			218747.90	2684924.04	RW	unconfined	Y	Y	7-Sep-10	37	4	15.0175	16.589	4.589	-15.411	12	20
AOI 4	RW-714			218727.60	2684903.44	RW	unconfined	Y	Y	8-Sep-10	37	4	15.2073	16.474	4.474	-15.526	12	20
AOI 4	RW-715			218705.63	2684883.28	RW	unconfined	Y	Y	15-Sep-10	40	4	15.3694	16.864	6.864	-18.136	10	25
AOI 4	RW-716			218684.36	2684863.56	RW	unconfined	Y	Y	16-Sep-10	40	4	15.5448	16.905	6.905	-18.095	10	25
AOI 4	RW-717			218663.44	2684843.76	RW	unconfined	Y	Y	17-Sep-10	40	4	15.6121	16.863	6.863	-18.137	10	25
AOI 4	S-26	SM-33		218758.26	2684615.95	MW	unconfined	Y	N	17-Dec-84	24	NA	20.76	17.6	NA	NA	NA	NA
AOI 4	S-27	SM-42		219121.70	2684393.05	MW	unconfined	Y	Y	19-Mar-85	34.75	NA	24.607	24.478	NA	NA	NA	30
AOI 4	S-28	SM-29	Damaged	219583.40	2684391.35	MW	unconfined	Y	N	17-Dec-84	25	NA	25.74	22.66	NA	NA	NA	NA
AOI 4	S-29	59		219694.79	2684380.20	MW	unconfined	Y	Y	8-Dec-86	40	NA	23.3	21.83	3.83	-18.17	18	22
AOI 4	S-30			219702.61	2684379.56	RW	unconfined	N	N	NA	NA	NA	23.13	21.64	NA	NA	NA	NA
AOI 4	S-31	SM-53	Damaged	219592.26	2684202.25	MW	unconfined	Y	N	31-Jul-85	25	NA	21.297	21.279	NA	NA	NA	NA
AOI 4	S-32	SM-27		219917.06	2684135.82	MW	unconfined	Y	N	17-Dec-84	25	NA	24.2	21.29	NA	NA	NA	NA
AOI 4	S-33	SM-54	Destroyed	220311.98	2684149.27	MW	NA	Y	N	30-Jul-85	28	NA	21.45	21.25	NA	NA	NA	NA
AOI 4	S-34	PN-1		220356.69	2684176.99	MW	unconfined	Y	Y	25-May-87	29	6	20.894	20.893	3.893	-6.107	17	10
AOI 4	S-35	PN-2		220363.97	2684236.72	MW	unconfined	Y	Y	28-May-87	29	6	20.941	21.552	4.552	-5.448	17	10
AOI 4	S-36	SM-34		220366.09	2684276.10	MW	unconfined	Y	N	18-Dec-84	21.5	NA	24.23	21.91	NA	NA	NA	NA
AOI 4	S-37	SM-25	Destroyed	220370.42	2684325.96	MW	NA	Y	N	17-Dec-85	30	NA	25.9	23.42	NA	NA	NA	NA
AOI 4	S-38	SM-31		219183.83	2685232.49	MW	unconfined	Y	N	19-Dec-84	23.2	NA	18.95	15.97	NA	NA	NA	NA
AOI 4	S-39	AS-7		220133.11	2685582.26	MW	unconfined	Y	Y	4-Feb-84	37	3	22.88	21.35	-3.65	-15.15	25	11.5
AOI 4	S-39D			220137.681	2685551.203	MW	lower aquifer	Y	Y	24-Feb-16	132	4	24.51	21.9	-100.1	-110.1	122	10
AOI 4	S-40	SM-55		220733.63	2685637.31	MW	unconfined	Y	N	31-Jul-85	28	NA	24.46	21.67	NA	NA	NA	NA
AOI 4	S-55	SM-20	Destroyed	221232.26	2684841.22	MW	NA	Y	N	17-Dec-84	19.6	NA	15.98	12.93	NA	NA	NA	NA
AOI 4	S-56	62		220723.49	2684592.77	MW	unconfined	Y	Y	13-Dec-86	29	2	15	13.45	-0.55	-15.55	14	15
AOI 4	S-57	SM-24		220382.65	2683745.49	MW	unconfined	Y	N	18-Dec-84	14	NA	12.5	10.13	NA	NA	NA	NA
AOI 4	S-58	RW-1		NA	NA	RW	NA	Y	Y	23-Jun-87	33	NA	NA	NA	NA	NA	10	20
AOI 4	S-67	SM-22		NA	NA	MW	NA	Y	N	18-Dec-84	20	NA	NA	NA	NA	NA	NA	NA
AOI 4	S-96			220718.53	2684857.12	MW	unconfined	N	N	NA	NA	NA	19.77	NA	NA	NA	NA	NA
AOI 4	S-97			219546.08	2684857.01	MW	unconfined	Y	Y	4-Apr-94	35	4	27.951	28.74	8.74	-6.26	20	15
AOI 4	S-102			221406.75	2683873.83	MW	unconfined	Y	Y	17-Oct-95	20	2	18.22	15.63	10.63	-4.37	5	15
AOI 4	S-103			221274.57	2684427.94	MW	unconfined	Y	Y	17-Oct-95	25	2	26.11	23.55	13.55	-1.45	10	15

Table 4-1
Existing Well Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Former Well ID[2]	Well Status/ Description	Northing[3]	Easting[3]	Well Type[4]	Hydrostratigraphic Unit[5]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[1]									
											Well Completion Depth (ft bgs)[6]	Well Diameter (in)[7]	Top of Inner Casing Elevation (ft NAVD88)[8]	Ground Surface Elevation (ft NAVD88)[8]	Top of Screen Elevation (ft NAVD88)[8]	Bottom of Screen Elevation (ft NAVD88)[8]	Depth to Screen (ft bgs)[6]	Screen Length (ft)[9]
AOI 4	S-104			221448.27	2684803.51	MW	unconfined	Y	Y	17-Oct-95	20	2	18.56	15.63	5.63	-4.37	10	10
AOI 4	S-111		Destroyed	220875.56	2684175.79	MW	NA	Y	Y	23-Jul-96	39.58	2	NA	NA	NA	NA	4.5	35
AOI 4	S-115		Destroyed	NA	NA	MW	NA	N	N	NA	NA	NA	NA	18.43	NA	NA	NA	NA
AOI 4	S-119	MW-E		220752.86	2685393.24	MW	unconfined	Y	Y	15-Aug-02	34	4	26.6	23.82	9.82	-10.18	14	20
AOI 4	S-120	MW-F		220402.98	2685596.68	MW	unconfined	Y	Y	16-Aug-02	30	4	19.82	16.47	6.47	-13.53	10	20
AOI 4	S-121	MW-G		220221.94	2685120.47	MW	unconfined	Y	Y	22-Aug-02	30	4	21.12	18.53	8.53	-11.47	10	20
AOI 4	S-122	MW-H		219646.60	2685442.91	MW	unconfined	Y	Y	19-Aug-02	34.6	4	25.71	22.92	7.92	-12.08	15	20
AOI 4	S-123	MW-I		219320.35	2684990.32	MW	unconfined	Y	Y	20-Aug-02	30	4	22.13	19.23	9.23	-10.77	10	20
AOI 4	S-124	MW-J		218884.83	2685003.67	MW	unconfined	Y	Y	22-Aug-02	30	4	23.2	20.46	10.46	-9.54	10	20
AOI 4	S-216			220866.96	2684617.94	MW	unconfined	Y	Y	19-Apr-05	26	4	15.76	14.57	3.57	-11.43	11	15
AOI 4	S-217		Destroyed	220147.23	2683893.13	MW	NA	Y	Y	29-Mar-05	27	4	11.53	8.87	-3.13	-18.13	12	15
AOI 4	S-218			220121.84	2684500.98	MW	unconfined	Y	Y	20-Apr-05	30	4	25.74	22.46	7.46	-7.54	15	15
AOI 4	S-218D			220117.664	2684511.91	MW	lower aquifer	Y	Y	1-Feb-16	96	4	24.52	21.85	-64.15	-74.15	86	10
AOI 4	S-219			219892.00	2684850.33	MW	unconfined	Y	Y	25-Mar-05	27	4	23.09	19.88	7.88	-7.12	12	15
AOI 4	S-220			219151.90	2684262.28	MW	unconfined	Y	Y	20-Apr-05	30	4	20.81	18.5	3.5	-11.5	15	15
AOI 4	S-221			219006.13	2684933.43	MW	unconfined	Y	Y	21-Apr-05	30	4	23	20.02	5.02	-9.98	15	15
AOI 4	S-222			218676.91	2684861.78	MW	unconfined	Y	Y	9-Jun-05	28	4	16.29	16.89	3.89	-11.11	13	15
AOI 4	S-223			218858.53	2685063.59	MW	unconfined	Y	Y	8-Jun-05	30	4	15.88	16.48	1.48	-13.52	15	15
AOI 4	S-224			218991.35	2685158.16	MW	unconfined	Y	Y	6-Jun-05	32	4	16.03	16.53	4.53	-15.47	12	20
AOI 4	S-225			221123.01	2684549.16	MW	unconfined	Y	Y	29-Mar-05	27	4	14.99	12.0	0	-15	12	15
AOI 4	S-229		Destroyed	220933.27	2683981.01	MW	NA	Y	Y	23-Mar-05	30	4	22.73	19.5	4.5	-10.5	15	15
AOI 4	S-233			218922.84	2684873.79	MW	unconfined	Y	Y	17-Oct-05	30	4	24.35	21.63	6.63	-8.37	15	15
AOI 4	S-234			218761.79	2684898.54	MW	unconfined	Y	Y	18-Oct-08	27	4	21.23	18.04	6.04	-8.96	12	15
AOI 4	S-235			218843.84	2684961.53	MW	unconfined	Y	Y	18-Oct-05	30	4	23.126	20.21	5.21	-9.79	15	15
AOI 4	S-236			219018.43	2684953.85	MW	unconfined	Y	Y	19-Oct-05	32	4	22.973	19.72	2.72	-12.28	17	15
AOI 4	S-237			218984.40	2684943.31	MW	unconfined	Y	Y	19-Oct-05	32	4	22.815	19.39	2.39	-12.61	17	15
AOI 4	S-238			218916.69	2685034.49	MW	unconfined	Y	Y	21-Oct-05	30	4	22.915	19.87	4.87	-10.13	15	15
AOI 4	S-239			218788.68	2684997.32	MW	unconfined	Y	Y	24-Oct-05	25	4	15.818	16.19	6.19	-8.81	10	15
AOI 4	S-240			218980.39	2684848.14	MW	unconfined	Y	Y	24-Oct-05	30	4	23.864	20.97	5.97	-9.03	15	15
AOI 4	S-241			219044.99	2684818.77	MW	unconfined	Y	Y	24-Oct-05	30	4	26.084	23.09	8.09	-6.91	15	15
AOI 4	S-242			218813.24	2684857.20	MW	unconfined	N	N	NA	NA	NA	21.89	19.15	NA	NA	NA	NA
AOI 4	S-243			218722.24	2684934.27	MW	unconfined	N	N	NA	NA	NA	15.74	16.181	NA	NA	NA	NA
AOI 4	S-244			219110.02	2685081.87	MW	unconfined	N	N	NA	NA	NA	21.94	18.734	NA	NA	NA	NA
AOI 4	S-245			219051.04	2684999.42	MW	unconfined	N	N	NA	NA	NA	22.211	19.655	NA	NA	NA	NA
AOI 4	S-246			219005.32	2685017.55	MW	unconfined	N	N	NA	NA	NA	21.564	19.335	NA	NA	NA	NA
AOI 4	S-278			218752.79	2684809.98	MW	unconfined	Y	Y	18-Nov-09	29	4	21.03	17.7	3.7	-11.3	14	15
AOI 4	S-279			219165.69	2684701.46	MW	unconfined	Y	Y	18-Nov-09	29	4	26.45	23.45	9.45	-5.55	14	15
AOI 4	S-282			220826.50	2683959.50	MW	unconfined	Y	Y	27-Apr-10	20	2	20.788	18.492	13.492	-1.508	5	15
AOI 4	S-329			218689.63	2684779.00	MW	unconfined	Y	Y	20-Sep-10	40	4	20.921	18.2	8.2	-16.8	10	25
AOI 4	S-364		Damaged	221075.22	2683860.87	MW	unconfined	Y	Y	19-Mar-13	30	4	21.326	18.81	3.81	-11.19	15	15
AOI 4	S-365			220854.65	2683838.84	MW	unconfined	Y	Y	18-Mar-13	30	4	20.753	18.146	3.146	-11.854	15	15
AOI 4	S-366			221391.63	2684586.17	MW	unconfined	Y	Y	15-Mar-13	30	4	22.255	20.505	5.505	-9.495	15	15
AOI 4	S-367			221273.79	2684688.49	MW	unconfined	Y	Y	13-Mar-13	28	4	16.023	13.507	0.507	-14.493	13	15
AOI 4	S-368			221485.16	2684900.54	MW	unconfined	Y	Y	14-Mar-13	28	4	18.021	15.454	2.454	-12.546	13	15
AOI 4	S-369			221204.23	2685725.71	MW	unconfined	Y	Y	2-Apr-13	42	4	29.423	29.807	9.807	-10.193	20	20
AOI 4	S-370			219838.79	2683832.63	MW	unconfined	Y	Y	22-Apr-13	26	4	12.061	9.556	-0.444	-15.444	10	15
AOI 4	S-371			219749.72	2684294.87	MW	unconfined	Y	Y	1-Apr-13	30	4	22.047	19.498	4.498	-10.502	15	15
AOI 4	S-373			219072.964	2684927.143	MW	unconfined	Y	Y	22-Mar-13	25	4	20.77	18.39	8.39	-6.61	10	15

Table 4-1
Existing Well Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Former Well ID[2]	Well Status/ Description	Northing[3]	Easting[3]	Well Type[4]	Hydrostratigraphic Unit[5]	Soil Boring Log Available (Y/N)	Construction Detail Available (Y/N)	Date of Well Completion	Well Construction Details[1]							
											Well Completion Depth (ft bgs)[6]	Well Diameter (in)[7]	Top of Inner Casing Elevation (ft NAVD88)[8]	Ground Surface Elevation (ft NAVD88)[8]	Top of Screen Elevation (ft NAVD88)[8]	Bottom of Screen Elevation (ft NAVD88)[8]	Depth to Screen (ft bgs)[6]	Screen Length (ft)[9]
AOI 4	S-379		Damaged	220886.52	2685665.99	MW	unconfined	Y	Y	12-Mar-13	30	4	25.646	23.244	8.244	-6.756	15	15
AOI 4	S-380			220595.99	2685673.67	MW	unconfined	Y	Y	20-Mar-13	30	4	21.318	21.786	6.786	-8.214	15	15
AOI 4	S-381			219563.42	2684589.82	MW	unconfined	Y	Y	25-Apr-13	32	4	25.856	23.189	6.189	-8.811	17	15
AOI 4	S-408			218599.95	2684258.89	MW	unconfined	Y	Y	23-Oct-15	30	4	15.88	13.35	3.35	-16.65	10	20
AOI 4	S-415			220822.22	2684131.69	MW	unconfined	Y	Y	13-Oct-15	30	4	19.23	16.47	6.47	-13.53	10	20
AOI 4	S-416			220681.079	2683997.482	MW	unconfined	Y	Y	13-Jul-16	27	4	19.18	15.44	3.44	-11.56	12	15
AOI 4	S-59D	S-58D		221368.11	2683843.11	MW	lower aquifer	Y	Y	13-Apr-05	56	2	17.13	15.26	-25.74	-40.74	41	15
AOI 4	S-119D			220820.25	2685497.80	MW	lower aquifer	Y	Y	4-Apr-05	72	2	25.1	23.36	-33.64	-48.64	57	15
AOI 4	S-38D			219173.76	2685231.04	MW	lower aquifer	Y	N	14-Mar-94	130	2	17.7	15.88	-104.12	-114.12	120	10
AOI 4	S-38D2			219162.59	2685229.49	MW	lower aquifer	Y	N	17-Mar-94	80	2	18.19	15.84	-54.16	-64.16	70	10

Notes:
1. Well construction details were obtained from well boring logs provided by Handex, SECOR, Aquaterra or other historic reports.
2. Former Well IDs were derived from handwritten notes on boring logs or as referenced in historic reports.
3. Coordinate pairs are projected in the Pennsylvania State Plane Coordinate System (feet), referenced to the North American Datum of 1983 (NAD83).
4. MW = monitoring well; RW = recovery well
5. The hydrostratigraphic unit denotes the aquifer and/or mappable water-bearing stratum in which the well is interpreted to be screened by Stantec.
Historic wells without lithologic logs, wells without as-built information, and/or destroyed wells were not assigned hydrostratigraphic units.
6. ft bgs = feet below ground surface
7. in = inches
8. NAVD88 = North American Vertical Datum of 1988
9. ft = feet
10. Y = Yes; N = No

General Note:
Stantec presently maintains an electronic database from which these well records were extracted. Many of the well records in that database were translated from historic paper records, or from electronic tables received from other consultants.
Maintenance of the electronic well database, including revisions to anamalous or missing information, is ongoing and as such this table may be subject to future revision.

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			MW-1		MW-4	RW-700							
Sample Date			6-May-05	17-Jun-13	6-May-05	19-Oct-10	13-Dec-12	26-Feb-14	18-Mar-15	15-Feb-16	17-Aug-16	17-Aug-16	12-Oct-16
Sample ID			MW1-050605	MW-4_06_17_2013	MW4-050605	RW-700_101910	RW-700-121312	RW 700	RW-700_20150318	AOI4_RW-700_021516	RW-700-20160817-WG	RW-700-20160817-WG DUP	RW-700-20161012-WG
Sampling Company			UNKNOWN	LANGAN	UNKNOWN	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	ACCUTEST	LL	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	JB40115	UNKNOWN	1218083	JB23819	JB60754	1546641	30173637	L854465	L854465	L865801
Volatile Organic Compounds													
BENZENE	µg/L	5	***100***	***128 MS***	ND (5)	***12000***	***6710***	***11800***	***610***	***9730***	***7700***	***8130***	***9060***
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	554	630	525
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	ND (76.2)	ND (19.0)	ND (190)
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5)	1 U MS	ND (5)	-	-	-	-	-	ND (72.2)	ND (18.0)	ND (180)
ETHYLBENZENE	µg/L	700	19	0.91 J MS	ND (5)	***1400***	685	619	220	***1070***	***900***	***986***	***995***
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	10	3.5 MS	ND (5)	-	-	-	-	-	ND (200)	ND (50.0)	ND (500)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5)	11.2 MS	ND (5)	ND (20)	-	-	-	-	***538***	***551***	ND (184)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	384	398	ND (500)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	ND (200)	ND (50.0)	ND (500)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	ND (200)	ND (50.0)	ND (500)
TOLUENE	µg/L	1000	10	10.1 MS	ND (5)	***5000***	***2130***	***7750***	460	***4730***	***4100***	***4370***	***3800***
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	1.5 J MS	-	-	-	-	-	-	***531***	***606***	***738***
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	3.7 MS	-	-	-	-	-	-	ND (200)	190	ND (500)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	27	8.1 MS	ND (5)	6600	4010	7000	1800	5280	4170	4420	4880
Volatile Organic Compounds (SW8011)													
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.028)	0.02 U MS	ND (0.028)	-	-	-	-	-	0.0271	0.0347	0.0367
Semi-Volatile Organic Compounds													
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	9.89	18.2	125
ANTHRACENE	µg/L	66	-	0.11 U MS	-	-	-	-	-	-	2.68	6.20	ND (2.50)
BENZO(A)ANTHRACENE	µg/L	4.9	-	2.44 MS	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (2.50)
BENZO(A)PYRENE	µg/L	0.2	-	***2.45 MS***	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.580)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	***2.48 MS***	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.106)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	***1.83 MS***	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.114)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.680)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	ND (10.0)	13.0	183
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	3.30	5.80	ND (3.54)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (15.0)
CHRYSENE	µg/L	1.9	ND (1)	***2.94 MS***	ND (1)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.540)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.198)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (15.0)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	16.5	14.7	ND (50.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	0.176	0.716	5.76
FLUORENE	µg/L	1900	ND (10)	0.11 U MS	ND (10)	-	-	-	-	-	9.12	17.0	90.5
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (2.50)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	222	417	***1280***
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) J
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	24.4	11.6	ND (50.0) J
NAPHTHALENE	µg/L	100	32	27.7 MS	ND (10)	-	-	-	-	-	***275***	***339***	***593***
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0)
PHENANTHRENE	µg/L	1100	ND (10)	4.54 MS	ND (10)	-	-	-	-	-	28.1	58.4	344
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	15.1	12.3	ND (50.0) J
PYRENE	µg/L	130	ND (10)	3.72 MS	ND (10)	-	-	-	-	-	1.23	2.61	23.2
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)	ND (33.9)
Metals, Dissolved													
ARSENIC	µg/L	10	-	-	-	-	6.2	-	-	5.4	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	ND (3.0)	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	ND (10)	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	ND (20)	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	ND (10)	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (1)	3 U MS	ND (1)	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	ND (0.20)	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	2.7 J	-	-	-	ND (2.00)	8.77	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	ND (10)	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	70.9	-	-	-	ND (25.0)	ND (25.0)	R

Sample Location	RW-701							RW-702						
Sample Date	19-Oct-10	13-Dec-12	26-Feb-14	18-Mar-15	15-Feb-16	17-Aug-16	12-Oct-16	19-Oct-10	14-Dec-12	26-Feb-14	18-Mar-15	15-Feb-16	17-Aug-16	12-Oct-16
Sample ID	RW-701_101910	RW-701-121312	RW 701	RW-701_20150318	AOI4_RW-701_021516	RW-701-20160817-WG	RW-701-20161012-WG	RW-702_101910	RW-702_12142012	RW 702	RW-702_20150318	AOI4_RW-702_021516	RW-702-20160817-WG	RW-702-20161012-WG
Sampling Company	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC
Laboratory Work Order	1218083	JB23819	JB60754	1546641	30173637	L854465	L865801	1218083	JB23910	JB60754	1546641	30173637	L854465	L865801
Volatile Organic Compounds														
BENZENE	***13000***	***10700***	***13900***	***2800***	***14100***	***13300***	***13300***	***16000***	***11700***	***5870***	***5000***	***18500***	***13700***	***14900***
CYCLOHEXANE	-	-	-	-	-	438	ND (500)	-	-	-	-	-	413	ND (200)
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	ND (19.0)	ND (190)	-	-	-	-	-	ND (7.62)	ND (76.2)
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	ND (18.0)	ND (180)	-	-	-	-	-	ND (7.22)	ND (72.2)
ETHYLBENZENE	***1400***	***1140***	***1160***	***830***	***1380***	***1160***	***1250***	***1200***	672	275	360	***964***	552	438
ISOPROPYLBENZENE (CUMENE)	-	-	-	-	-	ND (50.0)	ND (500)	-	-	-	-	-	23.6	ND (200)
METHYL TERTIARY BUTYL ETHER	ND (0.5)	-	-	-	-	***4980***	***5070***	ND (0.5)	-	-	-	-	***3820***	***4690***
HEXANE	-	-	-	-	-	ND (50.0)	975	-	-	-	-	-	ND (20.0)	ND (200)
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	ND (50.0)	ND (500)	-	-	-	-	-	ND (20.0)	ND (200)
BUTYLBENZENE, TERT-	-	-	-	-	-	ND (50.0)	ND (500)	-	-	-	-	-	ND (20.0)	ND (200)
TOLUENE	***9900***	***9260***	***10400***	***1300***	***8370***	***8430***	***6790***	***8600***	***5250***	***3740***	***3500***	***11800***	***7590***	***8180***
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	***714***	***840***	-	-	-	-	-	***579***	***385***
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	209	ND (500)	-	-	-	-	-	179	ND (200)
XYLENES, TOTAL (DIMETHYLBENZENE)	8200	6090	7290	5600	7360	6100	6410	6500	3560	2300	3000	7670	4960	4580
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	***0.491***	***0.537***	-	-	-	-	-	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds														
ACENAPHTHENE	-	-	-	-	-	6.94	149	-	-	-	-	-	2.60	46.7
ANTHRACENE	-	-	-	-	-	0.995	ND (2.50)	-	-	-	-	-	0.558	ND (2.50)
BENZO(A)ANTHRACENE	-	-	-	-	-	ND (0.0500)	ND (2.50)	-	-	-	-	-	ND (0.0500)	ND (2.50)
BENZO(A)PYRENE	-	-	-	-	-	ND (0.0500)	ND (0.580)	-	-	-	-	-	ND (0.0500)	ND (0.580)
BENZO(B)FLUORANTHENE	-	-	-	-	-	ND (0.0500)	ND (0.106)	-	-	-	-	-	ND (0.0500)	ND (0.106)
BENZO(G,H,I)PERYLENE	-	-	-	-	-	ND (0.0500)	ND (0.114)	-	-	-	-	-	ND (0.0500)	ND (0.114)
BENZO(K)FLUORANTHENE	-	-	-	-	-	ND (0.0500)	ND (0.680)	-	-	-	-	-	ND (0.0500)	ND (0.680)
1,1'-BIPHENYL	-	-	-	-	-	ND (10.0)	177	-	-	-	-	-	ND (10.0)	22.6
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	***9.48***	ND (3.54)	-	-	-	-	-	***37***	ND (3.00)
DI-N-BUTYL PHTHALATE	-	-	-	-	-	ND (3.00)	ND (15.0)	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	-	-	-	-	-	ND (0.0500)	ND (0.540)	-	-	-	-	-	ND (0.0500)	ND (0.540)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	ND (0.0500)	ND (0.198)	-	-	-	-	-	ND (0.0500)	ND (0.198)
DIETHYL PHTHALATE	-	-	-	-	-	ND (3.00)	ND (15.0)	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	-	-	-	-	-	95.8	ND (50.0)	-	-	-	-	-	22.3	19.4
2,4-DINITROPHENOL	-	-	-	-	-	ND (10.0)	ND (50.0)	-	-	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	-	-	-	-	-	ND (0.0500)	6.48	-	-	-	-	-	ND (0.0500)	ND (2.50)
FLUORENE	-	-	-	-	-	6.45	105	-	-	-	-	-	2.75	84.4
INDENO(1,2,3-C,D)PYRENE	-	-	-	-	-	ND (0.0500)	ND (2.50)	-	-	-	-	-	ND (0.0500)	ND (2.50)
2-METHYLNAPHTHALENE	-	-	-	-	-	169	***1700***	-	-	-	-	-	90.9	339
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	49.1	ND (50.0)	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	56.3	54.9	-	-	-	-	-	10.3	ND (10.0)
NAPHTHALENE	-	-	-	-	-	***323***	***734***	-	-	-	-	-	***302***	***268***
4-NITROPHENOL	-	-	-	-	-	ND (10.0)	ND (50.0)	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	-	-	-	-	-	14.6	452	-	-	-	-	-	4.74	121
PHENOL	-	-	-	-	-	16.9	ND (50.0)	-	-	-	-	-	20.6	19.6
PYRENE	-	-	-	-	-	0.572	27.8	-	-	-	-	-	0.222	7.25
PYRIDINE	-	-	-	-	-	ND (10.0)	ND (50.0)	-	-	-	-	-	ND (10.0)	16.8
QUINOLINE	-	-	-	-	-	ND (6.78)	ND (33.9)	-	-	-	-	-	ND (6.78)	ND (6.78)
Metals, Dissolved														
ARSENIC	-	6.0	-	-	5.7	-	-	-	2.6 J	-	-	5.2	-	-
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	ND (3.0)	-	-	-	-	-	-	ND (3.0)	-	-	-	-	-
CHROMIUM	-	8.1 J	-	-	-	-	-	-	ND (10)	-	-	-	-	-
CHROMIUM III	-	8.1 J	-	-	-	-	-	-	ND (20)	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	ND (10)	-	-	-	-	-	-	4.9 J	-	-	-	-	-
COBALT	-	-	-	-	-	2.08	ND (2.00)	-	-	-	-	-	ND (2.00)	ND (2.00)
LEAD	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)
MERCURY	-	0.12 J	-	-	-	-	-	-	ND (0.20)	-	-	-	-	-
NICKEL	-	3.1 J	-	-	-	ND (2.00)	ND (2.00)	-	3.6 J	-	-	-	ND (2.00)	ND (2.00)
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-	-	-
VANADIUM	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	-	8.2 J	-	-	-	ND (25.0)	R	-	9.4 J	-	-	-	ND (25.0)	R

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			RW-703							RW-704					RW-705							RW-706				
Sample Date			19-Oct-10	14-Dec-12	26-Feb-14	18-Mar-15	15-Feb-16	17-Aug-16	12-Oct-16	14-Dec-12	26-Feb-14	18-Mar-15	15-Feb-16	13-Oct-16	19-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	16-Feb-16	16-Aug-16	12-Oct-16	19-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	16-Feb-16
Sample ID			RW-703_101910	RW-703_12142012	RW 703	RW-703_20150318	AOI4_RW-703_021516	RW-703-20160817-WG	RW-703-20161012-WG	RW-704_12142012	RW 704	RW-704_20150318	AOI4_RW-704_021516	RW-704-20161013-WG	RW-705_101910	RW-705-121312	RW-705_040314	RW-705_20150318	AOI4_RW-705_021616	RW-705-20160816-WG	RW-705-20161012-WG	RW-706_101910	RW-706-121312	RW-706_040314	RW-706_20150318	AOI4_RW-706_021616
Sampling Company			UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA
Laboratory			LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	ACCUTEST	ACCUTEST	LL	PACE	ESC	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	LL	ACCUTEST	ACCUTEST	LL	PACE
Laboratory Work Order	**Units**	**MSC-PA**	1218083	JB23910	JB60754	1546641	30173637	L854465	L865801	JB23910	JB60754	1546641	30173637	L866384	1218083	JB23819	JB63936	1546641	30173637	L854116	L865801	1218083	JB23819	JB63936	1546641	30173637
Volatile Organic Compounds																										
BENZENE	µg/L	5	***15000***	***16400***	***19200***	***9500***	***20900***	***20700***	***18800***	***218***	***646***	***6900***	***10700***	***14200***	***820***	***12.1***	***12***	***76***	***38.5***	***45.6***	***5.99***	***5100***	***3540***	***6020***	***8300***	***5730***
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	417	259	-	-	-	-	51.9	-	-	-	-	-	82.6	40.1	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	ND (9.52)	ND (19.0)	-	-	-	-	ND (9.52) OE I	-	-	-	-	-	ND (0.381)	ND (0.381)	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	-	-	-	ND (9.02)	ND (18.0)	-	-	-	-	ND (9.02)	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	-
ETHYLBENZENE	µg/L	700	***1500***	***2350***	616	550	***774***	***989***	606	200	111	380	307	344	***1100***	19.1	72.2	75	ND (1.0)	65.2	7.80	***3000***	***728***	***872***	***950***	***727***
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	-	-	31.7	ND (50.0)	-	-	-	-	ND (25.0)	-	-	-	-	-	5.53	1.25	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	µg/L	20	***340***	-	-	-	-	***1090***	***1110***	-	-	-	-	***181***	ND (20)	-	-	-	-	ND (1.00)	ND (1.00)	ND (20)	-	-	-	-
HEXANE	µg/L	6200	-	-	-	-	-	ND (25.0)	ND (50.0)	-	-	-	-	ND (25.0)	-	-	-	-	-	37.9	11.1	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	ND (25.0)	ND (50.0)	-	-	-	-	ND (25.0)	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	ND (25.0)	ND (50.0)	-	-	-	-	ND (25.0)	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	-
TOLUENE	µg/L	1000	***12000***	***14400***	***8820***	***4800***	***11000***	***10700***	***9910***	394	74.5	***4500***	651	461	***3700***	12.5	62.4	100	19.3	39.2	ND (5.00)	***14000***	***5170***	***4800***	***5800***	***3890***
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	***1020***	***593***	-	-	-	-	***389***	-	-	-	-	-	***116***	18.1	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	320	175	-	-	-	-	111	-	-	-	-	-	31.2	5.24	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	8300	***16000***	5810	4600	6750	7070	5720	2290	1040	3000	3190	3280	7600	98.4	256	420	ND (3.0)	250	18.7	10000	3950	4620	5200	3910
Volatile Organic Compounds (SW8011)																										
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	ND (0.0100)	ND (0.0100)	-	-	-	-	ND (0.0100)	-	-	-	-	-	ND (0.0100)	ND (0.0100)	-	-	-	-	-
Semi-Volatile Organic Compounds																										
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	6.51	5.95	-	-	-	-	8.17	-	-	-	-	-	0.529	0.112	-	-	-	-	-
ANTHRACENE	µg/L	66	-	-	-	-	-	2.24	0.755	-	-	-	-	0.570	-	-	-	-	-	0.0929	ND (0.0500)	-	-	-	-	-
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (10.0)	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	***71.3***	ND (3.00)	-	-	-	-	ND (3.00)	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	-
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	ND (3.00)	10.5	-	-	-	-	ND (3.00)	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	-
CHRYSENE	µg/L	1.9	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	ND (3.00)	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	19.1	20.7	-	-	-	-	37.4	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (10.0)	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
FLUORANTHENE	µg/L	260	-	-	-	-	-	0.245	ND (0.0500)	-	-	-	-	0.0670	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
FLUORENE	µg/L	1900	-	-	-	-	-	5.47	5.76	-	-	-	-	6.52	-	-	-	-	-	0.618	0.102	-	-	-	-	-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	ND (0.100)	ND (0.0500)	-	-	-	-	ND (0.0500)	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	119	105	-	-	-	-	259	-	-	-	-	-	15.4	ND (0.250)	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	58.8	14.0	-	-	-	-	10.3	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	16.8	17.5	-	-	-	-	18.3	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	***233***	***232***	-	-	-	-	***243***	-	-	-	-	-	21.7	1.09	-	-	-	-	-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (10.0)	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
PHENANTHRENE	µg/L	1100	-	-	-	-	-	15.2	9.64	-	-	-	-	7.85	-	-	-	-	-	0.521	ND (0.0500)	-	-	-	-	-
PHENOL	µg/L	2000	-	-	-	-	-	32.5	29.5	-	-	-	-	46.4	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
PYRENE	µg/L	130	-	-	-	-	-	2.25	0.296	-	-	-	-	0.132	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
PYRIDINE	µg/L	120	-	-	-	-	-	ND (10.0)	12.5	-	-	-	-	ND (10.0)	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
QUINOLINE	µg/L	1.1	-	-	-	-	-	ND (6.78)	ND (6.78)	-	-	-	-	ND (6.78)	-	-	-	-	-	ND (6.78)	ND (6.78)	-	-	-	-	-
Metals, Dissolved																										
ARSENIC	µg/L	10	-	9.7	-	-	***20.3***	-	-	5.8	-	-	ND (5.0)	-	-	1.2 J	-	-	ND (5.0)	-	-	-	ND (3.0)	-	-	ND (5.0)
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	ND (3.0)	-	-	-	-	-	ND (3.0)	-	-	-	-	-	ND (3.0)	-	-	-	-	-	-	ND (3.0)	-	-	-
CHROMIUM	µg/L	100	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	-	4.1 J	-	-	-
CHROMIUM III	µg/L	100 s1	-	ND (20)	-	-	-	-	-	ND (20)	-	-	-	-	-	ND (20)	-	-	-	-	-	-	4.1 J	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-
COBALT	µg/L	35	-	-	-	-	-	ND (2.00)	ND (2.00)	-	-	-	-	ND (2.00)	-	-	-	-	-	ND (2.00)	ND (2.00)	-	-	-	-	-
LEAD	µg/L	5	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	ND (3.0)	-	-	-	ND (2.00)	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	-	ND (3.0)	-	-	-
MERCURY	µg/L	2	-	ND (0.20)	-	-	-	-	-	ND (0.20)	-	-	-	-	-	0.12 J	-	-	-	-	-	-	ND (0.20)	-	-	-
NICKEL	µg/L	100	-	11.6	-	-	-	ND (2.00)	ND (2.00)	15.1	-	-	-	ND (2.00)	-	9.7 J	-	-	-	ND (2.00)	ND (2.00)	-	3.1 J	-	-	-
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	-	-	ND (5.00)	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	-	-	-
ZINC	µg/L	2000	-	19.6 J	-	-	-	ND (25.0)	R	42.4	-	-	-	ND (25.0)	-	26.1	-	-	-	ND (25.0)	R	-	6.6 J	-	-	-

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			RW-707						RW-708					
Sample Date			21-Oct-10	14-Dec-12	14-Jun-13	4-Apr-14	18-Mar-15	16-Feb-16	21-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	16-Feb-16	13-Oct-16
Sample ID			RW-707_102110	RW-707_12142012	RW-707_06_14_2013	RW-707_040314	RW-707_20150318	AOI4_RW-707_021616	RW-708_102110	RW-708-121312	RW-708_040314	RW-708_20150318	AOI4_RW-708_021616	RW-708-20161013-WG
Sampling Company			UNKNOWN	LANGAN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA
Laboratory			LL	ACCUTEST	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC
Laboratory Work Order	Units	MSC-PA	1218083	JB23910	JB39854	JB63936	1546641	30173637	1218083	JB23819	JB63936	1546641	30173637	L866384
Volatile Organic Compounds														
BENZENE	µg/L	5	**4400**	**3980**	**605**	**39.6**	**21**	**318**	**7400**	**7360**	**656**	**3900**	**2530**	**2640**
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	ND (250)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	ND (95.2) OE
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	ND (5)	-	-	-	-	-	-	-	-	ND (90.2)
ETHYLBENZENE	µg/L	700	**3300**	**821**	293	34.9	12	149	**2800**	**1290**	640	**1000**	690	**905**
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	30.6	-	-	-	-	-	-	-	-	ND (250)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (20)	-	**26.6**	-	-	-	ND (20)	-	-	-	-	ND (91.8)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	ND (250)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	ND (250)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	ND (250)
TOLUENE	µg/L	1000	**7800**	**3950**	336	45.5	11	91.9	**9700**	**4250**	**3630**	**5600**	**4060**	**2420**
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	**590**	-	-	-	-	-	-	-	-	**1220**
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	221	-	-	-	-	-	-	-	-	379
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	9300	4470	1320	163	53	613	10000	6760	3820	5400	3690	5070
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	ND (0.02)	-	-	-	-	-	-	-	-	ND (0.0100)
Semi-Volatile Organic Compounds														
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	11.9
ANTHRACENE	µg/L	66	-	-	0.251	-	-	-	-	-	-	-	-	4.12
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	ND (0.1)	-	-	-	-	-	-	-	-	0.0682
BENZO(A)PYRENE	µg/L	0.2	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	17.0
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
CHRYSENE	µg/L	1.9	-	-	ND (0.1)	-	-	-	-	-	-	-	-	0.0999
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	65.6
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	0.742
FLUORENE	µg/L	1900	-	-	1.07	-	-	-	-	-	-	-	-	12.6
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	**531**
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	12.5
NAPHTHALENE	µg/L	100	-	-	80.3	-	-	-	-	-	-	-	-	**507**
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
PHENANTHRENE	µg/L	1100	-	-	1.74	-	-	-	-	-	-	-	-	36.9
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	28.7
PYRENE	µg/L	130	-	-	ND (0.1)	-	-	-	-	-	-	-	-	2.33
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)
Metals, Dissolved														
ARSENIC	µg/L	10	-	1.2 J	-	-	-	5.2	-	**20.4**	-	-	ND (5.0)	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	ND (3.0)	-	-	-	-	-	ND (3.0)	-	-	-	-
CHROMIUM	µg/L	100	-	2.1 J	-	-	-	-	-	8.2 J	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	ND (20)	-	-	-	-	-	8.2 J	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	1.5 J	-	-	-	-	-	ND (10)	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)
LEAD	µg/L	5	-	ND (3.0)	ND (3)	-	-	-	-	ND (3.0)	-	-	-	ND (2.00)
MERCURY	µg/L	2	-	ND (0.20)	-	-	-	-	-	0.12 J	-	-	-	-
NICKEL	µg/L	100	-	3.0 J	-	-	-	-	-	5.4 J	-	-	-	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	ND (10)	-	-	-	-	-	ND (10)	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)
ZINC	µg/L	2000	-	9.3 J	-	-	-	-	-	150	-	-	-	ND (25.0)

Sample Location	RW-709					RW-710					RW-711						
Sample Date	21-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	16-Feb-16	21-Oct-10	14-Jun-13	4-Apr-14	18-Mar-15	18-Feb-16	21-Oct-10	14-Dec-12	1-Apr-14	18-Mar-15	18-Feb-16	16-Aug-16	12-Oct-16
Sample ID	RW-709_102110	RW-709-121312	RW-709_040314	RW-709_20150318	AOI4_RW-709_021616	RW-710_102110	RW-710_06_14_2013	RW-710_040314	RW-710_20150318	AOI4_RW-710_021816	RW-711_102110	RW-711_12142012	RW-711_040114	RW-711_20150318	AOI4_RW-711_021816	RW-711-20160816-WG	RW-711-20161012-WG
Sampling Company	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory	LL	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC
Laboratory Work Order	1218083	JB23819	JB63936	1546641	30173637	1218083	JB39854	JB63936	1546641	30173977	1218083	JB23910	JB63936	1546641	30173977	L854116	L865801
Volatile Organic Compounds																	
BENZENE	**690**	**223**	**13.1**	1	4.9	**6200**	**1440**	4.6	ND (0.5)	**29.4**	**6600**	**134**	**12.5**	**400**	**312**	**378**	**13.6**
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52.8	30.1
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.381)	ND (0.381)
1,2-DICHLOROETHANE (EDC)	-	-	-	-	-	-	ND (2.6)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
ETHYLBENZENE	500	105	33.2	4	ND (1.0)	**1400**	**768**	9.8	ND (0.5)	0.67 J	**1600**	427	32.8	590	293	171	36.7
ISOPROPYLBENZENE (CUMENE)	-	-	-	-	-	-	23.6	-	-	-	-	-	-	-	-	6.46	2.44
METHYL TERTIARY BUTYL ETHER	ND (10)	-	-	-	-	ND (20)	ND (10)	-	-	-	ND (20)	-	-	-	-	ND (1.00)	ND (1.00)
HEXANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49.4	24.3
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	**4200**	291	147	5	4.3	**13000**	908	4.4	ND (0.5)	17.2	**11000**	229	50.2	55	54.2	53.9	10.4
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	**1370**	-	-	-	-	-	-	-	-	**271**	**93.9**
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	470	-	-	-	-	-	-	-	-	53.0	22.6
XYLENES, TOTAL (DIMETHYLBENZENE)	5300	830	229	21	ND (3.0)	9100	4580	49.4	ND (0.5)	1.9 J	9100	1580	175	790	839	634	145
Volatile Organic Compounds (SW8011)																	
1,2-DIBROMOETHANE (EDB)	-	-	-	-	-	-	ND (0.02)	-	-	-	-	-	-	-	-	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																	
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.128	ND (0.0500)
ANTHRACENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	-	-	-	-	-	-	0.337	-	-	-	-	-	-	-	-	0.142	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.7	2.01
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	-	-	-	-	-	-	**196**	-	-	-	-	-	-	-	-	54.2	5.14
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	-	-	-	-	-	-	0.476	-	-	-	-	-	-	-	-	0.0798	ND (0.0500)
PHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)
Metals, Dissolved																	
ARSENIC	-	ND (3.0)	-	-	ND (5.0)	-	-	-	-	ND (5.0)	-	3.1	-	-	ND (5.0)	-	-
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	ND (3.0)	-	-	-	-	-	-	-	-	-	ND (3.0)	-	-	-	-	-
CHROMIUM	-	ND (10)	-	-	-	-	-	-	-	-	-	ND (10)	-	-	-	-	-
CHROMIUM III	-	ND (20)	-	-	-	-	-	-	-	-	-	ND (20)	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	1.5 J	-	-	-	-	-	-	-	-	-	ND (10)	-	-	-	-	-
COBALT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
LEAD	-	ND (3.0)	-	-	-	-	ND (3)	-	-	-	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)
MERCURY	-	0.12 J	-	-	-	-	-	-	-	-	-	ND (0.20)	-	-	-	-	-
NICKEL	-	5.9 J	-	-	-	-	-	-	-	-	-	3.3 J	-	-	-	ND (2.00)	ND (2.00)
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	ND (10)	-	-	-	-	-	-	-	-	-	ND (10)	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	-	18.1 J	-	-	-	-	-	-	-	-	-	ND (20)	-	-	-	ND (25.0)	R

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			RW-712					RW-713					RW-714					RW-715							RW-716				
Sample Date			21-Oct-10	13-Dec-12	1-Apr-14	18-Mar-15	18-Feb-16	21-Oct-10	13-Dec-12	1-Apr-14	18-Mar-15	18-Feb-16	21-Oct-10	13-Dec-12	1-Apr-14	18-Mar-15	19-Feb-16	21-Oct-10	13-Dec-12	1-Apr-14	18-Mar-15	19-Feb-16	16-Aug-16	12-Oct-16	21-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	19-Feb-16
Sample ID			RW-712_102110	RW-712-121312	RW-712_040114	RW-712_20150318	AOI4_RW-712_021816	RW-713_102110	RW-713-121312	RW-713_040114	RW-713_20150318	AOI4_RW-713_021816	RW-714_102110	RW-714-121312	RW-714_040114	RW-714_20150318	AOI4_RW-714_021916	RW-715_102110	RW-715-121312	RW-715_040114	RW-715_20150318	AOI4_RW-715_021916	RW-715-20160816-WG	RW-715-20161012-WG	RW-716_102110	RW-716-121312	RW-716_040314	RW-716_20150318	AOI4_RW-716_021916
Sampling Company			UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA
Laboratory			LL	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	LL	ACCUTEST	ACCUTEST	LL	PACE
Laboratory Work Order	Units	MSC-PA	1218083	JB23819	JB63936	1546641	30173977	1218083	JB23819	JB63936	1546641	30173977	1218083	JB23819	JB63936	1546641	30173977	1218083	JB23819	JB63936	1546641	30173977	L854116	L865801	1218083	JB23819	JB63936	1546641	30173977
Volatile Organic Compounds																														
BENZENE	µg/L	5	**3500**	**5540**	**537**	**810**	**1450**	**1700**	**2060**	**755**	**830**	**1580**	**420**	**409**	**804**	**180**	**759**	**1500**	**936**	**7.8**	**11**	**77.2**	1.75	**115**	**19**	**12.4**	2.6	**6**	**43**
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.5	156	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	-
ETHYLBENZENE	µg/L	700	**2300**	**1430**	462	470	**957**	**1400**	**1270**	**816**	**800**	**910**	**1700**	424	514	**760**	546	650	582	9.4	4	26.6	ND (1.00)	8.82	4	2.6	1.0	0.7 J	16.4
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.22	9.86	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (20)	-	-	-	-	ND (20)	-	-	-	-	ND (20)	-	-	-	-	ND (5)	-	-	-	-	ND (1.00)	6.01	ND (1)	-	-	-	-
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.46	ND (1.00)	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	2.31	-	-	-	-	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	1.19	-	-	-	-	-
TOLUENE	µg/L	1000	**6300**	**4810**	780	860	**1130**	**10000**	**4560**	**4200**	**2200**	**1020**	**5600**	909	**1140**	520	569	**2700**	351	2.1	1	58.0	ND (5.00)	20.7	13	3.3	0.96 J	0.6 J	39.8
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.37	6.35	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.08	2.95	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	9300	7680	2530	1900	3800	7800	6920	5080	4700	5080	7600	6030	3300	4900	3140	4200	2110	15.2	9	137	4.41	46.4	56	1.3	ND (1.0)	0.7 J	85.9
Volatile Organic Compounds (SW8011)																														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0100)	ND (0.0100)	-	-	-	-	-
Semi-Volatile Organic Compounds																														
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.23 B	ND (3.00)	-	-	-	-	-
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	-
CHRYSENE	µg/L	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
FLUORENE	µg/L	1900	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.316	0.751	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.918	5.13	-	-	-	-	-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
PHENANTHRENE	µg/L	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
PYRENE	µg/L	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	-
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	-
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*	-	-	-	-	-
Metals, Dissolved																														
ARSENIC	µg/L	10	-	ND (3.0)	-	-	ND (5.0)	-	1.6 J	-	-	ND (5.0)	-	4.9	-	-	**17.3**	-	ND (3.0)	-	-	2.9 J	-	-	-	ND (3.0)	-	-	ND (5.0)
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	ND (3.0)	-	-	-	-	ND (3.0)	-	-	-	-	ND (3.0)	-	-	-	-	ND (3.0)	-	-	-	-	-	-	ND (3.0)	-	-	-
CHROMIUM	µg/L	100	-	ND (10)	-	-	-	-	1.1 J	-	-	-	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-
CHROMIUM III	µg/L	100 s1	-	ND (20)	-	-	-	-	ND (20)	-	-	-	-	ND (20)	-	-	-	-	ND (20)	-	-	-	-	-	-	ND (20)	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	-	-	-	-	-
LEAD	µg/L	5	-	ND (3.0)	-	-	-	-	1.9 J	-	-	-	-	ND (3.0)	-	-	-	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	-	ND (3.0)	-	-	-
MERCURY	µg/L	2	-	0.17 J	-	-	-	-	0.14 J	-	-	-	-	0.13 J	-	-	-	-	0.11 J	-	-	-	-	-	-	ND (0.20)	-	-	-
NICKEL	µg/L	100	-	4.1 J	-	-	-	-	7.1 J	-	-	-	-	3.6 J	-	-	-	-	4.6 J	-	-	-	ND (2.00)	ND (2.00)	-	3.2 J	-	-	-
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	ND (10)	-	-	-	-	-	-	ND (10)	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	-	-	-
ZINC	µg/L	2000	-	4.7 J	-	-	-	-	16.5 J	-	-	-	-	41.0	-	-	-	-	3.6 J	-	-	-	ND (25.0)	R	-	101	-	-	-

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			RW-717							S-26					
Sample Date			21-Oct-10	13-Dec-12	4-Apr-14	18-Mar-15	19-Feb-16	17-Aug-16	12-Oct-16	21-Oct-04	2-May-05	29-Nov-06	12-Jun-13	10-Aug-16	13-Oct-16
Sample ID			RW-717_102110	RW-717-121312	RW-717_040314	RW-717_20150318	AOI4_RW-717_021916	RW-717-20160817-WG	RW-717-20161012-WG	S-26	S26-050205	S-26	S-26_06_12_2013	S-26-20160810-WG	S-26-20161013-WG
Sampling Company			UNKNOWN	LANGAN	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory			LL	ACCUTEST	ACCUTEST	LL	PACE	ESC	ESC	UNKNOWN	LL	UNKNOWN	ACCUTEST	ESC	ESC
Laboratory Work Order	Units	MSC-PA	1218083	JB23819	JB63936	1546641	30173977	L854465	L865801	20140718EZ	UNKNOWN	20140718EZ	JB39629	L853818	L866384
Volatile Organic Compounds															
BENZENE	µg/L	5	**29**	**12.5**	**22.3**	**36**	**30.7**	ND (1.00)	1.20	ND (1.0)	ND (5)	ND (0.5)	ND (1)	ND (5.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	ND (1.00)	7.93	-	-	-	-	41.7	29.2
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	ND (0.381)	ND (0.381)	ND (0.020)	-	-	-	ND (1.90)	ND (0.381) OE
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	-	ND (1)	ND (5.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	15	2.1	11.4	16	13.2	ND (1.00)	1.12	ND (5.0)	ND (5)	ND (0.8)	ND (1)	ND (5.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	-	-	ND (1.00)	1.62	ND (5.0)	ND (5)	-	ND (2)	ND (5.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (1)	-	-	-	-	ND (1.00)	ND (1.00)	**39**	**32**	-	2.2	ND (5.00)	2.25
HEXANE	µg/L	6200	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	ND (5.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	ND (5.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	-	ND (5.00)	1.80
TOLUENE	µg/L	1000	19	1.7	7.5	13	31.1	ND (5.00)	ND (5.00)	ND (5.0)	ND (5)	ND (0.7)	ND (1)	ND (25.0)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	ND (2)	ND (5.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	-	ND (2)	ND (5.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	20	0.99 J	4.2	62	66.3	ND (3.00)	4.02	ND (10)	ND (5)	ND (0.8)	ND (1)	ND (15.0)	ND (3.00)
Volatile Organic Compounds (SW8011)															
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	ND (0.0100)	ND (0.0100)	-	ND (0.029)	-	ND (0.02)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds															
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	0.639	0.774
ANTHRACENE	µg/L	66	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.1)	0.109	0.0920
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	ND (3.75)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	ND (3.75)	ND (3.00)
CHRYSENE	µg/L	1.9	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.14)	ND (1)	-	ND (0.1)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	-	-	ND (3.75)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	-	ND (0.1)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	ND (0.250)	ND (0.250)	-	-	-	-	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
NAPHTHALENE	µg/L	100	-	-	-	-	-	ND (0.250)	0.783	ND (5.0)	ND (10)	-	ND (0.1)	0.390	0.587
4-NITROPHENOL	µg/L	60	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
PHENANTHRENE	µg/L	1100	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	-	ND (0.1)	ND (0.0500)	0.0662
PHENOL	µg/L	2000	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
PYRENE	µg/L	130	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	-	ND (0.1)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	-	-	ND (12.5)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	ND (6.78)	ND (6.78)	-	-	-	-	ND (8.48)	ND (6.78)
Metals, Dissolved															
ARSENIC	µg/L	10	-	1.6 J	-	-	ND (5.0)	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	0.30 J	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	ND (20)	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	ND (2.00)	ND (2.00)	-	-	-	-	2.41	8.78
LEAD	µg/L	5	-	ND (3.0)	-	-	-	ND (2.00)	ND (2.00)	ND (5.0)	ND (1)	-	ND (3)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	ND (0.20)	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	10.8	-	-	-	2.93 B	ND (2.00)	-	-	-	-	ND (2.00)	3.05
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	8.8 J	-	-	-	ND (25.0)	ND (25.0)	-	-	-	-	ND (25.0)	ND (25.0)

Sample Location			S-27			S-28			S-30		S-31	S-32		S-34	S-35			S-36
Sample Date			21-Oct-04	2-May-05	13-Oct-16	21-Oct-04	4-May-05	13-Jun-13	19-Aug-16	11-Oct-16	2-May-05	19-Aug-16	11-Oct-16	14-Jun-13	18-Aug-16	12-Oct-16	12-Oct-16	14-Jun-13
Sample ID			S-27	S27-050205	S-27-20161013-WG	S-28	S28-050405	S-28_06_13_2013	S-30-20160819-WG	S-30-20161011-WG	S31-050205	S-32-20160819-WG	S-32-20161011-WG	S-34_06_14_2013	S-35-20160818-WG	S-35-20161012-WG	S-35-20161012-WG-DUP	S-36_06_14_2013
Sampling Company			UNKNOWN	UNKNOWN	AQUATERRA	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	UNKNOWN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	LANGAN
Laboratory			UNKNOWN	LL	ESC	UNKNOWN	LL	ACCUTEST	ESC	ESC	LL	ESC	ESC	ACCUTEST	ESC	ESC	ESC	ACCUTEST
Laboratory Work Order	Units	MSC-PA	20140718EZ	UNKNOWN	L866380	20140718EZ	UNKNOWN	JB39760	L854978	L865495	UNKNOWN	L854978	L865495	JB39854	L854778	L865801	L865801	JB39854
Volatile Organic Compounds																		
BENZENE	µg/L	5	ND (1.0)	ND (5)	ND (1.00)	**57**	**51**	**5.3**	ND (5.00) SL	3.11 SL	**53**	ND (5.00) SL	2.65 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	**288**
CYCLOHEXANE	µg/L	53000	-	-	ND (1.00)	-	-	-	17.0 SL	13.9 SL	-	ND (5.00) SL	ND (1.00) SL	-	ND (5.00)	ND (1.00)	ND (1.00)	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.020)	-	ND (0.381)	ND (0.020)	-	-	ND (1.90) SL	ND (0.381) SL	-	ND (1.90) SL	ND (0.381) SL	-	ND (1.90)	ND (0.381)	ND (0.381)	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5.0)	ND (5)	ND (1.00)	ND (5.0)	ND (5)	ND (1)	ND (5.00) SL	ND (1.00) SL	ND (5)	ND (5.00) SL	ND (1.00) SL	-	ND (5.00)	ND (1.00)	ND (1.00)	ND (1)
ETHYLBENZENE	µg/L	700	ND (5.0)	ND (5)	ND (1.00)	ND (5.0)	12	0.34 J	ND (5.00) SL	ND (1.00) SL	39	ND (5.00) SL	1.48 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	36.9
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5.0)	5	ND (1.00)	5.3	6	9.6	32.8 SL	24.7 SL	6	ND (5.00) SL	1.31 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	41.8
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5.0)	ND (5)	ND (1.00)	**180**	**270**	19.5	19.0 SL	**23.9 SL**	**170**	**23.3 SL**	1.70 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	**21.9**
HEXANE	µg/L	6200	-	-	ND (1.00)	-	-	-	ND (5.00) SL	ND (1.00) SL	-	ND (5.00) SL	ND (1.00) SL	-	ND (5.00)	ND (1.00)	ND (1.00)	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	ND (1.00)	-	-	-	31.9 SL	11.6 SL	-	ND (5.00) SL	ND (1.00) SL	-	ND (5.00)	ND (1.00)	ND (1.00)	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	ND (1.00)	-	-	-	ND (5.00) SL	1.45 SL	-	ND (5.00) SL	ND (1.00) SL	-	ND (5.00)	ND (1.00)	ND (1.00)	-
TOLUENE	µg/L	1000	ND (5.0)	ND (5)	ND (5.00)	ND (5.0)	ND (5)	0.47 J	ND (25.0) SL	ND (5.00) SL	40	ND (25.0) SL	7.78 SL	-	ND (25.0)	ND (5.00)	ND (5.00)	71
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	ND (1.00)	-	-	2.9	ND (5.00) SL	10.2 SL	-	ND (5.00) SL	5.42 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	3
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	ND (1.00)	-	-	0.4 J	ND (5.00) SL	6.02 SL	-	ND (5.00) SL	1.84 SL	-	ND (5.00)	ND (1.00)	ND (1.00)	55.5
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (10)	26	ND (3.00)	ND (10)	13	0.94 J	ND (15.0) SL	6.23 SL	150	ND (15.0) SL	16.3 SL	-	ND (15.0)	ND (3.00)	ND (3.00)	121
Volatile Organic Compounds (SW8011)																		
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.029)	ND (0.0100)	-	ND (0.029)	ND (0.02)	ND (0.0100) SL	ND (0.0100) SL	ND (0.028)	ND (0.0100) SL	ND (0.0100) SL	-	ND (0.0100)	ND (0.0100)	ND (0.0100)	ND (0.02)
Semi-Volatile Organic Compounds																		
ACENAPHTHENE	µg/L	3800	-	-	ND (0.0500)	-	-	-	104 SL	204 SL	-	174 SL	8.67 SL	-	42.4	ND (0.0500)	0.731	-
ANTHRACENE	µg/L	66	-	-	ND (0.0500)	-	-	ND (0.11)	ND (2.50) SL	ND (2.50) SL	-	ND (3.00) SL	ND (0.0500) SL	-	ND (2.67)	ND (0.0500)	ND (0.0500)	ND (0.1)
BENZO(A)ANTHRACENE	µg/L	4.9	ND	-	ND (0.0500)	ND	-	ND (0.11)	ND (2.50) SL	ND (2.50) SL	-	**5.48 SL**	0.513 SL	-	ND (2.67)	ND (0.0500)	0.0527	ND (0.1)
BENZO(A)PYRENE	µg/L	0.2	ND	-	ND (0.0500)	ND	-	ND (0.11)	ND (0.580) SL	ND (0.580) SL	-	ND (0.696) SL	0.164 SL	-	ND (0.618)	ND (0.0500)	0.0684	ND (0.1)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND	-	ND (0.0500)	ND	-	ND (0.11)	ND (0.106) SL	ND (0.106) SL	-	ND (0.127) SL	0.182 SL	-	ND (0.113)	ND (0.0500)	ND (0.0500)	ND (0.1)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	ND (0.0500)	-	-	ND (0.11)	ND (0.114) SL	ND (0.114) SL	-	ND (0.136) SL	0.116 SL	-	ND (0.121)	ND (0.0500)	ND (0.0500)	ND (0.1)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	ND (0.0500)	-	-	-	ND (0.680) SL	ND (0.680) SL	-	ND (0.816) SL	0.0640 SL	-	ND (0.725)	ND (0.0500)	ND (0.0500)	-
1,1'-BIPHENYL	µg/L	430	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (400) SL	ND (400) SL	-	ND (200)	ND (400)	ND (200)	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	**100**	-	ND (3.00)	ND	-	-	ND (7.09) SL	ND (3.54) SL	-	ND (28.4) SL	ND (28.4) SL	-	ND (14.2)	**188**	ND (14.2)	-
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	ND (3.00)	-	-	-	ND (30.0) SL	ND (15.0) SL	-	ND (120) SL	ND (120) SL	-	ND (60.0)	ND (120)	ND (60.0)	-
CHRYSENE	µg/L	1.9	ND (0.14)	ND (1)	ND (0.0500)	ND (0.70)	ND (1)	ND (0.11)	ND (0.540) SL	ND (0.540) SL	-	**6.49 SL**	0.628 SL	-	ND (0.576)	ND (0.0500)	0.244	ND (0.1)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	ND	-	ND (0.0500)	ND	-	-	ND (0.198) SL	ND (0.198) SL	-	ND (0.238) SL	ND (0.0500) SL	-	ND (0.211) OE	ND (0.0500)	ND (0.0500)	-
DIETHYL PHTHALATE	µg/L	93000	-	-	ND (3.00)	-	-	-	ND (30.0) SL	16.5 SL	-	ND (120) SL	ND (120) SL	-	ND (60.0)	ND (120)	ND (60.0)	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (400) SL	ND (400) SL	-	ND (200)	ND (400)	ND (200)	-
2,4-DINITROPHENOL	µg/L	230	-	-	ND (10.0)	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (130) SL	ND (130) SL	-	ND (200) OE	ND (130) OE	ND (200) OE	-
FLUORANTHENE	µg/L	260	-	-	ND (0.0500)	-	-	-	2.88 SL	6.10 SL	-	13.4 SL	2.30 SL	-	4.13	ND (0.0500)	0.123	-
FLUORENE	µg/L	1900	ND (10)	ND (10)	ND (0.0500)	260	12	9.79	139 SL	268 SL	-	164 SL	8.82 SL	-	ND (2.67)	ND (0.0500)	ND (0.0500)	11.5
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	ND (0.0500)	-	-	-	ND (2.50) SL	ND (2.50) SL	-	ND (0.888) SL	0.0673 SL	-	ND (2.67) OE	ND (0.0500)	ND (0.0500)	-
2-METHYLNAPHTHALENE	µg/L	470	-	-	ND (0.250)	-	-	-	264 SL	**816 SL**	-	328 SL	23.4 SL	-	ND (13.3)	ND (0.250)	ND (0.250)	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (400) SL	ND (400) SL	-	ND (200)	ND (400)	ND (200)	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (400) SL	ND (400) SL	-	ND (200)	ND (400)	ND (200)	-
NAPHTHALENE	µg/L	100	ND (5.0)	14	ND (0.250)	ND (5.0)	12	ND (0.11)	29.8 SL	**122 SL**	-	ND (15.0) SL	10.3 SL	-	ND (13.3)	ND (0.250)	0.627 B	ND (0.1)
4-NITROPHENOL	µg/L	60	-	-	ND (10.0)	-	-	-	ND (20.1) SL	ND (50.0) SL	-	ND (80.4) SL	ND (80.4) SL	-	ND (40.2) OE	ND (80.4)	ND (40.2)	-
PHENANTHRENE	µg/L	1100	ND (10)	ND (10)	ND (0.0500)	550	26	16.3	311 SL	669 SL	-	439 SL	30.7 SL	-	110	ND (0.0500)	ND (0.0500)	16.5
PHENOL	µg/L	2000	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (400) SL	ND (400) SL	-	ND (200)	ND (400)	ND (200)	-
PYRENE	µg/L	130	ND (10)	ND (10)	ND (0.0500)	29	ND (10)	3.31	29.4 SL	73.0 SL	-	**152 SL**	18.2 SL	-	71.6	0.320 J	1.78 J	0.802
PYRIDINE	µg/L	120	-	-	ND (10.0) OE	-	-	-	ND (100) SL	ND (50.0) SL	-	ND (54.8) SL	ND (54.8) SL	-	ND (27.4)	ND (54.8)	ND (27.4)	-
QUINOLINE	µg/L	1.1	-	-	ND (6.78)	-	-	-	ND (67.8) SL	ND (33.9) SL	-	ND (271) SL	ND (271) SL	-	ND (67.8)	ND (271)	ND (136)	-
Metals, Dissolved																		
ARSENIC	µg/L	10	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	61	-	-	42	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	17	-	ND (2.00)	13	-	-	4.29 SL	2.49 SL	-	2.42 SL	ND (2.00) SL	-	ND (2.00)	ND (2.00)	ND (2.00)	-
LEAD	µg/L	5	ND (5.0)	ND (1)	ND (2.00)	ND (5.0)	ND (1)	ND (3)	ND (2.00) SL	ND (2.00) SL	ND (1)	ND (2.00) SL	ND (2.00) SL	3.4	ND (2.00)	ND (2.00)	ND (2.00)	-
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	ND (2.00)	-	-	-	13.9 SL	2.66 B SL	-	2.70 B SL	2.92 B SL	-	ND (2.00)	ND (2.00)	ND (2.00)	-
SELENIUM	µg/L	50	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	**54.1**	-	-	-	ND (5.00) SL	ND (5.00) SL	-	ND (5.00) SL	ND (5.00) SL	-	ND (5.00)	ND (5.00)	ND (5.00)	-
ZINC	µg/L	2000	-	-	ND (25.0)	-	-	-	ND (25.0) SL	ND (25.0) SL	-	ND (25.0) SL	ND (25.0) SL	-	ND (25.0)	ND (25.0)	ND (25.0)	-

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-38													
Sample Date			1-Jan-85	1-Jan-86	1-Jan-88	1-Jan-93	1-Jan-94	28-Dec-95	1-Jan-96	19-Nov-97	12-Nov-98	2-Dec-99	16-Nov-00	14-Nov-01	12-Nov-02	13-Nov-03
Sample ID			S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38	S-38
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Laboratory			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Laboratory Work Order	Units	MSC-PA	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ
Volatile Organic Compounds																
BENZENE	µg/L	5	***1200***	***1300***	***930***	***310***	1 J	***300***	***9.3***	***1300***	***700***	***89***	***8.5***	***1100***	ND (1)	***66.6***
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	µg/L	700	ND	ND	240	60	ND (5)	80	3.9	220	220	3	2.5	260	ND (1)	23.7
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	µg/L	20	-	-	-	-	-	-	-	-	-	-	ND (1)	*ND (100)*	ND (1)	ND (1.0)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	µg/L	1000	ND	160	260	120	ND (5)	42	5.5	720	410	3	5.1	180	ND (1)	5.2
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND	210	280	94	ND (10)	100	4.4	500	430	5	2.5	150	ND (1)	14.2
Volatile Organic Compounds (SW8011)																
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds																
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)ANTHRACENE	µg/L	4.9	ND	ND	*ND (10)*	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (2.0)	-	-
BENZO(A)PYRENE	µg/L	0.2	ND	ND	*ND (10)*	ND	*ND (1)*	*ND (1)*	*ND (1)*	*ND (1)*	*ND (2)*	*ND (2)*	*ND (1)*	*ND (2.0)*	-	-
BENZO(B)FLUORANTHENE	µg/L	1.2	ND	ND	*ND (10)*	ND	ND (1)	ND (1)	ND (1)	ND (1)	*ND (3)*	*ND (3)*	ND (1)	*ND (2.0)*	-	-
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	***11***	ND	*ND (10)*	ND	2	3	ND (1)	2	ND (3)	5	6	ND (2.0)	-	-
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	µg/L	1.9	ND	ND	ND	ND	*ND (10)*	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	1	*ND (2)*	*ND (2.0)*
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	ND	ND	*ND (10)*	ND	*ND (1)*	*ND (1)*	*ND (1)*	*ND (1)*	*ND (4)*	*ND (4)*	*ND (2)*	*ND (2.0)*	-	-
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	µg/L	1900	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	ND	***23***	***12***	***32***	*ND (10)*	***5 J***	*ND (5)*	*ND (10)*	***25***	*ND (10)*	*ND (10)*	***9.8***	*ND (10)*	2.3
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	µg/L	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	µg/L	130	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals, Dissolved																
ARSENIC	µg/L	10	ND	6.5	5	ND	***26***	***55***	***53***	***29***	ND (8)	***21***	ND (8)	***22***	-	-
BARIUM	µg/L	2000	39	-	200	173	210	360	510	460	145	555	135	ND (200)	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	ND	-	89	40.3	***140***	***640***	***770***	***810***	***246***	***233***	***110***	***183***	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	ND	ND	31	ND	***47***	***120***	***130***	***100***	32	***70***	33	*ND (50)*	-	-
LEAD	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SELENIUM	µg/L	50	ND	-	ND (5)	ND	ND (50)	ND (5.0)	ND (40)	ND (20)	ND (20)	ND (20)	ND (20)	ND (5.0)	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sample Location			S-38														
Sample Date			21-Oct-04	3-May-05	8-Nov-05	29-Nov-06	6-Dec-07	5-Nov-08	13-Nov-09	12-Nov-10	18-Nov-11	3-Apr-13	13-Jun-13	30-May-14	18-May-15	18-May-16	16-Aug-16
Sample ID			S-38	S38-050305	S-38_11_8_2005	S-38	S-38	S-38_110508	S-38	S-38	S-38	S-38_040313	S-38_06_13_2013	S-38	S-38_20150518	S-38-20160518	S-38-20160816-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	STANTEC	LANGAN	STANTEC	STANTEC	STANTEC	AQUATERRA
Laboratory			UNKNOWN	LL	Blue Marsh Labs	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	ESC
Laboratory Work Order	Units	MSC-PA	20140718EZ	UNKNOWN	UNKNOWN	20140718EZ	20140718EZ	1118614	20140718EZ	20140718EZ	20140718EZ	JB33197	JB39760	JB68176	1562471	1664163	L854116
Volatile Organic Compounds																	
BENZENE	µg/L	5	ND (1.0)	ND (5)	***16***	***7***	***26***	***140***	3	***12***	ND (5.0)	1.9	0.29 J	0.55	***160***	***180***	***198***
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.020)	-	-	ND (0.0097)	ND (0.0097)	-	ND (0.0097)	ND (0.0097)	ND (0.0097)	-	-	-	-	-	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5.0)	ND (5)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (5.0)	ND (5)	ND (1)	17	19	72	2	16	4	10.6	0.37 J	ND (1.0)	79	79	49.4
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5.0)	ND (5)	-	6.0	6.0	27	2 J	15	5	7.5	ND (2)	ND (1.0)	16	13	10.5
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5.0)	ND (5)	ND (1)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (5.0)	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21.7
NAPHTHALENE	µg/L	100	-	-	ND (1)	-	-	14	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)
TOLUENE	µg/L	1000	ND (5.0)	ND (5)	ND (1)	3.0 J	7.0	21	ND (0.5)	3	ND (5.0)	2.2	ND (1)	ND (1.0)	64	96	59.9
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	10	1 J	***71***	31	41.3	1.2 J	ND (2.0)	33	17	4.08
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	9	0.6 J	32	14	16.7	0.49 J	ND (2.0)	11	7	5.78
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (10)	ND (5)	ND (1)	6.0	29	41	1 J	32	10	23.9	0.43 J	ND (1.0)	88	83	30.6
Volatile Organic Compounds (SW8011)																	
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.029)	ND (0.02)	-	-	ND (0.0097)	-	-	-	ND (0.020)	ND (0.02)	ND (0.020)	ND (0.0096)	ND (0.0096)	ND (0.0100)
Semi-Volatile Organic Compounds																	
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.14)	ND (1)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	0.080 J	ND (1)	0.14 J	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
FLUORENE	µg/L	1900	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	-	-	ND (1)	ND (0.63)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	ND (0.1)	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.31
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
NAPHTHALENE	µg/L	100	ND (5.0)	ND (10)	-	4.0 J	4.0	-	ND (1)	4 J	6.4	1.66	ND (0.1)	0.180	20	26	19.2
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	0.069 J	ND (1)	0.31	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
PYRENE	µg/L	130	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	0.10 J	ND (1)	ND (0.096)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*
Metals, Dissolved																	
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)
LEAD	µg/L	5	ND (5.0)	ND (1)	ND (3)	0.18 J	ND (0.047)	ND (0.050)	0.11 J	0.14 J	0.13 J	1.4	ND (3)	***8.1***	0.095 J	ND (0.13)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.95
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	***20.9***
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location																S-39														
Sample Date			**10-Oct-16**	**1-Jan-93**	**1-Jan-94**	**28-Dec-95**	**1-Jan-96**	**19-Nov-97**	**12-Nov-98**	**2-Dec-99**	**16-Nov-00**	**14-Nov-01**	**12-Nov-02**	**20-Oct-04**	**3-May-05**	**8-Nov-05**	**29-Nov-06**	**6-Dec-07**	**7-Nov-08**	**13-Nov-09**	**11-Nov-10**	**18-Nov-11**	**2-Apr-13**	**2-Apr-13**	**13-Jun-13**	**19-May-14**	**18-May-15**	**12-May-16**	**10-Aug-16**	**11-Oct-16**
Sample ID			**S-38-20161010-WG**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39**	**S39-050305**	**S-39_11_8_2005**	**S-39**	**S-39**	**S-39_110708**	**S-39**	**S-39**	**S-39**	**S-39**	**S-39_040213**	**S-39_06_13_2013**	**S-39**	**S-39_20150518**	**S-39-20160512**	**S-39-20160810-WG**	**S-39-20161011-WG**
Sampling Company			**AQUATERRA**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**STANTEC**	**LANGAN**	**STANTEC**	**STANTEC**	**STANTEC**	**AQUATERRA**	**AQUATERRA**
Laboratory			**ESC**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**LL**	**Blue Marsh Labs**	**UNKNOWN**	**UNKNOWN**	**LL**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	**ACCUTEST**	**ACCUTEST**	**ACCUTEST**	**LL**	**LL**	**ESC**	**ESC**
Laboratory Work Order	**Units**	**MSC-PA**	**L865153**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**UNKNOWN**	**UNKNOWN**	**20140718EZ**	**20140718EZ**	**1119109**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**20140718EZ**	**JB33199**	**JB39760**	**JB67407**	**1562471**	**1660187**	**L853818**	**L865495**
Volatile Organic Compounds																														
BENZENE	µg/L	5	ND (1.00)	ND	1 J	ND	ND (0.3)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1.0)	ND (5)	ND (1)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	2	-	ND (1.0)	ND (1)	ND (0.50)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	*ND (0.381)*	-	-	-	-	-	-	-	-	-	-	ND (0.020)	-	-	ND (0.0097)	ND (0.0097)	-	ND (0.0099)	ND (0.0095)	ND (0.0096)	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (1.00)	-	-	-	-	-	-	-	-	-	-	ND (5.0)	ND (5)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (1.00)	ND	ND (5)	ND	ND (0.4)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (5.0)	ND (5)	ND (1)	ND (0.8)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	0.7 J	-	ND (1.0)	ND (1)	ND (0.50)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (1.00)	-	-	-	-	-	-	-	-	-	-	ND (5.0)	ND (5)	-	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (1.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (1.00)	-	-	-	-	-	-	-	1.7	1	ND (1)	ND (5.0)	ND (5)	ND (1)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)
HEXANE	µg/L	6200	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1)	-	-	ND (1)	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	µg/L	1000	ND (5.00)	ND	ND (5)	ND	ND (0.3)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (5.0)	ND (5)	ND (1)	ND (0.7)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	0.8 J	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	ND (1.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (3.00)	ND	ND (10)	ND	ND (0.6)	ND (1)	ND (1)	ND (2)	ND (2)	ND (2)	ND (1)	ND (10)	ND (5)	ND (1)	ND (0.8)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	2	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)																														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.0100)	-	-	-	-	-	-	-	-	-	-	-	ND (0.029)	ND (0.02)	-	-	ND (0.0096)	-	-	-	-	ND (0.020)	ND (0.02)	ND (0.020)	ND (0.0096)	ND (0.029)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																														
ACENAPHTHENE	µg/L	3800	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
ANTHRACENE	µg/L	66	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	ND (0.0500)	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	-	-	-	-	ND (0.1)	ND (2.0)	ND	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	ND (0.0500)	ND	*ND (1)*	*ND (1)*	*ND (1)*	*ND (1)*	*ND (2)*	*ND (2)*	*ND (1)*	-	-	-	-	ND (0.1)	*ND (2.0)*	ND	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND (0.0500)	ND	ND (1)	ND (1)	ND (1)	ND (1)	*ND (3)*	*ND (3)*	ND (1)	-	-	-	-	ND (0.1)	*ND (2.0)*	ND	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.1)	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	ND (3.00)	ND	3	ND (1)	2	3	ND (3)	ND (3)	ND (1)	-	-	-	-	-	**13.4**	ND	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	ND (3.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.0500)	ND	*ND (10)*	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	ND (1)	*ND (2)*	ND (0.14)	ND (1)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	ND (0.059)	ND (1)	ND (0.078)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	ND (0.0500)	ND	*ND (1)*	*ND (1)*	*ND (1)*	*ND (1)*	*ND (4)*	*ND (4)*	*ND (2)*	-	-	-	-	-	*ND (2.0)*	ND	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	ND (3.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	ND (10.0) OE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	-	-	ND (1)	ND (0.098)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	ND (0.0500)	ND	*ND (10)*	**4 J**	*ND (5)*	*ND (10)*	*ND (10)*	*ND (10)*	*ND (10)*	*ND (10)*	*ND (10)*	-	-	ND (0.1)	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	ND (0.250)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (0.250)	-	-	-	-	-	-	-	-	-	-	ND (5.0)	ND (10)	-	ND (1.0)	ND (1.0)	-	ND (1)	ND (1)	ND (0.98)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.250)	ND (0.250)
4-NITROPHENOL	µg/L	60	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	ND (0.039)	ND (1)	ND (0.078)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
PHENOL	µg/L	2000	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (0.0500)	-	-	-	-	-	-	-	-	-	-	ND (10)	ND (10)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	ND (0.098)	ND (1)	ND (0.098)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	ND (10.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	*ND (6.78)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved																														
ARSENIC	µg/L	10	-	ND	7.4	**22**	**20**	**19**	ND (8)	ND (8)	ND (8)	-	-	-	-	-	ND (5.0)	**17**	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	72.4	74	ND (200)	140	160	ND (100)	213	ND (100)	-	-	-	-	-	ND (200)	200	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	ND	22	92	88	91	10	24	ND (10)	-	-	-	-	-	10.7	10	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	ND (2.00)	ND	ND (20)	*ND (50)*	**40**	**49**	ND (10)	20	ND (10)	-	-	-	-	-	*ND (50)*	20	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (2.00)	-	-	-	-	-	-	-	-	-	-	ND (5.0)	ND (1)	ND (3)	0.16 J	ND (0.047)	ND (0.050)	ND (0.050)	ND (0.052)	0.080 J	ND (1)	-	ND (3)	1.8 J	ND (0.082)	ND (1.0)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	3.13 B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.88	6.06 B
SELENIUM	µg/L	50	-	ND	ND (50)	ND (5.0)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	-	-	-	-	-	ND (5.0)	ND	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	**66.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	25.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-40											
Sample Date			1-Jan-85	1-Jan-86	1-Jan-88	1-Jan-93	1-Jan-94	28-Dec-95	1-Jan-96	19-Nov-97	12-Nov-98	2-Dec-99	16-Nov-00	14-Nov-01
Sample ID			S-40	S-40	S-40	S-40	S-40	S-40	S-40	S-40	S-40	S-40	S-40	S-40
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Laboratory			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN
Laboratory Work Order	Units	MSC-PA	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ	20140718EZ
Volatile Organic Compounds														
BENZENE	µg/L	5	2800	600	2000	78	280	150	12	350	630	1000	600	1200
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	µg/L	700	1200	210	2900	12	140 J	29	3.4	ND (100)	ND (100)	ND (100)	ND (100)	68
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	-	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	µg/L	20	-	-	-	-	-	-	-	-	-	-	ND (100)	1200
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	µg/L	1000	ND	ND	ND	6	55 J	23	1.8	ND (100)	ND (100)	ND (100)	ND (100)	76
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	6100	1520	4100	16	75 J	51.2	1.9	56 J	ND (100)	ND (200)	ND (200)	ND (100)
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds														
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)ANTHRACENE	µg/L	4.9	ND	ND	ND (10)	ND	ND (1)	1	ND (1)	ND (1)	2	2	ND (13)	ND (2.0)
BENZO(A)PYRENE	µg/L	0.2	ND	ND	ND (10)	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (2)	ND (2)	ND (10)	ND (2.0)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND	ND	ND (10)	ND	ND (1)	1	ND (1)	ND (1)	ND (3)	ND (3)	ND (14)	ND (2.0)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	ND	ND	ND (10)	1 J	3	4	ND (1)	5	8	7	ND (9)	4.1
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	µg/L	1.9	ND	ND	ND	ND	ND (10)	ND	ND (1)	1	ND (1)	ND (1)	3	4
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	ND	ND	ND (10)	ND	ND (1)	ND (1)	ND (1)	ND (1)	ND (4)	ND (4)	ND (17)	ND (2.0)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	µg/L	1900	-	-	-	-	-	-	-	-	-	-	-	-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	ND	ND	ND	ND	ND (10)	ND	ND (5)	ND (5)	ND (10)	ND (10)	ND (10)	ND (10)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	µg/L	1100	-	-	-	-	-	-	-	-	-	-	-	-
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	µg/L	130	-	-	-	-	-	-	-	-	-	-	-	-
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-
Metals, Dissolved														
ARSENIC	µg/L	10	ND	22.9	ND (5)	11.3	21	25	29	20	37	ND (8)	15	22.2
BARIUM	µg/L	2000	150	-	86	163	160	250	380	260	738	974	187	ND (200)
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	ND	-	ND (20)	30	ND (20)	110	130	68	337	114	36	20.7
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	ND	ND	ND (20)	ND	ND (20)	ND (50)	28	18	93	45	13	ND (50)
LEAD	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
SELENIUM	µg/L	50	ND	-	ND (5)	ND	ND (50)	ND (5.0)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (5.0)
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-

Sample Location	S-40 (cont.)													
Sample Date	12-Nov-02	13-Nov-03	3-May-05	8-Nov-05	6-Dec-06	18-Dec-07	7-Nov-08	13-Nov-09	11-Nov-10	28-Nov-11	8-Apr-13	17-Jun-13	18-May-15	19-May-16
Sample ID	S-40	S-40-1	S40-050305	S-40_11_8_2005	S-40	S-40	S-40_110708	S-40	S-40	S-40	S-40_040813	S-40_06_17_2013	S-40_20150518	S-40-20160519
Sampling Company	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	STANTEC	LANGAN	STANTEC	STANTEC
Laboratory	UNKNOWN	UNKNOWN	LL	Blue Marsh Labs	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	LL	LL
Laboratory Work Order	20140718EZ	20140718EZ	UNKNOWN	UNKNOWN	20140718EZ	20140718EZ	1119109	20140718EZ	20140718EZ	20140718EZ	JB33644	JB40115	1562471	1664163
Volatile Organic Compounds														
BENZENE	240	987	370	436	220	3.0	ND (0.5)	5	72	ND (0.5)	ND (1)	0.58 J	10	18
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	-	-	-	-	ND (0.0097)	ND (0.0095)	-	ND (0.0099)	ND (0.0095)	ND (0.0099)	-	-	-	-
1,2-DICHLOROETHANE (EDC)	-	-	ND (5)	ND (10)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1)	ND (1)	ND (0.5)	ND (0.5)
ETHYLBENZENE	7	19.5	21	28	8.0	ND (0.5)	ND (0.5)	0.7 J	2	ND (0.5)	ND (1)	ND (1)	ND (0.5)	1
ISOPROPYLBENZENE (CUMENE)	-	-	40	-	17.0	1.0 J	ND (0.5)	4	12	0.6 J	ND (2)	1.3 J	6	16
METHYL TERTIARY BUTYL ETHER	ND (5)	ND (5.0)	ND (5)	ND (10)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1)	ND (1)	ND (0.5)	ND (0.5)
HEXANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	-	12	-	-	ND (1)	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	9	36.9	14	17	9.0	ND (0.5)	ND (0.5)	0.5 J	3	2	ND (1)	ND (1)	2	4
1,2,4-TRIMETHYLBENZENE	-	-	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2)	ND (2)	ND (0.5)	ND (0.5)
1,3,5-TRIMETHYLBENZENE	-	-	-	-	-	-	ND (0.5)	0.5 J	0.7 J	ND (0.5)	ND (2)	ND (2)	ND (0.5)	ND (0.5)
XYLENES, TOTAL (DIMETHYLBENZENE)	8	20.9	10	56	5.0 J	ND (0.5)	ND (0.5)	ND (0.5)	1	ND (0.5)	ND (1)	ND (1)	ND (0.5)	1
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	-	-	ND (0.03)	ND (0.02)	-	-	ND (0.0098)	-	-	-	ND (0.02)	ND (0.02)	ND (0.0096)	ND (0.0097)
Semi-Volatile Organic Compounds														
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	-	-	-	-	-	-	-	-	-	-	ND (0.1)	0.307	0.2 J	0.5 J
BENZO(A)ANTHRACENE	-	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.1)	0.236	ND (0.1)	0.2 J
BENZO(A)PYRENE	-	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
BENZO(B)FLUORANTHENE	-	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
BENZO(G,H,I)PERYLENE	-	-	-	ND (0.1)	-	-	-	-	-	-	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	ND (15)	ND (2.0)	ND (1)	ND (0.1)	ND (1.0)	ND (0.9)	ND (1)	0.37	1 J	6	ND (0.1)	0.31	ND (0.1)	0.2 J
DIBENZ(A,H)ANTHRACENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	-	-	ND (10)	0.9	3.0 J	1.0 J	-	-	6	6.7	0.135	0.586	0.4 J	1
INDENO(1,2,3-C,D)PYRENE	ND (100)	ND (2.0)	-	ND (0.1)	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	-	-	ND (10)	-	ND (1.0)	ND (1.0)	-	ND (1)	ND (1)	ND (9.6)	ND (0.1)	ND (0.1)	0.6	ND (0.1)
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	-	-	16	1.1	5.0 J	2.0 J	ND (1)	1.6	12	9.2	0.255	1.27	0.6	2
PHENOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	-	-	ND (10)	0.1	ND (1.0)	ND (0.9)	ND (1)	ND (0.10)	2 J	ND (0.096)	ND (0.1)	0.418	0.2 J	0.4 J
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals, Dissolved														
ARSENIC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	-	-	ND (1)	ND (3)	0.18 J	0.12 J	0.34 J	0.25 J	0.074 J	ND (0.080)	ND (3)	ND (3)	0.19 J	ND (0.13)
MERCURY	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-57			S-96				S-97				
Sample Date			12-Jun-13	15-Aug-16	13-Oct-16	20-Oct-04	1-Aug-05	14-Jun-13	17-Aug-16	20-Oct-04	4-May-05	13-Jun-13	17-Aug-16	13-Oct-16
Sample ID			S-57_06_12_2013	S-57-20160816-WG	S-57-20161013-WG	S-96	S96-080105	S-96_06_14_2013	S-96-20160817-WG	S-97	S97-050405	S-97_06_13_2013	S-97-20160817-WG	S-97-20161013-WG
Sampling Company			LANGAN	AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory			ACCUTEST	ESC	ESC	UNKNOWN	LL	ACCUTEST	ESC	UNKNOWN	LL	ACCUTEST	ESC	ESC
Laboratory Work Order	Units	MSC-PA	JB39629	L854116	L866380	20140718EZ	UNKNOWN	JB39854	L854465	20140718EZ	UNKNOWN	JB39760	L854465	L866380
Volatile Organic Compounds														
BENZENE	µg/L	5	ND (1)	ND (1.00)	ND (1.00)	ND (1.0)	ND (5)	0.46 J	***45.4***	***290***	***600***	2.8	ND (5.00)	ND (5.00)
CYCLOHEXANE	µg/L	53000	-	4.65	3.64	-	-	-	168	-	-	-	32.5	24.2
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	*ND (0.381)*	*ND (0.381)*	-	-	-	*ND (1.90)*	ND (0.020)	-	-	*ND (1.90)*	*ND (1.90)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (1)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	ND (1)	ND (5.00)	4.0	*ND (10)*	ND (1)	ND (5.00)	ND (5.00)
ETHYLBENZENE	µg/L	700	ND (1)	4.39	ND (1.00)	ND (5.0)	ND (5)	ND (1)	60.1	55	63	1.9	ND (5.00)	ND (5.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (2)	3.47	1.44	ND (5.0)	ND (5)	0.46 J	25.9	23	ND (50)	4.8	5.92	ND (5.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (1)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	1.2	ND (5.00)	ND (1.8)	ND (5)	ND (1)	ND (5.00)	ND (5.00)
HEXANE	µg/L	6200	-	1.96	ND (1.00)	-	-	-	109	-	-	-	15.3	7.35
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	10.8	2.48	-	-	-	ND (5.00)	-	-	-	ND (5.00)	ND (5.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	ND (1.00)	ND (1.00)	-	-	-	ND (5.00)	-	-	-	ND (5.00)	ND (5.00)
TOLUENE	µg/L	1000	ND (1)	ND (5.00)	ND (5.00)	ND (5.0)	ND (5)	1.1	51.1	19	ND (50)	0.68 J	ND (25.0)	ND (25.0)
1,2,4-TRIMETHYLBENZENE	µg/L	62	ND (2)	11.2	ND (1.00)	-	-	ND (2)	8.43	-	-	9.3	6.42	ND (5.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	ND (2)	4.00	ND (1.00)	-	-	ND (2)	19.2	-	-	10	12.2	5.80
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (1)	12.3	ND (3.00)	ND (10)	ND (5)	0.25 J	82.0	160	230	4.7	ND (15.0)	ND (15.0)
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.02)	ND (0.0100)	ND (0.0100)	-	ND (0.029)	ND (0.02)	ND (0.0100)	-	ND (0.028)	ND (0.02)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds														
ACENAPHTHENE	µg/L	3800	-	0.874	0.933	-	-	-	1.81	-	-	-	3.14	2.28
ANTHRACENE	µg/L	66	ND (0.1)	0.255	ND (0.0500)	-	-	ND (1)	ND (1.00)	-	-	ND (0.1)	1.17	ND (0.100)
BENZO(A)ANTHRACENE	µg/L	4.9	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (1)	ND (1.00)	-	-	ND (0.1)	ND (0.100)	ND (0.100)
BENZO(A)PYRENE	µg/L	0.2	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.12)	*ND (0.232)*	-	-	ND (0.1)	ND (0.100)	ND (0.100)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (1)	ND (1.00)	-	-	ND (0.1)	ND (0.100)	ND (0.100)
BENZO(G,H,I)PERYLENE	µg/L	0.26	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.16)	ND (0.0454)	-	-	ND (0.1)	ND (0.100)	ND (0.100)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.272)	-	-	-	ND (0.100)	ND (0.100)
1,1'-BIPHENYL	µg/L	430	-	ND (14.3)	ND (10.0) OE	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0) OE
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	ND (4.29)	ND (3.00)	-	-	-	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	ND (4.29)	ND (3.00)	-	-	-	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	0.176	ND (0.0500)	ND (0.0500)	-	ND (1)	ND (1)	ND (1.00)	ND (0.14)	ND (1)	ND (0.1)	ND (0.100)	ND (0.100)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0792)	-	-	-	ND (0.100)	ND (0.100)
DIETHYL PHTHALATE	µg/L	93000	-	ND (4.29)	ND (3.00)	-	-	-	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	ND (14.3)	ND (10.0) OE	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0) OE
2,4-DINITROPHENOL	µg/L	230	-	ND (14.3)	ND (10.0)	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (1.00)	-	-	-	0.199	ND (0.100)
FLUORENE	µg/L	1900	4.26	1.05	1.61	-	ND (5)	4.16	2.47	ND (10)	25	1.39	3.19	2.68
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (1.00)	-	-	-	ND (0.100)	ND (0.100)
2-METHYLNAPHTHALENE	µg/L	470	-	3.39	1.47	-	-	-	16.2	-	-	-	8.10	ND (0.500)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	ND (14.3)	ND (10.0) OE	-	-	-	ND (10.0)	-	-	-	15.8	ND (10.0) OE
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	ND (14.3)	ND (10.0) OE	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0) OE
NAPHTHALENE	µg/L	100	ND (0.1)	2.32	ND (0.250)	ND (5.0)	ND (5)	ND (1)	5.77	55	***110***	ND (0.1)	0.900	ND (0.500)
4-NITROPHENOL	µg/L	60	-	ND (14.3)	ND (10.0)	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	4.16	1.74	1.84	-	ND (5)	ND (1)	3.21	ND (10)	47	2.21	5.35	3.64
PHENOL	µg/L	2000	-	23.7	45.7 OE	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0) OE
PYRENE	µg/L	130	0.768	0.284	0.228	-	ND (5)	3.11	ND (1.00)	ND (10)	ND (10)	0.434	1.51	0.577
PYRIDINE	µg/L	120	-	ND (14.3)	ND (10.0) OE	-	-	-	ND (10.0)	-	-	-	ND (10.0)	ND (10.0) OE
QUINOLINE	µg/L	1.1	-	*ND (9.70)*	*ND (6.78)*	-	-	-	*ND (6.78)*	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved														
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	ND (2.00)	ND (2.00)	-	-	-	ND (2.00)	-	-	-	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (3)	ND (2.00)	ND (2.00)	-	ND (1)	2.9 J	ND (2.00)	ND (5.0)	ND (1)	***21.4***	4.91	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	4.50	4.77	-	-	-	2.35	-	-	-	4.89	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	ND (5.00)	ND (5.00)	-	-	-	ND (5.00)	-	-	-	***14.5***	ND (5.00)
ZINC	µg/L	2000	-	ND (25.0)	ND (25.0)	-	-	-	ND (25.0)	-	-	-	186	ND (25.0)

Sample Location	S-102				S-103	S-104		S-119				
Sample Date	21-Oct-04	6-May-05	12-Jun-13	12-Oct-16	12-Oct-16	19-Aug-16	11-Oct-16	20-Oct-04	3-May-05	12-Jun-13	12-Aug-16	10-Oct-16
Sample ID	S-102	S102-050605	S-102_06_12_2013	S-102-20161012-WG	S-103-20161012-WG	S-104-20160819-WG	S-104-20161011-WG	S-119	S119-050305	S-119_06_12_2013	S-119-20160812-WG	S-119-20161010-WG
Sampling Company	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory	UNKNOWN	LL	ACCUTEST	ESC	ESC	ESC	ESC	UNKNOWN	LL	ACCUTEST	ESC	ESC
Laboratory Work Order	20140718EZ	UNKNOWN	JB39629	L865801	L865801	L854978	L865495	20140718EZ	UNKNOWN	JB39629	L853817	L865153
Volatile Organic Compounds												
BENZENE	ND (1.0)	ND (5)	ND (1)	ND (1.00)	ND (3.31) SL	ND (5.00) SL	***18.8 SL***	ND (1.0)	5	ND (1)	ND (1.00)	2.83
CYCLOHEXANE	-	-	-	1.14	ND (10.0) SL	ND (5.00) SL	ND (10.0) SL	-	-	-	ND (1.00)	ND (1.00)
1,2-DIBROMOETHANE (EDB)	ND (0.020)	-	-	*ND (0.381)*	*ND (3.81) SL*	*ND (1.90) SL*	*ND (3.81) SL*	ND (0.020)	-	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (3.61) SL	ND (5.00) SL	ND (3.61) SL	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (1.00)
ETHYLBENZENE	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (10.0) SL	ND (5.00) SL	18.0 SL	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	6.9	ND (5)	0.84 J	ND (1.00)	23.5 SL	55.9 SL	21.5 SL	ND (5.0)	ND (5)	ND (2)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (10.0) SL	ND (5.00) SL	ND (10.0) SL	ND (5.0)	ND (5)	ND (1)	ND (1.00)	ND (1.00)
HEXANE	-	-	-	ND (1.00)	ND (10.0) SL	ND (5.00) SL	ND (10.0) SL	-	-	-	ND (1.00)	ND (1.00)
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	5.09	ND (10.0) SL	64.1 SL	12.8 SL	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	-	-	-	1.01	ND (10.0) SL	18.0 SL	ND (10.0) SL	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	ND (5.0)	ND (5)	ND (1)	ND (5.00)	ND (50.0) SL	ND (25.0) SL	57.9 SL	ND (5.0)	ND (5)	ND (1)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	-	-	ND (2)	ND (1.00)	ND (10.0) SL	ND (5.00) SL	***124 SL***	-	-	ND (2)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	-	-	ND (2)	ND (1.00)	ND (10.0) SL	ND (5.00) SL	43.9 SL	-	-	ND (2)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (10)	ND (5)	ND (1)	ND (3.00)	ND (30.0) SL	ND (15.0) SL	205 SL	ND (10)	ND (5)	ND (1)	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	-	ND (0.028)	ND (0.02)	ND (0.0100)	ND (0.0100) SL	ND (0.0100) SL	ND (0.0100) SL	-	ND (0.028)	ND (0.02)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds												
ACENAPHTHENE	-	-	-	0.946	4.49 SL	20.1 SL	13.8 SL	-	-	-	ND (0.0500)	ND (0.0500)
ANTHRACENE	-	-	0.292	0.751	ND (0.500) SL	ND (1.00) SL	ND (1.00) SL	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	-	-	0.212	0.469	ND (0.500) SL	1.13 B SL	ND (1.00) SL	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	-	-	ND (0.1)	0.163	ND (0.116) SL	*ND (0.232) SL*	*ND (0.232) SL*	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	-	-	ND (0.1)	0.121	ND (0.500) SL	ND (1.00) SL	ND (1.00) SL	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	-	-	ND (0.1)	0.0903	ND (0.0227) SL	ND (0.0454) SL	ND (0.0454) SL	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	-	-	-	ND (0.0500)	ND (0.500) SL	ND (0.272) SL	ND (0.272) SL	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	-	-	-	ND (10.0)	ND (200) SL	ND (130) SL	ND (162) SL	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	-	-	-	ND (3.00)	*ND (14.2) SL*	*ND (284) SL*	*ND (354) SL*	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	-	-	-	ND (3.00)	ND (60.0) SL	ND (1200) SL	ND (1500) SL	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	1.5	ND (1)	0.346	0.511	ND (0.500) SL	ND (1.00) SL	ND (1.00) SL	ND (0.14)	ND (1)	ND (0.1)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	-	-	-	ND (0.0500)	ND (0.500) SL	ND (0.0792) SL	ND (0.0792) SL	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	-	-	-	ND (3.00)	ND (60.0) SL	ND (1200) SL	ND (1500) SL	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	-	-	-	ND (10.0)	ND (200) SL	ND (250) SL	ND (312) SL	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	-	-	-	ND (10.0) OE	ND (200) OE SL	*ND (1300) SL*	*ND (1620) SL*	-	-	-	ND (10.0)	ND (10.0) OE
FLUORANTHENE	-	-	-	0.368	0.579 SL	1.79 SL	ND (1.00) SL	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	ND (10)	ND (10)	0.832	1.34	5.18 SL	23.6 SL	13.2 SL	ND (10)	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	-	-	-	ND (0.0500)	ND (0.500) SL	ND (1.00) SL	ND (1.00) SL	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	-	-	-	ND (0.250)	10.1 SL	ND (5.00) SL	78.5 SL	-	-	-	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	ND (10.0)	ND (200) SL	ND (106) SL	ND (133) SL	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	ND (10.0)	ND (200) SL	ND (4000) SL	ND (5000) SL	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	ND (5.0)	ND (10)	ND (0.1)	0.830	3.29 B SL	ND (5.00) SL	35.5 SL	ND (5.0)	ND (10)	ND (0.1)	ND (0.250)	ND (0.250)
4-NITROPHENOL	-	-	-	ND (10.0)	ND (40.2) SL	*ND (804) SL*	*ND (1000) SL*	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	ND (10)	ND (10)	0.634	3.41	10.1 SL	17.2 SL	19.0 SL	ND (10)	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)
PHENOL	-	-	-	ND (10.0)	ND (200) SL	ND (134) SL	ND (167) SL	-	-	-	ND (10.0)	ND (10.0)
PYRENE	ND (10)	ND (10)	0.341	1.15	2.28 SL	14.5 SL	7.19 SL	ND (10)	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)
PYRIDINE	-	-	-	ND (10.0)	ND (27.4) SL	*ND (548) SL*	*ND (685) SL*	-	-	-	ND (10.0) OE	ND (10.0)
QUINOLINE	-	-	-	*ND (6.78)*	*ND (136) SL*	*ND (2710) SL*	*ND (3390) SL*	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved												
ARSENIC	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	-	-	-	ND (2.00)	ND (2.00) SL	2.64 SL	6.54 SL	-	-	-	4.15	3.65
LEAD	ND (5.0)	ND (1)	ND (3)	ND (2.00)	ND (2.00) SL	ND (2.00) SL	ND (2.00) SL	ND (5.0)	ND (1)	ND (3)	ND (2.00)	ND (2.00)
MERCURY	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	-	-	-	ND (2.00)	ND (2.00) SL	2.02 B SL	2.15 B SL	-	-	-	3.05	2.62 B
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	ND (5.00)	ND (5.00) SL	ND (5.00) SL	ND (5.00) SL	-	-	-	ND (5.00)	ND (5.00)
ZINC	-	-	-	ND (25.0)	ND (25.0) SL	ND (25.0) SL	ND (25.0) SL	-	-	-	40.0	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-120																	S-121			
Sample Date			20-Oct-04	3-May-05	29-Nov-06	14-Dec-07	5-Nov-08	13-Nov-09	11-Nov-10	18-Nov-11	2-Apr-13	2-Apr-13	12-Jun-13	21-May-14	18-May-15	18-May-16	12-Aug-16	11-Oct-16	11-Oct-16	20-Oct-04	4-May-05	13-Jun-13	15-Aug-16
Sample ID			S-120	S120-050305	S-120	S-120	S-120_110508	S-120	S-120	S-120	S-120	S-120_040213	S-120_06_12_2013	S-120	S-120_20150518	S-120-20160518	S-120-20160812-WG	S-120-20161011-WG	S-120-20161011-WG-DUP	S-121	S121-050405	S-121_06_13_2013	S-121-20160815
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	STANTEC	LANGAN	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA
Laboratory			UNKNOWN	LL	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	ESC	ESC	ESC	UNKNOWN	LL	ACCUTEST	ESC
Laboratory Work Order	Units	MSC-PA	20140718EZ	UNKNOWN	20140718EZ	20140718EZ	1118614	20140718EZ	20140718EZ	20140718EZ	20140718EZ	JB33199	JB39629	JB67626	1562471	1664163	L853817	L865495	L865495	20140718EZ	UNKNOWN	JB39760	L854116
Volatile Organic Compounds																							
BENZENE	µg/L	5	ND (1.0)	ND (5)	ND (0.5)	ND (0.5)	0.5 J	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	**7.8**	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.0)	ND (5)	ND (1)	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	-	ND (1.00)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.020)	-	ND (0.0097)	ND (0.0095)	-	ND (0.0098)	ND (0.0097)	ND (0.0096)	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*	*ND (0.381)*	ND (0.020)	-	-	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5.0)	ND (5)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	ND (1)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (5.0)	ND (5)	ND (0.8)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	ND (1)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5.0)	ND (5)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	ND (2)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5.0)	ND (5)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (5.0)	ND (5)	ND (1)	ND (1.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	-	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	ND (1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	-	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	-	ND (1.00)
TOLUENE	µg/L	1000	ND (5.0)	ND (5)	ND (0.7)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	1.1	ND (0.5)	ND (0.5)	ND (5.00)	ND (5.00)	ND (5.00)	ND (5.0)	ND (5)	ND (1)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	-	-	ND (2)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	-	-	ND (2)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (10)	ND (5)	ND (0.8)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (3.00)	ND (3.00)	ND (3.00)	ND (10)	ND (5)	ND (1)	ND (3.00)
Volatile Organic Compounds (SW8011)																							
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.029)	-	-	ND (0.0098)	-	-	-	-	ND (0.020)	ND (0.02)	ND (0.020)	ND (0.0096)	ND (0.0098)	ND (0.0100)	ND (0.0100)	ND (0.0100)	-	ND (0.028)	ND (0.02)	ND (0.0100)
Semi-Volatile Organic Compounds																							
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.14)	ND (1)	ND (1.0)	ND (0.9)	ND (1)	ND (0.057)	ND (1)	ND (0.076)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.14)	ND (1)	ND (0.1)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)
FLUORENE	µg/L	1900	ND (10)	ND (10)	ND (1.0)	ND (0.9)	-	-	ND (1)	ND (0.095)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	ND (0.1)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)	ND (0.250)	-	-	-	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
NAPHTHALENE	µg/L	100	ND (5.0)	ND (10)	ND (1.0)	ND (1.0)	-	ND (1)	ND (1)	ND (0.95)	-	1.39	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.250)	ND (0.250)	ND (0.250)	ND (5.0)	ND (10)	ND (0.1)	ND (0.250)
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (10)	ND (10)	ND (1.0)	ND (0.9)	ND (1)	ND (0.038)	ND (1)	ND (0.076)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	ND (0.1)	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
PYRENE	µg/L	130	ND (10)	ND (10)	ND (1.0)	ND (0.9)	ND (1)	ND (0.095)	ND (1)	ND (0.095)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	ND (0.1)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0) OE	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*	-	-	-	*ND (6.78)*
Metals, Dissolved																							
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00)	-	-	-	ND (2.00)
LEAD	µg/L	5	ND (5.0)	ND (1)	0.16 J	0.10 J	ND (0.050)	ND (0.050)	ND (0.052)	ND (0.080)	ND (1)	-	ND (3)	ND (3.0)	ND (0.082)	ND (0.13)	ND (2.00)	ND (2.00)	ND (2.00)	ND (5.0)	ND (1)	ND (3)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.69	5.63 B	5.06 B	-	-	-	2.19
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	ND (5.00)	-	-	-	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.6	ND (25.0)	ND (25.0)	-	-	-	ND (25.0)

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-122																	S-123				S-124				S-216			
Sample Date			20-Oct-04	3-May-05	29-Nov-06	6-Dec-07	5-Nov-08	13-Nov-09	12-Nov-10	18-Nov-11	2-Apr-13	2-Apr-13	13-Jun-13	19-May-14	18-May-15	12-May-16	9-Aug-16	13-Oct-16	13-Oct-16	20-Oct-04	4-May-05	18-Aug-16	13-Oct-16	8-Apr-10	19-Aug-16	19-Aug-16	12-Oct-16	28-Apr-05	12-Jun-13	16-Aug-16	12-Oct-16
Sample ID			S-122	S122-050305	S-122	S-122	S-122_110508	S-122	S-122	S-122	S-122	S-122_040213	S-122_06_13_2013	S-122	S-122_20150518	S-122-20160512	S-122-20160809-WG	S-122-20161013-WG	S-122-20161013-WG-DUP	S-123	S123-050405	S-123-20160818-WG	S-123-20161013-WG	S-124 GROUNDWATER	S-124-20160819-WG	S-124-20160819-WG-DUP	S-124-20161012-WG	S216-042805	S-216_06_12_2013	S-216-20160816-WG	S-216-20161012-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	STANTEC	LANGAN	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	AQUATERRA	AQUATERRA	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory			UNKNOWN	LL	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	ESC	ESC	ESC	UNKNOWN	LL	ESC	ESC	LL	ESC	ESC	ESC	LL	ACCUTEST	ESC	ESC
Laboratory Work Order	Units	MSC-PA	20140718EZ	UNKNOWN	20140718EZ	20140718EZ	1118614	20140718EZ	20140718EZ	20140718EZ	20140718EZ	JB33199	JB39760	JB67407	1562471	1660187	L853820	L866378	L866378	20140718EZ	UNKNOWN	L854778	L866378	1189821	L854979	L854979	L865801	UNKNOWN	JB39629	L854116	L865801
Volatile Organic Compounds																															
BENZENE	µg/L	5	ND (1.0)	ND (5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (0.50)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	**150**	**8**	4.86	**6.14**	**2800**	**3210**	**3400**	**4230 SL**	**290**	**23.7**	**18.2**	**19.4**
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	11.8	40.0	-	411	446	243 SL	-	-	25.1	18.1
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.020)	-	ND (0.0098)	ND (0.0096)	-	ND (0.0097)	ND (0.0097)	ND (0.0096)	-	-	-	-	-	-	ND (0.381)	ND (0.381)	ND (0.381)	ND (0.020)	-	ND (0.381)	ND (0.381)	-	ND (19.0)	ND (19.0)	ND (19.0) SL	-	-	ND (0.381)	ND (1.90)
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5.0)	ND (5)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (3.7)	ND (5)	ND (1.00)	ND (1.00)	ND (10)	ND (18.0)	ND (18.0)	ND (18.0) SL	ND (2)	ND (1)	ND (1.00)	ND (5.00)
ETHYLBENZENE	µg/L	700	ND (5.0)	ND (5)	1.0 J	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (0.50)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	280	68	10.7	49.0	330	**876**	**921**	646 SL	110	0.85 J	1.05	ND (5.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5.0)	ND (5)	4.0 J	ND (0.5)	ND (0.5)	ND (0.5)	1 J	ND (0.5)	-	ND (2.0)	ND (2)	ND (1.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	19	10	ND (1.00)	2.33	-	ND (50.0)	ND (50.0)	ND (50.0) SL	73	26.2	28.8	22.3
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5.0)	ND (5)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (4.4)	ND (5)	ND (1.00)	ND (1.00)	9 J	ND (18.4)	ND (18.4)	ND (18.4) SL	**210**	0.6 J	4.17	ND (5.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	4.72	9.29	-	200	226	150 SL	-	-	ND (1.00)	ND (5.00)
NAPHTHALENE	µg/L	100	-	-	-	-	ND (1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	ND (1.00)	ND (1.00)	-	ND (50.0)	ND (50.0)	ND (50.0) SL	-	-	5.96	ND (5.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	-	ND (1.00)	ND (1.00)	-	ND (50.0)	ND (50.0)	ND (50.0) SL	-	-	2.10	ND (5.00)
TOLUENE	µg/L	1000	ND (5.0)	ND (5)	ND (0.7)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (5.00)	ND (5.00)	ND (5.00)	260	190	20.8	95.5	370	297	311	ND (250) SL	48	4.6	6.11	ND (25.0)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	ND (0.5)	ND (0.5)	2	ND (0.5)	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	-	-	12.5	32.0	-	**839**	**930**	**545 SL**	-	0.34 J	ND (1.00)	12.5
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	-	-	2.22	3.18	-	264	285	160 SL	-	ND (2)	ND (1.00)	ND (5.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (10)	ND (5)	2.0 J	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	-	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (1)	ND (3.00)	ND (3.00)	ND (3.00)	1300	250	43.4	134	3800	1820	2100	1390 SL	240	3.7	5.22	ND (15.0)
Volatile Organic Compounds (SW8011)																															
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.029)	-	-	ND (0.0098)	-	-	-	-	ND (0.020)	ND (0.02)	ND (0.020)	ND (0.0097)	ND (0.029)	ND (0.0100)	ND (0.0100)	ND (0.0100)	-	ND (0.028)	ND (0.0100)	ND (0.0100)	-	ND (0.0100)	ND (0.0100)	ND (0.0100) SL	ND (0.029)	ND (0.02)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																															
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	2.43	0.908	-	6.99	5.06	4.23 SL	-	-	1.77	1.58 J-
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	1.31	0.340	-	1.61	1.08	1.42 SL	-	0.246	ND (0.0500)	ND (0.0500) J
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	ND (0.1)	ND (0.0500)	ND (0.0500) J
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	ND (0.1)	ND (0.0500)	ND (0.0500) J
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	ND (0.1)	ND (0.0500)	ND (0.0500) J
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500) OE	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	ND (0.1)	ND (0.0500)	ND (0.0500) J
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	-	ND (0.0500)	ND (0.0500) J
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	ND (3.00) SL	-	-	**30**	5.23
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	ND (3.00) SL	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.14)	ND (1)	ND (1.0)	ND (1.0)	ND (1)	ND (0.059)	ND (1)	ND (0.076)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.14)	ND (1)	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	ND (1)	ND (0.1)	ND (0.0500)	ND (0.0500) J
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500) OE	ND (0.0500)	-	ND (0.0500) OE	ND (0.0500) OE	ND (0.0500) SL	-	-	ND (0.0500)	ND (0.0500) J
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	ND (3.00) SL	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	41.9	44.9	63.6 SL	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0) OE	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) OE SL	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	0.170	ND (0.0500)	-	0.0866	ND (0.0500)	0.135 SL	-	-	0.0961	0.0701 J-
FLUORENE	µg/L	1900	ND (10)	ND (10)	ND (1.0)	ND (1.0)	-	-	ND (1)	0.10 J	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	13	13	2.51	1.22	-	6.23	4.51	4.19 SL	60	3.47	2.96	2.68 J-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500) OE	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	-	-	ND (0.0500)	ND (0.0500) J
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)	ND (0.250)	-	-	3.04	0.802	-	258	184	111 SL	-	-	ND (0.250)	11.4 J-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (5.0)	ND (10)	2.0 J	ND (1.0)	-	ND (1)	ND (1)	ND (0.95)	-	ND (0.10)	ND (0.1)	ND (0.10)	0.2 J	ND (0.5)	ND (0.250)	ND (0.250)	ND (0.250)	**220**	26	2.41	4.23	-	**347**	**307**	**164 SL**	**150**	ND (0.1)	1.36	6.48 J-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0) OE	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (10)	ND (10)	ND (1.0)	ND (1.0)	ND (1)	ND (0.039)	ND (1)	ND (0.076)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	24	34	5.17	1.85	-	15.1	9.13	10.0 SL	87	2.71	3.61	3.53 J-
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (10)	ND (10)	ND (1.0)	ND (1.0)	ND (1)	ND (0.098)	ND (1)	ND (0.095)	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.5)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (10)	ND (10)	1.16	0.279	-	0.500	0.172	0.359 SL	ND (10)	ND (0.1)	0.170	0.122 J-
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)	ND (6.78)	-	-	ND (13.6)	ND (6.78)	-	ND (6.78)	ND (6.78)	ND (6.78) SL	-	-	ND (6.78)	ND (6.78)
Metals, Dissolved																															
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.23	ND (2.00)	ND (2.00)	-	-	5.99	2.97	-	2.19	2.23	2.87 SL	-	-	11.6	5.45
LEAD	µg/L	5	ND (5.0)	ND (1)	0.13 J	0.14 J	ND (0.050)	ND (0.050)	ND (0.052)	ND (0.080)	ND (1)	-	ND (3)	ND (3.0)	ND (0.082)	ND (1.0)	ND (2.00)	ND (2.00)	ND (2.00)	ND (5.0)	ND (1)	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (1)	ND (3)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00)	-	-	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	ND (2.00) SL	-	-	42.6	5.63
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	ND (5.00)	-	-	ND (5.00)	ND (5.00)	-	ND (5.00)	ND (5.00)	ND (5.00) SL	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)	ND (25.0)	-	-	ND (25.0)	ND (25.0)	-	ND (25.0)	ND (25.0)	ND (25.0) SL	-	-	ND (25.0)	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-218					S-219				S-220	
Sample Date			28-Apr-05	14-Jun-13	17-Aug-16	17-Aug-16	12-Oct-16	28-Apr-05	12-Jun-13	15-Aug-16	11-Oct-16	18-Aug-16	12-Oct-16
Sample ID			S218-042805	S-218_06_14_2013	S-218-20160817-WG	S-218-20160817-WG-DUP	S-218-20161012-WG	S219-042805	S-219_06_12_2013	S-219-20160815	S-219-20161011-WG	S-220-20160818-WG	S-220-20161012-WG
Sampling Company			UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	ACCUTEST	ESC	ESC	ESC	LL	ACCUTEST	ESC	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	JB39854	L854465	L854465	L865801	UNKNOWN	JB39629	L854116	L865495	L854778	L865801
Volatile Organic Compounds													
BENZENE	µg/L	5	**2200**	**682**	**638**	**636**	**498**	**23**	ND (1)	ND (1.00)	ND (1.00)	ND (3.31) SL	**174 SL**
CYCLOHEXANE	µg/L	53000	-	-	118	113	74.0	-	-	ND (1.00)	ND (1.00)	834 SL	675 SL
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	ND (3.81)	ND (1.90)	ND (3.81)	-	-	ND (0.381)	ND (0.381)	ND (3.81) SL	ND (38.1) SL
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (10)	ND (5)	ND (3.61)	ND (5.00)	ND (3.61)	ND (5)	ND (1)	ND (1.00)	ND (1.00)	ND (3.61) SL	ND (36.1) SL
ETHYLBENZENE	µg/L	700	**1300**	41.5	103	95.8	48.7	ND (5)	ND (1)	ND (1.00)	ND (1.00)	244 SL	342 SL
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (50)	15.7	22.1	21.6	13.8	ND (5)	ND (2)	ND (1.00)	ND (1.00)	70.0 SL	ND (100) SL
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5)	18.3	ND (10.0)	ND (5.00)	ND (10.0)	ND (5)	ND (1)	ND (1.00)	ND (1.00)	ND (10.0) SL	ND (36.7) SL
HEXANE	µg/L	6200	-	-	ND (10.0)	ND (5.00)	38.6	-	-	ND (1.00)	ND (1.00)	920 SL	900 SL
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	ND (10.0)	6.89	ND (10.0)	-	-	ND (1.00)	ND (1.00)	19.6 SL	ND (100) SL
BUTYLBENZENE, TERT-	µg/L	12000	-	-	ND (10.0)	ND (5.00)	ND (10.0)	-	-	ND (1.00)	ND (1.00)	ND (10.0) SL	ND (100) SL
TOLUENE	µg/L	1000	360	24.2	62.3	61.2	ND (50.0)	ND (5)	ND (1)	ND (5.00)	ND (5.00)	ND (50.0) SL	ND (500) SL
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	**89.1**	**119**	**112**	28.6	-	ND (2)	ND (1.00)	ND (1.00)	**902 SL**	**173 SL**
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	117	106	98.6	54.6	-	ND (2)	ND (1.00)	ND (1.00)	498 SL	122 SL
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	2400	267	307	286	132	6	ND (1)	ND (3.00)	ND (3.00)	542 SL	314 SL
Volatile Organic Compounds (SW8011)													
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	**0.052**	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100)	ND (0.029)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100) SL	ND (0.0100) SL
Semi-Volatile Organic Compounds													
ACENAPHTHENE	µg/L	3800	-	-	0.661	0.640	0.768	-	-	ND (0.0500)	ND (0.0500)	24.7 SL	9.72 J+ SL
ANTHRACENE	µg/L	66	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	4.43 J+ SL
BENZO(A)ANTHRACENE	µg/L	4.9	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	0.390 SL	0.221 J+ SL
BENZO(A)PYRENE	µg/L	0.2	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	**0.206 SL**	0.0754 J+ SL
BENZO(B)FLUORANTHENE	µg/L	1.2	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	0.146 SL	0.107 J+ SL
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	0.101 J+ SL
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500) SL	ND (0.0625) SL
1,1'-BIPHENYL	µg/L	430	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	12.5 SL	ND (10.0) SL
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	**29.9 SL**	**88.6 SL**
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	ND (3.00) SL	5.31 SL
CHRYSENE	µg/L	1.9	ND (1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (1)	ND (0.1)	ND (0.0500)	ND (0.0500)	0.444 SL	0.228 J+ SL
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500) OE SL	ND (0.0625) SL
DIETHYL PHTHALATE	µg/L	93000	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	ND (3.00) SL	ND (3.00) SL
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) SL	ND (10.0) SL
2,4-DINITROPHENOL	µg/L	230	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) OE SL	ND (10.0) OE SL
FLUORANTHENE	µg/L	260	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	0.887 SL	0.968 J+ SL
FLUORENE	µg/L	1900	ND (10)	0.424	0.814	0.710	0.917	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)	35.4 SL	14.9 J+ SL
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	0.0588 OE SL	ND (0.0625) SL
2-METHYLNAPHTHALENE	µg/L	470	-	-	52.4	41.0	44.0	-	-	ND (0.250)	ND (0.250)	**591 SL**	354 SL
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) SL	ND (10.0) SL
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) SL	ND (10.0) SL
NAPHTHALENE	µg/L	100	**250**	82.7	85.4	49.5	20.6	ND (10)	ND (0.1)	ND (0.250)	ND (0.250)	**349 SL**	**338 SL**
4-NITROPHENOL	µg/L	60	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) OE SL	ND (10.0) SL
PHENANTHRENE	µg/L	1100	ND (10)	0.386	0.723	0.630	0.817	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)	70.2 SL	36.4 J+ SL
PHENOL	µg/L	2000	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) SL	ND (10.0) SL
PYRENE	µg/L	130	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (10)	ND (0.1)	ND (0.0500)	ND (0.0500)	3.96 SL	1.88 J+ SL
PYRIDINE	µg/L	120	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	ND (10.0) SL	ND (10.0) SL
QUINOLINE	µg/L	1.1	-	-	ND (6.78)	ND (6.78)	ND (6.78)	-	-	ND (6.78)	ND (6.78)	ND (33.9) SL	ND (6.78) SL
Metals, Dissolved													
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	14.7	16.5	25.2	-	-	3.31 B	2.17	2.23 SL	ND (2.00) SL
LEAD	µg/L	5	ND (1)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00)	ND (1)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (2.00) SL
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	3.29	3.41	4.92	-	-	3.95 B	ND (2.00)	ND (2.00) SL	ND (2.00) SL
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	ND (5.00)	ND (5.00)	ND (5.00)	-	-	ND (5.00)	ND (5.00)	ND (5.00) SL	ND (5.00) SL
ZINC	µg/L	2000	-	-	ND (25.0)	ND (25.0)	ND (25.0)	-	-	ND (25.0)	ND (25.0)	ND (25.0) SL	ND (25.0) SL

Sample Location			S-222														
Sample Date			1-Aug-05	8-Nov-05	30-Nov-06	6-Dec-07	5-Nov-08	12-Nov-09	15-Nov-10	18-Nov-11	3-Apr-13	18-Jun-13	21-May-14	18-May-15	18-May-16	17-Aug-16	13-Oct-16
Sample ID			S-222-080105	S-222_11_8_2005	S-222	S-222	S-222_110508	S-222	S-222	S-222	S-222_040313	S-222_06_18_2013	S-222	S-222_20150518	S-222-20160518	S-222-20160817-WG	S-222-20161013-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	STANTEC	LANGAN	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA
Laboratory			LL	Blue Marsh Labs	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	UNKNOWN	20140718EZ	20140718EZ	1118614	20140718EZ	20140718EZ	20140718EZ	JB33197	JB40112	JB67626	1562471	1664163	L854465	L866384
Volatile Organic Compounds																	
BENZENE	µg/L	5	ND (5)	**12**	0.8 J	3.0	3	ND (0.5)	**15**	ND (0.5)	ND (1.0)	0.91 J	**29.7**	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	1.64
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	ND (0.0098)	ND (0.0098)	-	ND (0.0099)	ND (0.0097)	ND (0.0096)	-	-	-	-	-	ND (0.381)	ND (0.381) OE
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (5)	6	ND (0.8)	ND (0.5)	ND (0.5)	ND (0.5)	4	ND (0.5)	ND (1.0)	0.23 J	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	1.16
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5)	-	ND (1.0)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (2.0)	ND (2)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5)	ND (1)	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (1.0)	ND (1)	ND (1.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	12	-	-	ND (1)	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	µg/L	1000	ND (5)	5	ND (0.7)	1.0	ND (0.5)	ND (0.5)	2	ND (0.5)	ND (1.0)	0.43 J	6.8	ND (0.5)	ND (0.5)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	ND (0.5)	ND (0.5)	4	ND (0.5)	ND (2.0)	0.79 J	ND (2.0)	ND (0.5)	ND (0.5)	ND (1.00)	2.42
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	ND (0.5)	ND (0.5)	1 J	ND (0.5)	ND (2.0)	ND (2)	ND (2.0)	ND (0.5)	ND (0.5)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	10	13	ND (0.8)	0.5 J	ND (0.5)	ND (0.5)	16	ND (0.5)	ND (1.0)	0.86 J	ND (1.0)	ND (0.5)	ND (0.5)	ND (3.00)	4.73
Volatile Organic Compounds (SW8011)																	
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.029)	ND (0.02)	-	-	ND (0.0097)	-	-	-	ND (0.020)	ND (0.02)	ND (0.020)	ND (0.0097)	ND (0.0096)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																	
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	0.449
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	0.150
BENZO(A)ANTHRACENE	µg/L	4.9	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	ND (0.1)	-	-	-	-	-	-	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (1)	ND (0.1)	ND (1.0)	ND (1.0)	ND (1)	ND (0.058)	ND (0.058)	ND (0.076)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (6)	ND (0.1)	ND (1.0)	ND (1.0)	-	-	ND (0.096)	ND (0.095)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	0.482
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	ND (0.1)	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	1.32
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (6)	-	ND (1.0)	ND (1.0)	-	ND (1)	ND (0.96)	ND (0.95)	ND (0.10)	0.291	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.250)	0.704
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (6)	ND (0.1)	3.0 J	ND (1.0)	ND (1)	ND (0.080)	0.044 J	ND (0.076)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	0.468
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (6)	ND (0.1)	3.0 J	ND (1.0)	ND (1)	ND (0.096)	ND (0.096)	ND (0.095)	ND (0.10)	ND (0.1)	ND (0.10)	ND (0.1)	ND (0.1)	ND (0.0500)	0.0905
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)
Metals, Dissolved																	
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (1)	ND (3)	0.16 J	0.11 J	0.050 J	ND (0.050)	ND (0.052)	0.87 J	1.3	ND (3)	ND (3.0)	ND (0.082)	ND (0.13)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	4.35 B	5.90
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-223																							
Sample Date			1-Aug-05	29-Nov-06	14-Dec-07	5-Nov-08	12-Nov-09	15-Nov-10	18-Nov-11	14-Dec-12	3-Apr-13	18-Jun-13	15-Jan-14	4-Apr-14	30-May-14	12-Aug-14	6-Oct-14	6-Jan-15	16-Apr-15	21-Jul-15	19-Oct-15	8-Feb-16	26-Apr-16	19-May-16	17-Aug-16	13-Oct-16
Sample ID			S-223-080105	S-223	S-223	S-223_110508	S-223	S-223	S-223	S-223_12142012	S-223_040313	S-223_06_18_2013	S-223_010714	S223_040414	S-223	S223_081214	S-223_100614	S-223-20150106	S-223-20150416	S-223_20150721	S-223-20151019	S-223-20160208	S-223-20160426	S-223-20160519	S-223-20160817-WG	S-223-20161013-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	STANTEC	LANGAN	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA
Laboratory			LL	UNKNOWN	UNKNOWN	LL	UNKNOWN	UNKNOWN	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	LL	LL	LL	LL	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	20140718EZ	20140718EZ	1118614	20140718EZ	20140718EZ	20140718EZ	JB23910	JB33197	JB40112	JB57860	JB63937	JB68176	JB74111	JB78582	JB85719	1554684	1578888	1601985	1630089	1654782	1664163	L854465	L866378
Volatile Organic Compounds																										
BENZENE	µg/L	5	6100	4300	4700	8100	3900	3300	1100	6270	5530	7400	6280	2320	1470	4240	3000	11400	1100	3600	5900	1300	2300	2200	1520	401
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	281	165
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	ND (0.0094)	-	ND (0.0099)	ND (0.0097)	ND (0.0096)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.90)	ND (3.81)
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (10)	-	ND (5.0)	ND (5)	ND (3)	ND (3)	ND (5)	-	ND (10)	ND (13)	-	-	ND (3.0)	-	-	-	-	-	-	-	-	ND (0.5)	ND (5.00)	ND (3.61)
ETHYLBENZENE	µg/L	700	1300	930	900	1100	850	890	440	1250	866	709	960	259	396	713	642	871	330	400	440	250	380	440	496	193
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (50)	-	33	38	36	32	25	-	29.3 J	23.3 J	-	-	23.0	-	-	-	-	-	-	-	-	16 J	17.7	ND (10.0)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5)	-	-	ND (5)	ND (3)	ND (3)	ND (5)	-	ND (6.6)	ND (8.2)	-	-	ND (10)	-	-	-	-	-	-	-	-	ND (10)	ND (5.00)	ND (10.0)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208	88.1
NAPHTHALENE	µg/L	100	-	-	-	380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (10.0)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (10.0)
TOLUENE	µg/L	1000	9600	2800	2000	1700	460	410	110	408	337	2850	2030	1020	108	294	219	5410	190	570	1700	200	480	330	183	69.1
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	1000	1000	920	780	-	1070	766	-	-	812	-	-	-	-	-	-	-	-	490	533	280
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	330	360	360	350	-	351	269	-	-	314	-	-	-	-	-	-	-	-	170	187	105
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	6900	4400	4500	5100	3700	3800	1900	5490	4040	2930	3860	1370	1300	2820	2870	3980	1200	1900	2100	940	1600	1500	1500	550
Volatile Organic Compounds (SW8011)																										
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.029)	-	-	ND (0.010)	-	-	-	-	ND (0.020)	ND (0.02)	-	-	ND (0.020)	-	-	-	-	-	-	-	-	ND (0.0097)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																										
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.845	0.356
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	0.1 J	0.0978	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (1)	-	ND (1.0)	ND (1)	0.47	0.14 J	ND (0.077)	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.9	15.3
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (5)	-	2.0 J	-	-	3.4	3.7	-	0.625	0.772	-	-	0.940	-	-	-	-	-	-	-	-	0.8	0.764	0.171
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.8	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	430	-	380	-	330	170	170	-	130	159	-	-	38.6	-	-	-	-	-	-	-	-	87	34.2	1.41
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (5)	-	2.0 J	1 J	2.3	0.86	1.4	-	0.601	0.663	-	-	0.770	-	-	-	-	-	-	-	-	0.2 J	0.170	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (5)	-	ND (1.0)	ND (1)	ND (0.095)	1.1	ND (0.096)	-	ND (0.10)	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)
Metals, Dissolved																										
ARSENIC	µg/L	10	-	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	ND (3.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	2.4 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	2.4 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (1)	-	0.060 J	0.10 J	0.098 J	0.095 J	ND (0.080)	ND (3.0)	0.26 J	ND (3)	-	-	6.8	-	-	-	-	-	-	-	-	ND (0.13)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	ND (0.20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	2.9 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	19.6 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)

See notes on last page

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Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-224												
Sample Date			1-Aug-05	29-Nov-06	14-Dec-12	15-Jan-14	4-Apr-14	12-Aug-14	6-Oct-14	6-Jan-15	16-Apr-15	21-Jul-15	19-Oct-15	8-Feb-16	26-Apr-16
Sample ID			S-224-080105	S-224	S-224_12142012	S-224_010714	S224_040414	S224_081214	S-224_100614	S-224-20150106	S-224-20150416	S-224_20150721	S-224-20151019	S-224-20160208	S-224-20160426
Sampling Company			UNKNOWN	UNKNOWN	LANGAN	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			LL	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	LL	LL	LL
Laboratory Work Order	Units	MSC-PA	UNKNOWN	20140718EZ	JB23910	JB57860	JB63937	JB74111	JB78582	JB85719	1554684	1578888	1601985	1630089	1654782
Volatile Organic Compounds															
BENZENE	µg/L	5	2000	1200	527	405	110	114	431	255	480	200	88	630	240
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (2)	-	-	-	-	-	-	-	-	-	-	-	-
ETHYLBENZENE	µg/L	700	690	500	501	289	182	81.9	329	213	300	160	130	380	300
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	44	-	-	-	-	-	-	-	-	-	-	-	-
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	µg/L	1000	2800	1400	169	127	45.0	35.0	104	150	84	47	30	110	64
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	-	-	-	-	-	-	-	-	-	-
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	3500	2200	1200	697	363	197	711	457	370	290	190	520	480
Volatile Organic Compounds (SW8011)															
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.029)	-	-	-	-	-	-	-	-	-	-	-	-
Semi-Volatile Organic Compounds															
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-
CHRYSENE	µg/L	1.9	ND (1)	-	-	-	-	-	-	-	-	-	-	-	-
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-
FLUORENE	µg/L	1900	ND (5)	-	-	-	-	-	-	-	-	-	-	-	-
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-
NAPHTHALENE	µg/L	100	100	-	-	-	-	-	-	-	-	-	-	-	-
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-
PHENANTHRENE	µg/L	1100	ND (5)	-	-	-	-	-	-	-	-	-	-	-	-
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-
PYRENE	µg/L	130	ND (5)	-	-	-	-	-	-	-	-	-	-	-	-
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Metals, Dissolved															
ARSENIC	µg/L	10	-	-	ND (3.0)	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	ND (3.0)	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	ND (20)	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-
LEAD	µg/L	5	1.4	-	ND (3.0)	-	-	-	-	-	-	-	-	-	-
MERCURY	µg/L	2	-	-	0.10 J	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	3.7 J	-	-	-	-	-	-	-	-	-	-
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-
ZINC	µg/L	2000	-	-	9.5 J	-	-	-	-	-	-	-	-	-	-

Sample Location	S-224		S-225				S-229	S-233	S-234			S-235			
Sample Date	16-Aug-16	11-Oct-16	28-Apr-05	12-Jun-13	15-Aug-16	11-Oct-16	28-Apr-05	8-Apr-10	17-Jun-13	17-Aug-16	11-Oct-16	29-Nov-06	8-Apr-10	18-Aug-16	12-Oct-16
Sample ID	S-224-20160816-WG	S-224-20161011-WG	S225-042805	S-225_06_12_2013	S-225-20160815	S-225-20161011-WG	S229-042805	S-233 GROUNDWATER	S-234_06_17_2013	S-234-20160817-WG	S-234-20161011-WG	S-235	S-235 GROUNDWATER	S-235-20160818-WG	S-235-20161012-WG
Sampling Company	AQUATERRA	AQUATERRA	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	UNKNOWN	STANTEC	LANGAN	AQUATERRA	AQUATERRA	UNKNOWN	STANTEC	AQUATERRA	AQUATERRA
Laboratory	ESC	ESC	LL	ACCUTEST	ESC	ESC	LL	LL	ACCUTEST	ESC	ESC	UNKNOWN	LL	ESC	ESC
Laboratory Work Order	L854116	L865495	UNKNOWN	JB39629	L854116	L865495	UNKNOWN	1189821	JB40115	L854465	L865495	20140718EZ	1189821	L854778	L865801
Volatile Organic Compounds															
BENZENE	317	169	24	4.4	ND (3.31)	5.8	1900	3600	0.29 J	1.74	9.85	5300	1700	9730 SL	8610 SL
CYCLOHEXANE	458	201	-	-	105	28.9	-	-	-	61.8	37.7	-	-	326 SL	161 SL
1,2-DIBROMOETHANE (EDB)	ND (0.381)	ND (0.381)	-	-	ND (3.81)	ND (0.381)	-	-	-	ND (0.381)	ND (1.90)	-	-	ND (76.2) SL	ND (19.0) SL
1,2-DICHLOROETHANE (EDC)	ND (1.00)	ND (1.00)	ND (5)	ND (1)	ND (3.61)	ND (1.00)	ND (10)	ND (5)	ND (1)	ND (1.00)	ND (5.00)	-	ND (5)	ND (72.2) SL	ND (18.0) SL
ETHYLBENZENE	192	7.14	ND (5)	0.9 J	ND (10.0)	ND (1.00)	350	3200	3.5	18.9	6.53	1100	9 J	1170 SL	725 SL
ISOPROPYLBENZENE (CUMENE)	17.9	13.6	87	50	68.2	48.7	150	-	ND (2)	1.23	ND (5.00)	-	-	ND (200) SL	ND (50.0) SL
METHYL TERTIARY BUTYL ETHER	ND (1.00)	ND (1.00)	ND (5)	ND (1)	ND (10.0)	ND (1.00)	ND (5)	ND (3)	ND (1)	ND (1.00)	ND (5.00)	-	ND (3)	ND (73.4) SL	ND (18.4) SL
HEXANE	143	134	-	-	ND (10.0)	ND (1.00)	-	-	-	77.9	22.7	-	-	297 SL	71.5 SL
NAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	ND (1.00)	1.43	-	-	12.7	9.62	-	-	-	ND (1.00)	ND (5.00)	-	-	ND (200) SL	ND (50.0) SL
BUTYLBENZENE, TERT-	ND (1.00)	ND (1.00)	-	-	ND (10.0)	2.42	-	-	-	ND (1.00)	ND (5.00)	-	-	ND (200) SL	ND (50.0) SL
TOLUENE	57.3	41.0	10	2.9	ND (50.0)	ND (5.00)	ND (50)	4300	0.46 J	6.91	ND (25.0)	4500	340	ND (1000) SL	608 SL
1,2,4-TRIMETHYLBENZENE	136	101	-	0.38 J	ND (10.0)	ND (1.00)	-	-	10.8	46.2	19.5	-	-	1260 SL	384 SL
1,3,5-TRIMETHYLBENZENE	28.9	26.0	-	ND (2)	ND (10.0)	ND (1.00)	-	-	6.1	12.2	ND (5.00)	-	-	390 SL	119 SL
XYLENES, TOTAL (DIMETHYLBENZENE)	290	241	11	2.7	ND (30.0)	ND (3.00)	630	20000	13	79.2	34.4	6600	1600	6950 SL	3850 SL
Volatile Organic Compounds (SW8011)															
1,2-DIBROMOETHANE (EDB)	ND (0.0100)	ND (0.0100)	ND (0.029)	ND (0.02)	ND (0.0100)	ND (0.0100)	0.033	-	ND (0.02)	ND (0.0100)	ND (0.0100)	-	-	ND (0.0100) SL	ND (0.0100) SL
Semi-Volatile Organic Compounds															
ACENAPHTHENE	0.460	0.218	-	-	1.46	1.04	-	-	-	0.512	0.244	-	-	87.5 SL	1.21 SL
ANTHRACENE	ND (0.0500)	0.0746	-	0.436	0.279	0.217	-	-	ND (0.1)	0.160	ND (0.0500)	-	-	34.2 SL	0.233 SL
BENZO(A)ANTHRACENE	ND (0.0500)	ND (0.0500)	-	0.153	0.0828	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	1.64 SL	ND (0.0500) SL
BENZO(A)PYRENE	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.232) SL	ND (0.0500) SL
BENZO(B)FLUORANTHENE	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (1.00) SL	ND (0.0500) SL
BENZO(G,H,I)PERYLENE	ND (0.0500)	ND (0.0500)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	ND (0.0454) SL	ND (0.0500) SL
BENZO(K)FLUORANTHENE	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.272) SL	ND (0.0500) SL
1,1'-BIPHENYL	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	17.0 SL	ND (10.0) SL
BIS(2-ETHYLHEXYL) PHTHALATE	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	3.45	-	-	19.7 SL	ND (3.00) SL
DI-N-BUTYL PHTHALATE	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)	-	-	ND (3.00) SL	ND (3.00) SL
CHRYSENE	ND (0.0500)	ND (0.0500)	ND (1)	0.208	0.0713	ND (0.0500)	ND (1)	-	ND (0.1)	ND (0.0500)	ND (0.0500)	-	-	1.72 SL	ND (0.0500) SL
DIBENZ(A,H)ANTHRACENE	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.0792) OE SL	ND (0.0500) SL
DIETHYL PHTHALATE	ND (3.00)	ND (3.00)	-	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)	-	-	ND (3.00) SL	ND (3.00) SL
2,4-DIMETHYLPHENOL	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) SL	20.6 SL
2,4-DINITROPHENOL	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) OE SL	ND (10.0) OE SL
FLUORANTHENE	ND (0.0500)	ND (0.0500)	-	-	0.269	0.109	-	-	-	ND (0.0500)	0.0745	-	-	6.28 SL	ND (0.0500) SL
FLUORENE	0.986	0.502	56	2.74	2.49	2.08	11	-	ND (0.1)	0.525	0.206	-	-	95.8 SL	1.34 SL
INDENO(1,2,3-C,D)PYRENE	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (1.00) OE SL	ND (0.0500) SL
2-METHYLNAPHTHALENE	20.8	9.39	-	-	ND (0.250)	ND (0.250)	-	-	-	5.04	ND (0.250)	-	-	1770 SL	22.3 SL
CRESOL, M,P- (3&4-METHYLPHENOL)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) SL	ND (10.0) SL
CRESOL, O- (2-METHYLPHENOL)	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) SL	ND (10.0) SL
NAPHTHALENE	41.2	17.2	ND (10)	ND (0.1)	ND (0.250)	0.999	220	-	0.889	4.25	0.784	-	-	1060 SL	77.8 SL
4-NITROPHENOL	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) OE SL	ND (10.0) SL
PHENANTHRENE	0.942	0.497	71	2.02	0.591	1.61	15	-	0.377	0.966	ND (0.0500)	-	-	226 SL	1.42 SL
PHENOL	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	24.2 SL	32.0 SL
PYRENE	ND (0.0500)	0.0599	ND (10)	0.407	0.323	0.102	ND (10)	-	0.204	0.193	0.264	-	-	23.0 SL	0.137 SL
PYRIDINE	ND (10.0)	ND (10.0)	-	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (10.0) SL	ND (10.0) SL
QUINOLINE	ND (6.78)	ND (6.78)	-	-	ND (6.78)	ND (6.78)	-	-	-	ND (6.78)	ND (6.78)	-	-	ND (6.78) SL	ND (6.78) SL
Metals, Dissolved															
ARSENIC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	ND (2.00)	ND (2.00)	-	-	ND (2.00)	ND (2.00)	-	-	-	ND (2.00)	ND (2.00)	-	-	2.97 SL	5.07 SL
LEAD	ND (2.00)	ND (2.00)	ND (1)	ND (3)	ND (2.00)	ND (2.00)	ND (1)	-	ND (3)	ND (2.00)	ND (2.00)	-	-	ND (2.00) SL	ND (2.00) SL
MERCURY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	ND (2.00)	ND (2.00)	-	-	ND (2.00)	ND (2.00)	-	-	-	2.03 B	ND (2.00)	-	-	2.35 B SL	5.07 SL
SELENIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	ND (5.00)	ND (5.00)	-	-	ND (5.00)	ND (5.00)	-	-	-	ND (5.00)	ND (5.00)	-	-	ND (5.00) SL	ND (5.00) SL
ZINC	ND (25.0)	ND (25.0)	-	-	ND (25.0)	ND (25.0)	-	-	-	ND (25.0)	ND (25.0)	-	-	ND (25.0) SL	ND (25.0) SL

See notes on last page

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Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-237	S-239																S-242	
Sample Date			8-Apr-10	29-Nov-06	14-Dec-12	17-Jun-13	15-Jan-14	4-Apr-14	29-May-14	12-Aug-14	6-Oct-14	6-Jan-15	16-Apr-15	21-Jul-15	19-Oct-15	8-Feb-16	26-Apr-16	17-Aug-16	13-Oct-16	18-Aug-16	11-Oct-16
Sample ID			S-237 GROUNDWATER	S-239	S-239_12142012	S-239_06_17_2013	S-239_010714	S239_040414	S-239	S239_081214	S-239_100614	S-239-20150106	S-239-20150416	S-239_20150721	S-239-20151019	S-239-20160208	S-239-20160426	S-239-20160817-WG	S-239-20161013-WG	S-242-20160818-WG	S-242-20161011-WG
Sampling Company			STANTEC	UNKNOWN	LANGAN	LANGAN	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	UNKNOWN	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	LL	LL	LL	ESC	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	1189821	20140718EZ	JB23910	JB40115	JB57860	JB63937	JB68176	JB74111	JB78582	JB85719	1554684	1578888	1601985	1630089	1654782	L854465	L866378	L854778	L865495
Volatile Organic Compounds																					
BENZENE	µg/L	5	**_2500_**	**_12_**	2.1	ND (1)	ND (1.0)	0.49 J	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.50)	ND (0.5)	5	ND (0.5)	ND (0.5)	ND (1)	2.71	1.15	**_1640_**	**_582_**
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	523	360
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*	*ND (9.52)*	*ND (1.90)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5)	-	-	ND (1)	-	-	ND (1.0)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	*ND (9.02)*	ND (5.00)
ETHYLBENZENE	µg/L	700	250	310	21.2	3.3	ND (1.0)	0.79	ND (1.0)	ND (1.0)	ND (1.0)	0.51 J	ND (0.5)	4	ND (0.5)	ND (0.5)	ND (1)	2.06	ND (1.00)	675	311
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	-	-	ND (2)	-	-	ND (1.0)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (25.0)	10.1
METHYL TERTIARY BUTYL ETHER	µg/L	20	15 J	-	-	ND (1)	-	-	ND (1.0)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (9.18)	ND (5.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	309	204
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (25.0)	ND (5.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (25.0)	ND (5.00)
TOLUENE	µg/L	1000	360	260	13.0	0.53 J	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	0.26 J	ND (0.5)	3	ND (0.5)	ND (0.5)	ND (1)	ND (5.00)	ND (5.00)	175	118
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	-	7	-	-	0.95 J	-	-	-	-	-	-	-	-	2.26	ND (1.00)	**_460_**	**_278_**
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	-	2.3	-	-	0.35 J	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	159	111
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	5300	1100	111	9.8	0.74 J	3.5	ND (1.0)	ND (1.0)	0.72 J	2.0	ND (0.5)	16	ND (0.5)	ND (0.5)	ND (1)	9.29	ND (3.00)	1460	1130
Volatile Organic Compounds (SW8011)																					
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	ND (0.02)	-	-	ND (0.020)	-	-	-	-	-	-	-	-	ND (0.0100)	ND (0.0100)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																					
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0509	ND (0.0500)	0.456	0.203
ANTHRACENE	µg/L	66	-	-	-	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	0.18	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	-	0.193	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	0.242	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	0.18	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	-	-	-	0.241	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500) OE	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0) OE	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0596	ND (0.0500)	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	-	-	-	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	0.467	0.140
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500) OE	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.600	ND (0.250)	41.0	0.539
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	-	-	-	ND (0.1)	-	-	ND (0.10)	-	-	-	-	-	-	-	-	0.739	ND (0.250)	**_120_**	10.1
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0) OE	ND (10.0)
PHENANTHRENE	µg/L	1100	-	-	-	0.195	-	-	ND (0.10)	-	-	-	-	-	-	-	-	0.119	ND (0.0500)	0.678	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	-	-	-	0.323	-	-	ND (0.10)	-	-	-	-	-	-	-	-	0.0656	ND (0.0500)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved																					
ARSENIC	µg/L	10	-	-	ND (3.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	0.50 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	ND (20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	2.76	6.50
LEAD	µg/L	5	-	-	ND (3.0)	ND (3)	-	-	3.7	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	ND (0.20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	3.4 J	-	-	-	-	-	-	-	-	-	-	-	-	3.23 B	ND (2.00)	4.28 B	4.41 B
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.94	**_8.89_**	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	29.5	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)	ND (25.0)	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-243																S-244				S-245			
Sample Date			14-Dec-12	17-Jun-13	17-Jun-13	15-Jan-14	4-Apr-14	21-May-14	12-Aug-14	6-Oct-14	6-Jan-15	16-Apr-15	21-Jul-15	19-Oct-15	8-Feb-16	26-Apr-16	17-Aug-16	13-Oct-16	13-Jun-13	14-Jun-13	15-Aug-16	11-Oct-16	14-Jun-13	30-Aug-16	13-Oct-16	13-Oct-16
Sample ID			S-243_12142012	S-243 DUP_06_17_2013	S-243_06_17_2013	S-243_010714	S243_040414	S-243	S243_081214	S-243_100614	S-243-20150106	S-243-20150416	S-243_20150721	S-243-20151019	S-243-20160208	S-243-20160426	S-243-20160817-WG	S-243-20161013-WG	S-244_06_13_2013	S-244_06_14_2013	S-244-20160815	S-244-20161011-WG	S-245_06_14_2013	S-245-HS-20160830-WG	S-245-20161013-WG	S-245-HS-20161013-WG
Sampling Company			LANGAN	LANGAN	LANGAN	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	AQUATERRA	AQUATERRA	LANGAN	LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	LL	LL	LL	LL	LL	ESC	ESC	ACCUTEST	ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	JB23910	JB40115	JB40115	JB57860	JB63937	JB67626	JB74111	JB78582	JB85719	1554684	1578888	1601985	1630089	1654782	L854465	L866378	JB39760	JB39854	L854116	L865495	JB39854	L856904	L866378	L866383
Volatile Organic Compounds																										
BENZENE	µg/L	5	**6.9**	ND (1)	ND (1)	ND (1.0)	ND (0.50)	2.1	0.90	4.1	4.0	ND (0.5)	1	0.9 J	ND (0.5)	ND (1)	ND (1.00)	1.48	**223**	2.1	2.49	ND (1.00)	**164**	**432**	**450**	**378**
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.37	8.50	-	-	2.58	ND (1.00)	-	625	703	604
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.381)	ND (0.381)	-	-	ND (0.381)	ND (0.381)	-	ND (0.381)	ND (0.381)	ND (1.90)
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	ND (1)	ND (1)	-	-	ND (1.0)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (5.00)
ETHYLBENZENE	µg/L	700	49.8	3.5	1.4	4.4	8.4	36.1	31.0	130	92.8	28	5	34	5	12	4.67	5.14	156	2.8	1.07	ND (1.00)	198	533	**723**	576
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	ND (2)	ND (2)	-	-	2.3	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	14.7	ND (2)	ND (1.00)	ND (1.00)	11.3	19.2	33.4	31.5
METHYL TERTIARY BUTYL ETHER	µg/L	20	-	ND (1)	ND (1)	-	-	ND (1.0)	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (5.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	6.56	-	-	ND (1.00)	ND (1.00)	-	318	179	84.2
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	ND (1.00)	ND (1.00)	-	2.15	4.57	ND (5.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	-	-	ND (1.00)	ND (1.00)	-	ND (1.00)	ND (1.00)	ND (5.00)
TOLUENE	µg/L	1000	44.9	1.1	0.47 J	1.4	3.4	24.7	15.5	67.4	55.7	7	4	13	1 J	5	ND (5.00)	ND (5.00)	62.8	2.3	ND (5.00)	ND (5.00)	35.9	59.7	80.2	66.2
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	6.1	2.8	-	-	**63.4**	-	-	-	-	-	-	-	-	8.76	9.30	**133**	7	ND (1.00)	ND (1.00)	**405**	**282**	**488**	**418**
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	0.9 J	0.41 J	-	-	13.8	-	-	-	-	-	-	-	-	1.79	2.90	40.6	2.3	ND (1.00)	ND (1.00)	112	87.6	164	152
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	153	7.4	3.4	14.6	24.6	143	95.2	443	344	60	25	98	16	38	17.7	15.8	387	18.3	ND (3.00)	ND (3.00)	490	631	888	678
Volatile Organic Compounds (SW8011)																										
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.02)	ND (0.02)	-	-	ND (0.020)	-	-	-	-	-	-	-	-	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																										
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	0.342	-	2.76	2.29	2.15
ANTHRACENE	µg/L	66	-	ND (0.1)	0.287	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	0.0566	0.155	0.466	0.450	0.310
BENZO(A)ANTHRACENE	µg/L	4.9	-	0.479	1.22	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.100)
BENZO(A)PYRENE	µg/L	0.2	-	**0.467**	**1.12**	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.100)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	0.538	**1.29**	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.100)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	**0.375**	**0.85**	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.100)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	ND (0.100)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	ND (2.36)	ND (3.00)	-	ND (7.09)	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	ND (9.99)	ND (3.00)	-	ND (30.0)	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	-	0.568	1.4	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.100)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	ND (0.100)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	-	-	ND (9.99)	ND (3.00)	-	ND (30.0)	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	14.8
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100) OE	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	0.0514	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	ND (0.100)
FLUORENE	µg/L	1900	-	ND (0.1)	0.152	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	0.469	ND (0.1)	ND (0.0500)	0.332	0.989	2.75	2.47	2.26
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	-	-	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	ND (0.100)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)	-	-	ND (0.250)	2.07	-	50.2	51.3	34.8
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	-	ND (0.1)	ND (0.1)	-	-	5.62	-	-	-	-	-	-	-	-	ND (0.250)	0.570	8.19	1.06	ND (0.250)	0.605	8.63	**107**	**127**	90.6
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (20.1)	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	-	0.44	1.16	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	0.171	ND (0.1)	ND (0.0500)	0.543	0.264	3.87	3.44	2.74
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	-	0.745	1.83	-	-	ND (0.10)	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.258	0.165	0.221
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	-	-	ND (33.3)	ND (10.0)	-	ND (100)	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (6.78)	ND (6.78)	-	-	ND (22.6)	ND (6.78)	-	ND (67.8)	ND (6.78)	ND (6.78)
Metals, Dissolved																										
ARSENIC	µg/L	10	1.3 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	ND (3.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	ND (20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	-	-	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	ND (2.00)
LEAD	µg/L	5	1.7 J	ND (3)	ND (3)	-	-	1.5 J	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)	ND (3)	ND (3)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	ND (0.20)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	7.2 J	-	-	-	-	-	-	-	-	-	-	-	-	-	3.23 B	ND (2.00)	-	-	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	ND (10)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	-	-	ND (5.00)	**27.2**	-	ND (5.00)	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	17.8 J	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)	-	-	ND (25.0)	ND (25.0)	-	ND (25.0)	ND (25.0)	ND (25.0)

See notes on last page

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-246						S-278		S-279	
Sample Date			14-Dec-09	22-Jul-10	5-Jun-13	17-Jun-13	16-Aug-16	11-Oct-16	18-Aug-16	14-Oct-16	18-Aug-16	11-Oct-16
Sample ID			S-246_121409	S-246_072210	S-246A_06_05_2013	S-246_06_17_2013	S-246-20160816-WG	S-246-20161011-WG	S-278-20160818-WG	S-278-20161014-WG	S-279-20160818-WG	S-279-20161011-WG
Sampling Company			UNKNOWN	UNKNOWN	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	LL	ACCUTEST	ACCUTEST	ESC	ESC	ESC	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	1204492	JB39151	JB40115	L854116	L865495	L854778	L866406	L854778	L865495
Volatile Organic Compounds												
BENZENE	µg/L	5	4	ND (1)	ND (1)	ND (1)	**17.5**	ND (1.00)	**762 SL**	**766 SL**	**802 SL**	**632 SL**
CYCLOHEXANE	µg/L	53000	-	-	-	-	33.1	4.77	559 SL	263 SL	342 SL	186 SL
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	ND (0.381)	ND (0.381)	ND (38.1) SL	ND (38.1) OE SL	ND (38.1) SL	ND (0.381) SL
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (1)	ND (1)	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (36.1) SL	ND (36.1) SL	ND (36.1) SL	ND (1.00) SL
ETHYLBENZENE	µg/L	700	2	ND (1)	ND (1)	ND (1)	16.5	ND (1.00)	424 SL	396 SL	560 SL	391 SL
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (2)	ND (2)	ND (2)	ND (2)	4.36	ND (1.00)	ND (100) SL	ND (100) SL	ND (100) SL	40.1 SL
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (1)	ND (1)	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (36.7) SL	ND (36.7) SL	ND (36.7) SL	ND (1.00) SL
HEXANE	µg/L	6200	-	-	-	-	19.6	ND (1.00)	613 SL	216 SL	110 SL	141 SL
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	ND (1.00)	ND (1.00)	ND (100) SL	ND (100) SL	ND (100) SL	8.36 SL
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	ND (1.00)	ND (1.00)	ND (100) SL	ND (100) SL	ND (100) SL	ND (1.00) SL
TOLUENE	µg/L	1000	ND (1)	ND (1)	ND (1)	ND (1)	ND (5.00)	ND (5.00)	ND (500) SL	ND (500) SL	ND (500) SL	72.2 SL
1,2,4-TRIMETHYLBENZENE	µg/L	62	ND (2)	ND (2)	ND (2)	ND (2)	45.5	1.80	**1030 SL**	**714 SL**	**318 SL**	**133 SL**
1,3,5-TRIMETHYLBENZENE	µg/L	1200	ND (2)	ND (2)	ND (2)	ND (2)	14.1	ND (1.00)	495 SL	334 SL	127 SL	64.0 SL
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	6	ND (1)	ND (1)	0.24 J	43.7	ND (3.00)	1830 SL	1600 SL	588 SL	400 SL
Volatile Organic Compounds (SW8011)												
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.029)	ND (0.029)	ND (0.02)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100) SL	ND (0.0100) SL	ND (0.0100) SL	ND (0.0100) SL
Semi-Volatile Organic Compounds												
ACENAPHTHENE	µg/L	3800	-	-	-	-	0.319	0.152	54.5 SL	9.64 SL	3.56 SL	9.66 SL
ANTHRACENE	µg/L	66	-	-	ND (0.1)	ND (1)	0.0941	0.0609	14.9 SL	ND (0.0500) SL	ND (0.0500) SL	2.93 SL
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	ND (0.1)	ND (1)	ND (0.0500)	ND (0.0500)	0.590 SL	0.143 SL	0.119 SL	0.0765 SL
BENZO(A)PYRENE	µg/L	0.2	-	-	ND (0.1)	ND (0.12)	ND (0.0500)	ND (0.0500)	**0.350 SL**	0.0680 SL	0.0852 SL	ND (0.0500) SL
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	ND (0.1)	ND (1)	ND (0.0500)	ND (0.0500)	0.430 SL	0.108 SL	0.103 SL	ND (0.0500) SL
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	ND (0.1)	ND (0.16)	ND (0.0500)	ND (0.0500)	**0.457 SL**	0.0999 SL	0.144 SL	ND (0.0500) SL
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	ND (0.0500)	ND (0.0500)	0.126 SL	ND (0.0500) SL	ND (0.0500) SL	ND (0.0500) SL
1,1'-BIPHENYL	µg/L	430	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	ND (10.0) SL
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	3.22 B	ND (3.00)	ND (3.54) SL	ND (3.00) SL	**77.9 SL**	**8.31 SL**
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	ND (3.00)	ND (3.00)	ND (15.0) SL	ND (3.00) SL	ND (3.00) SL	ND (3.00) SL
CHRYSENE	µg/L	1.9	ND (1)	ND (1)	ND (0.1)	ND (1)	ND (0.0500)	ND (0.0500)	1.01 SL	0.237 SL	0.105 SL	0.111 SL
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	ND (0.0500)	ND (0.0500)	0.128 OE SL	ND (0.0500) SL	ND (0.0500) OE SL	ND (0.0500) SL
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	ND (3.00)	ND (3.00)	ND (15.0) SL	ND (3.00) SL	ND (3.00) SL	ND (3.00) SL
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	11.8 SL
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) OE SL	ND (10.0) SL	ND (10.0) OE SL	ND (10.0) SL
FLUORANTHENE	µg/L	260	-	-	-	-	ND (0.0500)	ND (0.0500)	2.40 SL	0.605 SL	0.414 SL	0.475 SL
FLUORENE	µg/L	1900	ND (5)	ND (5)	0.173	ND (1)	0.389	0.150	66.4 SL	12.2 SL	4.10 SL	12.4 SL
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	ND (0.0500)	ND (0.0500)	0.189 OE SL	ND (0.0500) SL	0.0514 OE SL	ND (0.0500) SL
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	7.31	0.353 B	**785 SL**	255 SL	50.6 SL	126 SL
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	ND (10.0) SL
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	ND (10.0) SL
NAPHTHALENE	µg/L	100	ND (5)	ND (5)	0.492	ND (1)	7.83	0.525 B	**538 SL**	**300 SL**	**143 SL**	**136 SL**
4-NITROPHENOL	µg/L	60	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) OE SL	ND (10.0) SL	ND (10.0) OE SL	ND (10.0) SL
PHENANTHRENE	µg/L	1100	ND (5)	ND (5)	0.17	ND (1)	0.435	0.146	106 SL	29.1 SL	6.69 SL	33.2 SL
PHENOL	µg/L	2000	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	ND (10.0) SL
PYRENE	µg/L	130	ND (5)	ND (5)	ND (0.1)	ND (1)	ND (0.0500)	0.0737	15.1 SL	3.43 SL	1.25 SL	2.99 SL
PYRIDINE	µg/L	120	-	-	-	-	ND (10.0)	ND (10.0)	ND (50.0) SL	ND (10.0) SL	ND (10.0) SL	ND (10.0) SL
QUINOLINE	µg/L	1.1	-	-	-	-	ND (6.78)	ND (6.78)	ND (33.9) SL	ND (6.78) SL	ND (6.78) SL	ND (6.78) SL
Metals, Dissolved												
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (2.00) SL	17.9 SL	5.51 SL
LEAD	µg/L	5	ND (1)	ND (1.0)	ND (3)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (2.00) SL	ND (2.00) SL	ND (2.00) SL
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (2.00) SL	6.77 B SL	2.07 B SL
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	ND (5.00)	ND (5.00)	ND (5.00) SL	ND (5.00) SL	ND (5.00) SL	ND (5.00) SL
ZINC	µg/L	2000	-	-	-	-	ND (25.0)	ND (25.0)	ND (25.0) SL	ND (25.0) SL	ND (25.0) SL	ND (25.0) SL

Sample Location			S-329				S-364	S-365		S-366			S-367			S-368		S-369	
Sample Date			21-Oct-10	17-Jun-13	17-Aug-16	13-Oct-16	12-Jun-13	18-Aug-16	12-Oct-16	12-Jun-13	16-Aug-16	11-Oct-16	12-Jun-13	15-Aug-16	11-Oct-16	12-Jun-13	11-Oct-16	16-Aug-16	10-Oct-16
Sample ID			S-329_102110	S-329_06_17_2013	S-329-20160817-WG	S-329-20161013-WG	S-364_06_12_2013	S-365-20160818-WG	S-365-20161012-WG	S-366_06_12_2013	S-366-20160816-WG	S-366-20161011-WG	S-367_06_12_2013	S-367-20160815	S-367-20161011-WG	S-368_06_12_2013	S-368-20161011-WG	S-369-20160816-WG	S-369-20161010-WG
Sampling Company			UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	1218083	JB40115	L854465	L866384	JB39629	L854778	L865801	JB39629	L854116	L865495	JB39629	L854116	L865495	JB39629	L865495	L854116	L865153
Volatile Organic Compounds																			
BENZENE	µg/L	5	**320**	**8.6**	**290**	**420**	**9.8**	**7.04 SL**	**64.5 SL**	**232**	**6.51**	**7.62**	0.83 J	ND (1.00)	ND (1.00)	1.3	**243 SL**	**2370**	**1870**
CYCLOHEXANE	µg/L	53000	-	-	301	408	-	293 SL	712 SL	-	210	141	-	ND (1.00)	ND (1.00)	-	52.7 SL	669	509
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	ND (19.0)	ND (3.81) OE	-	ND (1.90) SL	ND (19.0) SL	-	ND (0.381)	ND (0.381)	-	ND (0.381)	ND (0.381)	-	ND (3.81) SL	ND (9.52)	ND (7.62)
1,2-DICHLOROETHANE (EDC)	µg/L	5	-	ND (1)	ND (18.0)	ND (3.61)	ND (1)	ND (5.00) SL	ND (18.0) SL	ND (1)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1)	ND (3.61) SL	ND (9.02)	ND (7.22)
ETHYLBENZENE	µg/L	700	130	ND (1)	61.7	100	40.8	ND (5.00) SL	ND (50.0) SL	130	3.81	ND (1.00)	57.6	ND (1.00)	ND (1.00)	2.2	90.1 SL	ND (25.0)	ND (20.0)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	-	ND (2)	ND (50.0)	56.8	57.7	10.9 SL	67.4 SL	52.9	49.6	45.9	45.8	ND (1.00)	4.75	42	34.4 SL	71.7	62.4
METHYL TERTIARY BUTYL ETHER	µg/L	20	5	ND (1)	ND (18.4)	ND (10.0)	0.54 J	ND (5.00) SL	ND (18.4) SL	0.46 J	ND (1.00)	ND (1.00)	0.38 J	ND (1.00)	ND (1.00)	0.36 J	ND (10.0) SL	ND (9.18)	ND (20.0)
HEXANE	µg/L	6200	-	-	97.7	236	-	ND (5.00) SL	52.7 SL	-	1.08	ND (1.00)	-	ND (1.00)	ND (1.00)	-	44.8 SL	ND (25.0)	ND (20.0)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	ND (50.0)	18.2	-	ND (5.00) SL	ND (50.0) SL	-	9.92	6.96	-	ND (1.00)	1.59	-	19.4 SL	ND (25.0)	ND (20.0)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	ND (50.0)	ND (10.0)	-	ND (5.00) SL	ND (50.0) SL	-	2.69	2.09	-	2.14	2.21	-	ND (10.0) SL	ND (25.0)	ND (20.0)
TOLUENE	µg/L	1000	110	ND (1)	ND (250)	ND (50.0)	2.7	ND (25.0) SL	ND (250) SL	3.7	ND (5.00)	ND (5.00)	0.28 J	ND (5.00)	ND (5.00)	0.97 J	352 SL	ND (125)	ND (100)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	0.28 J	ND (50.0)	ND (10.0)	14.8	ND (5.00) SL	ND (50.0) SL	**148**	35.1	13.7	53.9	ND (1.00)	ND (1.00)	2.8	**589 SL**	ND (25.0)	ND (20.0)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	ND (2)	ND (50.0)	ND (10.0)	13.5	12.5 SL	ND (50.0) SL	45.1	22.9	13.4	14.7	ND (1.00)	ND (1.00)	1 J	217 SL	ND (25.0)	ND (20.0)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	320	0.35 J	ND (150)	ND (30.0)	16.7	ND (15.0) SL	ND (150) SL	335	10.3	3.17	45.3	ND (3.00)	ND (3.00)	6.6	995 SL	ND (75.0)	ND (60.0)
Volatile Organic Compounds (SW8011)																			
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100) SL	ND (0.0100) SL	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100) SL	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																			
ACENAPHTHENE	µg/L	3800	-	-	0.439	0.600	-	2.11 SL	4.68 SL	-	1.84	0.843	-	0.651	0.579	-	120 SL	1.36	2.14
ANTHRACENE	µg/L	66	-	ND (0.1)	ND (0.0500)	0.123	0.278	0.963 SL	2.43 SL	0.605	0.385	0.177	ND (0.1)	0.176	0.0819	0.138	45.5 SL	0.576	0.518
BENZO(A)ANTHRACENE	µg/L	4.9	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.515 SL	0.916 SL	0.327	0.111	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	4.48 SL	0.0811	0.152
BENZO(A)PYRENE	µg/L	0.2	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	**0.244 SL**	**0.421 SL**	ND (0.1)	0.0559	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.580) SL	ND (0.0500)	0.0695
BENZO(B)FLUORANTHENE	µg/L	1.2	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.244 SL	0.351 SL	ND (0.1)	0.0637	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.106) SL	ND (0.0500)	0.0654
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.129 SL	0.194 SL	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.114) SL	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	ND (0.0500)	ND (0.0500)	-	0.0639 SL	0.123 SL	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	-	ND (0.680) SL	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	276 SL	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	ND (3.00)	ND (3.00)	-	ND (3.54) SL	ND (3.54) SL	-	ND (3.00)	ND (3.00)	-	ND (3.33)	ND (3.00)	-	ND (3.54) SL	4.58 B	3.89
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	ND (3.00)	ND (3.00)	-	ND (15.0) SL	ND (15.0) SL	-	ND (3.00)	ND (3.00)	-	ND (3.33)	ND (3.00)	-	ND (15.0) SL	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	-	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.497 SL	0.856 SL	0.429	0.0864	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	**5.95 SL**	0.0860	0.153
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	ND (0.0500)	ND (0.0500)	-	0.0611 OE SL	0.0979 SL	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	-	ND (0.198) SL	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	ND (3.00)	ND (3.00)	-	ND (15.0) SL	ND (15.0) SL	-	ND (3.00)	ND (3.00)	-	ND (3.33)	ND (3.00)	-	ND (15.0) SL	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) OE SL	ND (50.0) OE SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0) OE
FLUORANTHENE	µg/L	260	-	-	ND (0.0500)	ND (0.0500)	-	1.06 SL	2.10 SL	-	0.396	0.0766	-	0.101	ND (0.0500)	-	6.36 SL	0.260	0.408
FLUORENE	µg/L	1900	-	ND (0.1)	0.270	0.616	1.21	2.39 SL	6.07 SL	3.24	2.93	1.41	0.873	1.53	1.46	1.56	89.3 SL	2.39	3.74
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	ND (0.0500)	ND (0.0500)	-	0.0626 OE SL	0.100 SL	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0500)	-	ND (2.50) SL	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	4.40	5.36	-	2.06 SL	73.4 SL	-	21.8	7.65	-	ND (0.250)	ND (0.250)	-	**1960 SL**	32.2	33.2
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	-	0.197	8.90	9.38	19.9	4.43 SL	23.5 SL	-	7.54	1.35	1.34	ND (0.250)	ND (0.250)	ND (0.1)	**429 SL**	11.9	10.4
4-NITROPHENOL	µg/L	60	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) OE SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	-	0.309	0.0508	1.09	1.29	2.73 SL	12.5 SL	2.61	3.23	0.981	ND (0.1)	ND (0.0500)	ND (0.0500)	0.887	352 SL	3.12	4.65
PHENOL	µg/L	2000	-	-	12.2	17.5	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	15.3	36.3
PYRENE	µg/L	130	-	ND (0.1)	ND (0.0500)	0.0591	0.21	2.24 SL	3.10 SL	0.711	0.504	0.0679	ND (0.1)	0.135	ND (0.0500)	ND (0.1)	86.2 SL	0.364	0.678
PYRIDINE	µg/L	120	-	-	ND (10.0)	ND (10.0)	-	ND (50.0) SL	ND (50.0) SL	-	ND (10.0)	ND (10.0)	-	ND (11.1)	ND (10.0)	-	ND (50.0) SL	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	ND (6.78)	ND (6.78)	-	ND (33.9) SL	ND (33.9) SL	-	ND (6.78)	ND (6.78)	-	ND (7.52)	ND (6.78)	-	ND (33.9) SL	ND (6.78)	ND (6.78)
Metals, Dissolved																			
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	2.57	2.70	-	ND (2.00) SL	ND (2.00) SL	-	11.5	4.14	-	ND (2.00)	ND (2.00)	-	ND (2.00) SL	ND (2.00)	ND (2.00)
LEAD	µg/L	5	-	ND (3)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00) SL	ND (2.00) SL	ND (3)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00) SL	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	2.04 B	ND (2.00)	-	4.10 B SL	ND (2.00) SL	-	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	-	ND (2.00) SL	ND (2.00)	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	ND (5.00)	ND (5.00)	-	ND (5.00) SL	ND (5.00) SL	-	ND (5.00)	ND (5.00)	-	ND (5.00)	ND (5.00)	-	ND (5.00) SL	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	ND (25.0)	ND (25.0)	-	ND (25.0) SL	ND (25.0) SL	-	ND (25.0)	ND (25.0)	-	ND (25.0)	ND (25.0)	-	ND (25.0) SL	ND (25.0)	ND (25.0)

See notes on last page

Stantec

Table 4-2
Analytical Results Summary- Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-370			S-371			S-373	S-379	S-380				S-381			S-408		S-415	S-416	
Sample Date			14-Jun-13	16-Aug-16	12-Oct-16	14-Jun-13	16-Aug-16	12-Oct-16	14-Oct-16	12-Jun-13	12-Jun-13	12-Aug-16	10-Oct-16	10-Oct-16	14-Jun-13	17-Aug-16	13-Oct-16	16-Dec-15	7-Apr-16	17-Dec-15	17-Aug-16	12-Oct-16
Sample ID			S-370_06_14_2013	S-370-20160816-WG	S-370-20161012-WG	S-371_06_14_2013	S-371-20160816-WG	S-371-20161012-WG	S-373-20161014-WG	S-379_06_12_2013	S-380_06_12_2013	S-380-20160812-WG	S-380-20161010-WG	S-380-20161010-WG-DUP	S-381_06_14_2013	S-381-20160817-WG	S-381-20161013-WG	AOI3_S-408_121615	S-408-20160407-WG	AOI3_S-415_121715	S-416-20160817-WG	S-416-20161012-WG
Sampling Company			LANGAN	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	LANGAN	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	LANGAN	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			ACCUTEST	ESC	ESC	ACCUTEST	ESC	ESC	ESC	ACCUTEST	ACCUTEST	ESC	ESC	ESC	ACCUTEST	ESC	ESC	ACTD	PACE	ACTD	ESC	ESC
Laboratory Work Order	Units	MSC-PA	JB39854	L854116	L865801	JB39854	L854116	L865801	L866406	JB39629	JB39629	L853817	L865153	L865153	JB39854	L854465	L866380	JC10806	30179320	JC11067	L854465	L865801
Volatile Organic Compounds																						
BENZENE	µg/L	5	ND (1)	ND (1.00)	ND (1.00)	***13.6***	***46.9***	***24.4 J-***	***3330 SL***	***19.9***	2.1	ND (1.00)	ND (1.00)	ND (1.00)	***296***	***10.3***	***19.4***	1.6	ND (1.0)	***694***	***7.22***	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	1.25	ND (1.00)	-	203	207 J-	ND (200) SL	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	30.2	45.5	-	-	-	129	73.0
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	*ND (0.381)*	*ND (0.381)*	-	*ND (9.52)*	*ND (3.81) J*	*ND (76.2) OE SL*	-	-	*ND (0.381)*	*ND (0.381)*	*ND (0.381)*	-	*ND (0.381)*	*ND (0.381)*	-	-	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (1)	ND (1.00)	ND (1.00)	ND (1)	*ND (9.02)*	ND (3.61) J	*ND (72.2) SL*	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (2.6)	ND (1.00)	ND (1.00)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (1)	ND (1.00)	ND (1.00)	15.5	567	224 J-	***752 SL***	1.5	0.26 J	ND (1.00)	ND (1.00)	ND (1.00)	554	65.2	101	0.32 J	ND (1.0)	1.5	1.41	1.25
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	4	5.83	12.9	15.5	51.3	36.7 J-	ND (200) SL	3.4	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	60.6	4.15	6.97	2.1	ND (1.0)	44.5	3.88	4.99
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (1)	ND (1.00)	ND (1.00)	2.3	ND (9.18)	ND (10.0) J	*ND (73.4) SL*	ND (1)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	***26***	ND (1.00)	ND (1.00)	6.3	2.0	3.9	ND (1.00)	ND (1.00)
HEXANE	µg/L	6200	-	ND (1.00)	ND (1.00)	-	330	254 J-	ND (200) SL	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	56.4	56.3	-	-	-	4.94	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	4.25	7.25	-	ND (25.0)	18.8 J-	ND (200) SL	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	1.41	2.43	-	-	-	1.01	1.12
BUTYLBENZENE, TERT-	µg/L	12000	-	ND (1.00)	ND (1.00)	-	ND (25.0)	ND (10.0) J	ND (200) SL	-	-	ND (1.00)	ND (1.00)	ND (1.00)	-	ND (1.00)	ND (1.00)	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	µg/L	1000	ND (1)	ND (5.00)	ND (5.00)	6	ND (125)	ND (50.0) J	ND (1000) SL	0.54 J	0.27 J	14.7	ND (5.00)	ND (5.00)	***1770***	109	172	0.27 J	ND (1.0)	290	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	0.28 J	1.90	ND (1.00)	44.5	***1190***	***844 J-***	***1010 SL***	0.53 J	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	***1130***	***88***	***150***	11.0	ND (1.0)	0.23 J	2.03	1.34
1,3,5-TRIMETHYLBENZENE	µg/L	1200	ND (2)	ND (1.00)	ND (1.00)	18.3	411	338 J-	295 SL	3.9	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	374	21.6	40.8	5.3	ND (1.0)	ND (2.0)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (1)	ND (3.00)	ND (3.00)	55.6	1450	649 J-	3840 SL	1.3	0.45 J	ND (3.00)	ND (3.00)	ND (3.00)	3600	217	352	3.5	ND (3.0)	1.6	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)																						
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100) SL	ND (0.02)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.0100)	ND (0.02)	ND (0.0100)	ND (0.0100)	ND (0.019)	ND (0.040)	ND (0.020)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																						
ACENAPHTHENE	µg/L	3800	-	3.45	2.50	-	4.92	15.4	894 SL	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	0.912	1.68	-	-	-	0.181	0.102
ANTHRACENE	µg/L	66	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	1.35	3.32	***355 SL***	ND (0.1)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	0.898	0.173	0.381	ND (0.10)	0.027 J	0.204	0.0830	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (1.00)	ND (2.05) SL	ND (0.1)	ND (0.1)	0.0689 B	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.050)	ND (0.10)	ND (0.050)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	ND (0.1)	ND (0.0500)	0.0604	ND (0.1)	ND (0.0500)	*ND (0.232)*	***0.289 SL***	ND (0.1)	ND (0.1)	0.0617	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.050)	0.0083 J	ND (0.050)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (1.00)	0.323 SL	ND (0.1)	ND (0.1)	0.0939	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.10)	0.024 J	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0454)	0.238 SL	ND (0.1)	ND (0.1)	0.0561	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.272)	0.0957 SL	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	ND (10.0)	ND (10.0)	-	14.5	18.0 J+	255 SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	***39.5 SL***	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	ND (15.0) SL	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.1)	0.0504	ND (1.00)	*ND (5.40) SL*	ND (0.1)	ND (0.1)	0.0698	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.100)	ND (0.100)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (0.0792)	ND (0.0500) SL	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	ND (15.0) SL	-	-	ND (3.00)	ND (3.00)	ND (3.00)	-	ND (3.00)	ND (3.00)	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (50.0) SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	ND (10.0)	ND (10.0) OE	-	ND (10.0)	ND (10.0)	ND (50.0) SL	-	-	ND (10.0)	ND (10.0) OE	ND (10.0) OE	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)
FLUORANTHENE	µg/L	260	-	ND (0.0500)	ND (0.0500)	-	0.0853	ND (1.00)	ND (25.0) SL	-	-	0.132	ND (0.0500)	0.0797	-	ND (0.100)	ND (0.100)	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (0.1)	6.84	5.32	1.44	7.18	21.5	748 SL	ND (0.1)	0.3	ND (0.0500)	ND (0.0500)	ND (0.0500)	9.73	1.25	2.45	ND (0.10)	0.035 J	1.51	0.225	0.110
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	ND (0.0500)	ND (0.0500)	-	ND (0.0500)	ND (1.00)	0.144 SL	-	-	ND (0.0500)	ND (0.0500)	ND (0.0500)	-	ND (0.100)	ND (0.100)	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	11.1	10.3	-	236	261	***8370 SL***	-	-	ND (0.250)	ND (0.250)	ND (0.250)	-	13.6	28.3	-	-	-	0.437	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (0.1)	4.72	2.22	2.52	***242***	***119***	***2410 SL***	ND (0.1)	ND (0.1)	ND (0.250)	ND (0.250)	ND (0.250)	***136***	21.5	33.5	ND (0.10)	0.21	ND (0.10)	1.29	0.874
4-NITROPHENOL	µg/L	60	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (50.0) SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (0.1)	3.46	2.77	0.606	13.3	36.5	***2250 SL***	0.199	ND (0.1)	0.0745 B	ND (0.0500)	0.0609	13.7	1.64	3.52	ND (0.10)	0.025 J	0.186	0.156	0.0621 B
PHENOL	µg/L	2000	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	13.1 SL	-	-	ND (10.0)	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (0.1)	0.149	0.0812	ND (0.1)	0.511	1.89	112 SL	ND (0.1)	ND (0.1)	0.126	ND (0.0500)	0.0809	0.677	0.129	0.382	ND (0.10)	0.042 J	ND (0.10)	0.0663	ND (0.0500)
PYRIDINE	µg/L	120	-	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0)	ND (10.0) SL	-	-	ND (10.0) OE	ND (10.0)	ND (10.0)	-	ND (10.0)	ND (10.0) OE	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	*ND (6.78)*	*ND (6.78)*	-	*ND (6.78)*	*ND (6.78)*	*ND (33.9) SL*	-	-	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*	-	*ND (6.78)*	*ND (6.78)*	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved																						
ARSENIC	µg/L	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	2.10 B	2.55	-	ND (2.00)	ND (2.00)	ND (2.00) SL	-	-	ND (2.00)	ND (2.00)	ND (2.00)	-	ND (2.00)	2.67	-	-	-	2.02	ND (2.00)
LEAD	µg/L	5	ND (3)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00) SL	ND (3)	ND (3)	ND (2.00)	ND (2.00)	ND (2.00)	ND (3)	ND (2.00)	ND (2.00)	ND (3.0)	ND (5.0)	ND (3.0)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	ND (2.00) SL	-	-	ND (2.00)	ND (2.00)	ND (2.00)	-	ND (2.00)	ND (2.00)	-	-	-	2.93	ND (2.00)
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	ND (5.00)	ND (5.00)	-	ND (5.00)	ND (5.00)	ND (5.00) SL	-	-	ND (5.00)	ND (5.00)	ND (5.00)	-	ND (5.00)	ND (5.00)	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	ND (25.0)	ND (25.0)	-	ND (25.0)	ND (25.0)	***23200 SL***	-	-	ND (25.0)	31.1	31.4	-	ND (25.0)	ND (25.0)	-	-	-	ND (25.0)	ND (25.0)

See notes on last page

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Table 4-2
Groundwater Analytical Results Summary-Unconfined Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Notes:

MSC-PA	Pennsylvania Department of Environmental Protection, Groundwater- Used Aquifer, Non Residential, TDS ≤ 2500
6.5	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Indicates the laboratory method detection limit (if available) was above the applicable standard. The reporting limit is shown if the laboratory method detection limit is not available.
ND (0.03)	Indicates concentration not detected above the laboratory reporting limit (in parentheses) except when the reporting limit is greater than the standard in which case the method detection limit is listed in parentheses.
-	Parameter not analyzed / not available
B	Indicates the analyte is detected in the associated blank as well as in the sample.
I	Matrix Interference
J	Indicates an estimated value
J+	Indicates an estimated value that is biased high.
J-	Indicates an estimated value that is biased low.
MS	Sample name resulting from field sample naming or data entry does not reflect the correct location of collection. The location assigned to the sample name in the database is correct.
OE	The associated batch QC was outside the established quality control range for precision/accuracy.
R	The data are unusable. The analyte may or may not be present in the sample.
SL	Sample was collected below LNAPL
U	Indicates that the compound was analyzed for, but not detected. The sample quantification limit corrected for dilution and percent moisture is reported.
s1	Hexavalent Chromium and Chromium III are compared to the standard for Total Chromium.
s2	Cresol, m&p (3-Methylphenol & 4-Methylphenol) co-elute and are reported as the summation of the co-eluting compounds. Standards shown are the stricter of the two.
µg/L	micrograms per liter
HS	HS within the sample ID indicates that field sample collection utilized passive (no-purge) methodology
LL	Eurofins Lancaster Laboratories Environmental
ESC	ESC Lab Sciences
PACE	Pace Analytical Services, LLC

Table 4-3
Groundwater Analytical Results Summary - Lower Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-38D											
Sample Date			21-Oct-04	3-May-05	6-Apr-11	6-Apr-11	29-Jun-11	29-Jun-11	24-May-12	16-Aug-12	25-Oct-12	25-Mar-13	18-Aug-16	10-Oct-16
Sample ID			S-38 D	S38D-050305	S-38D_04062011	S-38D_04062011 FILTERED	S-38D_06292011	S-38D_06292011 FILTERED	S-38D_52412	S-38D_081612	S-38D_102512	S-38D_32513	S-38D-20160818-WG	S-38D-20161010-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory			UNKNOWN	LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	ESC	ESC
Laboratory Work Order	Units	MSC-PA	20140718EZ	UNKNOWN	1241118	1241118	1254227	1254227	1311762	1329723	JB20299	JB32379	L854979	L865153
Volatile Organic Compounds														
BENZENE	µg/L	5	ND (1.0)	ND (5)	ND (0.5)	-	0.5 J	-	ND (0.5)	ND (0.5)	ND (1.0)	0.39 J	ND (1.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	-	12.2	ND (1.00)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.020)	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5.0)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (5.0)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	0.44 J	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5.0)	ND (5)	ND (0.5)	-	3	-	0.8 J	ND (0.5)	ND (2.0)	1.8 J	1.38	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5.0)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	ND (5.0)	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
TOLUENE	µg/L	1000	ND (5.0)	ND (5)	4	-	0.7 J	-	ND (0.5)	ND (0.5)	ND (1.0)	0.46 J	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (10)	ND (5)	ND (0.5)	-	1	-	ND (0.5)	ND (0.5)	ND (1.0)	0.97 J	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)														
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	ND (0.029)	ND (0.0096)	-	ND (0.0096)	-	ND (0.0096)	ND (0.0097)	ND (0.020)	ND (0.020)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds														
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
ANTHRACENE	µg/L	66	-	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	*ND (10)*	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	*ND (10)*	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	*ND (10)*	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	*ND (10)*	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.14)	ND (1)	ND (1)	-	ND (1)	-	ND (0.1)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	*ND (10)*	-	-	-	-	-	-	-	-	-	ND (0.0500) OE	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0) OE
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (10)	ND (10)	ND (1)	-	ND (1)	-	ND (0.1)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (5.0)	ND (10)	ND (1)	-	ND (1)	-	0.3 J	ND (0.09)	-	0.146	ND (0.250)	ND (0.250)
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (10)	ND (10)	ND (1)	-	ND (1)	-	0.2 J	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (10)	ND (10)	ND (1)	-	ND (1)	-	0.2 J	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved														
ARSENIC	µg/L	10	8	-	-	ND (2.0)	-	ND (2.0)	ND (2.0)	ND (2.0)	ND (3.0)	ND (3.0)	-	-
BARIUM	µg/L	2000	240	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	26	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	20	-	-	ND (5.0)	-	ND (5.0)	ND (5.0)	ND (5.0)	*ND (50)*	ND (0.59)	ND (2.00)	ND (2.00)
LEAD	µg/L	5	ND (5.0)	ND (1)	-	ND (1.0)	-	ND (1.0)	**12.9**	ND (1.0)	ND (3.0)	ND (3.0)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	ND (0.20)	ND (0.20)	ND (0.20)	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	-	ND (2.00)	ND (2.00)
SELENIUM	µg/L	50	ND (5)	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)

Sample Location	S-38D2														S-39D		
Sample Date	21-Oct-04	3-May-05	7-Apr-11	7-Apr-11	29-Jun-11	29-Jun-11	24-May-12	16-Aug-12	25-Oct-12	5-Feb-13	5-Feb-13	25-Mar-13	18-Aug-16	10-Oct-16	26-Apr-16	30-Aug-16	31-Aug-16
Sample ID	S-38 I	S38I-050305	S-38D2_04072011	S-38D2_04072011 FILTERED	S-38D2_06292011	S-38D2_06292011 FILTERED	S-38D2_52412	S-58D2_081612	S-38D2_102512	B-38D2_020513	B-38D2_020513	S-38D2_32513	S-38D2-20160818-WG	S-38D2-20161010-WG	S-39D-20160426	S-39D-HS-20160830-WG	S-39D-20160831-WG
Sampling Company	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	STANTEC	AQUATERRA	AQUATERRA
Laboratory	UNKNOWN	LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	ACCUTEST	ACCUTEST	ESC	ESC	LL	ESC	ESC
Laboratory Work Order	20140718EZ	UNKNOWN	1241306	1241306	1254227	1254227	1311762	1329723	JB20299	JB28204	JB28204R	JB32379	L854778	L865153	1654906	L856904	L857169
Volatile Organic Compounds																	
BENZENE	ND (1.0)	ND (5)	ND (0.5)	-	**110**	-	**43**	**60**	**12.7**	**57.5**	-	**106**	**7.36**	2.58	ND (0.5)	ND (1.00)	ND (1.00)
CYCLOHEXANE	-	-	-	-	-	-	-	-	-	-	-	-	2.00	ND (1.00)	ND (2)	ND (1.00)	ND (1.00)
1,2-DIBROMOETHANE (EDB)	ND (0.020)	-	-	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	ND (5.0)	ND (5)	2	-	1 J	-	1	2	ND (1.0)	ND (1.0)	-	1.4	1.57	1.02	ND (0.5)	ND (1.00)	ND (1.00)
ETHYLBENZENE	ND (5.0)	ND (5)	ND (0.5)	-	12	-	2	6	ND (1.0)	6.9	-	13.3	ND (1.00)	ND (1.00)	ND (0.5)	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	ND (5.0)	ND (5)	ND (0.5)	-	2 J	-	0.7 J	1 J	ND (2.0)	ND (2.0)	-	2.5	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	ND (5.0)	ND (5)	ND (0.5)	-	ND (1)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	-	ND (1.0)	ND (1.00)	ND (1.00)	**70**	**32.9**	**63.8**
HEXANE	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (2)	ND (1.00)	ND (1.00)
NAPHTHALENE	-	-	-	-	-	-	-	-	ND (5.0)	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)
TOLUENE	ND (5.0)	ND (5)	0.8 J	-	14	-	4	7	ND (1.0)	7.6	-	15.1	ND (5.00)	ND (5.00)	ND (0.5)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	-	-	ND (0.5)	-	ND (1)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	-	0.29 J	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	-	-	ND (0.5)	-	ND (1)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	-	0.38 J	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	ND (10)	ND (5)	ND (0.5)	-	20	-	4	12	ND (1.0)	11.2	-	23.9	ND (3.00)	ND (3.00)	ND (0.5)	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)																	
1,2-DIBROMOETHANE (EDB)	-	ND (0.029)	ND (0.0099)	-	ND (0.0095)	-	ND (0.0098)	ND (0.0096)	ND (0.020)	ND (0.020)	-	ND (0.020)	ND (0.0100)	ND (0.0100)	ND (0.0094)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																	
ACENAPHTHENE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
ANTHRACENE	-	-	-	-	-	-	-	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	ND	-	-	-	-	-	-	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	ND	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	ND	-	-	-	-	-	-	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	-	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	ND	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)
CHRYSENE	ND (0.14)	ND (1)	ND (0.9)	-	ND (0.9)	-	ND (0.09)	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	ND	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500) OE	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	-	-	-	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0) OE	ND (10.0) OE	ND (10)	ND (10.0) OE	ND (10.0)
FLUORANTHENE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
FLUORENE	ND (10)	ND (10)	ND (0.9)	-	ND (0.9)	-	ND (0.09)	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.0500) OE	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	-	-	-	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)	ND (0.1)	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)
NAPHTHALENE	ND (5.0)	ND (10)	ND (0.9)	-	ND (0.9)	-	0.3 J	0.5 J	-	-	-	0.434	0.319 B	ND (0.250)	ND (0.1)	ND (0.250)	ND (0.250)
4-NITROPHENOL	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0) OE	ND (10.0)	ND (10)	ND (10.0)	ND (10.0)
PHENANTHRENE	ND (10)	ND (10)	ND (0.9)	-	ND (0.9)	-	ND (0.09)	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	0.196
PHENOL	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)
PYRENE	ND (10)	ND (10)	ND (0.9)	-	ND (0.9)	-	ND (0.09)	ND (0.09)	ND (1.0)	-	-	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)
PYRIDINE	-	-	-	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (2)	ND (10.0)	ND (10.0)
QUINOLINE	-	-	-	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*	ND (1)	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved																	
ARSENIC	2.5	-	-	ND (2.0)	-	ND (2.0)	ND (2.0)	ND (2.0)	ND (3.0)	ND (3.0)	-	ND (3.0)	-	-	-	-	-
BARIUM	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	ND	-	-	ND (5.0)	-	ND (5.0)	ND (5.0)	ND (5.0)	*ND (50)*	*ND (50)*	-	2.0 J	11.2	9.26	4.6 J	5.61	5.05
LEAD	ND (5.0)	ND (1)	-	ND (1.0)	-	ND (1.0)	2.6	ND (1.0)	3.7	ND (3.0)	-	1.7 J	ND (2.00)	ND (2.00)	**7.9 J**	ND (2.00)	ND (2.00)
MERCURY	-	-	-	-	-	-	-	ND (0.20)	ND (0.20)	-	ND (0.20)	ND (0.20)	-	-	-	-	-
NICKEL	-	-	-	-	-	-	-	-	-	-	-	-	6.46 B	4.55 B	3.1 J	4.31 B	3.23 B
SELENIUM	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	-	-	-	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	ND (2.3)	ND (5.00)	ND (5.00)
ZINC	-	-	-	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)	34.6	ND (25.0)	ND (25.0)

See notes on last page

Table 4-3
Groundwater Analytical Results Summary - Lower Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Sample Location			S-39D		S-59D										
Sample Date			11-Oct-16	11-Oct-16	6-May-05	7-Apr-11	7-Apr-11	29-Jun-11	29-Jun-11	25-May-12	16-Aug-12	25-Oct-12	29-Mar-13	19-Aug-16	11-Oct-16
Sample ID			S-39D-20161011-WG	S-39D-HS-20161011-WG	S59D-050605	S-59D_04072011	S-59D_04072011 FILTERED	S-59D_06292011	S-59D_06292011 FILTERED	S-59D_52512	S-59D_081612	S-59D_102512	S-59D_32913	S-59D-20160819-WG	S-59D-20161011-WG
Sampling Company			AQUATERRA	AQUATERRA	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA
Laboratory			ESC	ESC	LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	ESC	ESC
Laboratory Work Order	Units	MSC-PA	L865801	L865801	UNKNOWN	1241306	1241306	1254227	1254227	1311763	1329723	JB20299	JB32843	L854977	L865495
Volatile Organic Compounds															
BENZENE	µg/L	5	ND (1.00)	ND (1.00)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	ND (1.00)	ND (1.00)	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	*ND (0.381)*	*ND (0.381)*	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (1.00)	ND (1.00)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (1.00)	ND (1.00)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (1.00)	ND (1.00)	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	**51.1**	17.5	ND (5)	2	-	2	-	4	5	4.4	2.7	1.11	3.13
HEXANE	µg/L	6200	ND (1.00)	ND (1.00)	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	-	-	ND (5.0)	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	ND (1.00)	ND (1.00)	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	ND (1.00)	ND (1.00)	-	-	-	-	-	-	-	-	-	ND (1.00)	1.52
TOLUENE	µg/L	1000	ND (5.00)	ND (5.00)	ND (5)	0.5 J	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	ND (1.00)	ND (1.00)	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	ND (1.00)	ND (1.00)	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (3.00)	ND (3.00)	ND (5)	2	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)															
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.0100)	ND (0.0100)	ND (0.028)	ND (0.0098)	-	ND (0.0097)	-	ND (0.0096)	ND (0.0097)	ND (0.020)	ND (0.020)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds															
ACENAPHTHENE	µg/L	3800	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	-	-	-	ND (0.0500)	0.0880
ANTHRACENE	µg/L	66	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	ND (0.09)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	ND (3.00)	ND (3.00)	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	ND (3.00)	ND (3.00)	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (0.0500)	ND (0.0500)	ND (1)	ND (0.9)	-	ND (1)	-	ND (0.09)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	ND (3.00)	ND (3.00)	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	ND (10.0) OE	ND (10.0) OE	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0) OE
FLUORANTHENE	µg/L	260	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (0.0500)	ND (0.0500)	ND (10)	ND (0.9)	-	ND (1)	-	ND (0.09)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	ND (0.0500)	ND (0.0500)	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	ND (0.250)	ND (0.250)	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (0.250)	ND (0.250)	ND (10)	ND (0.9)	-	ND (1)	-	ND (0.09)	ND (0.09)	-	ND (0.10)	ND (0.250)	ND (0.250)
4-NITROPHENOL	µg/L	60	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (0.0500)	ND (0.0500)	ND (10)	ND (0.9)	-	ND (1)	-	ND (0.09)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
PHENOL	µg/L	2000	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (0.0500)	ND (0.0500)	ND (10)	ND (0.9)	-	ND (1)	-	ND (0.09)	ND (0.09)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	ND (10.0)	ND (10.0)	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	*ND (6.78)*	*ND (6.78)*	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved															
ARSENIC	µg/L	10	-	-	-	-	**13.3**	-	**13.2**	**12.5**	**16.6**	**34.6**	**33.1**	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	ND (2.00)	ND (2.00)	-	-	11.9	-	10.8	10.8	11.2	*ND (50)*	9.8 J	ND (2.00)	7.00
LEAD	µg/L	5	ND (2.00)	ND (2.00)	ND (1)	-	ND (1.0)	-	ND (1.0)	ND (1.0)	ND (1.0)	4.7	3.6	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	-	-	ND (0.20)	ND (0.20)	ND (0.20)	-	-
NICKEL	µg/L	100	2.11	3.58	-	-	-	-	-	-	-	-	-	2.85 B	2.48 B
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	ND (5.00)	ND (5.00)	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	ND (25.0)	ND (25.0)	-	-	-	-	-	-	-	-	-	ND (25.0)	ND (25.0)

Sample Location			S-119D											S-218D				
Sample Date			3-May-05	6-Apr-11	6-Apr-11	28-Jun-11	28-Jun-11	23-May-12	16-Aug-12	25-Oct-12	26-Mar-13	19-Aug-16	11-Oct-16	26-Apr-16	30-Aug-16	31-Aug-16	11-Oct-16	11-Oct-16
Sample ID			S119D-050305	S-119D_04062011	S-119D_04062011 FILTERED	S-119D_06282011	S-119D_06282011 FILTERED	S-119D_52312	S-119D_081612	S-119D_102512	S-119D_032613	S-119D-20160819-WG	S-119D-20161011-WG	S-218D-20160426	S-218D-HS-20160830-WG	S-218D-20160831-WG	S-218D-20161011-WG	S-218D-HS-20161011-WG
Sampling Company			UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	LANGAN	AQUATERRA	AQUATERRA	STANTEC	AQUATERRA	AQUATERRA	AQUATERRA	AQUATERRA
Laboratory			LL	LL	LL	LL	LL	LL	LL	ACCUTEST	ACCUTEST	ESC	ESC	LL	ESC	ESC	ESC	ESC
Laboratory Work Order	Units	MSC-PA	UNKNOWN	1241118	1241118	1254047	1254047	1311484	1329723	JB20299	JB32453	L854977	L865495	1654906	L856904	L857169	L865801	L865801
Volatile Organic Compounds																		
BENZENE	µg/L	5	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	2.20	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
CYCLOHEXANE	µg/L	53000	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	-	-	-	-	-	-	-	-	-	*ND (0.381)*	*ND (0.381)*	-	*ND (0.381)*	*ND (0.381)*	*ND (0.381)*	*ND (0.381)*
1,2-DICHLOROETHANE (EDC)	µg/L	5	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
ETHYLBENZENE	µg/L	700	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (1.00)	ND (1.00)	ND (0.5)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
ISOPROPYLBENZENE (CUMENE)	µg/L	3500	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
METHYL TERTIARY BUTYL ETHER	µg/L	20	ND (5)	0.5 J	-	0.6 J	-	ND (0.5)	0.5 J	ND (1.0)	0.43 J	ND (1.00)	ND (1.00)	**65**	**92.5**	**53.7**	**55.3**	**51.1**
HEXANE	µg/L	6200	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (2)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
NAPHTHALENE	µg/L	100	-	-	-	-	-	-	-	ND (5.0)	-	-	-	-	-	-	-	-
BUTYLBENZENE, SEC-	µg/L	12000	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
BUTYLBENZENE, TERT-	µg/L	12000	-	-	-	-	-	-	-	-	-	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
TOLUENE	µg/L	1000	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (5.00)	ND (5.00)	6	ND (5.00)	ND (5.00)	ND (5.00)	ND (5.00)
1,2,4-TRIMETHYLBENZENE	µg/L	62	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
1,3,5-TRIMETHYLBENZENE	µg/L	1200	-	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (2.0)	ND (2.0)	ND (1.00)	ND (1.00)	ND (1)	ND (1.00)	ND (1.00)	ND (1.00)	ND (1.00)
XYLENES, TOTAL (DIMETHYLBENZENE)	µg/L	10000	ND (5)	ND (0.5)	-	ND (0.5)	-	ND (0.5)	ND (0.5)	ND (1.0)	ND (1.0)	ND (3.00)	ND (3.00)	ND (0.5)	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
Volatile Organic Compounds (SW8011)																		
1,2-DIBROMOETHANE (EDB)	µg/L	0.05	ND (0.029)	ND (0.0096)	-	ND (0.0098)	-	ND (0.0096)	ND (0.0096)	ND (0.020)	ND (0.020)	ND (0.0100)	ND (0.0100)	ND (0.0094)	ND (0.0100)	ND (0.0100)	ND (0.0100)	ND (0.0100)
Semi-Volatile Organic Compounds																		
ACENAPHTHENE	µg/L	3800	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
ANTHRACENE	µg/L	66	-	-	-	-	-	-	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(A)ANTHRACENE	µg/L	4.9	-	-	-	-	-	-	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(A)PYRENE	µg/L	0.2	-	-	-	-	-	-	ND (0.1)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(B)FLUORANTHENE	µg/L	1.2	-	-	-	-	-	-	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(G,H,I)PERYLENE	µg/L	0.26	-	-	-	-	-	-	ND (0.1)	*ND (1.0)*	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
BENZO(K)FLUORANTHENE	µg/L	0.55	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
1,1'-BIPHENYL	µg/L	430	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
BIS(2-ETHYLHEXYL) PHTHALATE	µg/L	6	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
DI-N-BUTYL PHTHALATE	µg/L	12000	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
CHRYSENE	µg/L	1.9	ND (1)	ND (1)	-	ND (0.9)	-	ND (0.1)	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
DIBENZ(A,H)ANTHRACENE	µg/L	0.6	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
DIETHYL PHTHALATE	µg/L	93000	-	-	-	-	-	-	-	-	-	ND (3.00)	ND (3.00)	ND (2)	ND (3.00)	ND (3.00)	ND (3.00)	ND (3.00)
2,4-DIMETHYLPHENOL	µg/L	2300	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
2,4-DINITROPHENOL	µg/L	230	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0) OE	ND (10)	ND (10.0) OE	ND (10.0)	ND (10.0) OE	ND (10.0) OE
FLUORANTHENE	µg/L	260	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
FLUORENE	µg/L	1900	ND (10)	ND (1)	-	ND (0.9)	-	ND (0.1)	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
INDENO(1,2,3-C,D)PYRENE	µg/L	2.8	-	-	-	-	-	-	-	-	-	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
2-METHYLNAPHTHALENE	µg/L	470	-	-	-	-	-	-	-	-	-	ND (0.250)	ND (0.250)	ND (0.1)	ND (0.250)	0.302	ND (0.250)	ND (0.250)
CRESOL, M,P- (3&4-METHYLPHENOL)	µg/L	580 s2	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
CRESOL, O- (2-METHYLPHENOL)	µg/L	5800	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
NAPHTHALENE	µg/L	100	ND (10)	ND (1)	-	ND (0.9)	-	0.2 J	0.1 J	-	ND (0.10)	ND (0.250)	ND (0.250)	ND (0.1)	ND (0.250)	0.529	ND (0.250)	ND (0.250)
4-NITROPHENOL	µg/L	60	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (10)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
PHENANTHRENE	µg/L	1100	ND (10)	ND (1)	-	ND (0.9)	-	ND (0.1)	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	0.192	ND (0.0500)	ND (0.0500)
PHENOL	µg/L	2000	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (0.5)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
PYRENE	µg/L	130	ND (10)	ND (1)	-	ND (0.9)	-	ND (0.1)	ND (0.1)	ND (1.0)	ND (0.10)	ND (0.0500)	ND (0.0500)	ND (0.1)	ND (0.0500)	ND (0.0500)	ND (0.0500)	ND (0.0500)
PYRIDINE	µg/L	120	-	-	-	-	-	-	-	-	-	ND (10.0)	ND (10.0)	ND (2)	ND (10.0)	ND (10.0)	ND (10.0)	ND (10.0)
QUINOLINE	µg/L	1.1	-	-	-	-	-	-	-	-	-	*ND (6.78)*	*ND (6.78)*	ND (1)	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*	*ND (6.78)*
Metals, Dissolved																		
ARSENIC	µg/L	10	-	-	4.6	-	4.6	ND (2.0)	2.9	3.6	2.1 J	-	-	-	-	-	-	-
BARIUM	µg/L	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CADMIUM	µg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM III	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHROMIUM, HEXAVALENT	µg/L	100 s1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
COBALT	µg/L	35	-	-	7.4	-	6.6	6.3	6.8	*ND (50)*	5.7 J	ND (2.00)	5.74	16.8	19.3	16.1	4.07	3.92
LEAD	µg/L	5	ND (1)	-	ND (1.0)	-	ND (1.0)	ND (1.0)	ND (1.0)	ND (3.0)	ND (3.0)	ND (2.00)	ND (2.00)	**12.7 J**	ND (2.00)	ND (2.00)	ND (2.00)	ND (2.00)
MERCURY	µg/L	2	-	-	-	-	-	-	ND (0.20)	ND (0.20)	ND (0.20)	-	-	-	-	-	-	-
NICKEL	µg/L	100	-	-	-	-	-	-	-	-	-	4.66 B	5.01 B	7.3 J	8.44	4.45	ND (2.00)	2.13
SELENIUM	µg/L	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SILVER	µg/L	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VANADIUM	µg/L	8.2	-	-	-	-	-	-	-	-	-	ND (5.00)	ND (5.00)	ND (2.3)	ND (5.00)	ND (5.00)	ND (5.00)	ND (5.00)
ZINC	µg/L	2000	-	-	-	-	-	-	-	-	-	41.2	ND (25.0)	106	ND (25.0)	ND (25.0)	ND (25.0)	ND (25.0)

See notes on last page

Table 4-3
Groundwater Analytical Results Summary - Lower Aquifer
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a Series of Evergreen Resources Group, LLC

Notes:

MSC-PA	Pennsylvania Department of Environmental Protection, Groundwater- Used Aquifer, Non Residential, TDS ≤ 2500
6.5	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Indicates the laboratory method detection limit (if available) was above the applicable standard. The reporting limit is shown if the laboratory method detection limit is not available.
ND (0.03)	Indicates concentration not detected above the laboratory reporting limit (in parentheses) except when the reporting limit is greater than the standard in which case the method detection limit is listed in parentheses.
-	Parameter not analyzed / not available
B	Indicates the analyte is detected in the associated blank as well as in the sample.
I	Matrix Interference
J	Indicates an estimated value
MS	Sample name resulting from field sample naming or data entry does not reflect the correct location of collection. The location assigned to the sample name in the database is correct.
OE	The associated batch QC was outside the established quality control range for precision/accuracy.
SL	Sample was collected below LNAPL
U	Indicates that the compound was analyzed for, but not detected. The sample quantification limit corrected for dilution and percent moisture is reported.
s1	Hexavalent Chromium and Chromium III are compared to the standard for Total Chromium.
s2	Cresol, m&p (3-Methylphenol & 4-Methylphenol) co-elute and are reported as the summation of the co-eluting compounds. Standards shown are the stricter of the two.
µg/L	micrograms per liter
HS	HS within the sample ID indicates that field sample collection utilized passive (no-purge) methodology
LL	Eurofins Lancaster Laboratories Environmental
ESC	ESC Lab Sciences
PACE	Pace Analytical Services, LLC

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 1	ARCO-1	12-May-14	---	26.03	---	0.92	
AOI 1	ARCO-1	13-May-15	---	26.31	---	0.64	
AOI 1	ARCO-1	09-May-16	---	26.87	---	0.08	
AOI 1	ARCO-1D	14-May-14	---	26.06	---	1.00	
AOI 1	ARCO-1D	13-May-15	---	26.35	---	0.71	
AOI 1	ARCO-1D	09-May-16	---	26.70	---	0.36	
AOI 1	ARCO-2	12-May-14	---	25.22	---	0.78	
AOI 1	ARCO-2	13-May-15	---	25.45	---	0.55	
AOI 1	ARCO-2	09-May-16	---	26.01	---	-0.01	
AOI 1	ARCO-3	12-May-14	---	24.06	---	0.25	
AOI 1	ARCO-3	13-May-15	---	24.23	---	0.08	
AOI 1	ARCO-3	09-May-16	---	24.64	---	-0.33	
AOI 1	S-41	12-May-14	---	25.11	---	0.64	
AOI 1	S-41	13-May-15	---	25.27	---	0.48	
AOI 1	S-41	09-May-16	---	25.84	---	-0.09	
AOI 1	S-42I	12-May-14	---	24.55	---	-0.99	Formerly S-42D
AOI 1	S-42I	13-May-15	---	24.81	---	-1.25	
AOI 1	S-42I	10-May-16	---	25.28	---	-1.72	
AOI 1	S-43	12-May-14	---	23.45	---	-0.23	
AOI 1	S-43	12-May-15	---	26.18	---	-2.96	
AOI 1	S-43	13-May-15	---	23.50	---	-0.28	
AOI 1	S-43	09-May-16	---	23.97	---	-0.75	
AOI 1	S-44	12-May-14	---	25.20	---	-1.86	
AOI 1	S-44	13-May-15	---	25.10	---	-1.76	
AOI 1	S-44	10-May-16	---	25.36	---	-2.02	
AOI 1	S-95	12-May-14	---	21.65	---	1.34	
AOI 1	S-95	13-May-15	---	21.87	---	1.12	
AOI 1	S-95	09-May-16	---	22.40	---	0.59	
AOI 1	S-118	12-May-14	---	16.89	---	1.01	
AOI 1	S-118	13-May-15	---	17.02	---	0.88	
AOI 1	S-118	09-May-16	---	17.49	---	0.41	
AOI 1	S-211	12-May-14	---	13.50	---	1.75	
AOI 1	S-211	13-May-15	---	13.05	---	2.20	
AOI 1	S-211	09-May-16	---	14.10	---	1.15	
AOI 1	S-212	12-May-14	---	16.89	---	1.48	
AOI 1	S-212	13-May-15	---	16.89	---	1.48	
AOI 1	S-212	09-May-16	---	17.52	---	0.85	
AOI 1	S-213	12-May-14	---	13.65	---	1.56	
AOI 1	S-213	13-May-15	---	13.46	---	1.75	
AOI 1	S-213	09-May-16	---	14.57	---	0.64	
AOI 1	S-214	12-May-14	---	18.45	---	1.39	
AOI 1	S-214	13-May-15	---	18.64	---	1.20	
AOI 1	S-214	09-May-16	---	19.21	---	0.63	
AOI 1	S-227	12-May-14	---	21.98	---	-0.19	
AOI 1	S-227	13-May-15	---	22.08	---	-0.29	
AOI 1	S-227	09-May-16	---	22.43	---	-0.64	
AOI 1	S-228	12-May-14	---	21.29	---	-0.11	
AOI 1	S-228	13-May-15	---	21.39	---	-0.21	
AOI 1	S-228	09-May-16	---	21.77	---	-0.59	
AOI 1	S-255	12-May-14	---	22.26	---	-0.35	
AOI 1	S-255	13-May-15	---	22.25	---	-0.34	
AOI 1	S-255	09-May-16	---	20.29	---	1.62	
AOI 1	S-256	12-May-14	---	21.29	---	0.12	
AOI 1	S-256	13-May-15	---	21.38	---	0.03	
AOI 1	S-256	09-May-16	---	21.57	---	-0.16	
AOI 1	S-257	12-May-14	---	22.85	---	0.42	
AOI 1	S-257	13-May-15	---	22.97	---	0.30	
AOI 1	S-257	09-May-16	---	23.32	---	-0.05	
AOI 1	S-258	12-May-14	---	23.54	---	-0.74	
AOI 1	S-258	13-May-15	---	23.63	---	-0.83	
AOI 1	S-258	09-May-16	---	23.61	---	-0.81	
AOI 1	S-259	12-May-14	---	24.40	---	-1.84	
AOI 1	S-259	13-May-15	---	24.29	---	-1.73	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 1	S-259	09-May-16	---	24.45	---	-1.89	
AOI 1	S-263	12-May-14	---	15.65	---	1.13	
AOI 1	S-263	13-May-15	---	15.82	---	0.96	
AOI 1	S-263	09-May-16	---	16.29	---	0.49	
AOI 1	S-312	12-May-14	---	5.19	---	12.69	
AOI 1	S-312	11-May-15	---	6.79	---	11.09	
AOI 1	S-312	13-May-15	---	6.89	---	10.99	
AOI 1	S-312	09-May-16	---	5.35	---	12.53	
AOI 1	S-392D	14-May-14	---	18.81	---	1.16	
AOI 1	S-392D	13-May-15	---	18.98	---	0.99	
AOI 1	S-392D	09-May-16	---	19.23	---	0.74	
AOI 1,11	S-46D	13-May-15	---	14.30	---	1.41	
AOI 1,11	S-46D	09-May-16	---	14.53	---	1.18	
AOI 1,11	S-264D	14-May-14	---	25.42	---	1.21	
AOI 1,11	S-264D	13-May-15	---	25.68	---	0.95	
AOI 1,11	S-264D	10-May-16	---	26.11	---	0.52	
AOI 2	S-54	13-May-14	21.16	21.29	0.13	1.79	
AOI 2	S-54	11-May-15	20.48	20.51	0.03	2.49	
AOI 2	S-54	10-May-16	21.66	21.94	0.28	1.26	
AOI 2	S-61	13-May-14	15.90	16.10	0.20	2.37	
AOI 2	S-61	11-May-15	15.77	15.93	0.16	2.51	
AOI 2	S-61	10-May-16	16.60	16.84	0.24	1.67	
AOI 2	S-305	13-May-14	---	17.89	---	1.84	
AOI 2	S-305	11-May-15	---	16.99	---	2.74	
AOI 2	S-305	10-May-16	---	18.58	---	1.15	
AOI 2	S-307	13-May-14	---	15.80	---	2.77	
AOI 2	S-307	11-May-15	---	15.76	---	2.81	
AOI 2	S-307	10-May-16	---	16.29	---	2.28	
AOI 2	S-309	13-May-14	---	17.20	---	2.53	
AOI 2	S-309	11-May-15	---	17.33	---	2.40	
AOI 2	S-309	10-May-16	---	17.66	---	2.07	
AOI 2	S-310	13-May-14	---	7.63	---	9.77	
AOI 2	S-310	11-May-15	---	8.62	---	8.78	
AOI 2	S-310	10-May-16	---	8.39	---	9.01	
AOI 2	S-311	13-May-14	24.46	24.55	0.09	1.70	
AOI 2	S-311	20-May-15	24.33	24.37	0.04	1.84	
AOI 2	S-311	10-May-16	25.00	25.11	0.11	1.16	
AOI 2	S-360	13-May-14	---	21.94	---	1.86	
AOI 2	S-360	11-May-15	---	21.07	---	2.73	
AOI 2	S-360	10-May-16	22.50	22.50	<0.01	1.31	
AOI 2	S-361	13-May-14	---	23.44	---	2.93	
AOI 2	S-361	11-May-15	---	23.05	---	3.32	
AOI 2	S-361	10-May-16	---	23.71	---	2.66	
AOI 2	S-363	15-May-14	24.21	24.28	0.07	1.63	
AOI 2	S-363	20-May-15	---	24.06	---	1.80	
AOI 2	S-363	10-May-16	24.86	24.87	0.01	1.00	
AOI 2,11	S-305D	14-May-14	---	19.09	---	1.39	
AOI 2,11	S-305D	11-May-15	---	19.41	---	1.07	
AOI 2,11	S-305D	10-May-16	---	19.82	---	0.66	
AOI 3	BF-88	13-May-14	---	9.29	---	1.32	
AOI 3	BF-88	12-May-15	---	9.76	---	0.85	
AOI 3	BF-88	09-May-16	---	9.68	---	0.93	
AOI 3	BF-107	13-May-14	---	11.20	---	1.16	
AOI 3	BF-107	12-May-15	---	11.68	---	0.68	
AOI 3	BF-107	09-May-16	---	11.81	---	0.55	
AOI 3	RW-2	13-May-14	10.72	11.10	0.38	0.50	
AOI 3	RW-2	12-May-15	10.84	11.21	0.37	0.38	
AOI 3	RW-2	09-May-16	11.37	11.82	0.45	-0.17	
AOI 3	S-5	13-May-14	3.98	4.03	0.05	1.84	
AOI 3	S-5	12-May-15	3.16	3.24	0.08	2.66	
AOI 3	S-5	09-May-16	---	2.91	---	2.91	
AOI 3	S-9	13-May-14	---	4.12	---	2.46	
AOI 3	S-9	12-May-15	---	3.19	---	3.39	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 3	S-9	09-May-16	---	3.03	---	3.55	
AOI 3	S-10	13-May-14	---	3.89	---	2.18	
AOI 3	S-10	12-May-15	---	4.13	---	1.94	
AOI 3	S-10	09-May-16	---	4.61	---	1.46	
AOI 3	S-11	13-May-14	---	3.95	---	2.43	
AOI 3	S-11	12-May-15	---	3.06	---	3.32	
AOI 3	S-11	09-May-16	---	2.87	---	3.51	
AOI 3	S-12	13-May-14	---	4.23	---	2.00	
AOI 3	S-12	12-May-15	---	4.88	---	1.35	
AOI 3	S-12	09-May-16	---	5.11	---	1.12	
AOI 3	S-14	13-May-14	---	2.75	---	2.99	
AOI 3	S-14	12-May-15	---	2.88	---	2.86	
AOI 3	S-14	09-May-16	---	2.57	---	3.17	
AOI 3	S-16	13-May-14	---	21.46	---	2.22	
AOI 3	S-16	12-May-15	---	21.86	---	1.82	
AOI 3	S-16	09-May-16	---	22.54	---	1.14	
AOI 3	S-17	13-May-14	NM	NM	NM	NM	Well is damaged
AOI 3	S-17	12-May-15	---	15.06	---	2.21	
AOI 3	S-17	09-May-16	---	15.68	---	1.17	
AOI 3	S-18	13-May-14	---	4.08	---	19.41	
AOI 3	S-18	12-May-15	---	4.35	---	19.14	
AOI 3	S-18	09-May-16	---	3.84	---	19.65	
AOI 3	S-20	13-May-14	---	18.05	---	2.21	
AOI 3	S-20	12-May-15	---	18.21	---	2.05	
AOI 3	S-20	09-May-16	---	19.16	---	1.10	
AOI 3	S-21	13-May-14	---	14.44	---	8.04	
AOI 3	S-21	12-May-15	---	10.09	---	12.39	Casing broken off at grade.
AOI 3	S-21	09-May-16	15.90	15.90	<0.01	6.84	
AOI 3	S-22	14-May-14	---	18.67	---	-0.01	
AOI 3	S-22	12-May-15	---	19.01	---	-0.35	
AOI 3	S-22	09-May-16	---	19.65	---	-0.99	
AOI 3	S-23	13-May-14	---	18.04	---	2.24	
AOI 3	S-23	12-May-15	---	18.52	---	1.76	
AOI 3	S-23	09-May-16	---	19.12	---	1.16	
AOI 3	S-25	13-May-14	---	9.85	---	2.26	
AOI 3	S-25	12-May-15	---	10.41	---	1.70	
AOI 3	S-25	09-May-16	---	10.96	---	1.15	
AOI 3	S-59	13-May-14	8.40	8.40	<0.01	4.09	
AOI 3	S-59	12-May-15	8.99	9.00	0.01	3.49	
AOI 3	S-59	09-May-16	9.44	9.45	0.01	3.04	
AOI 3	S-60	13-May-14	10.96	11.49	0.53	1.18	
AOI 3	S-60	12-May-15	11.10	11.54	0.44	1.06	
AOI 3	S-60	09-May-16	11.46	12.00	0.54	0.68	
AOI 3	S-113	13-May-14	11.35	12.07	0.72	1.19	
AOI 3	S-113	18-May-15	11.74	12.43	0.69	0.80	
AOI 3	S-113	09-May-16	11.88	12.68	0.80	0.64	
AOI 3	S-284	13-May-14	---	8.26	---	1.25	
AOI 3	S-284	12-May-15	---	8.68	---	0.83	
AOI 3	S-284	09-May-16	---	4.91	---	4.60	
AOI 3	S-285	13-May-14	13.00	15.73	2.73	1.92	
AOI 3	S-285	12-May-15	13.31	15.20	1.89	1.70	
AOI 3	S-285	09-May-16	13.85	14.05	0.20	1.34	
AOI 3	S-290	13-May-14	---	9.27	---	2.42	
AOI 3	S-290	12-May-15	---	9.58	---	2.11	
AOI 3	S-290	09-May-16	---	10.21	---	1.48	
AOI 3	S-291	13-May-14	---	7.37	---	4.62	
AOI 3	S-291	12-May-15	---	8.05	---	3.94	
AOI 3	S-291	09-May-16	---	7.85	---	4.14	
AOI 3	S-372	13-May-14	---	17.70	---	2.03	
AOI 3	S-372	12-May-15	---	18.07	---	1.66	
AOI 3	S-372	09-May-16	---	18.74	---	0.99	
AOI 3	S-384	13-May-14	---	15.32	---	1.20	
AOI 3	S-384	12-May-15	---	15.84	---	0.67	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 3	S-384	09-May-16	---	16.09	---	0.42	
AOI 3	S-385	13-May-14	---	11.58	---	1.33	
AOI 3	S-385	12-May-15	---	11.58	---	1.33	
AOI 3	S-385	09-May-16	---	12.10	---	0.81	
AOI 3	S-386	13-May-14	---	12.42	---	1.33	
AOI 3	S-386	12-May-15	---	12.84	---	0.91	
AOI 3	S-386	09-May-16	---	13.06	---	0.69	
AOI 3	S-387	13-May-14	---	3.48	---	3.63	
AOI 3	S-387	12-May-15	---	4.41	---	2.70	
AOI 3	S-387	09-May-16	---	4.26	---	2.85	
AOI 3	S-407	09-May-16	---	13.37	---	0.64	
AOI 3	S-409	09-May-16	---	2.65	---	19.64	
AOI 3	S-410	09-May-16	12.34	12.72	0.38	9.90	
AOI 3,11	S-8	15-May-14	---	6.65	---	-0.23	
AOI 3,11	S-8	12-May-15	---	7.10	---	-0.68	
AOI 3,11	S-8	09-May-16	---	7.43	---	-1.01	
AOI 3,11	S-13	15-May-14	---	6.62	---	-0.26	
AOI 3,11	S-13	12-May-15	---	6.97	---	-0.61	
AOI 3,11	S-13	09-May-16	---	7.49	---	-1.13	
AOI 3,11	S-284D	15-May-14	---	11.27	---	0.85	
AOI 3,11	S-284D	12-May-15	---	11.39	---	0.73	
AOI 3,11	S-284D	09-May-16	---	11.83	---	0.29	
AOI 4	MW-1	10-May-16	---	15.48	---	0.90	
AOI 4	RW-700	13-May-14	---	15.85	---	2.16	
AOI 4	RW-700	12-May-15	16.36	16.36	<0.01	1.66	
AOI 4	RW-700	10-May-16	---	20.30	---	-2.29	
AOI 4	RW-701	13-May-14	16.01	16.34	0.33	2.20	
AOI 4	RW-701	12-May-15	16.61	16.61	<0.01	1.67	
AOI 4	RW-701	10-May-16	---	19.60	---	-1.33	
AOI 4	RW-702	13-May-14	---	18.70	---	2.26	
AOI 4	RW-702	12-May-15	---	19.36	---	1.60	
AOI 4	RW-702	10-May-16	---	31.55	---	-10.60	
AOI 4	RW-703	13-May-14	---	18.41	---	2.21	
AOI 4	RW-703	12-May-15	---	19.01	---	1.61	
AOI 4	RW-703	10-May-16	---	29.00	---	-8.38	
AOI 4	RW-704	13-May-14	---	18.43	---	1.80	
AOI 4	RW-704	12-May-15	---	13.42	---	6.81	
AOI 4	RW-704	10-May-16	---	21.70	---	-1.47	
AOI 4	RW-705	13-May-14	---	13.62	---	2.30	
AOI 4	RW-705	12-May-15	---	14.26	---	1.66	
AOI 4	RW-705	10-May-16	---	14.58	---	1.34	
AOI 4	RW-706	13-May-14	---	13.70	---	2.19	
AOI 4	RW-706	18-May-15	---	14.52	---	1.37	
AOI 4	RW-706	10-May-16	---	19.40	---	-3.51	
AOI 4	RW-707	13-May-14	---	14.11	---	2.18	
AOI 4	RW-707	12-May-15	---	14.59	---	1.70	
AOI 4	RW-707	10-May-16	---	15.52	---	0.77	
AOI 4	RW-708	13-May-14	---	13.50	---	1.99	Top of Pump at 13.50 ft btoc
AOI 4	RW-708	12-May-15	NM	NM	NM	NM	
AOI 4	RW-708	10-May-16	---	17.05	---	-1.56	
AOI 4	RW-709	13-May-14	---	13.02	---	2.28	
AOI 4	RW-709	12-May-15	---	13.67	---	1.63	
AOI 4	RW-709	10-May-16	---	14.49	---	0.81	
AOI 4	RW-710	13-May-14	---	13.93	---	1.95	
AOI 4	RW-710	12-May-15	---	14.42	---	1.46	
AOI 4	RW-710	10-May-16	---	15.32	---	0.56	
AOI 4	RW-711	13-May-14	---	13.25	---	2.24	
AOI 4	RW-711	12-May-15	---	13.79	---	1.70	
AOI 4	RW-711	10-May-16	---	14.61	---	0.88	
AOI 4	RW-712	13-May-14	---	13.44	---	2.12	
AOI 4	RW-712	12-May-15	---	13.92	---	1.64	
AOI 4	RW-712	10-May-16	---	14.73	---	0.83	
AOI 4	RW-713	13-May-14	---	13.38	---	1.64	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 4	RW-713	12-May-15	---	13.36	---	1.66	
AOI 4	RW-713	10-May-16	---	14.16	---	0.86	
AOI 4	RW-714	13-May-14	---	13.24	---	1.97	
AOI 4	RW-714	12-May-15	---	13.21	---	2.00	
AOI 4	RW-714	10-May-16	---	14.30	---	0.91	
AOI 4	RW-715	13-May-14	---	13.20	---	2.17	
AOI 4	RW-715	12-May-15	---	13.64	---	1.73	
AOI 4	RW-715	10-May-16	---	14.49	---	0.88	
AOI 4	RW-716	13-May-14	---	13.35	---	2.20	
AOI 4	RW-716	12-May-15	---	13.52	---	2.03	
AOI 4	RW-716	10-May-16	---	14.60	---	0.95	
AOI 4	RW-717	13-May-14	---	13.33	---	2.28	
AOI 4	RW-717	12-May-15	---	13.81	---	1.80	
AOI 4	RW-717	10-May-16	---	14.61	---	1.00	
AOI 4	S-26	13-May-14	---	18.47	---	2.29	
AOI 4	S-26	12-May-15	---	19.05	---	1.71	
AOI 4	S-26	10-May-16	---	19.75	---	1.01	
AOI 4	S-27	13-May-14	---	22.55	---	2.06	
AOI 4	S-27	12-May-15	---	23.02	---	1.59	
AOI 4	S-27	10-May-16	NM	NM	NM	NM	Unable to locate
AOI 4	S-28	13-May-14	---	21.13	---	4.61	
AOI 4	S-28	12-May-15	---	21.10	---	4.64	
AOI 4	S-28	10-May-16	NM	NM	NM	NM	Dry or blocked at 18.80 ft btoc
AOI 4	S-29	13-May-14	19.84	23.00	3.16	3.03	
AOI 4	S-29	12-May-15	19.92	23.05	3.13	2.96	
AOI 4	S-29	10-May-16	20.55	23.10	2.55	2.41	
AOI 4	S-30	13-May-14	20.05	27.97	7.92	2.04	
AOI 4	S-30	12-May-15	20.39	28.60	8.21	1.66	
AOI 4	S-30	10-May-16	21.22	28.91	7.69	0.90	
AOI 4	S-31	13-May-14	18.22	18.95	0.73	2.97	
AOI 4	S-31	12-May-15	18.65	19.23	0.58	2.56	
AOI 4	S-31	10-May-16	NM	NM	NM	NM	Dry or blocked at 14.07 ft btoc
AOI 4	S-32	13-May-14	22.66	23.00	0.34	1.50	
AOI 4	S-32	12-May-15	22.73	22.80	0.07	1.46	
AOI 4	S-32	10-May-16	23.05	23.07	0.02	1.15	
AOI 4	S-34	13-May-14	---	19.59	---	1.30	
AOI 4	S-34	12-May-15	---	19.83	---	1.06	
AOI 4	S-34	10-May-16	---	19.65	---	1.24	
AOI 4	S-35	13-May-14	---	19.62	---	1.32	
AOI 4	S-35	12-May-15	---	19.85	---	1.09	
AOI 4	S-35	10-May-16	---	20.29	---	0.65	
AOI 4	S-36	13-May-14	---	22.80	---	1.43	
AOI 4	S-36	12-May-15	---	23.00	---	1.23	
AOI 4	S-36	10-May-16	---	23.51	---	0.72	
AOI 4	S-38	12-May-14	---	16.59	---	2.36	
AOI 4	S-38	12-May-15	---	17.23	---	1.72	
AOI 4	S-38	10-May-16	---	18.02	---	0.93	
AOI 4	S-39	12-May-14	---	20.43	---	2.45	
AOI 4	S-39	12-May-15	---	21.04	---	1.84	
AOI 4	S-39	10-May-16	---	21.82	---	1.06	
AOI 4	S-40	12-May-14	---	22.54	---	1.92	
AOI 4	S-40	12-May-15	---	23.09	---	1.37	
AOI 4	S-40	10-May-16	NM	NM	NM	NM	Area flooded
AOI 4	S-56	13-May-14	---	13.27	---	1.73	
AOI 4	S-56	12-May-15	---	13.42	---	1.58	
AOI 4	S-56	10-May-16	---	13.81	---	1.19	
AOI 4	S-57	13-May-14	---	10.31	---	2.19	
AOI 4	S-57	12-May-15	---	11.35	---	1.15	
AOI 4	S-57	10-May-16	---	10.49	---	2.01	
AOI 4	S-96	13-May-14	18.19	18.24	0.05	1.57	
AOI 4	S-96	12-May-15	18.23	18.23	<0.01	1.55	
AOI 4	S-96	10-May-16	---	19.01	---	0.76	
AOI 4	S-97	12-May-14	---	25.74	---	2.21	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 4	S-97	12-May-15	---	26.02	---	1.93	
AOI 4	S-97	10-May-16	NM	NM	NM	NM	Covered / Not accessible
AOI 4	S-102	13-May-14	---	16.84	---	1.38	
AOI 4	S-102	12-May-15	---	16.75	---	1.47	
AOI 4	S-102	10-May-16	---	17.36	---	0.86	
AOI 4	S-103	13-May-14	---	24.40	---	1.71	
AOI 4	S-103	12-May-15	---	24.19	---	1.92	
AOI 4	S-103	10-May-16	---	24.96	---	1.15	
AOI 4	S-104	13-May-14	15.27	16.56	1.29	3.13	
AOI 4	S-104	12-May-15	15.53	16.78	1.25	2.88	
AOI 4	S-104	10-May-16	15.60	16.89	1.29	2.80	
AOI 4	S-119	12-May-14	---	25.08	---	1.52	
AOI 4	S-119	12-May-15	---	25.27	---	1.33	
AOI 4	S-119	10-May-16	---	25.94	---	0.66	
AOI 4	S-120	12-May-14	---	17.46	---	2.36	
AOI 4	S-120	12-May-15	---	17.99	---	1.83	
AOI 4	S-120	10-May-16	---	18.22	---	1.60	
AOI 4	S-121	12-May-14	---	18.55	---	2.57	
AOI 4	S-121	12-May-15	---	19.52	---	1.60	
AOI 4	S-121	10-May-16	---	20.30	---	0.82	
AOI 4	S-122	12-May-14	---	23.24	---	2.47	
AOI 4	S-122	12-May-15	---	23.85	---	1.86	
AOI 4	S-122	10-May-16	---	24.70	---	1.01	
AOI 4	S-123	12-May-14	---	19.86	---	2.27	
AOI 4	S-123	12-May-15	---	20.43	---	1.70	
AOI 4	S-123	10-May-16	---	21.29	---	0.84	
AOI 4	S-124	13-May-14	---	21.00	---	2.20	
AOI 4	S-124	12-May-15	---	21.51	---	1.69	
AOI 4	S-124	10-May-16	22.36	22.39	0.03	0.83	
AOI 4	S-216	13-May-14	---	14.02	---	1.74	
AOI 4	S-216	12-May-15	---	14.13	---	1.63	
AOI 4	S-216	10-May-16	---	14.81	---	0.95	
AOI 4	S-218	13-May-14	---	23.68	---	2.06	
AOI 4	S-218	12-May-15	---	23.98	---	1.76	
AOI 4	S-218	10-May-16	---	24.64	---	1.10	
AOI 4	S-218D	10-May-16	---	24.48	---	0.04	
AOI 4	S-219	12-May-14	---	20.73	---	2.36	
AOI 4	S-219	12-May-15	---	21.29	---	1.80	
AOI 4	S-219	10-May-16	---	22.07	---	1.02	
AOI 4	S-220	13-May-14	18.48	18.88	0.40	2.27	
AOI 4	S-220	12-May-15	18.94	19.38	0.44	1.81	
AOI 4	S-220	10-May-16	19.69	20.14	0.45	1.05	
AOI 4	S-221	13-May-14	20.61	21.35	0.74	2.26	
AOI 4	S-221	12-May-15	21.08	21.81	0.73	1.79	
AOI 4	S-221	10-May-16	22.05	23.18	1.13	0.75	
AOI 4	S-222	13-May-14	---	13.83	---	2.46	
AOI 4	S-222	12-May-15	---	14.40	---	1.89	
AOI 4	S-222	10-May-16	---	15.18	---	1.11	
AOI 4	S-223	13-May-14	---	13.55	---	2.33	
AOI 4	S-223	12-May-15	---	14.10	---	1.78	
AOI 4	S-223	10-May-16	---	14.94	---	0.94	
AOI 4	S-224	13-May-14	---	13.66	---	2.37	
AOI 4	S-224	12-May-15	---	14.23	---	1.80	
AOI 4	S-224	10-May-16	---	15.12	---	0.91	
AOI 4	S-225	13-May-14	---	12.23	---	4.63	Well damaged
AOI 4	S-225	12-May-15	---	15.41	---	1.45	
AOI 4	S-225	10-May-16	---	16.26	---	-1.27	
AOI 4	S-233	13-May-14	18.97	19.43	0.46	5.30	
AOI 4	S-233	12-May-15	19.49	19.92	0.43	4.78	
AOI 4	S-233	10-May-16	20.37	21.26	0.89	3.82	
AOI 4	S-234	13-May-14	---	19.21	---	2.02	
AOI 4	S-234	12-May-15	---	19.80	---	1.43	
AOI 4	S-234	10-May-16	---	20.59	---	0.64	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 4	S-235	13-May-14	20.85	20.90	0.05	2.27	
AOI 4	S-235	12-May-15	21.39	21.41	0.02	1.73	
AOI 4	S-235	10-May-16	22.24	22.43	0.19	0.85	
AOI 4	S-236	13-May-14	20.67	21.34	0.67	2.18	
AOI 4	S-236	12-May-15	21.17	21.90	0.73	1.67	
AOI 4	S-236	10-May-16	22.11	23.01	0.90	0.70	
AOI 4	S-237	13-May-14	20.52	20.99	0.47	2.21	
AOI 4	S-237	12-May-15	21.02	21.54	0.52	1.70	
AOI 4	S-237	10-May-16	21.93	23.34	1.41	0.63	
AOI 4	S-238	13-May-14	20.64	20.64	<0.01	2.28	
AOI 4	S-238	12-May-15	21.17	21.17	<0.01	1.75	
AOI 4	S-238	10-May-16	---	22.04	---	0.88	
AOI 4	S-239	13-May-14	---	13.50	---	2.32	
AOI 4	S-239	12-May-15	---	14.07	---	1.75	
AOI 4	S-239	10-May-16	---	14.88	---	0.94	
AOI 4	S-240	13-May-14	21.69	21.83	0.14	2.15	
AOI 4	S-240	12-May-15	22.17	22.67	0.50	1.61	
AOI 4	S-240	10-May-16	22.93	24.13	1.20	0.72	
AOI 4	S-241	13-May-14	23.87	26.22	2.35	1.80	
AOI 4	S-241	12-May-15	24.25	26.35	2.10	1.46	
AOI 4	S-241	10-May-16	25.09	26.90	1.81	0.67	
AOI 4	S-242	13-May-14	---	19.59	---	2.30	
AOI 4	S-242	12-May-15	---	20.00	---	1.89	
AOI 4	S-242	10-May-16	---	20.97	---	0.92	
AOI 4	S-243	13-May-14	---	13.26	---	2.48	
AOI 4	S-243	12-May-15	---	13.84	---	1.90	
AOI 4	S-243	10-May-16	---	14.64	---	1.10	
AOI 4	S-244	13-May-14	---	10.30	---	11.64	
AOI 4	S-244	12-May-15	---	20.06	---	1.88	
AOI 4	S-244	10-May-16	---	11.92	---	10.02	
AOI 4	S-245	13-May-14	---	19.70	---	2.51	
AOI 4	S-245	12-May-15	---	20.29	---	1.92	
AOI 4	S-245	10-May-16	---	21.25	---	0.96	
AOI 4	S-246	13-May-14	---	16.49	---	5.07	
AOI 4	S-246	12-May-15	---	18.24	---	3.32	
AOI 4	S-246	10-May-16	---	17.69	---	3.87	
AOI 4	S-278	13-May-14	---	18.71	---	2.32	
AOI 4	S-278	12-May-15	19.23	19.23	<0.01	1.81	
AOI 4	S-278	10-May-16	19.96	20.00	0.04	1.06	
AOI 4	S-279	13-May-14	---	24.06	---	2.39	
AOI 4	S-279	12-May-15	24.40	24.40	<0.01	2.06	
AOI 4	S-279	10-May-16	25.23	25.23	<0.01	1.23	
AOI 4	S-282	13-May-14	19.45	20.29	0.84	1.18	
AOI 4	S-282	12-May-15	19.60	20.42	0.82	1.03	
AOI 4	S-282	10-May-16	19.98	20.00	0.02	0.80	
AOI 4	S-329	13-May-14	---	18.86	---	2.06	
AOI 4	S-329	12-May-15	---	19.43	---	1.49	
AOI 4	S-329	10-May-16	---	20.18	---	0.74	
AOI 4	S-364	13-May-14	---	20.30	---	1.03	
AOI 4	S-364	12-May-15	---	20.35	---	0.98	
AOI 4	S-364	10-May-16	NM	NM	NM	NM	Well damaged
AOI 4	S-365	13-May-14	19.66	19.85	0.19	1.06	
AOI 4	S-365	18-May-15	20.00	20.02	0.02	0.75	
AOI 4	S-365	10-May-16	20.30	20.30	<0.01	0.46	
AOI 4	S-366	13-May-14	---	20.90	---	1.36	
AOI 4	S-366	12-May-15	---	20.63	---	1.63	
AOI 4	S-366	10-May-16	---	21.50	---	0.76	
AOI 4	S-367	13-May-14	---	14.54	---	1.48	
AOI 4	S-367	12-May-15	---	14.38	---	1.64	
AOI 4	S-367	10-May-16	---	15.18	---	0.84	
AOI 4	S-368	13-May-14	---	16.14	---	1.88	
AOI 4	S-368	12-May-15	---	16.24	---	1.78	
AOI 4	S-368	10-May-16	16.70	18.40	1.70	1.11	

Table 4-4
2014 to 2016 Annual Gauging Data for AOI 4 and Surrounding Area
Philadelphia Refinery OPerations, a series of Evergreen Resources Group, LLC

AOI	Well ID	Date	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Apparent LNAPL Thickness (ft)	Corrected Groundwater Elevation (ft amsl)	Notes
AOI 4	S-369	12-May-14	---	28.77	---	0.65	
AOI 4	S-369	12-May-15	---	28.89	---	0.53	
AOI 4	S-369	10-May-16	---	29.51	---	-0.09	
AOI 4	S-370	13-May-14	---	10.64	---	1.42	
AOI 4	S-370	12-May-15	---	10.94	---	1.12	
AOI 4	S-370	10-May-16	---	11.33	---	0.73	
AOI 4	S-371	13-May-14	---	18.51	---	3.54	
AOI 4	S-371	12-May-15	---	19.28	---	2.77	
AOI 4	S-371	10-May-16	---	19.81	---	2.24	
AOI 4	S-379	12-May-14	---	24.33	---	1.32	
AOI 4	S-379	12-May-15	NM	NM	NM	NM	Blocked at 16.40 ft btoc
AOI 4	S-379	10-May-16	NM	NM	NM	NM	Blocked at 15.90 ft btoc
AOI 4	S-380	12-May-14	---	19.25	---	2.07	
AOI 4	S-380	12-May-15	---	19.67	---	1.65	
AOI 4	S-380	10-May-16	---	20.44	---	0.88	
AOI 4	S-381	13-May-14	---	23.90	---	1.96	
AOI 4	S-381	12-May-15	---	24.40	---	1.46	
AOI 4	S-381	10-May-16	---	25.16	---	0.70	
AOI 4	S-408	10-May-16	---	14.71	---	1.17	
AOI 4	S-415	10-May-16	---	18.48	---	0.75	
AOI 4,11	S-38D	14-May-14	---	17.40	---	0.30	
AOI 4,11	S-38D	12-May-15	---	17.71	---	-0.01	
AOI 4,11	S-38D	10-May-16	---	18.18	---	-0.48	
AOI 4,11	S-38D2	14-May-14	---	17.89	---	0.30	
AOI 4,11	S-38D2	12-May-15	---	18.20	---	-0.01	
AOI 4,11	S-38D2	10-May-16	---	18.78	---	-0.59	
AOI 4,11	S-59D	14-May-14	---	15.53	---	1.60	
AOI 4,11	S-59D	12-May-15	---	15.73	---	1.40	
AOI 4,11	S-59D	10-May-16	---	16.40	---	0.73	
AOI 4,11	S-119D	14-May-14	---	23.75	---	1.35	
AOI 4,11	S-119D	12-May-15	---	23.97	---	1.13	
AOI 4,11	S-119D	10-May-16	---	24.66	---	0.44	

Notes:
ft = feet
ft btoc = feet below top of casing
ft amsl = feet above mean sea level
LNAPL = Light Non Aqueous Phase Liquid
NM = Not measured

TABLE 5-1. GENERALIZED STRATIGRAPHIC SECTION
AND INTERPRETED HYDROSTRATIGRAPHIC UNITS
AOI 4 REMEDIAL INVESTIGATION
PHILADELPHIA REFINING COMPLEX

<table>
<tr><th>System</th><th>Series</th><th colspan="2">Hydrogeologic Unit</th><th>Hydrostratigraphic Unit</th></tr>
<tr><td rowspan="2">Quaternary</td><td>Holocene</td><td colspan="2">Alluvium</td><td rowspan="4">Unconfined (Water-Table) aquifer</td></tr>
<tr><td>Pleistocene</td><td colspan="2">Trenton "gravel"</td></tr>
<tr><td rowspan="7">Cretaceous</td><td rowspan="6">Upper Cretaceous</td><td rowspan="7">Potomac-Raritan-Magothy aquifer system</td><td>Upper clay unit</td></tr>
<tr><td>Upper sand unit</td></tr>
<tr><td>Middle clay unit</td><td>Aquitard</td></tr>
<tr><td>Middle sand unit</td><td rowspan="4">Semi-Confined Lower aquifer</td></tr>
<tr><td>Lower clay unit</td></tr>
<tr><td rowspan="2">Lower sand unit</td></tr>
<tr><td>Lower Cretaceous</td></tr>
<tr><td>Pre-Cretaceous</td><td></td><td>Wissahickon Formation</td><td></td><td></td></tr>
</table>

Notes:
1. Adopted from Figure 2 of Schreffler, 2001.
2. Hydrostratigraphic units interpreted by Stantec based on observed AOI 4 subsurface conditions.

Table 7-1
Air Analytical Results Summary
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Sample Location								AOI4 SAMPLE 19	AOI4 SAMPLE 20	AOI4 SAMPLE 21	AOI4-AA-16-001	TRIP_BLANK
Sample Date								24-Oct-12	24-Oct-12	24-Oct-12	23-Jun-16	24-Oct-12
Sample ID								Sample 19	Sample 20	Sample 21	AOI4-AA-16-001-20160623	Sample 24 TB
Sampling Company								STANTEC	STANTEC	STANTEC	Aquaterra	STANTEC
Laboratory								CASS	CASS	CASS	ESC	CASS
Laboratory Work Order								P1204493	P1204493	P1204493	L843668	P1204493
Laboratory Sample ID								P1204493-019	P1204493-020	P1204493-021	L843668-01	P1204493-023
Sample Type	Units	EPA-RSL [TR= 10E-5]	SVIA-NR SHS	SVIA-NR SSS	OSHA PEL	NIOSH REL	ACGIH TLV	Indoor	Ambient	Ambient	Ambient	BLANK
Volatile Organic Compounds												
BENZENE	µg/m3	13	16	1.6	3190	319	1600	3.6	2.1	4.9	6.97	ND (0.50)
CYCLOHEXANE	µg/m3	2600	26000	2600	1050000	1050000	334000	-	-	-	13.8	-
1,2-DIBROMOETHANE (EDB)	µg/m3	0.2	0.2	0.02	153800	346	n/v	*ND (0.23)*	*ND (0.24)*	*ND (0.21)*	ND (0.142)	ND (0.15)
1,2-DICHLOROETHANE (EDC)	µg/m3	3.1	4.7	0.47	202500	4000	40000	ND (0.21)	ND (0.22)	ND (0.20)	ND (0.249)	ND (0.14)
ETHYLBENZENE	µg/m3	49	49	4.9	435000	435000	87000	2.9	0.83	3.1	2.65	ND (0.50)
ISOPROPYLBENZENE (CUMENE)	µg/m3	180	1800	180	245000	245000	246000	0.77	ND (0.79)	ND (0.71)	1.33	ND (0.50)
M, P-XYLENES	µg/m3	44	440	44	435000	435000	434000	11	2.8	13	10.8	ND (1.0)
METHYL TERTIARY BUTYL ETHER	µg/m3	470	470	47	n/v	n/v	180000	ND (0.77)	ND (0.79)	ND (0.71)	ND (0.721)	ND (0.50)
HEXANE	µg/m3	3100	3100	310	1800000	180000	176000	-	-	-	23.8 OE	-
NAPHTHALENE	µg/m3	1.3	3.6	0.36	50000	50000	52000	ND (0.77)	ND (0.79)	ND (0.71)	ND (0.806)	ND (0.50)
O-XYLENE (1,2-DIMETHYLBENZENE)	µg/m3	44	440	44	435000	435000	434000	3.7	1.1	4.1	3.91	ND (0.50)
TOLUENE	µg/m3	2200	22000	2200	754000	375000	75000	14	7.4	19	13.6	ND (0.50)
1,2,4-TRIMETHYLBENZENE	µg/m3	3.1	31	3.1	n/v	125000	123000	***3.3***	0.92	***3.6***	***4.06***	ND (0.50)
1,3,5-TRIMETHYLBENZENE	µg/m3	n/v	31	3.1	n/v	125000	123000	1.3	ND (0.79)	1.6	1.25	ND (0.50)

Notes:

EPA-RSL	Environmental Protection Agency Regional Screening Level (Region 3) Industrial Air, Target Risk (TR) as indicated, Target Hazard Quotient (THQ)=0.1, lower of the Carcinogenic and Noncarcinogenic screening levels (updated May 2016)
PADEP	Pennsylvania Department of Environmental Protection
SVIA-NR	PADEP Vapor Intrusion Screening Values for Indoor Air, shown for the Statewide Health Standard (SHS) and Site-Specific Standard (SSS) Non-Residential (Technical Guidance Manual for Vapor Intrusion into Buildings from Groundwater and Soil under Act 2, effective January 2017)
OSHA PEL	Occupational Safety and Health Administration Permissible Exposure Limit
NIOSH REL	National Institute for Occupational Safety and Health Recommended Exposure Limit
ACGIH TLV	American Conference of Governmental Industrial Hygienists Threshold Limit Value
6.5	Concentration exceeds the EPA-RSL, TR=1E-5
n/v	EPA-RSL is not available for 1,3,5-trimethylbenzene; values are screened against the SVIA-NR SSS
15.2	Measured concentration did not exceed the indicated standard.
ND (0.50)	Indicates the laboratory method detection limit (if available) was above the applicable standard. The reporting limit is shown if the laboratory method detection limit is not available.
ND (0.03)	Indicates concentration not detected above the laboratory reporting limit (in parentheses) except when the reporting limit is greater than the standard in which case the method detection limit is listed in parentheses.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
OE	The associated batch QC was outside the established quality control range for precision/accuracy.
µg/m3	Micrograms per cubic meter
CASS	Columbia Analytical Services Inc.
ESC	Environmental Services Corporation

Stantec

Table 7-2
PADEP Air Toxics Monitoring Data: Marcus Hook, PA Monitoring Station
Area of Interest 4, Philadelphia Refining Complex
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

									AOI4 SAMPLE 20	AOI4 SAMPLE 21	AOI4-AA-16-001
								Sample Date	24-Oct-12	24-Oct-12	23-Jun-16
								Sample ID	Sample 20	Sample 21	AOI4-AA-16-001-20160623
								Sampling Company	STANTEC	STANTEC	Aquaterra
								Laboratory	CASS	CASS	ESC
								Laboratory Work Order	P1204493	P1204493	L843668
								Laboratory Sample ID	P1204493-020	P1204493-021	L843668-01
		Air Toxics Monitoring 2012, Marcus Hook PA Station									
Sample Type	**MW**	**% ND**	**Mean**		**Maximum**		**24 October 2012**		**Ambient**	**Ambient**	**Ambient**
			ppbv	µg/m3	ppbv	µg/m3	ppbv	µg/m3	µg/m3	µg/m3	µg/m3
Volatile Organic Compounds											
BENZENE	78.1	0	0.44	1.41	1.8	5.75	0.87	2.78	2.1	4.9	6.97
CYCLOHEXANE	8.16	10	0.15	0.05	0.45	0.15	0.31	0.10	-	-	13.8
1,2-DIBROMOETHANE (EDB)	187.66	100	NA	NA	0.013	0.10	ND	ND	ND (0.24)	ND (0.21)	ND (0.142)
1,2-DICHLOROETHANE (EDC)	98.66	90	NA	NA	0.037	0.15	ND	ND	ND (0.22)	ND (0.20)	ND (0.249)
ETHYLBENZENE	106.2	31	0.057	0.25	0.22	0.96	0.22	0.96	0.83	3.1	2.65
ISOPROPYLBENZENE (CUMENE)	120.19	NA	NA	NA	NA	NA	NA	NA	ND (0.79)	ND (0.71)	1.33
M, P-XYLENES	106.2	14	0.2	0.87	0.81	3.52	0.81	3.52	2.8	13	10.8
METHYL TERTIARY BUTYL ETHER	88.15	100	NA	NA	0.015	0.05	ND	ND	ND (0.79)	ND (0.71)	ND (0.721)
HEXANE	86.18	0	0.41	1.45	3.1	10.93	1.2	4.23	-	-	23.8 OE
NAPHTHALENE	128.2	NA	NA	NA	NA	NA	NA	NA	ND (0.79)	ND (0.71)	ND (0.806)
O-XYLENE (1,2-DIMETHYLBENZENE)	106.2	34	0.061	0.26	0.25	1.09	0.25	1.09	1.1	4.1	3.91
TOLUENE	92.1	0	0.65	2.45	1.9	7.16	1.8	6.78	7.4	19	13.6
1,2,4-TRIMETHYLBENZENE	120.2	57	0.043	0.21	0.14	0.69	0.14	0.69	0.92	3.6	4.06
1,3,5-TRIMETHYLBENZENE	120.2	98	NA	NA	0.061	0.30	0.061	0.30	ND (0.79)	1.6	1.25

Definitions:

MW: Molecular weight in grams per mol

ND: Not detected

ppbv: parts per billion by volume

µg/m^3: micrograms per cubic meter

NA: not available or not applicable

Notes:

1. PADEP air toxics data accessed January 23, 2017; data for 2016 is not available: http://www.dep.pa.gov/Business/Air/BAQ/MonitoringTopics/ToxicPollutants/Pages/Toxic-Monitoring-Sites-in-Pennsylvania.aspx

2. PADEP does not monitor ambient air for isopropylbenzene, naphthalene, sec-butylbenzene or tert-butylbenzene

3. PADEP results are reported in ppbv and converted to µg/m^3 at standard temperature and pressure, by this equation: ppbv *MW/24.45

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
416742	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	15	0	5	2		TRUE				
416741	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	20	0	5	2		TRUE				
416731	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	25	0	10	2		TRUE				
416730	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	20	0	15	2		TRUE				
416729	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	35	0	25	2		TRUE				
416728	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	25	0	10	2		TRUE				
644089	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/22/2016	NEW WELL	39.89582	-75.21969	PARRATT-WOLFF INC	Evergreen Resources Group		OTHER	45	0	25.5	4		FALSE				
644089	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/22/2016	NEW WELL	39.89582	-75.21969	PARRATT-WOLFF INC	Evergreen Resources Group		OTHER	45	25.5	28	4		FALSE				
644106	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/27/2016	NEW WELL	39.89804	-75.21938	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	35	0	16	4		FALSE				
644106	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/27/2016	NEW WELL	39.89804	-75.21938	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	35	16	18	4		FALSE				
644105	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/21/2016	NEW WELL	39.89573	-75.22036	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	60	0	36	4		FALSE				
644105	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/21/2016	NEW WELL	39.89573	-75.22036	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	60	36	38	4		FALSE				
644104	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/14/2016	NEW WELL	39.89757	-75.2196	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	70	0	55	4		FALSE				
644104	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/14/2016	NEW WELL	39.89757	-75.2196	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	70	55	58	4		FALSE				
644103	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/15/2016	NEW WELL	39.89945	-75.22197	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	45	0	21	4		FALSE				
644103	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/15/2016	NEW WELL	39.89945	-75.22197	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	45	21	23	4		FALSE				
644102	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/20/2016	NEW WELL	39.90225	-75.22167	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	39	0	20	4		FALSE				
644102	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/20/2016	NEW WELL	39.90225	-75.22167	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	39	20	22	4		FALSE				
644090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.8942	-75.22347	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	90	75	78	2		FALSE				
644090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.8942	-75.22347	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	90	0	75	2		FALSE				
644032	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/19/2016	NEW WELL	39.89823	-75.22238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	40	0	21	4		FALSE				
644032	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/19/2016	NEW WELL	39.89823	-75.22238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	40	21	23	4		FALSE				
644031	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.90035	-75.2238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	15	0	2	4		FALSE				
644031	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.90035	-75.2238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	15	2	4	4		FALSE				
643401	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/25/2016	NEW WELL	39.92517	-75.20346	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	66	0	51	4		TRUE		8		
643401	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/25/2016	NEW WELL	39.92517	-75.20346	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	66	51	54	4		TRUE		8		
643400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/23/2016	NEW WELL	39.92419	-75.19915	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	65	0	50	4		TRUE		12		
643400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/23/2016	NEW WELL	39.92419	-75.19915	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	65	50	53	4		TRUE		12		
643399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/17/2016	NEW WELL	39.9217	-75.20739	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	80.3	0	67	4		TRUE		14		
643399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/17/2016	NEW WELL	39.9217	-75.20739	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	80.3	67	70	4		TRUE		14		
642822	PHILADELPHIA	PHILADELPHIA				8/4/2016	NEW WELL	39.92395	-75.2059	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	25	0	1	4		FALSE				
642822	PHILADELPHIA	PHILADELPHIA				8/4/2016	NEW WELL	39.92395	-75.2059	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	25	1	6	4		FALSE				
620351	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/15/2015	NEW WELL	39.9232	-75.19409	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
620350	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/18/2015	NEW WELL	39.92268	-75.19418	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
620349	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/22/2015	NEW WELL	39.92257	-75.19422	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
620348	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/29/2015	NEW WELL	39.92336	-75.19393	EAST COAST DRILLING INC	Gas Works		UNUSED	21	0	16	2		TRUE		0		
620342	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/16/2015	NEW WELL	39.92171	-75.19509	EAST COAST DRILLING INC	Gas Works		UNUSED	19	0	14	2		TRUE		0		
620328	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92193	-75.19496	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
620327	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92257	-75.19477	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
620301	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/26/2015	NEW WELL	39.92265	-75.1946	EAST COAST DRILLING INC	Gas Works		UNUSED	21	0	16	2		TRUE		0		
620300	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92242	-75.19491	EAST COAST DRILLING INC	Gas Works		UNUSED	22	0	17	2		TRUE		0		
620294	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.9226	-75.19474	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	21		60
620293	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/22/2015	NEW WELL	39.92258	-75.19419	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
620292	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/25/2015	NEW WELL	39.92259	-75.19439	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	0.5	20		60
620291	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/25/2015	NEW WELL	39.92258	-75.19427	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	21		60
620278	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/25/2015	NEW WELL	39.92219	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	18.5	0	13.5	2		TRUE		0		
620277	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92199	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
620090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92262	-75.19458	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
620080	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2814 W Porter St	19145	6/16/2015	NEW WELL	39.92271	-75.19409	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
620079	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2814 W Porter St	19145	6/17/2015	NEW WELL	39.92274	-75.1941	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
620078	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2511 S Newkirk St	19145	6/17/2015	NEW WELL	39.92154	-75.19506	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	1.5	20		30
620071	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/26/2015	NEW WELL	39.92262	-75.19447	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
620070	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/10/2015	NEW WELL	39.92333	-75.19389	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	20		60
620069	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/10/2015	NEW WELL	39.92336	-75.19383	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	20		60
620068	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/12/2015	NEW WELL	39.92297	-75.19414	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
620064	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/19/2015	NEW WELL	39.92169	-75.19503	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	1.5	20		30
620059	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/26/2015	NEW WELL	39.92227	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
620057	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/26/2015	NEW WELL	39.92217	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
620056	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/19/2015	NEW WELL	39.92175	-75.195	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
620055	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/18/2015	NEW WELL	39.9216	-75.19504	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1	20		40
620051	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92266	-75.19467	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
620050	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/23/2015	NEW WELL	39.9219	-75.19499	EAST COAST DRILLING INC	Gas Works		UNUSED	31.5	0	28.5	2		TRUE	1			30
620048	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/24/2015	NEW WELL	39.92216	-75.19493	EAST COAST DRILLING INC	Gas Works		UNUSED	30	0	27	2		TRUE	1	20		30
620038	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/23/2015	NEW WELL	39.92197	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	30.5	0	27.5	2		TRUE	1.5	20		30
620003	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/25/2015	NEW WELL	39.92225	-75.19493	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	1.5	20		30
620002	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/24/2015	NEW WELL	39.92203	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	1	20		30
619980	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2519 S Newkirk St	19145	6/16/2015	NEW WELL	39.92146	-75.19508	EAST COAST DRILLING INC	Gas Works		UNUSED	35	0	32	2		TRUE	1	20		40
619979	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2521 S Newkirk St	19145	6/15/2015	NEW WELL	39.92138	-75.1951	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1	20		50
619975	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/11/2015	NEW WELL	39.92321	-75.19385	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619974	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/11/2015	NEW WELL	39.92314	-75.19405	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619973	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/17/2015	NEW WELL	39.92304	-75.19408	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619972	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/12/2015	NEW WELL	39.92298	-75.19397	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619971	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/16/2015	NEW WELL	39.92279	-75.19445	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619970	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/17/2015	NEW WELL	39.92263	-75.19419	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619969	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2820 W Porter St	19145	6/18/2015	NEW WELL	39.92258	-75.1943	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619968	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2820 W Porter St	19145	6/23/2015	NEW WELL	39.92255	-75.19433	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619967	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/23/2015	NEW WELL	39.92257	-75.1944	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
619959	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92249	-75.19487	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
619958	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92231	-75.1949	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
619960	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92187	-75.19497	EAST COAST DRILLING INC	Philadelphia		UNUSED	31	0	28	2		TRUE	1			30
641622	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90231	-75.20244	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
641620	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.20254	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
641619	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90257	-75.20232	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641618	PHILADELPHIA	PHILADELPHIA		6301 Pssyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90257	-75.20232	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641617	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90256	-75.20252	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641616	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9022	-75.20266	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641615	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
641613	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.91571	-75.21602	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
641612	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.21668	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
641611	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
641610	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90023	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
641609	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9002	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	29	0	0	0		FALSE				
641608	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90021	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
641555	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90244	-75.2024	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
641554	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90243	-75.21672	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
641553	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90239	-75.20001	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	13	0	0	0		FALSE				
641552	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.2026	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
641551	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.20259	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641550	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90227	-75.20244	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	31	0	0	0		FALSE				
641549	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20025	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641548	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20026	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
641547	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
641546	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641545	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20028	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
641544	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90023	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
641543	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90022	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
641542	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90021	-75.21668	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
641541	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9002	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	10	0	0	0		FALSE				
640524	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90242	-75.21676	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
640523	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90252	-75.2167	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
640522	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90245	-75.21676	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
640467	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90262	-75.20273	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
638317	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.91321	-75.21703	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	13	0	0	0		FALSE				
484904	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92218	-75.21929	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	46	0	0	0		FALSE		42		
484903	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92117	-75.21998	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	29	0	0	0		FALSE		15		
484902	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92158	-75.21834	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	30	0	0	0		FALSE		24		
484901	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92057	-75.21847	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	24	0	0	0		FALSE		12		
484057	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.9212	-75.21658	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	25	0	0	0		FALSE		15		
484055	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.9197	-75.21704	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	20	0	0	0		FALSE		7		
618285	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	25	0	0	0		FALSE				
618284	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20305	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	27	0	0	0		FALSE				
618283	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89973	-75.20305	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	14	0	0	0		FALSE				
618282	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	20	0	0	0		FALSE				
618281	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	16	0	0	0		FALSE				
618280	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89973	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	12	0	0	0		FALSE				
617003	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	16	0	0	0		FALSE				
617002	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	17	0	0	0		FALSE				
617001	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89971	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	15	0	0	0		FALSE				
617000	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	22	0	0	0		FALSE				
616999	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	20	0	0	0		FALSE				
616998	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	18	0	0	0		FALSE				
616914	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89971	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	18	0	0	0		FALSE				
29916	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1902		39.93861	-75.18556	THOMAS B HARPER	AMERICAN ICE CO	DESTROYED	UNUSED	487	0	72	8		FALSE	75	40		
29886	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1916		39.93194	-75.18639	ARTESIAN WELL DRLG CO	AMERICAN ICE CO	DESTROYED	UNUSED	90	0	70	6		FALSE	50			
29915	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			11/25/1949		39.93833	-75.20389	KOHL BROS. INC.	ANDERSON INC	DESTROYED	UNUSED	404	0	48	6		FALSE	50	40		
30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	20		FALSE	201	20.98709	42.6	
30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	16		FALSE	201	20.98709	42.6	
30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	54	12		FALSE	201	20.98709	42.6	
30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	0	16		FALSE		23		
30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	58	12		FALSE		23		
30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	0	16		FALSE	300			
30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	58	12		FALSE	300			
30443	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.92639	-75.20389	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	6		FALSE	325			
30443	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.92639	-75.20389	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	120		FALSE	325			
29876	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92722	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	0	0		FALSE				
29865	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.925	-75.20667	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	66	16		FALSE				
29865	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.925	-75.20667	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	20		FALSE				
29863	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.20639	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	104	0	0	18		FALSE		18.7		
29863	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.20639	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	104	0	0	24		FALSE		18.7		
29862	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.19889	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	94	0	0	0		FALSE				
29860	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1933		39.92444	-75.20583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	68	0	62	60		FALSE	200	6.5		
29857	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92389	-75.20278	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	0		FALSE				
29840	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1930		39.92083	-75.19278	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	150	0	95	16		FALSE		34		
29840	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1930		39.92083	-75.19278	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	150	0	95	16		FALSE	30			
29832	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1925		39.92056	-75.1925	LAYNE CHRISTENSEN COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	90	0	0	38		FALSE	300	20	35	
29832	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1925		39.92056	-75.1925	LAYNE CHRISTENSEN COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	90	0	56	26		FALSE	300	20	35	
29831	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92028	-75.19417	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	85	0	0	40		FALSE				
29831	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92028	-75.19417	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	85	0	62	24		FALSE				
29827	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92	-75.19333	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	97	0	75	20		FALSE				
29827	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92	-75.19333	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	97	0	77	16		FALSE				
29824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1937		39.91944	-75.19583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	0	20		FALSE	300	20		
29824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1937		39.91944	-75.19583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	81	16		FALSE	300	20		
29815	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.915	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	0	0	0	0		FALSE				
29812	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.91361	-75.20028	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	0	0	0	0		FALSE				
29788	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.90806	-75.19667	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	74	0	0	6		FALSE	100	35.3		
29881	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92944	-75.18528	UNKNOWN	BREEZE THEATER	DESTROYED	UNUSED	70	0	60	8		FALSE	47	41.2		
29937	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.94417	-75.20667	THOMAS B HARPER	BREYER ICE CREAM CO	DESTROYED	UNUSED	393	0	56	8		FALSE	100	20		
29937	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.94417	-75.20667	JOHN RULON	BREYER ICE CREAM CO	DESTROYED	UNUSED	393	0	0	0		FALSE	100	20		
29805	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1914		39.90972	-75.19111	THOMAS B HARPER	BROOKE H	DESTROYED	UNUSED	0	0	72	8		FALSE	75	25		
29901	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1905		39.93611	-75.20694	QUINN & HERRON	CITY OF PHILA	DESTROYED	UNUSED	442	0	28	8		FALSE	100	5		
29753	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89111	-75.22306	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
29751	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89083	-75.22333	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
29750	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89083	-75.22306	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
29746	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89056	-75.22333	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
30460	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/27/1936		39.93667	-75.19917	RIDPATH AND POTTER COMPANY	COCA-COLA BOTTLING C	DESTROYED	UNUSED	383	0	50	8		FALSE	120	25	85	
29900	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/3/1940		39.93583	-75.19056	LAYNE CHRISTENSEN COMPANY	EARL THEATER	DESTROYED	UNUSED	51	0	0	12		FALSE	114	33.875	41	
29900	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/3/1940		39.93583	-75.19056	LAYNE CHRISTENSEN COMPANY	EARL THEATER	DESTROYED	UNUSED	51	0	41	8		FALSE	114	33.875	41	
29895	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1897		39.935	-75.19917	THOMAS B HARPER	EDMUND WEBSTERS BRIC	DESTROYED	UNUSED	68	0	0	8		FALSE				
29930	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1914		39.94222	-75.20444	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	47	0	11	6		FALSE	50	20		
29927	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.94194	-75.20472	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	40	0	40	8		FALSE	37	18		
29926	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.94167	-75.20472	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	102	0	38	8		FALSE		18		
29894	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.935	-75.18722	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	1400	0	85	10		FALSE	15	27		
29893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1920		39.93472	-75.18667	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	490	0	80	8		FALSE	18	22		
29892	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.93444	-75.18694	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	580	0	83	8		FALSE	60	20		
29791	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90861	-75.2125	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	106	0	0	2		FALSE				
29789	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1936		39.90806	-75.20917	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	79	0	0	6		FALSE				
29781	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90667	-75.21222	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	90	0	0	2		FALSE				
29779	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1936		39.90611	-75.20833	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	70	0	0	2		FALSE				

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
29778	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1936		39.90444	-75.21278	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	73	0	0	2		FALSE				
29777	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90417	-75.20944	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	81	0	0	2		FALSE				
29775	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/1/1936		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	98	0	0	12		FALSE	100			
29775	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/1/1936		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	98	0	88	6		FALSE	100			
29773	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.9025	-75.20889	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	90	0	0	6		FALSE				
30470	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.93972	-75.19167	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	100	0	0	12		FALSE	50	20		
30470	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.93972	-75.19167	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	100	0	80	8		FALSE	50	20		
30467	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1934		39.93944	-75.19139	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	80	0	80	12		FALSE	115	33		
29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	0	16		FALSE		34		
29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	79	10		FALSE		34		
29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	0	16		FALSE	185	34.18841	61	
29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	79	10		FALSE	185	34.18841	61	
30404	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/2/1946		39.90833	-75.23194	UNKNOWN	HOG ISLAND LUMBER CO	DESTROYED	UNUSED	97	0	0	6		FALSE	1.5	16	58.5	
29924	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1929		39.94167	-75.19194	ARTESIAN WELL DRLG CO	HYMAN BRODSKY & SON	DESTROYED	UNUSED	65	0	65	8		FALSE	300	11		
29849	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.92167	-75.18889	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	215	0	96	6		FALSE	70			
29848	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1908		39.92167	-75.18861	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	240	0	90	6		FALSE	60			
29845	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.92139	-75.18889	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	250	0	96	6		FALSE	50			
29898	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1902		39.93556	-75.21222	THOMAS B HARPER	JOS RYERSON & SON IN	DESTROYED	UNUSED	200	0	9	8		FALSE	40	25		
29896	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.93528	-75.2125	THOMAS B HARPER	JOS RYERSON & SON IN	DESTROYED	UNUSED	528	0	0	8		FALSE	50			
30397	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90083	-75.18028	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	82	0	0	6		FALSE	100	9.4		
30396	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90028	-75.17889	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	0	0	0	6		FALSE	100			
29769	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90111	-75.17806	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	176	0	0	6		FALSE		31.4		
29768	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1952		39.90056	-75.17833	RIDPATH AND POTTER COMPANY	LEAGUE ISLAND PARK	DESTROYED	UNUSED	71	0	71	6		FALSE	50	18.84211	32	
30430	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1933		39.92222	-75.19722	ARTESIAN WELL DRLG CO	MIRTO CULLET SUPPLY	DESTROYED	UNUSED	66	0	66	6		FALSE	45	32		
29803	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1918		39.90944	-75.235	THOMAS B HARPER	PA FLEX MET TUBING C	DESTROYED	UNUSED	620	0	42	8		FALSE	60			
29772	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/26/1940		39.9025	-75.20056	RIDPATH AND POTTER COMPANY	PA RAILROAD	DESTROYED	UNUSED	90.5	0	74	6		FALSE	170	6.33	36.8	
29772	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/26/1940		39.9025	-75.20056	RIDPATH AND POTTER COMPANY	PA RAILROAD	DESTROYED	UNUSED	90.5	0	0	8		FALSE	170	6.33	36.8	
29766	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.89694	-75.19833	THOMAS B HARPER	PA RAILROAD	DESTROYED	UNUSED	154	0	100	6		FALSE	6	20.3		
29745	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1918		39.89	-75.22583	THOMAS B HARPER	PA RAILROAD	DESTROYED	UNUSED	49	0	41	8		FALSE	50	8		
29917	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/1/1940		39.93917	-75.185	JOHN RULON	PA RANGE & BOILER CO	DESTROYED	UNUSED	78	0	0	6		FALSE	12			
30414	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1903		39.91222	-75.19972	THOMAS B HARPER	PRINTZ DEGREASING CO	DESTROYED	UNUSED	253	0	106	6		FALSE	60	14		
29904	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1934		39.93694	-75.19833	ARTESIAN WELL DRLG CO	PURITAN LOOMS	DESTROYED	UNUSED	58	0	58	12		FALSE	180	19		
29855	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/24/1947		39.92333	-75.21972	RIDPATH AND POTTER COMPANY	REGAL PETROLEUM PROD	DESTROYED	UNUSED	351	0	22	8		FALSE	153	4	78.7	7.5
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	24		FALSE		10.2		
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	117	10		FALSE		10.2		
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	24		FALSE	560	24	44	
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	16		FALSE		10.2		
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	16		FALSE	560	24	44	
30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	117	10		FALSE	560	24	44	
30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	0	24		FALSE	440	28.2		
30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	107	10		FALSE	440	28.2		
30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	0	16		FALSE	440	28.2		
29758	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1942		39.89528	-75.19167	LAYNE CHRISTENSEN COMPANY	U S NAVY	DESTROYED	UNUSED	0	0	0	0		FALSE				
29731	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/1/1944		39.88611	-75.19722	ARTESIAN WELL DRLG CO	U S NAVY	DESTROYED	UNUSED	0	0	66	10		FALSE		19.1		
29813	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/5/1938		39.91389	-75.20917	RIDPATH AND POTTER COMPANY	WFIL TRANSMISSION ST	DESTROYED	UNUSED	71	0	62	6		FALSE	50	9	10	
495284	PHILADELPHIA	PHILADELPHIA				2/16/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
495283	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
484293	PHILADELPHIA	PHILADELPHIA				2/19/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	36	0	0	0		FALSE				
484292	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	36	0	0	0		FALSE				
484164	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484163	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
484162	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
484161	PHILADELPHIA	PHILADELPHIA				2/16/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
484160	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484158	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
484156	PHILADELPHIA	PHILADELPHIA				2/19/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40.5	0	0	0		FALSE				
484155	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484154	PHILADELPHIA	PHILADELPHIA				2/4/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484153	PHILADELPHIA	PHILADELPHIA				2/3/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484152	PHILADELPHIA	PHILADELPHIA				1/29/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
484151	PHILADELPHIA	PHILADELPHIA				1/28/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
483515	PHILADELPHIA	PHILADELPHIA				2/11/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
483493	PHILADELPHIA	PHILADELPHIA				2/13/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483492	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483491	PHILADELPHIA	PHILADELPHIA				2/10/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483490	PHILADELPHIA	PHILADELPHIA				2/11/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483489	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483488	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
483487	PHILADELPHIA	PHILADELPHIA				2/10/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	44	0	0	0		FALSE				
483486	PHILADELPHIA	PHILADELPHIA				2/6/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
483484	PHILADELPHIA	PHILADELPHIA				2/4/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
483483	PHILADELPHIA	PHILADELPHIA				1/27/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
482354	PHILADELPHIA	PHILADELPHIA		6310 Passayunk Ave. Phila. Pa		8/13/2010	NEW WELL	39.9145	-75.2172	B L MYERS BROS. OF PA. INC.	121 Point Breeze Terminal	MONITORING	OTHER	15	0	5	2		FALSE				
488537	PHILADELPHIA					6/29/2011	NEW WELL	39.91215	-75.19235	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	39	0	19	4		TRUE		24		
487864	PHILADELPHIA					6/28/2011	NEW WELL	39.91278	-75.19201	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	40	0	20	4		TRUE				
487862	PHILADELPHIA					7/7/2011	NEW WELL	39.91258	-75.19209	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	75	0	65	4		TRUE				
487862	PHILADELPHIA					7/7/2011	NEW WELL	39.91258	-75.19209	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	75	0	44	6		TRUE				
487860	PHILADELPHIA					6/29/2011	NEW WELL	39.91324	-75.19208	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	40	0	20	4		TRUE		24		
490586	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93277	-75.21628	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	36	0	0	0		FALSE				
490585	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93254	-75.21639	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490584	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93267	-75.21629	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490583	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93279	-75.2163	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490582	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93264	-75.21636	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490581	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93267	-75.21635	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490280	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93276	-75.21637	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	35	0	0	0		FALSE				
490279	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93292	-75.21645	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	55	0	0	0		FALSE				
490278	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93285	-75.21667	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	45	0	0	0		FALSE				
490277	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.9328	-75.21621	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	48	0	0	0		FALSE				
490121	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93272	-75.21634	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
490120	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93274	-75.2164	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
500145	PHILADELPHIA			1515 Arch St. Philadelphia	19102	4/26/2012	WELL ABANDONMENT	39.90485	-75.17715	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500144	PHILADELPHIA			1515 Arch St. Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90485	-75.177	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500143	PHILADELPHIA			1515 Arch Street Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90491	-75.17716	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500142	PHILADELPHIA			1515 Arch Street Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90515	-75.17674	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
500069	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90472	-75.17722	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500068	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90479	-75.1773	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500067	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90486	-75.17737	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
500066	PHILADELPHIA			1515 Arch St Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90501	-75.17699	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
512488	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90253	-75.19467	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	2		FALSE				
512487	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90339	-75.19633	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	4		FALSE				
512486	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90158	-75.19606	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	22	0	22	2		FALSE				
512485	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90114	-75.19694	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	17	0	17	2		FALSE				
512484	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90172	-75.19647	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	17	0	17	2		FALSE				
512483	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90214	-75.19578	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	25	0	25	2		FALSE				
512482	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90308	-75.19547	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	35	0	35	2		FALSE				
512467	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90161	-75.19622	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	22	0	22	4		FALSE				
512466	PHILADELPHIA	PHILADELPHIA		26th Street	19145	7/13/2013	WELL ABANDONMENT	39.90167	-75.19744	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	4		FALSE				
512465	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90258	-75.19628	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	27	0	27	2		FALSE				
512464	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90328	-75.19667	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	26	0	26	2		FALSE				
512463	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90233	-75.19761	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	26	0	26	2		FALSE				
512462	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90403	-75.19439	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	32	0	32	4		FALSE				
504475	PHILADELPHIA			S. 23rd Street Philadelphia PA 19145		1/14/2013	NEW WELL	39.91443	-75.18673	AMERIDRILL INC.	Defense Logistics Agency	MONITORING	UNKNOWN	45	0	15	4		TRUE				
632596	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19153	11/24/2015	NEW WELL	39.90259	-75.23553	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	35	0	5	2		FALSE				
632569	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19173	11/24/2015	NEW WELL	39.90193	-75.23588	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	35	0	5	2		FALSE				
632568	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19153	11/24/2015	NEW WELL	39.90214	-75.23757	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	38	0	3	2		FALSE				
481229	PHILADELPHIA			3062 South 61st.Street Philadelphia Pa		8/10/2009	NEW WELL	39.9216	-75.21833	B L MYERS BROS. OF PA. INC.	Essington Ave Partners II L.P.	MONITORING	OTHER	30	0	10	2		FALSE				
640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	81	84	4		FALSE				
640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	0	81	4		FALSE				
640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	84	86	4		FALSE				
640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	0	115	4		FALSE				
640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	115	119	4		FALSE				
640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	119	122	4		FALSE				
596661	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3112 S 26th St	19145	1/12/2015	OTHER	39.91899	-75.19127	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
596660	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3118 S 26th St	19145	1/13/2015	OTHER	39.91887	-75.1913	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
596204	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/9/2014	NEW WELL	39.91751	-75.1931	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
594712	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3102 S 26th St	19145	1/9/2015	NEW WELL	39.9192	-75.19123	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594711	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/8/2015	NEW WELL	39.91923	-75.19124	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594710	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/7/2015	NEW WELL	39.9193	-75.1912	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594650	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3106 S 26th St	19145	1/8/2015	OTHER	39.91913	-75.19124	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594165	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/6/2015	OTHER	39.91936	-75.19122	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594164	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3102 S 26th St	19145	1/7/2015	OTHER	39.91919	-75.19123	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
594163	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/5/2014	NEW WELL	39.91707	-75.19437	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	30	0	10	4		FALSE				
594162	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/10/2014	NEW WELL	39.91684	-75.19541	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
594160	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/8/2014	NEW WELL	39.91953	-75.19478	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
594159	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/9/2014	OTHER	39.91919	-75.19563	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
552538	PHILADELPHIA	PHILADELPHIA				12/3/2013	NEW WELL	39.91569	-75.19208	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	89	0	79	4		FALSE				
552529	PHILADELPHIA	PHILADELPHIA				2/27/2014	NEW WELL	39.91752	-75.19219	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	44	0	39	4		FALSE				
552528	PHILADELPHIA	PHILADELPHIA				2/25/2014	NEW WELL	39.92107	-75.19153	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	45	0	35	4		FALSE				
552527	PHILADELPHIA	PHILADELPHIA				2/4/2014	NEW WELL	39.9208	-75.19148	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	102	0	92	4		FALSE				
552526	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2615 Hartranft St		1/9/2014	NEW WELL	39.91301	-75.19408	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	72	0	62	4		FALSE				
552525	PHILADELPHIA	PHILADELPHIA				1/15/2014	NEW WELL	39.91783	-75.19622	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	98	0	88	4		FALSE				
552524	PHILADELPHIA	PHILADELPHIA				12/18/2013	NEW WELL	39.91667	-75.19388	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	92	0	82	4		FALSE				
552406	PHILADELPHIA	PHILADELPHIA				3/11/2014	NEW WELL	39.91773	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	55	0	50	4		FALSE				
552392	PHILADELPHIA	PHILADELPHIA				3/12/2014	NEW WELL	39.91779	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	74	0	69	4		FALSE				
552351	PHILADELPHIA	PHILADELPHIA				3/6/2014	NEW WELL	39.91779	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	45	0	40	4		FALSE				
552350	PHILADELPHIA	PHILADELPHIA				3/5/2014	NEW WELL	39.91576	-75.19208	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	54	0	49	4		FALSE				
552340	PHILADELPHIA	PHILADELPHIA				3/4/2014	NEW WELL	39.91665	-75.19384	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	57	0	52	4		FALSE				
552339	PHILADELPHIA	PHILADELPHIA				2/20/2014	NEW WELL	39.9209	-75.19156	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	80	0	70	4		FALSE				
552338	PHILADELPHIA	PHILADELPHIA				12/19/2013	NEW WELL	39.9175	-75.19216	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	82	0	72	4		FALSE				
642905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/8/2016	NEW WELL	39.92402	-75.20774	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	14	0	1	4		TRUE		10		
642905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/8/2016	NEW WELL	39.92402	-75.20774	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	14	1	8	4		TRUE		10		
642893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92394	-75.20592	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	33	0	1	4		TRUE				
642893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92394	-75.20592	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	33	1	22	4		TRUE				
642823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92429	-75.20617	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	16	0	1	4		TRUE		10		
642823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92429	-75.20617	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	16	1	6	4		TRUE		10		
642821	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/4/2016	NEW WELL	39.92521	-75.20528	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	25	1	8	4		TRUE		8		
642821	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/4/2016	NEW WELL	39.92521	-75.20528	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	25	0	1	4		TRUE		8		
642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	14	18	4		TRUE		23		
642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	0	1	4		TRUE		23		
642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	1	14	4		TRUE		23		
623945	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	7/27/2015	NEW WELL	39.90455	-75.22322	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	15	0	4	4		FALSE				
623780	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	3/3/2015	NEW WELL	39.91948	-75.19126	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	35	0	15	6		FALSE				
623779	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	Not F	2/20/2015	NEW WELL	39.91906	-75.19562	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	34	0	14	4		FALSE				
623634	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/23/2015	NEW WELL	39.90186	-75.22443	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	60	0	40	4		FALSE				
623612	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/15/2015	NEW WELL	39.89961	-75.22514	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	20	0	5	4		FALSE				
623611	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	Not F	6/19/2015	NEW WELL	39.89669	-75.22565	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	80	0	60	4		FALSE				
623589	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/12/2015	NEW WELL	39.899	-75.22534	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	60	0	40	4		FALSE				
623479	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	2/26/2015	NEW WELL	39.91974	-75.19122	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	35	0	15	6		FALSE				
623478	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	2/27/2015	NEW WELL	39.91957	-75.19125	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	34	0	14	6		FALSE				
476031	PHILADELPHIA	PHILADELPHIA		1952 Bryn Mawr Ave. Phila. PA		9/29/2011	NEW WELL	39.8992	-75.2265	B L MYERS BROS. OF PA. INC.	Former Bill's Auto	MONITORING	UNKNOWN	20	0	10	2		FALSE				
643672	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	Porter Station 28th Street	19145	9/13/2016	NEW WELL	39.9232	-75.1939	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	33	0	13	2		TRUE	1	23		60
643638	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	Walter Street	19145	9/12/2016	NEW WELL	39.92181	-75.19477	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	35	0	15	2		TRUE	1	22		60
643617	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	W. Porter Street	19145	9/12/2016	NEW WELL	39.92252	-75.19415	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	34	0	14	2		TRUE	1	25		60
473933	PHILADELPHIA	PHILADELPHIA		1630	19143	11/21/2010	NEW WELL	39.93655	-75.21016	ENVIRONMENTAL PROBING INVESTIGATIONS INC	hess	MONITORING	INDUSTRIAL	23	0	3	4		TRUE	1	6		30
477824	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93593	-75.21456	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	33	0	0	0		FALSE				
477823	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93483	-75.21365	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	26	0	0	0		FALSE				
477821	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93588	-75.2148	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	15	0	0	0		FALSE				
477819	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93598	-75.214	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	40	0	0	0		FALSE				
477165	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93556	-75.21501	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	31	0	0	0		FALSE				
481332	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19019	10/13/2011	NEW WELL	39.91354	-75.22156	ENVIRONMENTAL PROBING INVESTIGATIONS INC	Oil	MONITORING	INDUSTRIAL	26	0	1	4		TRUE	1	1		60
486018	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6850 Essington Avenue	19153	7/20/2009	NEW WELL	39.90252	-75.2247	ENVIRONMENTAL PROBING INVESTIGATIONS INC	Oil Terminal	MONITORING	INDUSTRIAL	30	0	10	4		TRUE	1	11		30
483890	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave. Phila. Pa		4/5/2010	WELL ABANDONMENT	39.91016	-75.21783	B L MYERS BROS. OF PA. INC.	Pacific Atlantic Terminal LLC	MONITORING	UNKNOWN	6	0	0	0		FALSE				
483882	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave. Phila. Pa		4/5/2010	NEW WELL	39.91013	-75.21785	B L MYERS BROS. OF PA. INC.	Pacific Atlantic Terminal LLC	MONITORING	OTHER	26	0	0	0		FALSE				
502555	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.91021	-75.2181	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	15	0	0	0		TRUE		4		
502554	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.91034	-75.21808	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	15	0	0	0		TRUE		4		
502519	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.90593	-75.21824	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	14.5	0	0	0		TRUE		4		
623377	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93959	-75.19896	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	26.5	0	16.5	2		FALSE				
623376	PHILADELPHIA	PHILADELPHIA		1201 S 35th st		8/13/2015	NEW WELL	39.93922	-75.19968	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	25	0	15	2		FALSE				

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
623375	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93968	-75.19963	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	25	0	15	2		FALSE				
623333	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93889	-75.19966	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	27.5	0	17.5	2		FALSE				
623332	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93865	-75.20003	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	30	0	20	2		FALSE				
504918	PHILADELPHIA			2751 S. 58th Street Philadelphia PA		2/13/2013	NEW WELL	39.92636	-75.21412	AMERIDRILL INC.	Philadelphia Industrial Development Corp.	MONITORING	UNKNOWN	15	0	5	4		TRUE				
496542	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94667	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	5	FALSE	0.1	13		
496542	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94667	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	5	FALSE	0.1	13		
484591	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94528	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	7	FALSE	0.1	7		
484591	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94528	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	7	FALSE	0.1	7		
478098	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		10/29/2008	NEW WELL	39.94556	-75.19889	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	9	FALSE	0.75	22		
478098	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		10/29/2008	NEW WELL	39.94556	-75.19889	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	9	FALSE	0.75	22		
499508	PHILADELPHIA	PHILADELPHIA		6310 Passyunk Ave. Phila. PA		5/18/2012	WELL ABANDONMENT	39.91599	-75.21521	B L MYERS BROS. OF PA. INC.	Point Breeze Terminal	MONITORING	UNKNOWN	15	0	0	0		FALSE				
499506	PHILADELPHIA	PHILADELPHIA		6310 Passyunk Ave. Phila. PA		5/18/2012	NEW WELL	39.91599	-75.21521	B L MYERS BROS. OF PA. INC.	Point Breeze Terminal	MONITORING	UNKNOWN	15	0	3	4		FALSE				
490718	PHILADELPHIA	PHILADELPHIA				9/16/2011	NEW WELL	39.93015	-75.20083	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		23		
490716	PHILADELPHIA	PHILADELPHIA				9/19/2011	NEW WELL	39.9303	-75.20139	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	23	0	13	2		TRUE		15		
490715	PHILADELPHIA	PHILADELPHIA				9/14/2011	NEW WELL	39.9311	-75.20052	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	34	0	24	2		TRUE		28		
490363	PHILADELPHIA	PHILADELPHIA				9/15/2011	NEW WELL	39.92997	-75.20042	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		25		
475994	PHILADELPHIA	PHILADELPHIA				9/13/2011	NEW WELL	39.93008	-75.20006	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		22		
475993	PHILADELPHIA	PHILADELPHIA				9/14/2011	NEW WELL	39.93133	-75.2003	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		22		
500377	PHILADELPHIA			5245 Lindbergh Blvd Philadelphia	19143	9/14/2010	NEW WELL	39.92537	-75.22092	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	25	0	5	2		TRUE				
500375	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia	19143	9/13/2010	NEW WELL	39.92561	-75.22165	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	25	0	5	2		TRUE				
499803	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia PA	19143	12/22/2011	NEW WELL	39.92536	-75.2209	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	30	0	5	2		TRUE				
499726	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia PA	19143	10/22/2011	NEW WELL	39.92527	-75.22082	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	30	0	5	2		TRUE				
641639	PHILADELPHIA	PHILADELPHIA		20th & Johnston Sts	19145	4/8/2015	NEW WELL	39.91634	-75.18079	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	28.5	0	13.5	2		FALSE				
641638	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91644	-75.17987	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	24	0	9	2		FALSE				
641637	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91415	-75.18027	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	29	0	14	2		FALSE				
641636	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91422	-75.18151	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	24	0	14	2		FALSE				
424563	PHILADELPHIA	PHILADELPHIA		4101 ISLAND AVENUE	19153	11/9/2007	NEW WELL	39.90194	-75.23833	ENVIRONMENTAL PROBING INVESTIGATIONS INC	SHERATON HOTEL	MONITORING	INDUSTRIAL	18	0	8	2		TRUE	1	8		30
424524	PHILADELPHIA	PHILADELPHIA		4101 ISLAND AVENUE	19153	11/9/2007	NEW WELL	39.90194	-75.23833	ENVIRONMENTAL PROBING INVESTIGATIONS INC	SHERATON HOTEL	MONITORING	INDUSTRIAL	17	0	7	2		TRUE	1	8		30
497842	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/30/2012	NEW WELL	39.91771	-75.23501	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
497824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avnue	19140	1/27/2012	NEW WELL	39.91692	-75.23498	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
497823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/30/2012	NEW WELL	39.91706	-75.23489	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
497767	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/31/2012	NEW WELL	39.91713	-75.23495	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
497456	PHILADELPHIA	PHILADELPHIA				6/10/2010	NEW WELL	39.91386	-75.20112	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
497455	PHILADELPHIA	PHILADELPHIA				6/4/2010	NEW WELL	39.91509	-75.19739	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	18	0	8	4		FALSE		8		
497454	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.90783	-75.21133	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	12	0	4	4		FALSE		2		
496800	PHILADELPHIA	PHILADELPHIA				6/15/2010	NEW WELL	39.90421	-75.20569	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	3		FALSE		4		
496797	PHILADELPHIA	PHILADELPHIA				5/7/2010	NEW WELL	39.91566	-75.20127	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
496796	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91554	-75.20161	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
496795	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91554	-75.20161	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
496791	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91556	-75.20143	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		22		
496790	PHILADELPHIA	PHILADELPHIA				5/7/2010	NEW WELL	39.91556	-75.20126	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
496789	PHILADELPHIA	PHILADELPHIA				5/18/2010	NEW WELL	39.91301	-75.19746	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	34	0	19	4		FALSE		23		
496788	PHILADELPHIA	PHILADELPHIA				5/21/2010	NEW WELL	39.91551	-75.20012	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
496787	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90966	-75.21112	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		8		
489934	PHILADELPHIA					8/26/2011	NEW WELL	39.91763	-75.201	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
488645	PHILADELPHIA					8/22/2011	NEW WELL	39.91555	-75.20272	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	25	0	5	2		TRUE				
488007	PHILADELPHIA					8/25/2011	NEW WELL	39.91776	-75.20135	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
488006	PHILADELPHIA					8/25/2011	NEW WELL	39.91698	-75.20149	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	20	0	3	2		TRUE				
488005	PHILADELPHIA					8/23/2011	NEW WELL	39.91721	-75.20174	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	25	0	5	2		TRUE				
488004	PHILADELPHIA					8/22/2011	NEW WELL	39.91549	-75.20251	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	0	57	4		TRUE				
485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	57	63	4		TRUE				
485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	63	67	4		TRUE				
484853	PHILADELPHIA					4/18/2011	NEW WELL	39.91644	-75.20606	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	13	2	3	4		FALSE				
484851	PHILADELPHIA					4/19/2011	NEW WELL	39.91787	-75.20547	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	2	4	4		FALSE				
484808	PHILADELPHIA					4/15/2011	NEW WELL	39.91472	-75.20708	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	15	0	5	4		FALSE				
484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	0	37	4		FALSE				
484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	37	39	4		FALSE				
484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	39	41	4		FALSE				
484266	PHILADELPHIA					4/20/2011	NEW WELL	39.91557	-75.21262	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	16	0	6	4		FALSE				
484265	PHILADELPHIA					4/20/2011	NEW WELL	39.91549	-75.20993	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	0	4	10		FALSE				
484264	PHILADELPHIA					4/18/2011	NEW WELL	39.91445	-75.20898	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	13	2	3	4		FALSE				
484263	PHILADELPHIA					4/19/2011	NEW WELL	39.91709	-75.20435	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	2	4	4		FALSE				
481942	PHILADELPHIA	PHILADELPHIA				5/21/2010	NEW WELL	39.91521	-75.20211	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
481799	PHILADELPHIA	PHILADELPHIA				6/11/2010	NEW WELL	39.91602	-75.20011	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
481798	PHILADELPHIA	PHILADELPHIA				5/12/2010	NEW WELL	39.91584	-75.2014	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
481793	PHILADELPHIA	PHILADELPHIA				5/19/2010	NEW WELL	39.91435	-75.19581	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	32	0	17	4		FALSE		18		
481792	PHILADELPHIA	PHILADELPHIA				5/20/2010	NEW WELL	39.91671	-75.19776	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
481791	PHILADELPHIA	PHILADELPHIA				6/8/2010	NEW WELL	39.91709	-75.20012	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	25	0	10	4		FALSE		14		
481790	PHILADELPHIA	PHILADELPHIA				5/25/2010	NEW WELL	39.91783	-75.19931	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	5	4		FALSE		10		
481789	PHILADELPHIA	PHILADELPHIA				5/26/2010	NEW WELL	39.92019	-75.19679	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	40	0	25	4		FALSE		31		
481787	PHILADELPHIA	PHILADELPHIA				6/16/2010	NEW WELL	39.91913	-75.20033	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	10	4		FALSE		10		
481782	PHILADELPHIA	PHILADELPHIA				5/18/2010	NEW WELL	39.90987	-75.20477	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	24	0	9	4		FALSE		13		
481781	PHILADELPHIA	PHILADELPHIA				5/1/2010	NEW WELL	39.91163	-75.20079	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	25	0	10	4		FALSE		15		
481778	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90982	-75.21231	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		8		
481776	PHILADELPHIA	PHILADELPHIA				5/26/2010	NEW WELL	39.9061	-75.21426	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	11	0	1	4		FALSE		1		
481770	PHILADELPHIA	PHILADELPHIA				5/27/2010	NEW WELL	39.90672	-75.21071	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
481764	PHILADELPHIA	PHILADELPHIA				6/15/2010	NEW WELL	39.90485	-75.20739	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
481763	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90421	-75.20569	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE				
481762	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.90896	-75.20578	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	15	0	5	4		FALSE		5		
481761	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.91001	-75.20656	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	6	4		FALSE		7		
481023	PHILADELPHIA	PHILADELPHIA				5/12/2010	NEW WELL	39.91602	-75.20174	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
481021	PHILADELPHIA	PHILADELPHIA				6/8/2010	NEW WELL	39.91585	-75.19702	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		30		
481020	PHILADELPHIA	PHILADELPHIA				5/5/2010	NEW WELL	39.91846	-75.20013	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	36	0	21	4		FALSE		24		
481018	PHILADELPHIA	PHILADELPHIA				6/9/2010	NEW WELL	39.91921	-75.19765	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
481016	PHILADELPHIA	PHILADELPHIA				6/16/2010	NEW WELL	39.90708	-75.20293	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	16	0	6	4		FALSE		6		
481013	PHILADELPHIA	PHILADELPHIA				5/14/2010	NEW WELL	39.91004	-75.20221	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	5	4		FALSE		8		
481002	PHILADELPHIA	PHILADELPHIA				5/27/2010	NEW WELL	39.90545	-75.21198	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	12	0	2	4		FALSE		2		
480994	PHILADELPHIA	PHILADELPHIA				6/10/2010	NEW WELL	39.90693	-75.20995	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
514233	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92399	-75.17616	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
514232	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92414	-75.17605	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
514166	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92411	-75.17622	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
514164	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92412	-75.17613	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	23	0	0	0		FALSE				
477745	PHILADELPHIA	PHILADELPHIA		30th Street & Grays Ferry Ave. Phila. Pa		2/9/2011	NEW WELL	39.9396	-75.1916	B L MYERS BROS. OF PA. INC.	The Grays Ferry Shopping Center	MONITORING	UNKNOWN	36	0	16	2		FALSE				

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
477570	PHILADELPHIA	PHILADELPHIA		30th Street & Grays Ferry Ave. Phila. Pa		2/9/2011	NEW WELL	39.9399	-75.1913	B L MYERS BROS. OF PA. INC.	The Grays Ferry Shopping Center	MONITORING	UNKNOWN	35	0	20	2		FALSE				
487857	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/2/2011	NEW WELL	39.9169	-75.2351	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
487856	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/2/2011	NEW WELL	39.9171	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
487855	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/1/2011	NEW WELL	39.917	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
486487	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/1/2011	NEW WELL	39.9171	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
29877	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1977		39.92722	-75.20667	UNKNOWN	ATLANTIC RICHFIELD C	OBSERVATION	UNUSED	18	0	9	12		FALSE		12		
29875	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/1/1979		39.92694	-75.205	UNKNOWN	ATLANTIC RICHFIELD C	OBSERVATION	UNUSED	25.4	0	16.4	16		FALSE		1.39		
30421	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/20/1976		39.91639	-75.23472	UNKNOWN	CITY OF PHILA	OBSERVATION	UNUSED	25	0	20	1.5		FALSE	0.08	15.5	23.5	2
29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	0	6		FALSE		14		
29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	75	4		FALSE		14		
29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	0	6		FALSE	30			2
29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	75	4		FALSE	30			2
29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	18	4		FALSE	15			2
29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	0	6		FALSE		14.1		
29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	18	4		FALSE		14.1		
29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	0	6		FALSE	15			2
29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE		18.4		
29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE		18.4		
29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE	10			2
29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE	10			2
29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	95	4		FALSE		19.5		
29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	0	6		FALSE		19.5		
29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	0	6		FALSE	50			2
29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	95	4		FALSE	50			2
29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE		19.4		
29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE		19.4		
29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE	7			2
29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE	7			2
29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	0	6		FALSE		20.6		
29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	105	4		FALSE		20.6		
29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	105	4		FALSE	30			2
29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	0	6		FALSE	30			2
29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	0	6		FALSE		14.3		
29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	35	4		FALSE		14.3		
29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	0	6		FALSE	15			2
29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	35	4		FALSE	15			2
29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	125	4		FALSE		15.7		
29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	0	6		FALSE		15.7		
29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	0	6		FALSE	50			2
29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	125	4		FALSE	50			2
625489	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22473	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
625488	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
625480	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22471	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
625165	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	4		TRUE				
625164	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
625163	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22471	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
625162	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
631015	PHILADELPHIA	PHILADELPHIA		6201 N. BROAD STREET	19145	5/4/2005	NEW WELL	39.91417	-75.1775	EICHELBERGERS INC.	EXXON/MOBIL	OBSERVATION	UNUSED	30	0	10	4		TRUE				
631014	PHILADELPHIA	PHILADELPHIA		6201 N. BROAD STREET	19145	5/4/2005	NEW WELL	39.91417	-75.1775	EICHELBERGERS INC.	EXXON/MOBIL	OBSERVATION	UNUSED	30	0	10	4		TRUE				
621612	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
621611	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
621610	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
621609	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
621226	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23057	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
29763	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89611	-75.21417	UNKNOWN	PENN DOT	OBSERVATION	OTHER	45	0	40	4		FALSE				
29756	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89222	-75.2225	UNKNOWN	PENN DOT	OBSERVATION	OTHER	88	0	82	4		FALSE				
29755	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89222	-75.2225	UNKNOWN	PENN DOT	OBSERVATION	OTHER	34	0	29	4		FALSE				
29729	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.88389	-75.21472	UNKNOWN	PENN DOT	OBSERVATION	OTHER	116	0	110	4		FALSE				
29728	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.88389	-75.21472	UNKNOWN	PENN DOT	OBSERVATION	OTHER	36	0	31	4		FALSE				
48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	55	8		FALSE	6			
48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	102	4		FALSE	6			
48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	14	12		FALSE	6			
48197	PHILADELPHIA		PHILADELPHIA			2/16/1994		39.88472	-75.21861	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	128	0	78	8		FALSE	6			
48197	PHILADELPHIA		PHILADELPHIA			2/16/1994		39.88472	-75.21861	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	128	0	116	4		FALSE	6			
48204	PHILADELPHIA		PHILADELPHIA			2/25/1994		39.92806	-75.21028	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	85	0	75	2		FALSE				
48203	PHILADELPHIA		PHILADELPHIA			3/4/1994		39.91944	-75.19972	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	99	0	89	2		FALSE				
48200	PHILADELPHIA		PHILADELPHIA			3/2/1994		39.90889	-75.20528	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	64	0	54	2		FALSE				
48199	PHILADELPHIA		PHILADELPHIA			3/14/1994		39.90667	-75.19444	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	130	0	120	2		FALSE				
596905	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.	19145	10/15/2012	NEW WELL	39.90588	-75.19399	EICHELBERGERS INC.	SUN COMPANY INC.	OBSERVATION	UNUSED	25	0	5	4		TRUE				
636003	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
636002	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
635716	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
594527	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89462	-75.22914	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	15	0	5	2		TRUE				
594526	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89459	-75.22897	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	20	0	5	2		TRUE				
594525	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89489	-75.22905	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	15	0	5	2		TRUE				
29730	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/8/1981		39.88417	-75.21222	A C SCHULTES & SONS	CITY OF PHILA	TEST	UNKNOWN	0	0	0	0		FALSE				
510983	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.93808	-75.21626	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	TEST	UNUSED	23	0	8	2	22	FALSE		12	12	
510959	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodlsnd Ave. Philadelphia	19143	12/4/2013	NEW WELL	39.93807	-75.21633	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	TEST	UNUSED	23	0	8	2	13	FALSE	1	11	11	
30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE	614			
30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE		10.6		
30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE	64	11.23158	14.6	1
637492	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1800 Bigler Street	19145	2/3/2016	CLOSED-LOOP GEOTHERMAL	39.91594	-75.17836	CHRISTROPHER C W COOK FOUNDATION INC.	City of Phila	UNUSED	UNUSED	505	0	0	0	146	FALSE				
29741	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88917	-75.22194	GRIFFIN WELL POINT	CITY OF PHILA	UNUSED	UNUSED	25	0	19	12		FALSE				
30422	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1912		39.9175	-75.18222	THOMAS B HARPER	GIRARD ESTATE	UNUSED	UNUSED	612	0	153	8		FALSE	120	22.3		
29771	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90222	-75.17778	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	UNUSED	UNUSED	0	0	0	6		FALSE	100	12.7		
29905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/24/1951		39.93722	-75.20083	RIDPATH AND POTTER COMPANY	MILLAR BROS & CO	UNUSED	UNUSED	230	0	54	8		FALSE	80	20.7		
29925	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/1/1931		39.94167	-75.2025	JOHN RULON	PHILA ABATTOIR CO	UNUSED	UNUSED	31	0	0	16		FALSE	60	4.56		
30431	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.92278	-75.19972	UNKNOWN	PHILA GAS WORKS	UNUSED	UNUSED	360	0	132	6		FALSE	19	31.7814	36.2	2
30431	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.92278	-75.19972	UNKNOWN	PHILA GAS WORKS	UNUSED	UNUSED	360	0	132	6		FALSE	120	29.4		
30442	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/1/1936		39.92611	-75.185	RIDPATH AND POTTER COMPANY	PRESIDENT THEATER	UNUSED	UNUSED	86	0	65	8		FALSE	15	29.1	31.6	2
30442	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/1/1936		39.92611	-75.185	RIDPATH AND POTTER COMPANY	PRESIDENT THEATER	UNUSED	UNUSED	86	0	65	8		FALSE	90			
30468	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974		39.93944	-75.19944	THOMAS G KEYES INC	SEABOARD SUPPLY CO	UNUSED	UNUSED	160	0	46	6		FALSE	50		159	1
30468	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974		39.93944	-75.19944	THOMAS G KEYES INC	SEABOARD SUPPLY CO	UNUSED	UNUSED	160	0	46	6		FALSE	11.1		43	2
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE		19.2		

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE	725		80	
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE		19.2		
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE		19.2		
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE	17.6		20.2	1
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE	17.6		20.2	1
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE	17.6		20.2	1
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE	725		80	
30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE	725		80	
30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	0	30		FALSE	735	28.4		
30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	148	12		FALSE	735	28.4		
30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	0	18		FALSE	735	28.4		
29920	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/19/1938		39.94083	-75.19139	RIDPATH AND POTTER COMPANY	VICTOR DAIRIES INC	UNUSED	UNUSED	490	0	21	8		FALSE	10	19	124	7.5
510997	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.9379	-75.21642	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	24	0	9	2	12	FALSE	1	12	12	
510993	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.9379	-75.2162	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	23	0	8	2	11	FALSE	1	12	12	
510985	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/4/2013	NEW WELL	39.938	-75.2161	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	24	0	9	2	11	FALSE	1	11	11	
30462	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.93722	-75.20389	RIDPATH AND POTTER COMPANY	ZUCKERMAN & HONICKMA	UNUSED	UNUSED	300	0	18	8		FALSE	78	9.89		
29808	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/24/1987		39.91083	-75.19583	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	30	0	10	14		FALSE	225	12.5	20.2	337
29802	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/27/1987		39.90944	-75.19917	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	27	0	17	6		FALSE	5.45	23.9	27	22
29801	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/28/1987		39.90944	-75.19861	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	27	0	17	6		FALSE	3.5	24.2	27	30.5
497975	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6770 Essington Avenue	19153	7/7/2011	NEW WELL	39.90143	-75.21995	THOMAS G KEYES INC	Auto Parts	WITHDRAWAL	INDUSTRIAL	182	0	101	6	90	FALSE	20	15	75	120
30374	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88833	-75.22083	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	10	12		FALSE				
29744	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88972	-75.22194	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	27	0	10	12		FALSE				
29743	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88972	-75.22167	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	32	0	10	12		FALSE				
29742	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88944	-75.22222	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	29	0	10	12		FALSE				
29738	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88861	-75.22139	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	0	0	0	12		FALSE				
29737	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88861	-75.22083	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	10	12		FALSE				
29734	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88833	-75.22139	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	14	12		FALSE				
514968	PHILADELPHIA	PHILADELPHIA		2231 S. 62nd St.	19142	3/6/2014	NEW WELL	39.92686	-75.22872	SUBSURFACE ENVIRONMENTAL TECHNOLOGIES LL(	Eckelmeyer	WITHDRAWAL	UNKNOWN	27	0	17	2		FALSE	2	21		30
510374	PHILADELPHIA					5/8/2013	NEW WELL	39.90555	-75.19301	TPI ENVIRONMENTAL INC.	Geosyntec Consultants	WITHDRAWAL	UNKNOWN	20	0	10	2		FALSE				
30399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	0	12		FALSE	420	11.6		4
30399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE	420	11.6		4
30398	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE	310		35	
30398	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE		11.9		
500376	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia	19143	9/14/2010	NEW WELL	39.92565	-75.22125	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	WITHDRAWAL	UNKNOWN	25	0	5	2		TRUE				
136068	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974	NEW WELL	39.93917	-75.19917	THOMAS G KEYES INC	SEABOARD SUPPLY CO	WITHDRAWAL	DOMESTIC	160	0	46	6	40	FALSE	50	29	159	1
48395	PHILADELPHIA		PHILADELPHIA			5/31/1995		39.92778	-75.21111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	15	0	0	0		FALSE	1	5	16	168
48394	PHILADELPHIA		PHILADELPHIA			11/5/1981		39.9275	-75.20667	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	25	0	0	0		FALSE	9	12	20	168
48393	PHILADELPHIA		PHILADELPHIA			5/12/1994		39.92722	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	0.5	15	24	168
48392	PHILADELPHIA		PHILADELPHIA			5/11/1994		39.92722	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	2.3	15	24	168
48391	PHILADELPHIA		PHILADELPHIA			5/12/1994		39.92722	-75.20167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	0.4	15	24	168
48390	PHILADELPHIA		PHILADELPHIA			5/10/1994		39.92694	-75.20333	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	26	0	0	0		FALSE	0.8	15	24	168
48389	PHILADELPHIA		PHILADELPHIA			6/2/1995		39.92694	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.1	15	24	168
48388	PHILADELPHIA		PHILADELPHIA			6/5/1995		39.92694	-75.20139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.8	15	24	168
48387	PHILADELPHIA		PHILADELPHIA			5/13/1994		39.92694	-75.20111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	0.5	15	24	
48386	PHILADELPHIA		PHILADELPHIA			6/5/1995		39.92694	-75.20083	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.5	15	24	168
48385	PHILADELPHIA		PHILADELPHIA			5/11/1994		39.92694	-75.20056	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	1.7	15	24	168
48384	PHILADELPHIA		PHILADELPHIA			6/1/1995		39.92667	-75.21167		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	10	9	14	168
48383	PHILADELPHIA		PHILADELPHIA			<Null>		39.92361	-75.20028		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	5	22	25	168
48382	PHILADELPHIA		PHILADELPHIA			10/11/1994		39.92333	-75.20083	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	50	0	0	0		FALSE	6.5	22	27	168
48381	PHILADELPHIA		PHILADELPHIA			5/19/1994		39.92306	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	37	0	0	0		FALSE	1.8	22	29	168
48380	PHILADELPHIA		PHILADELPHIA			10/19/1994		39.92306	-75.20167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	35	0	0	0		FALSE	2	22	27	168
48379	PHILADELPHIA		PHILADELPHIA			5/18/1994		39.92278	-75.20333	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	35	0	0	0		FALSE	7.5	22	27	168
48378	PHILADELPHIA		PHILADELPHIA			5/17/1994		39.92278	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	34	0	0	0		FALSE	1	22	29	168
48376	PHILADELPHIA		PHILADELPHIA			6/1/1995		39.92194	-75.20778		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	20	5	10	168
48374	PHILADELPHIA		PHILADELPHIA			5/26/1994		39.91972	-75.19056	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	37	0	0	0		FALSE	0.1	25	32	168
48373	PHILADELPHIA		PHILADELPHIA			9/9/1993		39.91833	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	50	0	0	0		FALSE	2	22	30	168
48372	PHILADELPHIA		PHILADELPHIA			5/24/1994		39.91806	-75.19139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	33	0	0	0		FALSE	0.9	22	30	168
48371	PHILADELPHIA		PHILADELPHIA			7/1/1994		39.91778	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	49	0	0	0		FALSE	1.1	22	30	168
48370	PHILADELPHIA		PHILADELPHIA			8/25/1994		39.91722	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	32	0	22	6		FALSE	0.1	24	30	168
48369	PHILADELPHIA		PHILADELPHIA			5/20/1994		39.91639	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	36	0	26	6		FALSE	0.3	24	26	168
48368	PHILADELPHIA		PHILADELPHIA			8/9/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	3.5	8	15	168
48367	PHILADELPHIA		PHILADELPHIA			5/9/1994		39.91556	-75.20111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	0	0		FALSE	0.5	18	24	168
48366	PHILADELPHIA		PHILADELPHIA			8/3/1995		39.91528	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	0.4	8	15	168
48365	PHILADELPHIA		PHILADELPHIA			5/5/1994		39.91528	-75.20139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	3	18	24	168
48364	PHILADELPHIA		PHILADELPHIA			5/10/1994		39.91528	-75.20028	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	27	0	0	0		FALSE	1	18	24	168
48363	PHILADELPHIA		PHILADELPHIA			5/9/1994		39.91528	-75.19972	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	1.6	18	24	168
48362	PHILADELPHIA		PHILADELPHIA			8/9/1995		39.915	-75.20306	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	0.3	10	15	168
48360	PHILADELPHIA		PHILADELPHIA			8/2/1995		39.91444	-75.20306	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	0.1	10	15	168
48202	PHILADELPHIA		PHILADELPHIA			8/10/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	0.2	8	15	168
48201	PHILADELPHIA		PHILADELPHIA			8/18/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	4	8	15	168
479770	PHILADELPHIA					8/5/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
479415	PHILADELPHIA					8/12/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
478889	PHILADELPHIA					8/13/2008	NEW WELL	39.91806	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
478886	PHILADELPHIA					8/27/2008	NEW WELL	39.91556	-75.19361	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
478853	PHILADELPHIA					7/31/2008	NEW WELL	39.91917	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
478852	PHILADELPHIA					7/30/2008	NEW WELL	39.91917	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
478667	PHILADELPHIA					8/27/2008	NEW WELL	39.91583	-75.19528	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
478648	PHILADELPHIA					7/29/2008	NEW WELL	39.91944	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	36	0	0	0		FALSE				
474515	PHILADELPHIA					8/5/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
424578	PHILADELPHIA	PHILADELPHIA				6/13/2008	NEW WELL	39.93139	-75.20306	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424577	PHILADELPHIA	PHILADELPHIA				5/13/2008	NEW WELL	39.92611	-75.20778	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
424576	PHILADELPHIA	PHILADELPHIA				6/17/2008	NEW WELL	39.92417	-75.20028	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
424572	PHILADELPHIA	PHILADELPHIA				6/20/2008	NEW WELL	39.92833	-75.20194	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	22	0	0	0		FALSE				
424571	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.9275	-75.20111	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
424570	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.92833	-75.20111	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
424565	PHILADELPHIA	PHILADELPHIA				7/1/2008	NEW WELL	39.92361	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
424514	PHILADELPHIA	PHILADELPHIA				6/19/2008	NEW WELL	39.9325	-75.20306	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	28	0	0	0		FALSE				
424513	PHILADELPHIA	PHILADELPHIA				6/5/2008	NEW WELL	39.92833	-75.19972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
424512	PHILADELPHIA	PHILADELPHIA				6/5/2008	NEW WELL	39.92861	-75.20194	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424511	PHILADELPHIA	PHILADELPHIA				6/4/2008	NEW WELL	39.92667	-75.2025	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424510	PHILADELPHIA	PHILADELPHIA				6/2/2008	NEW WELL	39.93	-75.20028	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
424509	PHILADELPHIA	PHILADELPHIA				5/23/2008	NEW WELL	39.92667	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424508	PHILADELPHIA	PHILADELPHIA				5/28/2008	NEW WELL	39.92361	-75.20278	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	34	0	0	0		FALSE				
424507	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.9275	-75.2	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				

Table 10-1
Pennsylvania Groundwater Information System Well Search Results - November 2016
Remedial Investigation Report - Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
424506	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.92528	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
424505	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.92806	-75.20222	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424504	PHILADELPHIA	PHILADELPHIA				5/22/2008	NEW WELL	39.92583	-75.19444	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424503	PHILADELPHIA	PHILADELPHIA				5/13/2008	NEW WELL	39.92472	-75.20667	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				
424490	PHILADELPHIA	PHILADELPHIA				7/9/2008	NEW WELL	39.92722	-75.20722	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424487	PHILADELPHIA	PHILADELPHIA				6/16/2008	NEW WELL	39.92889	-75.19917	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424479	PHILADELPHIA	PHILADELPHIA				6/9/2008	NEW WELL	39.92778	-75.20056	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424478	PHILADELPHIA	PHILADELPHIA				6/6/2008	NEW WELL	39.92611	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
424477	PHILADELPHIA	PHILADELPHIA				5/22/2008	NEW WELL	39.92639	-75.19889	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424476	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.925	-75.1975	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
424475	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.925	-75.19639	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				
424474	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.92583	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424473	PHILADELPHIA	PHILADELPHIA				5/20/2008	NEW WELL	39.92417	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				
424472	PHILADELPHIA	PHILADELPHIA				5/20/2008	NEW WELL	39.925	-75.20333	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
424471	PHILADELPHIA	PHILADELPHIA				5/16/2008	NEW WELL	39.92306	-75.20389	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	32	0	0	0		FALSE				
424470	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92361	-75.21	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
424469	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92278	-75.20972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
424468	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92194	-75.20944	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
424467	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92528	-75.20417	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424466	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92694	-75.21083	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424462	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92778	-75.20972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
424461	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92722	-75.2075	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
424457	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.92472	-75.20917	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	15	0	0	0		FALSE				
475283	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93166	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
475171	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93162	-75.20051	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
475170	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93143	-75.20034	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
475169	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93176	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
475168	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93166	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

November 17, 2014

Mr. C. David Brown, Ph. D., PG
Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

**RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex
3144 West Passyunk Avenue, Philadelphia, Philadelphia County, Pennsylvania**

Dear Mr. Brown:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed is the revised Notice of Intent to Remediate (NIR) for the Philadelphia Refinery Complex (site). The original NIR for the site was submitted on October 12, 2006. The purpose of this revision is to update owner and remediator information for the facility. This revision also includes a site location map depicting a change to property boundaries, most notably the exclusion of Belmont Terminal, which was covered under a separate NIR submission on October 6, 2014. It should be noted that the Belmont Terminal was not included in the original October 12, 2006 NIR, therefore, its exclusion from the revised NIR is not a change.

On August 14, 2012, Sunoco, Inc. (R&M) (Sunoco) entered into a Consent Order and Agreement with Philadelphia Energy Solutions Refining & Marketing LLC (PES) and the Pennsylvania Department of Environmental Protection (PADEP) for the Philadelphia Refinery Complex. As part of this buyer-seller agreement, Sunoco retained responsibility of remediation activities for environmental conditions existing at the time of the transfer, and PES is responsible for environmental conditions following the purchase agreement. On September 8, 2012, Sunoco conveyed the Philadelphia Refinery to PES. Effective December 30, 2013, "Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC" (Evergreen) assumed Sunoco legacy remediation liabilities with respect to the Philadelphia Refinery Complex. Evergreen will continue to manage the remediation work at the facility under the One Cleanup Program with the PADEP and United States Environmental Protection Agency (USEPA) and in accordance with 2012 Consent Order & Agreement.

Please call me at (302) 477-0192 with any questions or comments.

Best Regards,

James Oppenheim, PE
Vice President

cc: Evergreen File
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMUNITY REVITALIZATION AND LOCAL GOVERNMENT SUPPORT

For DEP Use Only
PF #________________
Rem ID #____________

NOTICE OF INTENT TO REMEDIATE

Act 1995-2 requires four general information items to be included in the NIR: the general location, listing of contaminants, intended use of property, and proposed remediation measures. In addition, indicate the standard(s) to be obtained (if known) and attach a scaled site map (if available).

Property Name Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex

Former Name(s) / AKA Sunoco Inc. (R&M) Philadelphia Refinery

Address / Location 3144 Passyunk Avenue

City Philadelphia　　Zip Code 19145

Municipality(s) City of Philadelphia　　County(ies) Philadelphia

Latitude 39 º (deg). 55 ‘ (min) 13.976 “ (sec)　　Longitude 75 º (deg). 11 ‘ (min) 52.429 “ (sec)

Horizontal Collection Method Geographic Information Systems

Horizontal Reference Datum NAD 1983　　Reference Point Visitor Entrance

☒ Wish to participate in the DEP/EPA MOA. Contact Troy Conrad at tconrad@state.pa.us for details.

EPA ID#, if known PAD049791098

DEP ID#(s), if known Multiple
(i.e., eFACTS site ID#, storage tank facility ID#, water quality permit #, watershed permit, air quality permit #, etc.)

Date Release Occurred (if known) ________________

Provide a brief description of the site contamination in plain language (e.g. fuel oil spill, historical chemical industrial area contamination), the names of any know primary contaminants to be addressed, and the intended future use of the property.

The site contamination consists of impacts to soil and groundwater associated with historic petrochemical refining operations. The primary consistuents of concern in soil and groundwater are lead, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, cumene, ethylbenzene, methyl tertiary butyl ether, toluene, total xylenes, ethylene dibromide, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene. The future use of the facility is to remain industrial.

Provide a general description of proposed remediation measures.

Evergreen is submitting this Notice of Intent to Remediate (NIR) in order update an NIR previously submitted on October 6, 2006 which formally entered the property into the PA Act 2 Program. In November 2011, the facility was formally entered into the PA One Cleanup Program with the USEPA and PADEP. The purpose of this NIR revision is to update the facility ownership and remediator information. The facility has been divided into 11 Areas of Interest (AOIs). These areas consist of the Point Breeze Processing Area North Yard (AOI 8) and South Yards (AOI 1 through AOI 4); the Girard Point South Tank Field (AOI 5) and Processing Area (AOI 6 and AOI 7); the Schuylkill River Tank Farm (AOI 9); the West Yard (AOI 10); and the deep aquifer (AOI 11). Each AOI will be characterized in accordance with PA Act 2, and remedial measures will be developed to address the risk of exposure identified during the characterization activities.

Remediation Standard(s) planned (if known at this time):

☐ Unknown at this time ☐ Soil ☐ Groundwater

☐ Background ☐ Soil ☐ Groundwater
Contaminants:

☐ Statewide Health - Residential ☐ Soil ☐ Groundwater
Contaminants:

☐ Statewide Health – Non-Residential ☐ Soil ☐ Groundwater
Contaminants:

☒ Site Specific ☒ Soil ☒ Groundwater
Contaminants:

☐ Special Industrial Area* ☐ Soil ☐ Groundwater
Contaminants:

*NOTE: Specific standard or Special Industrial Area require a 30-day municipal comment period

Remediator / Property Owner / Consultant. Complete the form below for *each* recipient obtaining a release of liability upon approval of the final report. Attach additional sheets as necessary.

Remediator

Contact Person/Title Jim Oppenheim, PE/Vice President eFACTS Client ID* 314958

Relationship to Site Remediator Client Type* Limited Liability Company
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (302) 477-0192 Email Address JROPPENHEIM@evergreenresmgt.com

Company Name Evergreen Resources Management Operations EIN or Federal ID # 46-4184955

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803

Property Owner

Contact Person/Title Charles Barksdale Jr./Site Environmental Director eFACTS Client ID* 298341

Relationship to Site Owner Client Type* Limited Liability Company
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number 215-339-2074 Email Address charles.barksdale@pes-companies.com

Company Name Philadelphia Energy Solutions Refining and Marketing, LLC EIN or Federal ID # 61-168974

Address (street, city, state, zip) 3144 Passyunk Ave, Philadelphia, PA 19145

Consultant

Contact Person/Title Jennifer Menges/Principal Consultant, LRS eFACTS Client ID* N/A

Relationship to Site Consultant Client Type* N/A
(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (610) 840-2540 Email Address Jennifer.Menges@stantec.com

Company Name Stantec EIN or Federal ID # N/A

Address (street, city, state, zip) 1060 Andrew Drive, Suite 140, West Chester, PA 19380

*Include eFACTS Client ID (if known) – "Client Types" below:

Association/Organization	Limited Liability company	Partnership-General
Authority	Limited Liability Partnership	Partnership-Limited
County	Municipality	School District
Estate/Trust	Non-Pennsylvania Government	Sole Proprietorship
Federal Agency	Other (Non-Government)	State Agency
Individual	Pennsylvania Corporation	

Preparer of Notice of Intent to Remediate

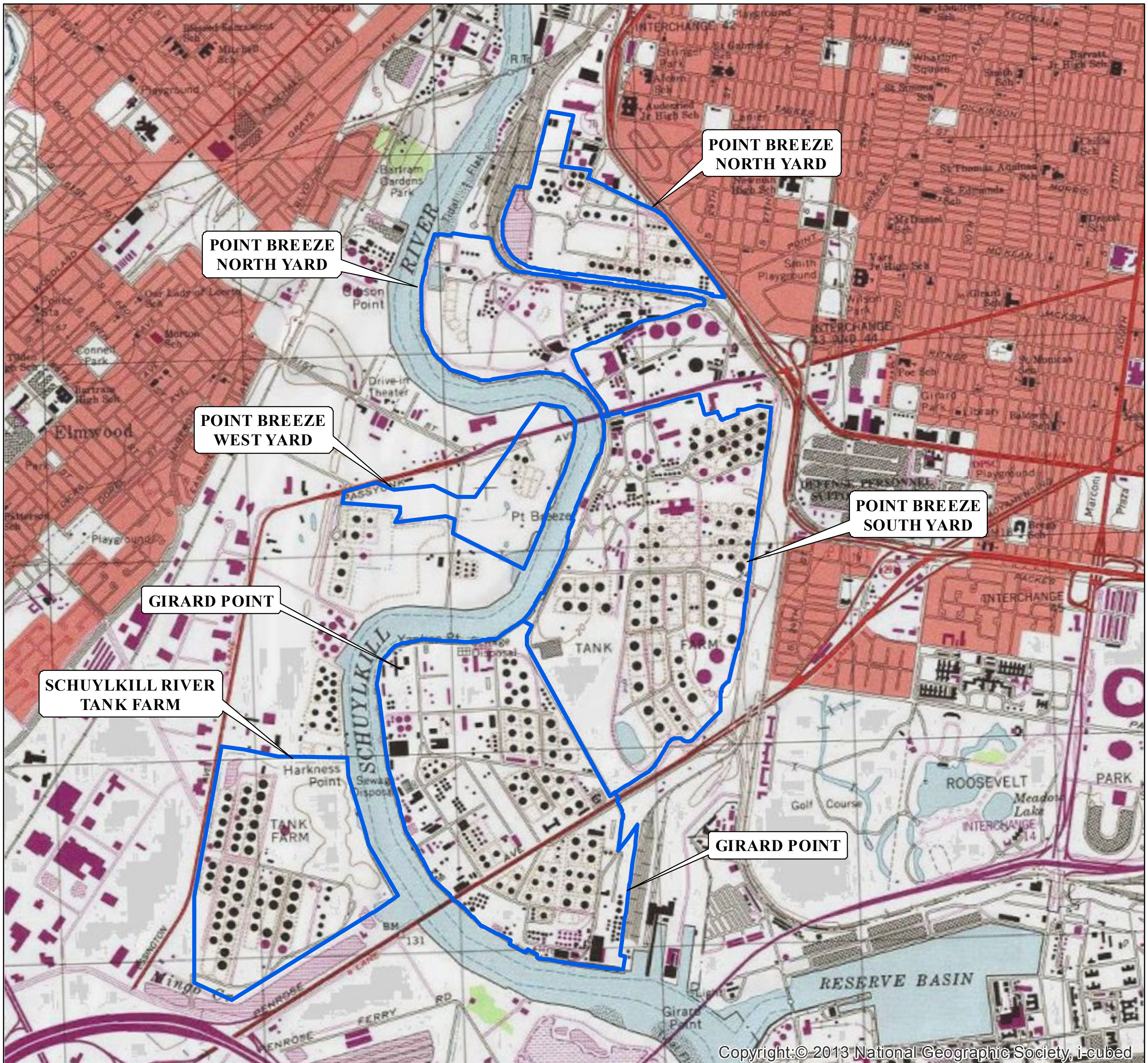
Name Jim Oppenheim, PE Title Vice President

Phone Number (302) 477-0192 Email Address JROPPENHEIM@evergreenresmgt.com

Company Name Evergreen Resources Management eFACTS Client ID

Operations

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803



REFERENCE: USGS 7.5 MINUTE QUADRANGLE; PHILADELPHIA, PA.-NJ, QUADRANGLE, 1995

Stantec

Stantec Consulting Services Inc.
1060 Andrew Drive, Suite 140
West Chester, Pennsylvania 19380
Tel. 610-840-2500
Fax. 610-840-2501
www.stantec.com

DRAWN BY: GWC
CHECKED BY: JKD
APPROVED BY: JLM
DATE: 11/11/2014

Prepared For:

EVERGREEN RESOURCES
MANAGEMENT OPERATIONS
PHILADELPHIA REFINERY COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA. 19145

Figure Title:

Philadelphia Refinery Complex
Site Location Map

Figure No.:

1

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

November 17, 2014

Leigh Anne Rainford, MPH
Sanitarian Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, PA 19104

RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery Complex
3144 West Passyunk Avenue Philadelphia, Philadelphia County

Dear Ms. Rainford:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) a site be provided to the municipality in which the site is located. This notification is to inform the City of Philadelphia of the submission of an update to the original October 12, 2006 NIR. The purpose of the revised NIR is to update the facility owner and remediator information. On September 8, 2012, Sunoco Inc., (R&M) (Sunoco) conveyed the Philadelphia Refinery to Philadelphia Energy Solutions Refining & Marketing LLC (PES). As part of the transaction, Sunoco retained responsibility for remediation activities for environmental conditions existing at the time of the transfer. Effective December 30, 2013, "Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC" (Evergreen) assumed Sunoco legacy remediation liabilities with respect to the Philadelphia Refinery Complex. A copy of the revised NIR is enclosed for your reference.

Please call me at (302) 477-0192 if you have any questions concerning the proposed remediation.

Best Regards,

James Oppenheim, PE
Vice President

cc: Evergreen File
C. David Brown, PADEP
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

December 14, 2016

Mr. C. David Brown, Ph. D., PG
Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

**RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex
3144 West Passyunk Avenue, Philadelphia, Philadelphia County, Pennsylvania**

Dear Mr. Brown:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed is the revised Notice of Intent to Remediate (NIR) for the Philadelphia Refining Complex (site). The original NIR for the site was submitted on October 12, 2006 and an updated NIR was submitted on November 17, 2014. The purpose of this revised NIR is to to change the selected remediation standard for lead in soil to the Residential Statewide Health Standard for the ball field area of the Point Breeze North Yard.

Please call me at (302) 477-1305 with any questions or comments.

Best Regards,

Tiffani Doerr, PG
Project Manager

cc: Evergreen File
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

8000-FM-CRLG0010 Rev. 9/2010

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMMUNITY REVITALIZATION AND LOCAL GOVERNMENT SUPPORT

For DEP Use Only
PF #________________
Rem ID #____________

NOTICE OF INTENT TO REMEDIATE

Act 1995-2 requires four general information items to be included in the NIR: the general location, listing of contaminants, intended use of property, and proposed remediation measures. In addition, indicate the standard(s) to be obtained (if known) and attach a scaled site map (if available).

Property Name Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex

Former Name(s) / AKA Sunoco Inc. (R&M) Philadelphia Refinery

Address / Location 3144 Passyunk Avenue

City Philadelphia Zip Code 19145

Municipality(s)City of Philadelphia County(ies) Philadelphia

Latitude 39 º (deg). 55 ‘ (min) 13.976 “ (sec) Longitude 75 º (deg). 11 ‘ (min) 52.429 “ (sec)

Horizontal Collection Method Geographic Information Systems

Horizontal Reference Datum NAD 1983 Reference Point Visitor Entrance

☒ Wish to participate in the DEP/EPA MOA. Contact Troy Conrad at tconrad@state.pa.us for details.

EPA ID#, if known PAD049791098

DEP ID#(s), if known Multiple
(i.e., eFACTS site ID#, storage tank facility ID#, water quality permit #, watershed permit, air quality permit #, etc.)

Date Release Occurred (if known) ________________

Provide a brief description of the site contamination in plain language (e.g. fuel oil spill, historical chemical industrial area contamination), the names of any know primary contaminants to be addressed, and the intended future use of the property.

The site contamination consists of impacts to soil and groundwater associated with historic petrochemical refining operations. The primary consistuents of concern in soil and groundwater are lead, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, cumene, ethylbenzene, methyl tertiary butyl ether, toluene, total xylenes, ethylene dibromide, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluorene, naphthalene, phenanthrene, and pyrene. The future use of the facility is to remain industrial.

Provide a general description of proposed remediation measures.

Evergreen is submitting this Notice of Intent to Remediate (NIR) in order to update NIRs previously submitted. The original NIR was submitted on October 6, 2006 and formally entered the property into the PA Act 2 Program. In November 2011, the facility was formally entered into the PA One Cleanup Program with the USEPA and PADEP. The facility has been divided into 11 Areas of Interest (AOIs). These areas consist of the Point Breeze Processing Area North Yard (AOI 8) and South Yards (AOI 1 through AOI 4); the Girard Point South Tank Field (AOI 5) and Processing Area (AOI 6 and AOI 7); the Schuylkill River Tank Farm (AOI 9); the West Yard (AOI 10); and the deep aquifer (AOI 11). On November 17, 2014, a revised NIR was submitted to update the facility ownership and remediator information. The purpose of this current NIR revision is to change the selected remediation standard for lead in soil to the Residential Statewide Health Standard for the ball field area of the Point Breeze North Yard. Each AOI will be characterized in accordance with PA Act 2, and remedial measures will be developed to address the risk of exposure identified during the characterization activities..

Remediation Standard(s) planned (if known at this time):

☐ Unknown at this time	☐ Soil	☐ Groundwater
☐ Background Contaminants:	☐ Soil	☐ Groundwater
☒ Statewide Health - Residential Contaminants:	☒ Soil	☐ Groundwater
☐ Statewide Health – Non-Residential Contaminants:	☐ Soil	☐ Groundwater
☒ Site Specific Contaminants:	☒ Soil	☒ Groundwater
☐ Special Industrial Area* Contaminants:	☐ Soil	☐ Groundwater

*NOTE: Specific standard or Special Industrial Area require a 30-day municipal comment period

Remediator / Property Owner / Consultant. Complete the form below for *each* recipient obtaining a release of liability upon approval of the final report. Attach additional sheets as necessary.

Remediator

Contact Person/Title Tiffani Doerr, PG/Project Manager — eFACTS Client ID* 314958

Relationship to Site Remediator — Client Type* Limited Liability Company

(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number ((302) 477-1305 — Email Address TLDOERR@evergreenresmgt.com

Company Name Evergreen Resources Management Operations — EIN or Federal ID # 46-4184955

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803

Property Owner

Contact Person/Title Charles Barksdale Jr./Site Environmental Director — eFACTS Client ID* 298341

Relationship to Site Owner — Client Type* Limited Liability Company

(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number 215-339-2074 — Email Address charles.barksdale@pes-companies.com

Company Name Philadelphia Energy Solutions Refining and Marketing, LLC — EIN or Federal ID # 61-168974

Address (street, city, state, zip) 3144 Passyunk Ave, Philadelphia, PA 19145

Consultant

Contact Person/Title Jennifer Menges/Principal Consultant, LRS — eFACTS Client ID* N/A

Relationship to Site Consultant — Client Type* N/A

(e.g. owner, remediator, participant in cleanup, consultant, etc.)

Phone Number (610) 840-2540 — Email Address Jennifer.Menges@stantec.com

Company Name Stantec — EIN or Federal ID # N/A

Address (street, city, state, zip) 1060 Andrew Drive, Suite 140, West Chester, PA 19380

*Include eFACTS Client ID (if known) – "Client Types" below:

Association/Organization	Limited Liability company	Partnership-General
Authority	Limited Liability Partnership	Partnership-Limited
County	Municipality	School District
Estate/Trust	Non-Pennsylvania Government	Sole Proprietorship
Federal Agency	Other (Non-Government)	State Agency
Individual	Pennsylvania Corporation	

Preparer of Notice of Intent to Remediate

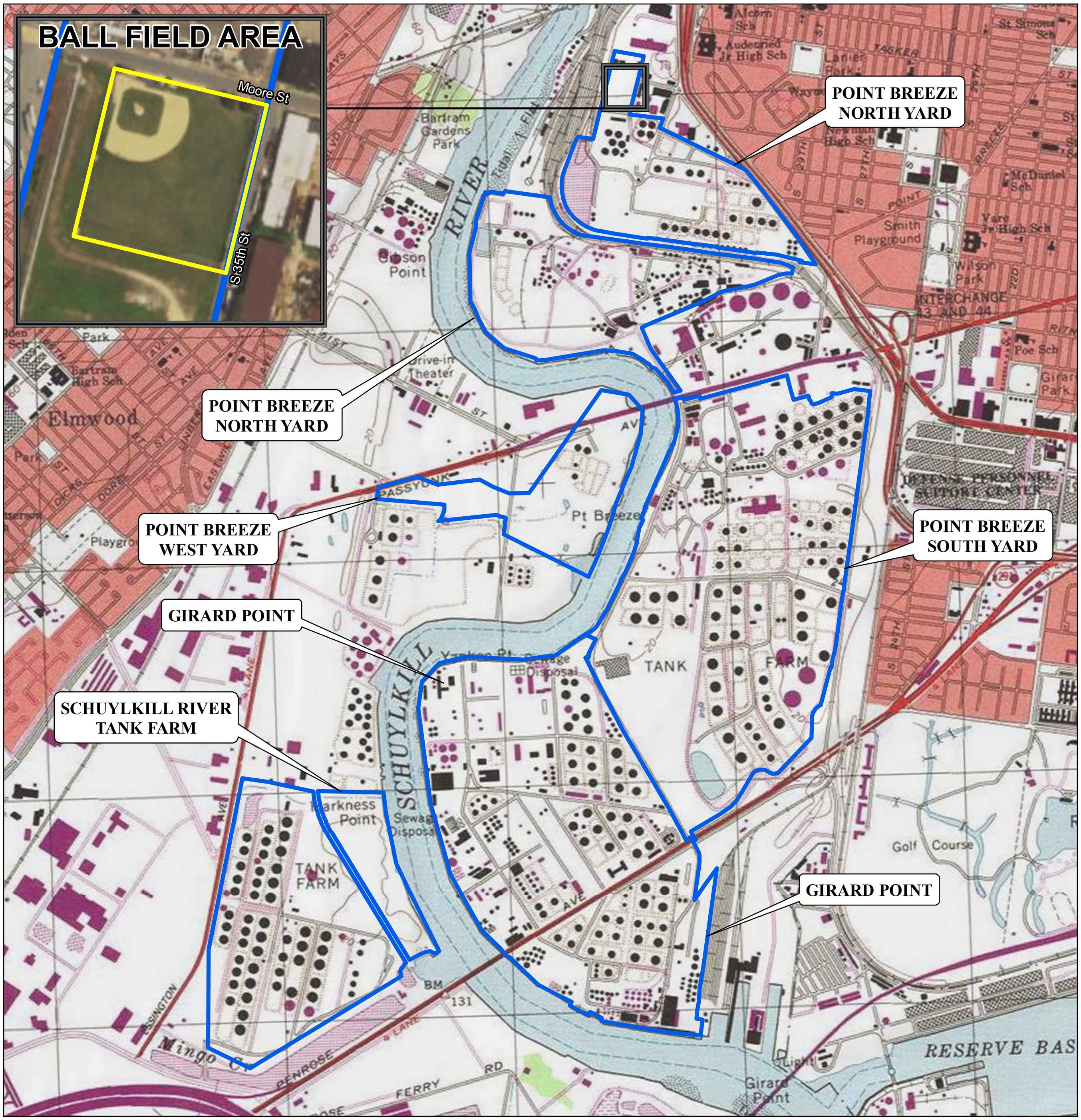
Name Tiffani Doerr, PG — Title Project Manager

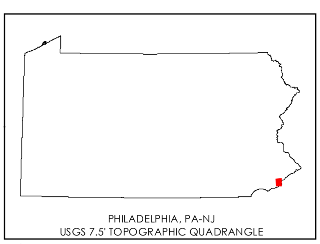
Phone Number (302) 477-1305 — Email Address TLDOERR@evergreenresmgt.com

Company Name Evergreen Resources Management — eFACTS Client ID 314958

Operations

Address (street, city, state, zip) 2 Righter Parkway, Suite 200, Wilmington, DE 19803





LEGEND

- PHILADELPHIA REFINING COMPLEX
- BALL FIELD AREA

0 1,100 2,200 Feet
1:26,400 (at original document size of 8.5x11)

N

Stantec

EVERGREEN

Notes
1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Source: Stantec, Evergreen Resources Management
3. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Copyright:© 2013 National Geographic Society, i-cubed

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Project Location 213402435
City of Philadelphia, Pennsylvania
Prepared by GWC on 11/23/2016
Technical Review by JKD on 11/28/2016
Independent Review by JLM on 12/12/2016

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
1

Title
SITE LOCATION MAP

Evergreen Resources Management
2 Righter Parkway, Suite 200
Wilmington, DE 19803

December 14, 2016

Leigh Anne Rainford, MPH
Sanitarian Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, PA 19104

RE: Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex
3144 West Passyunk Avenue Philadelphia, Philadelphia County

Dear Ms. Rainford:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) a site be provided to the municipality in which the site is located. This notification is to inform the City of Philadelphia of the submission of an update to previously submitted NIRs. The purpose of the revised NIR is to to change the selected remediation standard for lead in soil to the Residential Statewide Health Standard for the ball field area of the Point Breeze North Yard. A copy of the revised NIR is enclosed for your reference.

Please call me at (302) 477-1305 if you have any questions concerning the proposed remediation.

Best Regards,

Tiffani Doerr, PG
Project Manager

cc: Evergreen File
C. David Brown, PADEP
Charles Barksdale, Philadelphia Energy Solutions Refining and Marketing, LLC
Jennifer Menges, Stantec Consulting Services Inc.

Philadelphia Refinery

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Mr. Robert Day-Lewis
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Mr. Steve O'Neil
Pennsylvania DEP
2 East Main Street
Norristown, PA 19401

Re: Sunoco Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Mr. Day-Lewis and Mr. O'Neil:

In accordance with the Land Recycling and Environmental Remediation Standards Act (Act 2), enclosed are two copies of a Notice of Intent to Remediate (NIR) for the Sunoco Inc. (R&M) Philadelphia Refinery. This NIR covers remediation being done as part of the 2003 Consent Order and Agreement (CO&A) at Point Breeze, Girard Point and Schuylkill River Tank Farm. Remediation at Belmont Terminal, which is part of the CO&A, is not part of this NIR since this site is not subject to RCRA Corrective Action. Sunoco is considering submitting a separate NIR for this area under the Act 2 program only.

This NIR is being submitted with the intent to enter the Sunoco Philadelphia Refinery into the One Cleanup Program with PaDEP and the USEPA. All remediation work at the Philadelphia refinery will be completed under the 2003 Consent Order & Agreement (CO&A), however, RCRA Corrective Action measures will be addressed concurrently with work performed under the CO&A and within the Act 2 program.

Please call me at 610-859-1881 or email me at jroppenheim@sunocoinc.com with any questions or comments.

Best Regards,

James Oppenheim, PE
Sr. Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
David Burke, PADEP
Walter Payne, PADEP
Hon Lee, USEPA Region III
Colleen Costello, Langan

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.
Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
Contact Person: James R. Oppenheim
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
Phone Number: (610) 859-1881
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim

Address: 100 Green Street
Marcus Hook, PA 19061

Email Address: jroppenheim@sunocoinc.com

Title: Project Manager

Telephone: (610) 859-1881

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Sunoco Inc.
3144 Passyunk Avenue
Philadelphia PA 19145-5299
215 339 2000

October 12, 2006

Manager
Philadelphia Department of Public Health
Environmental Health Services
321 University Avenue
Philadelphia, PA 19104

Re: Sunoco, Inc. (R&M) Philadelphia Refinery
Philadelphia, Philadelphia County

Dear Sir/Madam:

The Land Recycling and Environmental Remediation Standards Act (Act 2) requires that a Notice of Intent to Remediate (NIR) be provided to the municipality in which the site is located when a site is being remediated to a site-specific Standard. The municipality is afforded a 30-day comment period. In accordance with this provision of the Act, Sunoco, Inc. (R&M) is formally notifying you of its intent to remediate the subject site under Act 2. A copy of the NIR, which will be sent to the Pennsylvania Department of Environmental Protection (PaDEP), is enclosed. This notice will also be published in the Pennsylvania Bulletin, and a summary of the notice appeared in the Philadelphia Daily News on October 16, 2006.

Publication of this notice in the Philadelphia Daily News initiates the 30-day public and municipal comment period. During the next thirty days, your municipality may request to become involved in the development of the remediation plans for the site. If the municipality wishes to become involved in this project, please send your comments to Sunoco to my attention.

Please call me at (610) 859-1881 if you have any questions concerning the proposed remediation.

Best Regards,

James R. Oppenheim, P.E.
Senior Environmental Consultant

Cc: Sunoco Legal Dept.
Philadelphia Refinery Environmental Central File
Steve O'Neil, PaDEP
Colleen Costello, Langan

Will remediation be to a site-specific standard ☒ or as a special industrial area ☐? If so, the municipality or municipalities must be provided 30-day comment period.
Remediator/Property Owner/Consultant. For each of these recipients of the approval of the final report, complete form below.

Remediator
Contact Person: James R. Oppenheim
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Remediation Project Manager
Phone Number: (610) 859-1881
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 100 Green St., Marcus Hook, PA 19061
Email Address: jroppenheim@sunocoinc.com
Property Owner
Contact Person: Scott Baker
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Environmental Manager
Phone Number: (215) 339-2074
Company Name: Sunoco, Inc. (R&M)
Address (street, city, state, zip): 3144 Passyunk Ave. Philadelphia, PA 19145
Email Address: sabaker@sunocoinc.com
Consultant
Contact Person: Colleen Costello
Relationship to site (e.g. owner, remediator, participating in cleanup, consultant): Consultant
Phone Number: (215) 864-0640
Company Name: Langan Engineering and Environmental Services
Address (street, city, state, zip): 30 South 17th St., Suite 1500, Philadelphia, PA 19103
Email Address: ccostello@langan.com

Preparer of Notice of Intent to Remediate:

Name: James Oppenheim

Title: Project Manager

Address: 100 Green Street
Marcus Hook, PA 19061

Telephone: (610) 859-1881

Email Address: jroppenheim@sunocoinc.com

Email Image File of Site Map showing property lines and general area of site(s) to be remediated to: (landrecycling@state.pa.us)

Proof of Publication in The Philadelphia Daily News
Under Act. No 587, Approved May 16, 1929

STATE OF PENNSYLVANIA
COUNTY OF PHILADELPHIA

Anna Dickerson being duly sworn, deposes and says that **The Philadelphia Daily News** is a newspaper published daily, except Sunday, at Philadelphia, Pennsylvania, and was established in said city in 1925, since which date said newspaper has been regularly issued in said County, and that a copy of the printed notice of publication is attached hereto exactly as the same was printed and published in the regular editions and issues of the said newspaper on the following dates:

October 16, 2006

Affiant further deposes and says that he is an employee of the publisher of said newspaper and has been authorized to verify the foregoing statement and that he is not interested in the subject matter of the aforesaid notice of publication, and that all allegations in the foregoing statement as to time, place and character of publication are true.

Anna Dickerson

Copy of Notice of Publication

Newspaper Notice of Intent to Remediate to an Environmental Standard. (Sections 302(e)(1)(ii), 303(h)(1)(ii), 304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act (Act), the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Sunoco Inc.(R&M) has submitted to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 Passyunk Ave., Philadelphia, Philadelphia County, Pennsylvania. This Notice of Intent to Remediate states that the site is a petroleum refinery. It has been determined that petroleum compounds have impacted soil and groundwater at the site. Sunoco Inc. (R&M) has indicated that proposed remediation measures will include source reduction and engineered boundary controls. The proposed future use of the property is industrial for continued operation as a petroleum refinery.

Sunoco Inc. (R&M) plans to use the site-specific remediation standard at the site. The Act provides for a 30-day public comment period for site-specific standard remediation. The 30-day comment period is initiated with the publication of this notice. Until November 16, 2006, the City of Philadelphia may submit a request to Sunoco Inc. (R&M) to be involved in the development of the remediation and reuse plans for the site. The City of Philadelphia may also submit a request to Sunoco Inc. (R&M) during this 30-day comment period to develop and implement a public involvement plan. Copies of these requests and of any comments should also be submitted to the Department of Environmental Protection at 2 East Main Street, Norristown, PA 19401 to the attention of Mr. Walter Payne. All correspondence with Sunoco Inc. (R&M) should be addressed to the Public Relations Dept., Sunoco Inc. (R&M) at 3144 Passyunk Ave, Philadelphia, PA, 19145.

Sworn to and subscribed before me this 16th day of October 2006

Mary Anne Logan
Notary Public

My Commission Expires:

NOTARIAL SEAL
Mary Anne Logan, Notary Public
City of Philadelphia, Phila. County
My Commission Expires March 30, 2009

LEGAL NOTICES

Newspaper Notice of Intent to Remediate
to an Environmental Standard.
(Sections 302(e)(1)(ii), 303(h)(1)(ii),
304(n)(1)(i), and 305(c)(1))

Pursuant to the Land Recycling and Environmental Remediation Standards Act (Act), the act of May 19, 1995, P.L. 4, No. 1995-2., notice is hereby given that Sunoco Inc.(R&M) has submitted to the Pennsylvania Department of Environmental Protection a Notice of Intent to Remediate a site located at 3144 Passyunk Ave., Philadelphia, Philadelphia County, Pennsylvania. This Notice of Intent to Remediate states that the site is a petroleum refinery. It has been determined that petroleum compounds have impacted soil and groundwater at the site. Sunoco Inc. (R&M) has indicated that proposed remediation measures will include source reduction and engineered boundary controls. The proposed future use of the property is industrial for continued operation as a petroleum refinery.

Sunoco Inc. (R&M) plans to use the site-specific remediation standard at the site. The Act provides for a 30-day public comment period for site-specific standard remediation. The 30-day comment period is initiated with the publication of this notice. Until November 16, 2006, the City of Philadelphia may submit a request to Sunoco Inc. (R&M) to be involved in the development of the remediation and reuse plans for the site. The City of Philadelphia may also submit a request to Sunoco Inc. (R&M) during this 30-day comment period to develop and implement a public involvement plan. Copies of these requests and of any comments should also be submitted to the Department of Environmental Protection at 2 East Main Street, Norristown, PA 19401 to the attention of Mr. Walter Payne. All correspondence with Sunoco Inc. (R&M) should be addressed to the Public Relations Dept., Sunoco Inc. (R&M) at 3144 Passyunk Ave, Philadelphia, PA, 19145.

Appeared in: ***Philadelphia Inquirer & Philadelphia Daily News*** on Monday, 10/16/2006

Back

Stantec

March 24, 2017

Attention: Leigh Anne Rainsford, MPH
Sanitarian Supervisor
Philadelphia Department of Public Health
Environmental Engineering Section
321 University Avenue
Philadelphia, PA 19104

Reference: Remedial Investigation Report, Area of Interest 4
Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex, 3144 West Passyunk Avenue, Philadelphia, Philadelphia County, PA

Dear Ms. Rainsford,

Notice is hereby given that Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (remediator) is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection for Area of Interest 4 located within the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Complex, City of Philadelphia, Philadelphia County, Pennsylvania. The report is being submitted in accordance with the site-specific remediation standards.

This notice is made under the provision of the Land Recycling and Environmental Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Regards,

STANTEC CONSULTING SERVICES INC.

A. Patel

Avani Patel
Geologist
Phone: (484)-354-9312
Fax: (610)-840-2501
Avani.patel@stantec.com

cc.

Tiffani Doerr, Evergreen
Charles Barksdale, PES
Jennifer Menges, Stantec

7015 1730 0000 1580 6194

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

For delivery information, visit our website at www.usps.com®.

PHILADELPHIA, PA 19104

OFFICIAL USE

Certified Mail Fee $3.35
$ $2.75

Extra Services & Fees (check box, add fee as appropriate)

- ☐ Return Receipt (hardcopy) $ $0.00
- ☐ Return Receipt (electronic) $ $0.00
- ☐ Certified Mail Restricted Delivery $ $0.00
- ☐ Adult Signature Required $ $0.00
- ☐ Adult Signature Restricted Delivery $

Postage $0.49
$

Total Postage and Fees $6.59
$

0780
25

WEST CHESTER POST OFFICE
MAR 24 2017

Postmark Here

03/24/2017

Sent To
Leigh Anne Rainsford (Philadelphia Dept. of Public Health)

Street and Apt. No., or PO Box No.
321 University Avenue

City, State, ZIP+4®
Philadelphia, PA 19104

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

Stantec

March 24, 2017

Via electronic mail: ads@phillynews.com

Attention:
Legal Advertising Department – Daily News
P.O. Box 8263 – 4th Floor
Philadelphia, PA 19101

Reference: Remedial Investigation Report, Area of Interest 4
Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex
3144 West Passyunk Avenue, Philadelphia, Philadelphia County, PA

Dear Ms. Logan,

On behalf of Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen), Stantec Consulting Services Inc. requests that the following Public Notice be published in the Philadelphia Daily News under the legal notices section.

Notification of Submittal of a Remedial Investigation Report
Notice is hereby given that Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (remediator) is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection, Southeast Regional Office for Area of Interest 4 located at the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Complex, Philadelphia, Philadelphia County, PA. The report is being submitted in accordance with the site-specific remediation standards. This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Please publish the notice as soon as possible and email the proof of publication to me at avani.patel@stantec.com. Please also mail the hard copy of the proof of publication to my attention at the following address:

Stantec Consulting Services Inc.
Attn: Avani Patel
400 Davis Drive, Suite 400
Plymouth Meeting, PA 19462

**Reference: Remedial Investigation Report, Area of Interest 4
Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refining Complex**

Should you have any questions or comments regarding the request, please contact me at (484) 354-9312.

Regards,

STANTEC CONSULTING SERVICES INC.

A. Patel

Avani Patel
Geologist
Phone: (484)-354-9312
Fax: (610)-840-2501
Avani.patel@stantec.com

cc.
Tiffani Doerr, Evergreen
Charles Barksdale, PES
Jennifer Menges, Stantec

THE PHILADELPHIA DAILY NEWS
LEGAL ADVERTISING DEPARTMENT

RE: Notice for Publication - PES Complex, AOI 4

RECEIPT

Thank you for placing your Legal Classified advertisement with us.

Your ad will appear in the Philadelphia Daily News on 3/27/2017.

The cost was $512.62 which was paid by credit card.

Thanks again for choosing the Philadelphia Daily News for your advertising needs.

Cindy Jakubowski
Legal Advertising Representative
(215) 854-5834

Notification of Submittal of a Remedial Investigation Report

Notice is hereby given that Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (remediator) is in the process of submitting a Remedial Investigation Report to the Pennsylvania Department of Environmental Protection, Southeast Regional Office for Area of Interest 4 located at the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Complex, Philadelphia, Philadelphia County, PA. The report is being submitted in accordance with the site-specific remediation standards. This notice is made under the provision of the Land Recycling and Environmental Remediation Standards Act, the Act of May 19, 1995, P.L. #4, No. 2.

Quality Assurance/ Quality Control Plan and Field Procedures Manual

Sunoco Partners Marcus Hook Industrial Complex and Philadelphia Energy Solutions (PES) Philadelphia Refinery Complex

Evergreen Resources Management Operations

May 20, 2016

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Appendix

1.0 INTRODUCTION

This Quality Assurance/Quality Control Plan and Field Procedures Manual (QA/QC Plan) outlines the procedures developed to ensure the collection and analysis of quality data for investigations completed under the United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA), Pennsylvania Department of Environmental Protection (PADEP) Act 2, and Pennsylvania and Delaware's Tank programs at the Sunoco Partners Marketing and Terminals, LP (Sunoco Partners) Marcus Hook Industrial Complex (MHIC) and the Philadelphia Energy Solutions Refining and Marketing, LLC (PES) Philadelphia Refinery Complex (PRC) on behalf of Evergreen Resources Management Operations (Evergreen). This document shall be used in conjunction with the site-specific work plans developed for each site and Standard Operating Procedures (SOPs) for field work as incorporated as Appendix A of this QA/QC Plan.

The QA/QC Plan is a planning document that provides a "blueprint" for obtaining the type and quality of data needed to support environmental decision making. The QA/QC Plan integrates relevant technical and quality aspects of a project and documents quality assurance and quality control.

The selection criteria and evaluation specified in this document will be used for validating the data in accordance with the USEPA Guidance on Environmental Data Verification and Data Validation (USEPA 240-R-02-004), dated November 2002 (EPA QA/G-8), USEPA Contract Laboratory Program National Functional Guidelines (NFGs) for Superfund Organic Methods Data Review (USEPA 540-R-08-01), dated June 2008 (SOM02.2) and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review (USEPA 540-R-10-011), dated January 2010 (ISM02.2). Qualifiers assigned to the data will be consistent with the data qualifiers specified in the NFGs and the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA 540-R-08-01), collectively referred to herein as validation guidance.

2.0 QUALITY CONTROL REQUIREMENTS

The field and laboratory QC requirements for the characterization and remediation activities are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the referenced analytical methods.

2.1 Field Sampling Quality Control

The field QC requirements include analyzing reference standards for field instrument calibration and for routine calibration verifications. All initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer's instructions to ensure the equipment is functioning within the specified tolerances. The calibration and maintenance history of the project-specific field instrumentation will be maintained in an active field logbook.

Field QC samples for this project include field duplicate samples to assess the overall precision of the sampling and analysis event, equipment rinse blanks to ensure proper cleaning of non-dedicated equipment is conducted between samples to avoid potential cross contamination (also generally referred to as field blanks), and trip blank samples to monitor cross contamination of water samples by volatile organic compounds (VOCs) during sample transport.

The frequency of collection of equipment rinse blanks will be one per sampling event. Field duplicate samples will only be prepared for groundwater samples, not for soil sampling events, at a collection frequency of 1 in 20 samples. One trip blank will be included for every shipment of samples to an analytical laboratory, at a minimum frequency of one trip blank per sample shipment which contains samples for VOCs analyses.

2.2 Analytical Quality Control

The laboratory QC requirements for the analyses may include evaluating chemical/thermal preservation, holding times, handling requirements, method blanks, instrument performance checks, initial calibration standards, calibration verification standards, internal standards, surrogate compound spikes, interference check samples, serial dilution samples, matrix spike/matrix spike duplicate (MS/MSD) samples, and laboratory control samples (LCS). The acceptance criteria for the above identified requirements will be generated by the laboratory and included in the laboratory reports, along with the other laboratory QC requirements.

3.0 DATA VERIFICATION, VALIDATION, AND USABILITY

All field and laboratory data will be reviewed, verified, and/or validated. These terms are defined as follows:

- Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly.
- Data verification is the process for evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, and/or contractual requirements.
- Data validation is an analyte-specific and sample-specific process that extends the evaluation of data beyond method, procedure, or contractual compliance (i.e., data verification) to determine the quality of a specific data set relative to the end use.

Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling, and sample handling procedures, were fulfilled.

Data verification, validation, and usability assessments performed on a percentage of lab packages to ensure that the data are scientifically defensible, properly documented, of known quality, and meet the project objectives, are described in the following sections. Data determined to be unusable may require corrective action be taken. Data use limitations will be identified in the data validation and usability assessment (VUA) report, which will be generated as required for characterization or final reporting to the agencies.

3.1 Data Review, Verification, and Validation Requirements

Data review, verification, and validation of the analytical data will be performed by each consultant completing the field activities. The exception to this scenario will be Aquaterra Technologies, Inc. (Aquaterra), in which case Aquaterra will review/verify the data and the consultant company working with Aquaterra will subsequently validate the samples.

Field information will be reviewed to ensure that all field measurements were conducted in accordance with the requirements of the site-specific work plan and this QA/QC Plan including applicable SOPs. Field measurements obtained using procedures inconsistent with the requirements of these documents will be evaluated and may require that additional samples are collected or the use of the data be restricted.

Stage 1 Verification and Validation Checks

One hundred percent of the sample results will go through a Stage 1 verification and validation. As part of the data management process, each consultant will complete verification and validation based on the validation guidance. Data verification and validation will consist of the following items based on the guidance stated.

Stage 1 verification and validation of the laboratory analytical data package consists of checks for the compliance of sample receipt conditions, sample characteristics (e.g., percent moisture), and analytical results (with associated information). It is recommended that the following minimum baseline checks (as relevant) be performed on the laboratory analytical data package received for a Stage 1 validation label:

1. Documentation identifies the laboratory receiving and conducting analyses, and includes documentation for all samples submitted by the project or requester for analyses.
2. Requested analytical methods were performed and the analysis dates are present.
3. Requested target analyte results are reported along with the original laboratory data qualifiers and data qualifier definitions for each reported result.
4. Requested target analyte result units are reported.
5. Requested reporting limits for all samples are present and results at and below the requested (required) reporting limits are clearly identified (including sample detection limits if required).
6. Sampling dates (including times if needed), date and time of laboratory receipt of samples, and sample conditions upon receipt at the laboratory (including preservation, pH and temperature) are documented.
7. Sample results are evaluated by comparing sample conditions upon receipt at the laboratory (e.g., preservation checks) and sample characteristics (e.g., percent moisture) to the validation guidance.

Stage 2 Verification and Validation Checks

A minimum of 10 percent of the samples will be flagged for VUA. When a laboratory work order is selected, the entire work order will undergo Stage 2 validation. Laboratory work orders or sample delivery groups (SDGs) that are selected for VUA will undergo validation based on the NFGs.

The selection of samples that will undergo VUA process is designed to meet the needs of the site investigation, characterization, remediation, and closure programs, such as tank closures. Sampling that falls outside these programs will not undergo the VUA process. This includes samples that are collected for permit compliance, such as RCRA and effluent wastewater, as well as product samples, onsite soil reuse samples, and waste characterization samples.

Ten percent of samples will be selected based on the following additional conditions:

1. Sample package selected will contain a field duplicate sample.
2. Sample package selected will contain an equipment rinse blank.
3. Sample package selected will be representative of the contracted analytical laboratories, sample media, parameters, time, and project goals.

QC samples that are collected in the field will provide the best information for completing the VUA reports. The conditions for selection of samples are designed to provide the most useful information regarding sample analysis. Therefore, field duplicate samples have been identified as a priority condition. However, field duplicate samples will only be prepared for groundwater samples, not for soil sampling events. This is due to the known, inherent heterogeneity of soil at the sites. For program efficiency, entire SDGs will be selected for submission in the VUA process. Individual samples should not be selected and processed unless there is an overriding reason to do so, such as a point of compliance sample result that when compared to the historic data set appears to be anomalous.

Stage 2 data validation includes a review of the following QC data deliverables:

1. Technical holding times
2. Method blanks
3. Surrogate spikes
4. MS/MSD results
5. LCS results
6. Field duplicates

7. Trip and equipment rinse blank samples

Stage 2B Verification and Validation Checks

Stage 2B verification and validation will be completed on inorganic analytical data and will contain the following (in addition to Stage 1 verification):

1. Requested methods (handling, preparation, cleanup, and analytical) are performed.
2. Method dates (including dates, times and duration of analysis for radiation counting measurements and other methods, if needed) for handling (e.g., Toxicity Characteristic Leaching Procedure), preparation, cleanup and analysis are present, as appropriate.
3. Sample-related QC data and QC acceptance criteria (e.g., method blanks, surrogate recoveries, deuterated monitoring compounds (DMC) recoveries, laboratory control sample (LCS) recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries, serial dilutions, post digestion spikes, standard reference materials) are provided and linked to the reported field samples (including the field quality control samples such as trip and equipment blanks).
4. Requested spike analytes or compounds (e.g., surrogate, DMCs, LCS spikes, post digestion spikes) have been added, as appropriate.
5. Sample holding times (from sampling date to preparation and preparation to analysis) are evaluated.
6. Frequency of QC samples is checked for appropriateness (e.g., one LCS per twenty samples in a preparation batch).
7. Sample results are evaluated by comparing holding times and sample-related QC data to the requirements in the data validation guidance.
8. Initial calibration data (e.g., initial calibration standards, initial calibration verification [ICV] standards, initial calibration blanks [ICBs]) are provided for all requested analytes and linked to field samples reported. For each initial calibration, the calibration type used is present along with the initial calibration equation used including any weighting factor(s) applied and the associated correlation coefficients, as appropriate. Recalculations of the standard concentrations using the initial calibration curve are present, along with their associated percent recoveries, as appropriate (e.g., if required by the project, method, or contract). For the ICV standard, the associated percent recovery (or percent difference, as appropriate) is present.
9. Appropriate number and concentration of initial calibration standards are present.

10. Continuing calibration data (e.g., continuing calibration verification [CCV] standards and continuing calibration blanks [CCBs]) are provided for all requested analytes and linked to field samples reported, as appropriate. For the CCV standard(s), the associated percent recoveries (or percent differences, as appropriate) are present.
11. Reported samples are bracketed by CCV standards and CCBs standards as appropriate.
12. Method specific instrument performance checks are present as appropriate (e.g., tunes for mass spectrometry methods, DDT/Endrin breakdown checks for pesticides and aroclors, instrument blanks and interference checks for ICP methods).
13. Frequency of instrument QC samples is checked for appropriateness (e.g., gas chromatography-mass spectroscopy [GC-MS] tunes have been run every 12 hours).
14. Sample results are evaluated by comparing instrument-related QC data to the requirements in the data validation guidance.

Stage 3 Verification and Validation Checks

Stage 3 verification and validation will be completed on organic analytical data and will contain the following (in addition to Stage 2B):

1. Instrument response data (e.g., GC peak areas, ICP corrected intensities) are reported for requested analytes, surrogates, internal standards, and DMCs for all requested field samples, matrix spikes, matrix spike duplicates, LCS, and method blanks as well as calibration data and instrument QC checks (e.g., tunes, DDT/Endrin breakdowns, interelement correction factors, and Florisil cartridge checks).
2. Reported target analyte instrument responses are associated with appropriate internal standard analyte(s) for each (or selected) analyte(s) (for methods using internal standard for calibration).
3. Fit and appropriateness of the initial calibration curve used or required (e.g., mean calibration factor, regression analysis [linear or non-linear, with or without weighting factors, with or without forcing]) is checked with recalculation of the initial calibration curve for each (or selected) analyte(s) from the instrument response.
4. Comparison of instrument response to the minimum response requirements for each (or selected) analyte(s).
5. Recalculation of each (or selected) opening and closing CCV (and CCB) response from the peak data reported for each (or selected) analyte(s) from the instrument response, as appropriate.

6. Compliance check of recalculated opening and/or closing CCV (and CCB) response to recalculated initial calibration response for each (or selected) analyte(s).
7. Recalculation of percent ratios for each (or selected) tune from the instrument response, as appropriate.
8. Compliance check of recalculated percent ratio for each (or selected) tune from the instrument response.
9. Recalculation of each (or selected) instrument performance check (e.g., DDT/Endrin breakdown for pesticide analysis, instrument blanks, interference checks) from the instrument response.
10. Recalculation and compliance check of retention time windows (for chromatographic methods) for each (or selected) analyte(s) from the laboratory reported retention times.
11. Recalculation of reported results for each reported (or selected) target analyte(s) from the instrument response.
12. Recalculation of each (or selected) reported spike recovery (surrogate recoveries, DMC recoveries, LCS recoveries, duplicate analyses, matrix spike and matrix spike duplicate recoveries, serial dilutions, post digestion spikes, standard reference materials etc.) from the instrument response.
13. Each (or selected) sample result(s) and spike recovery(ies) are evaluated by comparing the recalculated numbers to the laboratory reported numbers according to the requirements in the data validation guidance.

Stage 4 Verification and Validation Checks

Additional data validation may be completed for selected sites and/or sampling events, up to EPA Level 4 data review, which will require a laboratory data package inclusive of raw data. Stage 4 verification and validation includes all of the elements of the previous stages of validation and the following:

1. Evaluation of instrument performance checks (GC/MS)
2. Initial and continuing calibration checks (organic and inorganic analyses)
3. Review of internal standards (GC/MS)
4. Instrument blanks (inorganics)
5. Interference check samples (metals)
6. Recalculations of sample results and reporting limits

3.2 Validation Codes

Consultant specific validation codes will be added to the database. This will allow quick identification of the consultant that has performed the verification and/or VUA. Stantec may append additional codes for data management purposes to the codes provided in dt_result table approval_code field. Valid codes are as follows:

Langan:

- LAN1 – Historical data collected by Langan Level 1 Validation (Verification)
- LAN-VER – Langan performed verification
- LAN-USB – Langan performed usability

GHD:

- GHD-VER – GHD performed verification
- GHD-USB – GHD performed usability

Stantec:

- STN-VER – Stantec performed verification
- STN-USB – Stantec performed usability

This methodology creates a means for consultants to perform verification and usability on data collected by another consultant.

3.3 Data Updates in the Electronic Data Deliverables

All consultants will request EQuIS 4 file format Electronic Data Deliverables (EDDs) for data management from the analytical laboratories. In order to facilitate the data updates in the database, the following methodology will be used.

1. The consultant chemist / chemist team will open the .RES file for the EDD that has been selected to be validated for usability. The file can be opened using Excel, Access, Notepad, or similar tool. Although, it is a best practice to open the file in a way to preserve the textual nature of the EDD, it is not necessary.
2. The chemist will use the result_comment field in the .RES file to enter the qualifiers associated with the record and add a semicolon as a delimiter (;) followed by the reason code for the qualification.

3. The .RES file is to be saved with a .USB extension at the end of the file. This file is to be separate from the original .RES file provided and should not be used to over write the original .RES file that was sent with the EDD. This will result in the laboratory work order undergoing VUA having five files instead of four for the EDD. For example:
    - 1234.SMP
    - 1234.TST
    - 1234.BCH
    - 1234.RES
    - 1234.RES.USB
4. Stantec will use the fifth file to update the database with the appropriate qualifiers and codes in validator_qualifiers and approval_a through approval_d fields in dt_result table in the database.
5. Stantec will also change the validated y/n field in dt_result table in the database for the particular EDD.

3.4 Validation Qualifiers

The following qualifiers should be used during the validation/usability process. These are based on the NFGs, validation guidance, and commonly used qualifiers.

Data Qualifiers and Definitions

U The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample, potentially biased high.

J- The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample, potentially biased low.

UJ The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

NJ The analyte has been "tentatively identified" or "presumptively identified" as present and the associated numerical value is the estimated concentration in the sample.

R The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

B The analyte was detected in the method, field, and/or trip blank. This qualifier is not pursuant to the NFGs.

If additional qualifiers are required, please forward the suggestions to the Stantec Data Management Team and they will be added to the list of approved codes.

Submitting Data and Validation Codes for Inclusion in the Database

EDDs will be submitted to the database using the SharePoint portal intake forms. The appropriate qualifiers and codes that have been added to the result_comment field in the .RES.USB file will be included in the submission.

Reason Codes

Following is a list of reason codes available for validation. If additional codes are required, please forward the suggestions to the Stantec Data Management Team and they will be added to the list of approved codes.

Reason Code	Reason Description
General Use	
EC	Result exceeds the calibration range.
HT	Holding time requirement was not met
MB	Method blank or preparation blank contamination
LCS	Laboratory control sample evaluation criteria not met
FB	Field blank contamination
RB	Rinsate blank contamination
SQL	The analysis meets all qualitative identification criteria, but the measured concentration is less than the reporting limit.
FD	Field duplicate evaluation criteria not met
TvP	Total to Partial criteria not met
RL	Reporting limit exceeds decision criteria (for non-detects)
Inorganic Methods	
ICV	Initial calibration verification evaluation criteria not met
CCV	Continuing calibration verification evaluation criteria not met
CCB	Continuing calibration blank contamination
PB	Preparation Blank
ICS	Interference check sample evaluation criteria not met
D	Laboratory duplicate or spike duplicate precision evaluation criteria not met
MS	Matrix spike recovery outside acceptance range
PDS	Post-digestion spike recovery outside acceptance range
MSA	Method of standard additions correction coefficient _0.995
DL	Serial dilution results did not meet evaluation criteria
Organic Methods	
TUNE	Instrument performance (tuning) criteria not met
ICAL	Initial calibration evaluation criteria not met
CCAL	Continuing calibration evaluation criteria not met
SUR	Surrogate recovery outside acceptance range
MS/SD	Matrix spike/matrix spike duplicate precision criteria not met
MS	Matrix spike recovery outside acceptance range
IS	Internal standard evaluation criteria not met
LM	The PFK lock mass SICPs indicate that ion suppression evident
ID	Target compound identification criteria not met
Results Reported for Analytes Analyzed Multiple Times	
NSR	Not selected for reporting because the result was qualified as unusable
NSDL	Not selected for reporting because diluted resulted was selected for reporting
NSQ	Not selected for reporting because result was lesser quality based on data validation
NSO	Not selected for reporting because of other reason
Bias Codes	
H	Bias in sample result likely to be high
L	Bias in sample result likely to be low
I	Bias in sample result is indeterminate

3.4 Verification and Validation Summary

Verification of sample collection procedures will consist of reviewing sample collection documentation for compliance with the requirements of the site-specific work plan and this QA/QC Plan. If alternate sampling procedures were used, the acceptability of the procedure will be evaluated to determine the effect on the usability of the data. Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in this QA/QC Plan.

The results of the data verification and validation procedure will identify data that do not meet the measurement performance criteria of this QA/QC Plan. Data verification and validation will determine whether the data are acceptable, of limited usability (qualified as estimated), or rejected. Data qualified as estimated will be reviewed and a discussion of the usability of estimated data will be included in the VUA report.

Data determined to be unusable may require corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether or not the data are critical for project data quality objectives to be achieved. Data use limitations will be identified in VUA report, which will be generated as required for characterization or final reporting to the agencies. Each consultant will be responsible for their own VUA reports.

Revision History

Revision	Description	Prepared By	Date
1.0	Initial creation of document as SOP for VUA	Stantec (Gus Sukkurwala/Jennifer Menges/Andrew Bradley)	5/31/2015
2.0	Incorporation into QA/QC Plan	GHD (Colleen Costello)	3/21/2016
3.0	Inclusion of Field Procedures. Edits from Langan (Emily Strake & Kevin McKeever)	Stantec (Jennifer Menges)	5/13/2016

APPENDIX A
EVERGREEN FIELD PROCEDURES MANUAL

Evergreen
Field Procedures Manual

Sunoco Partners Marcus Hook Industrial Complex and Philadelphia Energy Solutions (PES) Philadelphia Refinery Complex

Evergreen Resources Management Operations

May 20, 2016

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1.0 INTRODUCTION

This Field Procedures Manual outlines the standard operating procedures developed to ensure the collection and analysis of quality data for investigations completed under the United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) program, Pennsylvania Department of Environmental Protection (PADEP) Act 2 program and Pennsylvania and Delaware's Tank programs at the Sunoco Partners Marketing and Terminals, LP (Sunoco Partners) Marcus Hook Industrial Complex (MHIC) and the Philadelphia Energy Solutions Refining and Marketing, LLC (PES) Philadelphia Refinery Complex (PRC) on behalf of Evergreen Resources Management Operations (Evergreen). The MHIC and PRC are herein referred to as facility or site.

Evergreen’s consultants collect data in pursuit of site characterization and remediation that will meet the expectations of the appropriate regulatory agencies. This document shall be used in conjunction with the site-specific work plans developed for each site and the QA/QC Plan of which this manual was incorporated as Appendix A.

1.1 Training Qualifications

All field personnel involved in field work at MHIC and the PRC shall have completed and where applicable, be current with OSHA 40-hour HAZWOPER training, annual OSHA 8-hour HAZWOPER refresher, Process Safety Management (PSM) training, site-specific safety module training for current facility badges (including fire watch and hole watch, if required), TWIC Card, annual drug screening, and annual respirator fit testing. All field personnel new to the facility should be provided with onsite health and safety (H&S) orientation by an experienced member of the project team. The onsite orientation should include review of the facility’s emergency action plan and training on Evergreen and site-specific H&S requirements. Appropriately qualified personnel should perform field work, based on the work scope and experience level required by the task to be executed.

1.2 Health and Safety Requirements

All consultants performing work at the referenced sites on behalf of Evergreen shall comply with the *Evergreen Resources Management Operations Health and Safety Requirements* dated June 1, 2014. This includes contractors, sub-contractors, and third party companies performing work for Evergreen at MHIC and the PES PRC. Each consultant must also have their own site-specific health and safety plan (HASP) submitted to and approved by Evergreen prior to performing any work. A site-specific HASP must be reviewed and signed by all field personnel prior to commencement of field activities.

1.3 PPE Requirements

The minimum standard PPE at the facilities includes fire resistant clothing (FRC; coveralls may be Nomex or other FRC, 6 ounce minimum, orange in color) with the name of the company displayed on the back of the garment, hard hat, sturdy safety-toe boots, safety glasses, long-gauntlet leather gloves, and personal H_2S monitors. Nitrile gloves for chemical protection and hearing protection may also be required depending on the location and type of work. Workers are to be trained on these PPE requirements before being permitted onsite. An appropriate respirator may be required if site-specific air monitoring action levels are met, in accordance with the site-specific HASP. If a worker has a particular sensitivity or concern, a respirator may be worn regardless of OSHA action levels. During winter weather conditions, slip prevention footwear such as crampons or overshoes should be worn for traction. Task-specific PPE will be further identified in following sections.

1.4 Site Controls

Safety cones and/or caution tape should be used in high traffic areas. The "Buddy System" may also be employed in high traffic areas, in areas where other contractors are working, and in remote areas. Additional task-specific site controls will be detailed in following sections.

1.5 Equipment and Decontamination

Numerous practices are employed throughout the processes of site investigation and sampling to assure the integrity of the resulting data. The risk in use of non-dedicated equipment at multiple sampling locations lies in the potential for cross-contamination. While the threat of cross-contamination is always present, it can be minimized through the implementation of a consistent decontamination program during sensitive site measurement and data collection activities.

All site equipment to be used in multiple locations (non-dedicated) for sampling of soil, sediment, and/or groundwater will be decontaminated immediately prior to initial use and between uses at each location according to the following steps:

- Remove particulates with a sorbent pad or towel and/or initial rinse with clean potable tap water;
- Wash equipment with clean sponge, soft cloth, or scrub brush as necessary in a solution of tap water/laboratory grade detergent (Alconox®, Liquinox®, or equivalent);
- Rinse with tap water;
- Rinse with deionized or distilled water; and
- Air dry for as long as possible.

Rinse water generated during decontamination procedures will be treated onsite by passing the water through a bucket or tube filled with activated carbon prior to discharge to the ground surface. Additional decontamination procedures may be appropriate depending on the task, and will be identified in the following sections, as applicable.

1.6 Documentation

All site activities and conditions for characterization activities should be recorded by field personnel in a field computer (e.g., YUMA) using the EQuIS Data Gathering Engine (EDGE) application, or if necessary, a field book may be used. The entry shall include at a minimum, the date, time, weather conditions, location, personnel present onsite, field readings, sampling methodology, as well as additional comments or observations. Task specific observations which should also be recorded will be identified in the following applicable sections.

2.0 LIQUID LEVEL ACQUISITION (WELL GAUGING) PROCEDURES

2.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered as well as slip/trip/fall potential during onsite well gauging activities. Additional hazards may be mentioned in the site-specific HASP and/or the daily job safety analysis (JSA).

2.2 Materials and Equipment Necessary for Task Completion

Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy, decontamination supplies (laboratory-grade detergent, deionized or distilled water, appropriate containers, scrub brush, and sorbent pads or paper towels), socket set, flathead screwdriver (or pry bar or manhole cover lifter), clear bailers with string for confirmation of light non-aqueous phase liquids (LNAPL), if necessary, and air monitoring instruments (optional, based on previous site visits).

2.3 Methodology

This task involves the deployment of an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy into a well (in most cases), recording the measurement, and decontaminating the probe. The recorded field measurements may then be utilized for one of several applications including: well sampling, water table gradient mapping, LNAPL occurrence, LNAPL thickness, and/or gradient mapping, and various testing procedures. Wells should be gauged in order of least to most contaminated, based on existing sampling data or LNAPL occurrence, to minimize the potential for cross-contamination between wells. If LNAPL is detected in a well that does not typically have LNAPL, it should be confirmed with a clear bailer.

The proper procedure for liquid level acquisition is as follows:

1) Decontaminate the optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy prior to initial deployment, and again after each well measurement to prevent cross-contamination between wells.

2) If warranted, mark off a work area surrounding the well(s) to be gauged with safety cones and/or caution tape in order to protect personnel from auto traffic; the "Buddy System" may also be employed.

3) Where applicable, lift the manhole cover off of the well head (a screwdriver, pry bar, or manhole cover lifter may be used to lift the cover depending on the size of the manhole) or open protective well casing (stickup) and remove the well plug, if present.

4) Most wells should contain a mark or notch in the top edge of the casing from which normalized readings are to be measured (reference point elevation). Slowly lower the optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy into the well until the instrument signals contact with liquid. Note whether or not the instrument's tone is indicative of the presence of free-phase LNAPL (commonly a solid tone), or water (commonly an oscillating or beeping tone). If LNAPL is present, record the depth at which LNAPL was first indicated to the nearest hundredth of a foot, as measured from the top of well casing mark/notch. Slowly lower the probe through the LNAPL until the instrument's tone changes to indicate the presence of water. Record the depth at which water was first indicated to the nearest hundredth of a foot. A clear bailer may be used to verify the existence or approximate amount and appearance of LNAPL. If no LNAPL is apparent, record the depth to water.

5) Retract the probe from the well and secure the well appropriately.

6) Note the date and time of measurement for gauging and record all measurements and observations in the field computer or, if necessary, in a field book for subsequent electronic data entry.

7) Decontaminate the probe in accordance with the decontamination procedure outlined in Section 1.5.

8) Clean up the work area, remove gauging equipment, and remove any traffic control devices.

3.0 GROUNDWATER MONITORING PROCEDURES

3.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered as well as slip/trip/fall potential during onsite well gauging activities. Additional hazards may be mentioned in the site-specific HASP and/or the daily JSA.

3.2 Materials and Equipment Necessary for Task Completion

A list of equipment required to access, gauge, purge, and sample site monitoring wells is presented below. Also listed are materials necessary to store, label, preserve, and transport groundwater samples.

- Current site map detailing well locations;
- Field book and/or field computer for recording site data;
- Graduated, optical oil/water interface probe;
- Keys and tools to provide well access;
- Appropriate, laboratory prepared sample containers and labels;
- Appropriate well purging apparatus as determined by volume of groundwater to be purged and compounds to be analyzed;
- Water quality meter for monitoring indicator field parameters (DO, pH, specific conductance, redox potential, and turbidity if available);
- Dedicated polyethylene bottom-loading bailer or well pump and disposable tubing for groundwater sample collection;
- Clean nylon or polypropylene bailer cord;
- Disposable nitrile sampling gloves;
- Decontamination supplies;
- Calibrated five-gallon bucket and watch or stopwatch to determine discharge rate during purging;
- Blank chain-of-custody forms; and

- Cooler(s) and ice for sample preservation.

3.3 Methodology for Three Well Volume Sampling

Prior to site visitation for the groundwater sampling event, the following data will be reviewed to ensure proper preparation for field activities:

- Most recent liquid level data from all wells;
- Most recent analytical data from all wells to determine gauging and sampling sequence; and
- Well construction characteristics.

Each monitoring well to be sampled will be gauged to obtain liquid level data immediately prior to initiation of the sampling process (refer to well gauging procedures above). Liquid level data should be recorded in a field computer or if necessary, a field book. Should free-phase LNAPL be detected by the gauging process, routine groundwater sampling will not be conducted at that location. If groundwater sampling under LNAPL is warranted, refer to the sub-LNAPL sampling section and methodology in Section 3.6.

Groundwater sampling will be initiated by purging from the well a minimum of three well volumes, except in cases where the well is pumped dry, as referenced below. Well purging is performed to remove stagnant water and to draw representative water from the aquifer into the well for subsequent sampling and analysis. In extreme cases where a well is pumped dry and/or shows little recharge capacity, the well should be evacuated once prior to sampling. Wellbore storage volume should be estimated using as-built information stored in the field computer or as indicated on the well log, and the depth to water measurement obtained immediately prior to sampling.

Water quality should be monitored and readings recorded in the field computer or field book while purging, typically through use of a multi-parameter water quality meter with a flow through cell or cord for down-well measurements. Water quality readings should be recorded a minimum of three times (pre-purge, during purge, and post-purge/sample collection) or four times (pre-purge and following each well volume). The parameters to be monitored and recorded are dissolved oxygen, pH, specific conductance, redox potential, temperature, and turbidity if available.

Well purging can be performed with various equipment including: a dedicated bailer for hand bailing low volumes of water; a surface mounted electric centrifugal pump with dedicated polyethylene tubing; and/or submersible pump (particularly when the depth to water is greater than 20 feet) with dedicated polyethylene tubing. During pumping, the intake will be placed directly below the static water surface and slowly lowered during the purging process. This procedure may not be necessary in low-yielding wells but is important in high-yielding, permeable strata where an intake initially placed deep in a well may draw laterally and have little influence in exchanging water from shallower depths within the well bore.

Flow rate during well purging will be approximated by the bucket and stop watch method. The duration of pumping required to remove three well volumes will be calculated directly from this flow rate. All fluids removed during purging will be treated onsite with activated carbon or in accordance with an approved work plan.

The sequence of obtaining groundwater samples will be based upon available historical site data for existing wells and photoionization detector (PID) readings for newly installed wells. Monitoring wells will be sampled in order of those having the lowest to highest concentration of constituents of concern (or PID readings for new wells), based upon the most recent available set of laboratory analyses, to reduce the potential for cross-contamination. For general monitoring events, groundwater samples will not be obtained for analysis from any well containing measurable free product. If groundwater sampling under LNAPL is warranted, refer to the sub-LNAPL sampling section and methodology in Section 3.6.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells.

1) Establish a clean work area where sampling equipment will not come in contact with the ground or any potentially contaminated surfaces.
2) Use a dedicated polyethylene sampling bailer for each well.
3) Use a clean pair of nitrile gloves.

4) Attach an appropriate length of unused, clean nylon or polypropylene cord to the designated sampling bailer.

5) Select appropriate laboratory-provided sample containers.

6) Slowly lower sampling bailer into well until water surface is encountered; continue to lower the sampling bailer into the standing water column to one foot below the water surface.

7) Retrieve bailer at a steady rate to avoid excess agitation.

8) Visually inspect bailed sample to ensure that no free product or organic detritus has been collected.

9) Uncap first designated sample vial and fill from bailer as rapidly as possible but minimizing agitation; secure septum and lid.

10) Inspect sealed sample for entrapped air; if air is present, remove the lid and gently top off sample in vial, seal and inspect. Repeat until no air is apparent.

11) Repeat Steps 9 and 10 for the remaining sample vials based on the laboratory and/or regulatory protocol.

12) Complete and attach labels to sample containers noting sample collector, date, time, and location of sample; record same data in field computer or field book.

13) Place samples in ice-filled cooler in such a manner as to avoid breakage. Samples will be maintained at a temperature of approximately 4°C.

14) Dispose of gloves, bailer, and bailer cord as solid waste and move to next sample location.

3.4 Methodology for Low-Flow Purging and Sampling

For wells that will be purged and sampled via low-flow methodology, the USEPA Region III Bulletin QAD023: *Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells* will be followed. The following data will be reviewed for each well in order to set the pump intake for the low-flow sampling:

- Soil boring lithologic log;
- Well construction log showing the screened interval;
- Identification of the most permeable zone screened by the well;
- Approximate depth to static water;

- Proposed pump intake setting; and
- Technical rationale for the pump intake setting, preferably across from the most impacted/contaminated subsurface interval.

Adjustable rate, submersible, bladder pumps in conjunction with polyethylene tubing for purging and sampling will be used. An alternate set up could include a stainless steel submersible pump, such as a Hurricane® pump or a Monsoon® pump with dedicated polyethylene tubing. The tubing diameter will be between 3/16-inch and ½-inch inner diameter and the length of the tubing extended outside of the well should be minimized. Flow-through cells will be used to monitor groundwater quality parameters during sampling. Monitoring well information, equipment specifications, water level measurements, parameter readings, and other pertinent information will be recorded during well purging and sampling.

The following sequence of procedures will be implemented for the collection of groundwater samples from monitoring wells by the low-flow methodology.

1) PID Screening of Well: A PID measurement may be collected at the rim of the well immediately after the well cap is removed and recorded in the field computer or field book, if historic data is not available.
2) Depth to Water Measurement: A depth to water measurement will be collected and recorded. To avoid disturbing accumulated sediment and to prevent the inadvertent mixing of stagnant water, measuring the total depth of the well should be done at the completion of sampling.
3) Low Stress Purging Startup: Water pumping will commence at a rate of 100 to 400 milliliters per minute (mL/min). This pumping should cause very little drawdown in the well (less than 0.2-0.3 feet) and the water level should stabilize. Water level measurements are made frequently, and flow rate will be recorded in mL/min on the sampling form or field computer.
4) Low Stress Purging and Sampling: The water level and pumping rate will be monitored and recorded every five minutes during purging, and any pumping rate adjustments will be recorded. During the early phase of purging, emphasis will be placed on minimizing and stabilizing pumping stress, and recording any necessary adjustments. Adjustments, when necessary, will be made in the first 15 minutes of purging. If necessary, pumping rates will

be reduced to the minimum capabilities of the pump to avoid well dewatering. If the minimal drawdown exceeds 0.3 feet, but the water level stabilizes above the pump intake setting, purging will continue until indicator field parameters stabilize, as detailed in Step 5 below. If the water level drops below the pump intake setting at the absolute minimum purge rate, the pump will remain in place and the water level will be allowed to recover repeatedly until there will be sufficient water volume in the well to permit the collection of samples.

5) Indicator Field Parameter Monitoring: During well purging, indicator field parameters (DO, pH, specific conductance, redox potential, and turbidity if available) will be monitored every five minutes (or less frequently, if appropriate). Purging will be considered complete and sampling can commence when all the indicator field parameters have stabilized. Stabilization will be achieved when three consecutive readings, taken at five minute intervals (or less frequently, if appropriate), are within the following limits:
    - DO (±10 percent);
    - turbidity (±10 percent);
    - specific conductance (±3 percent);
    - pH (± 0.1 unit); and
    - redox potential ([Eh] ±10 mv).

   Temperature and depth to water will be also monitored during purging. Should any of the parameter-specific components of the water quality meter fail during monitoring, the sampling team will attempt to locate a replacement multi-meter or individual criteria meter. If none are available, the sampling team will continue recording the parameters that are operational, and proceed with the sampling. Any other field observations relating to sample quality, such as odor, foaming, effervescence, and sheens, will also be recorded in the field computer or on the sampling form.

6) Collection of Ground Water Samples: Water samples for laboratory analyses will be collected prior to the flow-through cell by either using a bypass assembly or by temporarily disconnecting the flow-through cell. All sample containers will be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. During purging and sampling, the tubing should remain filled with water in order to minimize possible changes in water chemistry upon contact with the atmosphere. Methods employed to ensure that the outlet tubing will be filled include adjusting the tubing angle upward to

completely fill the tubing and restricting the diameter of the tubing near the outlet of the tubing.

The order in which samples will be collected is as follows:

- Volatile organics;
- Gas sensitive (e.g., Fe^{+2}, CH_4, H_2S/HS);
- Base neutrals or PAHs;
- Total petroleum hydrocarbons;
- Total metals;
- Dissolved metals;
- Cyanide;
- Sulfate and chloride;
- Nitrate and ammonia;
- Preserved inorganic;
- Non-preserved inorganic; and
- Bacteria.

After the appropriate laboratory-provided glassware is filled and labeled, the samples shall be placed in an ice-filled cooler and maintained at approximate 4°C for submittal to the laboratory. Upon completion of sampling at the well, decontaminate non-dedicated equipment in accordance with the decontamination procedure outlined in Section 1.5, and dispose of all dedicated equipment (gloves, tubing, etc.) as solid waste before moving to the next location.

3.5 Methodology for Passive (No-Purge) Sampling for Groundwater Collection

There are many passive groundwater sampling devices that allow for accurate sample collection without purging. Each device has specific uses and conditions for which they are more applicable. This methodology presents details for the use of HydraSleeve samplers.

The HydraSleeve is a disposable, single use device for the collection of representative groundwater samples for laboratory analysis of physical and chemical parameters.

HydraSleeves are placed within the screened interval (or other defined interval) of the well and activated after an equilibrium period. When used according to the manufacturer's instruction, the HydraSleeve will collect a groundwater sample without purging, thus causing no drawdown, agitation, or water column mixing. The HydraSleeve collects a sample from the screened interval only, and excludes water (or other fluids) from other parts of the well by use of check valve that seals when the sampler is full. The HydraSleeve takes advantage of the continuous natural movement of groundwater, which produces an equilibrium condition between the water in a well screen and the adjacent formation. HydraSleeves produce reliable data from low yield wells where other sample methods cannot due to well screen dewatering and associated alteration in water chemistry.

The HydraSleeve consists of the following components:

1) A long (usually 3 to 5 feet), flexible, lay-flat polyethylene sample sleeve, which is sealed at the bottom, and is equipped with a reed valve at the top allowing water to enter the HydraSleeve only during active sample retrieval.
2) A reusable, stainless steel weight attached with a clip to the bottom of the sleeve. The weight is used to carry the sample sleeve down the well to the specified depth (usually the bottom of the well screen). An optional top weight is also available to compress the sleeve in wells with short well screens.
3) A tether line attached to a spring clip at the top of the sample sleeve to deploy the device within the well and later retrieve it for sample collection.
4) A discharge tube is supplied with the device, which is used to puncture the wall of the sleeve after it is recovered to allow direct filling of sample bottles.

<u>Deployment</u>

Upon retrieval, the HydraSleeve is designed to effectively collect a "core" of water from within the well screen, which is equivalent in length and diameter to the sample sleeve. The upward motion opens the valve at the top, which then allows the device to fill with water. The Hydrasleeve should be installed with the top of the sample sleeve as close to the desired sample interval as possible. This will allow the sampler to fill and the check valve to close before the top of the device is pulled past the top of the sample interval.

To assemble and deploy the HydraSleeve:

1) Remove the Hydrasleeve from its package and hold it by the top, pinching the top at the holes.
2) Attach the spring clip and tether in the holes.
3) Slide the clip and bottom weight assembly into the holes at the bottom of the sleeve.
4) Lower the Hydrasleeve by the tether to the bottom or to the specified depth and secure the tether at the wellhead (Note: do not pull the HydraSleeve upward at any time during deployment, as this could cause the check valve to open and water to fill the sleeve inadvertently).

<u>Sample Collection</u>

Although the HydraSleeve only displaces approximately 100 milliliters (ml) of water during deployment, the well should be allowed to stabilize prior to sample collection so that natural flow conditions and contaminant distribution can return to equilibrium conditions. In certain jurisdictions, regulatory directives may prescribe a minimum equilibration period. When used for periodic monitoring programs, such as quarterly or semi-annual sampling, the HydraSleeve can be installed and remain in the well until the next sampling event, thus providing ample time for the well to equilibrate.

To collect a sample:

1) Be sure the tether is secured to the top of the well.
2) In one smooth motion, pull the tether upward at a rate of approximately 1 foot per second. The weight of the sampler will be felt when the valve closes. Continue pulling upward until the HydraSleeve is clear of the well.
3) Discard the water trapped at the top of the HydraSleeve above the reed valve.
4) Hold the HydraSleeve at the reed valve, and puncture the sleeve with the discharge tube just below the reed valve.
5) Decant the water into sample containers.
6) Discard the HydraSleeve as solid waste and process the excess water through activated carbon prior to discharge to the ground surface.

The weight and clips should be decontaminated prior to deploying a replacement HydraSleeve in the well. Tethers can be dedicated to individual wells or decontaminated and reused.

3.6 Methodology for Sub-LNAPL Sampling

The following section describes the methodology used for obtaining groundwater samples from the water column beneath LNAPL. Wells for sub-LNAPL sampling are not purged of three well volumes prior to sampling. This will prevent the potential of drawing LNAPL into the sample and to be representative of steady-state groundwater conditions beneath the LNAPL.

The following data will be reviewed for each well in order determine the appropriate equipment necessary:

- Well construction log showing diameter and total depth of the well;
- Approximate depth to LNAPL; and
- Approximate depth to static water.

A list of equipment for sub-LNAPL sampling is presented below:

- Field book or field computer for recording site data;
- Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy;
- Keys and tools to provide well access;
- Peristaltic pump;
- Polyethylene tubing specifications of 0.25-inch outer diameter x 0.17-inch inner diameter is preferable as this small diameter assists in achieving lower flow rates;
- Silicone tubing of appropriate diameter to operate peristaltic pump;
- Polyvinyl chloride (PVC) drop tube (1.5-inch or other appropriate diameter);
- PVC rod (0.5-inch or other appropriate diameter);
- PVC end cap for drop tube;
- Tether for end cap;
- Clamps for securing drop tube to well casing;
- Appropriate sample containers and labels;

- Decontamination supplies;
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

The following sequence of procedures will be implemented for the collection of sub-LNAPL groundwater samples.

1) Determine LNAPL Thickness: Use an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy to collect depth to LNAPL and depth to water measurements.
2) Installing Sampling Equipment: Deploy a 1.5-inch (or other appropriate diameter) PVC pipe (drop tube), with an attached end cap, through the LNAPL layer in the well. The end cap should be tethered to the drop tube so it is not lost in the well when removed and in a way that allows the drop tube to be sealed during installation. Lower the drop tube until the bottom of the tube is approximately two feet into the water column below the bottom of the LNAPL. Secure the drop tube to the well, and allow the system to equilibrate, approximately one half hour. The end cap is then removed by inserting a 0.5-inch (or other appropriate diameter) PVC rod into the drop tube and pushing on the cap until the lid is removed. The cap will be removed along with the tube upon completion of sampling.
3) Collection of Groundwater Samples: Lower polyethylene tubing through the 1.5-inch drop tube into the water column. Connect the polyethylene tubing to silicon tubing and engage the peristaltic pump for groundwater retrieval. Set the flow rate to the lowest pumping rate that can be sustained so that the LNAPL is not drawn into the tubing. Begin collecting groundwater in the sample container and continue until enough volume is obtained for all bottleware required by the laboratory for the requested analyses.

3.7 Decontamination Requirements

Of particular significance to the procedures of groundwater measurement and sampling is the limitation, whenever possible, of materials inserted into a well bore and, even more importantly, of materials transferred from well to well.

Many items can be discarded between well sampling and/or gauging locations without significantly impacting project costs. Dedicated sampling equipment which can be discarded between well sampling locations, will be used whenever possible to preclude decontamination requirements. Sampling equipment included in this category are polyethylene bailers, bailer cord, nitrile gloves, and sampling tubing. However, other monitoring and sampling equipment, such as oil/water interface probes and submersible sampling pumps, must be reused from well to well.

All site equipment to be used in multiple locations (non-dedicated) for gauging and/or sampling of groundwater will be decontaminated immediately prior to initial use and between uses at each location according to the following steps:

- Remove particulates with a sorbent pad or towel and/or initial rinse with clean potable tap water;
- Wash equipment with clean sponge, soft cloth, or scrub brush as necessary in a solution of tap water/laboratory grade detergent (Alconox®, Liquinox®, or equivalent);
- Rinse with tap water;
- Rinse with deionized or distilled water; and
- Air dry for as long as possible.

Rinse water generated during decontamination procedures will be treated onsite by passing the water through a bucket filled with activated carbon prior to disposal.

3.8 Documentation

All site activities and conditions at the time of purging and groundwater sampling should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well name), personnel present onsite, PID readings, sampling methodology, purge rate, purge volume, and the aforementioned groundwater indicator parameters. A field qualifier "SL" shall be applied to each sub-LNAPL sample entry to denote sample collection as sub-LNAPL. Additional comments or observations (e.g., well damage, nearby pumping, LNAPL sheen) should also be recorded.

4.0 SOIL SAMPLING & WELL INSTALLATION PROCEDURES

4.1 Site Controls

Prior to hand augering, hydroexcavation, utilizing a backhoe, or deploying any drilling apparatus to the site, an underground utility line protection request must be made (i.e., Pennsylvania One Call) for mark-out of known subsurface utilities and associated laterals proximal to the drilling location. Site plans, if available, should be reviewed to document and avoid the location of onsite utilities.

After review of all known mapped and marked utilities, a site reconnaissance will be performed to document the location of utility meters and storm sewer drains. In addition, the location of overhead utilities must be documented. After completing the subsurface and overhead utility review, the area to drill may be considered clear of utilities, or the location may be adjusted to a nearby location, which must also be cleared.

Lastly, any drilling activities must be preceeded by clearing of the borehole, prior to advancement of augers or split spoons. To ensure the safety of workers, the borehole will be cleared by hand, hydroexcavator, or backhoe to a depth of approximately 8 feet below ground surface.

4.2 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered during soil sampling and well installation, as well as slip/trip/fall potential. Drilling is considered a high risk activity which requires facility approval prior to implementation. Additional hazards are identified in the site-specific HASP and/or the daily JSA.

4.3 Materials and Equipment Necessary for Task Completion

A list of equipment required to oversee test boring advancement and, where applicable, sample soil is presented below. Also listed are materials necessary to store, label, preserve, and transport soil samples.

- Current site map detailing well locations;
- Field computer and/or field book for recording site data;

- Appropriate, laboratory prepared sample containers and labels;
- PID;
- Single-use, disposable plastic scoops or stainless steel scoop for collecting soil samples;
- Single-use, disposable, laboratory-supplied syringes for soil sample collection (if applicable);
- Scale for weighing samples (e.g., methanol kits, if necessary);
- Disposable nitrile sampling gloves;
- Measuring tape (for measuring core recovery);
- Munsell soil color chart/book (recommended);
- Decontamination equipment (if applicable);
- Blank chain-of-custody forms; and
- Cooler(s) and ice for sample preservation.

4.4 Decontamination Requirements

All down-hole drilling equipment must be steam cleaned prior to drilling at each soil boring or well location. All soil sampling equipment must be cleaned with detergent and rinsed with deionized or distilled water prior to deployment into the borehole. All well construction materials (i.e. PVC well casing, PVC well screen, sand pack, bentonite) should be clean and dedicated to each borehole.

4.5 Methodology for Soil Boring Installation

4.5.1. Borehole Advancement

During test drilling activities, a borehole is advanced into the subsurface via a rotary or direct-push drilling technique. Various types of drilling methods could be deployed at these facilities to advance the borehole and gain access to the subsurface for characterization and sampling. A description of the most commonly utilized drilling methods is included below:

4.5.1.1 Hollow Stem Auger

A hollow, steel pipe (available diameters vary) with welded, exterior steel “flights” is used to convey subsurface material to the surface when rotated clockwise. A bit at the bottom of the lead auger cuts into the subsurface material, and the rotation conveys the loosened material (cuttings) up the flights, allowing the hole to be advanced (cuttings may not always return to the surface, such as when drilling in soft, saturated materials). The hollow center of the auger allows the driller to access the subsurface for soil sample collection and, where applicable, well installation during borehole advancement. During borehole advancement, a center stem of steel rods connected to an auger plug prevent soil cuttings from entering the drill column. Once a desired drilling depth is reached, the center plug and rods can be pulled out, leaving the auger stem in place to prevent borehole collapse. A split-spoon sampler can be threaded onto the rods in place of the plug and driven via a hammer to obtain a sample (Standard Penetration Test), or if terminal depth has been reached a monitoring well could be installed through the augers.

4.5.1.2 Air and Mud Rotary

Rotary drilling methods are similar to hollow stem auger drilling, however specialized drilling bits at the bottom of rods are used to cut into the subsurface material using compressed air, vibration, and/or pressurized drilling mud. Compressed air or mud is forced through the drilling rods via an air compressor or pump, and escapes through small holes in the drill bit. The circulation of drilling mud, or air combined with introduced water or formation water, conveys the soil cuttings to the surface (while also cooling the drilling bit and preventing borehole collapse).

4.5.1.3 Geoprobe®

A direct-push drilling method, Geoprobe® sampling utilizes a hydraulic hammer to drive steel rods into the subsurface for soil sampling. This method advances a core barrel lined with a plastic Macro-Core® sleeve into the soil column for continuous soil core collection.

4.5.1.4 Hand Auger

A stainless steel or aluminum hand auger is physically advanced to a desired soil sampling depth through rotation of the auger and head.

4.5.2 Soil Sampling

Soil samples will be obtained for lithologic logging and where appropriate, for laboratory analysis with one of three different sampling devices: Split barrel spoon sampler, hand auger, or Geoprobe® soil sampler. For either method, the sampling devices are lowered through the hollow-stem augers or open borehole to allow sampling of undisturbed sediments below the bit or drive shoe. Soil samples will be collected at regular intervals for subsurface characterization and selection of appropriate well screen interval(s). Soils which appear to be visually impacted or from intervals which exhibit the highest deflections on the screening device (PID or similar) will be sampled for laboratory analysis in accordance with an approved sampling plan.

4.5.2.1. Split barrel spoon sampler (split spoon)

The split spoon sampler will be driven into the soil column in accordance with ASTM Standard Method D1586 (Reference A6, Appendix E). Soil sampling by split spoon is characterized by drilling a borehole with a hollow-stem auger to the desired sampling depth (the standard calls for one sample per five foot depth interval). The split spoon sampler is attached to the drilling rods after removal of the auger plug. The drill operator will drive the sampler into the undisturbed soil by repeatedly striking the drilling rods with a 140 pound safety hammer over a 30 inch drop. Field personnel will record the number of blows required to drive the split spoon sampler for each successive six-inch interval. After the sampler has been filled, the driller will remove the rods and sampler from the borehole and should provide the intact sampler to field personnel for opening (the drive shoe and head can be loosened). Field personnel should split the spoon, scan with PID, measure sample recovery, thoroughly describe the soil lithology, note visual observations and odors, note degree of saturation, and where applicable collect soil sample(s) utilizing a stainless steel or disposable scoop. An approved, retractable knife may be used to trim the top and edges of the sample, and once prepared the sample should be containerized in appropriate sample containers.

4.5.2.2. Geoprobe®

The Geoprobe® operator will advance the drilling rods into the subsurface using a truck or track-mounted drill with a hydraulic hammer. A dedicated Geoprobe® Macro-Core® liner is inserted into the core barrel to collect continuous core samples, usually one per 4 foot interval. The Geoprobe® operator will remove the soil filled liner from the core barrel, cut the liner, and provide field personnel with the intact cores. After retrieval of the sample, the liner may be removed by field personnel and the soil core should be scanned with a PID and logged, including documentation of core recovery, soil lithology, visual observations and odors, and degree of saturation. Where applicable, field staff should remove the soil sample utilizing a stainless steel or disposable scoop and containerize in an appropriate sample container.

4.5.2.3. Hand Auger

The self-powered hand auger allows for soil from the desired interval to be collected directly through removal of the soil sample that is collected in the auger head for every six inches of advancement.

4.6 Methodology for Leaded Tank Bottoms Soil Sampling

Leaded tank bottom material is described as containing materials distinguished by distinctive rust/red to black, metallic, mostly oxidized scale materials, sometimes in a matrix of petroleum wax sludge. The approach for identifying leaded tank bottom materials is summarized below:

- If materials are encountered within the previously designated leaded tank bottom areas, matching the physical description given above for leaded tank bottoms, then samples should be collected for lead analysis.
- If total lead results are above the site-specific standard (SSS) for lead of 2,240 milligrams per kilogram (mg/kg) then samples should be analyzed for lead via Toxicity Characteristic Leaching Procedure (TCLP), EPA Test Method 1311.
- Delineated areas that exhibit soils that physically resemble leaded tank bottoms, exhibit lead concentrations greater than 2,240 mg/kg, and exceed 5 milligrams per liter (mg/l) for lead in the TCLP leachate (which is characteristically hazardous for lead) will retain the leaded tank bottom designation. If no soils are encountered that meet all three of these criteria, then the area will no longer be classified as a leaded tank bottom area.

4.7 Methodology for Monitoring Well or Recovery Well Installation

4.7.1 Well Construction

After drilling to a desired terminal depth via any of the drilling methods referenced above, permanent monitoring wells can be installed to allow access to groundwater for future monitoring and groundwater sampling. In general, monitoring wells are constructed of pipe with a slotted interval(s) (screen) through which groundwater can flow into the well from a desired water-bearing stratum. In most cases, PVC materials are utilized for monitoring well construction.

- For applications where LNAPL thickness measurement is necessary, the screened interval should extend above the presumed highest groundwater level.
- For applications where the shallowest groundwater interval is to be monitored (e.g., water-table aquifer), a single well casing is installed.
- For applications where multiple water bearing strata will be penetrated and where deep groundwater conditions are selected for monitoring, a double-cased well may be installed to prevent the vertical migration of contaminants to the deeper water bearing zone from shallower zone(s).

Each well construction type and considerations for field staff regarding how many casings are needed have been provided below.

4.7.1.1 Single Casing Construction

The most commonly installed monitoring well at the facilities have single casings and are constructed of PVC. To determine the length of screen used, seasonal groundwater table or tidal fluctuations should be considered to allow the water table to intercept the well screen throughout the year. Field personnel should advise the driller on the required well diameter, total well depth, screen interval, screen length, and slot size based on available subsurface information prior to drilling. Once the borehole is completed and the drilling crew has been advised on the desired construction, the drilling crew will thread the well screen onto an end cap at the wellhead and will lower the well into the borehole, adding lengths of casing until the terminal depth is reached.

While the well is held near the center of the borehole, the annular space between the well screen and formation is carefully backfilled with a sand filter pack, which consists of clean, sorted quartz sand sized to the formation grain size (typically #1 or #2 sand). The sand pack establishes continuity with the formation and acts as a filter to prevent soil from entering the well (the well screen slot size should be sized according to the formation median grain size to mitigate sediment intrusion, however is most commonly available from suppliers as 0.01 or 0.02-inch diameter slot size).

The sand pack should extend one to two feet above the top of well screen, and care must be taken by the driller to not bridge the sand or overshoot the top of sand target depth (particularly when installing wells through the auger stem). Above the sand pack, a seal (grout) is installed in the annular space between the well casing and the soil. The seal is comprised of hydrated bentonite, sometimes amended with pellets or a grout consisting of hydrated Portland cement, bentonite powder, or a blend of the two. A conventional grout blend is 95% Portland cement and 5% bentonite powder. The purpose of the seal is to prevent surface water from infiltrating the well screen. It is installed from the top of the sand to one to two feet below ground surface.

In circumstances where the top of well sand terminates below the water table (e.g., deeper groundwater or submerged screen), grout should be mixed into a slurry at the ground surface and pumped via tremmie pipe or hose to prevent bridging. Above the well seal, the annular space can be backfilled with granular bentonite or concrete. A cement cap or well pad is placed at the surface to further mitigate potential infiltration of surface water. A locking, steel protective casing (stand pipe) or a locking, flush-mounted curb box should be installed to protect the well.

4.7.1.2 Double Casing Construction

Construction of a double cased well is similar to that of a single case well; however, to prevent groundwater infiltration from shallower water bearing zones, a second casing is installed through a surface casing. This type of construction requires drilling two different diameter boreholes.

During drilling through the shallower groundwater bearing zone(s), a larger diameter borehole is drilled and should be sized according to the desired well and/or outer casing diameter. This may require reaming of the borehole depending on the conditions and drilling equipment. An outer (surface) casing is installed and the annulus is grouted. After the outer casing is installed and the grout has set, the borehole is advanced through the surface casing with a smaller diameter drill stem and bit. When the desired terminal depth is reached, a monitoring well is installed through the inner casing using the above-referenced single casing construction procedure (the annular space between the outer and inner casings above the well filter sand should be pressure grouted).

4.7.2 Handling of Soil Cuttings

Soil cuttings generated during drilling will be containerized or stockpiled on plastic until sampling and analytical data can be obtained. Soil cutting final placement (onsite soil reuse or offsite disposal) will be performed in accordance with Pennsylvania Department of Environmental Protection (PADEP) approved onsite soil reuse plans for each facility.

4.7.3 Well Development

After installation, monitoring wells will be developed to remove residual soil from within the well and filter media and to establish communication between the well and formation. Pump and surge methodology, either through use of a ditch pump or air compressor connected to black polyethylene pipe and surge block, should be utilized to successively agitate relatively clear groundwater from the well. Surging should begin from the bottom of the screened interval and continue iteratively to the top of the well screen in approximately 2 to 4-foot intervals (i.e., pump and surge each 2 to 4 foot interval of well screen several times until relatively clear discharge water is maintained, then move up to the next screen interval until all of the screen has been developed).

Alternately, a submersible pump may be used to pump water from the screened interval of shallow wells, with the screen of the well surged to evacuate silt that remains in the sand pack. The well should be alternately surged and purged until groundwater flowing from the well appears relatively free of sediments. A vacuum truck may be used for development for wells that contains product. Well development water should be managed/treated in accordance with the site-specific work plan.

4.8 Documentation

All site activities and conditions at the time of soil sampling, well installation, and well development should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well or boring name), personnel present onsite, and the aforementioned lithologic data and well construction information. The entry shall include detailed data required to create representative soil boring lithologic logs and well as-built logs (if a well is constructed). This data should include but not be limited to soil type, soil texture (e.g., USCS), soil color, relative moisture content, depth of apparent water table, PID readings, blow counts (if split spoon samples are collected), sample recovery, total depth of borehole, length of well screen, length of well casing, sand pack interval, filter sand size, grout materials used, well seal interval, and all well construction materials. Notes should also include well development pumping rate, duration, and observations. Additional comments or observations should also be recorded, as appropriate.

5.0 LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL) SAMPLING PROCEDURES

5.1 Potential Hazards

Traffic, pinch points, chemical (airborne and physical contact), and biological are all likely hazards to be encountered during LNAPL sampling, as well as slip/trip/fall potential. Additional hazards may be mentioned in the site-specific HASP and/or the daily JSA. If significant amounts of LNAPL are being handled, a Tyvek suit should also be worn.

5.2 Materials and Equipment Necessary for Task Completion

A list of equipment required to sample LNAPL from a monitoring well is presented below:

- Current site map detailing well locations;
- Field book or field computer for recording site data;
- Optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy;
- Keys and tools to provide well access;
- Appropriate sample containers and labels. LNAPL samples will be collected in laboratory provided glassware with appropriate preservative, if applicable. A minimum of 10 ml is required for most laboratory analyses. In the case that sufficient volume is not obtained, a swabbing technique (described below) could be used;
- Sorbent pads (required for swabbing technique);
- Stainless steel or clear bottom-loading or top-loading bailer, depending on product thickness;
- Clean nylon or polypropylene bailer cord;
- Decontamination supplies;
- Blank chain-of-custody forms; and
- Cooler and ice for sample preservation.

5.3 Decontamination Requirements

During LNAPL sampling activities, dedicated sampling equipment (i.e., clear bailers, nitrile gloves, and bailer cord) may be utilized; thereby, minimizing decontamination requirements. However, a stainless steel bailer may be used and decontaminated between LNAPL sampling locations. The optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy used to record the presence or absence and approximate thickness of LNAPL prior to sampling also requires decontamination between sampling locations. Decontamination procedures are detailed in Section 1.5.

5.4 Sampling Procedure

Immediately prior to sampling, each monitoring well should be gauged to obtain liquid levels (i.e., depth to LNAPL and depth to water) for estimation of current LNAPL thickness. Refer to Section 3.0 for appropriate well gauging procedures. Liquid level data should be recorded in a field book or field computer through the EDGE application or, if necessary, a field book.

LNAPL sampling may be performed via two different methods, based upon the LNAPL thickness/availability at the time of sampling: direct sample or swabbing. As indicated above, a minimum LNAPL volume of 10 mL is typically required by the analytical laboratory for most LNAPL characterization.

The following sequence of procedures will be implemented for the collection of LNAPL samples from monitoring wells:

1) A clean work area will be established so that sampling equipment will not come in contact with the ground surface or any other potentially contaminated surfaces near the wellhead.
2) A pre-cleaned stainless steel bailer or dedicated disposable bailer will be used for each well.
3) A new pair of nitrile gloves will be worn during sampling and replaced for each well.
4) Based on the gauged depth to LNAPL, an appropriate length of dedicated nylon or polypropylene cord will be tied to the sampling bailer.
5) An appropriately sized (i.e., 40 ml glass vial with plastic cap fitted with Teflon® lined septum) laboratory-provided sample container will be used to containerize the LNAPL sample.

6) The sampling bailer will be slowly lowered into the well until the liquid level is encountered. Once encountered, the sampling bailer should be lowered into the standing liquid column to a depth of approximately 1 foot, or other appropriate depth based on product thickness.
7) The bailer should be retrieved at a steady rate to avoid excess agitation.
8) The bailed sample should be visually evaluated for the presence or absence of LNAPL. If sufficient LNAPL volume is present (>10 ml), a direct sample of the LNAPL will be collected into the laboratory vial. If less than 10 ml of LNAPL is apparent, a sorbent pad may be used to absorb the LNAPL from the surface of the groundwater sample and the swab placed in the laboratory vial. The site-specific work plan should dictate whether a swab sample should be analyzed, or if the well should be monitored at a later date for re-sampling.
9) Labels will be completed and attached to the sample vials, indicating the sample collector's name, date, time, and location of sample; record same data in field computer or field notebook.
10) Store samples in a secure location until possession is transferred to the laboratory.
11) Nitrile gloves, bailer, bailer cord, and any other trash will be disposed of as solid waste.

5.5 Documentation

All site activities and conditions at the time of sampling should be recorded by field personnel in a field computer via the EDGE application or, if necessary, a field book may be used. The entry shall include the date, time, weather conditions, location (well name), personnel present onsite, and the aforementioned well gauging parameters. Additional comments or observations (e.g., color or apparent viscosity of LNAPL) should be recorded.

6.0 INDOOR AND AMBIENT AIR SAMPLING PROCEDURES

In preparation for indoor and/or ambient air sampling, appropriate facility personnel should be notified of intended sampling prior to mobilization. The purpose of this would be to confirm that there are not any non-routine activities occurring in the building, such as painting of indoor walls, which would cause incidental contamination of the samples.

6.1 Materials and Equipment Necessary for Task Completion

A list of equipment required to collect indoor and/or ambient air samples is presented below:

- Field data book or field computer for recording site data;
- Laboratory certified Summa canisters (standard size is 6 liters);
- Flow controllers (standard duration is 8-hours) with integrated vacuum gauge;
- Equipment for elevating sample intake height (examples: extended sampling inlets, zip ties to attach units to fencing, tables, etc);
- Camera; and
- Blank chain-of-custody forms.

6.2 Precautions to Avoid Incidental Contamination

EPA Method TO-15 is the most common method used for analysis of air samples at these sites. This method is highly sensitive to trace concentrations of volatile organic compounds (VOCs). To avoid incidental contamination:

- Do not wear cologne or fragrance on day of sampling;
- Do not use hand sanitizers or lotions;
- Do not store canisters near containers of gasoline, or any fuel; and
- Make sure there are no sources of VOCs in the vehicle used to transport the canisters.

6.3 Sampling Procedure

1) Set Up Summa Canister. Inlets of the flow controllers are to be placed in the breathing zone, approximately 4 to 6 feet above the ground surface. Elevate Summa canisters using appropriate materials available onsite or use laboratory-provided extended inlets (approximately 3 ft long sampling canes). Indoor air samples should be representative of air

in the buildings and should be placed away from obvious ventilation to outdoor air or sources of VOCs. Securely attach flow controller and extended sampling inlet if applicable.

2) Start Air Sample Collection. Open the valve. Document the initial vacuum (should be between approximately -30 inHg and -26 inHg) and the start time of the test. If the vacuum is significantly outside of the range or has a high rate of change, consider using an alternate canister or flow controller as there may be leakage.
3) Monitoring Summa Condition During Sampling Period. Several times during the sampling period, verify that the Summa is in good condition and that the vacuum is decreasing at an appropriate rate several times during the sampling period. An example of a reasonable frequency would be every two hours during an 8-hour event. During these checks, record the time, remaining vacuum, and canister condition. If necessary, obtain a permit to operate a camera, and take a least one photo of each sampling location.
4) Completing Air Sample Collection. Near the end of the sampling period, monitor the gauge more frequently. The sample collection should be stopped when the gauge reads approximately -5 inHg. At this point, close the canister valve. Record the sample end time and sample end vacuum. Ensure that the canister is labeled with the sample ID. Remove all of the attached equipment from the canister. Pack the canisters, flow controller wrapped in bubble wrap, chain of custody (additional information in the following section), and any other laboratory provided equipment back into the original packaging.

6.4 Documentation

All site activities and conditions at the time of air sampling should be recorded by field personnel. The entry shall include the date, time, weather conditions (including wind direction and start/end barometric pressure), sample locations and IDs, and personnel present onsite. Any observation that could influence the level of VOCs in the samples should be noted.

7.0 SURFACE WATER SAMPLING PROCEDURES

7.1 Field Procedures for Surface Water Sampling

7.1.1 General

Surface water sampling is performed to obtain samples for surface water bodies that are representative of existing surface water conditions. Surface water sampling (or gauging) within 3 feet of a bulkhead at certain facilities will require field personnel to wear a life vest.

Surface water sampling locations for surface water quality and groundwater interaction studies are selected based on the following:

1) Study objectives
2) Location of point surface discharges
3) Non-point source discharges and tributaries
4) Presence of structures (e.g., bridge, dam)
5) Accessibility

During surface water sampling it is important to obtain samples that are not impacted by the re-suspension of sediment produced because of improper or poor surface water sampling techniques.

7.1.2 Surface Water Sample Location Selection

Prior to conducting surface water sampling activities, the first requirement is the consideration and development of surface water sampling locations. It is important that all surface water sampling locations be selected in accordance with the work plan.

Wading for surface water samples increases the chances of disturbance of sediments from the floor of the surface water body. When wading for surface water samples be aware of potential safety and health risks. A life vest and safety line must be worn at all times where footing is unstable or when sampling in fast moving or more than 3 feet (0.9 m) deep. A two-person team is required for most surface water sampling activities. If the site conditions require the use of the life vest and safety line, the two people involved in the sampling must be competent swimmers.

Surface water samples must be collected with no suspended sediments. Surface water samples are collected commencing with the furthest downstream location to avoid sediment interference with upstream locations.

7.1.2.1 Rivers, Streams, and Creeks

Surface water samples are generally collected in areas of surface water bodies that are representative of the surface water body conditions. Representative surface water samples will usually be collected in sections of surface water bodies that have a uniform cross section and flow rate. Mixing is influenced by turbulence and water velocity, therefore the selection of surface water sampling locations immediately downstream of a riffle area (i.e., fast flow zone) will ensure good vertical mixing. These locations are also likely areas for deposition of sediment since this occurs in areas of decreased flow velocity.

Surface water sampling locations should not be established in areas near point source discharges. Surface water sampling of these source discharge points can be performed to assess the impact of these source areas on overall surface water quality. Sample tributaries as close to the mouth as possible. It is important to select surface water sample locations considering the impact downstream, including tributary flow and sediment.

In all instances, properly document all surface water sampling locations. Documentation may include photographs and tie-ins to known structures.

7.1.2.2. Sampling Equipment and Techniques

When collecting surface water samples, direct dipping of the sample container into the stream or water is acceptable unless the sample container contains preservatives. If preserved, a pre-cleaned unpreserved sample container should be used to collect the surface water sample. The surface water sample is then transferred to the appropriate preserved sample container. When collecting surface water samples, submerse the inverted bottle to the desired sample depth and tilt the opening of the sample container upstream to fill. During surface water sample collection, wading or movement may cause sediment deposits to be re-suspended and can result in biased samples. Wading is acceptable if the stream has a noticeable current and the samples are collected directly in the sample container when faced upstream. If the stream is too deep to wade in or if addition samples must be collected at various depths, additional sampling equipment will be required. Surface water samples should be collected about 6 inches (15 cm) below the surface, with the sample bottles being completely submerged. Taking the surface water sample at this depth eliminates the collection of floating debris in the sample container.

Surface water sample collection where the flow depth is less than 1 inch (<2.5 cm) requires the use of special equipment to eliminate sediment disturbance. Surface water sampling may be conducted with a container then transferred to the appropriate sample container, or collection may be performed using a peristaltic pump. A small excavation in the stream bed to create a sump for sample collection can also be considered but should be prepared in advance to allow all the sediment to settle prior to surface water sampling activities.

Teflon™ bailers can be used for surface water sampling if it is not necessary to collect surface water samples at specific depths. A bottom loading bailer with a check ball is sufficient. When the bailer is lowered through the water, the water is continually displaced through the bailer until the desired depth is reached. The bailer is retrieved and the check ball prohibits the release of the collected surface water sample. Bailers are not suitable in surface water bodies with strong currents, or where depth-specific sampling is required. For discrete and specified depth surface water sampling, and the parameters to be monitored do not require a Teflon™ coated sampling device, a standard Kemmerer or Van Dorn sampler can be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the sampler ends open while the sampler is being lowered. The sampler is lowered in a vertical position to allow water to pass through. The Van Dorn sampler is plastic and is lowered in a horizontal position. For both samplers, a messenger is sent down a rope when the sampler has reached the required depth. The messenger causes the stopper on the sampler to close. The sampler is then retrieved and the surface water sample can be collected through a valve. DO sample bottles can be filled by allowing overflow using a rubber tube attached to the valve. During depth-specific surface water sampling, take care not to disturb bottom sediments.

Glass beakers or stainless steel cups may also be used to collect surface water samples if

parameter interference does not occur. The beaker or cup must be rinsed at least three times with the surface water sample prior to sample collection.
All equipment must be thoroughly decontaminated.

7.1.2.3 Field Notes for Surface Water Sampling

Record daily surface sampling activities, describe surface water sampling locations, sampling techniques, and, if applicable, provide a description of photographs taken. Visual observations are important and provide valuable information when interpreting surface water quality results. Observations include:

1) Weather conditions
2) Stream flow directions
3) Stream physical conditions (width, depth, etc.)
4) Tributaries
5) Effluent discharges
6) Impoundments
7) Bridges
8) Railway trestles
9) Oil sheens
10) Odors
11) Buried debris
12) Vegetation
13) Algae
14) Fish and other aquatic life
15) Surrounding industrial areas

The following factors should be considered for surface water sampling:

1) Predominant Surrounding Land Use: Observe the prevalent land use type in the vicinity and note any other land uses in the area which, although not dominant, may potentially affect surface water quality.

2) Local Watershed Erosion: Note the existing or potential erosion of soil in the local watershed and its movement into the stream. Erosion can be rated through visual observation of watershed stream characteristics including increases or decreases in turbidity.

3) Local Watershed Non-Point Source Pollution: This refers to problems or potential problems other than erosion and sedimentation. Nonpoint source pollution can be diffuse agricultural and urban runoff. Other factors may include feed lots, wetlands, septic systems, dams, impoundments, and mine seepage.

4) Estimated Stream Width: The estimated distance from shore at a transect representative of the stream width in the area.

5) Estimated Stream Depth: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from the water surface to the bottom of the surface water body at a representative depth at three locations.

6) High Water Mark: Estimate the vertical distance from the bank of the surface water body to the peak overflow level, as indicated by debris hanging in bank or flood plain vegetation, and deposition of silt. In instances where bank flow is rare, high water marks may not be evident.

7) Velocity: Record or measure the stream velocity in a representative run area.

8) Dam Present: Indicate the presence or absence of a dam upstream or downstream of the surface water sampling location. If a dam is present, include specific information detailing the alteration of the surface water flow.

9) Channelized: Indicate if the area surrounding the surface water sampling location is channelized.

10) Canopy Cover: Note the general proportion of open to shaded areas which best describes the amount of cover at the surface water sampling location.

7.2 References

For additional information pertaining to surface water sampling, the user of this manual may reference the following:

ASTM D5358 Practice for Sampling with a Dipper or Pond Sampler

ASTM D4489 Practices for Sampling of Waterborne Oils

ASTM D3325 Practice for the Preservation of Waterborne Oil Samples

ASTM D4841 Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents

ASTM D4411 Guide for Sampling Fluvial Sediment in Motion

ASTM D4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments

ASTM D3213 Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil

ASTM D3976 Practice for Preparation of Sediment Samples for Chemical Analysis

ASTM E1391 Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing

ASTM D4581 Guide for Measurement of Morphologic Characteristics of Surface Water Bodies

ASTM D5906 Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths

ASTM D5073 Practice for Depth Measurement of surface water

8.0 SEDIMENT SAMPLING PROCEDURES

8.1. Introduction

Sediment sampling is conducted to obtain samples that are representative of existing chemical and/or physical conditions of sediment.

8.2 Equipment Decontamination

On environmental sites, sediment sampling equipment (e.g., split spoons, trowel, spoons, shovels, bowls, dredges, corers, scoops) are typically cleaned as follows:

1) Wash with clean potable water and laboratory detergent, using a brush as necessary to remove particulates.
2) Rinse with tap water.
3) Rinse with deionized water.
4) Air dry for as long as possible.

Additional or different decontamination procedures may be necessary if sampling for some parameters, including VOCs and metals.

8.3 Sample Site Selection

Before any sampling is conducted, the first requirement is to consider suitable sampling locations. Sampling locations should be selected in accordance with the work plan. Wading for sediment samples in lagoons, lakes, ponds, and slow-moving rivers and streams must be done with caution since bottom deposits are easily disturbed. Sampling must only be attempted where safe conditions exist and samples must be collected from undisturbed sediments. All sediment samples are to be collected commencing with the most downstream sample to avoid sediment interference with other downstream samples. A life vest and safety line should be worn in all cases where footing is unstable or where water is fast moving or over 3 feet (0.85 m) in depth. A second person may also be required for most of the sampling scenarios.

8.3.1. Rivers, Streams, and Creeks

Sediment samples may be collected along a cross-section of a river or stream in order to adequately characterize the bed material, or from specific sediment deposits as described in the work plan. A common procedure is to sample at quarter points along the cross-section of the sampling site selected. Samples may be composited as described in the work plan. Samples of dissimilar composition (e.g., grain size, organic content) should not be combined. Representative samples can usually be collected in portions of the surface water body that have a uniform cross-section and flow rate. Since mixing is influenced by turbulence and water velocity, the selection of a site immediately downstream of a riffle area (e.g., fast flow zone) are likely areas for deposition of sediment since the greatest deposition occurs where stream velocity slows.

A site that is clear of immediate point sources (e.g., tributaries and industrial and municipal effluents) is preferred for the collection of sediment samples unless the sampling is being performed to assess these sources.

8.4 Sampling Equipment and Techniques

8.4.1. General

Any equipment or sampling technique(s) [e.g., stainless steel, polyvinyl chloride (PVC)] used to collect a sample is acceptable so long as it provides a sample which is representative of the area being sampled and is consistent with the work plan.

8.4.2. Sediment Sampling Equipment and Techniques

A variety of methods may be used to collect sediment samples from a stream, river, or lake bed. Dredging (Peterson, Ponar, Van Veen), coring and scooping are acceptable sediment sample collection techniques. Precautions shall be taken to ensure that a representative sample of the targeted sediment is collected. Caution should be exercised when wading in shallow water so as not to disturb the area to be sampled. Samplers should be selected based on the interval to be sampled, type of sediment/sludge (silt, sand, gravel), and required sample volume. More than one sampler is often required to implement a sampling program at a site. The following describes some of these methods. Manufacturer’s information should be consulted to determine the limitations of each type of sampling equipment.

8.4.3 Dredging

The Peterson dredge is best used for rocky bottoms, in very deep water, or when the stream velocity is rapid. The dredge should be lowered slowly as it approaches the bottom, so as to not disturb the lighter sediments.

The Ponar dredge is similar to the Peterson dredge in size and weight. The Ponar dredge is a "clam-shell" type unit that closes on contact with the river/lake bottom. Depending on the size of the unit, a winch is required for larger units, whereas smaller units are available for lowering by a hand line. Once retrieved, the unit is opened and the sample extracted using a sample scoop or spoon. The unit has been modified by the addition of side plates and a screen on top of the sample compartment. This permits water to pass through the sampler as it descends.

The Ponar grab sampler functions by the use of a spring-latch-messenger arrangement. The sampler is lowered to the bottom of the water body by means of a rope, then the messenger is sent down to trip the latch causing the sampler to close on the sediments. The sampler is then raised slowly to minimize the disturbance of the lighter sediments. Sediment is then placed into a stainless steel bowl, homogenized, and placed into the appropriate sample container (if collecting for VOC parameters, fill the VOC jars before homogenization).

8.4.4. Corers

Core samplers are used to obtain vertical columns of sediment. Many types of coring devices are available, depending on the depth of water from which the sample is to be collected, the type of bottom material, and the length of core to be obtained. They vary from hand-push tubes to weight or gravity-driven devices to vibrating penetration devices.

Coring devices are useful in contaminant monitoring due to the minimal disturbance created during descent. The sample is withdrawn intact, allowing the removal of only those layers of interest. Core liners consisting of plastic or Teflon may also be added, thereby reducing the potential for sample contamination and maintaining a stratified sample. The samples may be shipped to the lab in the tubes in which they were collected. The disadvantage of coring devices is that only a small sampling surface area and sample size is obtained, often necessitating repetitive sampling in order to collect the required amount of sediment for analysis. It is also often difficult to extract the sediment sample back out through the water column without losing the sample.

The core tube is pushed/driven into the sediment until only 4 inches (10 cm) or less of tube is above the sediment-water interface. When sampling hard or coarse sediments, a slight rotation of the tube while it is pushed will create greater penetration and reduce compaction. Cap the tube with a Teflon plug or a sheet of Teflon. The tube is then slowly withdrawn, keeping the sample in the tube. Before pulling the bottom part of the core above the water surface, it must be capped.

8.4.5 Scooping

The easiest way to collect a sediment sample is to scoop the sediment using a stainless steel spoon or scoop. This may be done by wading into the stream or pond and, while facing upstream (into the current), scooping the sample from along the bottom in an upstream direction. This method is only practical in very shallow water.

8.4.6 Mixing

Sediment samples collected for chemical analysis should be thoroughly mixed (except for VOCs) in a stainless steel bowl prior to placement in the appropriate sample container. Standard procedures exist for preparation of sediment samples (ASTM D3976). These should be followed or the laboratory informed of applicable procedures.

8.4.7 Air Monitoring

Prior to sediment/sludge sampling, measure the breathing space above the sample location with a PID, should the potential for volatiles be present, and use a hydrogen sulfide meter should hydrogen sulfide be present. Repeat these measurements during sampling. If either of these measurements exceed any of the air quality criteria established in the HASP, air purifying respirators (APRs) or supplied air systems will be required.

8.4.8 Sample Location Tie-In/Surveying

The recording of the sample locations and depth on the site plan is extremely important. This may be accomplished by manual measurement (i.e., swing ties), global positioning system (GPS) survey, or stadia methods. Manual measurements for each sample location should be tied into three permanent features (e.g., buildings, utility poles, hydrants). Diagrams with measurements should be included in the field book.

8.5 Field Notes

A bound field book is used to record daily activities, describe sampling locations and techniques, and describe photographs (if taken). Visual observations are important, as they may prove invaluable in interpreting water or sediment quality results. Observations shall include (as applicable) weather, stream flow conditions, stream physical conditions (width, depth, etc.), tributaries, effluent discharges, impoundments, bridges, railroad trestles, oil sheens, odors, buried debris, vegetation, algae, fish or other aquatic life, and surrounding industrial areas. The following observations should be considered:

- Predominant Surrounding Land Use: Observe the prevalent land use type in the vicinity (noting any other land uses in the area which, although not predominant, may potentially affect water quality).
- Local Watershed Erosion: The existing or potential erosion of soil within the local watershed (the portion of the watershed that drains directly into the stream) and its movement into a stream is noted. Erosion can be rated through visual observation of watershed and stream characteristics. (Note any turbidity observed during water quality assessment.)
- Local Watershed Non-point Source Pollution: This item refers to problems and potential problems other than siltation. Non-point source pollution is defined as diffuse agricultural and urban runoff (e.g., stormwater runoff). Other compromising factors in a watershed that may affect water quality are feedlots, wetlands, septic systems, dams and impoundments, and/or mine seepage.
- Estimated Stream Width: Estimate the distance from shore at a transect representative of the stream width in the area.

- Estimated Stream Depth: Riffle (rocky area), run (steady flow area), and pool (still area). Estimate the vertical distance from water surface to stream bottom at a representative depth at each of the three locations.
- High Water Mark: Estimate the vertical distance from the stream bank to the peak overflow level, as indicated by debris hanging in bank or floodplain vegetation, and deposition of silt or soil. In instances where bank overflow is rare, a high water mark may not be evident.
- Velocity: Record an estimate of stream velocity in a representative run area (see Section 12.0).
- Dam Present: Indicate the presence or absence of a dam upstream or downstream of the sampling station. If a dam is present, include specific information relating to alteration of flow.
- Channelized: Indicate whether the area around the sampling station is channelized.
- Canopy Cover: Note the general proportion of open to shaded area which best describes the amount of cover at the sampling station.
- Sediment Odors: Disturb sediment and note any odors described (or include any other odors not listed) which are associated with sediment in the area of the sampling station.
- Sediment Oils: Note the term which best describes the relative amount of any sediment oils observed in the sampling area.
- Sediment Characteristics: Note the grain size, color, consistency, layering, presence of biological organisms, man-made debris, etc. in accordance with standard ASTM soil description protocols.
- Sediment Deposits: Note those deposits described (or include any other deposits not listed) which are present in the sampling area. Also indicate whether the undersides of rocks not deeply embedded are black (which generally indicates low dissolved oxygen or anaerobic conditions).

8.6 References

For additional information pertaining to this topic, the user of this manual may reference the following:

ASTM D5358 Practice for Sampling with a Dipper or Pond Sampler
ASTM D4489 Practices for Sampling of Waterborne Oils
ASTM D3325 Practice for the Preservation of Waterborne Oil Samples

ASTM D4841 Practice for Estimation of Holding Time for Water Samples Containing Organic and Inorganic Constituents

ASTM D4416 Guide for Sampling Fluvial Sediment in Motion

ASTM D4823 Guide for Core-Sampling Submerged, Unconsolidated Sediments

ASTM D3213 Practice for Handling, Storing, and Preparing Soft Undisturbed Marine Soil

ASTM D3976 Practice for Preparation of Sediment Samples for Chemical Analysis

ASTM E1391 Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing

ASTM D4581 Guide for Measurement of Morphologic Characteristics of Surface Water Bodies

ASTM D5906 Guide for Measuring Horizontal Positioning During Measurements of Surface Water Depths

ASTM D5073 Practice for Depth Measurement of Surface Water

ASTM D5413 Test Methods for Measurement of Water Levels in Open-Water Bodies

9.0 SLUG TEST PROCEDURES

9.1 Materials and Equipment Necessary for Task Completion

Water level (data) logger capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger capable of advanced logging modes); vented, direct-read cable of sufficient length (with dessicant); interface tape/probe or water level meter; solid (mechanical) slug, pneumatic slug, or packer system [the introduction or removal of water is not recommended (e.g., bailer or bucket)]; 5 gallon bucket, traffic cones and/or barricades, deionized or distilled water and Alconox®; decontamination bucket and brush; and laptop computer or rugged reader.

9.2 Decontamination Requirements

Equipment utilized during slug testing must be thoroughly decontaminated with Alconox® and deionized/distilled water prior to and between uses at each test well to prevent cross contamination between wells. Any groundwater removed from the well during testing must be containerized and either treated and discharged to ground surface, or disposed of in an approved manner, preferably in a properly installed, onsite holding tank. If LNAPL is encountered/recovered, it should be containerized and properly disposed onsite. However, the preferred test initiation methods (solid and/or pneumatic slug) do not generate any groundwater.

9.3 Methodology for Slug Testing

Slug tests are utilized to provide in-situ estimations of hydraulic conductivity (k) in saturated media, most often in geologic formations that exhibit aquifer properties (low k media can also be tested with special consideration). Slug tests involve rapidly displacing the static water level in a well, and analyzing the well's rate and pattern of recovery back to near-static conditions. Falling head or slug-in tests involve analysis of displacement due to the addition of volume, and rising head or slug-out tests involve the analysis of displacement due to the removal of volume. Displacement is initiated using either a solid or pneumatic slug. Water level response is monitored immediately following the initial displacement and for the ensuing time period until the water level has returned to near-static level (generally within 5% of static). Water level response should be recorded using a water level (data) logger capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger). Logarithmic logging modes are preferred to shorten the data file while still providing high resolution data just after test initiation.

9.4 Field Procedures

1) Test Well Construction and Configuration - Well construction details are needed to perform slug test calculations and are important considerations when selecting appropriate wells for testing. Important as-built details include: total well depth, well screened interval(s), depth to (static) water, casing diameter, screen diameter, filter pack diameter, filter pack size, and filter pack interval. While these details should be documented on the well log, static water level and total well depth should be field-confirmed before the test. Of particular importance to the testing procedure is the relationship between static water level and well screened interval, and the degree of well development. Test results for poorly or insufficiently-developed wells may be strongly affected by drilling debris/disturbance in the formation that can create skin effects, lowering the apparent formation k. Analysis of testing data for wells screened across the water-table should consider drainage of the filter pack media. In addition, a pneumatic slug assembly should not be utilized unless the test well is screened below the water table and the water level remains above the screen throughout the test.

2) Test Setup and Initiation - Upon arrival, the test well should be gauged for static depth to water and total well depth so that the total water column length can be estimated. Well gauging data should be recorded in a rugged reader using an EDGE file, if available, or field form or book.

    a. Solid Slug
    The displacement volume of the slug is needed. It is suggested that the slug be prefabricated and calibrated for displacement volume prior to site use. Calculate the expected initial well displacement, using the slug volume and well casing radius, and deploy the data logger/cable to a depth just below that level while considering the slug length (to avoid conflict and tangling of the slug and transducer). Also consider the submergence depth limit of the data logger (usually indicated on the logger body). Generally, placing the data logger a foot or two below the bottom of the slug is good practice. Once submerged, allow the

data logger temperature to equilibrate with groundwater prior to initiating the test (up to 30 minutes).

While the data logger temperature equilibrates, secure the slug to an adequate length of disposable string or rope and hang in the well to a depth just above the water surface. Mark the string/rope to accommodate the slug length and tie off. Using the rugged reader or field computer, set up a new test (logarithmic mode or sub-second recording interval) in the data logger supplied software and start the test. Indicate in the file name the type of test and test number (e.g., rising or falling head; test 1 or 2). Once logging is initiated, quickly and smoothly lower the slug (slug-in or falling head test) to the submerged depth and tie off the string/rope (displacement should be instantaneous). Monitor the data logger data until the water level has returned to near-static level. Stop the falling head test.

Without moving the slug or data logger, set up a new test in the data logger supplied software with the same settings and indicate in the file name the type of test being performed (rising head or slug out). Start the test and once the data logger is running, instantaneously lift the slug and tie off the string/rope to its pre-test position (just above static). Monitor the data being recorded by the data logger and stop the test when the water level has returned to near-static.

b. Pneumatic Slug

If a high formation k is anticipated, solid slug removal is found to be too slow to capture well recovery, or to minimize equipment decontamination for wells with submerged screens, a pneumatic slug assembly should be utilized.

Open air release valve, secure pneumatic slug assembly to well casing and tighten coupling to provide an air tight seal. Insert the data logger/cable and deploy to the target submergence depth [it is generally best to keep the data logger shallow (~1-2 feet below static water level) and use small initial displacements to avoid dynamic recovery effects in high k formations]. Close the air release valve and attach the air pump or compressor. Pressurize the well and use the pressure gauge to set initial displacement. Check for air leaks using a soapy water mixture and sprayer (assembly must be air tight). Allow the water level to return to static and remove the air pump. Using the rugged reader or field computer, set up a new test (logarithmic mode or sub-second recording interval) in the data logger supplied software and start the test. Indicate in the file name the type of test and test number (e.g., rising head; test number). Once logging is initiated, open the air release valve and monitor the test data. Stop the test when the water level has returned to near-static.

3) Test Monitoring and Guidelines - The following are general guidelines for slug testing performance as published by Midwest Geosciences Group in "Field Guide for Slug Testing and Data Analysis:"

- Conduct at least three or more tests per well and if possible conduct both rising and falling head test data.
- Use two or more initial displacement values (2 slug sizes or air pressures applied) that vary by an order of magnitude or more.
- Final slug test initial displacement should be nearly equivalent to the first test's displacement.
- Allow tests to run until near-static conditions are achieved (+/- 5% of static)
- Digital slug test data files collected with the data loggers and/or EDGE files should be backed up to either a thumb drive, corporate email server, and/or corporate file server immediately after collection.

4) Test Data Reduction and Processing - Prior to slug test analyses, digital data logger files should be normalized so that multiple tests conducted on the same test well can be compared for the assessment of test validity and well conditions. Reducing the data as follows:

- From each raw data file, estimate the time of test initiation and the head (depth or pressure) under static conditions.

- In each slug test data file, subtract the time of test initiation from the elapsed time and save to a new field (normalized time or test time; start of test should be time zero).
- In each slug test data file, subtract the static pressure head from the test period pressure head values and save to a new field (deviation from static).
- To normalize the deviation from static values, divide that field by the displacement expected based upon the slug volume or air pressure head applied.
- Create a graphical plot of the normalized head data versus test time for each test performed on the test well. Review the data plots and confirm that the testing data for each repeat test roughly concur. Also confirm that the actual and expected initial displacements are nearly equal.
- If repeat testing data and/or expected versus actual initial displacements vary widely, review well completion details and testing methods prior to performing further analysis (step 5 below) as the results may not be valid (e.g., the well screen interval may be poorly developed or fouled, the data logger may have moved or placed too deep in the well, slug was removed too slowly). The well may need to be retested.

5) Test Data Analysis - For the purposes of this standard operating procedural document, it is assumed that slug test analysis software will be used to apply standard solution methods to the testing data. Various computer programs are available, such as AQTESOLV Professional. Choose an appropriate test solution method by considering the following well configurations (in AQTESOLV, use the Solution Expert):

a. Submerged Screen and/or Confined Aquifer Well - If the well screen fully penetrates the intersecting aquifer, utilize the Cooper et al. Model or Hvorslev Model and analyze the curve match and/or best fit. If well is partially penetrating a confined formation, utilize the KGS Model or Hvorslev Model. If well screen is submerged in an unconfined formation, utilize the KGS Model or Bouwer and Rice Model.

b. Water-Table Intersects Well Screen - If the well screen is intersected by the water table, utilize the Bouwer and Rice Model (double straight line effect) or KGS Model.

c. Rapid Well Recovery in High k Formations - If well response to displacement is extremely rapid and normalized head plots display an oscillatory or concave-downward form, utilize the Butler and Zhan Model (most comprehensive solution available) or High-k Hvorslev Model for confined wells, or the High-k Bouwer and Rice Model.

9.5 Limitations

In general, results of slug test data analyses provide an initial estimate of formation k and have a small scale of relevance (particularly in high k settings). Slug tests can be strongly affected by the degree of well development and can be used diagnostically to assess the degree of well development. In most cases, slug testing should be performed on several wells in an area of interest to develop an understanding of the formation characteristics (e.g., heterogeneous or homogeneous formations).

10.0 PUMP TEST PROCEDURES

10.1 Materials and Equipment Necessary for Task Completion

Water-level (data) loggers (transducers) capable of recording pressure and/or depth at sub-second time intervals (preferably a vented logger capable of advanced logging modes for at least the pumping well); vented, direct-read cables of sufficient length (with dessicant packs); interface tape/probe or water-level meter; well pump (preferably a submersible pump), drop pipe and layflat or comparable discharge line of sufficient length, totalizing flow meter (recommended) and 5 gallon bucket, stop watch, rain gauge or nearby weather station; materials needed to monitor surface water bodies near the test site (e.g., staff gauge, weir, stakes, data logger, camera with permission from refinery personnel); traffic cones and/or barricades, deionized or distilled water and Alconox®; decontamination bucket and brush; laptop computer or rugged reader; portable generator or other power supply appropriate for the submersible pump; and containment (e.g., frac tank) or activated carbon filtration for the temporary staging or filtering of discharge water.

10.2 Decontamination Requirements

Equipment utilized during pumping tests must be thoroughly decontaminated with Alconox® and deionized/distilled water prior to and between uses at each test well to prevent cross contamination between wells. Any groundwater removed from the tested well must be containerized and either treated (filtered as appropriate) and discharged to ground surface, or disposed of in an approved manner, preferably in a properly installed, onsite holding tank. If LNAPL is encountered/recovered, it should be containerized and properly disposed of on or off-site.

10.3 Methodology for Pump Testing

10.3.1 Pre-test Considerations

In general, pumping tests are performed to estimate large-scale in-situ hydraulic properties of water-bearing strata in the subsurface (i.e., transmissivity and storativity) and average out local-scale heterogeneity that can limit the applicability of smaller-scale testing methods, such as slug tests. The geographical area influenced by a pumping test will be determined by the hydraulic properties of the strata being tested (including hydraulic properties of other strata supplying recharge to the pumped formation), boundary conditions, and on the duration of the test.

Pumping tests are also commonly performed to generate drawdown data from which hydraulic boundary conditions, hydraulic flow regime (e.g., anisotropy), and aquifer type (i.e., unconfined or confined, leaky confined) may be estimated. Smaller-scale pumping tests may also be utilized to address pumping efficiency and/or signal to noise ratio (pumping rate) at the pumping well, or to assist in remedial system design. However at this scale, the assumptions of some data analysis methods may not be applicable and should be considered prior to testing.

Appropriate design of a pumping test should include review of site-specific information regarding the geology and hydrogeology of the test area. Pumping test design should also consider the goal(s) of the test (i.e., scale of application of derived aquifer properties, identification of boundary influences, sources of recharge, well efficiency). This should include review of available lithologic well logs or test boring logs, geologic maps, cross sections, structure contour maps, isopach maps, and any other available information so that a conceptual model relating geologic units to hydrostratigraphic units or water-bearing strata can be developed. Additional pre-test considerations should include identification of any potential positive or negative hydraulic barriers, tidal effects, and/or influence from other wells that may be pumping in the test area. Without sufficient knowledge of factors influencing water-levels and hydrology of the test area, test results could be misinterpreted.

Often times, budget considerations and/or time limitations will necessitate the use of an existing monitoring well as the pumping well and/or existing wells as observation points. While this is generally acceptable, the wells must be screened appropriately with respect to the goals of the test and knowledge of well construction is critical to applying test solutions. Wells should also be redeveloped prior to testing if they are relatively old or if records of sufficient well development at the time of installation are not readily available.

Pumping tests can be divided into two general classifications: step-drawdown tests and constant rate tests. Step tests typically involve pumping a well at progressively higher rates or “steps” at intervals of one or two hours per step (typically up to 3 steps). They are often used to estimate the yield a well will sustain during a constant rate pumping test and to evaluate well efficiency (frictional head losses between the screen/gravel pack and the formation). Constant rate pumping tests are used primarily to evaluate hydraulic properties of water-bearing strata for design of groundwater treatment systems and/or water supply purposes (e.g., groundwater allocation). Where budgets permit, the best pumping test approach is to first perform a step-drawdown test on the pumping well to evaluate well efficiency and sustainable yield (and to gauge whether or not the pumping well needs additional development), allow recovery to near-static conditions, and then initiate a constant rate test.

The test duration is subject to goals of the test and to budget considerations. Optimally, a constant rate test should be run until all drawdowns have stabilized or boundary conditions are identified, and gravity drainage effects are curtailed; however, this is seldom practical due to time limitations. In most instances, an 8 hour constant rate test will be adequate, and a 24 hour test will be sufficient for higher sensitivity sites. Occasionally a 72 hour pumping test is warranted, though this is usually reserved for large scale water supply work. If there are any unexplained water level anomalies observed toward the scheduled end of a test, the test should be continued if at all possible.

The approximate test flow rate needs to be determined in advance for proper pump and discharge design selection, and sizing of discharge containment. If it is not appropriate to perform a step test, sustainable yield can be estimated from slug test data or a brief (<30 minutes) pumping episode the day before the actual test. Generally, it is best to pump the test well at a rate that maximizes the signal to noise ratio (a higher pumping rate does not influence test scale and should not be used as a means to shorten the test duration).

If testing must be performed in an area where contamination is known to be present, careful consideration of the impacts of the test scale should be considered prior to testing so that the spread of subsurface contamination is not increased. If floating product (LNAPL) is present at or near the pumping well, drawdown should be limited so as to not impact uncontaminated soils below the static water table (i.e., create a “smear” zone or allow for the significant migration of free-phase product). Discharge water must be either 1) treated prior to discharge or 2) containerized for on or off-site disposal. If it is to be discharged directly on-site and allowed to infiltrate, it must be routed sufficiently far enough from the test area as to avoid any artificial recharge effects. All appropriate withdrawal and discharge permits must be obtained and complied with. If discharge water is to be treated on-site, proper contaminant loading calculations for the test flow rate, approximate contaminant loading and test duration must be performed in advance to insure treatment is sufficient. Any on-site treatment should also include at least one discharge effluent sample analysis by an approved laboratory to document treatment effectiveness.

10.3.2 Pre-Test Water Level Monitoring

Water-level conditions in the test area should be monitored for at least one week prior to initiation of testing to identify background trends and factors influencing groundwater levels in the test area. Data loggers should be deployed in all wells to be utilized in the pumping test and set to record depth or pressure at a resolution that is high enough to identify any potential trends (generally a 15 minute recording interval is sufficient for background monitoring). A manual water level should be measured with a water-level meter or interface probe and referenced to the top of casing mark to calibrate the data logger data at the time of deployment and at sufficient intervals throughout the recording period to validate the data and provide backup data in the event that a data logger was to fail.

Ideally, groundwater levels should be static prior to starting a pumping test so that pumping influences alone can be readily evaluated. Any significant precipitation events within the previous several days (documented through use of a site rain gauge or nearby weather station) will usually result in noticeable water level changes. If there are any major water level changes observed that cannot be explained prior to testing, additional investigation into possible area influences (e.g., local well pumping or construction de-watering) should be conducted.

10.3.3 Pumping Test Set Up

Prior to starting the test, all well measuring points (i.e. top of casing) should be clearly marked and preferably surveyed to the nearest 0.01 feet in elevation. The horizontal distance between all wells utilized should be measured and illustrated on a base map. If there are any surface water bodies in the vicinity, a staff gauge (or similar measuring device) should be set up and surveyed to evaluate possible test influences on water levels or stream flow.

The preferred pump to be used for a pumping test is a submersible centrifugal pump powered by either existing site power or a portable generator. These pumps are not explosion proof, so a conductivity probe must be tied into the pump controls to alleviate any possibility of product coming into contact with the pump (if product is anticipated). If the test pump is designed to pump total fluids (e.g. air operated double diaphragm pump, jack pump, etc.) discharge must either be containerized, or treatment must include an oil/water separator to handle any floating product. The submersible pump should be set deep enough to maintain flow during the test period or at a maximum of just above the screened interval, using a handling line to support the pump's weight [**NOTE:** extreme care must be taken that the power cord is neither bearing any of the pumps weight, nor damaged during installation due to the potential for severe electric shock]. A check valve (or two check valves) should be installed above the pump in the discharge line to prevent backflow into the well after testing.

Discharge piping from the pump should include a flow meter (preferably with totalizer), followed by a flow adjustment valve. The flow meter should be installed in a straight section of hard piping of sufficient length to avoid meter distortion caused by turbulence (typically about 10 pipe diameters on either side of the meter). In low-flow pumping tests, flow rate can be calculated by measuring the exact time required to fill a known-sized container (bucket and stop watch) several times throughout the testing period. The bucket and stop watch method of estimating flow should also be used to back up and check the flow meter data.

Precise and frequent water-level measurements (to the nearest 0.01 feet) and time denotations before, during, and after pumping tests are critical to achieving accurate test results. In terms of prioritization, data loggers should be utilized in at least the pumping well and observation wells closest to the pumping well. Wells further from the pumping well may be manually monitored, due to the reduced likelihood that early-time drawdown will be critical at distal locations. Back-up manual measurements should be collected at least hourly during the first 8 hours of the test, and then at least every 3 hours, to verify data logger measurements. Readings from the transducers are not completely reliable until they have been submerged for at least 30 minutes (sensor equilibration period). All field personnel should have watches with a second hand, and they should all be calibrated to the same time. Liquid level measurements should be obtained using an optical oil/water interface probe with a graduated measuring tape to 0.01 foot accuracy for those wells with floating product. For wells without product, a water-level meter may be sufficient. All non-dedicated probes must be properly decontaminated after each level reading to prevent any possibility of cross- contamination between wells.

Data loggers should be deployed in each selected well to a depth that will maintain submergence through the test period. Data loggers selected should be capable of being submerged to that anticipated depth (typically noted on the instrument body). The transducer cable should be secured at the wellhead (manufacturer supplied hangers, well caps, or electrical tape/cable ties) to minimize any movement of the sensor. Care must be taken that the transducer cable is not damaged from rough edges at the well head, and that no vehicles run over the cable. The data logger installed in the pumping well will need to be installed at a depth that will maintain submergence through the test, but also remain clear of the submersible pump (and pump noise if possible). In addition, wells with floating product may require an inner PVC stilling well surrounding the data logger cable to prevent damage from contact with the product. A stilling well may also eliminate the need for any water-level corrections for product thickness.

10.3.4 Running the Test

Once the data loggers have been deployed and secured, tests should be set up in each device and each device either started or "future" started to begin logging when the pump is turned on. The data logger in the pumping well should be set to logarithmic logging mode to capture sub-second data during the early portion of the test. If possible, the pump discharge control valve should be have been pre-set (based on the step test or mini pump test) to the desired flow rate prior to turning on the pump. However, depending on the test pumps performance curves, minor flow rate adjustments are generally needed during the first hour or two of the test to correct for the additional lift required by the pump due to increasing drawdown. In addition, movement of the discharge hose after the test has been started should be avoided, since any change in the elevation of the discharge will affect the pumping rate. All changes in flow rate should be recorded and time stamped.

A minimum of two field personnel are needed to run a pumping test, with additional personnel required for tests with multiple observations wells or additional complexity. One person should be designated to turn on the pump, monitor and adjust flow rate, maintain discharge and treatment, maintain the generator, etc. The second person should be responsible for data logger management and manual water-level measurements. As a rule of thumb regarding the frequency of manual well gauging, one measurement every half minute during the first 5 to 10 minutes, followed by one measurement every 3 to 5 minutes during the first hour, one measurement every 10 to 20 minutes for the second hour, and one hourly measurement thereafter is acceptable.

Throughout the test, data loggers should be downloaded in real time through use of direct-read, vented cables (or non-vented with a barometric logger for compensation) to monitor water-level conditions. It is essential that some data reduction be accomplished in the field, so that major water level trends are recognized during the test. At a minimum, drawdown trends from the pumping well and two of the nearest monitoring wells need to be semi-log plotted against time so that deviations indicative of boundary conditions can be discerned before pumping is ceased. This will allow decisions to be made about whether the test should run longer than planned.

Generally, water quality samples are collected during a pumping test for laboratory analysis of constituents of concern. These are generally collected after the first hour of pumping and just prior to pump shutdown. If the test is of more than 24 hours duration, it is advisable to collect additional samples during the testing period. All groundwater samples should be collected following Evergreen Field Procedures.

10.3.5 Post-test Recovery

At the conclusion of the test, water level recovery data should be collected until near-static conditions are re-established. This requires the installation of a check valve in the discharge line above the submersible pump to prevent backflow. The recovery data has the advantage in that there are no variations in the curve produced due to variations in pumping rate and is independent of test length. In water-table aquifers, however, the effects of formation de-watering can cause the recovery trends to be substantially different from drawdown trends. Consequently, recovery (residual drawdown) data should be used in conjunction with drawdown data where possible.

10.3.6 Data Analysis

The data collected during pumping tests are analyzed to estimate aquifer hydraulic properties, such as transmissivity, conductivity, and storage. Data collected by transducers must be downloaded and transformed (dimensionless drawdown or displacement from static) prior to analysis. Analysis typically involves curve matching of site data to type curves established in literature for particular flow regimes. Curve matching is commonly performed utilizing computer software, such as HydroSOLV's AQTESOLV program, along with diagnostic methods and derivative analysis to best estimate aquifer properties through identification of flow regimes and conditions.

It is noted that the mathematical solutions used in pumping test analysis include many assumptions that must be considered in the context of each test area (e.g., the formation is of uniform thickness and of infinite areal extent). In addition, some of the values incorporated into typical pumping test solutions are not actually measured, but are educated estimates (e.g., porosity based on lithology, etc.). Many problems associated with pumping test data evaluation are due to not recognizing, and/or correcting for, deviations from the theoretical solution employed. Some of the more common analytical errors occur due to: partial well penetration effects, formation de-watering effects, casing storage effects, poor pumping well efficiency and/or the application of incorrect equations or units. Consequently, a thorough understanding of the underlying assumptions inherent to the solution employed is required before the validity of the results can be trusted.

PROJECT: **Philly AOI-3 Logs 2015**
LOCATION: **Philly AOI-3**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
AOI4_BH-15-1
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **10/9/15** COMPLETED: **10/26/15**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **NS**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **10.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILT LITTLE CLAY LITTLE GRAVEL ; orangeish brown; fine-grained; moist; subrounded		0845 BH-15-1 _0-2			2	
					OI4_BH-15-1@ 2-4'			0.0	
5			**SANDY SILT LITTLE GRAVEL** ; orangeish brown; fine to medium-grained; moist; subrounded		OI4_BH-15-1@ 4-6'			0.0	5
			SAND AND GRAVEL ; reddish brown; fine to medium-grained; moist; subangular		OI4_BH-15-1@ 6-8'			0.0	
			SANDY SILT LITTLE GRAVEL ; reddish brown; fine to medium-grained; moist; subrounded		OI4_BH-15-1@ 8-10'			0.0	
10			Refusal at 10 feet. Borehole terminated at 10 feet.						10
15									15
20									20
25									25
30									30
35									35

A014

Company Confidential

LOG of BORING No. AS-9

DATE 2/15/82 SURFACE ELEV. ______ LOCATION See Plate

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Loose brown coarse to fine SAND					
5	■	3	Firm brown and gray mottled clayey SILT					
10	■	P						
15	■		Dense gray and brown coarse to fine SAND and GRAVEL					
20	■							
25	■		Loose brown silty fine SAND					
30	■							
35								

COMPLETION DEPTH 32.0 feet FLUID Depth enc. @ 25 ft. Date 2/15/82

SAMPLER: 2" O.D. SPLIT BARREL SAMPLER

JOB NO 81 C 2256A LOG

WCC

E 0 0 0 0 3 5 8 7

Company Confidential

A01 4

PIEZOMETER INSTALLATION REPORT

Project ARCO REFINERY

Project No. 81C2256 Installed By PFM

Method of Installation Hollow stem auger

Piezometer No. AS-9

Location See Fig.

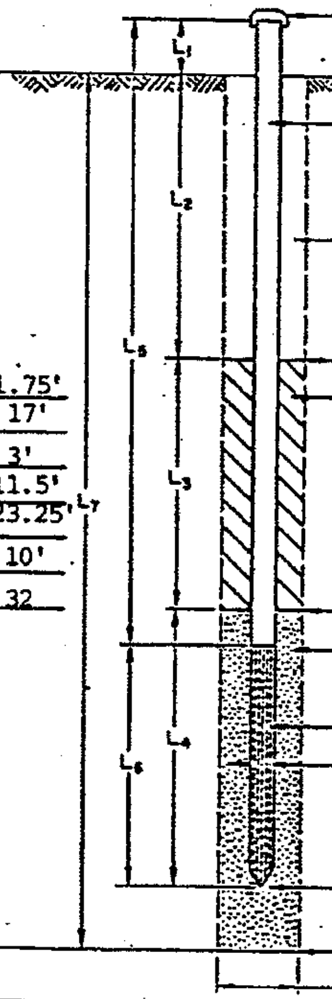
Date 2/15/82 Time

LOG OF BORING AND PIEZOMETER

BORING			PIEZOMETER
Depth in ft.	Description	Symbol	Type of Piezometer PVC

Ground Elev. 17.76'

Top of Riser Elev. 19.51'



L_1 = 1.75'

L_2 = 17'

L_3 = 3'

L_4 = 11.5'

L_5 = 23.25'

L_6 = 10'

L_7 = 32

Remarks

E 0 0 0 0 3 5 9 9

Inspected By PFM

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc.

BOREHOLE NO. **BH-13-81**

Page 1 of 1

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger
SITE LOCATION:	AOI-4	DRILLING METHOD	Hydroexcavation
JOB NO.:		SAMPLING METHOD	4" Hand auger
LOGGED BY:	Luke Mokrycki	TOTAL DEPTH:	10'
DATES DRILLED:	3/20/13		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0					
			(2'-4') Dark brown clay.		
		3.4	(4' - 6') Dark brown clay with small gravels.		
-5					
		2.3	(6' - 8') Brown coarse sand and samll gravels.		
	*Sample collected at 8' - 10' by hand auger for laboratory analysis.	4.0	(8' 10') Red-brown coarse sand with small gravels.		Boring terminated at 10'.
-10					

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc.

BOREHOLE NO. **BH-13-90**

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger
SITE LOCATION:	AOI-4	DRILLING METHOD	Hydroexcavation
JOB NO.:		SAMPLING METHOD	4" Hand auger
LOGGED BY:	Luke Mokrycki	TOTAL DEPTH:	10'
DATES DRILLED:	3/15/13		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0					
		0.7	(2'-4') Loose gray-brown clay.		
		0.7	(4' - 6') Orange-brown clay.		
-5					
		1.2	(6' - 8') Gray-red clay.		
	*Sample collected at 8' - 10' by hand auger for laboratory analysis.	1.8	(8' 10') Brown-gray clay with small gravels..		Boring terminated at 10'.
-10					

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc

BOREHOLE NO. **BH-13-91**

PROJECT: Sunoco - Philadelphia Refinery
SITE LOCATION: AOI-4
JOB NO.:
LOGGED BY: Luke Mokrycki
DATES DRILLED: 3/14/13

DRILLING CO.: Badger
DRILLING METHOD: Hydroexcavation
SAMPLING METHOD: 4" Hand auger
TOTAL DEPTH: 10'

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITHOLOGY	COMMENTS
0	*Sample collected at 0-2' by hand auger for laboratory analysis.	3.4	(0-2') Brown clay and small gravels.		
		1.8	(2'-4') Dark brown clay with small gravels.		
		1.8	(4' - 6') Brown black fine sands.		
-5					
		2.2	(6' - 8') Gray green clay with small gravels.		
	*Sample collected at 8' - 10' by hand auger for laboratory analysis.	2.8	(8' 10') Brown gravel and coarse sands, moist.		Boring terminated at 10'.
-10					

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc

BOREHOLE NO. **BH-13-92**

PROJECT: **Sunoco - Philadelphia Refinery**
SITE LOCATION: **AOI-4**
JOB NO.:
LOGGED BY: **Luke Mokrycki**
DATES DRILLED: **3/18/13**

DRILLING CO.: **Badger**
DRILLING METHOD **Hydroexcavation**
SAMPLING METHOD **4" Hand auger**
TOTAL DEPTH: **10'**

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0					
			(2'-4') Gray - tan clayey silt.		
		0	(4' - 6") Medium brown clay, loose.		
-5					
		0	(6' - 8') Medium brown, cohesive clay.		
	*Sample collected at 8' - 10' by hand auger for laboratory analysis.	0.3	(8' 10') Red-brown gravelly clay, some sands.		
-10					

SUBSURFACE BORING LOG

Aquaterra Technologies, Inc

BOREHOLE NO. **BH-13-94**

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger
SITE LOCATION:	AOI-4	DRILLING METHOD	Hydroexcavation
JOB NO.:		SAMPLING METHOD	4" Hand auger
LOGGED BY:	Luke Mokrycki	TOTAL DEPTH:	10'
DATES DRILLED:	3/15/13		

DEPTH (feet)	SAMPLE INTERVAL	PID (ppm)	LITHOLOGY DESCRIPTION	LITH-OLOGY	COMMENTS
0	*Sample collected at 0-2' by hand auger for laboratory analysis.	0.7	(0-2') Loose brown clay.		
		0.2	(2'-4') Loose brown clay, small gravel.		
		0.5	(4' - 6') Brown and gray clay, cohesive.		
-5					
		0.7	(6' - 8') Gray and brown clay.		
	*Sample collected at 8' - 10' by hand auger for laboratory analysis.	2.8	(8' 10') Gray clay.		Boring terminated at 10'.
-10					

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-001
PAGE 1 OF 1

DRILLING / INSTALLATION:
STARTED **6/21/16** COMPLETED: **7/15/16**
DRILLING COMPANY: **Sweeney/TQD**
DRILLING EQUIPMENT: **Backhoe/Tripod**
DRILLING METHOD: **Backhoe/Tripod**
SAMPLING EQUIPMENT: **Hand Auger/Spoon**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **16.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			CLAY SOME SILT ; light brown; slightly moist		12:05 BH-16-001 0-2 -20160621			0.1	
								0.1	
			CLAY SOME SILT ; light brown with light gray; moist		BH-16-001@ 1-2'			0.1	
			CLAY ; light brown and gray; moist		BH-16-001@ 2-3'			0.1	
			CLAY ; light brown and gray; moist		BH-16-001@ 3-4'			0.1	
5			**CLAY** ; gray and dark gray; moist; Color light brown.		BH-16-001@ 4-5'			6.8	5
			CLAY ; gray with brown; Color black.		BH-16-001@ 5-6'			5.8	
			CLAY ; brown with gray; Color dark gray.		BH-16-001@ 6-7'			35.8	
			SILTY CLAY WITH GRAVEL ; red and gray; With multicolored rounded small gravels.		BH-16-001@ 7-8'				
					BH-16-001@ 8-10'			46.0	
10			**SILT WITH GRAVEL** ; gray and brown; angular; loose		BH-16-001@ 10-12'			67.0	10
			CLAYEY SILT WITH FINE GRAVEL ; gray to dark gray; moist; rounded to angular gravel		BH-16-001@ 12-14'			89.0	
15			**SAND WITH MEDIUM TO COARSE GRAVEL** ; tan and gray; fine to coarse-grained; wet; Red sands with multicolored rounded to angular gravels		14:00 BH-16-001 14-16 -20160715			216.0	15
			Borehole terminated at 16 feet.						
20									20
25									25

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-002** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/21/16** COMPLETED: **6/23/16** DRILLING COMPANY: **Sweeney/TQD** DRILLING EQUIPMENT: **Backhoe/Tripod** DRILLING METHOD: **Backhoe/Tripod** SAMPLING EQUIPMENT: **Hand Auger/Spoon**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **12** LOGGED BY: **LM** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY ; light brown; slightly moist		14:25 BH-16-002 0-2 -20160621			0.1	
			SILTY CLAY ; light brown; slightly moist		BH-16-002@ 1-2'			0.1	
			SILTY CLAY ; light brown		BH-16-002@ 2-3'			0.1	
			CLAY ; light brown with brown; Color light gray		BH-16-002@ 3-4'			0.0	
			CLAY ; light brown with brown		BH-16-002@ 4-5'			0.1	
5			**CLAY** ; brown with light brown		BH-16-002@ 5-6'			0.0	5
			CLAY ; brown with light brown; Color dark brown		BH-16-002@ 6-7'			0.0	
			SANDY CLAY ; brown with light brown; fine to medium-grained		BH-16-002@ 7-8'			0.0	
			CLAYEY SILT AND FINE SAND ; light brown and gray		BH-16-002@ 8-10'			6	
10			**GRAVELLY SILT AND SAND** ; light brown and red		BH-16-002@ 10-12'			7.3	10
			SANDY GRAVEL WITH SILT ; brown and gray; Color pink		BH-16-002@ 12-14'			10	
15			**SAND AND GRAVEL** ; gray and pink; rounded; Multicolored (gray, pink, tan, orange)		14:00 BH-16-002 14-16 -20160718			17	15
			Borehole terminated at 16 feet.						
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-003
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:	NORTHING (ft):
STARTED **8/24/16** COMPLETED: **8/24/16**	EASTING (ft):
DRILLING COMPANY: **Sweeney**	LAT:
DRILLING EQUIPMENT: **Backhoe**	LONG:
DRILLING METHOD: **Backhoe**	GROUND ELEV (ft):
SAMPLING EQUIPMENT: **Hand Auger**	TOC ELEV (ft):
	INITIAL DTW (ft): **Not Encountered**
	WELL DEPTH (ft): **---**
	STATIC DTW (ft): **Not Encountered**
	BOREHOLE DEPTH (ft): **15.0**
	WELL CASING DIA. (in): **---**
	BOREHOLE DIA. (in): **12**
	LOGGED BY: **SS**
	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0-2			**GRAVEL WITH SILT** ; tan and brown; dry		10:45 BH-16-003 0-2 -20160824			43.3	
2-4			**SILT** ; tan and brown; dry		BH-16-003@ 2-4'			35.3	
4-6 (5)			**SILT** ; brown; dry		BH-16-003@ 4-6'			42.6	5
6-8			**SILT SOME SAND** ; brown and gray; slightly moist		BH-16-003@ 6-8'			45.1	
8-10					BH-16-003@ 8-10'			36.8	
10-12 (10)					BH-16-003@ 10-12'			39.2	10
12-14					BH-16-003@ 12-14'			43.4	
14-15			**SILT LITTLE SAND TRACE CLAY** ; brown and gray; moist		11:00 BH-16-003 14-15 -20160824			46.0	
15			Borehole terminated at 15 feet.						15
20									20
25									25

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-004** PAGE 1 OF 1 Aquaterra Technologies, Inc.

DRILLING / INSTALLATION: STARTED **8/24/16** COMPLETED: **8/24/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **SS**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **15.0** BOREHOLE DIA. (in): **12** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0-2			**GRAVEL WITH SILT** ; brown and gray; slightly moist; Fill (rip rap)		08:55 BH-16-004 0-2 -20160824			31.9	
2-4			**SILT LITTLE GRAVEL** ; brown and gray; slightly moist; rounded		BH-16-004@ 2-4'			33.0	
4-6 (5)			**SILTY SAND LITTLE GRAVEL** ; brown; slightly moist; rounded; less silt at 6' bgs.		BH-16-004@ 4-6'			24.2	5
6-8					BH-16-004@ 6-8'			10.3	
8-10 (10)					BH-16-004@ 8-10'			11.1	10
10-12					BH-16-004@ 10-12'			14.1	
12-14					BH-16-004@ 12-14'			22.7	
14-15 (15)			**SANDY CLAY** ; orange and gray; moist		09:55 BH-16-004 14-15 -20160824			46.1	15
			Borehole terminated at 15 feet.						
20									20
25									25

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-005** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/23/16** COMPLETED: **6/23/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **14.5** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **12** LOGGED BY: **LM** CHECKED BY: **MS**

Aquaterra Technologies, Inc.

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–2			**CLAYEY SILT WITH FINE GRAVEL AND COARSE SAND** ; brown and gray		09:00 BH-16-005 0-2 -20160623			6.0	
2–6			**SILT** ; black and greenish gray		BH-16-005@ 2-4'			15.0	
5					BH-16-005@ 4-6'			28.0	5
6–8			**CLAYEY SILT** ; brown and tan; Colors: brown, tan, gray, and green		BH-16-005@ 6-8'			52.0	
8–10			**SANDY SILT WITH SILT** ; brown; fine-grained		BH-16-005@ 8-10'			38.0	
10			**SILT** ; brown and gray; moist		BH-16-005@ 10-12'			82.0	10
12–14.5			**SILT** ; brown; wet		11:00 BH-16-005 14-15 -20160623			187.0	
15			Borehole terminated at 14.5 feet.						15
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:

BH-16-006

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/23/16** COMPLETED: **6/23/16**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **---**
LOGGED BY: **LM**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **---**
BOREHOLE DEPTH (ft): **16.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILT ; tan		13:00 BH-16-006 0-2 -20190623			0.1	
			SILT ; tan and brown		BH-16-006@ 2-4'			2.1	
5			**CLAYEY SILT** ; brown and tan		BH-16-006@ 4-6'			6.7	5
					BH-16-006@ 6-8'			13.0	
			SILTY CLAY ; tan and gray		BH-16-006@ 8-10'			33.0	
10			**SILTY CLAY** ; gray and orange		BH-16-006@ 10-12'			38.0	10
			SILTY CLAY ; gray and orangeish red; moist		BH-16-006@ 12-14'			39.0	
15			**SILTY CLAY** ; gray and orangeish red; wet		14:00 BH-16-006 14-15 -20160623			43.0	15
			Borehole terminated at 16 feet.						
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-007** PAGE 1 OF 1
DRILLING / INSTALLATION: STARTED **6/24/16** COMPLETED: **6/24/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **2** LOGGED BY: **LM** CHECKED BY: **MS**

Aquaterra Technologies, Inc.

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–4			**SILTY CLAY** ; dark; loose to soft		13:30 BH-16-007 0-2 -20160627			1.0	
					BH-16-007@ 2-4'			1.0	
5			**SANDY SILT** ; dark brown and gray		BH-16-007@ 4-6'			0.0	5
			SANDY SILT ; dark brown and gray; moist		BH-16-007@ 6-8'			3.0	
			SANDY SILT ; brown and gray		BH-16-007@ 8-10'			2.0	
10			**SANDY CLAY WITH SILT** ; light brown and gray; moist; with dark red sandy clays.		BH-16-007@ 10-12'			4.0	10
			CLAY WITH SILT AND SAND ; gray and tan; moist		BH-16-007@ 12-14'			8.0	
15			**GRAVELLY SAND** ; dark red; wet		15:00 BH-16-007 14-15 -20160627			9.0	15
			Borehole terminated at 16 feet.						
20									20
25									25

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-4**	**BH-16-008** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/14/16** COMPLETED: **6/14/16**	LAT:	LONG:
DRILLING COMPANY: **Aquaterra**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Hand Auger**	INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **---**
DRILLING METHOD: **Hand Auger**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **2.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM**	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–2			**SILT WITH FINE TO MEDIUM GRAVEL AND CLAY** ; tan to gray; rounded		13:00 BH-16-008 0-2 -20160614			0.0	
2			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-009** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **6/14/16** COMPLETED: **6/14/16** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **2** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			White; Fill (rip rap)		11:00 BH-16-009 0-2 -20160614 BH-16-009@ 0.5-1.5' BH-16-009@ 1.5-2'			0.0	
			SILTY CLAY WITH GRAVEL ; dark brown with gray; Red silty clay, with small rounded tan gravels.					0.1	
			CLAY WITH SAND AND SILT ; black; With sand and silt.						
			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-010** PAGE 1 OF 1		
DRILLING / INSTALLATION: STARTED **6/14/16** COMPLETED: **6/14/16** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **2** CHECKED BY: **MS**	

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY ; light brown to brown; mottled; Colors: light brown, brown, dark red, gray, and tan		09:00 BH-16-010 0-2 -20160614			0.1	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-011
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:	NORTHING (ft):
STARTED **6/13/16** COMPLETED: **6/13/16**	EASTING (ft):
DRILLING COMPANY: **Aquaterra**	LAT:
DRILLING EQUIPMENT: **Hand Auger**	LONG:
DRILLING METHOD: **Hand Auger**	GROUND ELEV (ft):
SAMPLING EQUIPMENT: **Hand Auger**	TOC ELEV (ft):
	INITIAL DTW (ft): **Not Encountered**
	WELL DEPTH (ft): **---**
	STATIC DTW (ft): **Not Encountered**
	BOREHOLE DEPTH (ft): **2.0**
	WELL CASING DIA. (in): **---**
	BOREHOLE DIA. (in): **2**
	LOGGED BY: **LM**
	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Black; Fill (slag)		11:15 BH-16-011 0-2 -20160613 BH-16-011@ 0.5-2'			0.0	
			CLAY WITH COARSE SAND ; light brown to dark brown					0.0	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-012
PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/13/16** COMPLETED: **6/13/16**
DRILLING COMPANY: **Aquaterra**
DRILLING EQUIPMENT: **Hand Auger**
DRILLING METHOD: **Hand Auger**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **2.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **2**
LOGGED BY: **LM**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			Brown black; Fill (slag)		10:00 BH-16-012 0-2 -20160613			0.1	
			CLAY ; yellow orange		BH-16-012@ 0.5-1'			0.5	
			CLAY ; dark gray brown; moist		BH-16-012@ 1-2'			1.1	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-013 PAGE 1 OF 1

DRILLING / INSTALLATION:
STARTED **6/30/16** COMPLETED: **6/30/16**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **14.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **12**
LOGGED BY: **LM**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SANDY SILT WITH GRAVEL ; tan to dark brown; With small gravels.		10:00 BH-16-013 0-2 -20160630			1.0	
			SILTY CLAY WITH GRAVEL ; dark brown; With metallic gravels.		BH-16-013@ 2-4'			1.0	
5			**SILTY CLAY WITH GRAVEL AND SAND** ; dark brown; With sandy gravels.		BH-16-013@ 4-6'			2.0	5
			CLAYEY SILT ; dark brown; moist		BH-16-013@ 6-8'			14.0	
			SANDY SILT WITH CLAY ; dark tan to dark brown; moist; Sheen visible.		BH-16-013@ 8-10'			24.0	
10			**CLAYEY SILT** ; brown gray; moist; Colors: brown, gray, and tan		BH-16-013@ 10-12'			32.0	10
			SILTY CLAY ; dark gray to dark brown; wet		12:30 BH-16-013 13-14 -20160630			136.0	
			Borehole terminated at 14 feet.						
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-014** PAGE 1 OF 1	Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/29/16** COMPLETED: **6/29/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **14.0** BOREHOLE DIA. (in): **12** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY ; gray and tan; Some black staining.		10:00 BH-16-014 0-2 -20160629			63.0	
			CLAYEY SILT ; brown and gray; mottled		BH-16-014@ 2-4'			84.0	
5			**CLAYEY SILT** ; dark gray to brown		BH-16-014@ 4-6'			181.0	5
			CLAYEY SAND WITH GRAVEL AND SILT ; dark gray and black; moist; Refusal at 6' bgs. Moved boring 15' SE corner of Pump House 15.		BH-16-014@ 6-8'			276.0	
			CLAY ; black and gray; moist; Green clay.		BH-16-014@ 8-10'			294.0	
10			**SILTY CLAY WITH GRAVEL** ; black to gray		BH-16-014@ 10-12'			323.0	10
			SILTY SAND WITH GRAVEL ; black and gray; wet; rounded; With multicolored gravel.		14:00 BH-16-014 13-14 -20160629			387.0	
			Borehole terminated at 14 feet.						
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:

BH-16-015

PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/22/16** COMPLETED: **6/22/16**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **15.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **12**
LOGGED BY: **LM**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0–2			**CLAYEY SILT** ; dark brown and dark gray		12:30 BH-16-015 0-2 -20160622			0.1	
2–4			**CLAYEY SILT GRAVEL** ; light brown; rounded		BH-16-015@ 2-4'			3.0	
4–6			**CLAYEY SILT** ; brown to gray		BH-16-015@ 4-6'			3.0	
6–8			**CLAYEY SILT** ; dark brown and gray; moist		BH-16-015@ 6-8'			3.8	
8–10			**SILT** ; reddish orange and gray; moist		BH-16-015@ 8-10'			4.6	
10–12			**SAND WITH GRAVEL** ; red and brown; fine to coarse-grained; rounded		BH-16-015@ 10-12'			8.0	
12–15			**SANDY GRAVEL SOME CLAY** ; tan and dark gray; coarse-grained; rounded		BH-16-015@ 12-14'			13.0	
					14:25 BH-16-015 13-15 -20160622			15.0	
15			Borehole terminated at 15 feet.						

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-016

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **6/20/16** COMPLETED: **6/21/16**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):	EASTING (ft):
LAT:	LONG:
GROUND ELEV (ft):	TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **16.0**
WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **12**
LOGGED BY: **LM**	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY ; brown to dark brown; Trace of mica.		10:30 BH-16-016 0-2 -20160620			0.0	
			SILTY CLAY ; brown to gray		BH-16-016@ 2-4'			0.1	
5			**SILTY CLAY WITH FINE SAND** ; brown to gray; To black silty clays.		BH-16-016@ 4-6'			3.0	5
			CLAY WITH SILT WITH FINE SAND ; dark gray and black; Tan clay.		BH-16-016@ 6-8'			3.0	
			CLAYEY SILT WITH FINE SAND ; dark gray to light reddish brown		BH-16-016@ 8-10'			8.0	
10			**SILTY CLAY** ; gray and brown		BH-16-016@ 10-12'			8.7	10
			CLAYEY SILT ; gray to brown; moist		BH-16-016@ 12-14'			10.0	
15			**SILT** ; gray with brown; wet; cohesive		10:00 BH-16-016 14-16 -20160621			12.0	15
			Borehole terminated at 16 feet.						
20									20
25									25

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-4**	**BH-16-017** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/21/16** COMPLETED: **6/21/16**	LAT:	LONG:
DRILLING COMPANY: **Sweeney**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **---**
DRILLING METHOD: **Backhoe**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **14.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **12**
	LOGGED BY: **LM**	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			CLAY ; gray and brown; high plasticity; soft to medium soft.		12:30 BH-16-017 0-2 -20160621			0.0	
			SANDY SILT ; gray and brown; fine to coarse-grained; Color: gray, brown, and black		BH-16-017@ 2-4'			3.0	
5			**SILT SOME CLAY** ; light gray		BH-16-017@ 4-6'			3.0	5
			SILT ; brown and gray; moist		BH-16-017@ 6-8'			12.0	
			SILTY CLAY ; brown and gray		BH-16-017@ 8-10'			15	
10			**SILTY CLAY** ; gray and brown		BH-16-017@ 10-12'			23	10
			SAND WITH GRAVEL ; reddish brown; coarse-grained; rounded; with multicolored gravel		14:30 BH-16-017 12-14 -20160621			32	
			Borehole terminated at 14 feet.						
15									15
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-018** PAGE 1 OF 1	Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/28/16** COMPLETED: **6/28/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **LM**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **16.0** BOREHOLE DIA. (in): **12** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILT ; dark tan to dark gray; moist		10:00 BH-16-018 0-2 -20160628			1.0	
			SILT WITH COARSE SAND ; dark gray; fine-grained; With brown sand (coarse).		BH-16-018@ 2-4'			2.0	
5			**SAND** ; brown and tan; fine to coarse-grained		BH-16-018@ 4-6'			3.0	5
			SAND WITH GRAVEL ; brown and tan; coarse-grained; Dark red angular gravels.		BH-16-018@ 6-8'			17.0	
			SAND WITH GRAVEL ; brown tan; coarse-grained; White sands, with multicolored gravels.		BH-16-018@ 8-10'			23.0	
10			**SAND WITH CLAY SILT** ; fine to coarse-grained; moist; Multicolored sands with white gray silty clay.		BH-16-018@ 10-12'			33.0	10
			CLAY WITH SAND AND GRAVEL ; moist; Multicolored clay with sands and gravels.		BH-16-018@ 12-14'			43.0	
15			**SANDY SILT WITH GRAVEL** ; fine to coarse-grained; wet; Multicolored sandy silts with rounded gravels.		11:00 BH-16-018 14-15 -20160628			82.0	15
			Borehole terminated at 16 feet.						
20									20
25									25

PROJECT: **Philadelphia Refinery**
LOCATION: **AOI-4**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
BH-16-019

DRILLING / INSTALLATION:
STARTED **6/27/16** COMPLETED: **6/27/16**
DRILLING COMPANY: **Sweeney**
DRILLING EQUIPMENT: **Backhoe**
DRILLING METHOD: **Backhoe**
SAMPLING EQUIPMENT: **Hand Auger**

NORTHING (ft):
EASTING (ft):
LAT:
LONG:
GROUND ELEV (ft):
TOC ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
WELL DEPTH (ft): **---**
STATIC DTW (ft): **Not Encountered**
BOREHOLE DEPTH (ft): **14.0**
WELL CASING DIA. (in): **---**
BOREHOLE DIA. (in): **12**
LOGGED BY: **LM**
CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			CLAYEY SILT ; dark brown and gray		12:30 BH-16-019 0-2 -20160627			0.0	
			SILT ; brown and gray; soft		BH-16-019@ 2-4'			1.0	
			SILT ; gray to brown; moist		BH-16-019@ 4-6'			2.0	
			CLAYEY SILT WITH FINE GRAVEL ; orangeish brown to gray; angular		BH-16-019@ 6-8'			3.0	
			CLAYEY SILT ; gray to dark gray; hard; moist; cohesive		BH-16-019@ 8-10'			37.0	
			SANDY SILT SOME CLAY ; red brown; fine to coarse-grained; moist; dark red sandy silt with some gray clay.		BH-16-019@ 10-12'			43.0	
			SAND AND FINE TO MEDIUM GRAVEL ; reddish orange and brown; coarse-grained; wet; rounded		14:30 BH-16-019 13-15 -20160627			101.0	
			Borehole terminated at 14 feet.						

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-4**	**BH-16-020** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/24/16** COMPLETED: **6/24/16**	LAT:	LONG:
DRILLING COMPANY: **Sweeney**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **Backhoe**	INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **---**
DRILLING METHOD: **Backhoe**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **14.0**
SAMPLING EQUIPMENT: **Hand Auger**	WELL CASING DIA. (in): **---**	BOREHOLE DIA. (in): **12**
	LOGGED BY: **LM**	CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			CLAYEY SILT ; brown and gray; mottled		10:00 BH-16-020 0-2 -20160624			218.0	
			SILT ; gray and brown; soft		BH-16-020@ 2-4'			43.0	
5			**SILT** ; brown; fine-grained; soft; cohesive		BH-16-020@ 4-6'			17.0	5
			SILT ; brown; fine-grained; moist		BH-16-020@ 6-8'			15.0	
			SANDY SILT ; dark gray; fine-grained; loose		BH-16-020@ 8-10'			12.0	
10			**SAND SOME SILT AND FINE GRAVEL** ; brown and gray; moist		BH-16-020@ 10-12'			40.0	10
			SILTY SAND ; brown and gray; fine-grained; wet		12:30 BH-16-020 13-15 -20160624			57.0	
15			Borehole terminated at 14 feet.						15
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-021** PAGE 1 OF 1 Aquaterra Technologies, Inc.
DRILLING / INSTALLATION: STARTED **6/22/16** COMPLETED: **6/22/16** DRILLING COMPANY: **Sweeney** DRILLING EQUIPMENT: **Backhoe** DRILLING METHOD: **Backhoe** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): EASTING (ft): LAT: LONG: GROUND ELEV (ft): TOC ELEV (ft): INITIAL DTW (ft): **Not Encountered** WELL DEPTH (ft): **---** STATIC DTW (ft): **Not Encountered** BOREHOLE DEPTH (ft): **16.0** WELL CASING DIA. (in): **---** BOREHOLE DIA. (in): **12** LOGGED BY: **LM** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
0-2			**SILT** ; gray to brown		09:00 BH-16-021 0-2 -20160622			0	
2-4			**SILT** ; brown and gray		BH-16-021@ 2-4'			0.7	
4-6 (5)			**SILT** ; brown to gray; moist		BH-16-021@ 4-6'			3.1	5
6-10			**SILT** ; reddish brown to greenish brown; moist; Green, brown silts.		BH-16-021@ 6-8' BH-16-021@ 8-10'			5.8 7.0	
10-12 (10)			**SANDY SILT** ; red brown; fine-grained		BH-16-021@ 10-12'			10.0	10
12-14			**CLAYEY SILT** ; red brown; moist		BH-16-021@ 12-14'			14.0	
14-16 (15)			**CLAYEY SILT** ; reddish brown to greenish gray; wet; Green, gray clayey silts.		11:30 BH-16-021 14-15 -20160622			26.0	15
16			Borehole terminated at 16 feet.						
20									20
25									25

PROJECT: **Philadelphia Refinery** LOCATION: **AOI-4** PROJECT NUMBER:	WELL / PROBEHOLE / BOREHOLE NO: **BH-16-022** PAGE 1 OF 1	
DRILLING / INSTALLATION: STARTED **6/23/16** COMPLETED: **6/23/16** DRILLING COMPANY: **Aquaterra** DRILLING EQUIPMENT: **Hand Auger** DRILLING METHOD: **Hand Auger** SAMPLING EQUIPMENT: **Hand Auger**	NORTHING (ft): LAT: GROUND ELEV (ft): INITIAL DTW (ft): **Not Encountered** STATIC DTW (ft): **Not Encountered** WELL CASING DIA. (in): **---** LOGGED BY: **RD**	EASTING (ft): LONG: TOC ELEV (ft): WELL DEPTH (ft): **---** BOREHOLE DEPTH (ft): **2.0** BOREHOLE DIA. (in): **12** CHECKED BY: **MS**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)
			SILTY CLAY ; dark brown; Fill		12:40 BH-16-022 0-2 -20160623 BH-16-022@ 1-2'			17.1	
			SILTY CLAY ; brown black					50.5	
			Borehole terminated at 2 feet.						
5									5
10									10
15									15
20									20
25									25

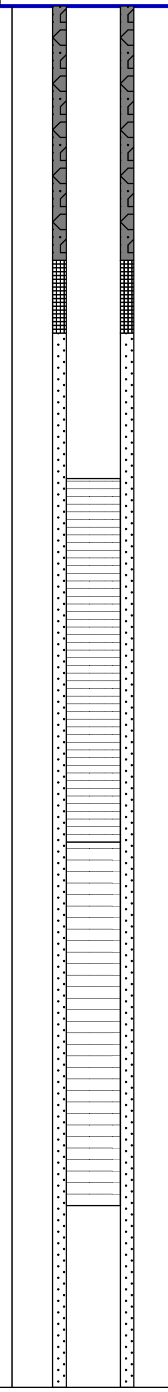
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-700

- PROJECT: **Sunoco-Marcus Hook Refinery**
- SITE LOCATION: **AOI-4/Penrose Ave**
- JOB NO.: **RW-1 in field notes**
- LOGGED BY: **Shaun Sykes**
- DATES DRILLED: **8/27/2010**
- TOTAL DEPTH: **38'**
- DRILLING CO.: **Total Quality Drilling**
- DRILLING METHOD: **Hollow Stem Auger**
- SAMPLING METHOD: **Split Spoon**
- SCREEN/RISER DIAMETER: **4"**
- WELLBORE DIAMETER: **6"**
- ELEVATION: **N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled.	Hand cleared to 8' No soil samples collected	
-5					13' PVC Riser
			Little recovery - backfill sand		
-10	14.5		50% recovery - gray/orange sandy silt, stiff, moist, sl odor		
	38.1				
	10.9		Same with fine gravels to 15'		
	24.7				
	29.9				
-15	327		Brown/red/gray fine/med sands and large gravels, moist, strong odor		10' of 0.01-slot screen
	1358				
	7200				
	1369		Same to 30' - wet at 18'.		
	1776				
-20	1312				
	1201		50% recovery - med brown silty sands and gravels, wet strong vapors		
	704				
	408				
	819				
-25	643				10' of 0.02-slot screen
	405				
	312				
				Hollow stem auger terminal depth = 38'	
-30	7200		Tan/brown sand and mixed gravels, wet, strong odor, some clay		
	1330				
	1227		Same, increased clay content		
	1043				
	7200				
-35	1039		Tan/gray sandy clay, some gravels - same to 38'		5' solid PVC Riser for sump
	889				
	791				

WELL DIAGRAM



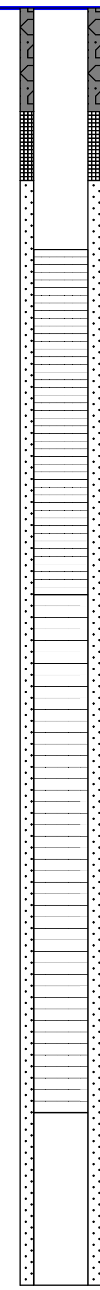
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-701

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-2 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**8/25/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**37'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected	
-5					7' PVC Riser
-10					
-15					10' of 0.01-slot screen
-20					
-25					15' of 0.02-slot screen
-30				Hollow stem auger terminal depth = 40'	
-35					5' solid PVC Riser for sump
-40					

WELL DIAGRAM

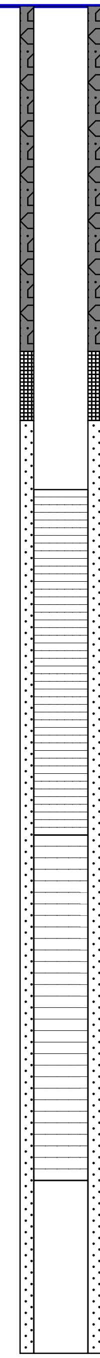


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-702

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-3 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**8/25/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**39'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					14' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					10' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						

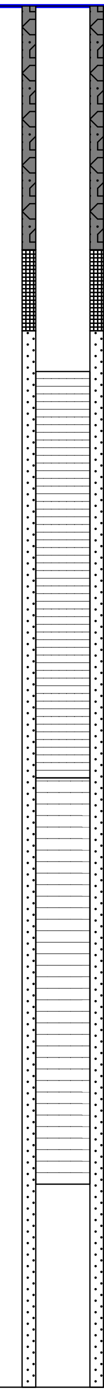


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-703

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-4 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**8/24/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**34'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					9' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					10' of 0.02-slot screen	
-30			Refusal interpreted to be on large gravel/cobble of Trenton Gravel.	Hollow stem auger terminal depth = 34' (refusal)	5' of solid riser (bottom sump)	

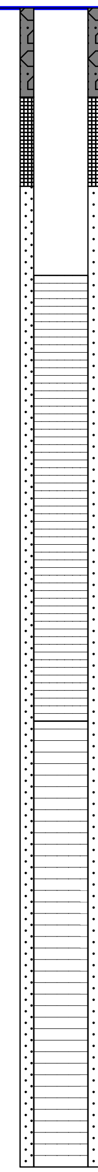


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-704

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-5 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	8/25/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	26'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					6' PVC Riser	
-10					10' of 0.01-slot screen	
-15						
-20					10' of 0.02-slot screen	
-25						
-30			Auger refusal at 31' interpreted to be on large gravel/cobble of Trenton Gravel.	Hollow stem auger terminal depth = 31' (refusal)		



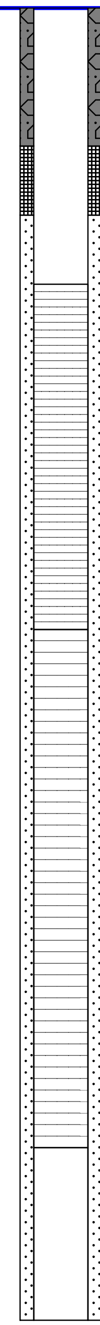
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-705

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-6 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	10/5/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	38'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled.	Hand cleared to 8' No soil samples collected	
-5					8' PVC Riser
	0.0 0.0		25% recovery - some backfilled sand; lt brown sandy silt.		
-10	5.6 10.9 16.2 19.3 32.6		50% recovery - lt brown med sandy silt, stiff, sl odor, some fine gravels - Same to 16'		
-15	73.3 127 303 356 313		25% recovery - brown/gray/white/red fine-med sands and silt with mixed gravels, moist Same as above - wet - STRONG vapors (switch to supplied air)		10' of 0.01-slot screen
-20	297 289 315 263 212		50% recovery - med brown silty sands and gravels, wet strong vapors Same to 40' (trace clay at 36'-40')		
-25	202 193 212 165 173				15' of 0.02-slot screen
-30	209 201 217			Hollow stem auger terminal depth = 40'	
-35	253 176 143 127 115				5' solid PVC Riser for sump
-40					

WELL DIAGRAM

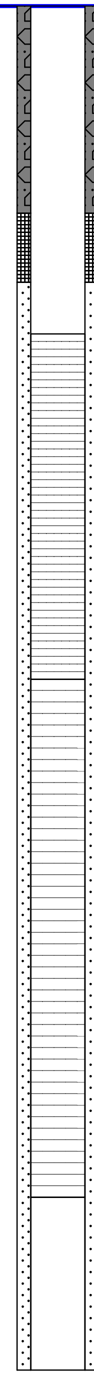


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-706

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-7 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**10/4/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**39.5'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					9.5' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20				High vapors - switch to supplied air at 20'.		
-25					15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						



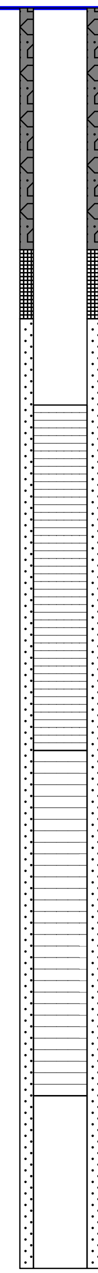
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-707

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-8 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**8/31/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**36.5'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected	
-5					11.5' PVC Riser
			Fill, dark brown sandy silt to 16'		
-10					
-15			16'-22' - large gravels and sand		10' of 0.01-slot screen
-20			22'-26' - large gravels and sand, wet		
-25			26'-40' - wet, medium brown sand and gravels, some silt/clay, odor/vapors		10' of 0.02-slot screen
-30				Hollow stem auger terminal depth = 40'	
-35					5' of solid riser (bottom sump)
-40					

WELL DIAGRAM



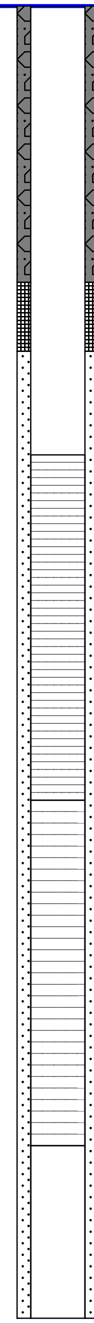
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-708

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-9 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**9/1-2/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**38'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 9' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 9' No soil samples collected NOTE: PID readings are from breathing space during drilling (not soil).	
-5					13' PVC Riser
-10	0.1				
	0.0				
	0.0				
-15	3.2			Hollow stem auger terminal depth = 40'	10' of 0.01-slot screen
	304				
-20	76.9				
	337				
-25	380		Heavy odors and high PID readings in breathing space. Benzene measurements ~370ppm. Stop and switch to Level B work.		10' of 0.02-slot screen
	210				
	330				
-30	20				
-35	267				5' of solid riser (bottom sump)
-40	270				

WELL DIAGRAM



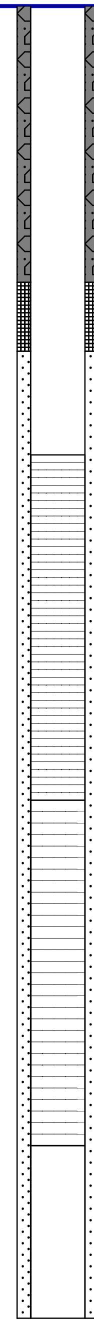
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-709

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-10 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/2/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	38'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 10' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 10' No soil samples collected NOTE: PID readings are from breathing space, not soil.	
-5					13' PVC Riser
-10					
	24.1				
	16.9				
-15				Hollow stem auger terminal depth = 40'	10' of 0.01-slot screen
	3.4				
	4.2				
-20	12				
	50				
-25	19		Heavy odors and high PID readings in breathing space.		
	120				10' of 0.02-slot screen
	308				
-30	306				
	647				
-35	230				
					5' of solid riser (bottom sump)
	303				
	350				
-40					

WELL DIAGRAM



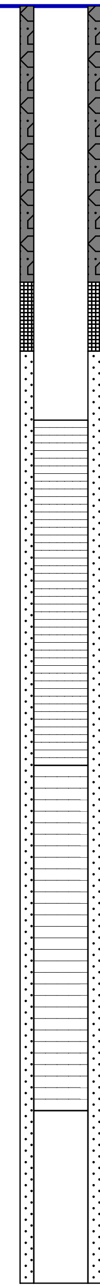
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-710

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-11 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/3-7/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	37'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 9' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 9' No soil samples collected NOTE: PID readings are from breathing space, not soil.	
-5					12' PVC Riser
-10	5.8				
	1.7				
	1.6				
-15	1.0			Hollow stem auger terminal depth = 40'	10' of 0.01-slot screen
	3.5				
-20	8.7				
	10.6				
	15.7				
-25					10' of 0.02-slot screen
-30					
-35					5' of solid riser (bottom sump)
-40					

WELL DIAGRAM

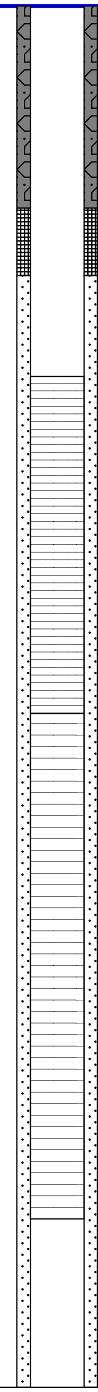


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-711

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-12B in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**9/21/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**41'**	ELEVATION:	**N/A**

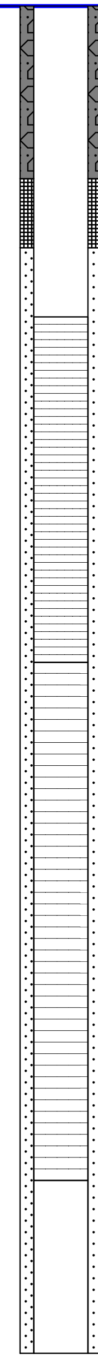
Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					11' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 41'		
-35					5' solid PVC Riser for sump	
-40						



MONITORING WELL LOG: RW-712

Aquaterra Technologies, Inc.

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-12A in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/21/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	39'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					9' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						

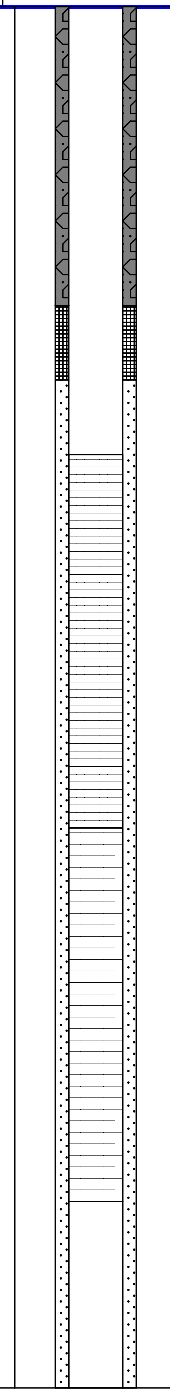
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-713

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-13 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/7/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	37'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected	
-5					12' PVC Riser
-10					
-15					10' of 0.01-slot screen
-20			18'-20' - brown/dk brown sandy silt and gravel, dry to 17'. Odors at 17'. 20'-30' - wet, dk brown silty sand, strong odors/vapors Note: shut down temporarilly due to high vapor concentrations (above LEL).		
-25					10' of 0.02-slot screen
-30				Hollow stem auger terminal depth noted as 30' (not refusal - set shallow due to high vapors) in notes. Well gauged at 37' bgs.	
-35					5' of solid riser (bottom sump)

WELL DIAGRAM

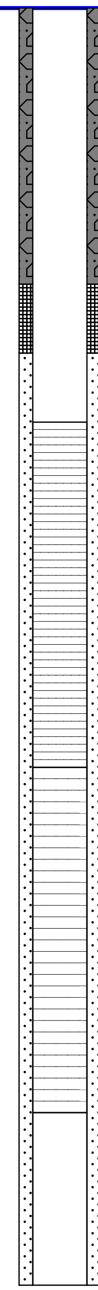


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-714

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-14 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/8/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	37'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					12' PVC Riser	
-10			"Gravels, sand, silty sand" described for whole column			
-15					10' of 0.01-slot screen	
-20						
-25					10' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						



MONITORING WELL LOG: RW-715

Aquaterra Technologies, Inc.

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-15 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**9/15/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**40'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					10' PVC Riser	
-10			8'-25' - Brown fine sandy silt, wet at 16' (30-399 ppm breathing zone)			
-15					10' of 0.01-slot screen	
-20						
-25			25'-40' - Med brown sand and silt, trace clay, odor (100-300 ppm breathing zone)		15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						

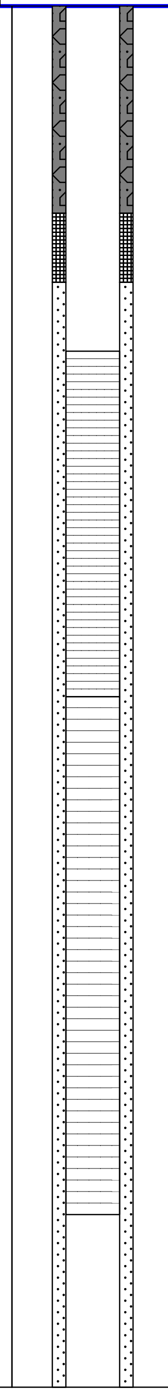
Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-716

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	RW-16 in field notes	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/16/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	40'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected	
-5					10' PVC Riser
-10			8'-20' - Brown fine sandy silt, wet at 16' (5-101 ppm breathing zone)		
-15					10' of 0.01-slot screen
-20			20'-25' - Color change to red-brown, trace clay, very moist, no odor (0-13 ppm breathing zone)		
-25			25'-40' - Wet, brown/gray fine/med sand, less silt with depth (0-5 ppm breathing zone)		15' of 0.02-slot screen
-30				Hollow stem auger terminal depth = 40'	
-35					5' solid PVC Riser for sump
-40					

WELL DIAGRAM

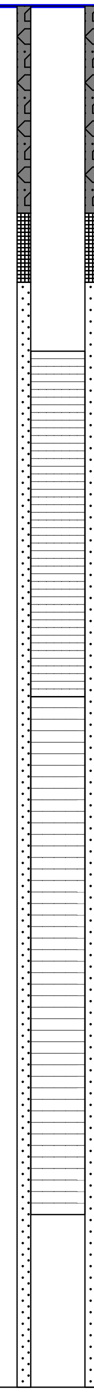


Aquaterra Technologies, Inc.

MONITORING WELL LOG: RW-717

PROJECT:	**Sunoco-Marcus Hook Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI-4/Penrose Ave**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:	**RW-17 in field notes**	SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Shaun Sykes**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**9/17/2010**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**40'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					10' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						



5-24

C.V.M. industries — **geotechnical division inc.**
post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: SOUTH YARD, PHILADELPHIA, PA.
Project No.
Boring No.: SM-32 Depth: 16.0'
Elevation
Spoon Size Casing Size
Core Size Bit No.
Hammers:
Spoon, weight Drop
Drive, weight Drop
Date Started: 3-18-85

Driller: S.B.
Helper: W.G.H.
Inspector: MC
Job No.: 2890

Ground Water Data:
TOTAL PIPE - 19.0'

Date Completed: 3-18-85

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Data: Depth	Sampling Data: No.	Sampling Data: Blows per 6"	REMARKS
		GRANULAR PRODUCT SATURATED MATERIAL (POSSIBLE SOIL FILL) 8.0'				DUE TO OIL LEVEL BEING LESS THAN 1.0' BELOW SURFACE. NO BENTONITE WAS USED. INSTEAD IT WAS FILLED WITH GRAVEL.
		PRODUCT SATURATED SILTY SOIL 16.0'				15.0' OF WELL SCREEN WAS USED TO ASSURE THE TOP OF FLUID LEVEL PENETRATED THE WELL AND WAS NOT CUT OFF.
		COMPLETE AT 16.0'				

SHEET NO. .... OF ....

S-24

C.V.M. industries — **geotechnical division inc.**

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No.: 9200
Boring No.: SM-32 Depth: 10.0'
Elevation:
Spoon Size: Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: Drop:
Drive, weight: Drop:
Date Started: 12-18-84

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:

Date Completed: 12-18-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL 1.0'				
		HIT CRUDE OIL AT 1.0' BUBBLED AND STOPPED DRILLING AT 10.0'				NO PIPE LENGTH INSTALLED
		10.0'				
		CONTACTED MCKEE AND RJ FOR VISUAL CONFIRMATION.	ABANDONED HOLE.			
		INSTRUCTED US TO GO TO NEXT HOLE.				

SHEET NO. .... OF ....

S-26

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania

215-947-2555

Client: ARCO

Project: WELL INSTALLATION

Location: PHILADELPHIA, PA

Project No.: 9200

Boring No.: SM-33 Depth: 24.0'

Elevation:

Spoon Size: Casing Size:

Core Size: Bit No.:

Hammers:

Spoon, weight: Drop:

Drive, weight: Drop:

Date Started: 12-17-84

Driller: SB

Helper: WGH

Inspector: MC

Job No.: 2890

Ground Water Data:
0 HRS: WATER AT 18'8"
TOTAL PIPE - 27.0'

Date Completed: 12-17-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL 0.				3.0' STICK-UP
		SILT AND VERY FINE SAND. TAN - BROWN 10.0'				
		FINE TO COARSE SAND AND GRAVEL MULTI-COLORED 19.0'				
		FINE BROWN SAND WITH TRACE OF CLAY. 24.0'				
		COMPLETE AT 24.0'				

SHEET NO. .... OF ....

S-27

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania

215-947-2555

Client ARCO
Project WELL INSTALLATION
Location SOUTH YARD, PHILADELPHIA, PA.
Project No.
Boring No. SM-42 Depth 34'9"
Elevation
Spoon Size
Casing Size
Core Size
Bit No.
Hammers:
Spoon, weight
Drop
Drive, weight
Drop
Date Started 3-19-85

Driller SB
Helper WGH
Inspector MC
Job No. 2890

Ground Water Data:
0 HRS: WATER AT 36'9"

TOTAL PIPE - 36'9"

Date Completed 3-19-85

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		ASH AND CINDER FILL. 7.0'				PRODUCT ODOR OBVIOUS
		TAN VERY FINE TO FINE SAND AND SILT 14.0'				DUE TO DIFFICULTIES IN DETERMINING WATER LEVEL, APPROXIMATLY 30.0' OF SLOTTED SCREEN WAS INSTALLED.
		BROWN FINE TO COARSE SAND AND GRAVEL				IN THIS WAY, THERE IS MORE THAN ADEQUATE SCREEN FOR THE ADJUSTING WATER LEVEL.
		WITH GRAVEL GRADING INTO A TAN FINE TO MEDIUM SAND. 34'9"				TOP 9.0' WAS SEALED WITH BENTONITE. RISER + ≃ 1' BS WAS SOLID PIPE.
		COMPLETE AT 34'9"				

SHEET NO. .... OF ....

S-28

C.V.M. industries
geotechnical division inc.
post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No. 9200
Boring No. SM-29 Depth 25.0'
Elevation
Spoon Size Casing Size
Core Size Bit No.
Hammers:
Spoon, weight Drop
Drive, weight Drop
Date Started 12-17-84

Driller: SB
Helper: WGH
Inspector: MC
Job No. 2890

Ground Water Data:
O. Hrs: WATER AT 20'8"
TOTAL PIPE - 28.0'

Date Completed 12-17-84

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Data Depth	Sampling Data No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL: CINDER AND ASH 2.5'				
		TAN SANDY SILT 5.0'				PRODUCT ODOR VERY APPARENT
		GREY CLAY. TRACE OF VERY FINE SAND. 12.0'				
		FINE TO COARSE SAND AND GRAVEL. 19.0'				
		GREY FINE SAND. 25.0'				

SHEET NO. .... OF ....

5-29

WELL 59

WELL ELEVATION:
WELL INSTALLED: 12/08/86
WELL DEVELOPED: 12/13/86
WELL DEPTH:

BORING 59

SURFACE ELEVATION:
DRILLING METHOD: H.S.A.
BORING DEPTH:

DEPTH IN FEET	WELL	USCS	DESCRIPTION	BLOWS	% RETAINED	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE
0	2" Sch. 40 PVC	ML	SILT: with a trace of very fine sand, brown					
	Cement Grout		Very moist with H.C. odors					
5								
10								
15		MH	CLAYEY SILT: 14-17 ft. - less odors, gray					
	Bentonite Seal							
	3 bags of sand	SP	SAND: poorly graded sand, medium to coarse, with trace of gravel @ 17 feet, brown	9 11 13 13	62	1		
20		SW	SAND: fine to coarse with some gravel, varied	8 22 55	40	2		

Drilled by CVM Inc.
Logged by J. Lundberg
Client ARCO
Job No. 502-158-02
Page 1 of 2

ENGINEERING ENTERPRISES, INC.

5-29

WELL 59 Cont. | BORING 59 Cont.

Depth in Feet	Well	Soil Type USCS	Boring	Blows	% Retained	Sample No.	Sample Depth	Sample Type
20		SW	SAND: fine to coarse with some gravel, varied	– 19 16 13	50	3		
		SM	SILTY SAND: fine to medium with some silt & quartz cobbles-saturated with gas 21.5-23 feet, brown					
		CL	CLAY: dense clay-mottled with 2" of sand in middle of core; 4" of sand @ 25', gray orange	7 10 10 12	75	4		
25	.020" slotted screen	MH	CLAYEY SILT: silt - mottled with some carbon deposits & wood fragments, grades to silty sand, brown	6 9 11 13	100	5		
		SM	SILTY SAND: fine to coarse with some gravel - H.C. odors brown	– 13 22 34	100	6 7		
30		GM	SILTY GRAVEL: well graded sand to 3/4" gravel with some silt; dark brown	– 12 19 29	80	8		
			No sample from 30½ to 40 - dark brown silt on tip of auger					
35	Caved							
40			T.D. = 40'					

EEI ENGINEERING ENTERPRISES, INC.

S-31

C.V.M. industries — **geotechnical division inc.**

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO REFINERY
Project: WELLS AND TEST BORINGS.
Location: PHILADELPHIA, PA.
Project No.:
Boring No.: SM-53 Depth: 25.0'
Elevation:
Spoon Size: 2" Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: 140 # Drop: 30"
Drive, weight: Drop:
Date Started: 7-31-85

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 3115

Ground Water Data:
0 HRS: WATER AT 21.0'
TOTAL PIPE - 28.0'

Date Completed: 7-31-85

Depth	Casing Blows	Strata Classification	Sampling Data Depth	Sampling Data No.	Blows per 6"	Remarks
		MISCELLANEOUS FILL. ASH - CINDER	4.0 - 6.0	S-1	6 - 6, 8 - 10	SAMPLE HOLE OFFSET APPROXIMATELY 2.0 - 4.0' FROM WELL ON 8-5-85
		8.0'				
		YELLOW SANDY SILT. GRADING TO MULTI-COLORED FINE TO COARSE SAND AND GRAVEL.	18.0 - 20.0	S-2	16 - 38, 40 - 54	
		25.0'				
		COMPLETE AT 25.0'				

SHEET NO. .... OF ....

S-32

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No.: 9200
Boring No.: SM-27 Depth: 25.0'
Elevation:
Spoon Size: Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: Drop:
Drive, weight: Drop:
Date Started: 12-17-84

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:
0 HRS: WATER AT 21'6"
TOTAL PIPE - 28.0'

Date Completed: 12-17-84

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Data Depth	Sampling Data No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL 2.0'				3' STICK-UP
		GREY-GREEN CLAY TRACE OF SILT VERY FINE SAND. 10.5'				
		MULTI-COLORED FINE TO COARSE SAND AND GRAVEL. 17.0'				GASOLINE ODOR OBVIOUS
		TAN FINE SAND 25.0'				
		COMPLETE AT 25.0'				

SHEET NO. .... OF ....

S-33

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania

215-947-2555

Client: ARCO REFINERY
Project: WELLS AND TEST BORINGS
Location: PHILADELPHIA, PA.
Project No.
Boring No. SM-54   Depth 28.0'
Elevation
Spoon Size 2"   Casing Size
Core Size   Bit No.
Hammers:
Spoon, weight 140#   Drop 30"
Drive, weight   Drop
Date Started 7-30-85

Driller SB
Helper WGH
Inspector MC
Job No. 3115

Ground Water Data:
0 HRS: WATER AT 22.0'
TOTAL PIPE - 31.0'

Date Completed 7-30-85

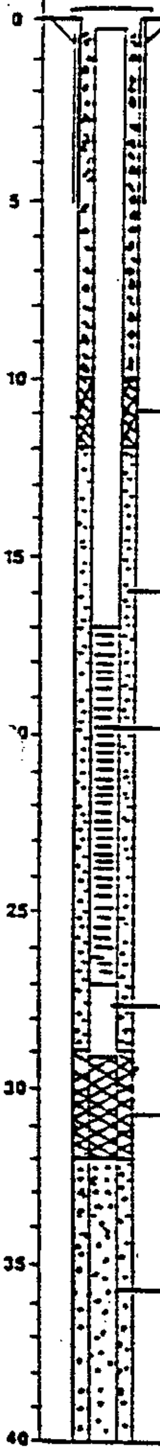
Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Depth	Sampling No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL	4.0-6.0	S-1	3-2 / 2-3	APPROXIMATELY 3.0' OF PRODUCT ON TOP OF WATER SURFACE.
		± 8.5'				
		BROWN SANDY SILT WITH FINE GRAVEL GRADING TO SILTY SAND AND FINE TO COARSE SAND WITH FINE TO MEDIUM GRAVEL.	18.0-20.0	S-2	13-13 / 12-16	SAMPLE HOLE OFFSET APPROXIMATELY 2.0-4.0' OF WELL ON 8-2-85
		28.0'				
		COMPLETE AT 28.0'				

SHEET NO. .... OF ....

5-34

WELL PN-1

WELL ELEVATION:
WELL INSTALLED: 5/26/87
WELL DEVELOPED: 5/27/87
WELL DEPTH: 29.0



BORING PN-1

SURFACE ELEVATION:
DRILLING METHOD: Mud Rotary
BORING DEPTH: 40.0

Columns: DEPTH IN FEET; SOIL TYPE (USCS, SYMBOLS); SAMPLE DATA (BLOWS, % RETAINED, SAMPLE NO., SAMPLE DEPTH, SAMPLE TYPE)

0.0 - 4.0 FILL

4.0 - 5.0 SILT: sandy; brown

5.0 - 9.0 SILT: sandy w/trace gravel; brown

9.0 - 11.0 GRAVEL LAYER

11.0 - 27.0 SAND AND GRAVEL: (fine-very coarse) trace silt; variegated

27.0 - 29.5 CLAY: sandy; variegated

29.5 - 33.0 SAND: (fine-medium) w/silt; brown & gray

33.0 - 36.0 SAND: (fine-coarse w/gravel and silt

36.0 - 40.0 SAND: clayey w/gravel

Drilled By W. C. Services
Logged By P. Dougherty
Client ARCO
Job No. 522-189-00
Page 1 Of

EEI ENGINEERING ENTERPRISES, INC.

5-35

WELL SPECS | SOIL TYPE | BORING EN-2

WELL ELEVATION:
WELL INSTALLED: 5/28/87
WELL DEVELOPED: 5/28/87
WELL DEPTH: 29.0

SURFACE ELEVATION:
DRILLING METHOD: Mud Rotary
BORING DEPTH: 40.0

Columns: DEPTH IN FEET | USCS | SYMBOLS | BLOWS | % RETAINED | SAMPLE NO. | SAMPLE DEPTH | SAMPLE TYPE

Well construction:
- Cement/bentonite grout
- Bentonite seal
- J. Morie #1 gravel pack
- 6" 20 slot PVC screen
- 6" PVC sump
- Bentonite plug
- Native

Depth (ft)	Description
0.0 - 2.0	FILL
2.0 - 7.0	SILT: sandy w/some clay; brown
7.0 - 10.0	SILT: clayey w/ gravel lenses; brown and gray
10.0 - 18.0	SAND AND GRAVEL: (medium-very coarse); variegated
18.0 - 27.5	SAND & GRAVEL: (medium-coarse) trace silt; variegated
27.5 - 32.0	CLAY: sandy w/ silt; green and gray
32.0 - 35.0	SAND & GRAVEL: coarse w/some silt
35.0 - 40.0	SAND: silt w/some gravel; red and brown

Drilled By W.C. Services
Logged By P. Dougherty
Client ARCO
Job No. 522-189-00
Page 1 Of

EEI ENGINEERING ENTERPRISES, INC.

S-36

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-255

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No.: 9200
Boring No.: SM-34 Depth: 21.5'
Elevation:
Spoon Size: Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: Drop:
Drive, weight: Drop:
Date Started: 12-18-84

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:
0 HRS: WATER AT 17'1"
TOTAL PIPE - 24.5'

Date Completed: 12-18-84

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Data Depth	Sampling Data No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL: STONE, CINDER, TIMBER, ETC. 12.0'				HYDROCARBON ODOR OBVIOUS
		PINKISH COLORED SILT AND VERY FINE SAND. TRACE OF CLAY 16.0'				
		MULTI-COLORED SAND AND GRAVEL 21.5'				
		COMPLETE AT 21.5'				

SHEET NO. .... OF ....

5-37

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No.: 9200
Boring No.: SM-25 Depth: 30'
Elevation:
Spoon Size: Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: Drop:
Drive, weight: Drop:
Date Started: 12-17-85

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:
0 HRS WATER AT 24'3"
TOTAL PIPE 32.9'

Date Completed: 12-17-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL ASH AND CINDER 1.0'				2'10" STICK-UP
		TAN SILTY CLAY WITH TRACE TO SOME VERY FINE SAND. 9.0'				STRONG GAS ODOR APPARENT.
		BLUE - GREY CLAY. 14.0'				
		SAND AND GRAVEL. MULTI-COLORED. 20.0'				
		TAN-LIGHT ORANGE FINE SAND WITH TRACE TO SOME SILT AND CLAY. 30.0'				
		COMPLETE AT 30.0'				

SHEET NO. .... OF ....

S-38

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No. 9-200
Boring No. SM-31 Depth 23.2'
Elevation
Spoon Size Casing Size
Core Size Bit No.
Hammers:
Spoon, weight Drop
Drive, weight Drop
Date Started 12-19-84

Driller: SB
Helper: WGH
Inspector: MC
Job No. 2890

Ground Water Data:
0 HRS: WATER AT 21.4'
TOTAL PIPE: 26.2'

Date Completed 12-19-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		MISCELLANEOUS ASH AND CINDER FILL 6"				
		TAN VERY FINE SAND AND SILT WITH TRACE OF CLAY. 7.0'				3' STICK-UP
		INTERBEDDED WITH LAYERS OF SAND AND GRAVEL. 12.0'				
		MULTI-COLORED SAND AND GRAVEL. 22.0'				
		TAN BROWN CLAY WITH TRACE GRAVEL 23.2'				
		COMPLETE AT 23.2'				

SHEET NO. .... OF ....

BORING LOG

ENSR

Sheet 1 of 4

Project No. 6445-051-100 Date - Start 3/8/94 1115 Finish 3/14/94 1400 Boring # 538D

Project Name Sun-Philadelphia Refinery Drilling Co. Empire Drilling Co.

Location East of Tank 826 Drilling Method Hollow Stem Auger

Total Depth 130' Inspector M. Irani Reviewer

Remarks

Depth Feet	Sample: Type & No.	Blows per .6 In.	Depth Range	Rec.	PID ~~Graphic Log~~	Lithologic Description	Equipment Installed
2'	S.S. 1	8-10-6-6	0'-2'		[illegible]	0-6" fill, gravel + pebbles; 6" brown clayey silt, abundant fines	
4'	S.S. 2	6-6-8-8	2'-4'		0.5	~~[illegible]~~ brownish orange clayey silt	
6'	S.S. 3	6-4-6-10	4'-6'		22 / 82	same, some interbedded silty clay	
8'	S.S. 4	11-12-15-20	6'-8'		9	orange/brown sandy silt to 7'; orange brown silty sand /	
10'	S.S. 5	7-8-12-14	8'-10'		[illegible] 65	dry, orange brown clayey silt	
12'	S.S. 6	14-14-15-17	10'-12'	poor	1	poor recovery, gray sandstone, rock frags, brown sand w/ quartz gravels + pebbles	
14'	S.S. 7	17-50/3	12'-14'	poor		same brown sand w/ gravels + pebbles	
16'	S.S. 8	15-6-7-6	14'-16'		13	brown + reddish brown silty sand w/ little gravel	
18'	S.S. 9	13-12-16-15	16'-18'		55	same to 17', color change to orange brown sand w/ abundant qtz pebbles + gray sandstone rock fragments	
20'	S.S. 10	21-11-10-8	18'-20'	poor	12	poor recovery, same, large sandstone fragment present, wet	
22'	S.S. 11	0-13-13-15	20'-22'	[illegible]	53	coarse brown, and orange brown sand w/ abundant qtz. gravels + pebbles, loose	
24'	S.S. 12	9-13-15-20	22'-24'		108	same, strong petro. odor from sands @ bottom of spoon sample	
26'	S.S. 13	0-0-0-0 weight of rods and hammer	24'-26'		130	same, strong odor	
28'	S.S. 14	10-12-12-12	26'-28'		120	gray coarse sand, strong odor, some interbedded reddish brown silty clay @ bottom of spoon sample	
30'	S.S. 15	0-0-10-13	28'-30'		16	orange brown coarse sand, few gravels + pebbles	
32'	S.S. 16	0-0-10-19	30'-32'		115	same	
34'	S.S. 17	12-20-22-27	32'-34'		122	same sand, color change to white @ last 6" of sample	
36'	S.S. 18	0-0-0-12	34'-36'		[illegible]	same, grayish white	
38'	S.S. 19	17-25-47-44	36'-38'		95	same sand, frequent color changes (white, orange brown, gray)	
40'	S.S. 20	5-6-25-41	38'-40'		52	same sand, orange/brown	

M890278

BORING LOG

ENSR

Project No. ____ Date - Start ____ Finish ____ Boring S38D

Project Name ____ Drilling Co. ____

Location ____ Drilling Method ____

Total Depth ____ Inspector ____ Reviewer ____

Remarks ____

Depth Feet	Sample: Type & No.	Sample: Blows per 6 In.	Sample: Depth Range	Sample: Rec.	PID ~~Graphic Log~~	Lithologic Description	Equipment Installed
40'–42'	S.S.21	4/2-14-14	40'-42'		76	same sand	
45'–47'	S.S.22	21-44-72-	~~43~~ 45'-47'	[illegible]	108	same	
50'–52'	S.S.23	12-16-16-20	50'-52'	none	—	no recovery, still appears to be running sands - bright reddish brown silty clay present on outside casing of spoon sample	
55'–57'	S.S.24	8-11-14-24	55'-57'		6	- same sand, ~6" of bright reddish brown silty clay @ bottom of spoon sample	
60'–62'	S.S.25	8-12-21-30	60'-62'		11	very stratified: reddish brown sand → brown sand → tan sandy silt → mottled silty clay (tan + orange/brown) (last 6" of sample, dense)	
65'–67'	S.S.26	20-44-50/3	65'-67'		0	grayish white silty sand + coarse sand, thin interbed of grayish white silty clay	
70'–72'	S.S.27	50-55/5			2	reddish brown coarse sand → grayish white color change, little fines	
75'–77'		no spoon sample taken					
80'							

M890278

ENSR

BORING LOG

Sheet 3 of 4

Project No. ______ Date - Start ______ Finish ______ Boring 538D

Project Name ______ Drilling Co. ______

Location ______ Drilling Method ______

Total Depth ______ Inspector ______ Reviewer ______

Remarks ______

Depth Feet	Sample: Type & No.	Sample: Blows per 6 In.	Sample: Depth Range	Sample: Rec.	PID ~~Graphic Log~~	Lithologic Description	Equipment Installed
80'–82'	S.S.28	50-50/4	80'-82'		4.5	brown coarse sand w/abundant quartz gravels + pebbles, trace fines	
85'–87'	S.S.29	37-50/3	85'-87'		NR	same	
90'–92'	S.S.30	26-60/3	90'-92'		13.5	light brown silty sand, little gravel + pebbles, color change → reddish brown (bottom 6" of sample)	
95'–97'	S.S.31	70/6	95'-97'		NR	brown coarse sand w/ abundant quartz gravels + pebbles	
100'–102'	S.S.32	52-50/4	100'-102'			grayish white clayey silt, some silty clay, no gravels/pebbles	
105'–107'	S.S.33	50-46-50/3	105'-107'		74	reddish brown coarse sand, no gravels/pebbles	
110'–112'	S.S.34	50-52-50/4	110'-112'		18	mica rich, dk. gray weathered mica schist (silty + sand clay – abundant silt)	
115'–117'	S.S.35	100/5	115'-117'		NR	same, little recovery	

M890278

BORING LOG

ENSR

Project No. ______ Date - Start ______ Finish ______ Boring 538D

Project Name ______ Drilling Co. ______

Location ______ Drilling Method ______

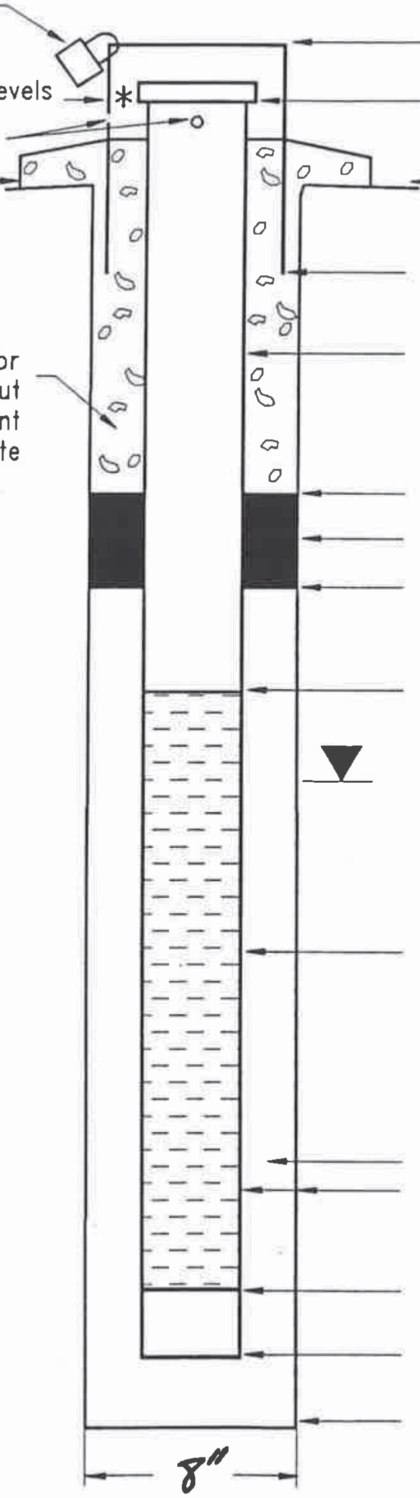
Total Depth ______ Inspector ______ Reviewer ______

Remarks ______

Depth Feet	Sample Type & No.	Sample Blows per 6 In.	Sample Depth Range	Sample Rec.	Graphic Log	Lithologic Description	Equipment Installed
120' – 122'	S.S. 36	60/0	120'-122'			- no representative recovery → only loose reddish brown sand, (appears) to be running sands again @ ~120'	
125' – 127'	S.S. 37	60/0	122'-124'			- same as above, split spoon sampling no longer effective due to running sands - no evidence of weathered mica schist material encountered @ 110'-115'	
130'						well set @ 130'	

Project No: 6445-051	Client: Sun	Site: Philadelphia Refinery	WELL No: 538D
Well Location: South Yard - East of Tank 826			Date Installed: 3/14/94
Contractor: Empire Drilling Co.	Method: hollow stem auger		Inspector: M. Irani

MONITORING WELL CONSTRUCTION DETAIL



	Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe	~2.5'	
Top of Riser Pipe	~2'	
Ground Surface (G.S.)	0.00	
Bottom of Steel Guard Pipe		
Riser Pipe: Length 122'; Inside Diameter (ID) 2"; Type of Material SCH 40 PVC		
Top of Bentonite Seal	~114'	
Bentonite Seal Thickness 3"		
Top of Sand	117'	
Top of Screen	120'	
Stabilized Water Level		
Screen: Length 10'; Inside Diameter (ID) 2"; Slot Size 0.01"; Type of Material SCH 40 PVC		
Type/Size of Sand Morie #1		
Sand Pack Thickness 3"		
Bottom of Screen	130'	
Bottom of Tail Pipe: Length 6"		
Bottom of Borehole	130'	

* Describe Measuring Point: Top of PVC casing

Approved: Mark J. Irani (Signature) 3/15/94 (Date)

ENSR®

Project No: 6445-057 Client: Sun Site: Philadelphia Refinery

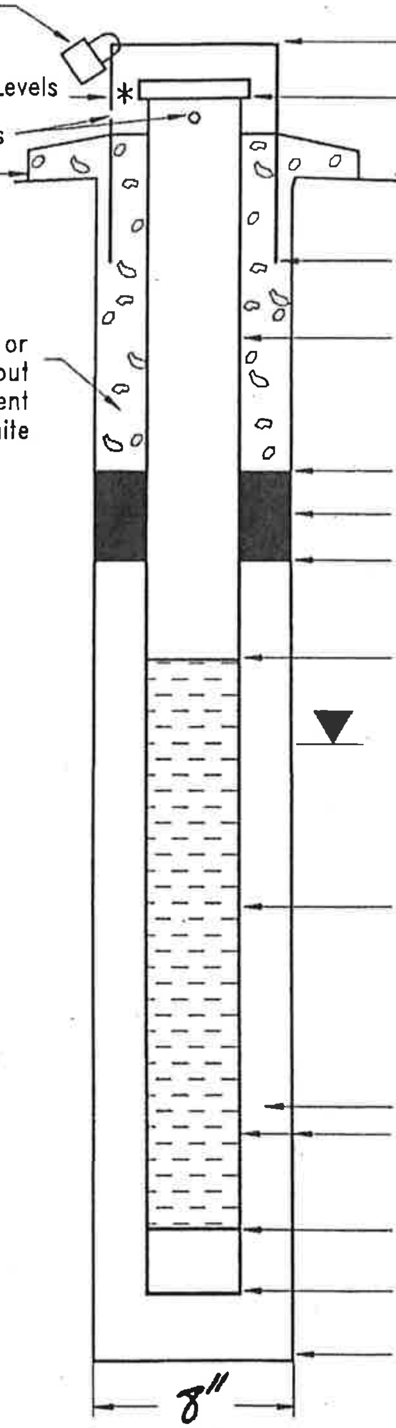
WELL No: S38I

Well Location: South Yard - East of Tank 826

Date Installed: 3/17/94

Contractor: Empire Drilling Co. Method: hollow stem auger Inspector: M. Irani

MONITORING WELL CONSTRUCTION DETAIL



	Depth from G.S. (feet)	Elevation (NGVD)
Top of Steel Guard Pipe	~2.5'	
Top of Riser Pipe	~2'	
Ground Surface (G.S.)	0.00	
Bottom of Steel Guard Pipe		
Riser Pipe: Length 72'; Inside Diameter (ID) 2"; Type of Material SCH 40 PVC		
Top of Bentonite Seal	~62'	
Bentonite Seal Thickness 3"		
Top of Sand	67'	
Top of Screen	70'	
Stabilized Water Level		
Screen: Length 10'; Inside Diameter (ID) 2"; Slot Size 0.01"; Type of Material SCH 40 PVC		
Type/Size of Sand Morie #1		
Sand Pack Thickness 3"		
Bottom of Screen	80'	
Bottom of Tail Pipe: Length 6"		
Bottom of Borehole	80'	

* Describe Measuring Point: Top of PVC casing

Approved: [signature] 3/17/94

Signature Date

ENSR

S-39

LOG of BORING No. AS-7

DATE 2/4/82 SURFACE ELEV. ______ LOCATION See Plate

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	DESCRIPTION	ELEVATION	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0								
5	■	23	Stiff to hard brown and gray mottled clayey SILT					
10	■	26						
15	■	24	Dense brown and gray coarse to fine SAND and GRAVEL					
20	■	37						
25	■	17	Dense gray silty fine SAND					
30	■	18						
35	■	17						
40								

COMPLETION DEPTH 37.0 feet FLUID Depth enc. @ 25 ft. Date 2/4/82

SAMPLER: 2" O.D. SPLIT-BARREL SAMPLER

JOB NO 81 C 2256A

WCC RP

S-39

PIEZOMETER INSTALLATION REPORT

Project: ARCO REFINERY

Project No.: 81C2256 Installed By: PFM

Method of Installation: Hollow stem auger

Piezometer No.: AS-7

Location: See Fig.

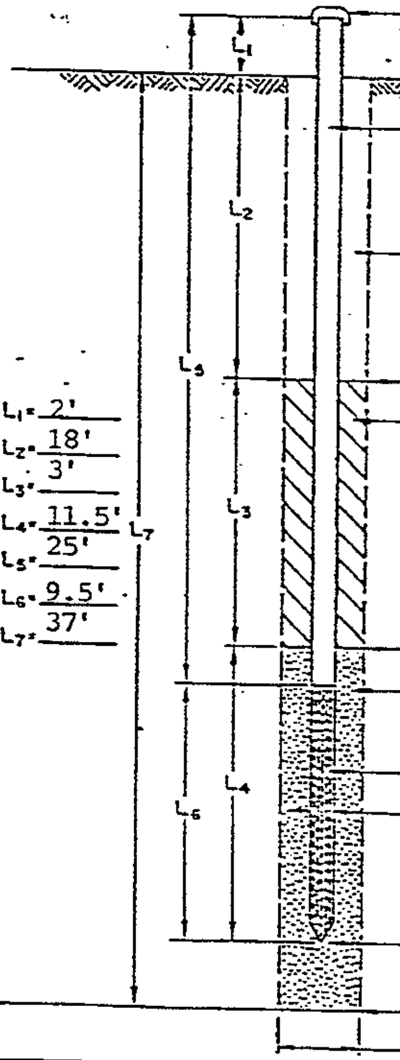
Date: 2/4/82 Time:

LOG OF BORING AND PIEZOMETER

BORING			PIEZOMETER
Depth in ft.	Description	Symbol	Type of Piezometer: PVC

Ground Elev. 20.06'

Top of Riser Elev. 22.08'



Vented Cap

L1 = 2'
L2 = 18'
L3 = 3'
L4 = 11.5'
L5 = 25'
L6 = 9.5'
L7 = 37'

I.D. of Riser Pipe: 3"

Type of Pipe: PVC

Type of Backfill Around Riser: cement grout

Top of Seal Elev. 2.06'

Type of Seal Material: bentonite balls

Top of Filter Elev. -.94'

Type of Filter Material: sand

Size of Openings: .010"

Diameter of Piezometer Tip: 3"

Bottom of Piez. Elev. -12.44'

Bottom of Boring Elev. -16.94'

Diameter of Boring: 12"

Remarks:

Inspected By: PFM

PROJECT: **PHRO - Corrective Measures Program**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI 4 Remedial Investigation**	PAGE 1 OF 6 **S-39D**
PROJECT NUMBER: **213402602**	

DRILLING: STARTED **2/8/16**	COMPLETED: **2/24/16**	*NORTHING (ft): **220137.68**	*EASTING (ft): **2685551.2**
INSTALLATION: STARTED **2/24/16**	COMPLETED: **2/24/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.51**
DRILLING COMPANY: **Parratt Wolff**		INITIAL DTW (ft): **24**	BOREHOLE DEPTH (ft): **162**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**		STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **132.3**
DRILLING METHOD: **HSA; Mud Rotary**		WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**		LOGGED BY: **D Downing**	CHECKED BY: **A Klingbeil**
		*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88	

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Well Construction
0-0.5		APPARENT FILL [coarse sand and crushed stone, few cinders]	S-39D@ 0-0.5'			0	4" PVC Casing
0.5-8	SM	APPARENT RECENT ALLUVIUM [Pale yellow to yellow to brownish yellow fine to medium SAND and silt (dry)]	S39D-1.5-2-20160121			0	
			39D-7.5-8.0-20160208			0	
8-12	SM	Light yellowish brown very fine SAND, and to some silt, trace very coarse sand, trace fine gravel (damp)	S-39D@ 8-12'	1.5 1.2	5 5 6 8 2 2 7 11	0	
12-14	SM	APPARENT "TRENTON GRAVEL" [NO RECOVERY (gravel lodged in drive shoe)]	S-39D@ 12-14'	0	14 18 15 15	0	
14-18.5	SM	Yellow and gray med-coarse SAND, trace gravel (red sandstone) (dry)	S-39D@ 14-18.5'	1 1.2	5 14 15 13 13 13 15 12	0	
18.5-20	SM	Reddish brown fine to very coarse SAND, some medium gravel, trace to little silt (moist)	S-39D@ 18.5-20'	1.3	11 16 12 14	0	Tremie Grout - Bentonite Amended Cement
20-22	SM	Reddish brown fine to medium SAND and GRAVEL, little to some silt (wet)	S-39D@ 20-22'	1	9 8 9 13	0	
22-22.5	SM	Medium tan SAND, some gravel (damp)	S-39D@ 22-22.5'			0	
22.5-24	GM	Dark reddish brown fine to medium GRAVEL, and to some fine to coarse sand, little silt (gravels are mixture of sandstone, gneiss, quartz) (moist)	S-39D@ 22.5-24'	1	14 15 14 12	0	
24-24.1	CL	APPARENT PRM UPPER CLAY UNIT [Greenish gray to white CLAY/SILT, little fine sand (wet)]					
24.1-26	SP		S-39D@ 24-26'	1.1	8 9 10 10	0	
26-27	SP	APPARENT PRM UPPER SAND UNIT [Medium yellow SAND, trace to no silt (some brownish yellow lenses) (saturated)]					
27-30		Light grey to very pale brown medium-fine SAND, some coarse sand, trace to no silt (saturated)	S-39D@ 26-30'	1.2 0.8	11 14 17 19 11 14 17 19	0	

Initial DTW at 24 ft.

GEO FORM 304 - EVERGREEN AOI4_BORINGLOGS_20160425.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 3/23/17

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-39D**

Stantec

DRILLING: STARTED **2/8/16**	COMPLETED: **2/24/16**	*NORTHING (ft): **220137.68**	*EASTING (ft): **2685551.2**
INSTALLATION: STARTED **2/24/16**	COMPLETED: **2/24/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.51**
DRILLING COMPANY: **Parratt Wolff**		INITIAL DTW (ft): **24**	BOREHOLE DEPTH (ft): **162**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**		STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **132.3**
DRILLING METHOD: **HSA; Mud Rotary**		WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**		LOGGED BY: **D Downing**	CHECKED BY: **A Klingbeil**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description
30-34		NO SAMPLES AVAILABLE
34-38	SP	Light gray medium-fine SAND, trace to no silt (slightly micaceous) (laminated with heavy minerals) (saturated)
38-40	SP	Light grey fine to very fine SAND, trace to no silt, trace gravel (saturated)
40-46	SP	Pale yellow to light grey medium-fine SAND, trace to no silt, trace gravel (saturated)
46-54	SP-SM	Light grey to grey coarse to very coarse SAND, little gravel, trace silt (saturated)
54-56	CH	APPARENT PRM MIDDLE CLAY UNIT [Red and white/light grey CLAY/SILT, trace fine sand (high plasticity) (intensely mottled) (moist)]
56-60	CH	SAME (trace gravel) (moist)

Sample Interval (feet)	Measured Recov. (feet)	Blow Count
34-36	1.3	9, 10, 10, 11
36-38	1.8	9, 11, 12, 15
38-40	1	5, 7, 8, 9
40-42	1	6, 8, 9, 10
42-44	1.3	9, 11, 11, 14
44-46	0.8	9, 11, 12, 12
46-48	1.4	9, 11, 14, 16
48-50	0.7	7, 8, 11, 14
50-52	1.2	11, 17, 18, 19
52-54	1.2	14, 17, 18, 16
54-56	1.7	4, 5, 6, 8
56-58	1.5	6, 8, 9, 11
58-60	1.5	4, 5, 7, 9

Sample ID	Headspace PID (ppm)
S-39D@ 30-34'	
S-39D@ 34-37.5'	0
S-39D@ 37.5-38'	0
S-39D@ 38-42'	0
S-39D@ 42-44'	0
S-39D@ 44-46'	0
S-39D@ 46-52'	0
S-39D@ 52-54'	0
S-39D@ 54-56'	0
S-39D@ 56-58'	0

Well Construction: ← Tremie Grout - Bentonite Amended Cement (at 50 ft)

PROJECT: **PHRO - Corrective Measures Program**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI 4 Remedial Investigation**	PAGE 3 OF 6 **S-39D**
PROJECT NUMBER: **213402602**	

DRILLING: STARTED **2/8/16** COMPLETED: **2/24/16**	*NORTHING (ft): **220137.68**	*EASTING (ft): **2685551.2**
INSTALLATION: STARTED **2/24/16** COMPLETED: **2/24/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.51**
DRILLING COMPANY: **Parratt Wolff**	INITIAL DTW (ft): **24**	BOREHOLE DEPTH (ft): **162**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**	STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **132.3**
DRILLING METHOD: **HSA; Mud Rotary**	WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**	LOGGED BY: **D Downing**	CHECKED BY: **A Klingbeil**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Depth (feet)	Well Construction
61	CH		S-39D@ 58-64.2'	1.8	4 9 11 13	0		
63				1.7	12 14 17 19			
64-66	SC	Grey to light grey fine to very fine SAND and CLAY/SILT (slightly micaceous) (moist)	S-39D@ 64.2-66'	2	12 14 17 20	0	65	
66-68	CL	Light gray CLAY/SILT, some fine sand (red mottles) (damp)	S-39D@ 66-68'	1.5	14 16 18 20	0		
68-70			S-39D@ 68-70'	1.7	5 7 9 11	0	70	
70-72	CH	Red to dark red CLAY/SILT (light gray mottles) (dry)	S-39D@ 70-72'	1.8	8 10 11 14	0		
72-74	CH	SAME (saturated)	S-39D@ 72-74'	0.8	16 21 26 28	0		
74-76	SC	APPARENT PRM MIDDLE SAND UNIT [Light grey to grey very fine SAND, some clay/silt (moist)]	S-39D@ 74-76'	1.7	26 36 50/2"	0	75	
76-78			S-39D@ 76-78'	2	50/1"	0		
78-80	SM	Light grey SILT and very fine SAND, trace clay (yellow mottles) (moist)	S-39D@ 78-80'	1.1	48 50/2"	0	80	← Tremie Grout - Bentonite Amended Cement
80-82			S-39D@ 80-82'	0.7	53/6"	0		
82-84	SM	Light grey and pale yellow very fine SAND, some silt (white clay clasts) (moist, few wet spots)	S-39D@ 82-84'	0.8	55/6"	0		
84-86			S-39D@ 84-86'	0.7	54/6"	0	85	
86-88	SP-SM	Light grey medium-fine SAND, trace silt (dark grey laminations) (saturated at bottom, SAND gets coarse @ 87.5')	S-39D@ 86-88'	0.7	61/6"	0		
88-90	SP	Light grey medium-coarse SAND, trace to no silt (saturated)	S-39D@ 88-90'	1.7	47 47 46 48	0		

GEO FORM 304 - EVERGREEN AOI4_BORINGLOGS_20160425.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 3/23/17

PROJECT: **PHRO - Corrective Measures Program**	WELL / PROBEHOLE / BOREHOLE NO:	Stantec
LOCATION: **AOI 4 Remedial Investigation**	PAGE 4 OF 6	**S-39D**
PROJECT NUMBER: **213402602**		

DRILLING: STARTED **2/8/16**	COMPLETED: **2/24/16**	*NORTHING (ft): **220137.68**	*EASTING (ft): **2685551.2**
INSTALLATION: STARTED **2/24/16**	COMPLETED: **2/24/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.51**
DRILLING COMPANY: **Parratt Wolff**		INITIAL DTW (ft): **24**	BOREHOLE DEPTH (ft): **162**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**		STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **132.3**
DRILLING METHOD: **HSA; Mud Rotary**		WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**		LOGGED BY: **D Downing**	CHECKED BY: **A Klingbeil**
		*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88	

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Well Construction
90–94	SP-SM	SAME (trace silt) (trace gravel) (saturated)	S-39D@ 90-92'	1.6	41 46 44 46	0	
			S-39D@ 92-94'	1.7	43 47 50/3"	0	
94–102	SP-SM	Olive yellow coarse to very coarse SAND, little gravel, trace silt (saturated)	S-39D@ 94-102'	1.5	46 48 48 46	0	
				1.5	39 48 43 34		
				1.3	11 18 25 26		
				1.4	24 36 38 39		Tremie Grout - Bentonite Amended Cement (at 100)
102–104	SC	APPARENT PRM LOWER SAND UNIT [Light grey/pale yellow fine-medium SAND, some clay/silt, some coarse gravel (moist)]	S-39D@ 102-104'	1	33 45 50/3"	0	
104–110	SP-SM	Yellow to grey/light grey fine SAND, trace silt (dark grey laminations at 107.5' and 109.5')	S-39D@ 104-110'	1.8	40 45 55 40	0	
				1.5	29 49 51 46		
				1.5	10 20 23 48		
110–117	SW-SM	Pale yellow medium-fine SAND, some to and coarse to fine gravel (saturated)	S-39D@ 110-112'	0.7	44 50/4"	0	
			S-39D@ 112-114'	1.3	56 23 16 18	0	
			S-39D@ 114-116'	1.5	30 34 30 28	0	
			S-39D@ 116-118'	0.4	72/6"	0	Bentonite Seal (at 117)
117–120	GW-GM	Yellow GRAVEL and fine to coarse SAND, little silt (silt content increases with depth; white w/ gravel in shoe) (saturated)					
			S-39D@ 118-120'	0.8	48 46 50/3"	0	

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-39D**

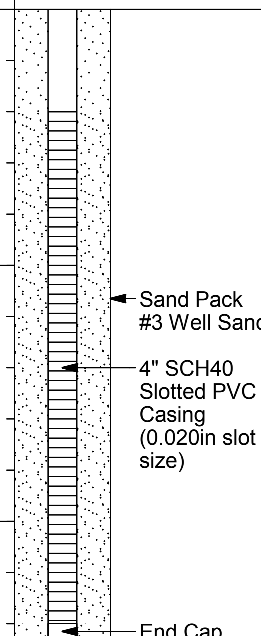
Stantec

DRILLING: STARTED **2/8/16** COMPLETED: **2/24/16**
INSTALLATION: STARTED **2/24/16** COMPLETED: **2/24/16**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA; Mud Rotary**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**

*NORTHING (ft): **220137.68** *EASTING (ft): **2685551.2**
*GROUND ELEV (ft): **21.9** *TOC ELEV (ft): **24.51**
INITIAL DTW (ft): **24** BOREHOLE DEPTH (ft): **162**
STATIC DTW (ft): **Not Measured** WELL DEPTH (ft): **132.3**
WELL CASING DIAMETER (in): **4** BOREHOLE DIAMETER (in): **8**
LOGGED BY: **D Downing** CHECKED BY: **A Klingbeil**
*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)
120-122	GM	Medium GRAVEL, and to some grey SILT, some yellow to dark grey fine sand (saturated)	S-39D@ 120-122'	0.8	51 43 46 54	0
122-124	SW-SM	Pale yellow fine to coarse SAND and GRAVEL, trace silt/clay (saturated)	S-39D@ 122-124'	0.7	69 82/6"	0
124-128			S-39D@ 124-128'	0.4 / 1	46 52 50/2" / 51 56 51 56	0
128-132	GM	Med-coarse GRAVEL and med-fine pale yellow to white SAND, some silt (wet)	S-39D@ 128-132'	0.7 / 1	61 57 50/2" / 39 62 50/3"	0
132-134		NO RECOVERY	S-39D@ 132-134'	0	96/6"	0
134-136	GM	Coarse GRAVEL, some fine to coarse sand, little to some silt (wet)	S-39D@ 134-136'	1	52 50 56 49	0
136-138			S-39D@ 136-138'	1	54 55 58 50/1"	0
138-140			S-39D@ 138-140'	1	53 48 43 58	0
140-142		NO RECOVERY (coarse gravel jammed in drive shoe)	S-39D@ 140-142'	0	108/6"	0
142-144	SW-SM	Yellow fine SAND and coarse GRAVEL (some pale yellow silt/clay in bottom 6" of spoon) (wet)	S-39D@ 142-144'	1.2	56 68 69 61	0
144-146			S-39D@ 144-146'	1	51 53 54 50	0
146-148			S-39D@ 146-148'	0.5	59 98/6"	0
148-150		NO SAMPLES AVAILABLE (hard drilling on apparent gravelly sediments)				

Well Construction



PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-39D**

Stantec

DRILLING: STARTED **2/8/16**	COMPLETED: **2/24/16**	*NORTHING (ft): **220137.68**	*EASTING (ft): **2685551.2**
INSTALLATION: STARTED **2/24/16**	COMPLETED: **2/24/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.51**
DRILLING COMPANY: **Parratt Wolff**		INITIAL DTW (ft): **24**	BOREHOLE DEPTH (ft): **162**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**		STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **132.3**
DRILLING METHOD: **HSA; Mud Rotary**		WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**		LOGGED BY: **D Downing**	CHECKED BY: **A Klingbeil**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	Graphic Log	USCS	Description	Sample	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Depth (feet)	Well Construction
151–154					S-39D@ 148-154'					
154–156		GP-GM	Coarse GRAVEL and yellow fine SAND, some light grey silt (trace white clay in drive shoe) (damp)		S-39D@ 154-156'	1.1	55 68 64 74	0	155	
156–158.5			NO SAMPLES AVAILABLE (hard drilling on apparent gravelly sediments; *drilling change at 158.5' +/- bgs)		S-39D@ 156-160'					
158.5–162			APPARENT WEATHERED BEDROCK [gray and dark gray clay/silt, little to some coarse sand (coarsely micaceous) (apparent weathered mica schist) (wet)]		S-39D@ 160-162'	2	20 36 52 66	0	160	
163–179									165, 170, 175	

S-40

C.V.M. industries
geotechnical division inc.
post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client ARCO REFINERY
Project WELLS AND TEST BORINGS
Location PHILADELPHIA, PA.
Project No. -
Boring No. SM-55 Depth 28.0'
Elevation
Spoon Size 2" Casing Size
Core Size Bit No.
Hammers:
Spoon, weight 140 # Drop 30"
Drive, weight Drop
Date Started 7-31-85

Driller S.B
Helper WGH
Inspector MC
Job No. 3115

Ground Water Data:
0 HRS:
WATER AT 25.5'
TOTAL PIPE - 30.0'

Date Completed 7-31-85

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Depth	Sampling No.	Blows per 6"	REMARKS
		MISCELLANEOUS FILL 1.5'				
		FILL SOIL	4.0 - 6.0	S-1	4 - 4 4 - 4	
		MEDIUM BROWN FINE TO COARSE SAND. TRACE SILT TRACE FINE GRAVEL.				SAMPLE HOLE OFFSET APPROXIMATELY 2.0-4.0' OF WELL ON 8-2-85
			21.0 - 23.0	S-2	6 - 10 13 - 14	
		28.0'				
		COMPLETE AT 28.0'				

SHEET NO. .... OF ....

S-55

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania

215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA.
Project No.
Boring No.: SM-20 Depth: 19.6'
Elevation
Spoon Size Casing Size
Core Size Bit No.
Hammers:
Spoon, weight Drop
Drive, weight Drop
Date Started: 12-17-84

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:
0 HRS: WATER AT 16.1
TOTAL PIPE - 22.6'

Date Completed: 12-17-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		TAN FINE TO COARSE SAND. TRACE GRAVEL. 3.5'				
		GREY-TAN SILTY CLAY TRACE VERY FINE TO FINE SAND 7.0'				
		MULTI-COLORED FINE TO COARSE SAND AND GRAVEL. 19.6'				
		COMPLETE AT 19.6'				

SHEET NO. .... OF ....

S-56

WELL 62

WELL ELEVATION:
WELL INSTALLED: 12/11/86
WELL DEVELOPED: 12/13/86
WELL DEPTH:

BORING 62

SURFACE ELEVATION:
DRILLING METHOD: H.S.A.
BORING DEPTH:

Depth in feet	Well construction	USCS	Description	Blows	% Retained	Sample No.	Sample Depth	Sample Type
0	2 ft riser; 2" Sch. 40 PVC	GM	FILL: gravelly fill					
5	Cement Grout	GP	GRAVEL: 1" gravel with medium sand; gray					
	Bentonite Seal	SM	SILTY SAND: fine to medium sand with some silt; gray					
10	Sand	GM	GRAVEL: silty gravel -- poor recovery due to plugged sampler; brown	16 11 29 35	5	1		
			SILTY GRAVEL: 1" gravel and larger with some silt and possibly cobbles; red-brown and varied	24 47 48 100	10	2		
15	.020 Slotted Screen		GRAVEL: 1/4" to 1" gravel; red brown with a little silt & varied sands - H.C. odors	40 43 31 41	70	3		
		SM	SAND: sand lens @ 16.5'; medium	22 32 39 33	80	4		
20		GM	GRAVEL: 1/4" to 1" gravel with some silt and sand - several colors - compacted; dense; varied	40 38 41 58	80	5		

Drilled by CVM Inc.
Logged by J. Lundberg
Client ARCO
Job No. 502-158-02

EEI ENGINEERING ENTERPRISES, INC.

S-56

WELL 62 Cont. | BORING 62 Cont.

DEPTH IN FEET	WELL 62 Cont.	USCS	BORING 62 Cont.	BLOWS	% RETAINED	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE
20		GM	Same with interbedded sands	36 22 55 25		6		
		GM SM	Same with interbedded sands Softer @ 24' - Clay					
25	Caved					N/S		
		CL	SANDY CLAY: low plasticity clay with fine to medium sand; brown; olive	3 2 3 5	100	7		
			T.D. = 29'					
30								
35								
40								

EEI ENGINEERING ENTERPRISES, INC.

3-57

C.V.M. industries

geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client: ARCO
Project: WELL INSTALLATION
Location: PHILADELPHIA, PA
Project No.: 9200
Boring No.: SM-24 Depth: 14.0'
Elevation:
Spoon Size: Casing Size:
Core Size: Bit No.:
Hammers:
Spoon, weight: Drop:
Drive, weight: Drop:
Date Started: 12-18-84

Driller: SB
Helper: WGH
Inspector: MC
Job No.: 2890

Ground Water Data:
0 HRS: WATER AT 11'2"
TOTAL PIPE - 17.0'

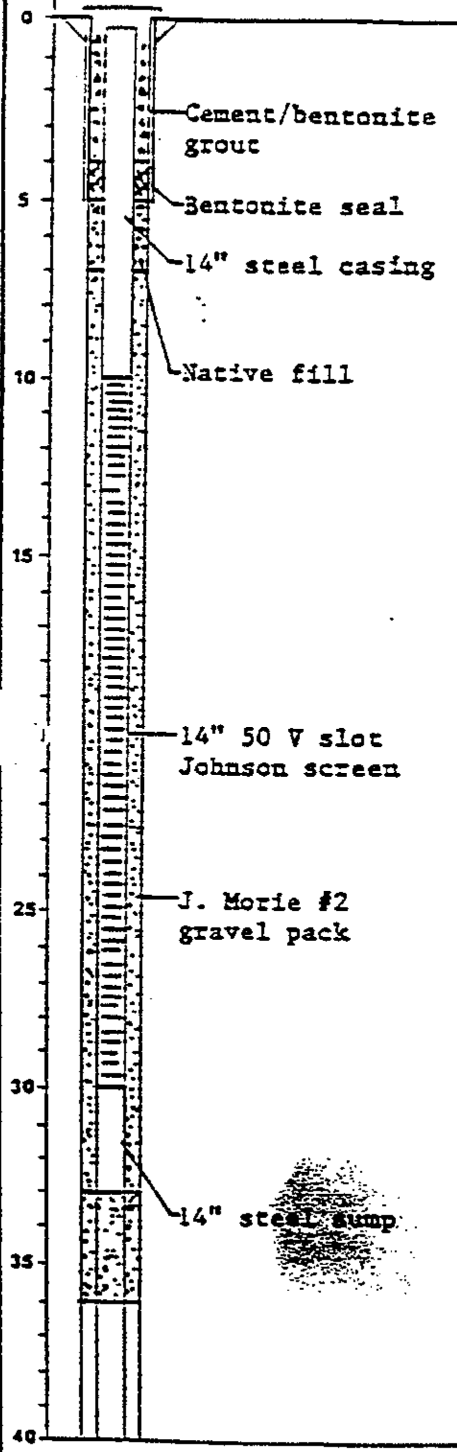
Date Completed: 12-18-84

Depth	Casing Blows	STRATA CLASSIFICATION	Sampling Data Depth	Sampling Data No.	Blows per 6"	REMARKS
		CRUSHED STONE MISCELLANEOUS FILL 2.0'				
		GREENISH GREY SILT VERY FINE SAND. 12.0'				
		MULTI-COLORE SAND AND GRAVEL 14.0'				
		COMPLETE AT 14.0'				

SHEET NO. .... OF ....

S-58

WELL RW-1	BORING RW-1
WELL ELEVATION:	SURFACE ELEVATION:
WELL INSTALLED: 6/23/87	DRILLING METHOD: Reverse/Bucket
WELL DEVELOPED: 6/24/87	BORING DEPTH: 36.0
WELL DEPTH: 33.0	



SOIL TYPE: USCS | SYMBOLS

- 0.0 - 1.0 FILL
- 1.0 - 3.0 SILT: sandy; brown
- 3.0 - 5.0 SILT: sand w/clay and gravel; gray
- 5.0 - 7.5 SAND: (fine-coarse) w/gravel; gray
- 7.5 - 13.0 SAND & GRAVEL: (medium-coarse) w/cobbles
- 13.0 - 16.0 SAND: (fine-coarse) w/gravel and cobbles; brown
- 16.0 - 20.0 SAND: (fine-coarse) w/gravel and some cobbles; gray
- 20.0 - 34.0 SAND: (fine-coarse) w/gravel (very clean)
- 34.0 - 36.0 SAND: clayey; brown

SAMPLE DATA

BLOWS	% RETAINED	SAMPLE NO.	SAMPLE DEPTH	SAMPLE TYPE

Drilled By W.C. Services
Logged By P. Dougherty
Client ARCO
Job No. 522-189-00
Page 1 Of 1

EEI ENGINEERING ENTERPRISES, INC.

Aquaterra Technologies, Inc.
Subsurface Log: S-59D

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-59D **Log By:** M.B. Spancake **Date:** 3/24 & 4/12 & 13/05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 2" **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 42'
Casing Diameter: 2" **Length:** 41' **Type:** PVC
Drilling Method: Hollow Stem Auger/ Mud Rotary **Sample Method:** Split Spoon **Rig Type:** HSA/Mud rotary

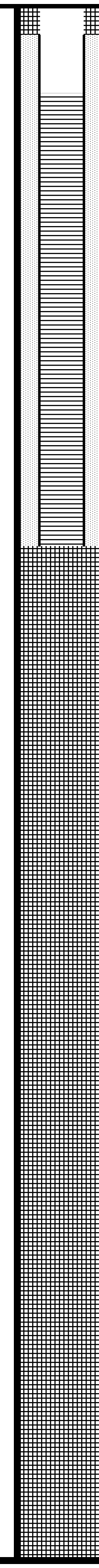
Construction Details

Total Well Depth: 56' BGS **Bentonite Interval:** 0'-39'
Screen Interval: 41'-56" **Cement/Grout Interval:**
Sand Pack Interval: 39'-56' **Sand Pack Type:** # 2
Completion Details: Completed with 2' Steel stick-up

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blowcount	Lithology	Well Schematic
0				Vacuum Utility Clearance to 9' below ground surface (bgs). Advance augers to 10' BGS and beging continuous split spoons.	
5					
10	10-12	0	1.75 4-5-5-7	Brown stiff clay becoming slightly sandy towards the bottom	
	12-14	0	2 7-7-9-12	Brown sandy clay, sand is coarse grained. Moist.	
	14-16	80	0.5	Wet brown sandy gravel.	
15			32-32-50 / 0.4		
	16-18		0 50 / 0.1	No recovery	
	18-20	100	1.25 7-9-18-8	Reddish gray coarse sandy gravel, wet.	
20	20-22	186	0.75 8-14-14-15	Same as above	
	22-24	92	1.5 48-24-20-20	Same as above. Rock fragment in shoe of spoon. Less moisture content towards bottom.	
	24-26	17	0.75	Wet fine sand and large rock fragments. Most of recovery is large	
25			10-16-30-40	rock fragments	
	26-28	NA	2 23-27-28-31	Wet gray coarse sandy gravel. Bottom 3" changing to a gray clayey silt and fine sand.	
	28-30	214	2 4-5-5-6	Wet medium gray sand and small gravel	
30	30-32	0	2 3-3-4-5	Moist dark gray clayey silt and fine sand	
	32-34	44	2 5-7-8-13	Moist gray fine sandy clay, changing in color to a brownish gray in the bottom 2"	
	34-36	0	1	Grayish tan clayey silt, slightly moist	
35			1-2-1-2		
	36-38	0	1.25 3-4-4-5	Greenish gray stiff clayey silt with fine sand. Slightly moist.	

Aquaterra Technologies, Inc.
Subsurface Log: S-59D (Continued)

Depth (ft)					Well Schematic
	38-40	0	1 5-7-7-9	Same as above. Set 4" steel casing at 38' BGS on 3/24/05 and grouted in place. Continue with mud rotary on 4/12/05	
40	40-42	0	1 12-12-12-15	Brown fine sand, slightly moist to becoming wet at bottom.	
	42-44	0	1.5 14-12-12-16	Wet brown and gray fine sand Advance to 50' BGS and collect spoons every 5'.	
45					
50	50-52	NA	0 50/ 0.0	No recovery. Advance to 55' BGS.	
55	55-57	0	1.75 30-25-22-14	Coarse brown sand, large gravel and pebble present, wet.	
60	60-62			Borehole not staying open at this interval. Advance to 65' BGS.	
65	65-67	0	1 17-13-10-10	Gray and tan coarse sand and small poorly sorted gravel. Some large pebble fragments and a thin lense of reddish brown sandy silt at 61.5'	
70	70-72	0	1.25 11-11-12-15	Same as above.	
75	75-77	0	1 10-12-11-13	Coarse well sorted gravel, wet.	
80	80-82	0	1.5 22-14-24-21	Moist white saprolitic mica schist, dense and compact.	
85	85-87	0	1.25 17-19-14-15	Black and white saprolitic mica schist, dense and compact.	
90	90-92	0	1 21-16-17-19	Same as above. End boring and set well at 56' BGS. Backfilled anular space with bentonite chips.	

S-67

C.V.M. industries geotechnical division inc.

post office box 2 • huntingdon valley, pennsylvania
215-947-2555

Client ARCO
Project WELL INSTALLATION
Location PHILADELPHIA, PA.
Project No.
Boring No. SM-22 Depth 20.0'
Elevation
Spoon Size
Casing Size
Core Size
Bit No.
Hammers:
Spoon, weight 140# Drop 30"
Drive, weight Drop
Date Started 12-18-84

Driller SB
Helper WGH
Inspector MC
Job No. 2890

Ground Water Data:
0 HRS: WATER AT 16.9'
TOTAL PIPE - 23.0'

Date Completed 12-18-84

Depth	Casing Blows	STRATA CLASSIFICATION	Depth	SAMPLING DATA No.	Blows per 6"	REMARKS
		GREY CRUSHED ROCK FILL 7.5'				3' STICK-UP
		GREY AND TAN SILTY CLAY TRACE FINE GRAVEL 16.0'				
		MULTI-COLORED FINE TO COARSE SAND AND GRAVEL. 20.0'				
		COMPLETE AT 20.0'				

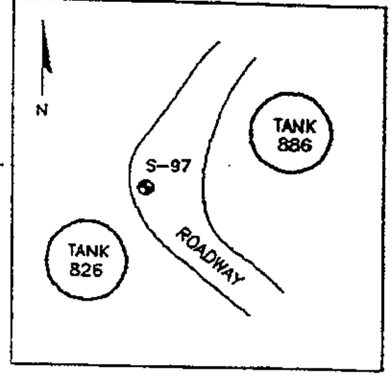
SHEET NO. .... OF ....

GROUNDWATER & ENVIRONMENTAL SERVICES, INC.
DRILLING LOG

GES

Project Sun Philadelphia Refinery
Owner Sun Company, Inc. (R & M)
Location South Yard
Permit No. NA
Well Number S-97
Total Depth 35 ft. **Diameter** 10 in.
Casing Elevation 33.33 ft.
Water Level: Initial 27 ft. **Static** 28.60 ft.
Screen Dia. 4 in.
Length 15 ft. **Slot Size** 0.02 in.
Casing Dia. 4 in.
Length 20 ft. **Type** Sch. 40 PVC
Drilling Method Hollow-Stem Auger
Sample Method Split-Spoon
Completion Details 2 ft. stick-up locking cap w/6 in. steel protective casing
Driller B. L. Myers Brothers, Inc.
Log By MDH **Date** 4/4/94

Sketch Map



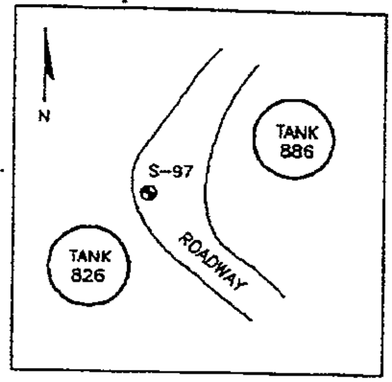
Depth (feet)	Sample No.	Well Const.	OVM (ppm)	Blow Count	Lithology	
					FILL	- Limestone gravel
			1.5		CLAY	- Orange/brown silty clay, no odor, dry
5			10	3,4,4,6		- Brown silty clay, slight odor, slight increase in moisture
						- Orange/brown silty clay, few small mica flakes, no odor, dry
10			21	3,4,9,11		- Same lithology, no odor, dry
					SAND	- Brown medium grained sand, no odor, dry
						- Same lithology, increase in fine-grained sand, no odor, dry
			0			
15			5	4,4,56		
					CLAY	- Dark brown silty clay, no odor, dry
					GRAVEL	- Poorly sorted cobble size gravel, coarse sands, no odor, dry
20				Refusal		
			45	4,5,9,21		- Same lithology, slight odor, dry
25				Refusal		
					▽	Initial groundwater encountered at 27 feet.

GROUNDWATER & ENVIRONMENTAL SERVICES, INC.
DRILLING LOG

GES

Project: Sun Philadelphia Refinery
Owner: Sun Company, Inc. (R & M)
Location: South Yard
Permit No.: NA
Well Number: S-97
Total Depth: 35 ft. Diameter: 10 in.
Casing Elevation: 33.33 ft.
Water Level: Initial 27 ft. Static 28.60 ft.
Screen Dia.: 4 in.
Length: 15 ft. Slot Size: 0.02 in.
Casing Dia.: 4 in.
Length: 20 ft. Type: Sch. 40 PVC
Drilling Method: Hollow-Stem Auger
Sample Method: Split-Spoon
Completion Details: 2 ft. stick-up locking cap w/6 in. steel protective casing
Driller: B. L. Myers Brothers, Inc.
Log By: MDH Date: 4/4/94

Sketch Map



Depth (feet)	Sample No.	Well Const.	OVM (ppm)	Blow Count	Lithology
			65		SAND – Medium grained quartz sand, black staining, strong odor, wet
					Static groundwater level at 28.60 feet.
30			811	5,6,5,6	GRAVEL – Poorly-sorted gravel, some medium grained sand, strong odor, wet
					SAND – Running sands with some pebbles, poorly sorted, strong odor, wet
35			1200	3,2,33	WELL COMPLETED AT 35 FEET.

Groundwater & Environmental Services, Inc.

Drilling Log

GES

Project: Sun Point Breeze Refinery Owner: Sun Company, Inc.

Location: South Yard Permit No.: —

Well number: S-102 Total Depth: 20 feet Diameter: 10.25 inch

Casing Elevation: 20.39 feet Water Level: Initial 15 feet Static 18.70 feet

Screen Dia.: 2 inch Length: 15 feet Slot Size: 0.020 inch

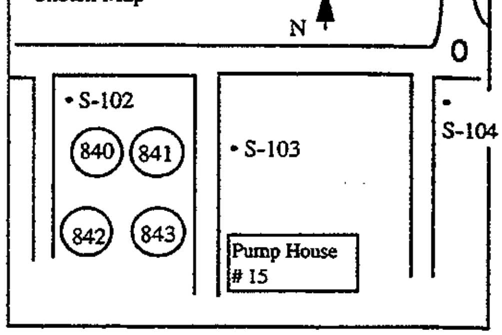
Casing Dia.: 2 inch Length: 5 feet Type: Sch. 40 PVC

Drilling Method: Hollow stem auger Sample Method: NA

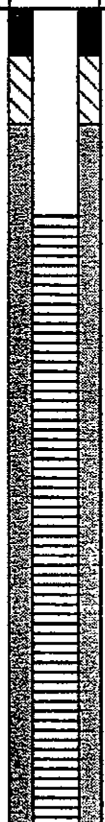
Completion Details: Three foot protective steel stick-up with locking sanitary seal

Driller: Lutz Environmental Log By: MD Haslett Date: 17 Oct 95

Sketch Map



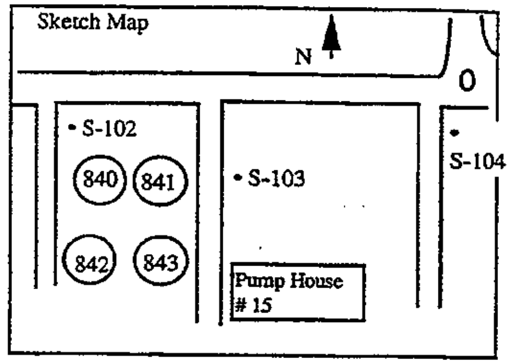
Depth (feet)	Sample No.	Well Const.	OVA (ppm)	Blow Count	Lithology
0			0		SAND - Silty sand, some pebbles, dry, no odor
5			1970		CLAY - Silty clay, some fine sand, few rounded pebbles, moist, slight odor
10			325		GRAVEL - Large rounded pebbles to cobbles, silty sand matrix, odor, wet
15			250		Initial water encountered at 15 feet below grade. - Same lithology, odor, moist Static groundwater level at 18.70 feet
20					WELL COMPLETED AT 20 FEET.



Groundwater & Environmental Services, Inc.

Drilling Log

Project: Sun Point Breeze Refinery
Owner: Sun Company, Inc.
Location: South Yard
Permit No.: —
Well number: S-103
Total Depth: 25 feet
Diameter: 10.25 inch
Casing Elevation: 28.31 feet
Water Level: Initial 20 feet Static 27.45 feet
Screen Dia.: 2 inch
Length: 15 feet
Slot Size: 0.020 inch
Casing Dia.: 2 inch
Length: 10 feet
Type: Sch. 40 PVC
Drilling Method: Hollow stem auger
Sample Method: NA
Completion Details: Three foot protective steel stick-up with locking sanitary seal
Driller: Lutz Environmental
Log By: MD Haslett
Date: 17 Oct 95

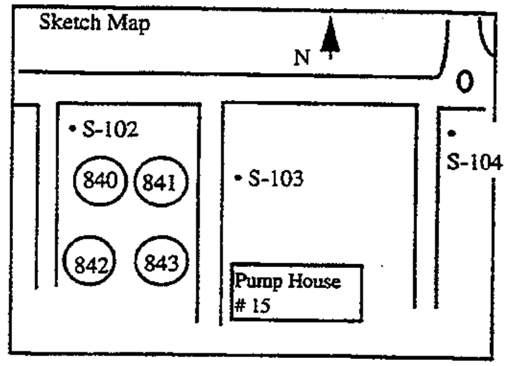


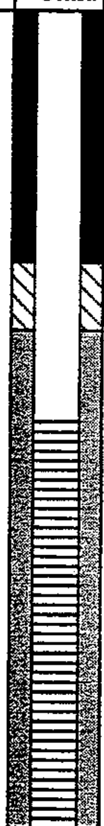
Depth (feet)	Sample No.	Well Const.	OVA (ppm)	Blow Count	Lithology
0			0		FILL - Silty sand, few pebbles, construction debris, dry, no odor
5			0		- same lithology, dry, no odor
10			0		GRAVEL - Large rounded pebbles to cobbles, silty sand matrix, odor, dry
15			20		- Same lithology, fewer pebbles, no cobbles, slight odor, dry
20					Initial water encountered at 20 feet below grade.
			3116		SAND - Silty sand, some rounded pebbles, odor, wet
					Static groundwater level at 27.45 feet
25					WELL COMPLETED AT 25 FEET.

Groundwater & Environmental Services, Inc.

Drilling Log

Project: Sun Point Breeze Refinery
Owner: Sun Company, Inc.
Location: South Yard
Permit No.: —
Well number: S-104
Total Depth: 20 feet
Diameter: 10.25 inch
Casing Elevation: 20.38 feet
Water Level: Initial 10 feet Static 18.70 feet
Screen Dia.: 2 inch
Length: 10 feet
Slot Size: 0.020 inch
Casing Dia.: 2 inch
Length: 10 feet
Type: Sch. 40 PVC
Drilling Method: Hollow stem auger
Sample Method: NA
Completion Details: Three foot protective steel stick-up with locking sanitary seal
Driller: Lutz Environmental
Log By: MD Haslett
Date: 17 Oct 95





Depth (feet)	Sample No.	Well Const.	OVA (ppm)	Blow Count	Lithology
0			0		SAND - Brown silty sand, few angular pebbles, dry, no odor
5			20		- Increased silt, slightly moist, slight odor
10					Initial water encountered at 10 feet below grade.
					- Fine silty sand, moist, odor
15			110		- Increased sand, few pebbles, moist, odor
					Static groundwater at 18.77 feet
20			90		BORING COMPLETED AT 20 FEET
25					

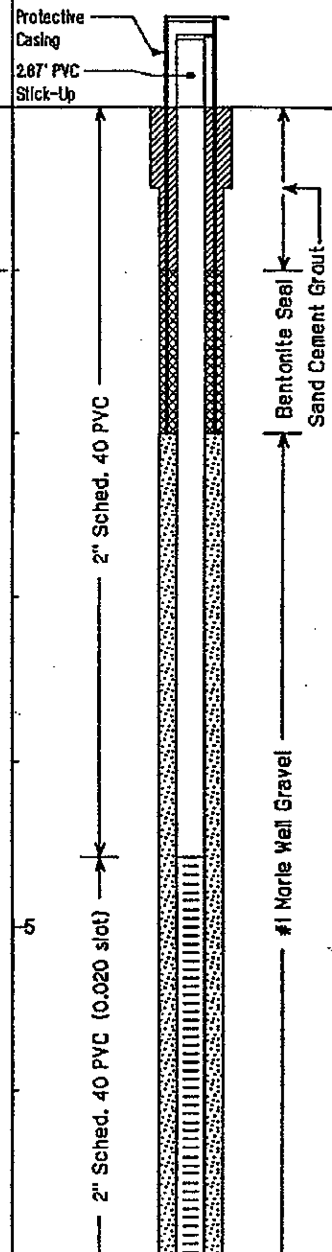
Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1996*	Use: *Monitoring*
Location: *3144 Passyunk Avenue, Philadelphia, PA*		Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*		Handex Loc #: *110535*
Owner Address: *Philadephia, PA*	BORING – Depth: *40 ft.*	Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING – Length: *7.25 ft.*	Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN – Length: *35 ft.*	Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1996)*	WELL – Depth: *39.58 ft.*	

Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.		Graphic Log	Geologic Description
						Brown Topsoil
						Brown to black Clayey SILT, trace fine sand (dry, possible fill material)
5						

Well Diagram



Geologist: Arsin Sahba	Driller: Dan Fincham – NFE

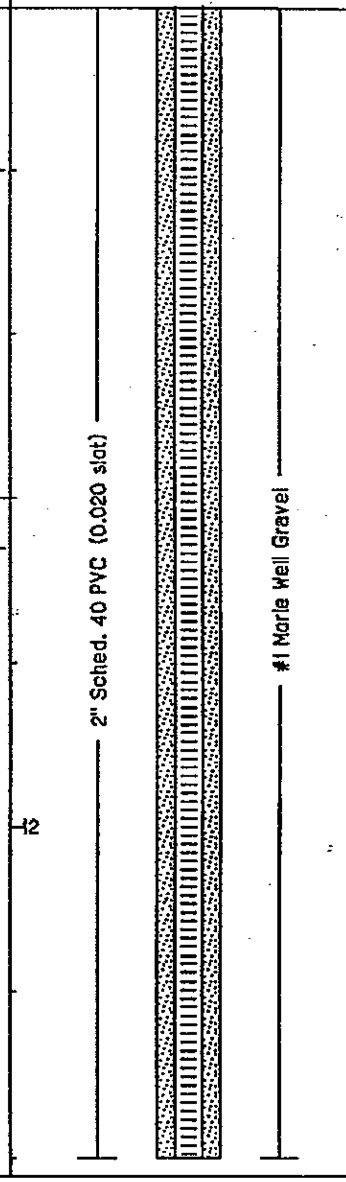
Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1998*	Use: *Monitoring*
Location: *3144 Passyunk Avenue, Philadelphia, PA*		Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*		Handex Loc #: *110535*
Owner Address: *Philadephia, PA*	BORING - Depth: *40 ft.*	Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING - Length: *7.25 ft.*	Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN - Length: *35 ft.*	Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1998)*	WELL - Depth: *39.58 ft.*	

Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.		Graphic Log	Geologic Description
						Brown Silty CLAY (mp, moist)
						Black to brown fine, medium (+), to coarse SAND, dry
						Red to black fine to coarse (+) SAND and fine to coarse (-) GRAVEL, little Clay (moist at 12', wet at 14', clay is dry and nodular)
12	111-1		7-14-15-13			
	111-2		5-7-8-8			

Well Diagram



Geologist: Arsin Sahba	Driller: Dan Fincham - NFE

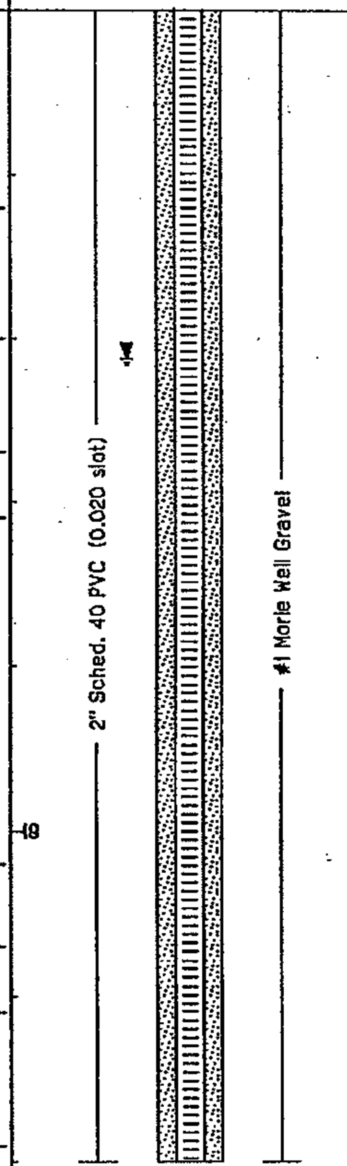
Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1998*	Use: *Monitoring*
Location: *3144 Passyunk Avenue, Philadelphia, PA*		Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*		Handex Loc #: *110535*
Owner Address: *Philadephia, PA*	BORING – Depth: *40 ft.*	Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING – Length: *7.25 ft.*	Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN – Length: *35 ft.*	Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1998)*	WELL – Depth: *39.58 ft.*	

Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.		Graphic Log	Geologic Description
						Brown fine to coarse (+) SAND, some fine (+) to medium GRAVEL, wet
	111-3		8-14-12-8			Brown fine to coarse (–) SAND, little medium Gravel, wet
						Brown fine to coarse (–) SAND, some fine to medium (+) Gravel, wet
	111-4		5-8-9-9			Red-brown fine (–) to coarse SAND, little fine to medium Gravel, wet
18						Yellowish black medium to coarse (+) SAND, some fine (+) to medium Gravel, wet
	111-5		3-3-4-4			Red-brown fine (–) to coarse SAND, little fine to medium Gravel, wet
						Brown fine (–) to coarse SAND, trace fine Gravel, wet
						Light brown fine to coarse (–) SAND, trace fine Gravel, trace Clay (matrix); wet

Well Diagram



Geologist: Arsin Sahba	Driller: Dan Fincham – NFE

Handex®

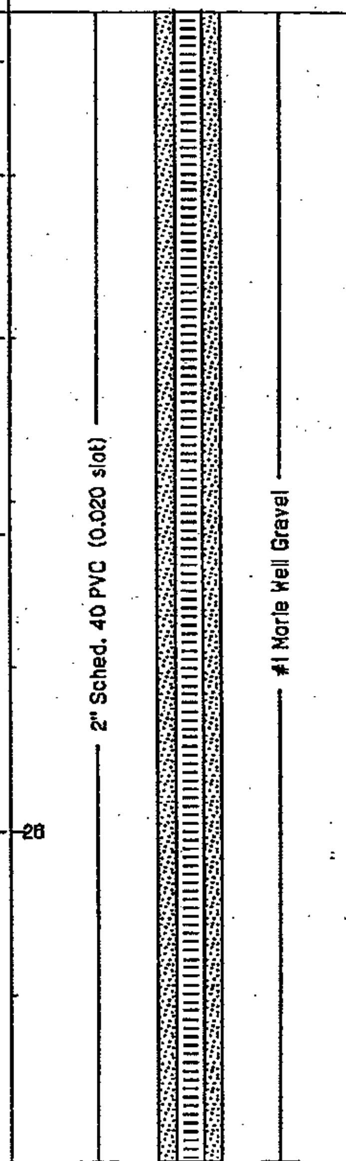
Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1996*
Use: *Monitoring*	
Location: *3144 Passyunk Avenue, Philadelphia, PA*	Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*	Handex Loc #: *110535*
Owner Address: *Philadephia, PA*	BORING – Depth: *40 ft.* Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING – Length: *7.25 ft.* Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN – Length: *35 ft.* Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1996)*	WELL – Depth: *39.58 ft.*

Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.		Graphic Log	Geologic Description
						Brown to black fine, medium (+), to coarse SAND, trace fine Gravel, wet
	111-6		3-4-4-5			Brown medium (–) to coarse SAND, trace fine Gravel, wet
						Brown medium to coarse (–) SAND, trace fine to medium (+) Gravel, wet
	111-7		3-4-7-10			Brown, tan, to gray fine to coarse (+) GRAVEL, little Clay (dry, nodular), trace fine Sand, wet
20	111-8		14-11-8-8			Brown to tan fine to coarse (–) GRAVEL, some fine to coarse (+) Sand, little Clay (red-yellow, nodular, dry); wet
	111-9		5-6-8-4			

Well Diagram



Geologist: Arsin Sahba

Driller: Dan Fincham – NFE

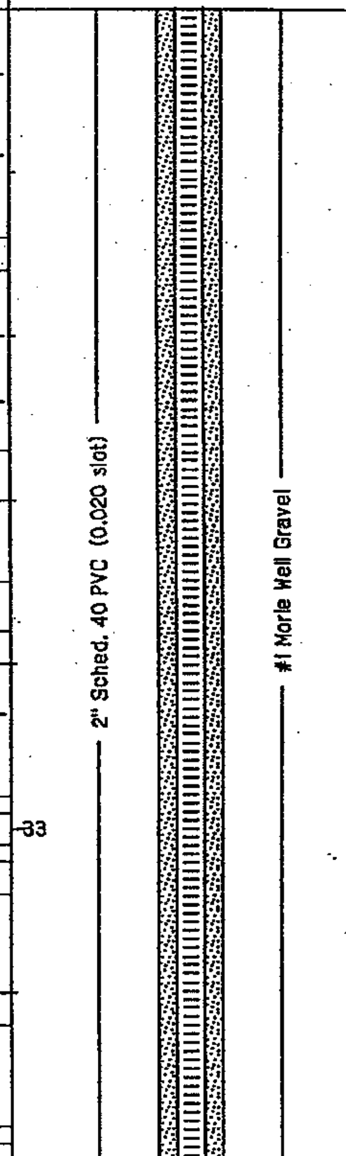
Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1996*	Use: *Monitoring*
Location: *3144 Passyunk Avenue, Philadelphia, PA*		Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*		Handex Loc #: *110535*
Owner Address: *Philadephia, PA*	BORING - Depth: *40 ft.*	Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING - Length: *7.25 ft.*	Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN - Length: *35 ft.*	Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1996)*	WELL - Depth: *39.58 ft.*	

Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.		Graphic Log	Geologic Description
						Brown/orange f (-) to c SAND, little f to m Gravel
						Brown/tan f to c (-) GRAVEL, some f to c (+) Sand, little Clay (r-y, nodular, dry)
						Red and light green CLAY (dry, low plasticity, horizontal layering, highly weathered rock)
	111-10		10-13-12-13			Brown fine to coarse (+) SAND, some fine to medium Gravel, trace Clay (matrix)
						Gray f (+) to m SAND, little Silt, trace CLAY
						Orange f SAND, some Silt, little Clay (hp)
						Gray CLAY, trace Silt, hp
						Gray fine SAND, some Silt, little Clay
						Gray to orange CLAY, hp, moist
						Orange f to m SAND, little Silt, trace Clay
	111-11		4-2-5-6			Orange SILT & CLAY, trace f Sand, lp-mp
						Gray Silty CLAY, trace fine Sand, hp, moist
33						Gray fine SAND, some Silt, little Clay
						Gray/orange Silty CLAY, little f Sand, mp, moist
						Gray fine to medium SAND, little Silt
						Orange/gray Silty CLAY, little fine Sand
						Orange fine SAND, little Silt, little Clay
	111-12		3-2-2-3			Gray Silty CLAY, trace fine Sand, hp
						Red fine SAND, little Silt, trace Clay
						Orange Silty CLAY, little fine Sand, mp
						Orange fine SAND, little Silt, little Clay

Well Diagram



Geologist: Arsin Sahba	Driller: Dan Fincham - NFE

Handex Of Maryland

WELL LOG: S-111

Permit #: *N/A*	Drill Date: *July 23, 1996*	Use: *Monitoring*
Location: *3144 Passyunk Avenue, Philadelphia, PA*		Owner Loc #: *Philadelphia Refinery*
Owner: *Sun Company, Inc.*		Handex Loc #: *110535*

Owner Address: *Philadelphia, PA*	BORING – Depth: *40 ft.*	Diameter: *7 in.*
Drilling Method: *Hollow-Stem Auger*	CASING – Length: *7.25 ft.*	Diameter: *2 in.*
Sampling Method: *Split Spoon*	SCREEN – Length: *35 ft.*	Diameter: *2 in.*
Static Water Level: *18.8 ft.* *(July 23, 1996)*	WELL – Depth: *39.58 ft.*	

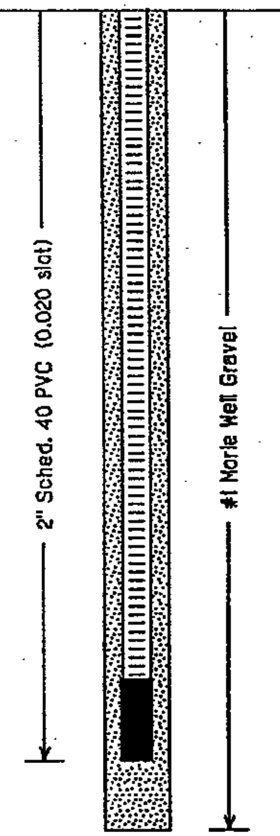
Depth (ft.)	Sample ID	Sample Depth	Blows/6 in.
	111-13		2-2-3-4
	111-14		3-3-3-3
40	111-15		3-3-2-2

Geologic Description

- Gray Silty CLAY, little fine Sand, hp
- Orange fine SAND, little Clay, little Silt
- Gray SILT and CLAY, dark striations, lp
- Gray f to m SAND, trace Silt, trace Clay
- Gray Silty CLAY, trace fine Sand, hp, moist
- Orange Clayey SILT, some fine Sand, moist
- Orange f to m SAND, little Clay, trace Silt
- Orange f,m (+),c SAND, trace Silt, trace Clay
- Orange SILT and CLAY, little fine Sand, mp
- Gray and purple striated Silty CLAY, mp
- Gray fine, medium (+), to coarse SAND
- Gray and purple SILT and CLAY, mp
- Gray SILT & CLAY, w/black hrz org striations
- Red orange f (+) to m SAND, some Clay, little Silt
- Orange, gray, to purple fine (+) to medium SAND, some Clay, trace Silt
- Purple dk gray Silty CLAY, trace fine Sand, trace black organics, medium to low plasticity
- Dk gray f (+) to c SAND, some Clay, trace f Gravel

40

Well Diagram



NOTES: 1) Gravels subrounded quartz/feldspar, 2) Residual hydrocarbons 14-20.1 ft, 3) Strong hydrocarbon odor 20.1-22 ft, 4) Medium to strong hydrocarbon odor 12-14 ft and 22-24 ft, 5) Medium hydrocarbon odor 24-28.6 ft, 6) Slight hydrocarbon odor 28.6-30 ft, 7) hp = high plasticity, 8) mp = medium plasticity, 9) lp = low plasticity, 10) c = coarse, 11) m = medium, 12) f = fine.

Geologist: Arsin Sahba	Driller: Dan Fincham – NFE

S-119

SECOR
International Incorporated

Logged By:	Dates Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/14/02 08/15/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-E

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		▽ 29.14	34.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
Riser			SILT AND SAND, fine; little medium to coarse sand, brown, dry.	1.3	0.0
Grout			SILT; little fine to medium sand, dark brown, dry.		0.0
			SILT; little fine sand, dark brown, dry.	1.0	0.0
	5		CLAY AND SILT; trace fine sand, black, dry.	0.2	0.0
			SILT; little fine sand, brown and gray, dry.	2.0	0.0
			SILT; little fine sand, brown and gray, dry.	2.0	0.0
Bentonite Seal	10		NO RECOVERY; stone in shoe of spoon.	0.0	
#1 Sand and Riser			SILT; trace fine sand, brown and gray, dry.	2.0	0.0
Schedule 40 PVC, 20 Slot			SILT; trace fine sand, brown and gray, dry.	2.0	0.0
	15		SILT; some clay, little fine sand, brown, dry.		0.0
			SAND, fine; little medium to coarse sand, little silt, trace fine gravel, orangish-brown, dry.	1.7	0.0
			SAND, fine; some medium to coarse sand, little fine gravel, trace silt, orangish-brown, dry.	2.0	0.0
	20		SAND, fine to coarse; some fine gravel, orangish-brown, dry.	1.5	0.0
			SAND, fine to coarse; some fine gravel, orangish-brown, dry.		
			SAND, fine to coarse; little fine gravel, brown, dry (wet at 25.9 feet).	2.0	0.0

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. **62SU.01011.02** Date **August 2002**

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

(sheet 1 of 2)

5-119

SECOR
International Incorporated

Logged By: SM	Dates Drilled: 08/14/02 08/15/02	Drilling Contractor Parratt-Wolff, Inc.	Project Name: Sunoco, Inc. Philadelphia Refinery, PA	Method/Equipment: Hollow Stem Auger Split Spoon	Well Number: MW-E
See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.): 4	Surface Elev.(ft.):	Groundwater Depth (ft.): ▽ 29.14	Total Depth (ft.): 34.0	Drive wt.(lbs.): / Drop Dist.(in.):

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
			SAND, fine to medium; little coarse sand, trace fine gravel, brown, wet.	1.8	0.0
			SAND, fine to coarse; some fine gravel, brown, wet.	1.6	0.0
	30		SAND, fine to medium; some coarse sand, little fine gravel, brown, wet.	1.5	7.1
			SAND, fine to medium; some coarse sand, little fine gravel, brown, wet.	2.0	9.1
			SAND, fine to medium; little coarse sand, little fine gravel, gray, wet.	2.0	57.5
			SAND, fine to coarse; brown, wet.		26.8
	35		CLAY; little fine sand, little silt, gray and orangish-brown, wet.		0.0
			SAND, fine; gray, wet.		5.4
	40				
	45				

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Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

Aquaterra Technologies, Inc.
Subsurface Log: S-119D

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-119D **Log By:** M.B. Spancake **Date:** 3/22/05 & 4/7/05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 2" **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 57
Casing Diameter: 2" **Length:** 57' **Type:** PVC
Drilling Method: Hollow Stem Auger/ Mud Rotary **Sample Method:** Split Spoon **Rig Type:** HSA Rig/Mud Rotary

Construction Details

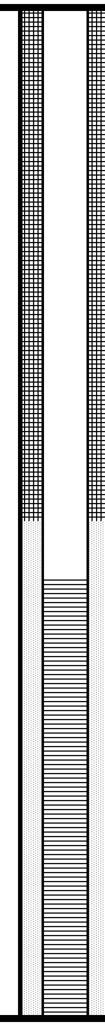
Total Well Depth: 72' BGS **Bentonite Interval:** 0-55'
Screen Interval: 57'-72' **Cement/Grout Interval:**
Sand Pack Interval: 55'-72' **Sand Pack Type:** 62'-79'
Completion Details: Completed with 2' Steel stick-up

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft)/ Blow Count	Lithology	Well Schematic
0	**1'-1.5'**			Vacuum Utility Clearance to 9' below ground surface (bgs). Hand auger to 1.5' BGS to collect soil sample on 4/1/05. Advance augers to 10' BGS and begin split spoons	
5					
10	10-12	0	2 5-7-7-12	Moist gray silt, slight clay content with some brown silt banding	
	12-14	0	2 12-17-15-21	Same as above	
15	14-16	0	1.25 4-4-8-10	Same as above in top 6", changing to a brown sandy silt for 4" Changing to a gray & brown medium to fine sandy silt.	
	16-18	0	1.25 26-16-23-30	Brown medium sand and gravel, pebble fragments. Dry	
	18-20	0	1.5 3-8-12-12	Moist gray silty clay in top 0.75' changing to a brownish orange fine to medium sand with some gravel.	
20	20-22	0	1.25 9-11-13-18	Brown fine sand and poorly sorted gravel with layers of coarse tan and gray sand, rock fragment in bottom of spoon	
	22-24	0	1 9-15-23-27	Same as above, more gravel and rock fragments present.	
25	24-26	0	1.75 5-6-4-6	Brownish gray medium sand, wet. Some gravel in top 4"	
	26-28	0	1.5 3-9-16-23	Wet brown fine sand and brown silt	
	28-30	0	1.25 10-22-32-26	Same as above, gravel and pebble fragments present	
30	30-32	0	1.25 20-23-25-31	Same as above. Weathered green serpentine rock fragments towards bottom of spoon	
	32-34	0	1.5 24-26-31-30	Wet brown fine sand with some gravel and pebble fragments	
35	34-36	0	1.75 4-19-26-28	Moist to dry dark gray clayey silt. Wet gray medium sand in bottom of spoon.	
	36-38	0	1.5 8-8-16-27	Wet gray medium sand	

Aquaterra Technologies, Inc.
Subsurface Log: S-119D (Continued)

Depth (ft)					Well Schematic
	38-40	0	2 1-1-2-2	Brown coarse sand in top 6" changing to a brownish gray moist to wet clay	
40	40-42	0	1 1-1-2-2	Same as above changing to a dark gray clayey silt, slightly moist.	
	42-44	0	0.75 2-2-2-2	Dark brown clayey silt, slightly moist.	
45	44-46	0	1.5 4-6-7-7	Same as above	
	46-48	0	1 4-4-5-5	Same as above	
	48-50	0	1.75 4-5-6-5	Same as above. Set 4" steel casing to 48' BGS. Grouted in place. Drilling continued on 4/7/05 Advance Mud rotary to 50' BGS and continue split spoons.	
50	50-52	0	2 6-7-9-12	Dark grayish brown clayey silt, slightly moist.	
	52-54	0	2 13-17-18-28	Same as above	
55	54-56	0	2 5-7-10-13	Dark grayish brown silt changing to a dark grayish brown silt and fine sand in bottom 6" of spoon. Slightly moist	
	56-58	0	1.5 13-19-24-18	Moist brown silty fine sand in top 4" of spoon changing to a wet gray and tan coarse sand with some small gravel.	
	58-60	0		Advance mud rotary to 65' BGS and collect spoon	
60	60-62				
65	65-67	0	2 24-10-10-15	Greenish gray silt and fine sand, slight moisture. 1" lense of light gray medium sand at 66' BGS. Advance to 70' BGS	
70	70-72	0	6" 52-50 / 0.2	White/light gray fine sand, wet and compact. End boring, set well at 72' BGS	



Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

SECOR
International Incorporated

5-120

Logged By:	Dates Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/15/02 08/16/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-F

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 22.75	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
Riser			SILT; some fine to medium sand, brown, moist.	1.7	0.0
Grout			SILT; trace fine sand, orangish-brown and brown, moist.	1.1	0.0
			SILT; little clay, little fine to coarse sand, brown, moist.	2.0	0.0
	5		SAND, fine to coarse; little fine gravel, brown, dry.		0.0
Bentonite Seal			SAND, fine; little medium to coarse sand, brown, dry.	1.5	0.0
			SAND, fine to coarse; little fine gravel, brown, dry.		0.0
#1 Sand and Riser			SAND, fine; little medium to coarse sand, trace fine gravel, brown, dry.	1.6	0.0
			SAND, fine; trace medium to coarse sand, reddish-brown, dry.		0.0
Schedule 40 PVC, 20 Slot	10		SAND, fine; little medium to coarse sand, trace fine gravel, brown, dry.	1.4	0.0
			SILT; some clay, little fine to coarse sand, brown, moist.		0.0
			SAND, fine to coarse; little fine gravel, brown, dry.		0.0
			SAND, fine AND SAND, medium to coarse; little fine gravel, trace silt, dark red, brown and white, dry.	2.0	0.0
			SILT; little fine to coarse sand, brown, dry.	1.7	0.0
	15		SAND, fine to medium; little coarse sand, brown, dry.		0.0
			SAND, fine to medium; little coarse sand, brown, dry.	1.9	0.0
			SAND, fine; little medium to coarse sand, dark red, dry.		0.0
			SAND, fine to medium; little coarse sand, brown, dry.	2.0	0.0
			SAND, fine to medium; little coarse sand, brown, wet.		
	20		CLAY; some silt, white and tan, dry.	2.0	0.0
			SILT AND SAND, fine; little clay, brown, wet.		0.0
			SAND, fine; some medium to coarse sand, little silt, trace fine gravel, brown, wet.		0.0 0.0
			CLAY AND SILT; trace fine sand, tan and white, dry.	2.0	0.0
			SAND, fine; gray, wet.		0.0
			SAND, fine; gray, wet.		
			SAND, fine; orangish-brown, wet.	0.8	0.0
			SAND, fine; some silt, some medium to coarse sand, orangish-brown, wet.		0.0

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

SECOR
International Incorporated

S-120

Logged By:	Dates Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/15/02 08/16/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-F

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 22.75	30.0		

Depth, (ft.)	Description	Recovery (feet)	PID Reading (ppm)
	SAND, fine; gray, wet.		0.0
	SAND, fine; gray, wet.	1.1	0.0
	SAND, fine; tan, wet.	1.0	0.0
30	SAND, fine to medium; little coarse sand, light brown, wet.		0.0
35			
40			
45			

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

SECOR
International Incorporated

5-121

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/22/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-G

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 23.46	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
Riser Grout			SILT; little fine sand, brown, dry.	0.6	0.0
			SILT; little fine sand, brown and light gray, dry.	1.5	0.0
	5		SILT; little fine sand, brown and light gray, dry.	2.0	0.0
Bentonite Seal			SILT; little fine sand, brown and light gray, dry.	1.8	0.0
#1 Sand and Riser			SILT; little fine to coarse sand, reddish-brown, dry. SILT; little fine sand, brown and gray, dry. SAND, fine to coarse; little silt, red and orangish-brown, dry.	2.0	0.0 0.0 0.0
Schedule 40 PVC, 20 Slot	10		SILT; little fine sand, brown and gray, dry. SAND, fine to coarse; trace fine gravel, reddish-brown, dry.	1.8	0.0 0.0
			SAND, fine; little medium sand, brown, dry. SILT; little fine sand, gray and brown, dry.	0.6	0.0 0.0
			SAND, fine to coarse; trace fine gravel, red and brown, dry. SAND, fine to coarse; little fine gravel, reddish-brown, dry.	1.1	0.0 0.0
	15		SAND, fine; some medium to coarse sand, trace fine gravel, orangish-brown, dry.	0.8	0.0
			SILT; little fine sand, brown and gray, dry. SAND, fine to coarse; trace fine gravel, reddish-brown, dry.	2.0	0.0 0.0
	20		SAND, fine to coarse; trace fine gravel, reddish-brown, dry at top of section, wet at bottom of section.	1.8	0.0
			SAND, fine to coarse; trace fine gravel, reddish-brown, wet.	2.0	0.0
			SILT; little fine sand, trace clay, brown, dry to moist. CLAY; little silt, dark gray, wet.	2.0	0.0 0.0

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Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

(sheet 1 of 2)

5-121

SECOR
International Incorporated

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/22/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-G

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 23.46	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
			SILT AND CLAY; little fine sand, gray, wet.		0.0
			SAND, fine; some silt, orangish-brown and gray, wet.		0.0
			SAND, fine; trace silt, orangish-brown, wet.	2.0	0.0
			SAND, fine; trace medium to coarse sand, gray, wet.	2.0	0.0
			SAND, fine; some medium to coarse sand, orangish-brown, wet.		0.0
	30		SAND, fine; trace medium to coarse sand, brown, wet.		0.0
	35				
	40				
	45				

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

5-122

SECOR
International Incorporated

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/19/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-H

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		▽ 29.77	34.6		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
Riser			SAND, fine to coarse; brown, dry.	0.9	0.0
Grout			SILT; little fine sand, brown, dry.		0.0
			SILT; little fine sand, trace clay, brown, slightly moist.	0.8	0.0
			SILT; little fine sand, little clay, brown, slightly moist.	1.2	0.0
	5		SILT; some fine sand, orangish-brown and gray, dry.		0.0
			SILT; some fine sand, trace medium sand, orangish-brown and gray, dry.	0.6	0.0
			SILT; some fine sand, pieces of brick, dark brown, dry.	1.2	0.0
			SILT; little fine sand, little clay, orangish-brown, moist.		0.0
Bentonite Seal	10		NO RECOVERY	0	0.0
#1 Sand and Riser			SILT; some clay, little fine sand, pieces of brick, brown, wet. Coarse gravel sized piece of brick in shoe of spoon.	0.2	0.0
Schedule 40 PVC, 20 Slot	15		SILT; some clay, little fine sand, brown, wet.	1.0	0.0
			SILT; some clay, little fine sand, brown, moist to dry.	2.0	0.0
			SILT AND CLAY; trace fine sand, dark gray, moist.	2.0	0.0
			SAND, fine; brown, dry.		0.0
			SAND, fine to coarse; little fine gravel, brown, dry.		0.0
	20		SAND, fine AND SAND, medium to coarse; gray, dry.	0.7	0.0
			SAND, fine to medium; dark brown, moist.		0.0
			SAND, fine AND SAND, medium to coarse; gray, dry.		0.0
			SILT; little fine sand, little clay, orangish-brown and gray, dry.	2.0	0.0
			SILT; some clay, trace fine sand, dark brown, moist.		0.0
			SAND, fine to medium; gray, dry.		0.0
			SILT AND CLAY; trace fine sand, dark brown, moist.	1.5	0.0

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. **62SU.01011.02** Date **August 2002**

Log of Well

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

Figure

SECOR
International Incorporated

S-122

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/19/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-H

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		▽ 29.77	34.6		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
			SAND, fine to medium; some coarse sand, brown, dry.		0.0
			SAND, fine to coarse; trace fine to coarse gravel, brown, wet.	1.1	0.0
			SILT; some clay, little fine sand, brown, wet.	0.7	0.0
	30		SAND, fine to coarse; little fine to coarse gravel, brown, wet.	0.1	0.0
			SAND, fine to coarse; little fine to coarse gravel, brown, wet.	1.5	0.0
			SAND, fine; brown, wet.		0.0
			SAND, fine to coarse; brown, wet.	1.4	0.0
			SAND, fine to coarse; trace fine gravel, brown, wet.		14.1
	35		SAND, fine; some medium sand, trace silt, brown, wet.		473
			SAND, fine to coarse; black, wet.		281
	40				
	45				

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. **62SU.01011.02** Date **August 2002**

Log of Well

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

Figure

SECOR
International Incorporated

S-123

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/20/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-I

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		▽ 24.35	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
Riser			SILT; trace fine sand, brown, dry.		
Grout			SILT; trace fine sand, brown, dry.	0.6	0.0
	5		SILT; trace fine sand, trace clay, brown and gray, moist.	0.8	0.0
Bentonite Seal			SILT; trace fine sand, trace clay, brown and gray, moist.	1.4	0.0
			SILT; little fine to medium sand, light gray, dry.		0.0
#1 Sand and Riser			SILT; some fine to medium sand, brown, dry.	1.2	0.0
			SILT; some fine sand, brown, dry.		0.0
Schedule 40 PVC, 20 Slot	10		SILT; some fine sand, trace clay, brown, dry.	1.0	0.0
			SILT AND SAND, fine; little medium to coarse sand, trace fine gravel, brown, dry.	0.6	0.0
	15		SILT; some clay, little fine to coarse sand, brown, moist. Stone in shoe of spoon.	0.1	0.0
			SAND, fine; little medium to coarse sand, tan and gray, dry.	1.4	0.0
			SAND, fine to coarse; some fine gravel, brown and dark red, dry.	1.0	333
	20		GRAVEL, fine to coarse; white, dry.	0.6	0.0
			SAND, fine; some medium to coarse sand, little fine gravel, black, dry.		630
			SILT AND SAND, fine; little medium to coarse sand, moist.	1.3	76.7
			SAND, fine to coarse AND GRAVEL, fine; black, wet.		1111
▽			SAND, fine; gray and brown, wet.	1.5	1326

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

S-123

SECOR
International Incorporated

Logged By:	Date Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/20/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-I

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 24.35	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
			SAND, fine to medium; trace coarse sand, brown, wet.		1900
			SAND, fine to medium; trace coarse sand, trace fine gravel, brown, wet.	1.7	2020
			SAND, fine; some medium sand, trace coarse sand, brown, wet.		3327
			SAND, fine; little medium to coarse sand, trace fine gravel, brown, wet.	2.0	3437
	30				
	35				
	40				
	45				

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. **62SU.01011.02** Date **August 2002**

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

S-124

SECOR
International Incorporated

Logged By:	Dates Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/21/02 08/22/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-J

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 26.79	30.0		

Well Construction: Riser; Grout; Bentonite Seal; #1 Sand and Riser; Schedule 40 PVC, 20 Slot

Depth (ft.)	Description	Recovery (feet)	PID Reading (ppm)
	FILL - SAND, fine to coarse AND GRAVEL, fine to coarse; brown, dry.		
	SILT; some fine to coarse sand, brown, dry.	2.0	0.0
	SILT; some fine to coarse sand, brown, dry.	2.0	0.0
5	SILT; some cinders, little fine sand, brown, dry.		0.0
	SILT; little fine sand, brown, dry.		0.0
	SILT; little fine sand, brown and tan, dry.	1.5	0.0
	SILT; some fine sand, brown, dry.	0.6	0.0
10	SILT; little fine sand, little clay, gray and brown, dry.	1.7	22.6
	SILT; little fine sand, brown, dry.	0.5	15.2
	SILT; some fine sand, trace clay, gray and brown, dry.	1.3	0.0
15	SILT AND SAND, fine; brown, dry.		25.6
	SILT; little fine sand, trace clay, gray, dry.	0.5	14.1
	SAND, fine to coarse AND GRAVEL, fine to coarse; brown, dry.	1.1	11.9
	SAND, fine; trace medium to coarse sand, gray and brown, dry.		723
20	SAND, fine; trace medium to coarse sand, gray, dry.	1.6	849
	SAND, fine; little coarse sand, brown and gray, dry.		640
	SAND, fine; some medium to coarse sand, brown, dry.		312
	SAND, fine; some medium to coarse sand, brown, dry.	1.0	326
	SAND, fine; gray, dry.		429
	SAND, fine; some medium to coarse sand, little fine gravel, brown, dry.		1085
	SAND, fine to coarse AND GRAVEL, fine; brown, wet.	1.8	2311

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. 62SU.01011.02 Date August 2002

Log of Well

Figure

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

SECOR
International Incorporated

S-124

Logged By:	Dates Drilled:	Drilling Contractor	Project Name:	Method/Equipment:	Well Number:
SM	08/21/02 08/22/02	Parratt-Wolff, Inc.	Sunoco, Inc. Philadelphia Refinery, PA	Hollow Stem Auger Split Spoon	MW-J

See "Legend to Logs" for sampling method, classifications and laboratory testing methods	Boring Diam.(in.):	Surface Elev.(ft.):	Groundwater Depth (ft.):	Total Depth (ft.):	Drive wt.(lbs.):	Drop Dist.(in.):
	4		∇ 26.79	30.0		

Well Construction	Depth, (ft.)	Sample Type	Description	Recovery (feet)	PID Reading (ppm)
			SAND, fine to medium; some coarse sand, brown, wet.		1969
			SAND, fine to coarse; brown and gray, wet.	1.7	2220
			SAND, fine to medium; some coarse sand, gray, wet.	1.8	2415
	30				
	35				
	40				
	45				

The substrata descriptions above are generalized representations and based upon visual/manual classification of cuttings and/or samples obtained during drilling. Predominant material types shown on the log may contain different materials and the change from one predominant material type to another could be different than indicated. Descriptions on this log apply only at the specific location at the time of drilling and may not be representative of subsurface conditions at other locations or times.

Project No. **62SU.01011.02** Date **August 2002**

Log of Well

DRILL LOGS AUG 2002.GPJ
LOG OF BOREHOLE

Figure

Aquaterra Technologies, Inc.
Subsurface Log: S-216

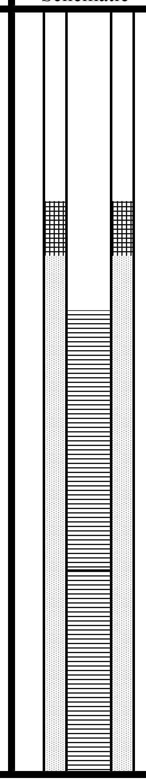
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-216 **Log By:** M.B. Spancake **Date:** 19-Apr-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 16'
Casing Diameter: 4 inch **Length:** 20.5 **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 26' bgs **Backfill:** 0'-7'
Screen Interval: 11'-26' **Cement/Grout Interval:**
Sand Pack Interval: 9'-26' **Bentonite Interval:** 7'-9'
Completion Details: 3' stick up **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS. Advance augers to 10' BGS and begin continuous	
	1'-1.5'			Hand auger to 1.5' BGS to collect soil sample on 3/25/05.	
				Advance augers to 10' BGS and begin continuous split spoons	
5					
10	10-12	21	1.5 6-7-9-8	Brown coarse sand and poorly sorted gravel, slight reddish color and slight moisture	
	12-14	21	1 8-15-9-10	Same as above, more red in color.	
15	14-16	263	0.75 8-11-17-21	Reddish brown coarse sandy gravel, poorly sorted. Moist to wet.	
	16-18	292	1.75 23-13-13-18	Same as above, wet.	
	18-20	358	1 11-14-13-10	Same as above.	
20	20-22	318	1.25 6-8-10-12	Same as above	
	22-24	258	1.75 4-6-10-12	Same as above. Gravel is becoming larger. Large pebble in bottom of spoon	
25	24-26	NA	0 50 / 0.4	No recovery. Advance to 26' BGS and set well.	

Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-217

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

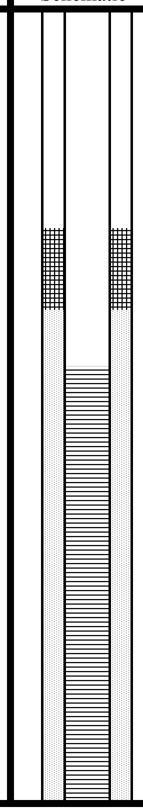
Boring Number: S-217 **Log By:** M.B. Spancake **Date:** 29-Mar-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 27' bgs **Backfill:** 0'-7'
Screen Interval: 12'-27' **Cement/Grout Interval:**
Sand Pack Interval: 10'-27' **Bentonite Interval:** 7'-10'
Completion Details: 3' stickup **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 7' BGS.	
	1-1.5'			Hand auger to 1.5' BGS to collect soil sample on 4/1/05. Sample collected 5' from well location Advance augers to 10' below ground surface and begin split spoons every 5 feet.	
5				No lithology recorded. Driller indicated spoons recovered a sandy gravel matrix. Some spoons had more sand, some had more gravel.	
10	10-12	NA			
15	15-17	NA			
20	20-22	NA			
25	25-27	NA		Well set at 27' BGS.	



Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-218

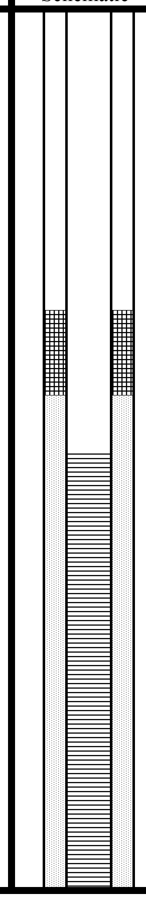
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-218 **Log By:** M.B. Spancake **Date:** 20-Apr-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 25'
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** 0-11' = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 11-'13' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 10' BGS Advance augers to 10' below ground surface and begin split spoons every 5 feet.	
5					
10	10-12	NA	1.5 1-2-3-3	Moist to wet gray clayey silt, some fine sand	
15	15-17	NA	0.75 21-12-13-16	Gray coarse sandy gravel, slightly moist. Gravel is small.	
20	20-22	NA	1.25 20-17-15-15	Reddish brown coarse sandy gravel, slightly moist.	
25	25-27	NA	1 6-5-6-16	Wet brown medium sand and silt, some small gravel. Advance augers to 30' BGS and set well	
30					



Note: PID not working, therefore no readings available.

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-218D**

Stantec

DRILLING: STARTED **1/14/16** COMPLETED: **2/1/16**	*NORTHING (ft): **220117.66**
INSTALLATION: STARTED **2/2/16** COMPLETED: **2/2/16**	*EASTING (ft): **2684511.91**
DRILLING COMPANY: **Parratt Wolff**	*GROUND ELEV (ft): **21.9**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**	*TOC ELEV (ft): **24.52**
DRILLING METHOD: **HSA; Mud Rotary**	INITIAL DTW (ft): **22**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**	BOREHOLE DEPTH (ft): **114**
	STATIC DTW (ft): **Not Measured**
	WELL DEPTH (ft): **97**
	WELL CASING DIAMETER (in): **4**
	BOREHOLE DIAMETER (in): **8**
	LOGGED BY: **A Klingbeil**
	CHECKED BY: **A Patel**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description
0–1.5		APPARENT FILL [crushed stone, concrete, asphalt, few cinders]
1.5–13	CL	APPARENT RECENT ALLUVIUM [Light gray SILT/CLAY, some fine sand (slightly micaceous) (common, distinct greenish gray to brownish yellow mottles) (sand content increases with depth, few very fine to fine sand lenses) (moist to wet)]
13–14.4	SC	APPARENT "TRENTON GRAVEL" [Brownish yellow very coarse to fine SAND, some to and silt/clay, some coarse to fine gravel (in thin lenses) (coarsely micaceous) (coarse sandstone gravel at 14.4' +/-) (moist)]
14.4–16.9	SM	Pale greenish gray very fine SAND, trace silt, trace coarse sand, trace coarse gravel (weathered gneiss cobble from 16.4-16.9' +/-) (damp)
16.9–18.5	CL	Reddish yellow SILT/CLAY and very fine SAND (slightly cemented) (damp-dry)
18.5–20.9	SW-SM	Varicolored (mostly brownish yellow) fine to coarse SAND, some to and fine to medium gravel (subangular gneiss, sandstone and quartzite), little to trace silt (coarsens with depth) (damp)
20.9–22.5	SC	Reddish brown very fine SAND, some silt, trace to little clay, trace fine to medium sand (micaceous) (moist to wet)
22.5–22.9	SM	Strong brown fine SAND, little medium sand, trace silt (slightly micaceous) (saturated)
22.9–23.1	CL	Light reddish brown CLAY/SILT (slightly micaceous) (slightly cemented) (wet)
23.1–28	SM	Stratified Deposit (4-6" beds of coarsening upward sequences) consisting of reddish brown CLAY/SILT, trace fine sand; fine SAND; yellowish brown very coarse to fine SAND, trace silt; and coarse GRAVEL(red, purple sandstone) (saturated with wet lenses)
28–	CL	APPARENT PRM UPPER CLAY UNIT [Very pale brown, light brownish gray, and yellow CLAY/SILT, trace fine sand (slightly micaceous) (medium plasticity) (common

Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)
AOI4-S218D-0.5-1.0-20160205			1,200
AOI4-S218D-6-6.5-20160108			1,200
S-218D@ 6.5-8'			1,200
S-218D@ 8-10'	1.2	2 5 5 5	37
S-218D@ 10-12'	1.4	2 5 4 4	0
S-218D@ 12-12.9'	1.8	3 4 12 18	1
S-218D@ 12.9-14'			1
S-218D@ 14-14.4'	0.9	9 18 11 10	1
S-218D@ 14.4-16'			1,173
S-218D@ 16-16.9'	1.3	12 14 16 15	118
S-218D@ 16.9-18'			128
S-218D@ 18-18.5'	1.5	15 16 18 18	9
S-218D@ 18.5-20'			35
S-218D@ 20-20.9'	1.0	13 14 13 7	2
S-218D@ 20.9-22'			0
S-218D@ 22-22.5'	1.5	7 8 11 13	0
S-218D@ 22.5-22.9'			0
S-218D@ 22.9-23.1'			0
S-218D@ 23.1-24'			0
S-218D@ 24-26'	1.2	5 7 9 5	0
S-218D@ 26-28'	1.4	6 10 11 17	0
S-218D@ 28-28.1'	1.8	5 3 3 2	215
S-218D@ 28.1-30'			17

Well Construction:
- 4" PVC Casing
- Tremie Grout - Bentonite Amended Cement

GEO FORM 304 - EVERGREEN AOI4_BORINGLOGS_20160425.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 3/23/17

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-218D**

Stantec

DRILLING: STARTED **1/14/16** COMPLETED: **2/1/16**	*NORTHING (ft): **220117.66**
INSTALLATION: STARTED **2/2/16** COMPLETED: **2/2/16**	*EASTING (ft): **2684511.91**
DRILLING COMPANY: **Parratt Wolff**	*GROUND ELEV (ft): **21.9**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**	*TOC ELEV (ft): **24.52**
DRILLING METHOD: **HSA; Mud Rotary**	INITIAL DTW (ft): **22**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**	BOREHOLE DEPTH (ft): **114**
	STATIC DTW (ft): **Not Measured**
	WELL DEPTH (ft): **97**
	WELL CASING DIAMETER (in): **4**
	BOREHOLE DIAMETER (in): **8**
	LOGGED BY: **A Klingbeil**
	CHECKED BY: **A Patel**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Well Construction
30-32	CL	reddish yellow mottles with depth) (wet)]	S-218D@ 30-32'	2.0	1/12" 1/12"	3	
32-32.6			S-218D@ 32-32.6'			0	
32.6-34	SC (33)	APPARENT PRM UPPER SAND UNIT [Light gray, pinkish gray, and pink very fine to fine SAND, little to trace clay/silt (few fine distinct olive yellow mottles with depth) (strong brown cemented lens @ base) (saturated)]	S-218D@ 32.6-34'	1.2	1 3 4 4	586	
34-36			S-218D@ 34-36'	1.3	1 1 2 3	1,058	
36-38			S-218D@ 36-38'	1.4	3 5 7 15	55	
38-39.5			S-218D@ 38-39.5'	1.5	4 5 6 9	0	
39.5-40			S-218D@ 39.5-40'			0	
40-42	SP (40)	Yellow, brownish yellow and gray medium to fine SAND, trace coarse sand, trace to no silt (coarsens with depth to coarse to fine sand, little fine gravel) (trace heavy minerals) (saturated)	S-218D@ 40-42'	1.2	10 13 18 20	0	Tremie Grout - Bentonite Amended Cement (40)
42-44			S-218D@ 42-44'	1.6	18 22 21 24	0	
44-46			S-218D@ 44-46'	1.5	4 11 16 15	0	
46-48			S-218D@ 46-48'	1.1	7 12 13 18	0	
48-50			S-218D@ 48-50'	1.1	8 9 10 11	0	
50-50.5			S-218D@ 50-50.5'			0	
50.5-52	SM (50.5)	Reddish yellow very coarse to fine SAND, some silt, little fine to medium gravel (quartz) (few thin gravel lenses) (wet)	S-218D@ 50.5-52'	0.9	7 8 11 8	0	
52-54	GC (53)	Reddish yellow to reddish brown fine to medium GRAVEL, some coarse to fine sand, some silt/clay (gravel content increases and gravels coarsen with depth) (wet to saturated)	S-218D@ 52-54'	0.9	10 23 13 13	0	
54-55			S-218D@ 54-55'	0.2	6 11 15 19	0	
55-56			S-218D@ 55-56'			0	
56-58			S-218D@ 56-58'	0.9	13 29 33 35	0	
58-60	CL (58)	APPARENT PRM MIDDLE CLAY UNIT [Very dark gray CLAY/SILT, trace very fine to fine sand, trace coarse sand (few laminations of gray very fine micaceous sand) (wet)]	S-218D@ 58-60'	1.0	4 6 6 8	0	

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO: **S-218D**

Stantec

DRILLING: STARTED **1/14/16**	COMPLETED: **2/1/16**	*NORTHING (ft): **220117.66**	*EASTING (ft): **2684511.91**
INSTALLATION: STARTED **2/2/16**	COMPLETED: **2/2/16**	*GROUND ELEV (ft): **21.9**	*TOC ELEV (ft): **24.52**
DRILLING COMPANY: **Parratt Wolff**		INITIAL DTW (ft): **22**	BOREHOLE DEPTH (ft): **114**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**		STATIC DTW (ft): **Not Measured**	WELL DEPTH (ft): **97**
DRILLING METHOD: **HSA; Mud Rotary**		WELL CASING DIAMETER (in): **4**	BOREHOLE DIAMETER (in): **8**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**		LOGGED BY: **A Klingbeil**	CHECKED BY: **A Patel**

*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description
60-65	CL	
65-70	SP-SC	APPARENT PRM MIDDLE SAND UNIT [Pale green and light greenish gray very fine SAND, little fine sand, trace medium sand, trace silt/clay (few stringers of dark gray clay) (trace lignite) (slightly laminated appearance) (saturated)]
70-73	SC	Stratified Deposit (3-4" beds of coarsening upward sequences) consisting of pale green very fine to fine SAND, trace silt; dark greenish gray very fine SAND and CLAY/SILT; dark greenish gray CLAY/SILT; and pale green GRAVEL (wet with dry lenses)
73-74.5	SP	Pale green fine SAND, little medium to coarse sand, trace to no silt (saturated)
74.5-77	GW-GM	Pale green, brownish yellow and olive yellow medium to coarse GRAVEL, some fine to coarse sand, little to trace silt/clay (angular to sub-angular quartz and sandstone gravel) (saturated)
77-80	GC	Pale green, brownish yellow and olive yellow medium to coarse GRAVEL, some fine to coarse sand, some clay (few lenses very coarse sand, trace silt) (color changes to reddish yellow with light gray mottles) (wet with saturated lenses)
80-86	GW-GM	Yellow to pale yellow medium to coarse GRAVEL and very coarse to fine SAND, little to trace clay/silt (saturated to wet)
86-90	SP	APPARENT PRM LOWER SAND UNIT [Pale yellow to white to reddish yellow coarse to medium SAND, little very coarse sand, little fine sand, little fine gravel, trace coarse gravel, trace to no silt (gravels are multi-colored) (saturated)]

Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)
S-218D@ 60-62'	0.0	4 5 6 5	0
S-218D@ 62-64'	0.8	7 8 9 8	0
	0.0	5 6 19 27	
S-218D@ 66-68'	1.2	38 55 45 30	*
S-218D@ 68-70'	1.5	11 9 13 12	*
S-218D@ 70-72'	1.5	9 8 11 12	*
S-218D@ 72-74'	1.2	15 19 35 19	*
S-218D@ 74-76'	1.0	10 7 12 26	*
S-218D@ 76-78'	1.0	24 23 29 36	*
S-218D@ 78-80'	1.3	28 32 32 25	0
S-218D@ 80-82'	0.9	54 50 54 50/2"	0
S-218D@ 82-84'	0.5	73 50/2"	0
S-218D@ 84-86'	0.9	32 52 50/2"	0
S-218D@ 86-88'	1.0	43 51 50/3"	0
S-218D@ 88-90'	0.2	50/3"	0

Well Construction:
TR-30 3/8" Coated Bentonite Pellet Seal

PROJECT: **PHRO - Corrective Measures Program**
LOCATION: **AOI 4 Remedial Investigation**
PROJECT NUMBER: **213402602**

WELL / PROBEHOLE / BOREHOLE NO:
PAGE 4 OF 4 **S-218D**

Stantec

DRILLING: STARTED **1/14/16** COMPLETED: **2/1/16**
INSTALLATION: STARTED **2/2/16** COMPLETED: **2/2/16**
DRILLING COMPANY: **Parratt Wolff**
DRILLING EQUIPMENT: **Truck-Mounted CME-55**
DRILLING METHOD: **HSA; Mud Rotary**
SAMPLING EQUIPMENT: **Split Spoon, Cuttings**

*NORTHING (ft): **220117.66** *EASTING (ft): **2684511.91**
*GROUND ELEV (ft): **21.9** *TOC ELEV (ft): **24.52**
INITIAL DTW (ft): **22** BOREHOLE DEPTH (ft): **114**
STATIC DTW (ft): **Not Measured** WELL DEPTH (ft): **97**
WELL CASING DIAMETER (in): **4** BOREHOLE DIAMETER (in): **8**
LOGGED BY: **A Klingbeil** CHECKED BY: **A Patel**
*COORDINATE SYSTEM AND DATUMS: PA STATE PLANE SOUTH, NAD83; NAVD 88

Depth (feet)	USCS	Description	Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (ppm)	Well Construction
90–93	SP		S-218D@ 90-92'	1.3	18 52 36 41	0	Sand Pack #3 Well Sand
			S-218D@ 92-92.9'	1.2	31 46 50/3"	0	
93–102.5	GW-GM	Yellow and white coarse GRAVEL, some fine to coarse sand, little silt, trace clay (few reddish yellow lenses) (wet with saturated lenses)	S-218D@ 92.9-94'			0	4" SCH40 Slotted PVC Casing (0.020in slot size)
			S-218D@ 94-96'	0.5	43 50/1"	0	
			S-218D@ 96-98'	0.8	62 71	0	End Cap
			S-218D@ 98-100'	0.8	28 34 32 31	0	
			S-218D@ 100-102'	1.5	51 26 50/2"	0	
			S-218D@ 102-102.5'	1.3	65 52 36 41	0	
102.5–104	GW	Yellow coarse to medium GRAVEL, some very coarse to coarse sand, trace to little silt (saturated)	S-218D@ 102.5-104'			0	
104–112	GW	NO SAMPLES AVAILABLE (hard drilling on apparent gravel and cobbles; rig shaking; *drilling change at 112' +/- bgs)					
112–114		APPARENT WEATHERED BEDROCK [white and gray clay/silt, little to some coarse sand (coarsely micaceous) (apparent weathered pegmatite?) (wet)]	S-218D@ 112-113.5'	1.5	24 26 72	0	

Depth scale: 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119

Aquaterra Technologies, Inc.
Subsurface Log: S-219

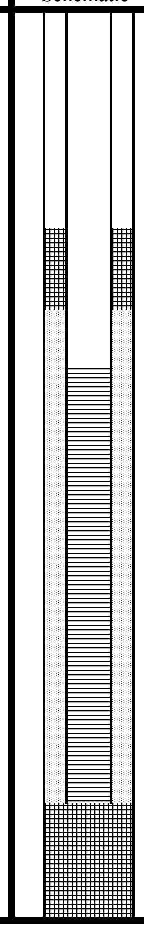
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-219 **Log By:** M.B. Spancake **Date:** 25-Mar-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 16'
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 27' bgs **Backfill:** 0'-7' = Backfill
Screen Interval: 12'-27' **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: 10'-27' **Bentonite Interval:** 7'-10' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blow Count	Lithology	Well Schematic
0	**1-1.5**			Soft dig to 10' BGS Hand auger to 1.5' BGS to collect soil sample.	
5				Advance augers to 10' below ground surface and begin split spoons every 5 feet.	
10	10-12	0	1 7-8-9-13	Brownish gray medium sand and some small gravel and pebble. Slightly moist	
15	15-17	0	1.5 4-4-4-5	Gray and brown silty clay, moist. Lense of wet fine sand and gravel at 16' BGS. Changing to a brown orange silty clay.	
20	20-22	0	0.5 10-9-9-9	Wet gray medium sandy gravel changing to a brown silty clay.	
25	25-27	0	1 8-13-13-11	Brown silty clay, moist. Changing to a coarse tan sandy gravel.	
30	30-32		2	Tan clay in top 6" of spoon changing to a medium to fine tan sand, wet. Set well at 27' BGS. Backfilled 27' - 32' with bentonite chips	



Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-220

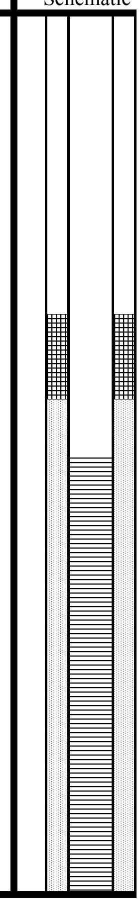
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-220 **Log By:** M.B. Spancake **Date:** 20-Apr-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 20'
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** 0'-10' = Backfill
Screen Interval: 15-'30' **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 10'-13' = Bentonite
Completion Details: 3-foot Stickup **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blowcount	Lithology	Well Schematic
0				Soft dig to 10' BGS	
	1'-1.5'			Hand auger to 1.5' BGS to collect soil sample on 4/1/05.	
				Advance augers to 10' below ground surface and begin split spoons every 5'	
5					
10	10-12	NA	NA 7-7-3-3	Dry brown coarse sand and small gravel	
15	15-17	NA	NA 6-4-6-4	Same as above	
20	20-22	NA	NA 5-4-4-4	Wet grayish green coarse sandy gravel changing to a brown silt, moist and stiff	
25	25-27	NA	NA 2-4-6-6	Tan and brown clayey silt. Some fine to medium sand, slightly moist	
				Advance augers to 30' BGS and set well.	
30					



Note: PID not working, therefore no readings available.
Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-221

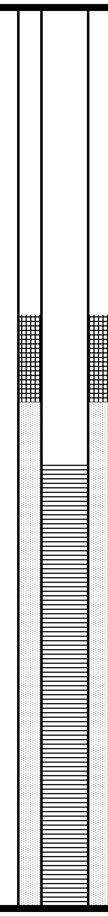
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-221 **Log By:** M.B. Spancake **Date:** 21-Apr-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 22'
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** 0'-10'
Screen Interval: 15'-30' **Cement/Grout Interval:**
Sand Pack Interval: 13'-30' **Bentonite Interval:** 10'-13'
Completion Details: 3' Stick up **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS	
	1.5'-2'			Hand auger to 2' BGS to collect soil sample on 3/25/05.	
				Advance augers to 10' BGS and begin continuous split spoons	
5					
10	10-12	21	2	Wet gray clayey silt and some small gravel in top 6" Change to a stiff	
			5-8-11-15	reddish brown clay, slightly moist.	
	12-14	NA	1.5	Stiff reddish brown silty clay, slight moisture	
			12-14-20-22		
	14-16	463	0.5	Slightly moist brown coarse sand and medium sized gravel.	
15			8-9-9-6		
	16-18	390	1	Fine and medium brown sand, some small gravel. Changing to a fine	
			15-11-12-21	gray sand in bottom 4". Moist.	
	18-20	920	0.75	Wet coarse sandy gravel, large pebbles present. Gray in color.	
			13-12-12-10	Large pebble in shoe of spoon.	
20	20-22	NA	0	No Recovery	
			9-11-15-16		
	22-24	920	1.25	Wet reddish brown and gray coarse sand and medium to large poorly	
			19-17-17-18	sorted gravel	
	24-26	801	1	Medium and coarse brown sand, wet.	
25			5-4-3-5		
	26-28	824	1.25	Same as above.	
			7-5-7-8		
	28-30	974	1.75	Same as above. Advance augers to 30' BGS and set well.	
			7-9-10-15		
30					

Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-222

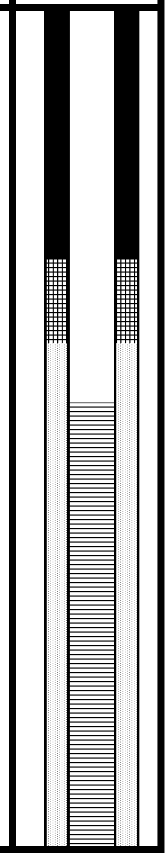
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-222 **Log By:** M.B. Spancake **Date:** 9-Jun-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 13' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 28' bgs **Backfill:**
Screen Interval: 13'-28' **Cement/Grout Interval:** 0'-8'
Sand Pack Interval: 11'-28' **Bentonite Interval:** 8'-11'
Completion Details: Flushmount with manhole **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS	
				Advance augers to 28' BGS and set well'	
				Cuttings were brown silt and gravel	
5				No lithology recorded	
10					
15					
20					
25					

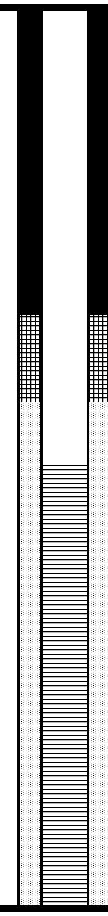
Aquaterra Technologies, Inc.
Subsurface Log: S-223

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-223 **Log By:** M.B. Spancake **Date:** 8-Jun-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** 0'-10' = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 10'-13' = Bentonite
Completion Details: Flushmount with manhole **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS Advance augers to 30' BGS and set well' Cuttings were brown silt and gravel	
5				No lithology recorded	
10				Augers grinding from 12'- 17' BGS. Cuttings are brown sandy silt anc coarse gravel	
15					
20				Wet cuttings at 20' BGS	
25					
30				Well set at 30' BGS	

Aquaterra Technologies, Inc.
Subsurface Log: S-224

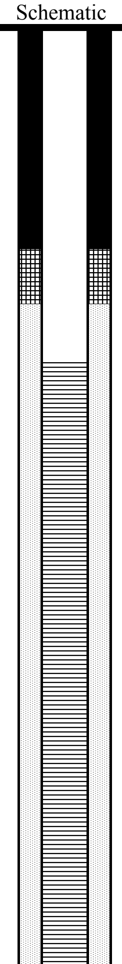
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-224 **Log By:** M.B. Spancake **Date:** 6-Jun-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 20' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 12' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 32' bgs **Backfill:**
Screen Interval: 12'-32 **Cement/Grout Interval:** 0'-8'
Sand Pack Interval: 10'-32' **Bentonite Interval:** 8'-10'
Completion Details: Flushmount with manhole **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS Advance augers to 32' BGS and set well	
5				No lithology recorded	
10					
15					
20					
25					
30					

Aquaterra Technologies, Inc.

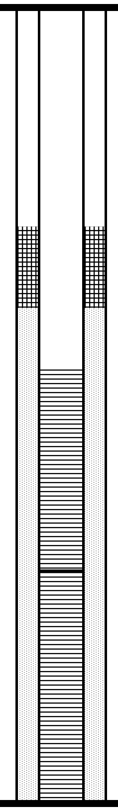
Subsurface Log: S-225

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-225 **Log By:** M.B. Spancake **Date:** #
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25"
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 17'
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 27' bgs **Backfill:** 0'-7' = Backfill
Screen Interval: 12'-27' **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: 10'-27' **Bentonite Interval:** 7'-10' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 10' BGS Advance augers to 10' below ground surface and begin split spoons every 5 feet.	
5					
10	10-12	280	1'	Tight brown sandy silt with small gravel. Slight staining present. Becoming more sandy towards bottom.	
15	15-17	326	0.75'	Reddish brown silt with coarse sandy gravel. Moist. Becoming wet towards bottom.	
20	20-22	362	1.25'	Wet brownish red coarse sandy gravel.	
25	25-27	26	2'	Wet gray clayey sand. Sand is fine grain. Slight color change to brown-gray at 26.5' BGS. Set well at 27' BGS.	

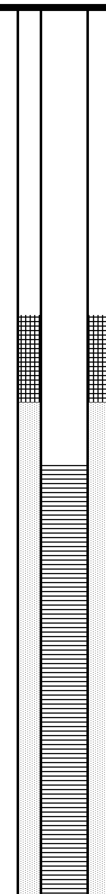
Aquaterra Technologies, Inc.
Subsurface Log: S-229

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: S-229 **Log By:** M.B. Spancake **Date:** 23-Mar-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 20'
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Split Spoon **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** 0-10' = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 10'-13' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blow Count	Lithology	Well Schematic
0	**1.5'-2'**			Soft dig to 10' BGS Hand auger to 2' BGS to collect soil sample. Advance augers to 10' below ground surface and begin continuous split spoons	
5					
10	10-12	0	0.5 2-2-5-5	Rock fragments in a brown sand and silt matrix, dry.	
12	12-14	0	1 6-6-7-8	Same as above, slight moisture	
14	14-16	0	1 3-6-13-20	Same as above	
16	16-18	11	1 16-21-20-23	Dry coarse sandy gravel	
18	18-20	14	0.5 25-16-14-12	Same as above, more large gravel and rock fragments present.	
20	20-22	NA	0.25 3-2-4-5	Wet brown gray sand, SPP present	
22	22-24	NA	1.25 7-12-12-12	Wet poorly sorted coarse sandy gravel changing to a fine to medium gray brown sand towards bottom. SPP present	
24	24-26	NA	1.5 2-2-5-15	Same as above, lense of fine to medium brown gray sand in bottom.	
26	26-28	NA	1 31-17-33-16	Wet coarse sandy gravel, poorly sorted, brownish gray in color.	
28	28-30	NA	2 13-19-23-40	Same as above Set well at 30' BGS	
30					

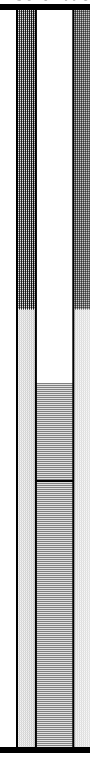
No PID readings after 20' due to heavy rain.
Note: Highlighted cell indicates soil sample submitted for laboratory analysis.

Aquaterra Technologies, Inc.
Subsurface Log: S-233

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-233 **Log By:** M.B. Spancake **Date:** 17-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 18 **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** NA = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 0'-13' = Bentonite
Completion Details: 3' stick up **Sand Pack Type:** #2 = Sand

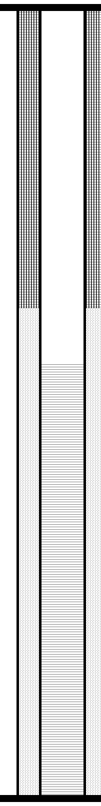
Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 7' BGS. Advance augers to 30' BGS	
5					
	7'-10'			No Cuttings	
10	10'-15'			Moist gray clay cuttings, some small gravel, very odorous	
15	15'-20'			Same as above. Change in color at 17' BGS to reddish gray. Ginding/gravel at 18' BGS	
20	20'-25'			Augers grinding from 21'-23' BGS. Becoming slightly softer from 23'-24' Pebbles, coarse sand, and gravel present in cuttings Mosit clayey reddish brown silt.	
25	25'-30'			Softer material, no cuttings.	
30				End boring at 30' BGS and set well	

Aquaterra Technologies, Inc.
Subsurface Log: S-234

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-234 **Log By:** M.B. Spancake **Date:** 18-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 15' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 27' bgs **Backfill:** NA = Backfill
Screen Interval: 12'-27' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 10'-27' **Bentonite Interval:** 0'-10' = Bentonite
Completion Details: 3' stickup **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS.	
5					
	8'-10'			No cuttings	
10	10'-15'			Augers jumping/grinding at 13' BGS. No cuttings	
15	15'-20'			Very hard material at 16' BGS.	
				Cuttings at 18' BGS moist brown gray clay, trace sand and some small gravel, odorous	
20	20'-25'			Gravel, augers grinding	
25	25-27	NA		Softer at 26' BGS, some float rock present. Very odorous Well set at 27' BGS.	

Aquaterra Technologies, Inc.
Subsurface Log: S-235

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-235 **Log By:** M.B. Spancake **Date:** 18-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25"
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 20'
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** NA
Screen Interval: 15'-30' **Cement/Grout Interval:** NA
Sand Pack Interval: 13'-30' **Bentonite Interval:** 0'-13'
Completion Details: 3' Stick up **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

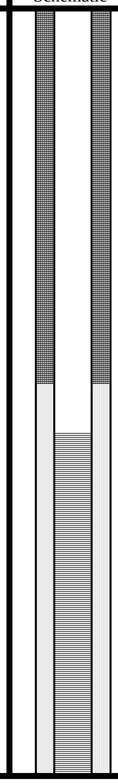
Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 8' BGS	
5					
	8'-10'			No cuttings	
10	10'-15'			No cuttings	
15	15'-20'			No cuttings, slight grinding at 17' BGS, gravel material	
20	20'-25'			Pebbles followed by moist to wet gray-brown sandy gravel, very odorous	
25	25-27			Same as above, wet.	
				Soft material at 29' BGS	
30				Advance augers to 30' BGS and set well	

Aquaterra Technologies, Inc.
Subsurface Log: S-236

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-236 **Log By:** M.B. Spancake **Date:** 19-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 20'
Casing Diameter: 4 inch **Length:** 20' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 32' bgs **Backfill:** NA = Backfill
Screen Interval: 17'-32' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 15'-32' **Bentonite Interval:** 0'-15' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blow Count	Lithology	Well Schematic
0				Soft dig to 7' BGS	
5					
	7'-10'			No cuttings	
10	10'-15'			No cuttings	
				Augers grinding at 13' BGS Very heavy grinding at 14' BGS	
15	15'-20'			Assorted pebbles in brown clayey silt and sand matrix. Very hard material	
20	20'-25'			Wet coarse sand and small gravel, reddish brown in color, odorous.	
25	25-30'			Same as above	
30	30-32			Same as above Set well at 32' BGS	

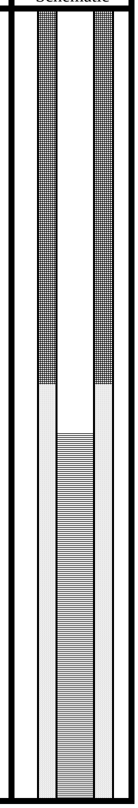
Aquaterra Technologies, Inc.
Subsurface Log: S-237

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-237 **Log By:** M.B. Spancake **Date:** 19-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 20' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 32' bgs **Backfill:** NA = Backfill
Screen Interval: 17-'30' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 15'-30' **Bentonite Interval:** 0'-15' = Bentonite
Completion Details: 3-foot Stickup **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Recovery (ft) / Blowcount	Lithology	Well Schematic
0				Soft dig to 8' BGS	
5					
	8'-10'			No cuttings	
10	10'-15'			No cuttings	
15	15'-20'			Grinding starting at 15' BGS Wet brown sandy clay cuttings	
20	20'-25'			Same as above	
25	25'-30'			Same as above	
30				Advance augers to 32' BGS and set well	



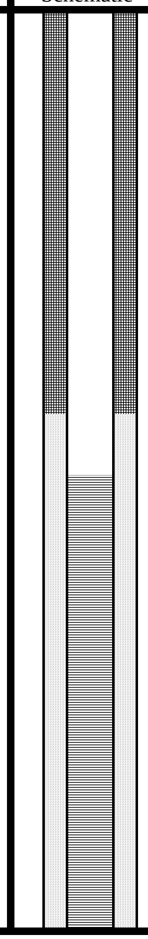
Aquaterra Technologies, Inc.
Subsurface Log: S-238

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-238 **Log By:** M.B. Spancake **Date:** 21-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 23'
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** NA = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 0'-13' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 6' BGS	
5					
	6'-10'			Stained gray silt and rock fill, very odorous. Dry	
10	10'-15'			Same as above.	
				Change to a gray and brown clay with gravel at 13' BGS	
15	15'-20'			Same as above	
				Change to pebbles and gravel in a gray brown silt at 17' BGS	
20	20'-25'			Same as above. Pebbles becoming larger.	
				Wet gray sand and silt at 23' BGS	
25				Wet gray silty coarse sand	
30				Set well at 30' BGS	



Aquaterra Technologies, Inc.
Subsurface Log: S-239

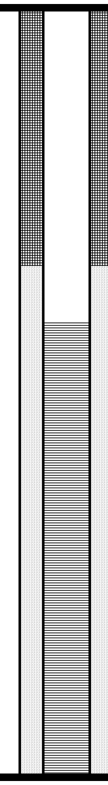
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-239 **Log By:** M.B. Spancake **Date:** 24-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** 19'
Casing Diameter: 4 inch **Length:** 10' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 25' bgs **Backfill:** NA
Screen Interval: 10'-25' **Cement/Grout Interval:** NA
Sand Pack Interval: 8'-25' **Bentonite Interval:** 8'-11'
Completion Details: Flushmount with manhole **Sand Pack Type:** #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 7' BGS	
5					
	7'-10'			Brown silty clay and gravel cuttings. Moist	
10	10'-15'			Change to a very moist gray sandy clay at 12' BGS	
15	15'-20'			Grinding at 19' BGS. Wet gray brown sand and clayey silt, odorous	
20	20'-25'			No cuttings	
25				Set well at 25' BGS	



Aquaterra Technologies, Inc.
Subsurface Log: S-240

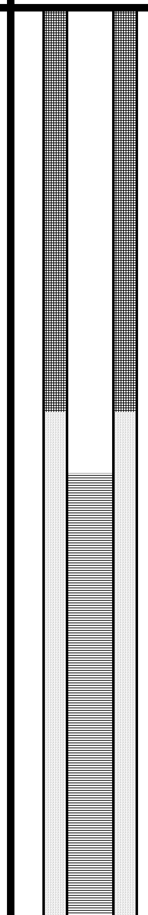
Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Pennrose Ave **Permit No.:**
Philadelphia, Pennsylvania
Boring Number: S-240 **Log By:** M.B. Spancake **Date:** 24-Oct-05
Casing Elevation: N/A **Driller:** Total Quality Drilling **Borehole Dia:** 8.25'
Screen Diameter: 4 inch **Length:** 15' **Slot Size:** 0.02 **Water Level (Init):** NA
Casing Diameter: 4 inch **Length:** 18' **Type:** PVC
Drilling Method: Hollow Stem Auger **Sample Method:** Cuttings **Rig Type:** HSA Rig

Construction Details

Total Well Depth: 30' bgs **Backfill:** NA = Backfill
Screen Interval: 15'-30' **Cement/Grout Interval:** NA = Cement/Grout
Sand Pack Interval: 13'-30' **Bentonite Interval:** 0'-13' = Bentonite
Completion Details: 3' Stick up **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology
0				Soft dig to 6' BGS
5	6'-10'			No cuttings
10	10'-15'			Moist brown gray clay, some sand and small gravel, slight odor
15	15'-20'			Same as above, strong odor Grinding at 17' BGS
20	20'-25'			Very heavy grinding at 21' BGS. Pebble and gravel in a silt and coarse sand matrix, brownish gray in color.
25				Same as above
30				Well set at 30' BGS

Well Schematic



Aquaterra Technologies, Inc.
Subsurface Log: S-241

Project Name: Sunoco Philadelphia Refinery AOI - 4
Owner: Sunoco, Inc. (R&M)
Location: Pennrose Ave
Philadelphia, Pennsylvania
Permit No.:
Boring Number: S-241
Log By: M.B. Spancake
Date: 26-Oct-05
Casing Elevation: N/A
Driller: Total Quality Drilling
Borehole Dia: 8.25'
Screen Diameter: 4 inch **Length:** 15'
Slot Size: 0.02
Water Level (Init): 25'
Casing Diameter: 4 inch **Length:** 18'
Type: PVC
Drilling Method: Hollow Stem Auger
Sample Method: Cuttings
Rig Type: HSA Rig

Construction Details

Total Well Depth: 30' bgs
Backfill: NA
Screen Interval: 15'-30'
Cement/Grout Interval: NA
Sand Pack Interval: 13'-30'
Bentonite Interval: 0'-13'
Completion Details: 3' Stick up
Sand Pack Type: #2

= Backfill
= Cement/Grout
= Bentonite
= Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 7' BGS	
5					
	7'-10'			Brown silt, very odorous	
10	10'-15'			Gray silt, slight clay content	
15	15'-20'			Grinding at 17'-18' BGS. Pebble and gravel in a brown silt	
				Change to a brown medium sand and silt at 19' BGS	
20	20'-25'			Slight grinding at 21' BGS. Pebbles and small gravel in brown silt and sand	
25				Wet coarse sand and small gravel. Sheen observed on soil/water surface	
30				Set well at 30' BGS	

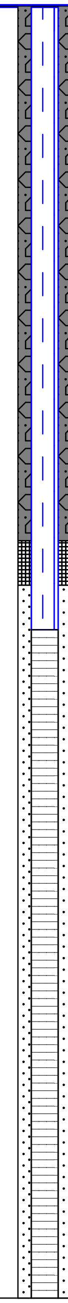
Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-278

PROJECT:	**Sunoco - Philadelphia Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI - 4**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**11/18/2009**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**29'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0					
-5				Utility clearance to 8' by Mobile Dredging	
	62.7		Spoon 8-10', 12" recovery, top 3" - orange brown very fine, slightly micaceous sand, moist, remainder - gray, moist very fine slightly micaceous sand	Set augers @ 8'	PVC Riser (0-14')
-10					Grout (0-12')
					Bentonite (12-13')
	39.7		Spoon 14-16', 14" recovery, mottled, wet silty very fine sand, slightly micaceous, strong odors		Sand (13-29')
-15					
	620		Spoon 19-21', Full recovery, saturated, very strong odors, dark gray, medium-coarse sand with few small rounded quartz pebbles, with 1"-2" alternating layers of orange-brown fine sandy silt		PVC Screen (14-29')
-20					
	1932		Spoon 24-26', loose, saturated, brown sandy gravel with some clay, very strong odors but no LNAPL visible		
-25					
	1260		Spoon 26-28', saturated, loose, light gray coarse sand with few small gravel (rounded), slight sheen at top of spoon	End of boring @ 29'	

WELL DIAGRAM



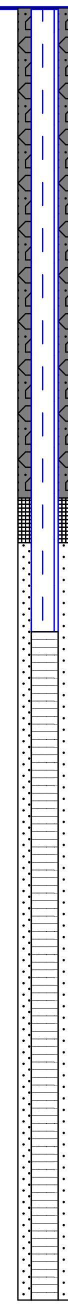
Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-279

PROJECT:	**Sunoco - Philadelphia Refinery**	DRILLING CO.:	**Total Quality Drilling**
SITE LOCATION:	**AOI - 4**	DRILLING METHOD:	**Hollow Stem Auger**
JOB NO.:		SAMPLING METHOD:	**Split Spoon**
LOGGED BY:	**Tiffani Doerr**	SCREEN/RISER DIAMETER:	**4"**
DATES DRILLED:	**11/18/2009**	WELLBORE DIAMETER:	**6"**
TOTAL DEPTH:	**29'**	ELEVATION:	**N/A**

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0					
-5				Utility clearance to 8' by Mobile Dredging	
	1823		Spoon 8-10', very moist, gray/light brown slightly mottled, very fine sand, very strong odors	Set augers @ 8'	PVC Riser (0-14')
-10					Grout (0-11')
					Bentonite (11-12')
	1358		Spoon 14-16', same as above, more orange mottling/layers and slightly plastic		Sand (12-29')
-15					
	2056		Spoon 19-21', 19-20' - same as above, 20-21' - sand and gravel, heterogeneous (colors, composition, size), moist		PVC Screen (14-29')
-20					
	1567		Spoon 24-26', same, gravel with some clayey silt, layers (gray), 24.5-25' - very tight, moist, reddish-brown clay with few sands		
-25					
			Spoon 29-31', top half - same gray/brown (orange) mottled/layered very fine sandy silt (slightly plastic), bottom half - sand and gravel, saturated and loose		
	812				
-30				End of boring @ 29', spooned to 31'	

WELL DIAGRAM



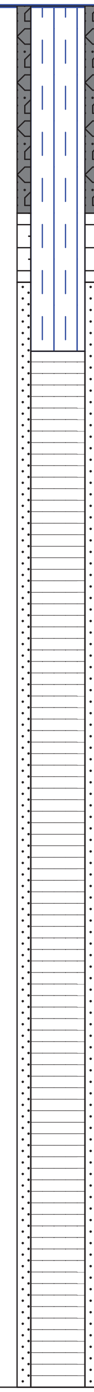
Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-282

PROJECT:	Sunoco-Philadelphia Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-3	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	S. Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	4/27/10	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	20'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0				Hand cleared to 8'	
	0.0		Gray sand and gravel to 3'	Sample collected from (1'-2') submitted to the laboratory for analysis	
	0.0				
			Large gravel/rocks 3-4" dia. and sand, no odors, all fill		5' PVC Riser Bentonite 3-4'
					Sand 4-20'
-5					
	0.0		50% recovery - Dark brown/gray fine sand, very moist		
	0.0				
-10	0.0		50% recovery - Same as above		15' PVC Screen
	0.0				
	0.0		25% recovery - (12') gray very fine sand, micaceous, very moist (13') Black, same as above		
	0.0				
	7.6		Brown/black silty sand, odor, very moist to wet		
-15	8.9				
	127		25% recovery - Black coarse sand and gravel, trace clay, strong odor, wet		
	239				
	356		100% recovery - Black coarse sand and gravel, trace clay, strong odor, wet		
	337			Hollow stem auger terminal depth = 20'	
-20					

WELL DIAGRAM

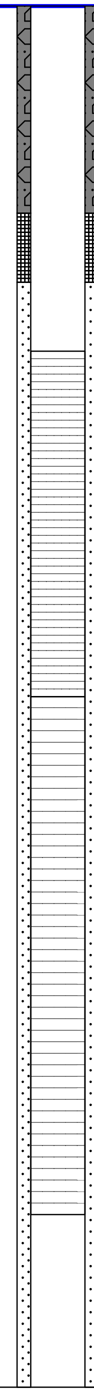


Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-329

PROJECT:	Sunoco-Marcus Hook Refinery	DRILLING CO.:	Total Quality Drilling
SITE LOCATION:	AOI-4/Penrose Ave	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:		SAMPLING METHOD:	Split Spoon
LOGGED BY:	Tiffani Doerr	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	9/20/2010	WELLBORE DIAMETER:	6"
TOTAL DEPTH:	40'	ELEVATION:	N/A

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			Hole cleared to 8' and backfilled. Hollow stem auger to depth - no split spoon samples.	Hand cleared to 8' No soil samples collected		
-5					10' PVC Riser	
-10						
-15					10' of 0.01-slot screen	
-20						
-25					15' of 0.02-slot screen	
-30				Hollow stem auger terminal depth = 40'		
-35					5' solid PVC Riser for sump	
-40						



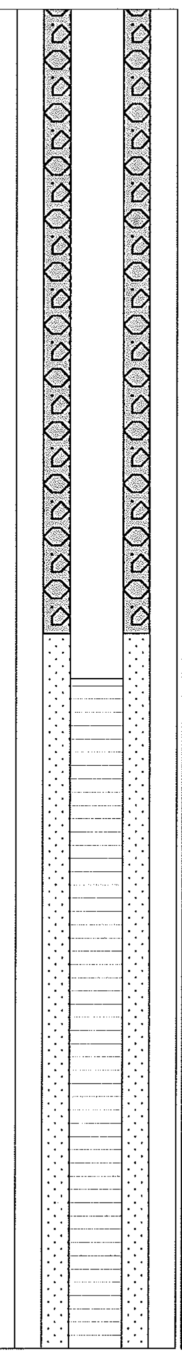
Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-364

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	5 March 2013 (clrd) 18-19 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0	0.0		(0-2') Sandy gravel, fill, some silt.	*Sample collected @ 0.5-1' for laboratory analysis	
	0.0		(2-4') Same as above.		
	429.7		(4-6') Brownish gray silty clay, some gravel, moist, odor.		
-5	420		(6-8') Same as above.	*Sample collected @ 4-5' for laboratory analysis	
	410		(8-10') Gravely sand, some silt.	Cleared to 10' via vac truck (samples collected by hand auger)	
-10	254		(10-12') Brownish green silty sand, with small gravel, wet, odor.		Bentonite/grout seal 0-14'
	1056		(12-14') Brown sandy silt with small gravel, wet, strong odor.		PVC Surface Casing 0-15'
	1051		(14-16') Brown sandy silt, with small gravel, wet, strong odor.		
-15	24.1		(16-18') Brown sandy silt with gravel, wet, odor.		
	702		(18-20') Brown sandy silt with small gravel, wet, strong odor.	Water encountered @ 18-19'. *Sample collected @ 19' for laboratory analysis	
-20	931		(20-22') Brown sandy silt with small gravel, wet, strong odor.		Sand 14-30'
	1364		(22-24') Brown sandy silt with gravel, wet, very strong odor.		
	1284		(24-26') Brown sandy silt with gravel, wet, very strong odor.		PVC Sreen 15-30'
-25	770		(26-28') Brown sandy silt with gravel, wet, strong odor.		
	911		(28-30') Brown sandy silt with gravel, wet, strong odor.		
-30					

WELL DIAGRAM



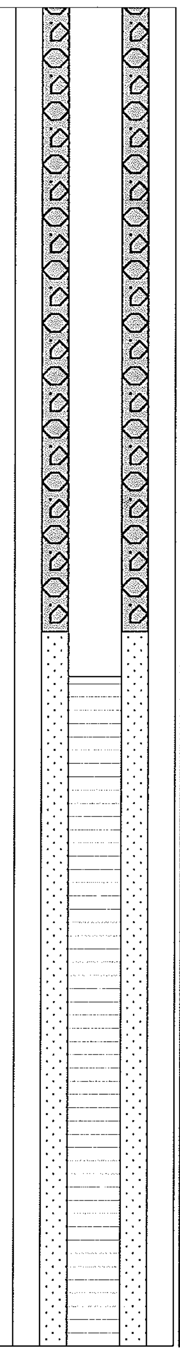
Aquaterra Technologies, Inc

MONITORING WELL LOG: S-365

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Luke Mokrycki/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	4 March 2013 (clrd) 18 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			(0-2') Orange - brown clay		
	0		(2-4') Dark gray, black clay	*Sample collected @ 0' - 2' for laboratory analysis	
-5	5.9		(4-10') Dark gray - black clay, strong odor.	*Sample collected @ 4' - 6' for laboratory analysis	
	250.9				
	35.8				PVC Surface Casing 0-15'
-10	40.3		(10-14') Grey silty sand with small gravel, dry, no odor.		
	1.1			*Sample collected @ 12' - 14' for laboratory analysis	Bentonite/grout seal 0-14'
-15	0.8		(14-16') Brownish grey sand silt with very small gravel, dry, no odor.		
	19.6		(16-18') Brownish red sand silt with small gravel, dry, odor.		
	197		(18-20') Brownish green sandy gravel, moist, odor.		Sand 14' - 30'
-20	89.6		(20-22') Brownish green sandy gravel, wet, strong odor.		
	257		(22-24') Brownish green sandy silt with small gravel, wet, strong odor.		PVC Screen 15' - 30'
-25	782		(24-26') Brownish green sandy silt with small gravel, wet, extremely strong odor.		
	948		(26-28') Grey sandy gravel, large gravel, wet, strong odor.		
	863		(28-30') Brownish green sand silt with small gravel, wet, strong odor.		
-30					

WELL DIAGRAM

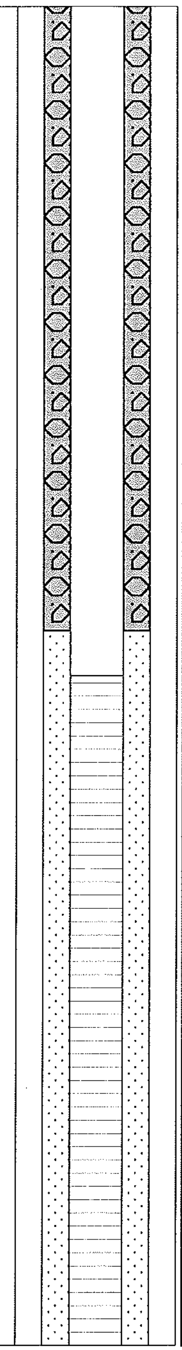


Aquaterra Technologies, Inc.

MONITORING WELL LOG: S-366

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	5 March 2013 (cleared) 15 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0	0.0		(0-2') Brown sandy gravel, fill.	*Sample collected @ 0-1' for laboratory analysis		
	0.1		(2-4') Brown sandy gravel, fill, some silt, trace clay.			
-5	15.7		(4-6') Gray clayey silt, trace gravel.	*Sample collected @ 4.5-5.5' for laboratory analysis		
	10.1		(6-8') Same as above.			
	5.4		(8-10') Same as above.			
-10	1.2		(10-12') Brownish tan sandy silt, dry, no odor.	Cleared to 10' via vac truck (samples collected by hand auger)	Bentonite/grout seal 0-14'	
	18.5		(12-14') Brownish gray sandy silt, dry, slight odor.		PVC Surface Casing 0-15'	
-15	20.3		(14-16') Brownish green silty sand with gravel, dry, slight odor.	*Sample collected @ 14-16' for laboratory analysis		
	114		(16-18') Brownish green silty sand with gravel, dry, odor.			
	726		(18-20') Brownish green silty sand with gravel, moist, strong odor.			
-20	582		(20-22') Brown silty sand with gravel, wet, strong odor, visible sheen.	Water encountered @ 21'.	Sand 14-30'	
	93.8		(22-24') Brown silty sand with gravel, wet, slight odor.			
-25	238		(24-26') Brown silty sand with fine gravel, wet, odor, sheen.		PVC Sreen 15-30'	
	138		(26-28') Brown silty sand with fine gravel, wet, odor.			
-30	253		(28-30') Brown sandy silt with fine gravel, wet, strong odor.			

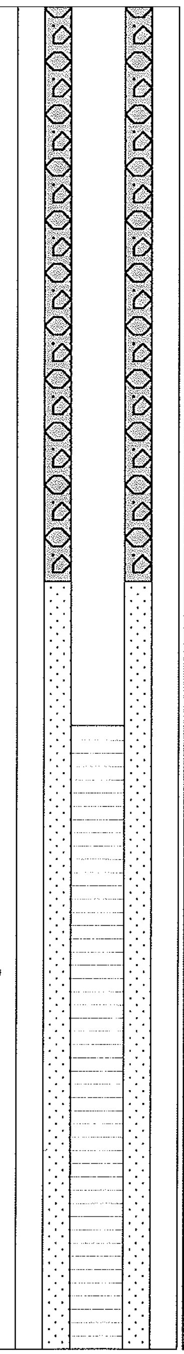


Aquaterra Technologies, Inc

MONITORING WELL LOG: S-367

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Luke Mokrycki/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	5 March 2013 (clrd) 13 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	28'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			(0-2') Black, fill, gravel, silt, strong odor.			
	180.7		(2-4') Black clay some gravel (small), strong odor.	*Sample collected @ 0' - 2' for laboratory analysis		
	55.1		(4-6') Brown clay, moist.			
-5						
	33.1		(6-8') Dark brown clay, moist.			
	35.8		(8-10') Fill, black clay, wet.	*Sample collected @ 8' - 10' for laboratory analysis	PVC Surface Casing 0-13'	
-10	60.8		(10-12') Grey brown silty sand with small gravel. moist, odor.	*Sample collected @ 10' for laboratory analysis	Bentonite/grout seal 0-12'	
	244		(12-14') Blackish brown silty sand with small gravel, moist, slight odor.	*Sample collected @ 14' for laboratory analysis		
	158		(14-16') Greyish tan silty sand with large gravel, dry.			
-15				Depth to water 15.5'.		
	4		(16-18') Greyish brown silty sand with gravel, dry.			
	0		(18-20') Brownish grey silty sand with gravel, wet.		Sand 12' - 28'	
-20	14		(20-24') Brown/red silty sand with small gravel, wet, slight odor.		PVC Screen 13' - 28'	
	12					
	3		(24-26') Brown silty sand with small gravel, wet, no odor.			
-25						
	1		(26-28') Brown silty sand with very small gravel, wet, no odor.			



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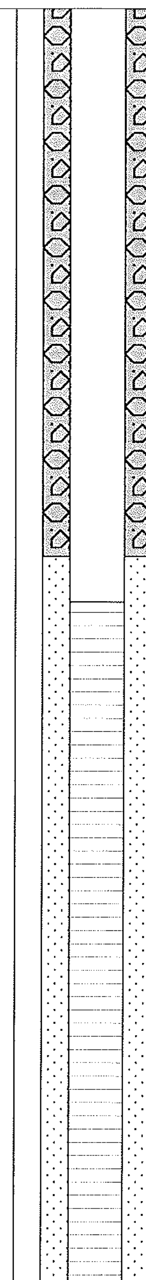
MONITORING WELL LOG: S-368

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	5 March 2013 (clrd) 14 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	28'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			(0-0.5') Gravel, fill		
			(0.5-2') Brown silty sand, some gravel.	*Sample collected @ 0-1' for laboratory analysis	
	0		(2-4') Brown clayey silt.		
-5	0		(4-6') Same as above.		
	0		(6-8') Gray silty clay.	*Sample collected @ 6-7' for laboratory analysis	
	49.9		(8-10') Same as above.		
-10	24.9		(10-12') Brown/green silty sand, dry, slight odor.	Cleared to 10' via vac truck (samples collected by hand auger)	Bentonite/grout seal 0-12'
	76.7		(12-14') Brownish green silty sand, moist, slight odor.		PVC Surface Casing 0-13'
-15	58.7		(14-16') Brownish black silty sand with gravel, dry, no odor.	*Sample collected @ 14' for laboratory analysis	
	5.8		(16-18') Black silty sand with small gravel, wet, strong odor.		
	77		(18-20') Blackish brown silty sand with small gravel, wet, strong odor.		
-20	156		(20-22') Brown silty sand with small gravel, wet, slight odor.		Sand 12'-28'
	2.3		(22-24') Brown silty sand with gravel, wet, slight odor.		
-25	25.3		(24-26') Brownish gray silty sand with gravel, wet, strong odor.		PVC Screen 13-28'
	57.3		(26-28') Brown silty sand with gravel, wet, strong odor.		
	90.3				

WELL DIAGRAM



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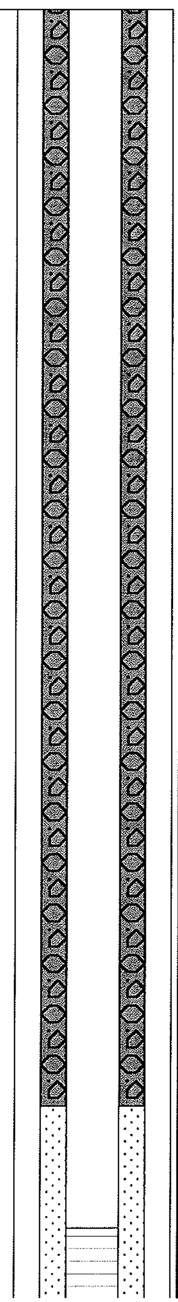
MONITORING WELL LOG: S-369

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Luke Mokrycki/Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	4 March 2013 (cleared) 2 April 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	42' (Well Depth - 40')	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0			(0-2') Dark/tan clay, sand and gravel		
	14.8		(2-4') Dark tan/brown clay, gravels	*Sample collected @ 0-2' for laboratory analysis	
-5	1.5		(4-6') Dark gray clay	*Sample collected @ 2-4' for laboratory analysis	
	0.5		(6-8') Dark tan clay	*Sample collected @ 6-8' for laboratory analysis	
	15.8		(8-10') Medium brown-tan clayey silt	*Sample collected @ 8-10' for laboratory analysis Cleared to 10' via vac truck (samples collected by hand auger)	
-10	1.5		(10-12') 12" Recovery - Gray fine sandy clay (50% sand), moist	*Sample collected @ 11' for laboratory analysis	Bentonite/grout seal 0-18'
	0.8		(12-14') 12" Recovery - Same as above, less sand with depth, moist		PVC Surface Casing 0-20'
-15	0.7 0.5		(14-16') Full Recovery - Gray/tan clay, little fine sand, moist		
	0.4 0.2		(16-18') Full Recovery - Gray/orange fine sandy clay (10% sand), moist		
	0.3		(18-20') 6" Recovery - Same as above with reddish angular gravels		
-20	0.3		(20-22') 10" Recovery - Brown/red-brown medium sand and few mixed gravels		

WELL DIAGRAM



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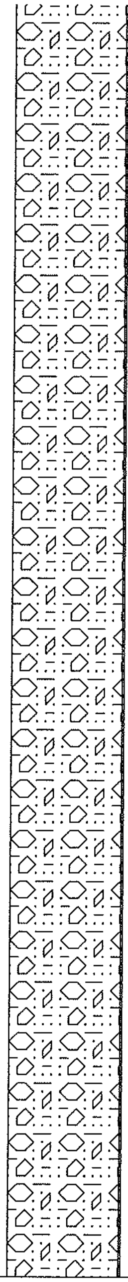
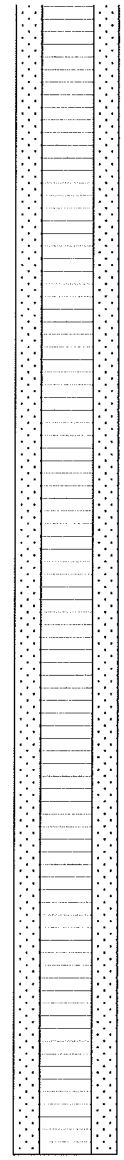
MONITORING WELL LOG: S-369

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
			(angular), dry to moist		Sand 18-40'	
	15.5		(22-24') Little Recovery - Brown/dark brown medium-coarse sand with few mixed gravels, moist			
-25	23.3		(24-26') 6" Recovery - Medium-coarse sand (red/gray/white/green) and mixed gravels, moist		PVC Sreen 20-40'	
	22.2		(26-28') 10" Recovery - Same as above			
	13.3		(28-30') 10" Recovery - Same as above			
-30	6.6		(30-32') 12" Recovery - Dark brown/black medium-coarse sand and mixed gravels (white,red), wet			
	410		(32-34') 8" Recovery - Red/brown/white/gray medium-coarse sand and mixed gravels, wet	*Sample collected @ 32' for laboratory analysis		
-35	1213		(34-36') Medium-coarse sand (dark gray/black) wtih few mixed gravels, wet			
	1118		(36-38') Full Recovery - Same as above			
	1207					
	1283		(38-40') Full Recovery - Same as above			
-40	1069		(40-42') Little Recovery - Same as above			

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MONITORING WELL LOG: S-370

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Luke Mokrycki/Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	1 March 2013 (cleared) 22 April 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	26' (Well Depth - 25')	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			(0-2') Light brown clayey silt			
	0.9		(2-4') Light brown clayey silt	*Sample collected @ 0-2' for laboratory analysis		
	0.0		(4-6') Red/medium brown sand, silt, small gravels			
-5						
	0.0		(6-8') Red-dark brown clay, silt, gravels			
	1.8		(8-10') Dark brown sand, silt, gravel, strong odor	*Sample collected @ 8-10' for laboratory analysis	Bentonite/grout seal 0-8'	
-10	280.1		(10-12') 16" Recovery [10-11'] Medium-coarse sand and mixed gravels, moist [11-12'] Light gray fine to medium sand, trace clay, wet	Cleared to 10' via vac truck (samples collected by hand auger)	PVC Surface Casing 0-10'	
	167					
	155		(12-14') Full Recovery - Light gray fine to medium sandy clay (20-50% sand), moist/wet, few small gravels			
	139					
	155		(14-16') 6" Recovery - Same as above			
-15					Sand 8-25'	
	79.9		(16-18') Full Recovery - Light gray fine sand and clay (50-70% sand), moist			
	33.3					
	1.8		(18-20') Full Recovery [18-19'] Same as above [19-20'] Brown/gray fine sand with trace gray clay, wet			
	2.6					
-20	5.2		(20-22') Full Recovery - Gray/light gray fine sandy clay (50% sand) moist/wet		PVC Sreen 10-25'	

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MONITORING WELL LOG: S-370

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	3.4					
	6.1		(22-24') Full Recovery - Brown/gray fine to medium sand and clay (60% sand), wet			
	5.9					
	6.7		(24-26') Full Recovery - Brown/gray fine sand, little clay, moist/wet			
-25	5.3					

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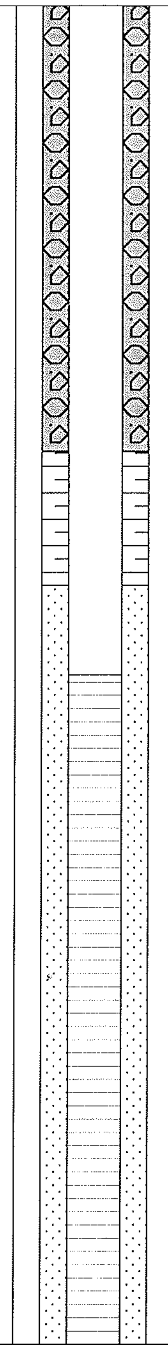
MONITORING WELL LOG: S-371

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	4 March 2013 (cleared) 1 April 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0	6.1		(0'-2') Brown silty sand, some gravel.	*Sample collected @ 1'-1.5' for laboratory analysis	
	24.6		(2' - 4') Brown clayey silt, trace sand.		
-5	6.9		(4'-6') Same as above.	*Sample collected @ 2'-3' for laboratory analysis	
	0.1		(6'-8') Gray clayey silt.		
			(8'-10') Same as above.	*Sample collected @ 5' - 8.5' for laboratory analysis	PVC Surface Casing 0 - 15'
-10	0.1		(10'-12') Medium gray clay, compact, little fine to medium sand, moist.		Bentonite/grout seal 0 - 13'
	0.3		(12'-14') Orange/brown/gray fine to medium sandy clay, moist.		
-15	0.5		(14'-16') Same as above, moist/wet.		
	3.5		(16' - 18') Tan/brown/gray fine-medium sandy clay, moist/wet.		
	1014		(18'-19') Gray medium-coarse sand, red/white rounded small gravels, wet.	*Sample collected @ 18' -20' for laboratory analysis	Sand 13'-30'
-20	1213 765		(19' -20.5') Fine-medium yellow/brown sand, few small gravels, wet.	LNAPL present on spoon @ 19' - 20'	PVC Screen 15'-30'
	47.7 61.4		(20.5'-22') Dark brown/tan/gray compact clay, moist/wet.		
	57.7 103		(22'-25') Dark brown/tan/gray clay, little sand and rounded gravels, moist/wet.		
-25	1257 1165		(25'-26') Medium-coarse sand and mixed gray/brown/red/white gravel		
	986		(26'-28') Same as above with gray/red/white gravel, wet.		
-30			(28'-30')Same as above with little gray clay, wet.		

WELL DIAGRAM



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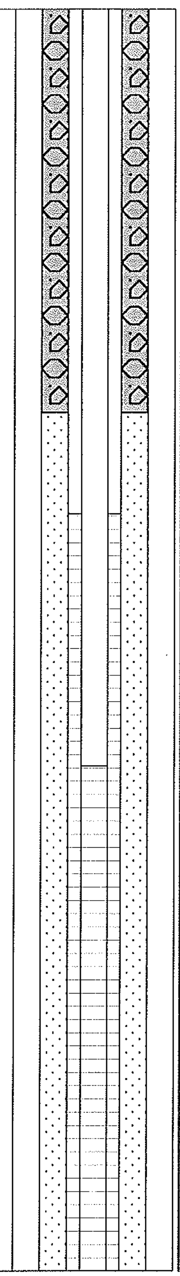
MONITORING WELL LOG: S-373

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hydroexcavation
JOB NO.:	-	SAMPLING METHOD:	Hand auger
LOGGED BY:	Luke Mokrycki	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	19-22 March 2013	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	25'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0	11.2		(0-2') Orange brown clay.		
	193.7		(2-4') Dark gray clay.		
-5	492.0		(4-6') Dark gray, green clay.	*Sample collected @ 4-6' for laboratory analysis.	PVC Surface Casing 0-10'
	187.0		(6-8') Gray, green clay.		
	373		(8-10') Brown coarse sand with small gravels.		Bentonite/grout seal 0-8'
-10	328.0		(10-12') Brown coarse sand.		
				Soil samples were collected and logged to the extent of the hand auger.	PVC Sreen 10-25'
-15					
					Sand 8-25'
-20				Hydroexcavated to 20'.	
				2" steel well driven to 25' - Casing 0-15', Screen 15-25'	
-25					

WELL DIAGRAM



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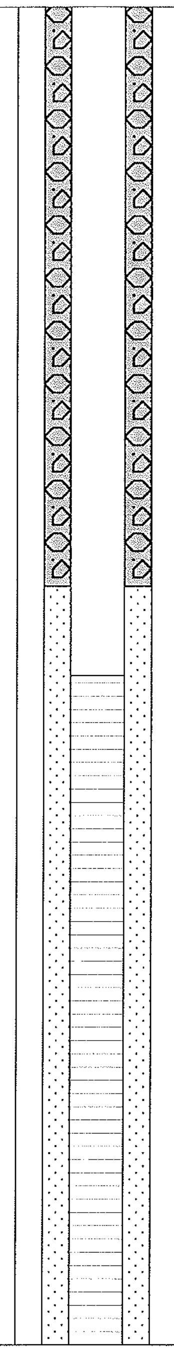
MONITORING WELL LOG: S-379

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	28 Feb. 2013 (cleared) 12 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION
0	0.0		(0'-2') Gravel, some sand, fill.	*Sample collected @ 0' - 2' for laboratory analysis	
			(2' - 4') Brown clayey silt, some gravel.		
-5	9.8		(4'-6') Same as above, black stained.	*Sample collected @ 4' - 5' for laboratory analysis	
			(6'-7') Same as above.		
	0.0		(7'-9') Gray clayey silt, gravel, trace sand.	*Sample collected @ 8' - 9' for laboratory analysis	PVC Surface Casing 0 - 15'
-10			(9'-10') Same as above.		Bentonite/grout seal 0 - 13'
	0.0		(12'-14') Gray brown slightly micaceous sand, moist, with fine sand.		
-15	0.0		(14'-16') Gray brown slightly micaceous sand with fine gravel, moist.		
	2.1		(16' - 18') Gray brown slightly micaceous sand with fine gravel, dry.		
	30		(18'-20') Brown slightly micaceous sand with very fine gravel, dry, odor.		Sand 13'-30'
-20	140		(20'-22') Brown slightly micaceous sand with large gravel, wet, odor.		PVC Screen 15'-30'
			(22'-24') Hard compacted layer of gravel with some sand, dry.		
-25	0.0		(24'-26') Gravel with some sand, wet.		
	0.2		(26'-28') Gravel with some sand, wet.		
-30	20.2		(28'-30) Gravel with some sand, wet, odor.		

WELL DIAGRAM



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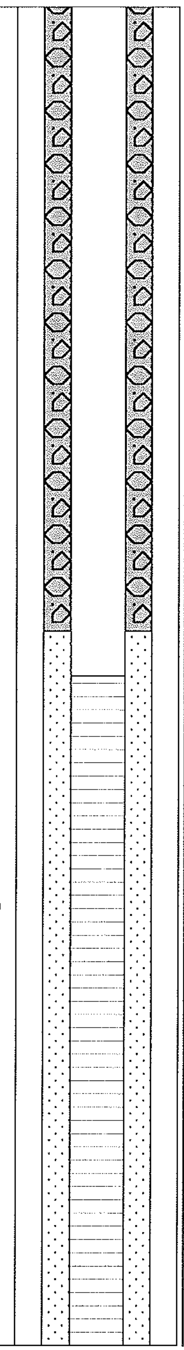
MONITORING WELL LOG: S-380

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Luke Mokrycki/Evan Ellwanger	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	1 March 2013 (cleared) 20 March 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	30'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			(0-2') Orange - brown clay, some gravel.			
	0.1		(2-4') Orange- brown clay, moist.	*Sample collected @ 0' - 2' for laboratory analysis		
	0.1		(4-6') Brown clay.			
-5						
	0		(6-8') Medium brown clay, moist.			
	0		(8-10') Light - brown clay, moist.	*Sample collected @ 8' - 10' for laboratory analysis	PVC Surface Casing 0 - 15'	
-10	0		(10-12') Brown sandy silt, wet, no odor.		Bentonite/grout seal 0 - 14'	
			(12-14') Brown black silty sand, dry, no odor.			
			(14-18') Brown black silty sand with small gravel, dry, no odor.			
-15						
			(18-20') Brown silty sand with gravel, moist, no odor.		Sand 14' - 30'	
-20			(20-22') Brown silty sand with gravel, wet, no odor.		PVC Screen 15' - 30'	
			(22-24') Brown black sandy silt with large gravel, wet, no odor.			
			(24-26') Brown green sandy silt with gravel, wet, no odor.			
-25						
			(26-28') Brown tan silty sand, wet, no odor.			
			(28-30) Clay-silt, tan, wet, no odor.			
-30						



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MONITORING WELL LOG: S-381

PROJECT:	Sunoco - Philadelphia Refinery	DRILLING CO.:	Badger / Total Quality Drilling
SITE LOCATION:	AOI-4	DRILLING METHOD:	Hollow Stem Auger
JOB NO.:	-	SAMPLING METHOD:	Split Spoon
LOGGED BY:	Pat Troy/Shaun Sykes	SCREEN/RISER DIAMETER:	4"
DATES DRILLED:	15 March 2013 (cleared) 25 April 2013 (drilled)	WELLBORE DIAMETER:	8"
TOTAL DEPTH:	32'	ELEVATION:	-

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
0			(0-0.6') Sandy silt grey			
			(0.6' - 1') Tank dike material.	*Sample collected @ 0' - 0.6' for laboratory analysis		
	0.0		(2' - 4') Clayey silt, dark grey.	*Sample collected @ 2' - 4' for laboratory analysis		
	533.1		(4'-6') Clayey silt, dark grey.	*Sample collected @ 4' - 6' for laboratory analysis		
-5						
	109.5		(6'-8') Clayey silt, dark grey.	*Sample collected @ 6' - 8' for laboratory analysis		
	35.0		(8'-10') Groundwater, may be perched.		PVC Surface Casing 0 - 17'	
-10			(10'-12') Orange/gray fine sandy clay, compact (20 - 30% sand), slightly moist.		Bentonite/grout seal 0 - 15'	
	4.1					
	2.2		(12'-14') Gray fine sand, clay (50% sand), moist.	*Sample collected @ 12' for laboratory analysis		
	156		(14'-16') Medium coarse sand, mixed gravels, little clay, moist - wet. Gravels mostly rounded, gray/white.			
-15						
	215		(16' - 18') Fine - medium sand and large rounded gravels, moist, dark gray/red/white.			

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MONITORING WELL LOG: S-381

Depth (feet)	OVM (ppm)	USCS	LITHOLOGY	COMMENTS	WELL CONSTRUCTION	WELL DIAGRAM
	141		(18'-20') Fine - medium sand and large rounded gravels, moist, dark gray/red/white.		Sand 15' - 32'	
-20	181		(20'-22') Reddish brown fine-medium sand and few rounded gravels (large), moist.		PVC Screen 17' - 32'	
	369 565		(22'-24') Dark gray/dark green medium-coarse sand and gravels, rounded - white/red/gray, wet. Clear LNAPL			
-25	676 680		(24'-26') Dark gray/black medium-coarse sand and mixed gravels, large, wet. Clear LNAPL.	*Sample collected @ 24' for laboratory analysis		
	614 731		(26'-28') Dark gray/black medium-coarse sand and mixed gravels, large, wet.			
	605		(28'-30) Gray/dark gray medium-coarse sand and gravels (white,gray, red), wet.			
-30	246		(30'-32') Gray fine-medium sand and few mixed gravels (white,gray, red), wet.			

PROJECT: **Philly AOI-3 Logs 2015**
LOCATION: **Philly AOI-3**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO:
S-408 PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **10/9/15** COMPLETED: **10/23/15**
DRILLING COMPANY: **Total Quality Drillling**
DRILLING EQUIPMENT: **HSA**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **4**
LOGGED BY: **NS**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **30.0**
BOREHOLE DEPTH (ft): **30.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **TD**

Time & Depth (feet)	Description	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)
0-2	**SAND AND GRAVEL** ; dark brown and black; fine to medium-grained; moist; subangular; Fill	1015 S-408 _0-2			2
2-4	**SILT SOME CLAY LITTLE SAND** ; grayish brown; fine to medium-grained; moist	S-408@ 2-4'			0.0
4-6 (5)	**SILT LITTLE CLAY TRACE SAND** ; orangeish brown; fine to medium-grained; moist	S-408@ 4-6'			0.0
6-8	**SILT LITTLE CLAY TRACE GRAVEL** ; orangeish brown and gray; fine-grained; moist; subrounded; Utility clearing completed to a depth of 8' bgs via backhoe.	S-408@ 6-8'			0.0
8-10 (10)	**SILT SOME SAND LITTLE GRAVEL** ; dark brown; fine to medium-grained; moist; subangular	S-408@ 8-10'	0.6		0.4
10-12	**GRAVEL LITTLE CLAY LITTLE SAND** ; grayish brown; medium to coarse-grained; moist; subangular	S-408@ 10-12'	0.5		4
12-14	**SILTY SAND LITTLE GRAVEL** ; reddish brown to orangeish brown; fine to medium-grained; moist to wet; subangular	S-408@ 12-14'	0.9		5
14-16 (15)	**SAND AND GRAVEL** ; grayish brown; fine to medium-grained; wet; subrounded	1130 S-408 _14-16	0.9		24
16-18	**GRAVEL LITTLE SAND** ; grayish brown; fine to coarse-grained; wet; subrounded; (Trenton)	S-408@ 16-18'	0.6		7
18-20 (20)		S-408@ 18-20'	0.2		0.0
20-22	**SAND** ; grayish brown; fine to medium-grained; wet	S-408@ 20-22'	0.1		0.0
22-24	**GRAVEL LITTLE SAND** ; grayish brown; fine to medium-grained; wet; subangular	S-408@ 22-24'	1.1		0.0
24-26 (25)	**SAND LITTLE GRAVEL** ; grayish brown; fine to medium-grained; wet; subangular	S-408@ 24-26'	0.3		0.0
26-28		S-408@ 26-28'	0.5		0.0
28-30 (30)		S-408@ 28-30'	0.6		0.0
30	Borehole terminated at 30 feet.				

Borehole Backfill:
1-8.5' bgs: Bentonite
8.5-30' bgs: Sand
10-30' bgs: 30-slot PVC Screen

PROJECT: **Philly AOI-3 Logs 2015**
LOCATION: **Philly AOI-3**
PROJECT NUMBER:

WELL / PROBEHOLE / BOREHOLE NO: **S-415** PAGE 1 OF 1

Aquaterra Technologies, Inc.

DRILLING / INSTALLATION:
STARTED **10/12/15** COMPLETED: **10/13/15**
DRILLING COMPANY: **Total Quality Drillling**
DRILLING EQUIPMENT: **HSA**
DRILLING METHOD: **HSA**
SAMPLING EQUIPMENT: **Split Spoon**

NORTHING (ft):
LAT:
GROUND ELEV (ft):
INITIAL DTW (ft): **Not Encountered**
STATIC DTW (ft): **Not Encountered**
WELL CASING DIA. (in): **4**
LOGGED BY: **NS**

EASTING (ft):
LONG:
TOC ELEV (ft):
WELL DEPTH (ft): **30.0**
BOREHOLE DEPTH (ft): **30.0**
BOREHOLE DIA. (in): **12**
CHECKED BY: **TD**

Time & Depth (feet)	Graphic Log	USCS	Description	Sample	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
0-4			**GRAVEL SOME SILT AND SAND** ; brown; fine to coarse-grained; dry; subangular; Fill (bricks)		0845 S-415 _0-2			0.0		
					S-415@ 2-4'			6		
4-6			**SILTY CLAY LITTLE GRAVEL** ; dark brown; fine to medium-grained; hard to dense; dry; subangular		S-415@ 4-6'			0.0	5	1-8.5' bgs: Bentonite
6-8			**SILTY CLAY LITTLE GRAVEL** ; yellowish brown; fine to medium-grained; dry to moist; subangular; Utility clearing completed to a depth of 8' bgs via backhoe.		S-415@ 6-8'			0.4		
8-10			No recovery			0				
10-14			**SANDY CLAY LITTLE SILT** ; brown and gray; fine to medium-grained; moist; gray (quartzite) subangular medium size gravel bottom of spoon		S-415@ 10-12'	1.1		1.6	10	
					S-415@ 12-14'	0.5		0.1		
14-16			**GRAVEL LITTLE SILT AND CLAY** ; gray; fine to medium-grained; moist; subangular		S-415@ 14-16'	0.8		310	15	
16-20			**SAND AND GRAVEL** ; gray; fine to medium-grained; moist to wet; subrounded; (trenton gravel)		1300 S-415 _16-18	1.2		1328		
					S-415@ 18-20'	0.8		516		8.5-30' bgs: Sand
20-24			**SAND SOME GRAVEL** ; dark gray; fine to medium-grained; wet; subrounded		S-415@ 20-22'	2		598	20	10-30' bgs: 30-slot PVC Screen
					S-415@ 22-24'	1.2		1202		
24-30			**SAND AND GRAVEL** ; dark gray; fine to medium-grained; wet; subrounded		S-415@ 24-26'	0.5		164.8	25	
					S-415@ 26-28'	2		44.1		
					S-415@ 28-30'			10.8		
30			Borehole terminated at 30 feet.						30	
35									35	

PROJECT: **Philadelphia Refinery**	WELL / PROBEHOLE / BOREHOLE NO:
LOCATION: **AOI-4**	**S-416** PAGE 1 OF 1
PROJECT NUMBER:	

DRILLING / INSTALLATION:	NORTHING (ft):	EASTING (ft):
STARTED **6/20/16** COMPLETED: **7/13/16**	LAT:	LONG:
DRILLING COMPANY: **Total Quality Drilling**	GROUND ELEV (ft):	TOC ELEV (ft):
DRILLING EQUIPMENT: **HSA**	INITIAL DTW (ft): **Not Encountered**	WELL DEPTH (ft): **27.0**
DRILLING METHOD: **HSA**	STATIC DTW (ft): **Not Encountered**	BOREHOLE DEPTH (ft): **27.0**
SAMPLING EQUIPMENT: **Split Spoon**	WELL CASING DIA. (in): **4**	BOREHOLE DIA. (in): **12**
	LOGGED BY: **LM**	CHECKED BY: **MS**

Time & Depth (feet)	Description	Time Sample ID	Measured Recov. (feet)	Blow Count	Headspace PID (units)	Depth (feet)	Borehole Backfill
0-2	**CLAY WITH FINE GRAVEL** ; dark brown; moist; rounded	12:30 S-416 0-2			0		0-8' bgs: Grout
2-4	**SILTY CLAY TRACE GRAVEL** ; dark brown and dark gray; mottled; With black mottling.	S-416@ 2-4'			5.0		
4-6 (5)	**SILTY CLAY WITH FINE GRAVEL** ; dark gray and tannish green; moist; rounded	S-416@ 4-6'			7.0	5	
6-8	**CLAY WITH SILT AND FINE GRAVEL** ; gray and; rounded	S-416@ 6-8'			8.0		
8-10	**CLAY SOME CONSTRUCTION DEBRIS** ; tan to brown; mottled; FILL (bricks), gray mottling.	S-416@ 8-10'			30.0		8-10.5' bgs: Bentonite
10-12 (10)	**CLAY WITH GRAVEL** ; tan brown; mottled; Red, white, black gravels present.	S-416@ 10-12'			44.0	10	
12-14	**SILTY CLAY** ; orangeish tan and brown; moist	S-416@ 12-14'			224.0		
14-16 (15)	**CLAYEY SILT WITH GRAVEL** ; tannish gray to dark gray; wet; angular	14:00 S-416 14-15			331.0	15	
16-18	**SANDY SILT WITH GRAVEL** ; reddish brown and yellow	S-416@ 16-18'			240.0		
18-20	**CLAYEY SILT WITH GRAVEL** ; dark brown; saturated; Multicolored gravel.	S-416@ 18-20'	0.5		143.0		10.5-27' bgs: Sand 12-27' bgs: 30-slot PVC Screen
20-22 (20)	**SANDY SILT WITH GRAVEL** ; dark brown; Poor recovery.	S-416@ 20-22'			151.0	20	
22-24	**CLAYEY SILT WITH GRAVEL AND SAND** ; brown and gray; coarse-grained; medium plasticity; hard	S-416@ 22-24'		19 16 16 10	158.0		
24-26 (25)	**SAND WITH FINE GRAVEL** ; brown; coarse-grained	S-416@ 24-26'			63.0	25	
	Borehole terminated at 27 feet.						

GEO FORM 304 2016-06-PHL_AOI4_WELL AND SOIL BORING INSTALLATIONS.GPJ STANTEC ENVIRO TEMPLATE 010509.GDT 9/21/16

Aquaterra Technologies, Inc.
Subsurface Log: SS-S34-20'-22'-042105

Project Name: Sunoco Philadelphia Refinery AOI - 4 **Owner:** Sunoco, Inc. (R&M)
Location: Philadelphia, PA **Permit No.:**

Boring Number: SS-S34-20'-22'-042105 **Log By:** M.B. Spancake **Date:** 21-Apr-05
Casing Elevation: N/A **Driller:** Parrat Wolff **Borehole Dia:** 8.25'
Screen Diameter: NA **Length:** NA **Slot Size:** NA **Water Level (Init):** NA
Casing Diameter: NA **Length:** NA **Type:** NA
Drilling Method: Hollow Stem Auger **Sample Method:** 3" Spoon with brass liners **Rig Type:** HSA Rig

Construction Details

Total Boring Depth: 22' bgs **Backfill:** 0-22' = Backfill
Screen Interval: NA **Cement/Grout Interval:** = Cement/Grout
Sand Pack Interval: NA **Bentonite Interval:** NA = Bentonite
Completion Details: NA **Sand Pack Type:** #2 = Sand

Depth (ft)	Sample Depth (ft)	OVM (ppm)	Amount of Recovery (ft)	Lithology	Well Schematic
0				Soft dig to 10' BGS Advance augers to 20' below ground surface and collect 3" diameter spoon with (4) 6" brass liners for SPP saturated soil sample Boring is located 25' south of S-34.	
5					
10	10-12				
15	15-17				
20	20-22			Drove spoon 2' and collected soil sample. Sample was collected in four 6" long brass liners and sealed and placed on dry ice. Samples were submitted to PTS GeoLabs for SPP mobility testing in soils.	

LIGHT NON-AQUEOUS PHASE LIQUID CONCEPTUAL SITE MODEL AREA OF INTEREST 4

Philadelphia Refining Complex
3144 West Passyunk Avenue
Philadelphia, Pennsylvania
Sitewide PADEP Facility ID No. 780190
Area of Interest 4 PADEP Facility ID No. 770318

Stantec

Prepared for:
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Prepared by:
Stantec Consulting Services Inc.

March 24, 2017

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(see following page for list of attachments)

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ACRONYMS AND ABBREVIATIONS

ANT	apparent NAPL thickness
AOI	Area of Interest
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
cm/s	centimeters per second
cm^2	square centimeters
cm^3s/g	cubic centimeter seconds per gram
cP	centipoise
Evergreen	Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC
ft	Feet or foot
g/ml	grams per milliliter
IST	Integrated Science & Technology, Inc.
ITRC	Interstate Technology & Regulatory Council
K_i	intrinsic permeability
K_{ro}	LNAPL relative permeability
LCSM	LNAPL Conceptual Site Model
LDRM	LNAPL Distribution and Recovery Model
LNAPL	Light Non-aqueous Phase Liquid
M_o	LNAPL mobility term
NAPL	Non-aqueous Phase Liquid
PADEP	Pennsylvania Department of Environmental Protection
PES Complex	Philadelphia Refining Complex
Q_0	LNAPL discharge rate
Q_w	water discharge rate
RIR	Remedial Investigation Report
SCR	Site Characterization Report
SECOR	Secor International Inc.
Site	AOI 4 of the PES Complex
Stantec	Stantec Consulting Services Inc.
Sunoco	Sunoco, Inc.
T_n	LNAPL Transmissivity
T_w	aquifer transmissivity
USEPA	U.S. Environmental Protection Agency
μ_o	LNAPL dynamic viscosity
ρ_r	LNAPL/water density ratio

1.0 Introduction

Stantec Consulting Services Inc. (Stantec) has prepared this Light Non-aqueous Phase Liquid (LNAPL) Conceptual Site Model (LCSM) report on behalf of Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen), for Area of Interest (AOI) 4 (Site) at the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Philadelphia Refining Complex (Complex) (**Figure 1**). This LCSM includes analysis of subsurface data from areas adjacent to AOI 4 where available and beneficial to this study. Detailed evaluation of Site background, geology, and hydrogeology is provided in the AOI 4 Remedial Investigation Report (RIR) (Stantec, 2017).

The purpose of the LCSM is to communicate Site conditions with respect to subsurface impacts associated with historical petroleum releases. The impacts are described in terms of the release scenario, inferred source area(s), potential subsurface migration pathways, spatial and temporal distribution of LNAPL, and potential mobility. The information presented in the LCSM is intended to establish a framework which allows stakeholders to make informed environmental management decisions regarding the Site. Understanding current conditions is fundamental to the development of the LCSM and allows a platform for data extrapolations and prediction of future conditions. As new information becomes available, the LCSM should be modified, as necessary, to reduce uncertainties and improve the understanding of Site conditions.

2.0 Fundamental Concepts of LNAPL Transport

Mobility of an immiscible liquid such as petroleum in soil depends on a balance of capillary, gravitational, hydrodynamic, and surface tension forces. The permeability of a porous medium to either a wetting or a non-wetting fluid is a function of saturation. For a fluid to flow through a porous medium to an appreciable degree, the fluid saturation must be above residual. Therefore, only the amount of fluid above residual is mobile to normal forces found in ground-water systems.

In unsaturated soils, the residual (immobile) LNAPL ranges from 5% to 20% of total pore volume, while in the saturated zone these concentrations are higher, with typical values ranging from 15% to 50% of total pore volume (U.S. Environmental Protection Agency (USEPA), 1992).

In the air/LNAPL/water system of the vadose zone, LNAPL is considered to be the wetting phase with respect to air on the surface of the water enveloping the soil grains, and water is the wetting fluid with respect to LNAPL on the soil grain surfaces. Because water is present, the LNAPL pressure must be larger than the entry capillary pressure of the LNAPL into water before the LNAPL will flow. Entry capillary pressure is defined as the value of capillary pressure at which the water saturation decreases rapidly. Since water is the wetting fluid between the water and LNAPL, the LNAPL will not displace the water from the surface of the soil grain. As the amount of LNAPL surpasses residual, however, it will percolate downward under the influence of gravity displacing air and water in the pores. The “slug” of LNAPL continues downward and air re-enters most of the pores behind it, except for the pores that remain filled or partly filled with LNAPL (constituting residual LNAPL saturation). Some lateral migration of the mobile LNAPL will also occur due to capillary forces. However, for a low viscosity LNAPL the primary transport path is vertical. Thinner fluids move more rapidly through the subsurface than thicker fluids. This means that a thinner (low viscosity) petroleum product (i.e., gasoline and middle distillates) is generally more easily recovered from the subsurface and leaves a lower residual saturation than a thicker petroleum product.

In a near surface release, as the LNAPL migrates downward due to pressure and gravity, the quantity of mobile LNAPL decreases due to the residual oil left behind. If the amount of LNAPL spilled is small, the mobile LNAPL will eventually become exhausted in the vadose zone and the LNAPL will percolate no further. The column of LNAPL is immobile and never reaches the capillary fringe unless it is displaced by water from a surface source. However, as exhibited in some areas at the Site, if the quantity of LNAPL released per unit surface area is sufficient, mobile LNAPL will reach the capillary fringe above the water table. LNAPL continues to spread out until it is at residual saturation. Because constituents of LNAPL are slightly soluble in water, the constituents of LNAPL will slowly dissolve in accordance with their relative solubilities and be transported with the groundwater.

2.1 DEFINITION OF TERMS

The objective of the LNAPL mobility assessment was to evaluate if remaining LNAPL is residual, mobile, or migrating. In order to provide consistency across the industry, the Interstate Technology & Regulatory Council (ITRC) has provided standard definitions for these terms in the document LNAPL Technology Selection for Achieving Project Goals (ITRC, 2009).

Residual LNAPL, or immobile LNAPL, represents LNAPL that is trapped in soil pores similar to water that cannot drain out of a sponge. Residual LNAPL is a consequence of porous media and capillary behavior. Below residual LNAPL saturation, LNAPL is discontinuous and immobile under the applied gradient. Residual LNAPL will not accumulate in a well installed across the LNAPL interval. Residual LNAPL saturations are higher for saturated conditions than in the vadose zone. As a result, a well may not exhibit LNAPL under high water-tables but may exhibit LNAPL under lower water-table conditions as a result of changes in water saturation resulting in a change in LNAPL residual saturation magnitude.

Mobile LNAPL, often referred to as recoverable LNAPL, is LNAPL that exceeds residual saturation. Mobile LNAPL, when combined with a gradient, is capable of moving laterally and/or vertically within the soil pore space. This term can be used when LNAPL is present and is at a high enough saturation to be hydraulically connected in the pore spaces so that it may flow under an induced gradient. If a well is placed in a location with mobile LNAPL present, LNAPL will accumulate in the well.

Migrating LNAPL is LNAPL that is observed to spread or expand laterally or vertically or otherwise result in an increased volume of the LNAPL extent (usually indicated by time-series data or observation). It is only likely to be present shortly after a release occurs or if the release is ongoing. Migrating LNAPL has sufficient mobility at the pore-scale to cause expansion of the extent of the LNAPL. Mobile LNAPL includes migrating LNAPL, but not all mobile LNAPL is migrating LNAPL.

3.0 LNAPL Mobility Assessment

The following multiple lines of evidence were used to assess LNAPL mobility at the Site:

- LNAPL Distribution (Section 3.1);
- LNAPL Source (Section 3.2);
- LNAPL Characterization (Section 3.3);
- Site-Specific LNAPL Transmissivity Estimates (Section 3.4);
- LNAPL Mobility Term (Section 3.5.2);
- LNAPL Pore Entry Pressure Evaluation (Section 3.5.3);
- LNAPL Mobility Modeling (Section 3.5.4); and,
- American Petroleum Institute (API) LNAPL Distribution and Recovery Model (LDRM) (Section 3.5.5).

3.1 LNAPL DISTRIBUTION

3.1.1 LNAPL Apparent Thickness

A primary line of evidence for evaluation of LNAPL plume stability and mobility is observational data. If observational data indicates that the LNAPL plumes are stable or shrinking, the potential for LNAPL mobility is low. LNAPL is deemed to be potentially migrating when:

- Fluid level gauging over time indicates that the apparent LNAPL thickness is increasing within monitoring wells in a manner not attributable to seasonal water-table fluctuations; or

- LNAPL is identified in a portion of the monitoring well network that has historically lacked measurable LNAPL.

The accumulation of LNAPL in monitoring wells is a primary line of evidence used to evaluate the distribution of LNAPL in the subsurface. LNAPL may be able to flow through connected macropores in the subsurface under sufficient hydraulic head and saturation conditions. Assuming that a monitoring well is properly constructed and developed, the accumulation of LNAPL in the monitoring well may occur when the LNAPL fluid pressure is greater than the atmospheric pressure. However, even when LNAPL is observed in monitoring wells, the soil pores are generally not completely filled with LNAPL, rather this is merely an indication that LNAPL is locally present. In-well LNAPL thickness is not a reflection of the residual and entrapped saturations of LNAPL in the aquifer. The free-phase LNAPL that enters a monitoring well is usually only a small fraction of the LNAPL present in the aquifer (USEPA, 2005). Due to this difference, the LNAPL thickness measured in a monitoring well is referred to as an apparent NAPL thickness (ANT). Research has reported that the LNAPL thickness measured in a monitoring well typically exceeds the LNAPL-saturated formation thickness by a factor estimated to range between approximately 2 and 10 (i.e. an ANT of 1 foot in an observation well may equate to 0.1 to 0.5 feet of LNAPL thickness in the aquifer) (USEPA, 1992; Mercer and Cohen, 1990).

There are many common misconceptions with regard to the in-well LNAPL thickness (ITRC, 2009). The following points outline the correct concepts:

- The absence of LNAPL in a monitoring well does not mean that LNAPL is not present in the screened aquifer, rather it is a reflection of the residual saturation;
- The presence of LNAPL in a monitoring well does not necessarily mean that the LNAPL plume is migrating or has the potential to migrate; and
- Apparent LNAPL thickness in a well is not a good predictor of the potential rate of recovery.

The thickness of LNAPL observed in the monitoring wells depends on a number of factors such as the geology and water table fluctuations. A falling water table for an unconfined system typically results in greater observed LNAPL thickness in the monitoring wells as a result of drainage from the unsaturated zone. The effect of a falling water table is more pronounced for coarse-grained than fine-grained soils. Identification of trends in ANT is complicated by changes to the regional water table from precipitation trends and by variations in operation of recovery systems (discussed further in **Sections 3.1.1.1 and 3.1.1.2**).

3.1.1.1 Precipitation

Figure 2 presents a graph of the cumulative deviation of precipitation from the long term average from 1980 through November 2016 based on weather data from the National Oceanic and Atmospheric Administration (NOAA) station located at the Philadelphia International Airport (NOAA, 2016). As indicated on **Figure 2** and discussed in previous investigation reports, a long term drought occurred in the late 1990s and early 2000s in the area of the Site. Since 2008, precipitation has generally been higher than average. Precipitation data from 2016 indicates that this year will fall below the long term average. Overall, groundwater elevation in Site wells has generally increased or remained stable since 2008. Note that groundwater elevation response to seasonal fluctuations in precipitation, depicted as water level oscillations within a single year, are also apparent in many of the hydrographs.

3.1.1.2 Remedial System Operation

Four systems have operated within or adjacent to AOI 4 at various intervals throughout the Site monitoring and remedial history, influencing groundwater elevations and ANT in nearby wells.

1. *The S-30 Remediation System* involving the single recovery well operated from January 1996 through November 2010. The system was operational until November 17, 2010 when the product pump probe was not functioning. On December 30, 2010, S-30 was gauged and there was no significant product accumulation; this is likely to have corresponded to water level fluctuations. Since 2010, LNAPL thickness in S-30 has risen approximately 7 feet (ft). Installation of a new probe, pump, and control panel are planned for 2017.

2. *The S-36 Remediation System* including recovery wells S-34, S-35, and S-36 operated from September 2004 through July 2010. The system was shut-off July 28, 2010 due to absence of measurable LNAPL thickness. A decrease of LNAPL apparent thickness was observed in the system wells beginning between 2006 and 2008. This decrease coincided with rising groundwater elevations. Since 2010, groundwater elevations appear to have been stable around a new (higher) static average, with apparent seasonal fluctuations.
3. *The Penrose Avenue Remediation System (Penrose System)* became operational in March 2013 and is currently active. The Penrose System, located at the southeast AOI 4 boundary, consists of 18 recovery wells situated in two approximately parallel northeast-southwest trending rows. Five recovery wells (RW-700 through RW-704) are located along the northern leg, and thirteen recovery wells (RW-705 through RW-717) are located along the southern leg.
4. *Recovery Well RW-2* was active from September 2002 through February 2009. Although located within AOI 3, RW-2 is located directly to the west of the western AOI 4 boundary.

3.1.1.3 Well Construction

Generally, submerged screens prevent LNAPL from entering a well. Review of well construction records for the Site identified 11 wells with screens that are regularly or sporadically submerged. Of these wells, 5 are screened in the unconfined aquifer. These wells are listed in **Table 1.** Additionally, **Figures 3a-3e and 4** include symbology to indicate which wells have submerged screens. Note that the wells with submerged screens were excluded from analysis during the LNAPL mobility assessment.

3.1.1.4 Trends

Numerous monitoring wells across the Site have been gauged for LNAPL over the course of the investigation and remediation history. **Table 2** of this LCSM presents a summary of unconfined well gauging throughout the monitoring record. **Figures 3a through 3e** present the historical extent of observed LNAPL apparent thicknesses for 1995 through 2015 in five year increments. Each map displays wells gauged during that year and indicates the maximum observed LNAPL thickness. **Figure 4** presents maximum observed thickness from recent gauging events in 2016, and **Figure 5** presents the maximum observed LNAPL thickness for each monitoring well over the period of record (1995-2016). Hydrographs of AOI 4 wells (**Appendix I**) include groundwater elevation, ANT, and well construction details (top and bottom well screen elevations). The historical limit of groundwater gauging data in the Site database, used as a basis for this report, is December 1995.

Hydrographs of AOI 4 wells were reviewed to qualitatively identify trends in ANT over time. As discussed above, careful review is required to identify ANT trends that are not related to changes in water levels or remedial system operation. At the majority of AOI 4 locations where LNAPL has been observed, LNAPL apparent thicknesses through time have generally decreased or remained stable. Over the period of record, LNAPL has been detected in 43 of the 78 wells (55%) gauged within the limits of AOI 4. In May 2016, LNAPL was detected in only 19 of the 63 wells (30%) gauged within the limits of AOI 4. These statistics do not include wells outside of the AOI 4 limits, recovery wells (RW-700 through RW-717), or wells screened in the lower confined aquifer.

The qualitative hydrograph review identified instances in which ANT is decreasing (even to non-detect) over several years. For some of these wells, the decreasing ANT trends coincided with a rising water table. For example, LNAPL was not identified in S-56 beginning in 2004; however, an increasing water table has resulted in a submerged screen since that time. Other examples of decreasing trends related to changes in water levels or system operation include: S-34, S-35, S-36, S-57, and S-97. With the exceptions of S-57 and S-97, these wells are proximal to one of the recovery systems listed above; specifically, S-34, S-35, and S-36 are part of the inactive S-36 Remediation System. Rising water levels and decreasing LNAPL thicknesses at these wells generally correspond with the cessation of pumping.

Three wells (S-28, S-103, and S-234) have exhibited potentially decreasing trends of LNAPL thickness that do not appear to be related to a rising water table. These wells are located in different sections of AOI 4: S-28 is near the center of AOI 4, S-103 is near the northern AOI 4 boundary, and S-234 is in the southeast section near the Penrose System.

Qualitative review of hydrographs identified the following wells which appear to exhibit an increasing ANT trend:

- S-30 and S-31: located within the influence of inactive S-30 Remediation System (S-30 System).
- S-104 and S-368: these wells are located adjacent to the northern (center) AOI 4 border.
- S-221, S-240, S-241, and RW-701: these wells are located along or north of the northern leg of the Penrose System.
- S-220: located to the northwest of the Penrose System.

These wells are discussed in further detail in the discussion section below (**Section 3.1.4**).

Gauging data from several wells, including S-233, S-235, S-236, S-237, S-238, S-278, S-282, S-365, and S-373, did not demonstrate discernable LNAPL thickness trends.

3.1.2 Spatial/Temporal Distribution

Figures 3a through 3e present a historical summary of the aerial distribution of LNAPL over time in five year intervals from 1995 to 2015. Each figure shows the wells gauged within the indicated year. Wells screened in the lower aquifer are not shown. Wells that had measurable product during a gauging event within the indicated year are labeled with the maximum LNAPL thickness observed during that year. A different symbol is used to show wells where a sheen of LNAPL was observed (less than 0.01 feet). **Figure 4** presents the maximum observed thickness from 2016 gauging events. **Figure 5** presents the maximum observed thickness for the wells that have historically been gauged at the Site within the period of record. Also included on these figures are select adjacent off-Site wells (in neighboring AOIs) for reference and discussion regarding LNAPL delineation. For the purpose of the discussion below, only unconfined aquifer wells located within the limits of AOI 4 are included in gauging statistics.

- In 1995, 23 unconfined aquifer wells were gauged. LNAPL was detected in 15 wells with a maximum thickness of 9.66 feet at well S-29. LNAPL was detected in the majority of installed wells at the Site, excluding the eastern boundary and the southern one-third of the AOI 4.
- In 2000, 24 unconfined aquifer wells were gauged. LNAPL was detected in 11 wells with a maximum thickness of 9.03 feet at well S-30. The LNAPL was detected in the same areas as in 1995.
- By 2005, the monitoring well network included wells located within the eastern one-third and southeastern corner of the Site. During the year, 37 unconfined aquifer wells were gauged. LNAPL was detected in 19 wells with a maximum thickness of 7.65 feet at well S-29. LNAPL was not encountered in the eastern one-third of the Site.
- In 2010, 49 unconfined aquifer wells were gauged. LNAPL was detected in 17 wells with a maximum thickness of 4.52 feet at well S-29. Additionally, 18 recovery wells (RW-700 through 717) were gauged; only one of the RWs (RW-704) contained measurable LNAPL. No significant changes to spatial distribution from 2005 were observed. LNAPL in the southeast corner of the Site was limited to the area immediately up-gradient of the Penrose System.
- In 2015, 65 unconfined aquifer wells were gauged. LNAPL was detected in 19 wells with a maximum thickness of 8.21 feet at well S-30. The inactive S-36 Remediation System (S-36 System) recovery wells did not contain product in 2015. Within the active Penrose System, LNAPL continued to be mainly located along and to the north of the northern leg of the system, although a few wells between the two legs continued to contain measurable LNAPL. In 2015, a sheen was detected in RW-708 along the southern leg of the Penrose System. No additional changes to spatial distribution from 2010 were noted.
- Stantec completed LNAPL and groundwater elevation gauging events in May and November 2016. During these events, 63 unconfined aquifer wells were gauged. LNAPL was detected in 19 wells with a maximum thickness of 7.86 feet at well S-30.

3.1.3 LNAPL Delineation

LNAPL at the Site has been delineated to the south along the southeastern AOI 4 boundary, in the vicinity of the Penrose System. No measurable LNAPL thickness has been observed in wells located along and southeast of the AOI 4 boundary, which runs parallel to the southern leg of the Penrose System. To the west and north, the Site is bordered by other AOIs at the PES Complex (**Figure 6**). The northern plume is likely connected to the adjacent AOI 2 plume. There are three plumes located along or adjacent to the western Site border. The most northern plume is likely connected to the western adjacent AOI 3 plume in the vicinity of RW-2. The two others (near S-285 and S-410) are separate plumes (either physically or compositionally distinct) within AOI 3 and are likely not connected to the Site. The eastern extent of LNAPL is delineated by a roughly north to south line of wells that divides the eastern one-third of the Site (starting from the north: S-119, S-121, S-219, and S-38) from the western two-thirds.

The only well to exhibit measurable LNAPL thickness on the eastern one-third of the Site is well S-369, located in the northeastern-most corner of the Site. Monitoring well S-369 was first gauged in 2013 and was observed to contain 0.03 ft of product. Gauging data since 2013 has not indicated the presence of product; note that this location has been gauged five times since the initial gauging event. Additionally, LNAPL has not been detected in nearby well S-41 (AOI 1) or in nearby offsite wells (ARCO-1 and ARCO-2).

Recent and historical gauging data indicate that LNAPL is likely present in the subsurface in the following Site areas:

1. North-central AOI 4 border with northern adjacent AOIs 1 and 2
   (reference wells: S-104 and S-368)
2. Western AOI 4 border to the east of former pumping recovery well RW-2
   (reference wells: S-365 and S-282)
3. Discrete occurrences throughout the southwest quadrant of the Site
   (reference wells: S-30-S-32, S-36, and S-220)
4. Southeast AOI 4 limit in the vicinity of the Penrose System
   (reference wells: RW-701 through RW-717; S-124, S-221, S-233-238, S-240-241, S-278, S-373)

The history of LNAPL detections in these areas are discussed in more detail in the discussion section below.

3.1.4 Discussion

The following section discusses the areas within AOI 4 that have had measurable LNAPL during recent gauging events and their relation, if any, to adjacent AOIs.

1. North-central AOI 4 border with northern adjacent AOIs 1 and 2
   (reference wells: S-104 and S-368)
   - Both reference wells have exhibited increasing trends of LNAPL thickness, despite relatively stable groundwater elevations. Increasing LNAPL thickness began in 2001 for S-104, despite slightly increasing water levels. Monitoring well S-368 has been gauged six times between 2013 and 2016. LNAPL was not detected until the most recent gauging events at monitoring well S-368 in May and November 2016 at a maximum thickness of 2.25 ft.
   - Recent groundwater contours (Stantec, May 2016) indicate a southward groundwater flow potential from the northern adjacent AOI 1 and AOI 2.
   - Observed LNAPL thicknesses in downgradient wells S-103, S-225, S-366, and S-367 have not exhibited similar trends.

- Nearby upgradient wells in AOI 2 (S-54, S-311, S-360, and S-363) historically contained and continue to contain measurable LNAPL.
- The increasing thicknesses, although possibly indicative of migrating LNAPL, do not necessarily indicate migrating LNAPL within AOI 4 but potentially into AOI 4.

2. Western AOI 4 border to the east of former recovery well RW-2
   (reference wells: S-365 and S-282)
   - Pumping operations from RW-2 (located just to the west of the western AOI 4 boundary) were active from September 16, 2002 through February 12, 2009, prior to the installation and gauging of S-365 and S-282. After pumping ceased, water levels near RW-2 rose, submerging the screen at well S-59.
   - Monitoring wells S-365 and S-282 have been gauged 6 to 8 times since their installation in March 2013 and April 2010, respectively. During that time, water levels and ANT observed in these wells have been relatively stable.
   - The rising water table, submerged screen at S-59, and relatively short gauging records within this area of AOI 4 limit the ability to evaluate LNAPL migration in the area. However, the stable ANT thicknesses observed at wells S-365 and S-282 are indicative of LNAPL that is mobile but not migrating.

3. Discrete occurrences throughout the southwest quadrant of the Site
   (reference wells: S-30, S-32, S-36, and S-220)
   - *Inactive S-36 Remediation System area including S-34, S-35, and S-37*. Pumping was active in wells S-34, S-35, and S-36 between 2004 and 2010. Although ANT has not been recently detected at the wells in this area, the apparent decrease in ANT appears to correspond with a rising water table. At S-34, for example, LNAPL has not been detected since 2007, but the groundwater elevation simultaneously rose by approximately 2.5 ft, and continued to slowly rise (although in an oscillatory [seasonal] pattern). The groundwater elevation was above the top of screen during approximately 15% of gauging events from 2008 to present.
   - *Inactive S-30 Remediation System area including S-28, S-29, and S-31*. Pumping was active in S-30 between 1996 and 2010. Increasing trends of ANT are apparent in S-30 and S-31. The ANT increase in S-30 began in 2010 when pumping ceased. The increase at S-31 was observed beginning in 2013, a few years after pumping ceased at S-30. LNAPL thickness in S-29 decreased between 1996 and 2010, during the period when S-30 pumping was active. However, LNAPL thickness has been relatively stable, yet oscillating, since 2010 when the S-30 System became inactive. S-371, located approximately 95 ft northwest of S-30, has not exhibited measurable LNAPL thickness in the four gauging events conducted at this well between 2013 and 2016.
   - S-32 is located between the S-30 and S-36 Systems. LNAPL is infrequently detected in this well. The two primary exceptions (2002 and 2013-2014) correspond to periods of groundwater lows. Well S-285, located to the southwest

of S-32 beyond the AOI 4 western boundary with AOI 3, contains LNAPL. However, the two plumes are not connected. Well S-370, located to the east of S-285 within AOI 4, has not contained measurable LNAPL in the 8 gauging events occurring between 2013 and 2016.

- S-220 is located between the S-30 and Penrose Systems. Gauging data indicate a weak increasing ANT trend since 2010. As discussed above, there is a plume situated in AOI 3, close to the southwestern Site border. Results of LNAPL characterization sampling indicates that this is a separate plume, not connected to AOI 4. LNAPL in S-19, S-21, and S-410 is a heavy distillate type, while S-220 is a light/middle distillate.
- Increasing ANT trends indicate the potential that LNAPL is migrating in these areas. However, nearby wells with historical LNAPL absence have not exhibited recent indications of LNAPL (including wells S-27, S-218, S-219, S-370, S-371, and S-381).

4. Southeast AOI 4 boundary in the vicinity of the Penrose System
(reference wells: RW-701 through RW-717; S-124, S-221, S-233, S-235, S-236, S-237, S-240, S-241, S-278, S-373)
    - Several wells along and to the north of the northern Penrose System leg have had detectable ANT. Of these locations, a few have exhibited potentially increasing ANT trends in 2016: S-240, S-241, RW-701, and S-221. ANT was not detected at S-240 between 2006 and 2008, but has consistently been detected since 2008. The maximum ANT throughout the period of record at S-240 was observed in the most recent gauging event in 2016. ANT has consistently been detected in S-241 since monitoring began in 2006. The thicknesses observed at S-241 over the monitoring period indicate a weak increasing trend. Similar to S-240, the maximum ANT was observed in the most recent 2016 gauging event. LNAPL was first detected at RW-701 in 2012, and has been detected intermittently since then with increasing thickness. The fluid levels observed in this recovery well appear to be largely controlled by the pumping rate and system activity. LNAPL has consistently been detected in S-221 since 2006. The apparent LNAPL thickness oscillations observed throughout the monitoring record correlate to seasonal and regional water level fluctuations. The maximum ANT was observed in the most recent 2016 gauging event, coinciding with a historical groundwater elevation minimum. However, it is important to note that these conclusions regarding ANT trends assume that no additional LNAPL source is being introduced to the subsurface. According to PES, very recent product release(s) have occurred which complicate the analysis (**Section 3.2**).
    - Increasing ANT trends detected in wells upgradient of the Penrose System indicate the potential that LNAPL is migrating in these areas. However, these trends seem to be related to groundwater elevations at the time of gauging. In contrast, the increasing ANT trend may be the result of other external factors, such as Penrose System operation and/or a recent increase in LNAPL source

volume due to product release(s) in this area (**Section 3.2**). Other wells in the area have had decreasing or stable ANT trends.

A review of the ANT data over time suggests that the LNAPL plumes are not migrating, in general, because the ANT observed in wells has not been increasing, with limited exceptions as listed below.

- In the area near wells S-30 and RW-701, increasing trends of ANT have recently been observed in several wells indicating LNAPL in this localized area may be migrating, however, these trends may be associated with recovery system operation or inactivity. It is important to note that the increasing ANT trend in the RW-701 area may be the result of recent release(s) (**Section 3.2**).

- The increasing trends of ANT in wells S-220, S-104, and S-368 do not appear to be related to system operations. The discrete increasing ANT trend at well S-220 may be related to decreasing water levels. Increasing ANT in S-104 and S-368 do not appear to be explained by systems operations or water level trends, and may be indicative of locally migrating LNAPL in the northern portion of AOI 4 near the Site boundary.

Review of the aerial extent of ANT data suggests that the LNAPL plumes are not migrating, in general, because fluid level gauging over time indicates that LNAPL has not been identified in a down-gradient portion of the monitoring well network that has historically lacked measurable LNAPL. LNAPL has recently been detected in S-368 which indicates the potential for migrating LNAPL. Prior to 2016, LNAPL had not been observed in this well since monitoring began in 2013. However, LNAPL has been historically observed in nearby well S-104, located approximately 100 ft and downgradient of S-368. The recent occurrence of LNAPL in a well that has historically lacked measurable thickness indicates potential LNAPL migration. Given the current understanding of groundwater flow direction, LNAPL may be migrating *onto AOI 4* from the northern adjacent AOI 2, but not migrating *within AOI 4* in that area. Increasing ANT trends unrelated to water level fluctuations and/or recent release(s) of petroleum, are also indicative of potentially migrating LNAPL in AOI 4 (near S-220, S-30, and the Penrose System area).

3.2 LNAPL SOURCE

The sources of the LNAPL at the Site are equivocal. Numerous potential sources have historically been present at the Site. Plumes from various sources appear to have co-mingled at the Site and there have been documented releases from several tanks located onsite since August 5, 1989. Currently, operations at AOI 4 are primarily comprised of crude oil and gas oil tankage (No. 4 Tank Farm). Infrastructure within the AOI mainly includes aboveground storage tanks (ASTs) and process equipment required for the blending and storage of gasoline and additives, including numerous aboveground and underground process lines. Use of the No. 4 Tank Farm has altered little over the course of the complex's history with primary changes being various ASTs taken in and out of service. The only occupied building in AOI 4 is the 15 Pump House, located in the north central section of AOI 4.

As is discussed in section 3.3, LNAPL characterization samples collected from the Site have indicated a wide range of weathering from "slight" to "severe" (**Table 3**). The area with the greatest degree of weathering is in the vicinity of the inactive S-30 and RW-2 Systems, as well as, at S-32. Conversely, both samples in the vicinity of the Penrose System indicated a more recent release of LNAPL (**Figure 6**).

In July/August 2016, product soaked soil was identified at the ground surface around pipes which are associated with Tank 253, located north of well S-241, north of the Penrose System. The area around the lines was excavated and product removed by PES personnel. In addition, there is a line that is suspected to have leaked which runs north-south past the former S-30 and S-36 Systems approximately bisecting the Site.

3.3 LNAPL CHARACTERIZATION

Various petroleum products have been stored and distributed within AOI 4. The LNAPL plumes at the Site are expected to be made up of various combinations of these products. Numerous samples have been collected over the period of record to characterize the LNAPL at the Site. The results are summarized on **Table 3**, **Figure 6,** and are discussed below.

A total of 26 LNAPL samples have been collected, between 2004 and 2016 in AOI 4 for analysis, in order to classify the generalized LNAPL type/sub-type and degree of weathering, and to quantify the product density.

Analytical LNAPL sample data packages are provided in Appendix II.

Spatial Distribution of Generalized LNAPL Types

Petroleum refinery streams and products are complex mixtures of hydrocarbons. These products are generally derived from crude oil and may be categorized by boiling point into gases, distillates (light, middle, and heavy) and residuum (IFRF, 2016).

Below is a summary of the generalized LNAPL characterization types used to characterize LNAPL present at the Site (Light and Heavy Distillate descriptions are included for reference within the context of the PES Complex).

- **Light Distillates** include liquid petroleum gas (LPG), gasoline, and naphtha. LNAPL types grouped into the light distillate category include samples that have been primarily characterized as gasoline, heavy virgin naphtha or reformed light naphtha. The primary components included in these products generally have carbon numbers between 3 and 10.

- **Mixes of Light/Middle Distillates** include samples that were characterized to be intermediate mixes of light and middle distillate products. The light/middle distillate samples had an average density of 0.81 grams per milliliter (g/ml).

- **Middle Distillates** include kerosene, jet fuel, diesel fuels, and light (#2) fuel oils. The LNAPL types grouped into the middle distillate category include samples that were characterized to be primarily middle distillate or that include significant proportions of coker naphtha mixed with middle distillate. The primary components included in these products generally have carbon numbers between 9 and 20. The middle distillate samples had an average density of 0.86 g/ml.

- **Heavy distillates** include heavier (#4 and #6) fuel oil and heavy atmospheric gas oil. The LNAPL types grouped into the heavy distillate category include samples that were characterized as lubricating oil, residual oil, and heavy distillate. The primary components included in these products have carbon numbers between 14 and 40.

Table 3 summarizes available, historical and recent LNAPL characterization results. The results have been grouped into the following three generalized LNAPL types for the Site and adjacent areas: Mixes of Light/Middle Distillates, Middle Distillates, and Heavy Distillates. More than half of the LNAPL samples collected from AOI 4 were characterized as Middle Distillates; the remaining were characterized as mixtures of Light/Middle Distillates. Heavy Distillate-type LNAPL have been identified west of the southwestern Site boundary in AOI 3. This discrete plume is not considered to be part of the Site and is chemically distinct from onsite LNAPL. **Figure 6** presents the location of the LNAPL characterization samples included in **Table 3**, and the generalized LNAPL type for the AOI 4 LNAPL plumes.

In AOI 4, all LNAPL samples have been categorized as middle distillate or mixes of light and middle distillate. The middle distillate-type LNAPL is mostly limited the west-central portion of the Site, in the vicinity of S-32 and the S-30/S-36 Systems. The remaining LNAPL occurrences are mixtures of light and middle distillate and are spread out as described in the **Section 3.1**. LNAPL in S-220 (mix of light/middle distillate) is distinct from LNAPL in the vicinity of S-410 in AOI 3 (heavy distillate), thus indicting two separate plumes as depicted on **Figure 6**. The LNAPL plume area observed across the northern AOI 4 boundary with AOI 2 suggests that two plumes may have comingled from distinct sources (i.e., a middle distillate source near well S-104/S-368 and light distillate source near well S-360/S-363). Data supports that a continuous LNAPL plume area may be present across the AOI 3 and AOI 4 boundary, near well RW-2. In February 2017, Stantec revisited the S-30 System area and collected one LNAPL sample from well S-30 to reevaluate LNAPL occurrence in that area. The sample was characterized as extremely-weathered middle distillate with a very similar density [0.8680 grams per milliliter (g/ml) versus 0.8681 g/ml] to what was collected and characterized as middle distillate in 2004 from that well.

3.4 SITE-SPECIFIC LNAPL TRANSMISSIVITY ESTIMATES

Traditionally, remediation success of LNAPL has been defined by the reduction of LNAPL thickness, as measured in wells at a site. More recent publications suggest a better metric of LNAPL remediation is to examine LNAPL transmissivity to infer mobility and recoverability (American Society for Testing and Materials (ASTM), 2013; ITRC, 2009). Records of LNAPL and groundwater recovery ratios were used to provide LNAPL transmissivity estimates for the Site (particularly in the vicinity of the Penrose System) and are discussed in detail below. LNAPL transmissivity estimates from 2013 through 2016 were evaluated for potential changes in product recoverability over time.

3.4.1 Water-Enhanced LNAPL Recovery

LNAPL transmissivity may be estimated using discharge data from LNAPL/groundwater recovery systems. This estimation method is applicable even when the total recovery rate is variable or the system experiences periods of down time. The analysis assumes that LNAPL and groundwater are pumped from a well using a single or dual pumping system. The analysis assumes that the discharge rate is sufficiently low to prevent significant smearing of the LNAPL. When the skimming drawdown is small relative to the water extraction induced drawdown, the following equation can be used to determine LNAPL transmissivity (ASTM, 2013 and Charbeneau, 2007):

$$T_n = \frac{Q_0 T_w \rho_r}{Q_w}$$

Where:
T_n = LNAPL transmissivity
Q_0 = LNAPL discharge rate
Q_w = water discharge rate
T_w = Aquifer transmissivity
ρ_r = LNAPL/Water Density Ratio

The S-30 and S-36 Systems previously in operation within AOI 4 involved operation of pneumatic submersible skimming pumps installed in the four recovery wells. Available historical records from operation of these systems do not contain drawdown data for the period of operation, so LNAPL transmissivity estimates have not been calculated for these systems. However, operation of the S-36 System ceased due to an absence of measurable (and recoverable) product.

System status reports for the Penrose System include monthly LNAPL recovery and water recovery volumes throughout the entire operational history (March 2013 – present). LNAPL transmissivity estimates derived from these data are discussed in detail below and summarized in **Table 4**.

Table 5 of this report summarizes the results of aquifer tests completed in AOI 4. Hydraulic conductivity estimates for the Site range from 11.7 ft/day to 452 ft/day. Two slug tests were completed in unconfined aquifer wells: S-120 yielding a hydraulic conductivity estimate of 11.7 ft/day and S-122 yielding a hydraulic conductivity estimate of 12.6 ft/day (SECOR, 2003). A pumping test was completed at RW-2 (AOI 3) in 1997 (IST, 1998). The results indicated that regional hydraulic conductivity values in the unconfined aquifer at the PES Complex may range from approximately 434 to 460 ft/day. The monitoring wells on the east leg (S-103 and S-55) exhibited an estimated hydraulic conductivity of 452 ft/day. The monitoring wells on the southeast leg (S-34 and S-31) exhibited an estimated hydraulic conductivity of 434 ft/day.

Well logs completed in AOI 4 document the presence of significant sand and gravel in the saturated zone. Soil and groundwater investigations at the Site indicate an average saturated thickness of 28.6 ft. As a conservative approach, an average value of 443 ft/day was used for the hydraulic conductivity of the unconfined aquifer. Assuming a saturated thickness of 28.6 feet yields an estimated transmissivity of water of 12,670 ft^2/day.

Table 4 presents monthly and annual average LNAPL transmissivity for the wells included in the recovery system during the period of record. It should be noted that the LNAPL transmissivity estimates based on system performance data represent an average value for the wells included in the system and individual wells may have higher or lower LNAPL transmissivity if measured separately.

3.4.2 LNAPL Transmissivity Trends

LNAPL transmissivity values can be interpreted as a reflection of LNAPL mobility and can serve as a remediation performance metric, which is irrespective of in-well LNAPL thickness. The minimum LNAPL transmissivity for practicable product recovery (when recovery is the only goal for a remediation project) has been suggested to be approximately 0.1 to 0.8 ft^2/day (ITRC, 2009).

Overall, the monthly T_n values have increased since operation of the Penrose System began in March 2013. In 2013 and 2014, the average transmissivity was approximately 0.1-0.3 ft^2/day. By 2015, the average transmissivity had increased to approximately 1.4 ft^2/day. In 2016, based on monthly data from January through November, LNAPL transmissivity is estimated at an average of 4.5 ft^2/day. Additionally, the average T_n estimated for September through November of 2016 was 29.1 ft^2/day.

It should be noted that this method of estimating T_n is sensitive to changes in the operation of the system. Changes to the system that would improve LNAPL recovery efficiency would also increase the estimated value of T_n. The apparent increase in LNAPL recovery in 2016 did not correspond to seasonal water table fluctuations or changes in the total volume of pumped water. As mentioned above, increased LNAPL recovery during the latter half of 2016 coincides with a suspected release in the area north of the system.

The estimated LNAPL transmissivity for the recovery system demonstrates LNAPL recoverability, indicating that LNAPL in AOI 4 is mobile within the vicinity of the Penrose System. LNAPL migration in that area is likely system-induced through the pumping-enhanced gradient.

3.5 CALCULATIONS AND MODELING

Figure 7 depicts the apparent LNAPL thickness for locations included in the LNAPL calculations and modeling described in this section. The calculations and modeling evaluation process was applied to the 20 wells that contained more than 0.1 feet of apparent LNAPL thickness during

2016, with the exception of well S-31 and the five recovery wells known to contain LNAPL (RW-700, RW-701, RW-703, RW-704, and RW-714). Well S-31 was not gauged during 2016; however, it is known to contain LNAPL, and therefore the maximum apparent LNAPL thickness observed in 2015 was used. The period of record maxima for the identified recovery wells were used. This is considered a conservative and representative approach to quantifying the likely LNAPL thickness in these wells. Although the recovery wells are frequently gauged, pump depth at the time of gauging obstructs the LNAPL/water interface, thereby missing the presence (and measurement) of LNAPL during times of low water table conditions.

3.5.1 Input Parameter Discussion

LNAPL mobility calculations and modeling rely on and are sensitive to LNAPL characteristics including density, viscosity, and interfacial tension. LNAPL parameters reported in the literature are generally based on fresh samples of specific product types. Site-specific LNAPL parameters are preferred to literature based values given the weathering, co-mingling, and dissolution that may occur to LNAPL present in the subsurface.

Table 6 summarizes the density and viscosity values used in the evaluation and specify the source of the value used. Wells without site-specific LNAPL density results were assigned values based on the assigned generalized LNAPL type and nearby site-specific samples with similar product type.

Viscosity results were not available for wells in AOI 4, so viscosity values were assigned based on the generalized LNAPL type assigned to the well **(Section 3.3)**. For mixtures of light and middle distillates a dynamic viscosity value of 0.83 centipoise (cP) was assigned based on an LNAPL characterization sample collected from S-198 in AOI 1 (Sunoco, 2007). This is a conservative value compared to literature values for mixtures of light and middle distillates. Samples 73, 74, and 75 from the API parameter database (API, 2006) were classified as 80% gasoline and 20% diesel mixtures and had an average dynamic viscosity of 1.44 cP at 60 degrees Fahrenheit (or ~15.6 degrees Celsius). For middle distillates a dynamic viscosity value of 4.0 cP was assigned based on literature values for diesel fuel oil (API, 2004). **Figure 8** depicts the LNAPL density sample locations for AOI 4; well S-198, viscosity sample result utilized herein, is located in northern AOI 1 and is not depicted on the figure.

LNAPL interfacial tension parameters used in the evaluation were also assigned based on the generalized LNAPL type assigned to the well. For mixtures of light and middle distillates the tension parameters were based on an LNAPL characterization sample collected from S-198 in AOI 1. For middle distillates the tension parameters were based on an LNAPL characterization sample collected from S-34 (Sunoco, 2007).

Model input parameters for soil properties were generally based on literature values. Boring logs for the wells included in the LDRM model were reviewed where available to evaluate soil type near the capillary fringe. Soil parameters for the LDRM were based on API default values for the soil type near the capillary fringe for each well. Boring logs were not available (or did not contain soil descriptions of the capillary fringe interval) for wells S-30, S-373, RW-701, RW-703, and

RW-704. For these wells, the soil type used was based on review of boring logs for other wells located in close proximity. **Table 7** presents the field observations and the generalized soil type used in the models.

Site-specific hydraulic conductivity values based on slug test results were available for wells S-120 and S-122 (**Table 5**). The boring logs for these wells were also reviewed and the soil type at the capillary fringe was a closest match to the API default soil type of fine sand. The average hydraulic conductivity value calculated for these two wells (12.15 ft/d) was used as a representative value for fine sand.

It is important to note that migration of LNAPL in the subsurface is strongly influenced by the characteristics of the soil within the interval of LNAPL saturation. LNAPL saturation is typically highest at and just above the water table; therefore, the characteristics of the soil near the capillary fringe are more applicable to LNAPL modeling than are the soil characteristics of the overall saturated aquifer thickness. As discussed in this LCSM, a conservative hydraulic conductivity estimate for the saturated portion of the unconfined aquifer at the PES Complex may be 443 ft/day. This value is based on large-scale aquifer testing results and as such may be representative of the saturated zone as a whole; however, it may not accurately represent soil properties at all locations (particularly when considering the lithologic heterogeneity of the deposits that comprise the bulk of unconfined aquifer soils at the Site).

3.5.2 LNAPL Mobility Term

The LNAPL Mobility Term is a site-specific evaluation of LNAPL mobility based on intrinsic permeability, LNAPL viscosity, and relative permeability. Sale (2001) introduced an LNAPL "Mobility Term" defined as:

$M_o = 100\ k_{ro}k_i / \mu_o$

Where:

- M_o = mobility term in cubic centimeter seconds per gram (cm^3s/g);
- The factor of 100 appearing in this expression converts meters to centimeters in the viscosity units;
- K_{ro} = LNAPL relative permeability, permeability based upon a function of the relative saturation, in this case an extremely conservative approach is considered with a relative permeability of 1;
- K_i = intrinsic permeability (square centimeters [cm^2]) = 1.59×10^{-6} cm^2, based upon conservative estimate of representative hydraulic conductivity of the unconfined aquifer (443 ft/day – average estimated hydraulic conductivity in the east and southeast monitoring legs of the RW-2 pumping test) (IST, 1998); and

- μ_o = dynamic viscosity for LNAPL, (cP) =0.83 cP [based on LNAPL viscosity results from a sample collected at S-198 in AOI 1]. Note that this is considered to be a conservative value.

Thus, the PES Complex-specific Mobility Term for this Site can be estimated as follows:

- $M_o = 100\ (1)(1.59\times10^{-6})\ /\ 0.83 = 1.92\times10^{-4}\ cm^3s/g$

If the LNAPL "Practical Limit of Mobility (PLM)" defined using a Mobility Term is less than 1×10^{-7} cm^3s/g, then LNAPL can be presumed to be effectively immobile (Golder, 2008). The term is heavily influenced by the value of intrinsic permeability for which estimates can vary over orders of magnitude. Based upon the conservative estimation of the LNAPL mobility term, the mobility of some of the LNAPL encountered at the Site may be above the practical limit of mobility.

3.5.3 LNAPL Pore Entry Pressure Evaluation

LNAPL occurrence in a monitoring well does not necessarily imply that LNAPL is able to move in the formation. LNAPL must overcome a finite pore entry pressure before it can penetrate water-filled pores and flow laterally (Charbeneau, 2007). The head required to exceed the pore entry pressure is referred to as the displacement head (ITRS 2009).

A multiphase model can be used to estimate the displacement head, assuming Brooks-Corey soil characteristics. The Brooks-Corey water retention model assumes that a minimum capillary pressure must be applied before the interface between the wetting and non-wetting fluids is displaced from the largest pore spaces (air/water displacement head) (Charbeneau, 2003).

Generally, if the thickness of the LNAPL in the monitoring well is greater than the Brooks-Corey displacement head, then the free-phase LNAPL is potentially mobile. If there are monitoring wells near the periphery of the LNAPL plume where the LNAPL in-well thickness is less than the displacement head, then the free-phase LNAPL is theoretically unable to migrate laterally beyond these monitoring wells.

The observed monitoring well LNAPL thickness necessary for LNAPL to flow laterally into a porous medium can be described by the equation:

$$b_n[crit] = \left(\frac{\sigma nw}{(1-\rho r)\sigma aw} + \frac{\sigma an}{\rho r\ \sigma aw}\right)\frac{hd}{\sigma aw}$$

where:

- $b_n[crit]$ = minimum LNAPL thickness in monitoring well for LNAPL to penetrate the formation (LNAPL apparent thickness; m);
- σ_{nw} = LNAPL/water interfacial tension (dynes/cm);
- σ_{an} = Air/LNAPL interfacial tension (dynes/cm);
- σ_{aw} = Air/water interfacial tension (dynes/cm);
- ρ_r = relative LNAPL density (density of LNAPL/density of water); and,

- h_d = displacement pressure head also known as bubbling pressure head (meters (m))

Table 8 presents a summary of LNAPL pore entry pressure calculations for the selected 20 wells. Literature values for h_d based on soil type are provided in the API Publication 4729 (Charbeneau, 2003) and range from a low of 0.5 meters for sand to a high of 2.0 for silty clay. **Table 8** presents a summary of critical LNAPL pore entry pressure calculations using a conservative h_d value for sand.

The calculated critical pore entry pressure for monitoring wells with 2016 LNAPL thickness greater than 0.1 feet ranged from 0.38 to 0.70 feet with an average of 0.45 feet. For 18 of the 20 wells evaluated, the observed LNAPL thickness was greater than the critical pore entry pressure indicating that the LNAPL observed at these wells is potentially mobile. For wells RW-704 and S-373 the period of record maximum also falls below the calculated critical pore entry pressure indicating the LNAPL observed at these wells would be unable to migrate laterally. Both wells are located along/near the Penrose System: RW-704 is situated along the northern system leg and S-373 is located approximately 300 ft to the northeast.

3.5.4 LNAPL Mobility Modeling

Similar to groundwater, LNAPL in the subsurface only moves under Darcy's Law, and thus movement is a function of the relative permeability based upon saturation and porous media characteristics, LNAPL density, and LNAPL viscosity. Using the American Society for Testing and Materials (ASTM) guidance, LNAPL pore velocities less than $1x10^{-6}$ centimeters per second (cm/s) indicate LNAPL in the formation is functionally immobile. When pore velocity exceeds this criterion, it is an indication that LNAPL is potentially mobile at the pore scale and capable of moving vertically and laterally within the formation.

Site-specific LNAPL mobility can be characterized through the use of site data and advanced LNAPL mobility calculations and models presented in the API Interactive LNAPL guide (API, 2004). The approach is additionally referenced as a component of site management/characterization in a 2005 EPA document titled A Decision Making Framework for Cleanup of Sites Impacted with Light Non-Aqueous Phase Liquids.

Stantec used the API Interactive guide and calculation tools (API, 2004) to model the distribution and recovery of LNAPL at the Site. The model calculates an expected LNAPL saturation and corresponding LNAPL relative permeability based on input of the physical properties of the product and aquifer matrix and assumed water/LNAPL saturation conditions in the aquifer. Soil capillary pressure characteristics are assumed to follow the van Genuchten model for relating fluid saturation to capillary pressure. Modeled LNAPL saturation and relative permeability are used to calculate an estimated pore velocity.

The following input parameters are required:

- Site characteristics (e.g. soil type, LNAPL thickness, plume distribution);

- Fluid characteristics (e.g. LNAPL and water density, air-water-LNAPL interfacial tensions); and
- Aquifer characteristics (e.g. porosity, soil capillarity parameters, irreducible water saturation, and residual LNAPL saturation).

Table 9 summarizes the input parameters for and results of the model. Input parameters are discussed in detail in **Section 3.5.1**.

The groundwater hydraulic gradient used in the LNAPL mobility modeling was 0.004 feet per foot. The hydraulic gradient was estimated from May 2016 groundwater elevation data in the vicinity of the Penrose System. The majority of the wells included in the model are located within that part of the AOI **(Figure 7)**.

Based on the above input parameters, the model calculated plume velocities ranged from $5.2x10^{-7}$ cm/s to $2.5x10^{-4}$ cm/s with an average velocity of $1.3x10^{-4}$ cm/s. **Figure 9** presents a map of the plume velocity estimates.

ASTM suggests that LNAPL seepage velocities less than $1x10^{-6}$ cm/s indicate that the LNAPL is functionally immobile. Calculated values for the wells included in the analysis were greater than the limit of functional mobility, except for S-368 (located near the northern-central AOI border). Based on this criterion, the model results indicate that the plume may be able to migrate at the locations included in the model.

3.5.5 LNAPL Distribution and Recovery Model (LDRM)

The API LNAPL Distribution and Recovery Model (LDRM) (API, 2007) was used to estimate the thicknesses of total, mobile, and recoverable LNAPL present at each of the wells included in the model (**Table 10**). Additionally, saturation profile graphs were produced and are included in **Appendix III**.

Model input parameters and results are summarized in **Table 10**. The model was run using a variable LNAPL residual saturation with an f-factor of 0.3 (Charbeneau, 2007). Model input parameters for fluid characteristics were the same as those used in the LNAPL mobility modeling discussed in **Section 3.5.4**.

Based on the input parameters used, the LDRM model calculated LNAPL transmissivity values ranging from 0.01 ft^2/day to 131.88 ft^2/day with an average transmissivity of 16.21 ft^2/day. **Figure 10** presents a map of the LDRM estimated LNAPL transmissivity values.

As discussed in **Section 3.4.2**, the minimum LNAPL transmissivity for practicable product recovery has been suggested to be approximately 0.1 to 0.8 ft^2/day (ITRC, 2009). Of these 20 wells, 13 have LNAPL transmissivity values within the practicably recoverable range, five wells are in the transitional range (S-29, S-31, S-278, RW-704, and S-373) and two wells (S-368 and S-104) have estimated LNAPL transmissivity values below the limit of practicable recoverability.

4.0 Summary and Conclusions

This report documents the LNAPL CSM for AOI 4 of the Philadelphia Refinery Complex. The objective of the LNAPL mobility assessment was to evaluate if remaining LNAPL is residual, mobile, or migrating. As discussed above, residual LNAPL represents LNAPL that is trapped in soil pores, mobile LNAPL is LNAPL that exceeds residual saturation, and migrating LNAPL is LNAPL that is observed to spread or expand. Mobile LNAPL includes migrating LNAPL, but not all LNAPL indicated to be mobile is migrating. The following summarizes key elements of the LNAPL CSM utilizing data gathered from literature review, field investigations, laboratory analyses, and remediation efforts.

- Numerous LNAPL characterization samples collected from the Site by Stantec and others have identified the presence of several variably-weathered product mixtures in the subsurface at AOI 4. The variation in LNAPL characteristics is indicative of multiple product releases at different times with subsequent co-mingling of plumes. Middle distillate is the most common product type encountered at the Site. For the purposes of this LNAPL CSM, the characterized LNAPL samples have been generalized into two groups listed below:

    - Light Distillates
    - Mixture of Light and Middle Distillates
    - Middle Distillates

- A review of apparent LNAPL thickness data through time suggests that LNAPL plumes at the Site are not migrating, in general, because the vertical thickness of LNAPL has not been increasing. In the following wells, increasing trends in apparent LNAPL thickness have recently been observed indicating that LNAPL in these areas may be migrating:

    - S-30 and S-31: located within the influence of inactive S-30 System.
    - S-104 and S-368: these wells are located adjacent to the northern (center) AOI 4 border with AOIs 1 and 2, along Hartranft Street.
    - S-221, S-240, S-241, and RW-701: these wells are located along or north of the northern leg of the Penrose System.
    - S-220: located to the northwest of the Penrose System.

- Review of the aerial extent of apparent LNAPL thickness through monitoring well observations suggests that overall, AOI 4 LNAPL plumes are not migrating because fluid level gauging over time indicates that LNAPL has not been identified in a down gradient portion of the monitoring well network that has historically lacked measurable LNAPL, with one possible exception: monitoring well S-368 has been gauged six times between 2013 and 2016. LNAPL was not detected until the most recent gauging events at monitoring well S-368 in May and November 2016 at a maximum thickness of 2.25 ft.

- At the Penrose System area along the southern AOI 4 boundary, use of ANT and aerial extent of LNAPL through time cannot completely demonstrate LNAPL delineation at the apparent downgradient boundary (point of compliance) as efforts by Evergreen to install offsite monitoring wells have been unsuccessful due to property access. Operation of the Penrose System wells is meant to mitigate the potential offsite migration of LNAPL in this area. ANT trends support continued operation of the Penrose System.

- Recent (post-2015) product releases are suspected to have occurred in the Penrose System area and may account for the ANT increases observed and discussed in the LCSM. During July/August 2016, product soaked soil was identified at the ground surface around pipes which are associated with Tank 253 but outside the emergency containment dike, located north of well S-241. The area around the lines was excavated and product removed by PES personnel. In addition, there is a product line that is suspected to have leaked which runs north-south along the access road leading to the Penrose system wells, approximately bisecting AOI 4. This line is being excavated and replaced in sections by PES. **Figure 6-1** of the RIR contains an inset map that comparatively shows the ANT in May 2015 in this area versus the maximum thickness for the time period 2013 – 2016.

- LNAPL at the Site has been delineated and characterized.

- Average LNAPL transmissivity for the Penrose System was calculated using monthly system operational data. Annual averages for the system were calculated to range from 0.5 ft^2/day in 2013 to 4.5 ft^2/day in 2016 with a significant increase in estimated transmissivity occurring in September 2016. The significant increase in Penrose System LNAPL transmissivity in 2016 is likely the result of new product releases in the area north of the system. These estimates are based on average extraction rates for the Penrose System as a whole. LNAPL transmissivity may be higher or lower at individual wells included in or near the system and changes in the combination of pumping wells used, pump settings, and recovery rates from individual wells may be contributing factors to the apparent increasing LNAPL transmissivity. For AOI 4, LNAPL baildown testing of system wells could be used to facilitate future optimization of the Penrose System.

- A conservative value for the Site-specific Mobility Term was calculated to be $1.92x10^{-4}$ cm^3s/g which is above the practical limit of mobility.

- The critical pore entry pressure was estimated for wells that had greater than 0.1 feet of apparent LNAPL thickness in 2016. The estimated critical pore entry pressure thickness ranged from 0.38 to 0.70 feet with an average of 0.45 feet. For 18 of the 20 wells evaluated, the observed LNAPL thickness was greater than the critical pore entry pressure indicating that the LNAPL observed at these wells is potentially mobile.

- ASTM suggests that LNAPL seepage velocities less than $1x10^{-6}$ cm/s are indicative of functionally immobile LNAPL. Plume velocities were calculated as part of the 2013 Site

Characterization Report (SCR) (Sunoco, 2013). For the fifteen wells modeled in the 2013 SCR, the calculated plume velocities ranged from 2.83×10^{-12} cm/s to 2.76×10^{-4} cm/s.

- As a part of this LNAPL CSM, plume velocity calculations were updated for wells with greater than 0.5 feet of apparent LNAPL thickness in 2016. Model calculated plume velocities ranged from 5.2×10^{-7} cm/s to 2.5×10^{-4} cm/s with an average velocity of 1.3×10^{-4} cm/s. The higher calculated plume velocity values may be explained by differences in the values used for soil permeability in the 2013 model and hydraulic conductivity in the current model.

- The API LDRM model was run for wells with greater than 0.1 feet of ANT in 2016. The LDRM model indicates that LNAPL in 13 of the 20 wells modeled have LNAPL transmissivity values within the practicably recoverable range, five wells are in the transitional range (S-29, S-31, S-278, RW-704, and S-373) and two wells (S-368 and S-104) have estimated LNAPL transmissivity values below the limit of practicable recoverability. LNAPL transmissivity testing completed at these wells could be used to further calibrate the LDRM model and in simulating recovery methods over time.

Table 11 provides a summary of the various line of evidence that indicate the migrating potential of LNAPL in AOI 4. Lines of evidence include (1) increasing ANT; (2) current/recent LNAPL thickness exceedance of critical pore entry pressure; (3) estimated plume velocity exceedance of functional mobility limit; and (4) estimated LNAPL transmissivity exceedance of the practicable product recovery range. As shown on **Table 11**, seven wells indicate potentially mobile and practicably recoverable LNAPL based on the four metrics provided as lines of evidence. The seven wells are located in three distinct areas of the Site: (1) S-30 System area (based on S-30 and S-31); (2) Penrose System area (based on S-221, S-240, S-241, and RW-701); and (3) in the vicinity of S-220 (between the S-30 and Penrose System areas). Increasing ANT trends at S-104 and S-368 indicated potentially mobile LNAPL, however, the estimated plume velocity and/or LNAPL transmissivity indicate that the onsite edge of this plume is functionally immobile and not practically recoverable.

The results of this LNAPL mobility assessment may be used to focus additional testing and to facilitate recovery system optimization. As additional site-specific LNAPL data becomes available it may be used to update and calibrate the LNAPL mobility evaluations presented in this AOI 4 LNAPL CSM.

5.0 References

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FIGURES

PHILADELPHIA REFINING COMPLEX
3144 WEST PASSYUNK AVENUE
PHILADELPHIA, PENNSYLVANIA
SITEWIDE PADEP FACILITY ID NO. 780190
AREA OF INTEREST 4 PADEP FACILITY NO. 770318

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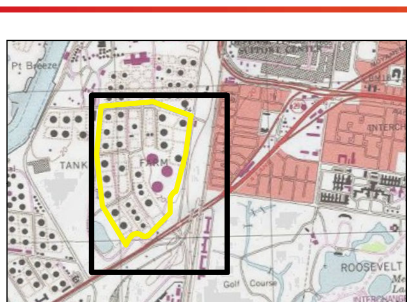

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)

Legend

AOI 4 Monitoring Well Locations

Hydrostratigraphic Unit

- Unconfined Aquifer
- Lower Confined Aquifer
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 150 300 Feet

1:3,600 (at original document size of 11x17)

N

Figure No.
1

Title

AOI 4 Site Map

Client/Project

PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location: CITY OF PHILADELPHIA, PENNSYLVANIA

2132402602

Prepared by LB on 2017-01-04
Technical Review by AP on 2017-01-31
Independent Review by JLM on 2017-03-01

Stantec

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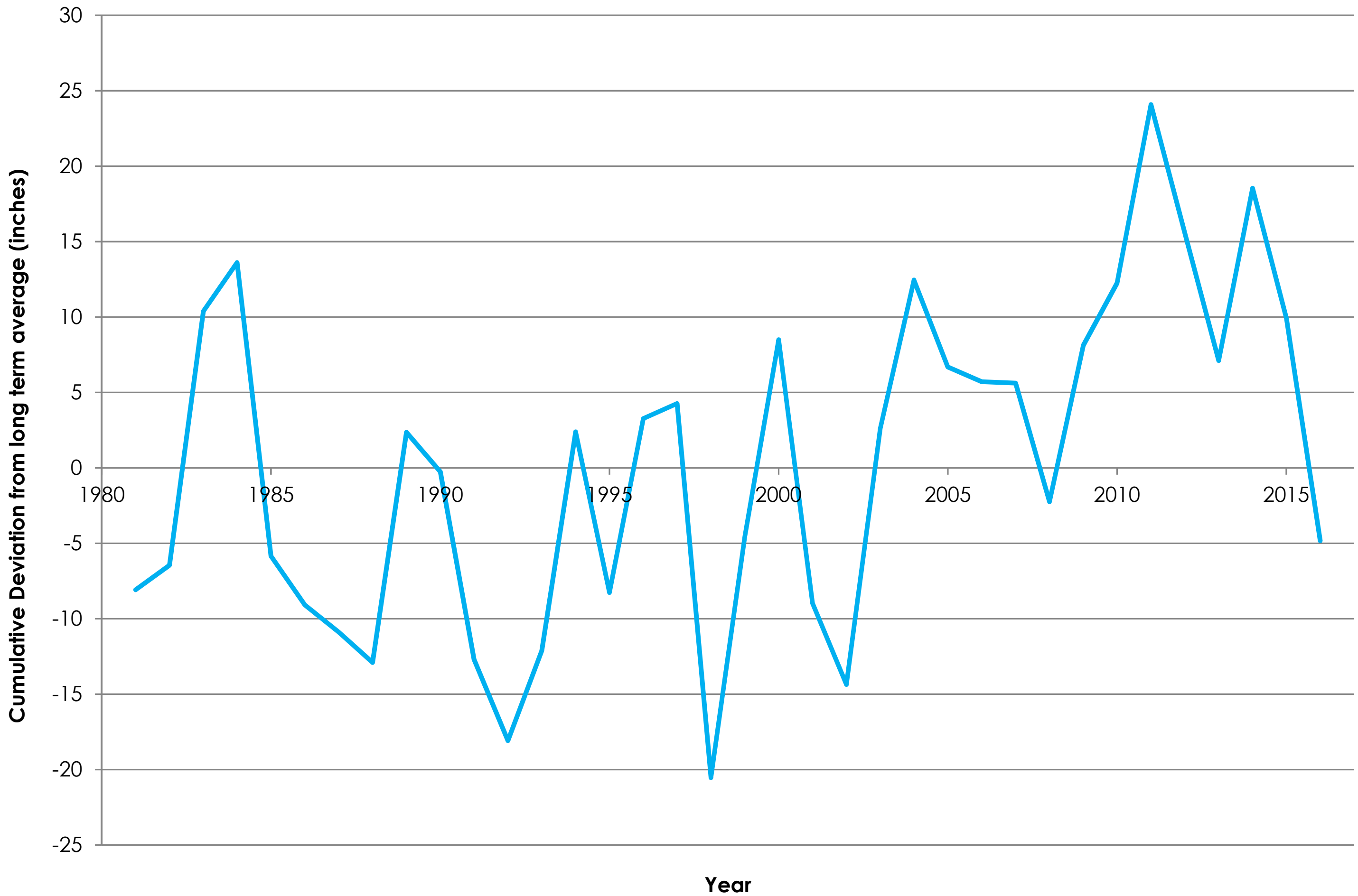


Client/Project

AOI 4 LNAPL Site Conceptual Model
Philadelphia Refinery Operations,
a Series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

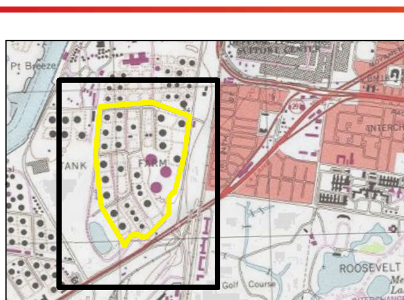
2

Title

Precipitation Cumulative Deviation from Long Term Average

Weather data from the NOAA Station at Philadelphia International Airport, Pennsylvania.
(https://www.ncdc.noaa.gov/cdo-web/datasets/GHCND/stations/GHCND:USW00013739/detail)

V:\1905\miscellaneous\PHL\GIS\mxd\AOI4\Fig3a-e_AnnualMaxLNAPL_Bn_time.mxd Revised: 2017-03-23 By: tbest



Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Submerged Screen
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Sewer Line

0 175 350 Feet

1:4,200 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Wells included in the year's gauging event(s) are depicted.
4. Confined aquifer wells are not included on this figure.

Figure No.
3a

Title
Maximum Apparent Thickness in 1995

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location
CITY OF PHILADELPHIA, PENNSYLVANIA

2132402602
Prepared by LB on 2017-01-04
Technical Review by JD on 2017-01-04
Independent Review by JLM on 2017-03-01

Stantec

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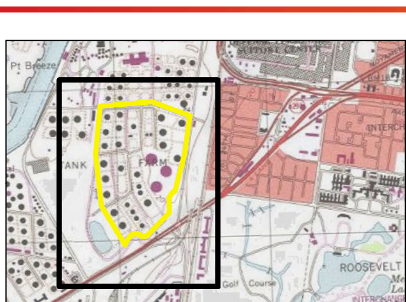

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Submerged Screen
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Sewer Line

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Wells included in the year's gauging event(s) are depicted.
4. Confined aquifer wells are not included on this figure.

0 175 350 Feet
1:4,200 (at original document size of 11x17)
N

Figure No.
3b

Title

Maximum Apparent Thickness in 2000

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF
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3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location
CITY OF PHILADELPHIA, PENNSYLVANIA

2132402602
Prepared by LB on 2017-01-04
Technical Review by JD on 2017-01-04
Independent Review by JLM on 2017-03-01

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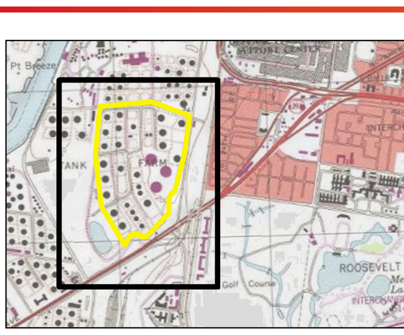

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Wells included in the year's gauging event(s) are depicted.
4. Confined aquifer wells are not included on this figure.

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Submerged Screen
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Sewer Line

0 175 350 Feet

1:4,200 (at original document size of 11x17)

N

Figure No.
3c

Title

Maximum Apparent Thickness in 2005

Client/Project

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PHILADELPHIA, PA 19145

Project Location: CITY OF PHILADELPHIA, PENNSYLVANIA

2132402602

Prepared by LB on 2017-01-04
Technical Review by JD on 2017-01-04
Independent Review by JLM on 2017-03-01

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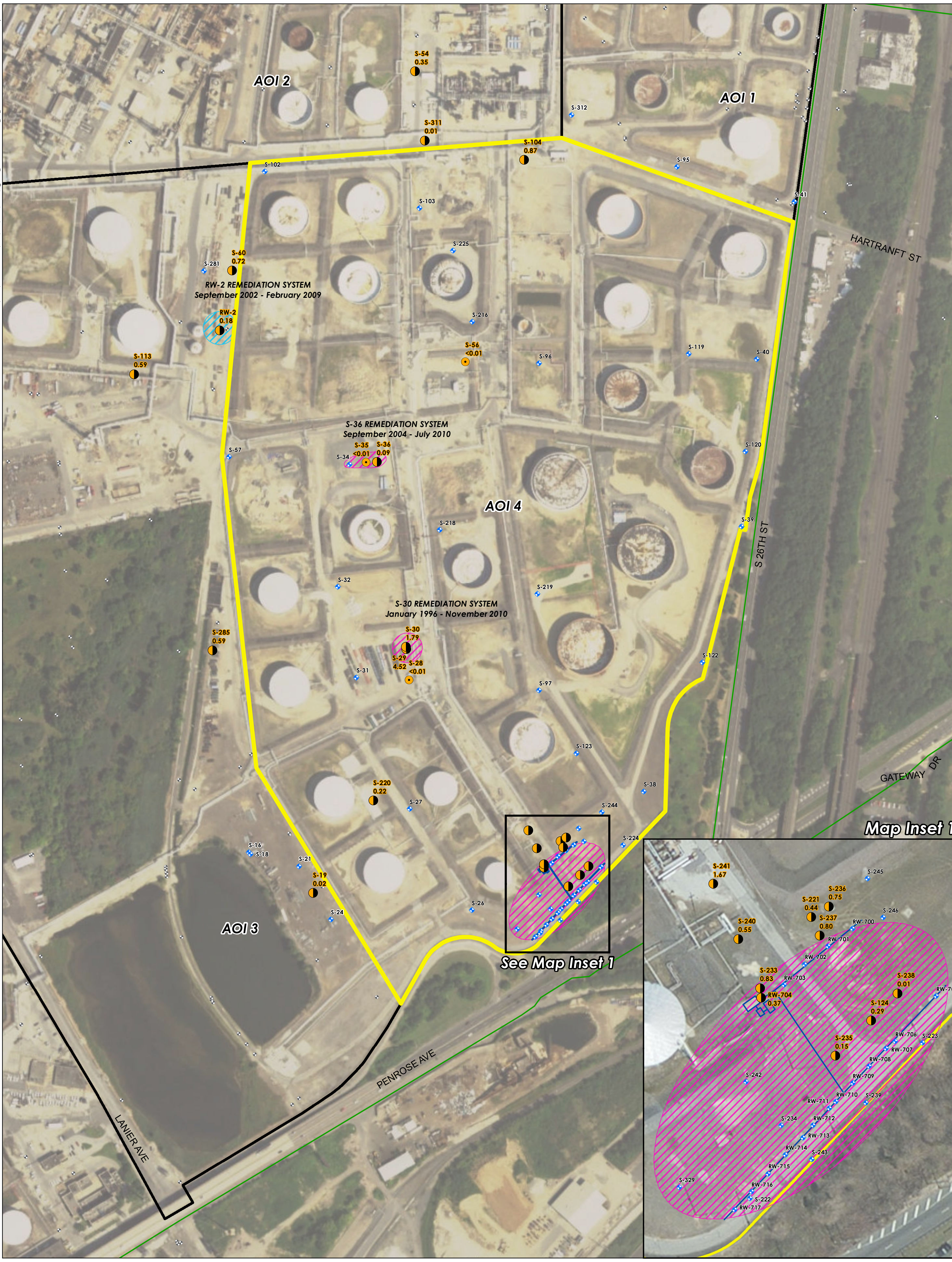

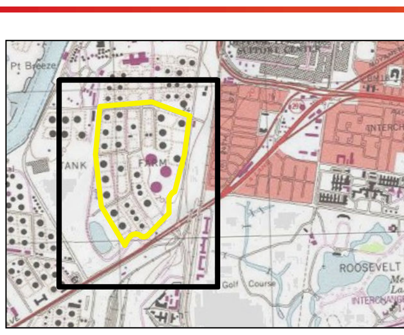

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 175 350 Feet

1:4,200 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Wells included in the year's gauging event(s) are depicted.
4. Confined aquifer wells are not included on this figure.

Figure No.
3d

Title

Maximum Apparent Thickness in 2010

Client/Project

PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location: CITY OF PHILADELPHIA, PENNSYLVANIA

2132402602

Prepared by LB on 2017-01-04
Technical Review by JD on 2017-01-04
Independent Review by JLM on 2017-03-01

Stantec

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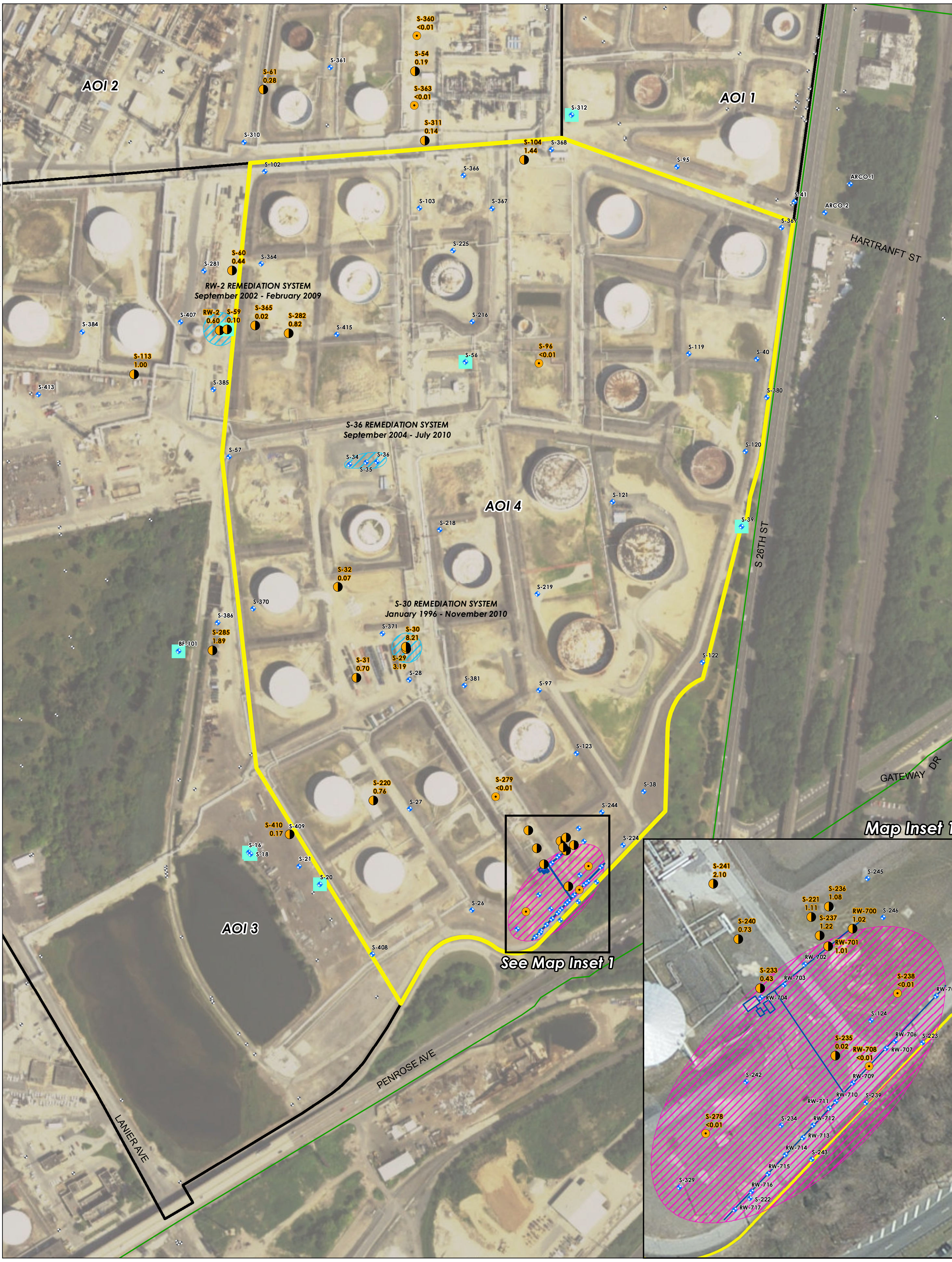

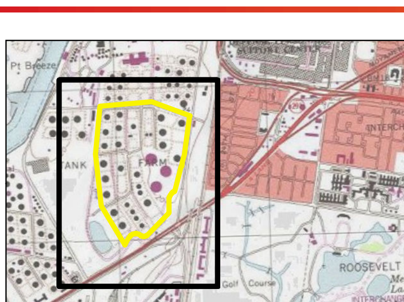

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Submerged Screen
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 175 350 Feet

1:4,200 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Wells included in the year's gauging event(s) are depicted.
4. Confined aquifer wells are not included on this figure.

Figure No.
3e

Title

Maximum Apparent Thickness in 2015

Client/Project

PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 2132402602

CITY OF PHILADELPHIA, PENNSYLVANIA

Prepared by LB on 2017-01-04
Technical Review by JD on 2017-01-04
Independent Review by JLM on 2017-03-01

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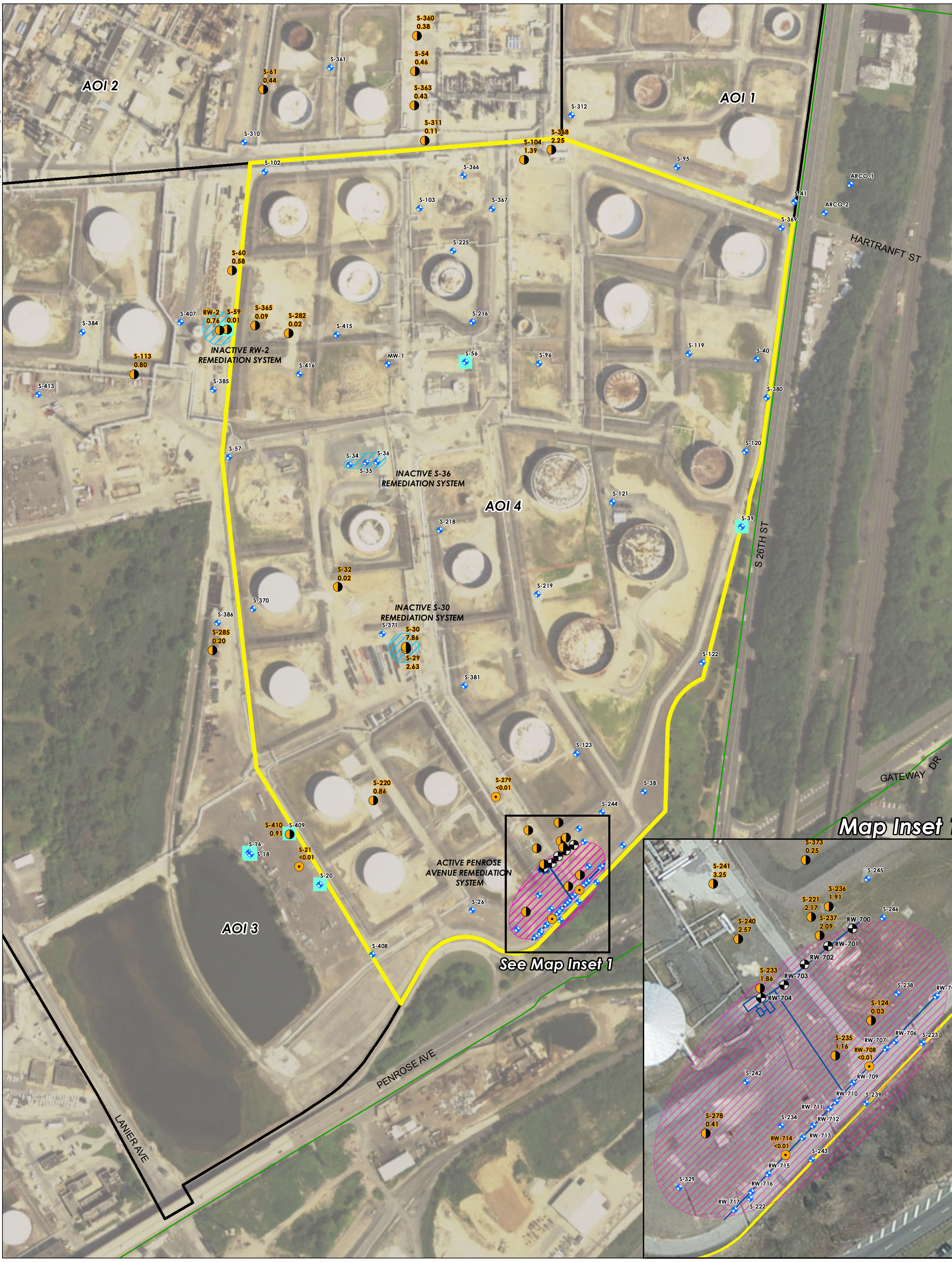

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Pumping Wells*
- Submerged Screen
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 175 350 Feet

1:4,200 (at original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Maximum apparent product thickness observed in 2016 is depicted for each well gauged in 2016.
4. Product thickness is in units of feet.
5. Confined aquifer wells are not included on this figure.
6. * Indicates a recovery well that was pumping during 2016 gauging events. Apparent LNAPL thickness was not measured (due to pump depth).

Figure No.
4

Title
Maximum Apparent LNAPL Thickness (2016)

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 2132402602
CITY OF PHILADELPHIA, PENNSYLVANIA

Prepared by LB on 2017-01-04
Technical Review by AP on 2017-01-31
Independent Review by JML on 2017-03-01

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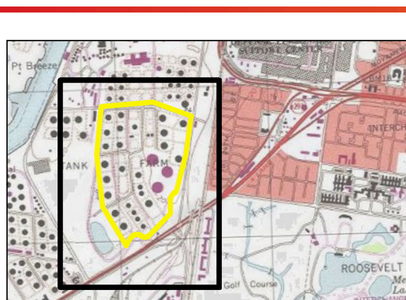

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Legend

Unconfined Aquifer Wells

LNAPL Indication

- Measurable Apparent LNAPL Thickness
- Sheen Observed
- No Measurable LNAPL Thickness
- Submerged Screen
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Maximum product thickness observed displayed in units of feet.
4. Period of monitoring record for AOI 4 (variable for each well): December 13, 1995 - December 1, 2016. Note that several adjacent wells located outside of the AOI 4 limits are depicted for discussion of LNAPL delineation.
5. Confined aquifer wells are not included on this figure.

0 175 350 Feet

1:4,200 (at original document size of 11x17)

N

Figure No.
5

Title
Maximum Observed Apparent LNAPL Thickness for Period of Record (1995-2016)

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 2132402602
CITY OF PHILADELPHIA, PENNSYLVANIA

Prepared by LB on 2017-01-29
Technical Review by AP on 2017-01-31
Independent Review by JLM on 2017-03-01

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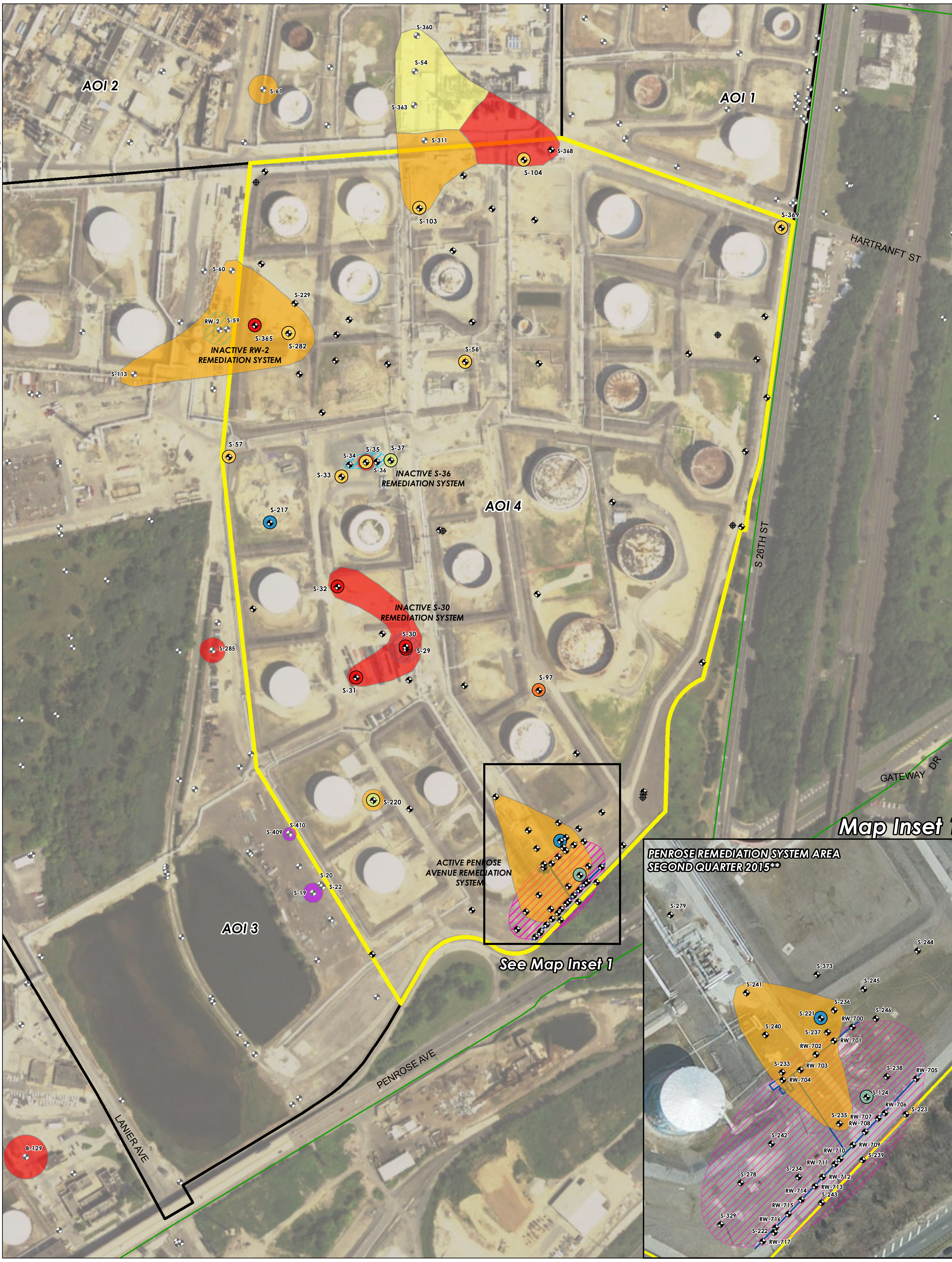

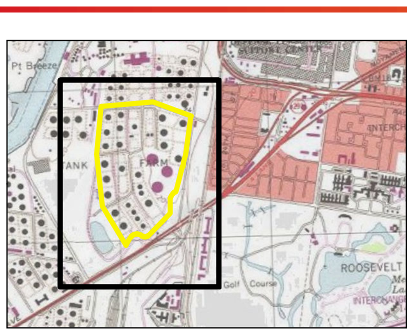

AOI 4 Monitoring Well Locations

Hydrostratigraphic Unit

- Unconfined Aquifer
- Lower Confined Aquifer
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation Systems Designated As Currently Active
- Remediation Systems Designated as Inactive
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

Generalized LNAPL Type

- Light Distillate
- Middle Distillate
- Mixes of Light/Middle Distillate
- Heavy Distillate

Degree of Weathering

- Slight
- Moderate
- High
- Extreme
- Severe
- Unknown/Unclassified

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. See Table 3 for additional details.

**NOTE: IN THE PENROSE REMEDIATION SYSTEM AREA, THE INSET MAP DEPICTS THE ESTIMATED PLUME EXTENT IN MAY 2015 (SECOND QUARTER GAUGING).

0 175 350 Feet

1:4,200 (at original document size of 11x17)

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Figure No.
6

Title

LNAPL Characterization Samples (Generalized LNAPL Type and Weathering)

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF
EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 2132402602
CITY OF PHILADELPHIA, PENNSYLVANIA

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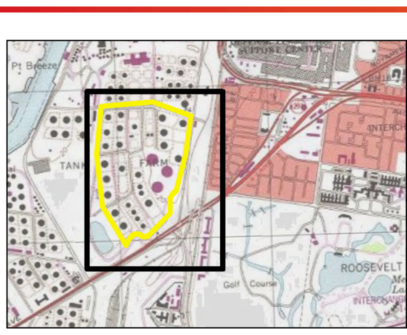

Legend

Unconfined Monitoring Well Locations

- Measurable Apparent LNAPL Thickness (2016)
- Submerged Screen
- Recent Measurable Apparent LNAPL Thickness (not gauged in 2016)
- Recovery Wells with LNAPL (Maximum Apparent Thickness, 1995-2016)
- Facility Monitoring Well
- AOI 4
- Area of Interest (AOI)
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 150 300 Feet

1:3,600 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Annual maximum product thickness observed in 2016 is depicted for each well gauged in 2016. Locations with historical LNAPL indication that were not included in 2016 gauging are included in the LNAPL analysis, however, for those locations, the most recent gauging result is shown. Historical maximum LNAPL thickness is shown for recovery wells; due to pump placement in well, gauging records are not always indicative of LNAPL apparent thickness.
4. Product thickness is in units of feet.
5. Confined aquifer wells are not included on this figure.

Figure No.
7

Title
LNAPL Thickness and Extent for Modeling Application

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF
EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location
CITY OF PHILADELPHIA,
PENNSYLVANIA

2132402602
Prepared by LB on 2017-01-04
Technical Review by PRB on 2017-02-21
Independent Review by JLM on 2017-03-01

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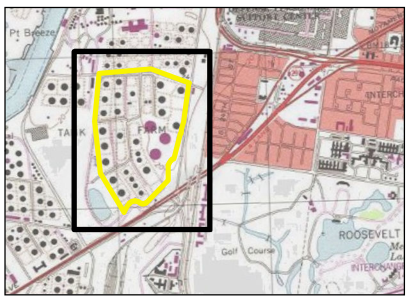


Legend

- AOI 4 LNAPL Density Samples
- AOI 4
- Area of Interest (AOI)
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 150 300 Feet

1:3,600 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. Location of AOI 4 LNAPL density samples and results (in gm/cm3).

Figure No.
8

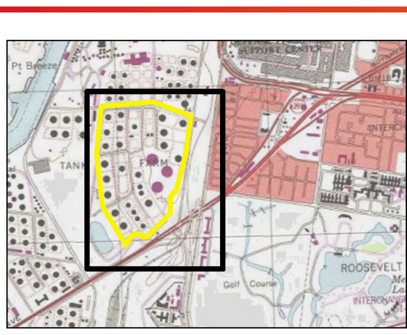
Title

LNAPL Density Samples

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF
EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location
CITY OF PHILADELPHIA,
PENNSYLVANIA

2132402602
Prepared by LB on 2017-02-21
Technical Review by PRB on 2017-02-21
Independent Review by JLM on 2017-03-01



Legend

AOI 4 Monitoring Wells Calculated Plume Velocities (cm/sec)

- Measurable Apparent LNAPL Thickness (2016)
- Recent Measurable Apparent LNAPL Thickness (not gauged in 2016)
- Recovery Wells with LNAPL (Maximum Period of Record Apparent Thickness)
- AOI 4
- Area of Interest (AOI)
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 150 300 Feet

1:3,600 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. See Table 9 for details of input parameters.
4. Plume velocity in units of cm/s.

Figure No.
9

Title

LNAPL Plume Velocity Estimates

Client/Project
PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location | 2132402602

CITY OF PHILADELPHIA, PENNSYLVANIA

Prepared by LB on 2017-02-16
Technical Review by PRB on 2017-02-21
Independent Review by JLM on 2017-03-01

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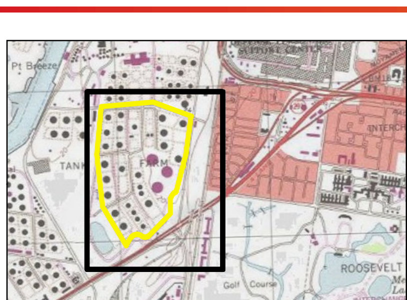

Legend

AOI 4 Monitoring Wells Calculated LNAPL Transmissivity (ft2/day)

- Measurable Apparent LNAPL Thickness (2016)
- Recent Measurable Apparent LNAPL Thickness (not gauged in 2016)
- Recovery Wells with LNAPL (Maximum Period of Record Apparent Thickness)
- AOI 4
- Area of Interest (AOI)
- Remediation System (Penrose Avenue Remediation System)
- Sewer Line

0 150 300 Feet

1:3,600 (at original document size of 11x17)

N

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Basemap: ArcGIS World Imagery (Main and Inset 1 maps) and USA Topo Maps (Key Map)
3. See Table 10 for details of input parameters.
4. Transmissivity in units of square feet per day (ft2/d).

Figure No.
10

Title

LDRM LNAPL Transmissivity Estimates

Client/Project

PHILADELPHIA REFINERY OPERATIONS, A SERIES OF
EVERGREEN RESOURCES GROUP, LLC
PHILADELPHIA REFINING COMPLEX
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 2132402602

CITY OF PHILADELPHIA, PENNSYLVANIA

Prepared by LB on 2017-02-16
Technical Review by PRB on 2017-02-21
Independent Review by JLM on 2017-03-01

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TABLES

PHILADELPHIA REFINING COMPLEX
3144 WEST PASSYUNK AVENUE
PHILADELPHIA, PENNSYLVANIA
SITEWIDE PADEP FACILITY ID NO. 780190
AREA OF INTEREST 4 PADEP FACILITY NO. 770318

Table 1
List of Wells with Submerged Screens
Philadelphia Refining Complex, AOI 4

Well ID	Apparent LNAPL Thickness Observed	Hydrostratigraphic Unit	Notes
MW-4		Unconfined	Well was successfully gauged twice in 2006 (5/10/2006 and 11/2/2006). Well has been destroyed since 2007.
S-119D		Lower Aquifer	
S-217	Y	Unconfined	Well has been destroyed since 2007.
S-218D		Lower Aquifer	
S-225		Unconfined	
S-38D		Lower Aquifer	
S-38D2		Lower Aquifer	
S-39		Unconfined	
S-39D		Lower Aquifer	
S-56	Y	Unconfined	No measurable product thickness since 2004; sheen observed in 2007 and 2010.
S-59D		Lower Aquifer	

Notes:

Y Indicates measurable apparent thickness of LNAPL has been observed in well

Table 2
Summary of Well Gauging
Philadelphia Refining Complex, AOI 4

Year	Number of Wells Gauged	Number of Wells with LNAPL	% of Wells Gauged with LNAPL
1995	23	15	65%
1996	25	19	76%
1997	25	18	72%
1998	24	17	71%
1999	23	14	61%
2000	24	11	46%
2001	24	12	50%
2002	24	15	63%
2003	30	16	53%
2004	29	15	52%
2005	37	19	51%
2006	51	25	49%
2007	49	23	47%
2008	49	19	39%
2009	49	17	35%
2010	49	17	35%
2011	51	14	27%
2012	52	14	27%
2013	66	25	38%
2014	64	18	28%
2015	65	19	29%
2016	63	19	30%

Notes:

1. Wells screened in the unconfined aquifer are included in these counts.
2. Recovery wells (RW-700 through RW-717) are not included.
3. Measurable apparent LNAPL thickness and observed sheen are considered LNAPL indicators for these counts.

Table 3
Summary of LNAPL Characterization Results
Philadelphia Refining Complex, AOI 4

Generalized LNAPL Type1	Generalized LNAPL Sub-Type	Well ID	LNAPL Sample Date	LNAPL Components		Degree of Weathering	Sampled By	LNAPL Density
				Type	Proportion (%)			
Light/Middle Distillates	Gasoline (<90%) / Middle Distillate	S-103	2/27/2004	Aviation Gasoline	70	Extreme	Aquaterra / Stantec	0.7978
				Middle Distillate	30	Extreme		
		S-217	4/27/2005	Gasoline and Heavy Virgin Naphtha	61	Slight	Aquaterra	NA
				Middle Distillate	39	Slight		
		S-220	4/27/2005	Gasoline and Heavy Virgin Naphtha	70	Moderate	Aquaterra	NA
				Middle Distillate	30	High		
		S-221	4/27/2005	Gasoline and Heavy Virgin Naphtha	67	Slight	Aquaterra	NA
				Middle Distillate	33	Slight		
	Other	S-365	6/1/2013	Unknown Light Material	48	Unknown	Aquaterra	0.8158
				Middle Distillate	52	Extreme		
Middle Distillates	Middle Distillate	S-29	2/27/2004	Middle Distillate	100	High	Aquaterra / Stantec	0.855
		S-29	7/25/2013	NA	NA	NA	Stantec	0.8665
		S-32	2/27/2004	Middle Distillate	100	Severe	Aquaterra / Stantec	0.8805
		S-32	7/25/2013	NA	NA	NA	Stantec	0.8805
		S-33	3/1/2004	Gasoline	5	Extreme	Aquaterra / Stantec	0.8578
				Middle Distillate	95	Extreme		
		S-35	4/21/2005	Middle Distillate	100	Extreme	Aquaterra	0.8665
		S-37	4/21/2005	Gasoline	2	Unknown	Aquaterra	0.8639
				Middle Distillate	98	High		
		S-56	2/27/2004	Gasoline	2	Extreme	Aquaterra / Stantec	0.8684
				Middle Distillate	98	Extreme		
		S-57	4/21/2005	Middle Distillate	100	Extreme	Aquaterra	0.862
		S-97	2/27/2004	Middle Distillate	100	Severe	Aquaterra / Stantec	0.8653
		S-104	2/27/2004	Middle Distillate	100	Extreme	Aquaterra / Stantec	0.8787
		S-124	2/27/2004	Coker Naphtha	40	High	Aquaterra / Stantec	0.8223
				Middle Distillate	60	Moderate		
		S-282	7/15/2010	Middle Distillate	70	Extreme	Stantec	0.8104
				Aviation Gasoline	20	Severe		
				Heavier Material[1]	10	Extreme		
		S-369	6/1/2013	Middle Distillate	80	Extreme	Aquaterra	NA
				Alkyate	20	Unknown		
		S-241	8/2/2016	Middle Distillate	NA	NA	Stantec	0.893
		S-368	7/25/2016	Middle Distillate	NA	NA	Stantec	0.886
		S-30	2/16/2017	Middle Distillate	NA	Extreme	Stantec	0.868
NA	NA	S-30	7/25/2013	NA	NA	NA	Stantec	0.8681
		S-31	7/25/2013	NA	NA	NA	Stantec	0.8524
		S-233	4/8/2010	NA	NA	NA	Stantec	0.84
		S-237	4/8/2010	NA	NA	NA	Stantec	0.85

Notes:
LNAPL = Light Non-Aqeuous Phase Liquid
NA = Not Applicable / Not Analyzed
[1] = Heavier material could either be crude oil or residual oil

Table 4
Summary of LNAPL Transmissivity Estimates
Penrose Avenue Recovery System
Philadelphia Refining Complex, AOI 4

Year	Q_w (gallons)	Q_n (gallons)	T_w[1] (ft^2/d)	ρ_n[2] (unitless)	T_n[3] (ft^2/d)
2013					
March	239,800	0	12,670	0.85	0
April	726,600	0	12,670	0.85	0
May	729,500	93	12,670	0.85	1.4
June	679,300	96	12,670	0.85	1.5
July	654,220	3.9	12,670	0.85	0.06
August	393,060	6.1	12,670	0.85	0.2
Septembe	389,400	0	12,670	0.85	0
October	277,200	0	12,670	0.85	0
November	278,900	0	12,670	0.85	0
December	165,900	0.7	12,670	0.85	0.05
Annual	4,533,880	199	12,670	0.85	0.5
				Average	*0.3*
2014					
January	297,400	0	12,670	0.85	0
February	341,900	0	12,670	0.85	0
March	416,900	0	12,670	0.85	0
April	485,700	15	12,670	0.85	0.3
May	214,100	4.5	12,670	0.85	0.2
June	553,500	11	12,670	0.85	0.2
July	622,300	15	12,670	0.85	0.3
August	442,100	1.3	12,670	0.85	0.03
Septembe	4,100	0	12,670	0.85	0
October	486,000	24	12,670	0.85	0.5
November	254,200	2.9	12,670	0.85	0.1
December	186,800	0	12,670	0.85	0
Annual	4,305,000	74	12,670	0.85	0.2
				Average	*0.1*
2015					
January	514,700	0	12,670	0.85	0
February	628,100	33	12,670	0.85	0.6
March	97,100	0	12,670	0.85	0
April	106,400	8	12,670	0.85	0.8
May	0	0	12,670	0.85	-
June	378,100	12	12,670	0.85	0.3
July	396,356	5	12,670	0.85	0.1
August	424,624	4	12,670	0.85	0.10
Septembe	414,680	38	12,670	0.85	1.0
October	300,360	60	12,670	0.85	2.2
November	128,780	42	12,670	0.85	3.5
December	200,190	119	12,670	0.85	6.4
Annual	3,589,390	321	12,670	0.85	1.0
				Average	*1.4*
2016					
January	355,270	40	12,670	0.85	1.2
February	195,159	41	12,670	0.85	2.2
March	492,950	12	12,670	0.85	0.3
April	289,860	7.7	12,670	0.85	0.3
May	358,390	15	12,670	0.85	0.5
June	530,990	21	12,670	0.85	0.4
July	343,480	26	12,670	0.85	0.8
August	267,840	129	12,670	0.85	5.2
Septembe	89,330	309	12,670	0.85	37.3
October	171,620	349	12,670	0.85	21.9
November	158,370	416	12,670	0.85	28.3
Annual	3,253,259	1,366	12,670	0.85	4.5
				Average	*8.9*

Notes:
T_w Water Transmissivity
ρ_n LNAPL/Water Density Ratio
Q_n LNAPL Production
Q_w Water Production
T_n LNAPL Transmissivity
ft^2/d square feet per day
1 Estimated T_w based on pumping test results from RW-2 (average of hydraulic conductivity for the east and southeast legs, located within AOI 4; see Table 5 for details). Saturated thickness assumed 28.6 ft (RIR, Stantec, 2017).
2 Source of ρ is average of AOI 4-specific LNAPL density values, classified primarily as Light/Middle Distillate and Middle Distillate Gasoline (see Table 3).
3 LNAPL transmissivity calculated from equation for estimating Tn using data from water-enhanced LNAPL recovery (total fluids pumping) systems, as presented in the *ASTM Standard Guide for Estimation of LNAPL Transmissivity* (2013); see Charbeneau, 2007.

Table 5
Summary of Aquifer Properties
Hydraulic Conductivity and Transmissivity
Philadelphia Refining Complex, AOI 4

Well	Test Method	Aquifer Parameters		Notes	Reference
		T	K		
		ft^2/d	ft/d		
S-103 and S-55 *(east leg)*	Pumping Test*	8824	452	Observation Wells	(IST, 1998)
S-34 and S-31 *(southeast leg)*	Pumping Test*	8448	434	Observation Wells	(IST, 1998)
S-120	Slug Test	-	11.7	Test Well	(Secor, 2003)
S-122	Slug Test	-	12.6	Test Well	(Secor, 2003)

Notes:

K Hydraulic Conductivity
T Transmissivity
ft/day feet per day
ft^2/day square feet per day
* Pumping test was completed at RW-2

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Table 6
Summary of LNAPL Density and Viscosity Attributes for Model Wells
Philadelphia Refining Complex, AOI 4

Well	LNAPL Density		LNAPL Viscosity	
	g/cm^3	Sample/Surrogate	cP	Sample/Surrogate
RW-700	0.8223	S-124	0.83	S-198
RW-701	0.8223	S-124	0.83	S-198
RW-703	0.8223	S-124	0.83	S-198
RW-704	0.8223	S-124	0.83	S-198
RW-714	0.8223	S-124	0.83	S-198
S-104	0.8787	S-104	4.00	-
S-220	0.8223	S-124	0.83	S-198
S-221	0.8223	S-124	0.83	S-198
S-233	0.8223	S-124	0.83	S-198
S-235	0.8223	S-124	0.83	S-198
S-236	0.8223	S-124	0.83	S-198
S-237	0.8223	S-124	0.83	S-198
S-240	0.8223	S-124	0.83	S-198
S-241	0.8930	S-241	0.83	S-198
S-278	0.8223	S-124	0.83	S-198
S-29	0.8665	S-29	4.00	-
S-30	0.8681	S-30	4.00	-
S-31	0.8524	S-31	4.00	-
S-368	0.886	S-368	4.00	-
S-373	0.8223	S-124	0.83	S-198

Notes:

1. In the absence of an LNAPL density/viscosity sample result, a value was assigned based on generalized LNAPL type and proximity to surrogate wells.
2. S-198 is located in AOI 1.

\- Indicates the viscosity assignment is a literature value for diesel fuel oil (API, 2004).

Table 7
2016 Maximum Apparent LNAPL Thickness and Soil Classifications
Philadelphia Refining Complex, AOI 4

Well ID	Gauging Date	LNAPL Thickness (ft)	Soil Classification[C]
RW-700[A]	5/10/2013	11.28	Medium Sand
RW-701[A]	11/12/2014	1.42	Coarse Sand[D]
RW-703[A]	8/3/2012	1.58	Coarse Sand[D]
RW-704[A]	11/3/2010	0.37	Coarse Sand[D]
RW-714[A]	8/3/2012	0.5	Coarse Sand
S-104	11/15/2016	1.39	Fine Sand
S-220	11/15/2016	0.86	Coarse Sand
S-221	11/15/2016	2.17	Coarse Sand
S-233	11/15/2016	1.86	Coarse Sand
S-235	8/12/2016	1.16	Coarse Sand
S-236	11/15/2016	1.91	Coarse Sand
S-237	8/12/2016	2.09	Fine Sand
S-240	8/12/2016	2.57	Coarse Sand
S-241	11/15/2016	3.25	Coarse Sand
S-278	8/12/2016	0.41	Coarse Sand
S-29	8/12/2016	2.63	Medium Sand
S-30	2/8/2016	7.86	Coarse Sand[D]
S-31[B]	2/10/2015	0.7	Coarse Sand
S-368	11/15/2016	2.25	Silty Sand
S-373	8/12/2016	0.25	Coarse Sand[D]

Notes:

[A] Recovery wells (RW-700, RW-701, RW-703, RW-704, RW-714) were gauged in 2016; however, due to pump depth at the time of gauging, LNAPL thickness was not measurable, except at RW-714 where a sheen was detected. Given the history of product recovery in these wells, the 2016 gauging data is not necessarily representative of LNAPL thickness at these locations. Therefore, the maximum observed apparent LNAPL thickness (period of record) is used instead (RW-700, 2013; RW-701, 2014; RW-703, 2012; RW-704, 2010; RW-714, 2012) and is considered more representative of current LNAPL conditions at these locations.

[B] S-31 was not gauged in 2016. The maximum apparent LNAPL thickness from 2015 was used.

[C] API lithology type based on review of soil boring log within the screened interval, particularly at the water table.

[D] No boring logs available (or soil not logged for water table interval); assumed coarse sand lithology as a conservative approach and based on adjacent wells and overall site geology.

Table 8
Pore Entry Pressure Evaluation
Philadelphia Refining Complex, AOI 4

				Tension Parameters			Density						
AOI	**Well**	**Generalized LNAPL Type**	**Source of Generalized LNAPL Type[1]**	σ_{nw}[2]	σ_{an}[2]	σ_{aw}[2]	ρ_r[3]	**Source of** ρ_r	**USDA Soil Type**	h_d	b_n**[crit]**		b_n**[2016][4]**
				dynes/cm	dynes/cm	dynes/cm				m	m	ft	ft
AOI 4	RW-700	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**11.28**
AOI 4	S-30	Middle Distillates	S-30	16.6	28.6	57.7	0.8681	S-30	Sand	0.069	0.19	0.62	**7.86**
AOI 4	S-241	Light/Middle Distillates		14.4	23.3	65.7	0.8930	S-241	Sand	0.069	0.17	0.55	**3.25**
AOI 4	S-29	Middle Distillates	S-29	16.6	28.6	57.7	0.8665	S-29	Sand	0.069	0.19	0.62	**2.63**
AOI 4	S-240	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**2.57**
AOI 4	S-368	Middle Distillates		16.6	28.6	57.7	0.8860	S-368	Sand	0.069	0.21	0.70	**2.25**
AOI 4	S-221	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**2.17**
AOI 4	S-237	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**2.09**
AOI 4	S-236	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**1.91**
AOI 4	S-233	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**1.86**
AOI 4	RW-703	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**1.58**
AOI 4	RW-701	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**1.42**
AOI 4	S-104	Middle Distillates	S-104	16.6	28.6	57.7	0.8787	S-104	Sand	0.069	0.20	0.66	**1.39**
AOI 4	S-235	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**1.16**
AOI 4	S-220	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**0.86**
AOI 4	S-31	Middle Distillates	S-31	16.6	28.6	57.7	0.8524	S-31	Sand	0.069	0.17	0.57	**0.70**
AOI 4	RW-714	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**0.50**
AOI 4	S-278	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	**0.41**
AOI 4	RW-704	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	0.37
AOI 4	S-373	Light/Middle Distillates		14.4	23.3	65.7	0.8223	S-124	Sand	0.069	0.11	0.38	0.25

Notes:

$$b_n[crit] = \left(\frac{\sigma nw}{(1-\rho r)\sigma aw} + \frac{\sigma an}{\rho r\ \sigma aw}\right)\frac{hd}{\sigma aw}$$

b_n[crit]	minimum LNAPL thickness in monitoring well for LNAPL to penetrate the formation (LNAPL apparent thickness; m);
σ_{nw}	LNAPL/water interfacial tension (dynes/cm)
σ_{an}	Air/LNAPL interfacial tension (dynes/cm)
σ_{aw}	Air/water interfacial tension (dynes/cm)
ρ_r	relative LNAPL density (density of LNAPL/density of water)
h_d	displacement pressure head also known as bubbling pressure head (m)
cm	centimeter
m	meter
ft	feet

Bold and highlighted formatting indicates that the b_n[2016][4] was greater than the b_n[crit]

[1] Generalized LNAPL type is based on LNAPL characterization results for the reference wells specified (Table 3) and attributed based on proximity to reference wells and/or similarility of LNAPL type (Figure 6).

[2] Tension parameters are based on generalized product type. For mixtures of light and middle distillates the tension parameters were based on a LNAPL characterization sample collected from S-198 in AOI 1. For middle distillates the tension parameters were based on an LNAPL characterization sample collected from S-34.

[3] Relative LNAPL density values are based on Site-specific samples collected assuming groundwater density of 1000 kg/m3 (see Table 6 for source of density data).

[4] Maximum apparent LNAPL thickness in 2016. Well S-31 was not gauged in 2016 but is known to contain LNAPL; therefore, the maximum apparent LNAPL thickness in 2015 was used. Representative values used for recovery wells (RW-700, RW-701, RW-703, and RW-704) are based on the maximum observed thickness from monitoring record in these pumping wells; the water/LNAPL interface is frequently below pump intake and cannot be measured. This is considered a conservative approach for b_n[crit] comparison.

Table 9
Summary of LNAPL Plume Velocity Estimates
Philadelphia Refining Complex, AOI 4

Well[1]	Soil Properties[2]									LNAPL Properties[5]				Results[6]
	Modeled API Soil Type Surrounding Well Screen	van Genuchten Alpha	van Genuchten "n"	Saturated Hydraulic Conductivity	Residual Saturation of Water	Residual Saturation of LNAPL	Total Porosity	Groundwater Hydraulic Gradient[3]	Source Area Parameters[4]	Density	Oil/Water Interfacial Tension	Oil/Air Interfacial Tension	Viscosity	Plume Velocity
		1/ft		ft/day					ft	gm/cm^3	dynes/cm	dynes/cm	cP	cm/s
RW-700	Medium Sand	0.4602	2.04	23.9513	0.29	0.15	0.38	0.004	11.28	0.8223	14.40	23.30	0.83	**1.1E-04**
S-30	Coarse Sand[7]	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	7.86	0.8681	16.60	28.60	4.00	**5.2E-05**
S-241	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	3.25	0.8930	14.40	23.30	0.83	**2.5E-04**
S-29	Medium Sand	0.4602	2.04	23.9513	0.29	0.15	0.38	0.004	2.63	0.8665	16.60	28.60	4.00	**1.3E-05**
S-240	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	2.57	0.8223	14.40	23.30	0.83	**2.1E-04**
S-368	Silty Sand	0.5517	2.02	0.9581	0.36	0.23	0.41	0.004	2.25	0.8860	16.60	28.60	4.00	5.2E-07
S-221	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	2.17	0.8223	14.40	23.30	0.83	**2.1E-04**
S-237	Fine Sand	0.6644	2.61	12.15	0.32	0.2	0.43	0.004	2.09	0.8223	14.40	23.30	0.83	**3.1E-05**
S-236	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	1.91	0.8223	14.40	23.30	0.83	**2.0E-04**
S-233	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	1.86	0.8223	14.40	23.30	0.83	**2.0E-04**
RW-703	Coarse Sand[7]	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	1.58	0.8223	14.40	23.3	0.83	**2.0E-04**
RW-701	Coarse Sand[7]	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	1.42	0.8223	14.40	23.30	0.83	**1.9E-04**
S-104	Fine Sand	0.6644	2.61	12.15	0.32	0.2	0.43	0.004	1.39	0.8787	16.60	28.60	4.00	**2.3E-06**
S-235	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	1.16	0.8223	14.40	23.30	0.83	**1.9E-04**
S-220	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.86	0.8223	14.40	23.30	0.83	**1.7E-04**
S-31	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.7	0.8524	16.60	28.60	4.00	**3.3E-05**
RW-714	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.5	0.8223	14.40	23.30	0.83	**1.4E-04**
S-278	Coarse Sand	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.41	0.8223	14.40	23.30	0.83	**1.3E-04**
RW-704	Coarse Sand[7]	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.37	0.8223	14.40	23.30	0.83	**1.3E-04**
S-373	Coarse Sand[7]	1.1795	1.62	38.0596	0.27	0.15	0.33	0.004	0.25	0.8223	14.40	23.30	0.83	**1.1E-04**

Notes:

ft feet
ft/day feet per day
1/ft per foot
gm/cm^3 grams per cubic centimeter
dynes/cm dynes per centimeter
cP Centipoise
cm/s centimeters per second

Bold and highlighted formatting indicates a plume velicity greater than 1E-06 cm/s (the ASTM lower limit of pore scale potential mobility).

1 Wells with less than 0.1 feet of LNAPL observed in 2016 were not included in the mobility calculation and are assumed to have insufficient mass for mobility calculations.
2 Soil Properties are API default values for the soil type specified. Soil type surrounding the well screen is based on nearest available boring log (see Table 7 for additional detail).
3 Based on May 2016 groundwater elevation contours in the vicinity of the Penrose System.
4 Maximum observed LNAPL apparent thickness in 2016. Well S-31 was not gauged in 2016; maximum observed LNAPL apparent thickness from 2015 was used. Period of record maximum thicknesses for recovery wells (RW-700, RW-701, RW-703, RW-704, and RW-714) were used as conservative and representative values given pump depth interference with gauging data records.
5 LNAPL properties based on Site specific values for viscosity and density and literature values for tension parameters (see Table 6 for additional detail).
6 API Interactive LNAPL Guide Mobility Calculation Tool.
7 Log not available; modeled soil type is a conservative estimate based on sitewide soil types.

Table 10
LDRM LNAPL Transmissivity Estimates
Philadelphia Refining Complex, AOI 4

Well	Thickness, Elevations, Vertical Gradient				Fluid Characteristics[4]						Soil Characteristics[4]								Results: API LDRM			
	Max b_n[1]	Ground Surface Elevation	Water Table Depth[2]	Vertical Groundwater Gradient[3]	LNAPL density	LNAPL Viscosity	Air/Water surface tension	Air/LNAPL Surface Tension	LNAPL/Water Surface Tension	API Soil Type	Porosity	Hydraulic Conductivity	van Genuchten "n"	van Genuchten Alpha	Irreducible water saturation	Residual LNAPL Saturation	Residual LNAPL f-factor	LNAPL Thickness	Total LNAPL	Recoverable LNAPL	LNAPL Transmissivity
	ft	ft NAVD88	ft bgs		gm/cm^3	cP	dynes/cm	dynes/cm	dynes/cm			ft/day		1/ft				ft	ft	ft	ft^2/day
RW-700	11.28	19.25	21.54	0	0.8223	0.83	65.7	23.30	14.40	Medium Sand	0.38	23.9513	2.04	0.4602	0.29	Variable	0.3	11.28	2.14	1.5	**131.88**
S-30	7.86	21.64	27.49	0	0.8681	4.00	57.7	28.60	16.60	Coarse Sand[5]	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	7.86	1.02	0.72	**28.99**
S-241	3.25	23.09	26.08	0	0.8930	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	3.25	0.25	0.17	**33.51**
S-29	2.63	21.83	21.83	0	0.8665	4.00	57.7	28.60	16.60	Medium Sand	0.38	23.9513	2.04	0.4602	0.29	Variable	0.3	2.63	0.08	0.05	**0.41**
S-240	2.57	20.97	23.06	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	2.57	0.28	0.19	**31.46**
S-368	2.25	15.45	16.83	0	0.8860	4.00	57.7	28.60	16.60	Silty Sand	0.41	0.9581	2.02	0.5517	0.36	Variable	0.3	2.25	0.05	0.03	0.01
S-221	2.17	20.02	21.96	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	2.17	0.21	0.15	**23.32**
S-237	2.09	19.39	21.03	0	0.8223	0.83	65.7	23.30	14.40	Fine Sand	0.43	12.15	2.61	0.6644	0.32	Variable	0.3	2.09	0.22	0.15	**3.24**
S-236	1.91	19.72	21.52	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	1.91	0.17	0.12	**18.44**
S-233	1.86	21.63	20.31	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	1.86	0.16	0.11	**17.51**
RW-703	1.58	21.61	30.00	0	0.8223	0.83	65.7	23.3	14.4	Coarse Sand[5]	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	1.58	0.12	0.09	**12.75**
RW-701	1.42	19.34	20.62	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand[5]	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	1.42	0.1	0.07	**10.27**
S-104	1.39	15.63	15.63	0	0.8787	4.00	57.7	28.60	16.60	Fine Sand	0.43	12.15	2.61	0.6644	0.32	Variable	0.3	1.39	0.02	0.01	0.01
S-235	1.16	20.21	20.89	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	1.16	0.07	0.05	**6.68**
S-220	0.86	18.50	19.09	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.86	0.04	0.03	**3.36**
S-31	0.7	21.28	19.39	0	0.8524	4.00	57.7	28.60	16.60	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.70	0.01	0.01	**0.20**
RW-714	0.5	16.47	15.68	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.50	0.01	0.01	**0.85**
S-278	0.41	17.70	17.67	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.41	0.01	0.01	**0.50**
RW-704	0.37	22.13	23.60	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand[5]	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.37	0.01	0.00	**0.38**
S-373	0.25	18.39	18.57	0	0.8223	0.83	65.7	23.30	14.40	Coarse Sand[5]	0.33	38.0596	1.62	1.1795	0.27	Variable	0.3	0.25	0.00	0.00	**0.12**

Notes:

b_n	LNAPL thickness
ft	feet
gm/cm^3	grams per cubic centimeter
cP	centipoise
dynes/cm	dynes per centimeter
ft^2/day	square feet per day
1/ft	per foot
ft bgs	feet below ground surface
ft NAVD88	elevations are in units of feet and are referenced to the North American Vertical Datum of 1988
### (highlighted)	Bold and highlighted formatting indicates transimissivity values within range of practical recoverability
###	Bold formatting indicates transmissivity values in the transiional range of recoverability

1 Max b_n was based on the maximum value observed in 2016 (or 2015 for S-31 as this well was not gauged in 2016). Period of record maximum values were used as conservative representation of LNAPL thickness in recovery wells (RW-700, RW-701, RW-703, RW-704, and RW-714) due to pump depth interferences with gauging records.

2 Water table depth corresponds to the uncorrected depth to water reading collected on the same date as the max b_n value.

3 The LDRM model is relatively insensitive to this parameter.

4 See Tables 6 and 7 for additional detail regarding fluid and soil characteristics.

5 Log not available; modeled soil type is a conservative estimate based on sitewide soil types.

Table 11
Summary of Key LNAPL Characteristics
Philadelphia Refining Complex, AOI 4

Well	Location	Increasing LNAPL Thickness since 2010[1]	LNAPL Thickness Exceeds the Critical Pore Entry Pressure[2]	Estimated Plume Velocities Greater than the ASTM Limit of Functional Mobility[3]	LDRM Estimated LNAPL Transmissivity Greater than the Transmissivity Range for Practicable Product Recovery[4]
RW-700	Penrose Avenue Recovery System		x	x	x
RW-701	Penrose Avenue Recovery System	x	x	x	x
RW-703	Penrose Avenue Recovery System		x	x	x
RW-704	Penrose Avenue Recovery System			x	x*
RW-714	Penrose Avenue Recovery System		x	x	x
S-104	North-central AOI 4 border with adjacent AOIs 1 and 2	x	x	x	
S-220	Northwest of Penrose Avenue Recovery System and southwest of S-30 System	x	x	x	x
S-221	Penrose Avenue Recovery System area	x	x	x	x
S-233	Penrose Avenue Recovery System area		x	x	x
S-235	Penrose Avenue Recovery System area		x	x	x
S-236	Penrose Avenue Recovery System area		x	x	x
S-237	Penrose Avenue Recovery System area		x	x	x
S-240	Penrose Avenue Recovery System area	x	x	x	x
S-241	Penrose Avenue Recovery System area	x	x	x	x
S-278	Penrose Avenue Recovery System area		x	x	x*
S-29	S-30 System area		x	x	x*
S-30	S-30 System area	x	x	x	x
S-31	S-30 System area	x	x	x	x*
S-368	North-central AOI 4 border with adjacent AOIs 1 and 2	x	x		
S-373	Penrose Avenue Recovery System area			x	x*

Notes:

1 Locations with increasing LNAPL thickness since 2010 not related to decreasing water levels.
2 See Section 3.5.3 and Table 8.
3 ASTM suggests that LNAPL seepage velocities less than $1x10^{-6}$ cm/s indicate that the LNAPL is functionally immobile (see Section 3.5.4 and Table 9).
4 Minimum LNAPL transmissivity for practicable product recovery has been suggested to be approximately 0.1 to 0.8 ft^2/day (ITRC, 2009) (see Section 3.5.5 and Table 10).
x* Estimated LNAPL transmissivity between 0.1 and 0.8 ft^2/day (transitional range of estimated transmissivity associated with practicable LNAPL recovery, see Note 4 above).

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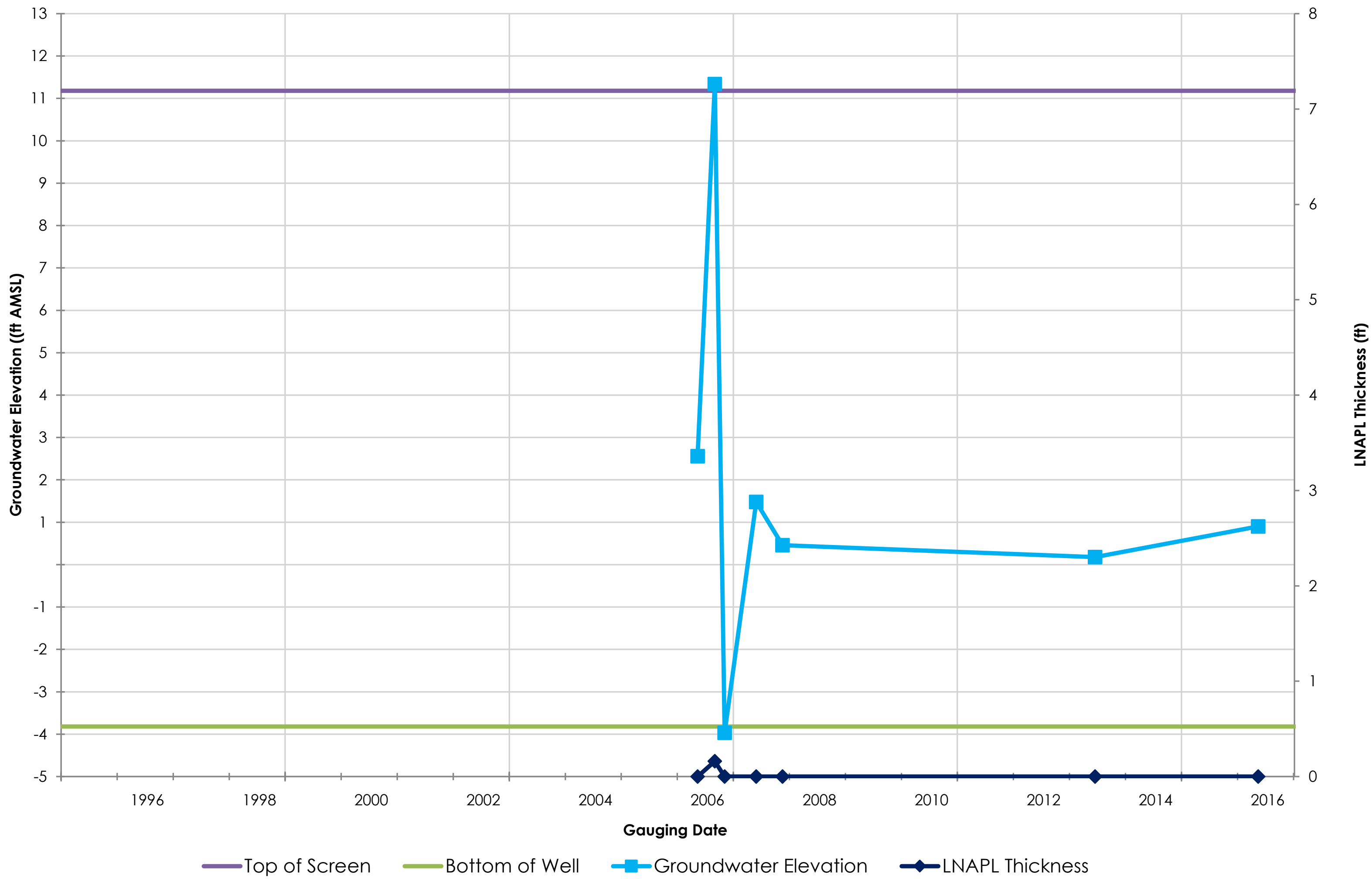
APPENDIX I
APPARENT LNAPL THICKNESS AND GROUNDWATER ELEVATION HYDROGRAPHS

PHILADELPHIA REFINING COMPLEX
3144 WEST PASSYUNK AVENUE
PHILADELPHIA, PENNSYLVANIA
SITEWIDE PADEP FACILITY ID NO. 780190
AREA OF INTEREST 4 PADEP FACILITY NO. 770318



Client/Project

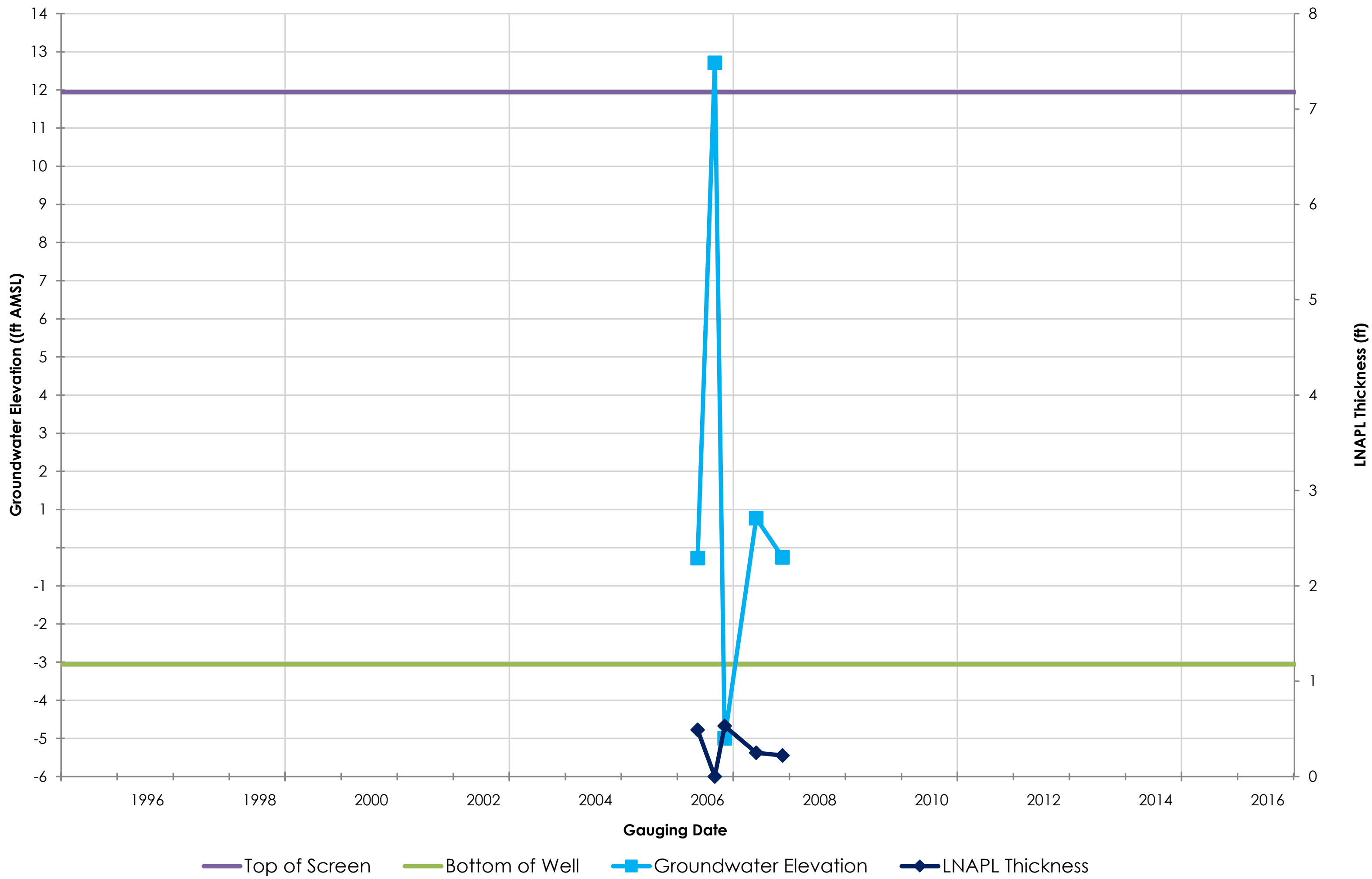
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

MW-1

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

Philadelphia Refinery Operations,
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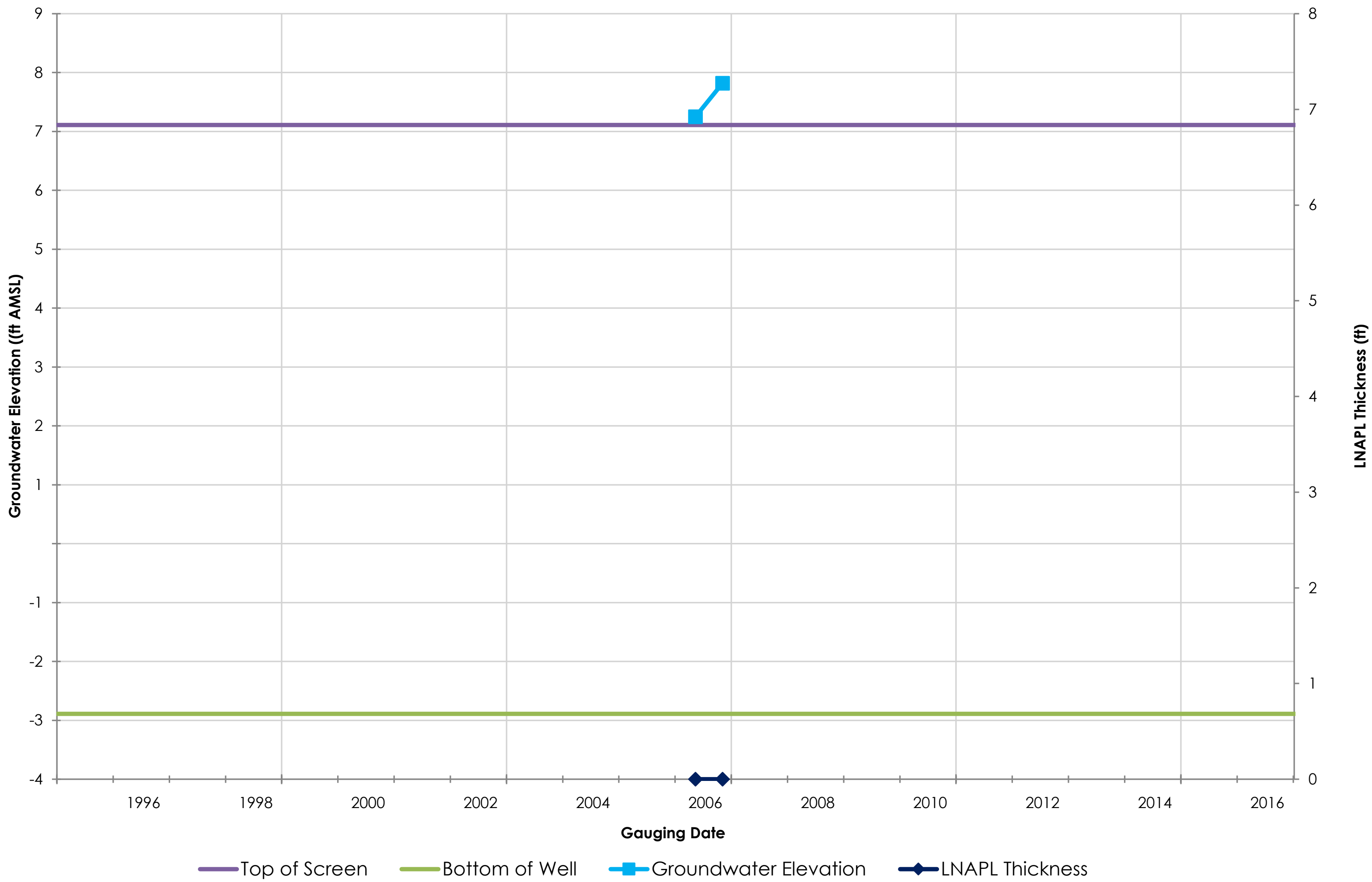
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

MW-3

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

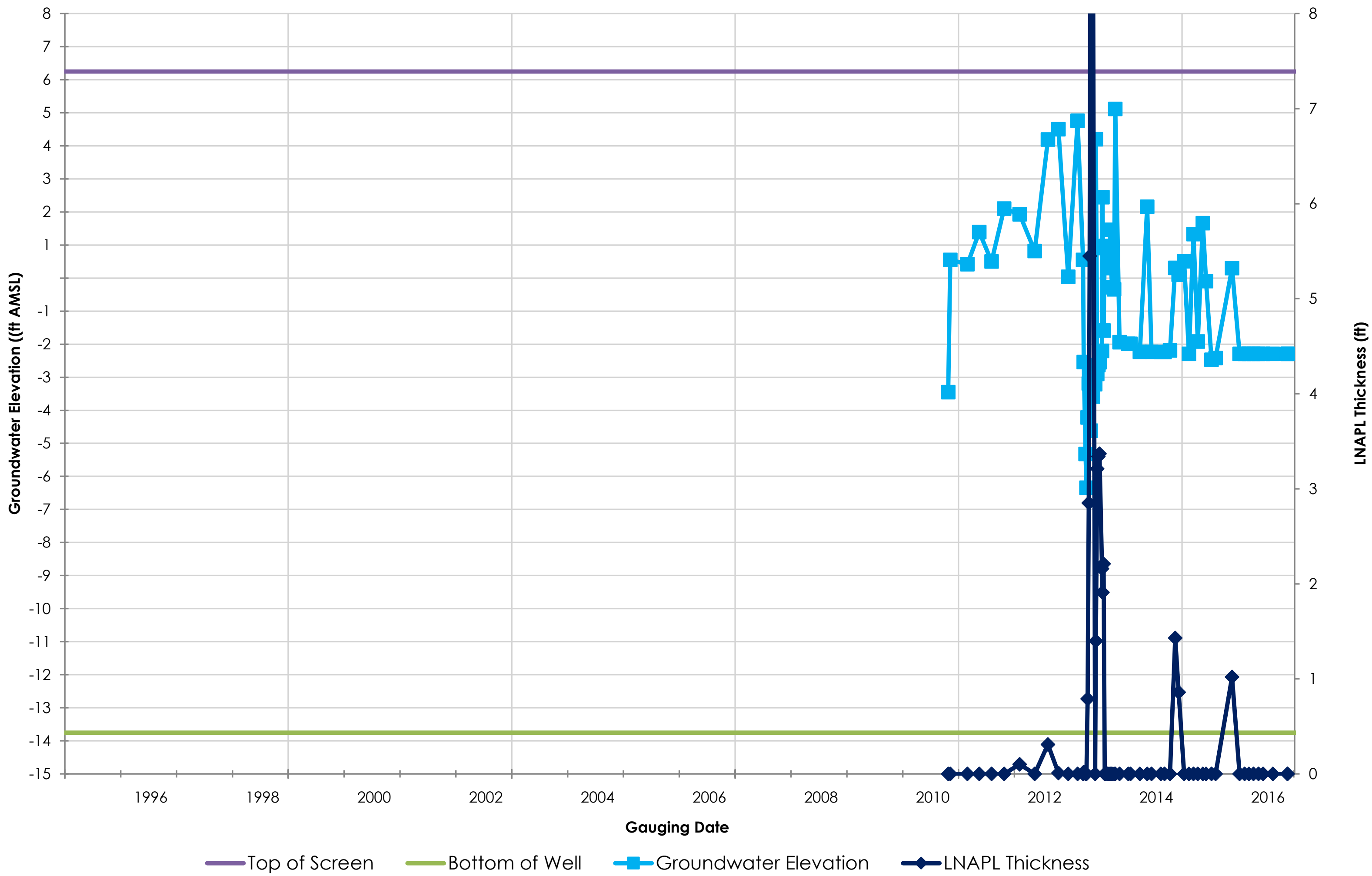
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

MW-4

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

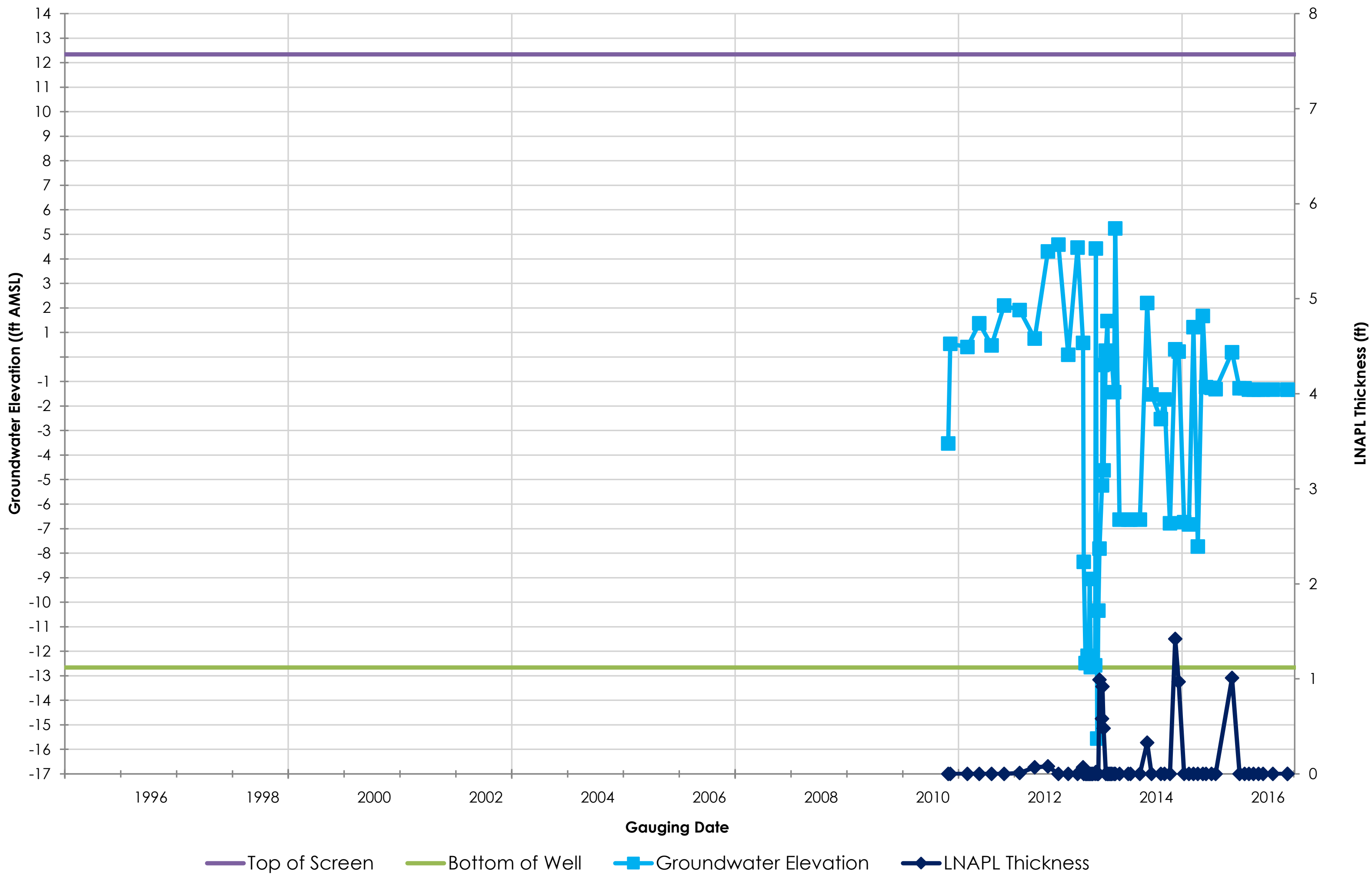
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-700

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

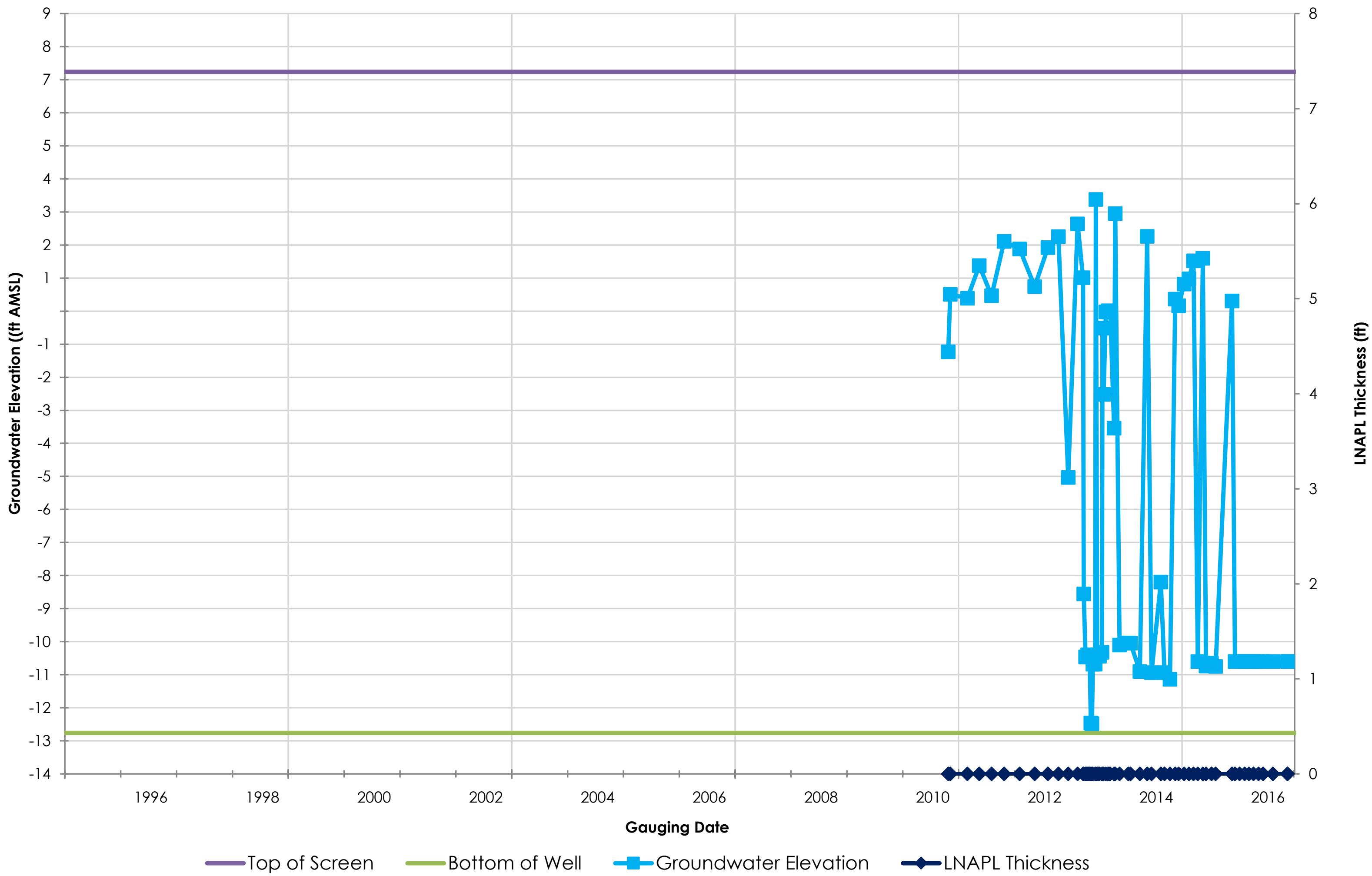
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-701

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

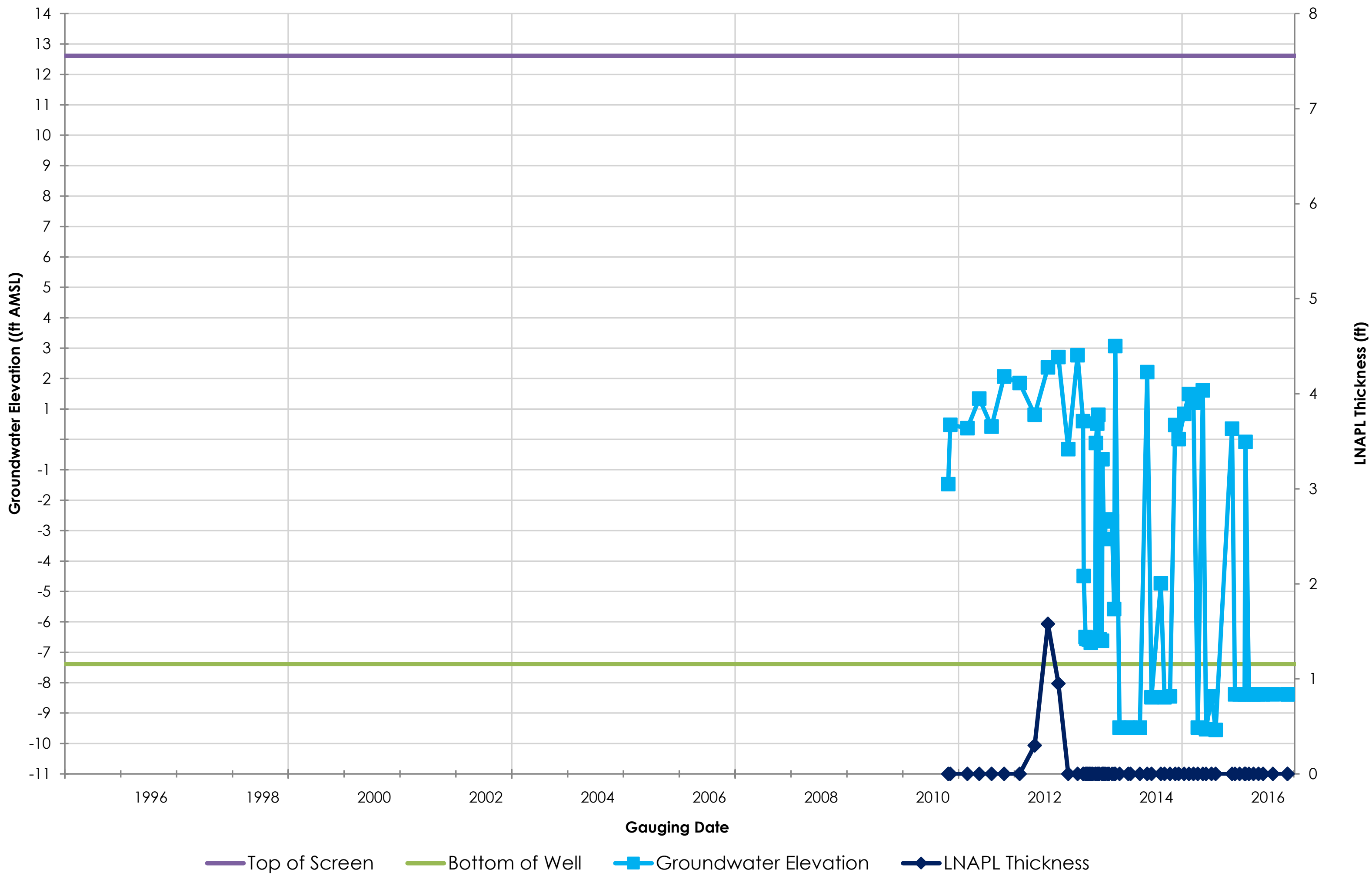
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-702

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

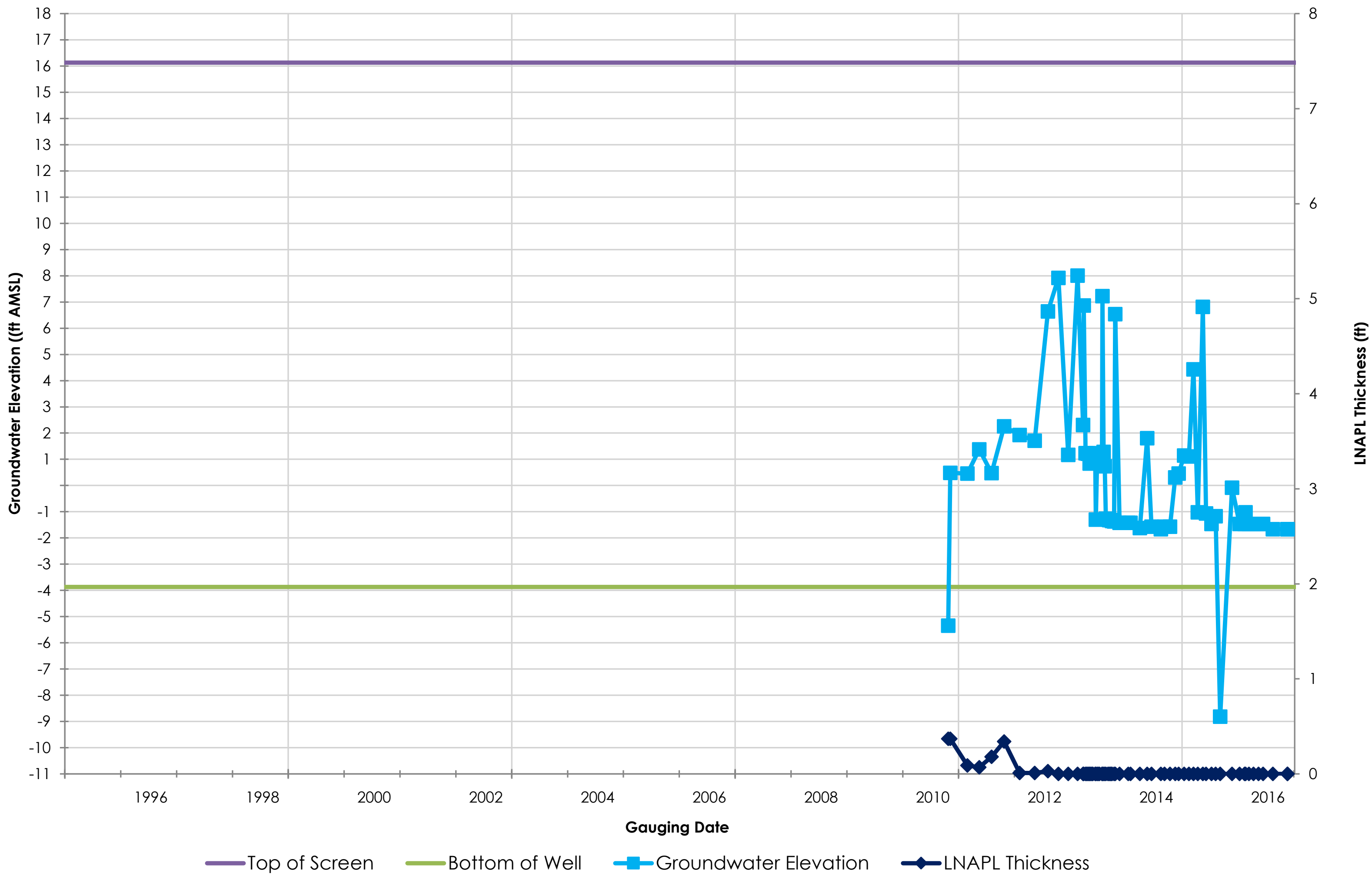
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-703

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

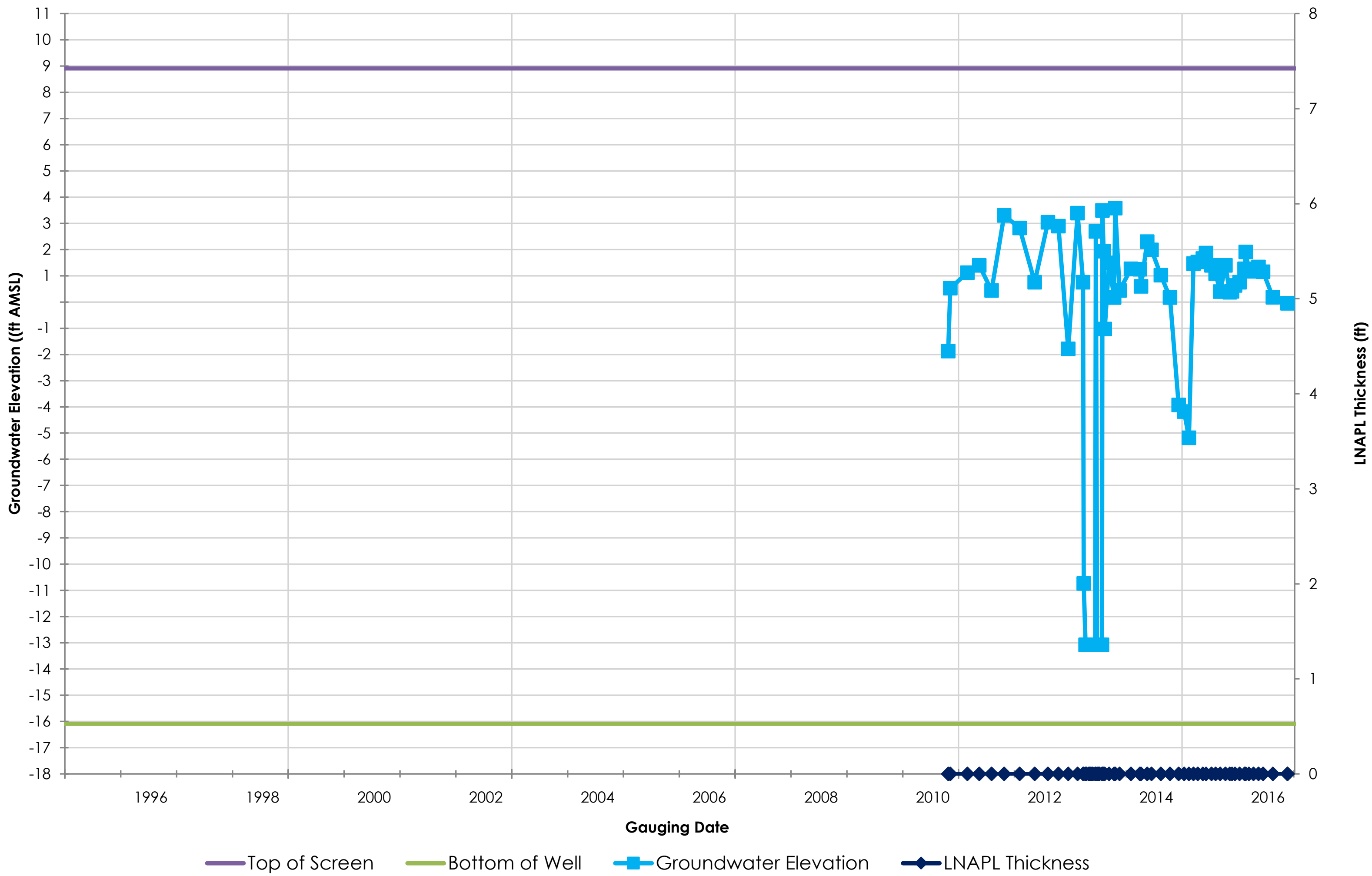
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-704

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

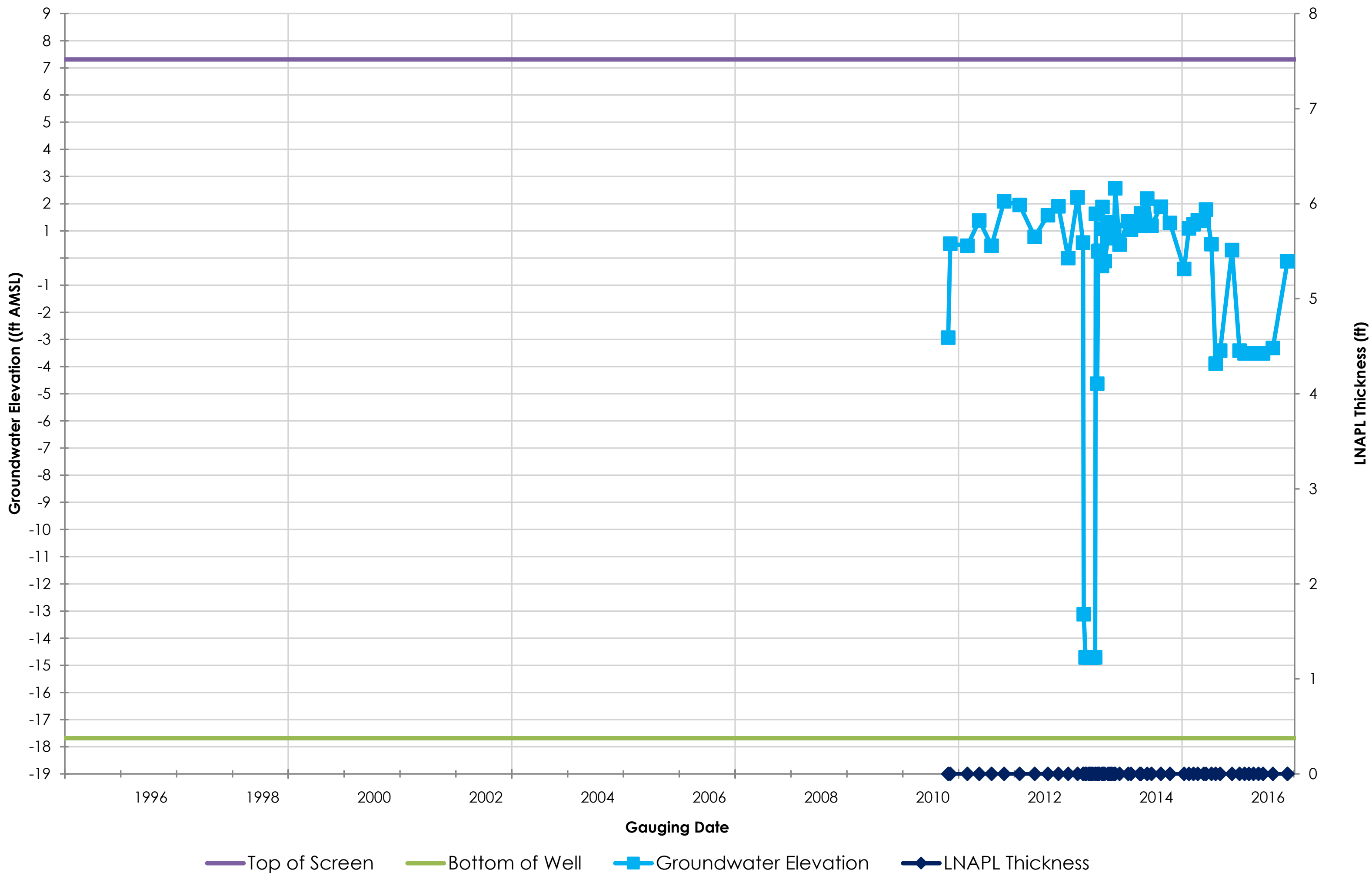
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-705

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

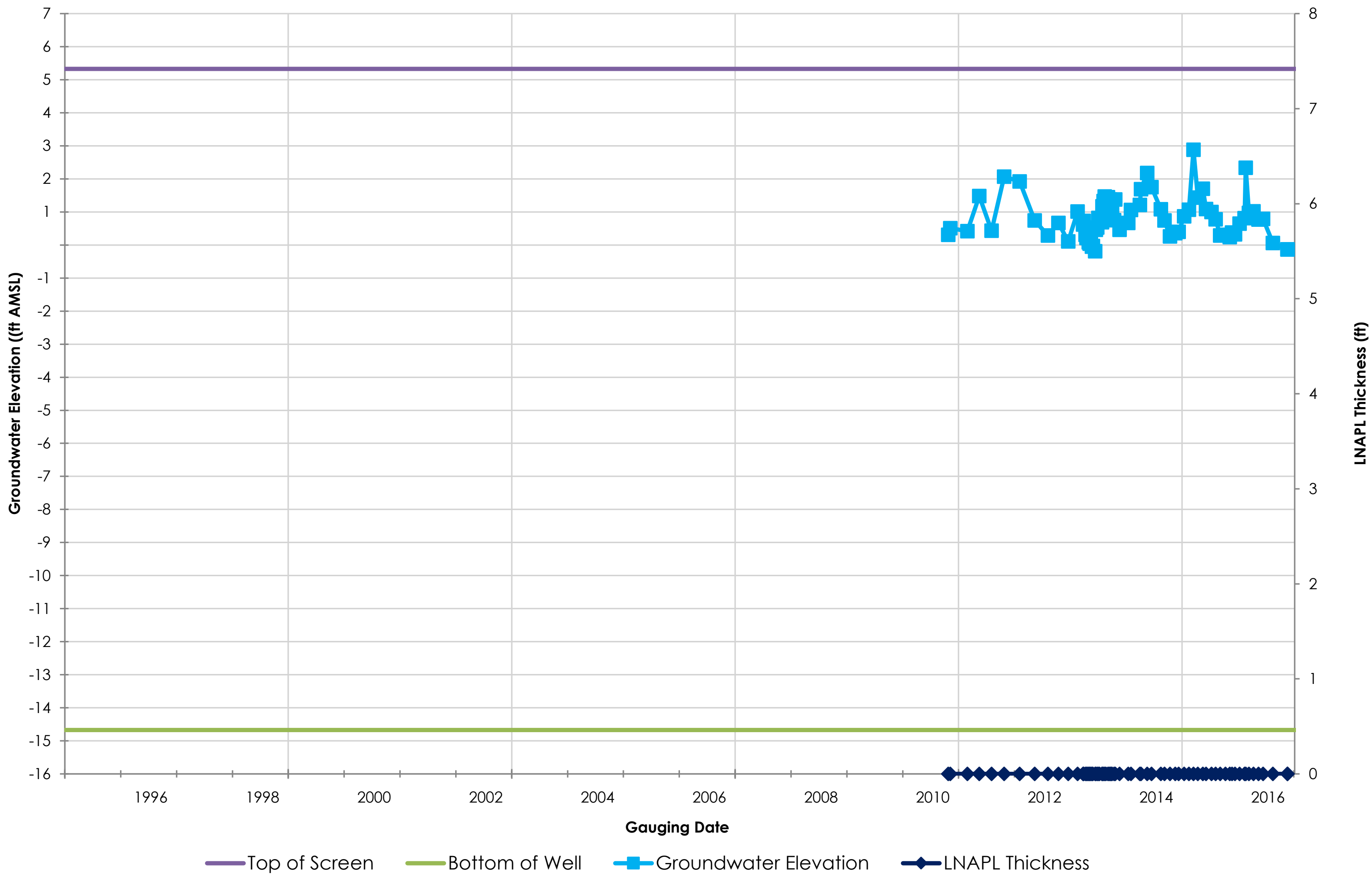
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-706

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

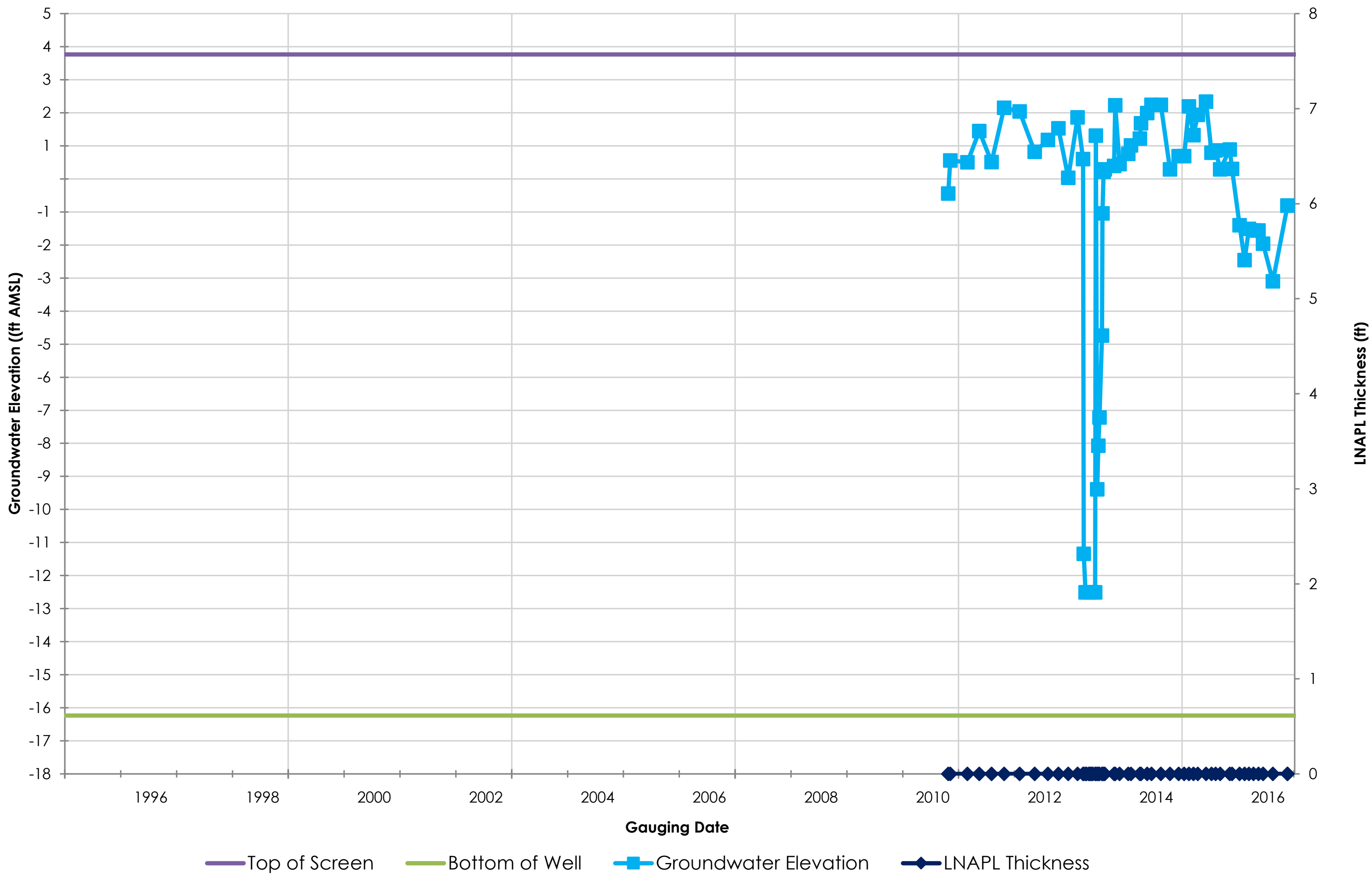
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-707

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

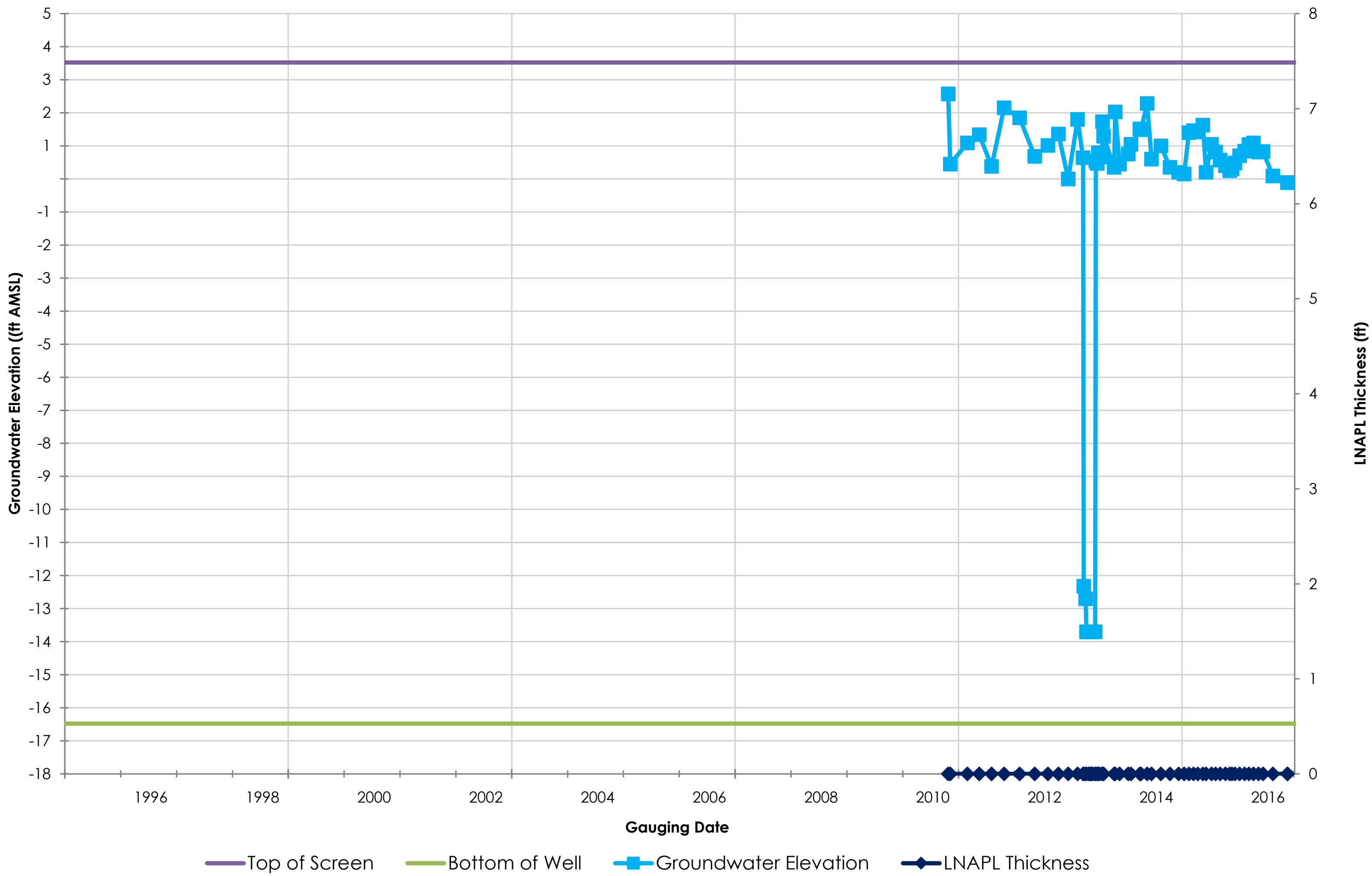
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-708

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

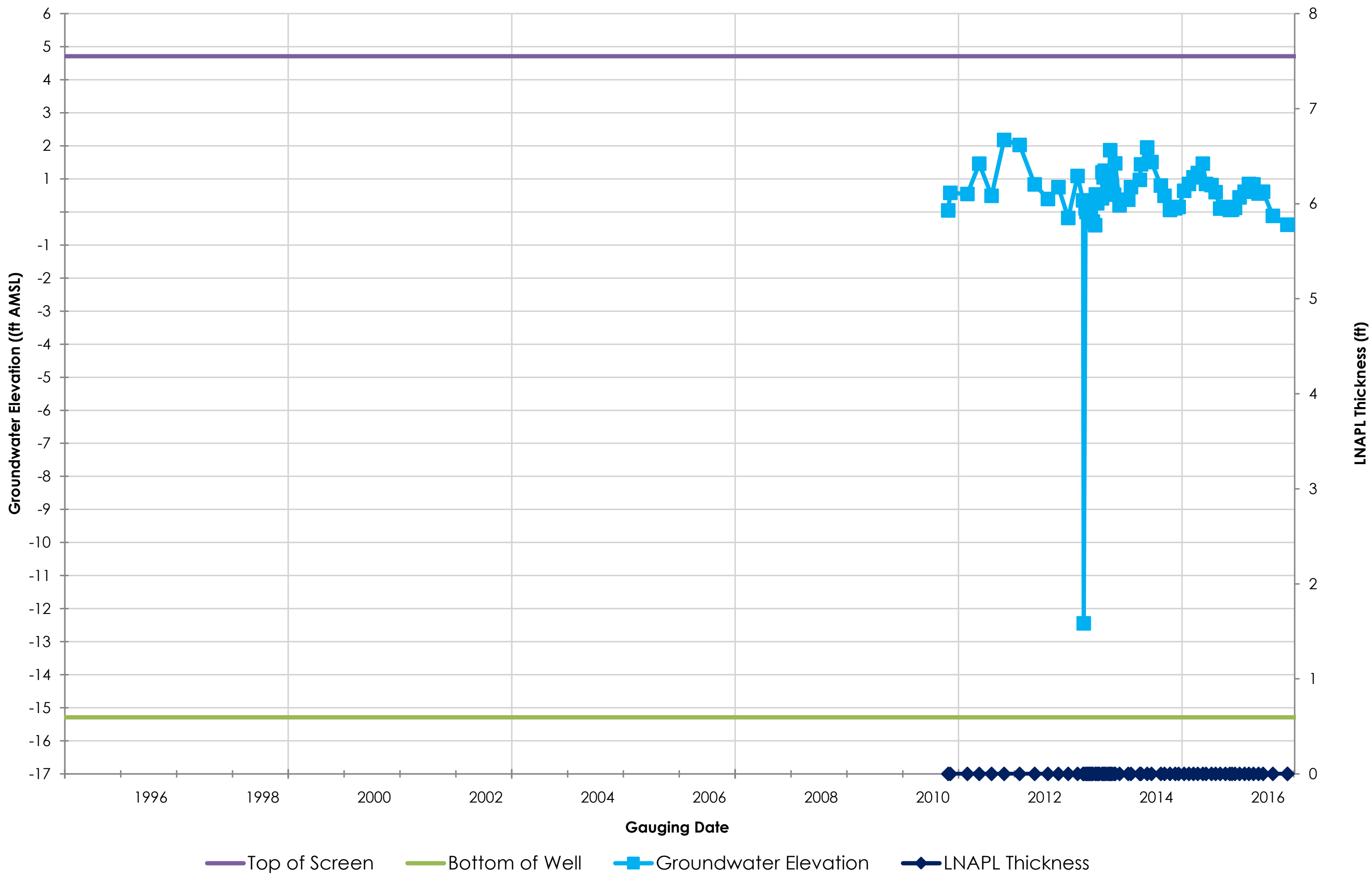
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-709

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

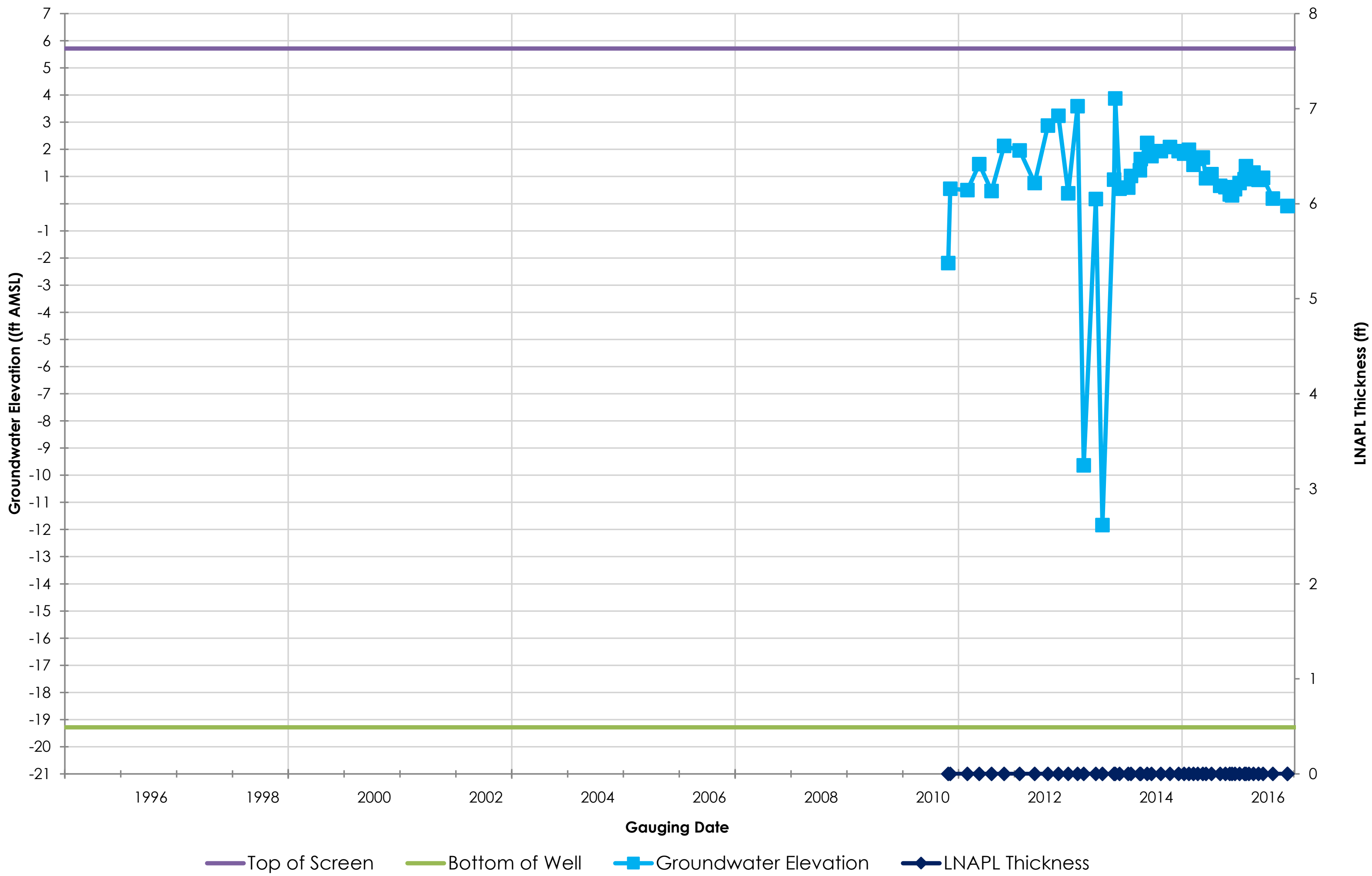
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-710

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

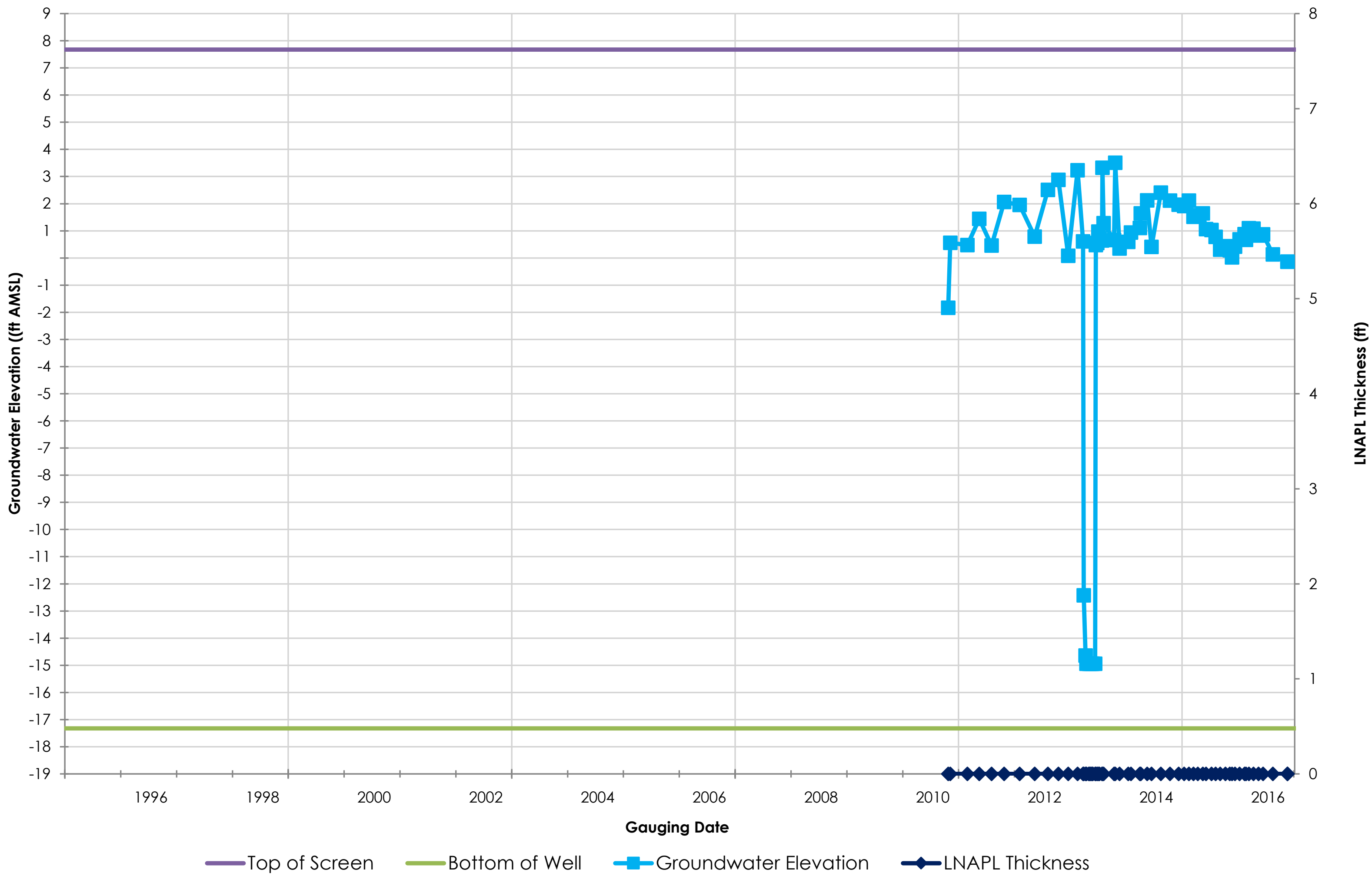
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-711

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

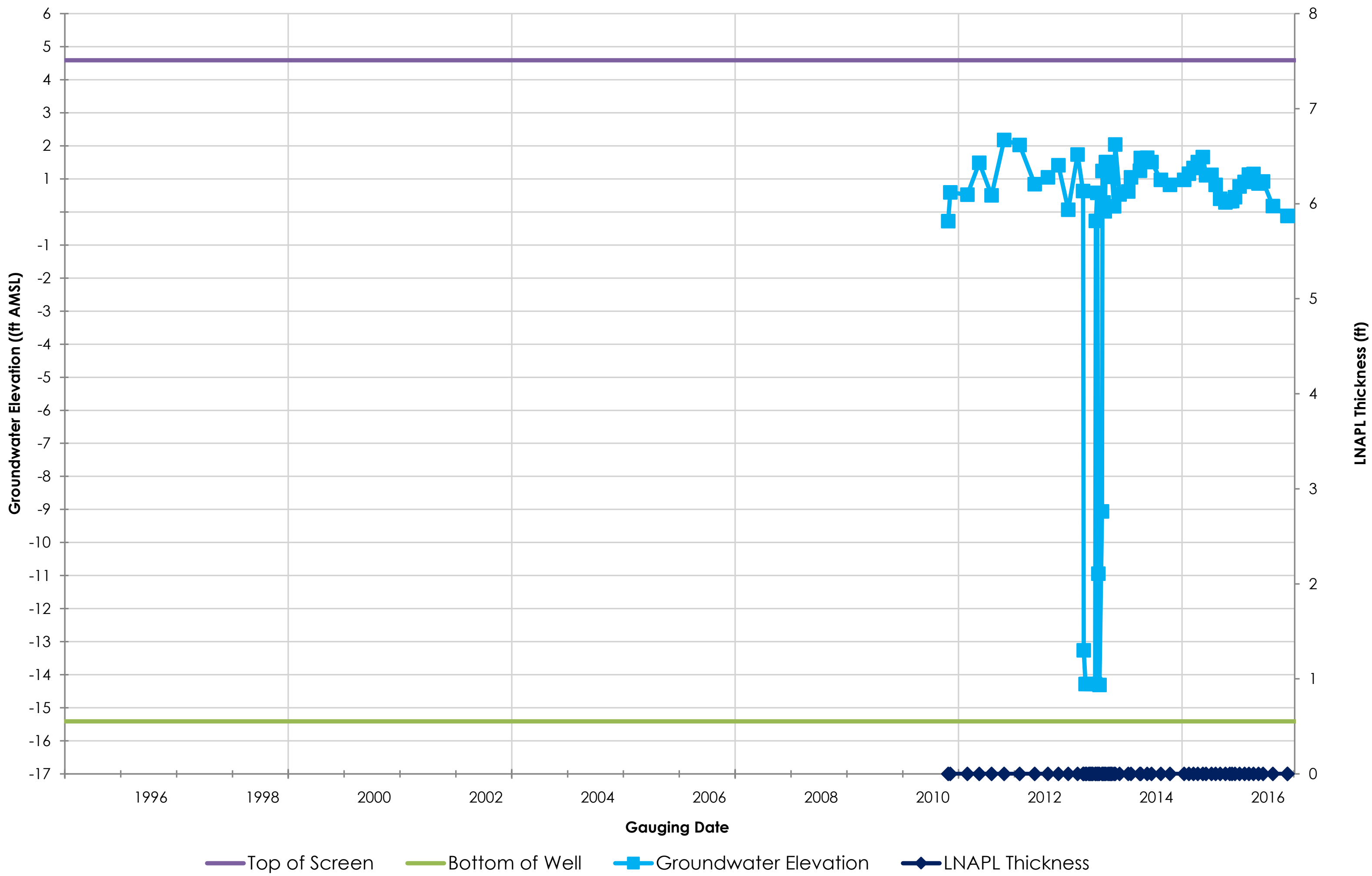
Stantec

Figure/Well No.

RW-712

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

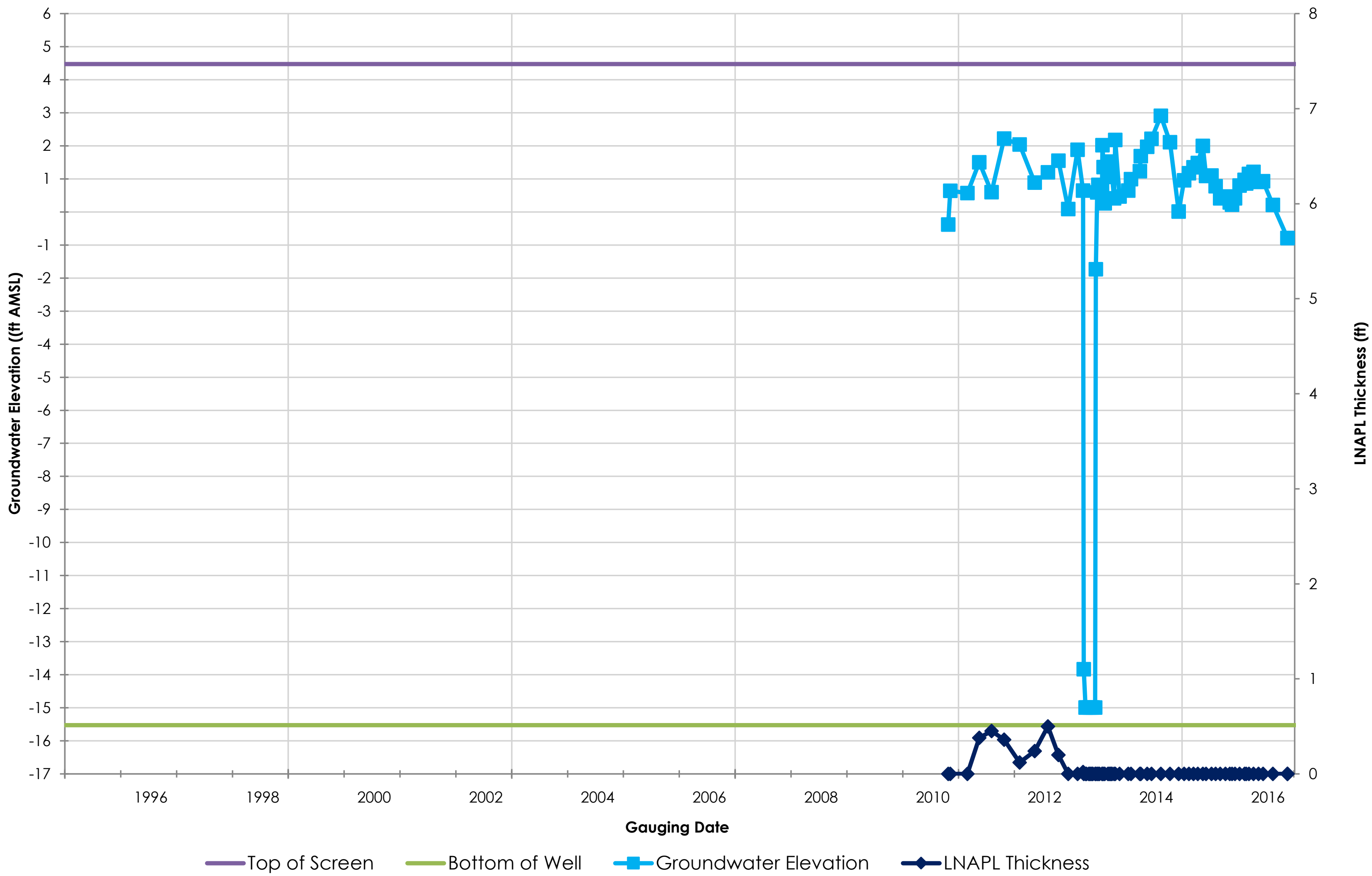
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-713

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

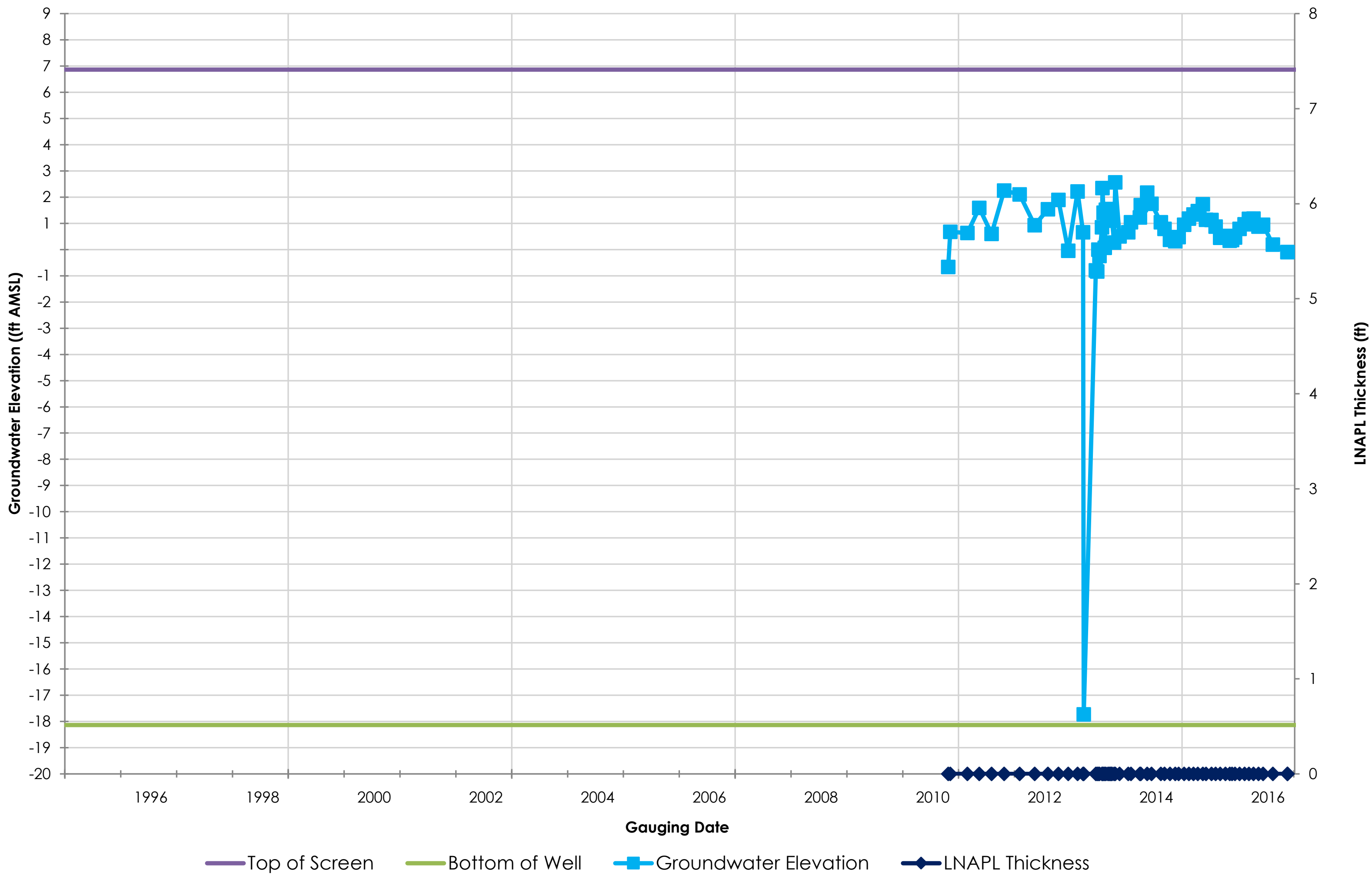
Stantec

Figure/Well No.

RW-714

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

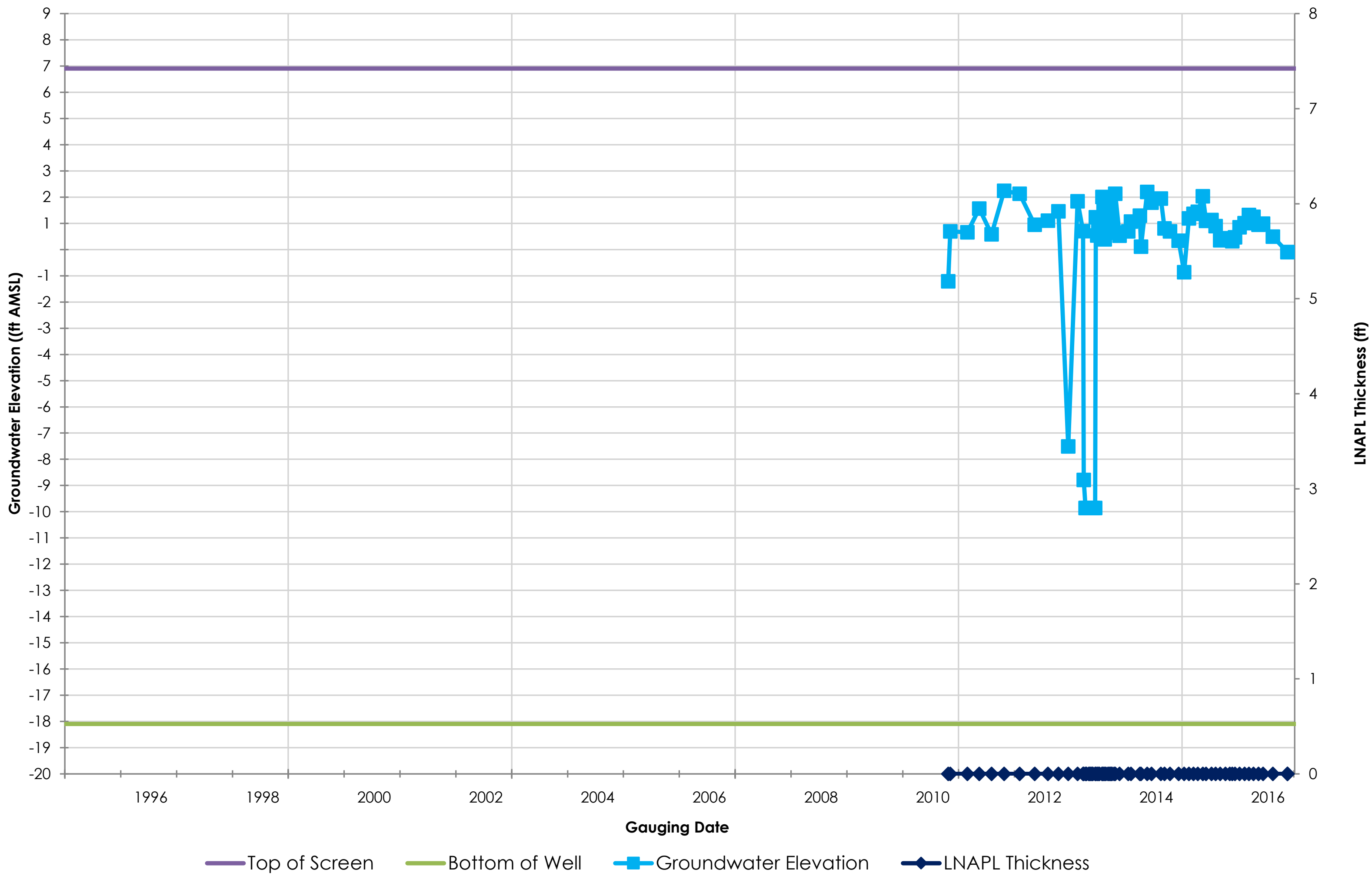
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-715

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

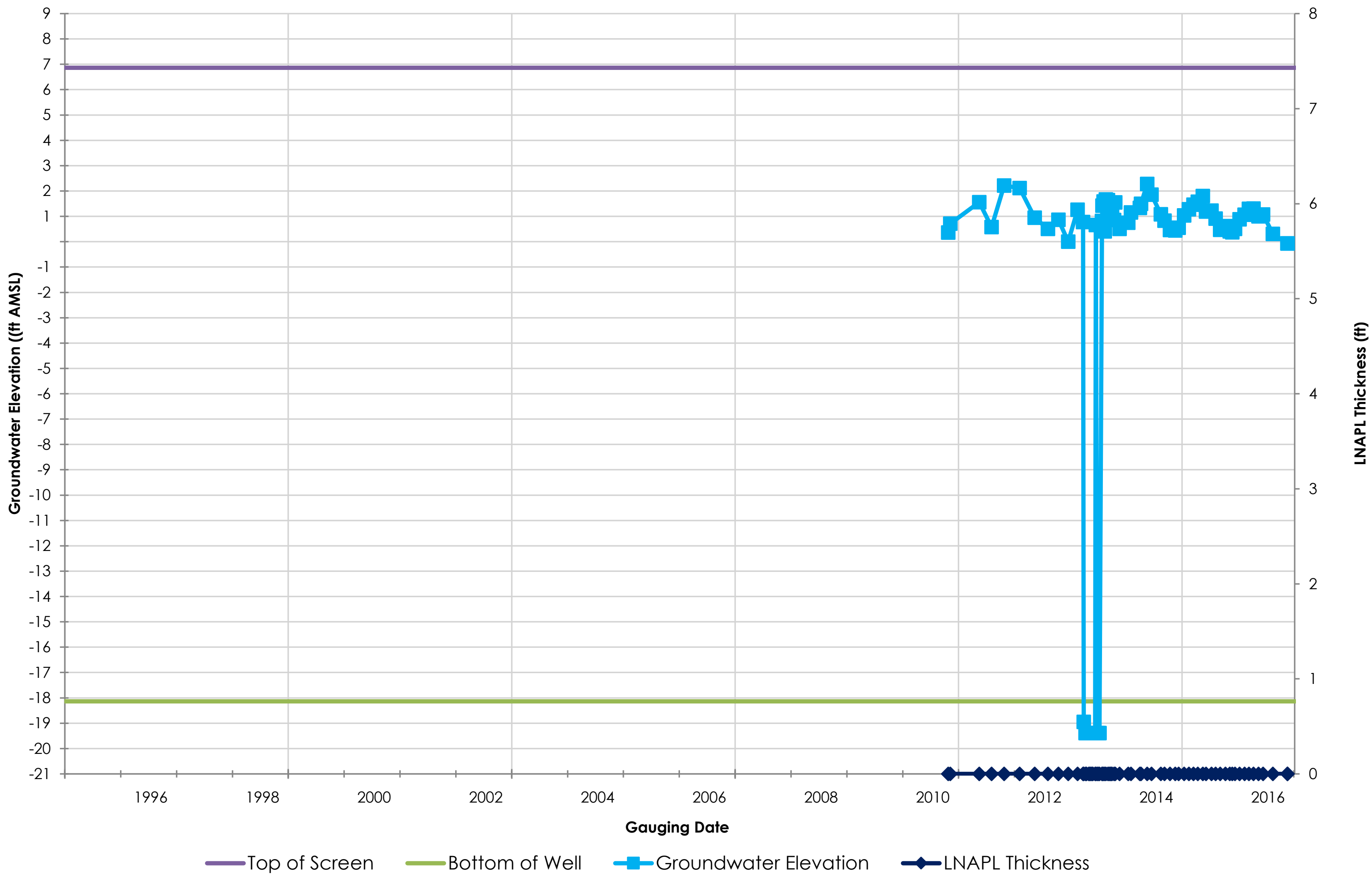
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-716

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

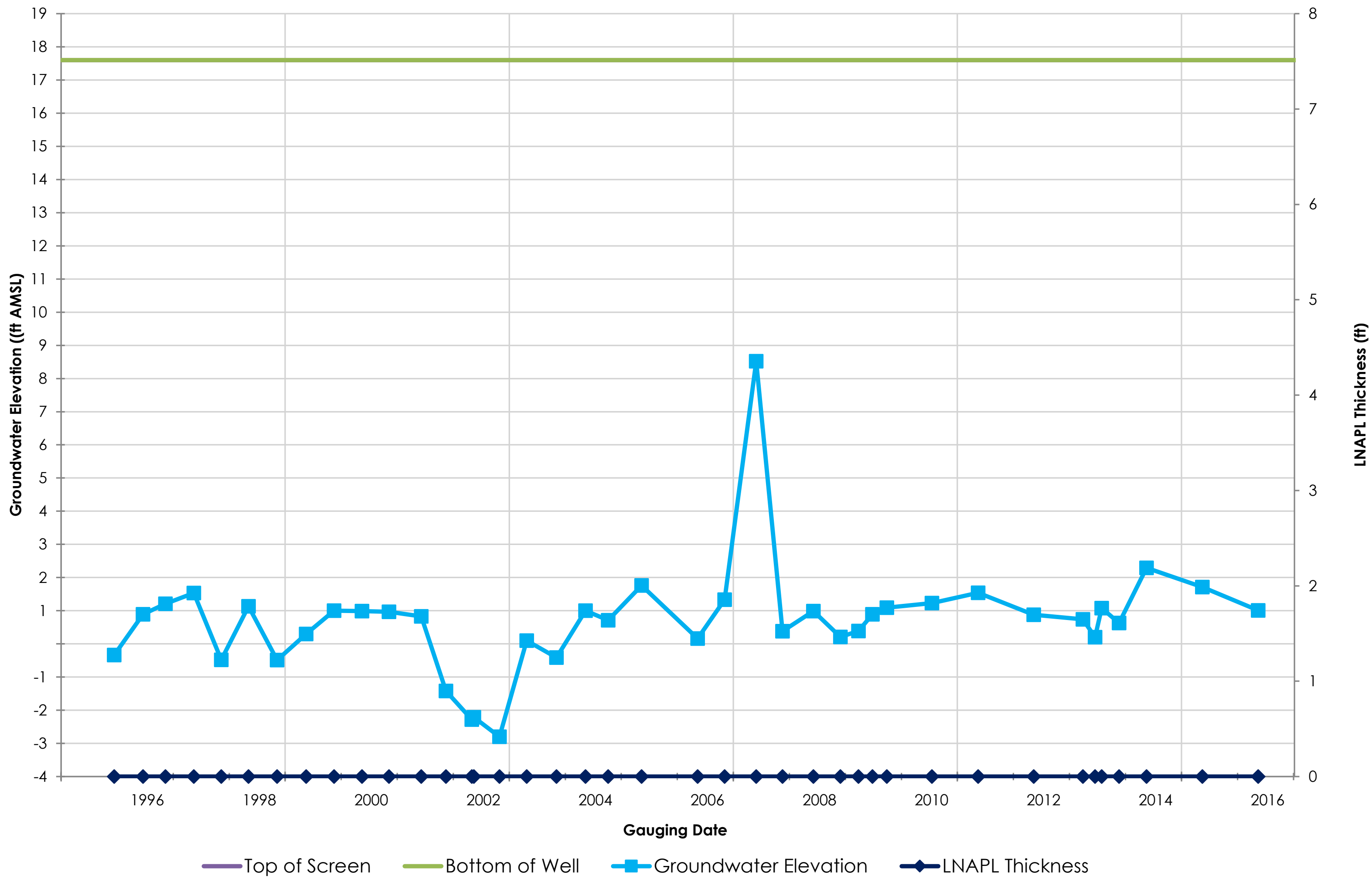
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

RW-717

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

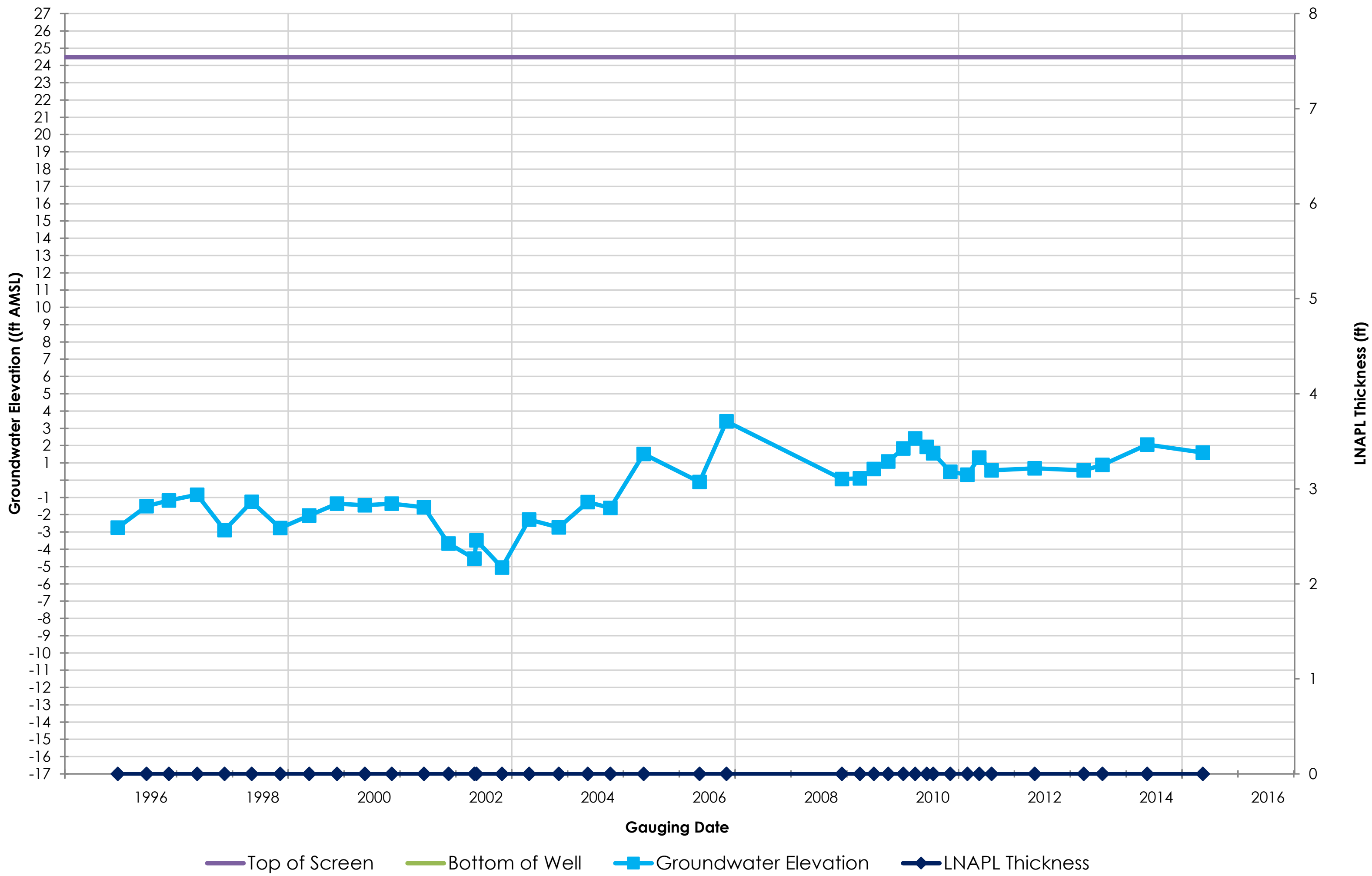
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-26

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

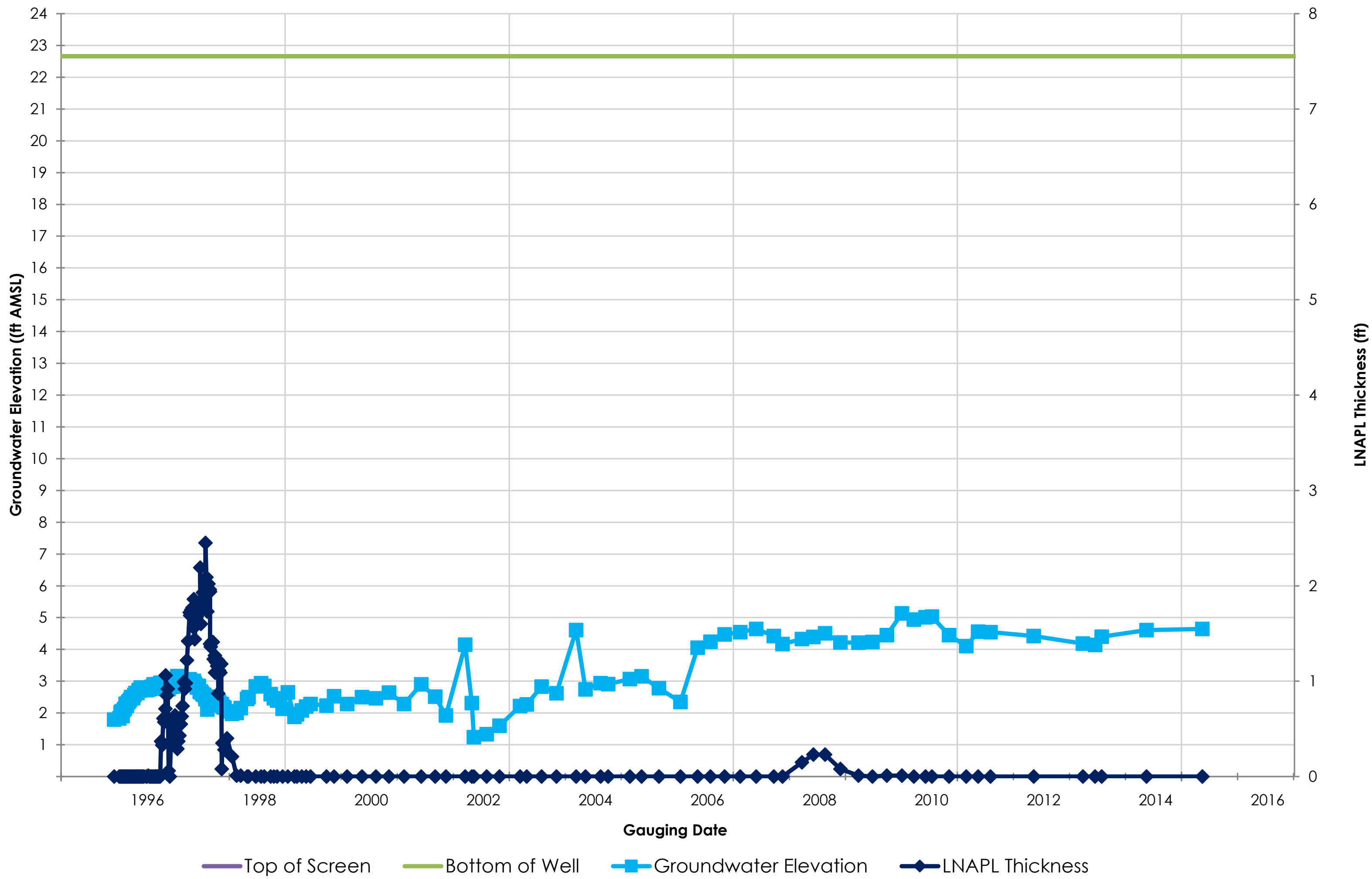
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-27

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

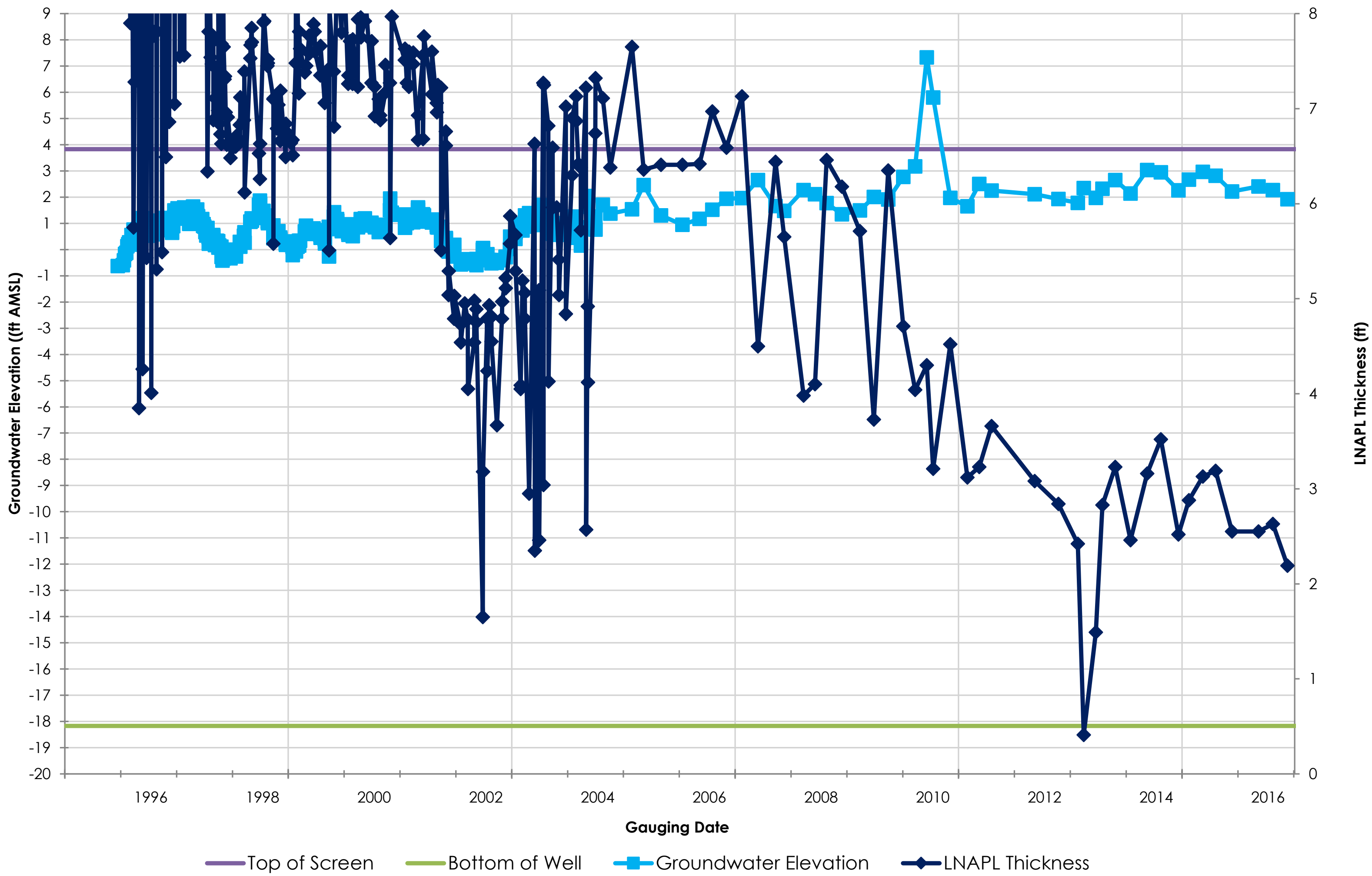
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-28

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

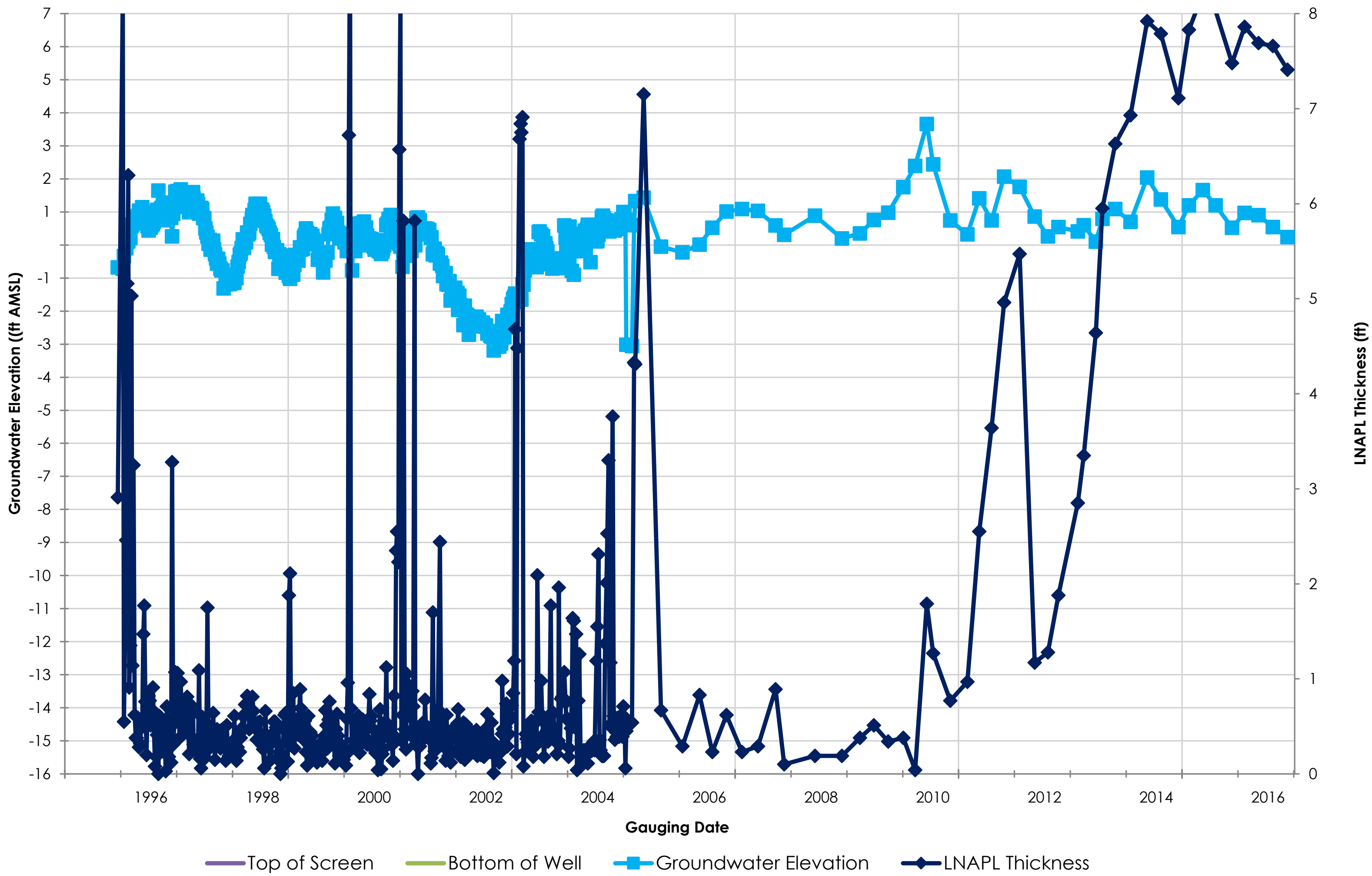
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-29

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

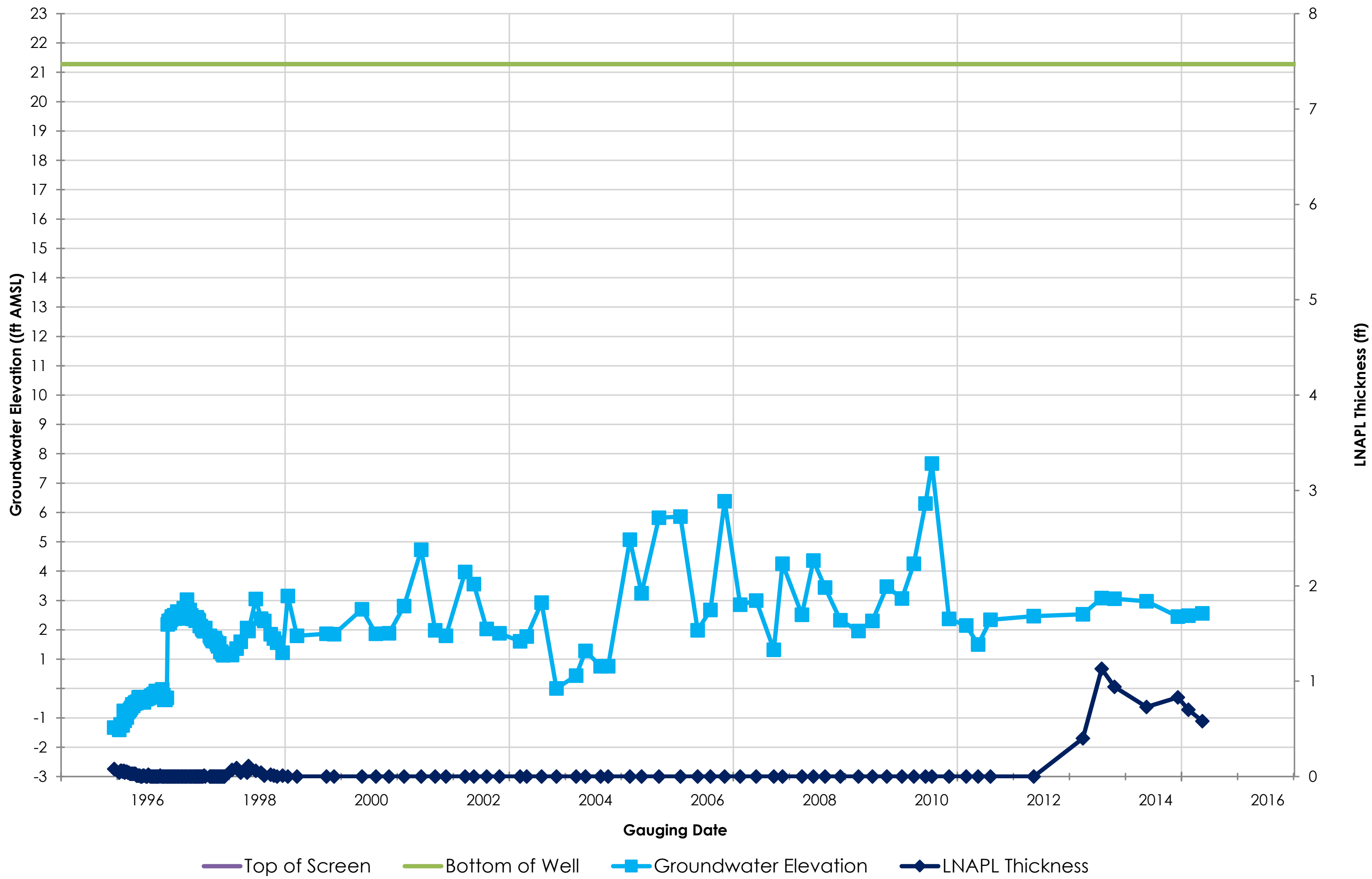
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-30

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

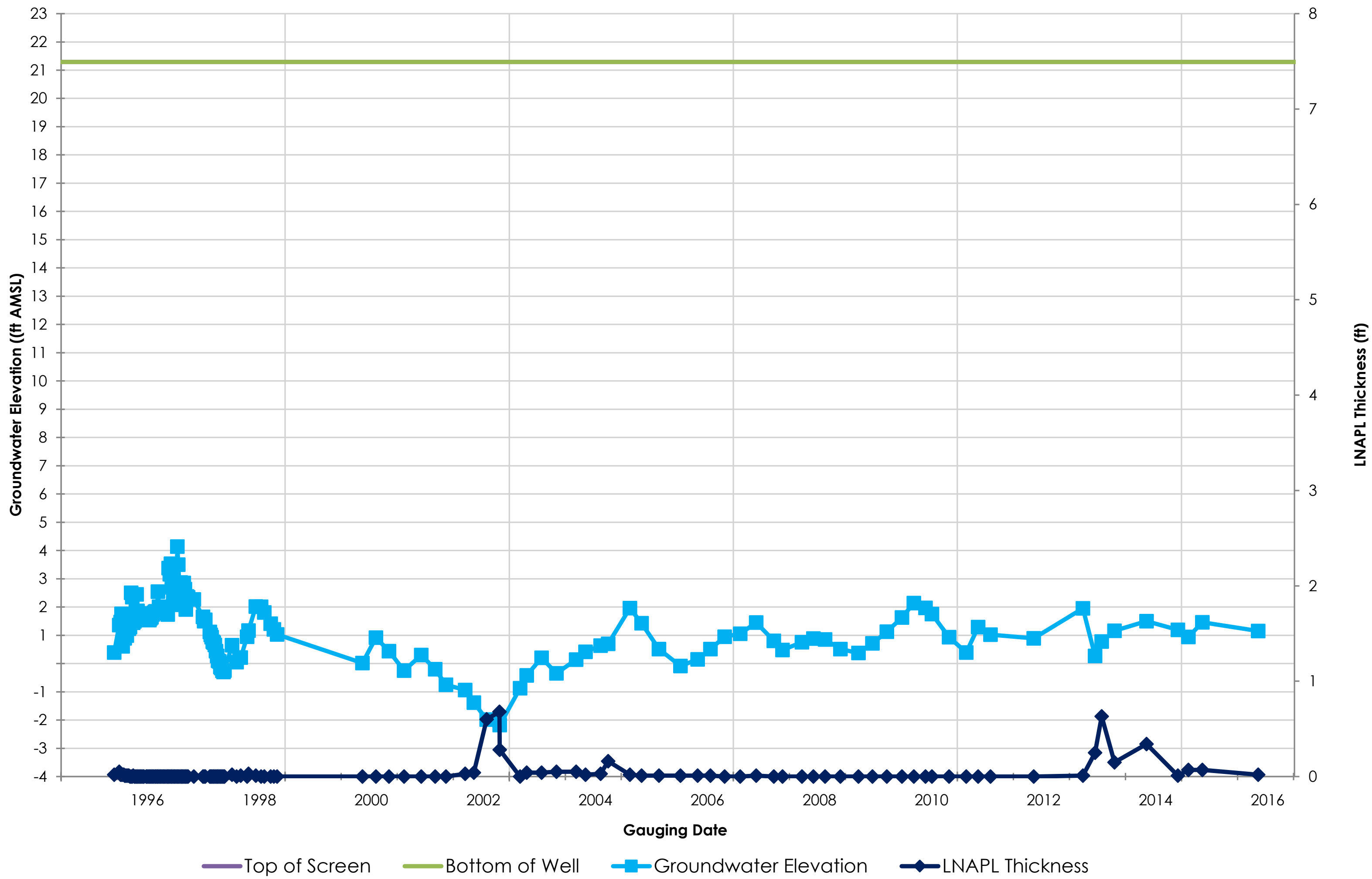
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-31

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

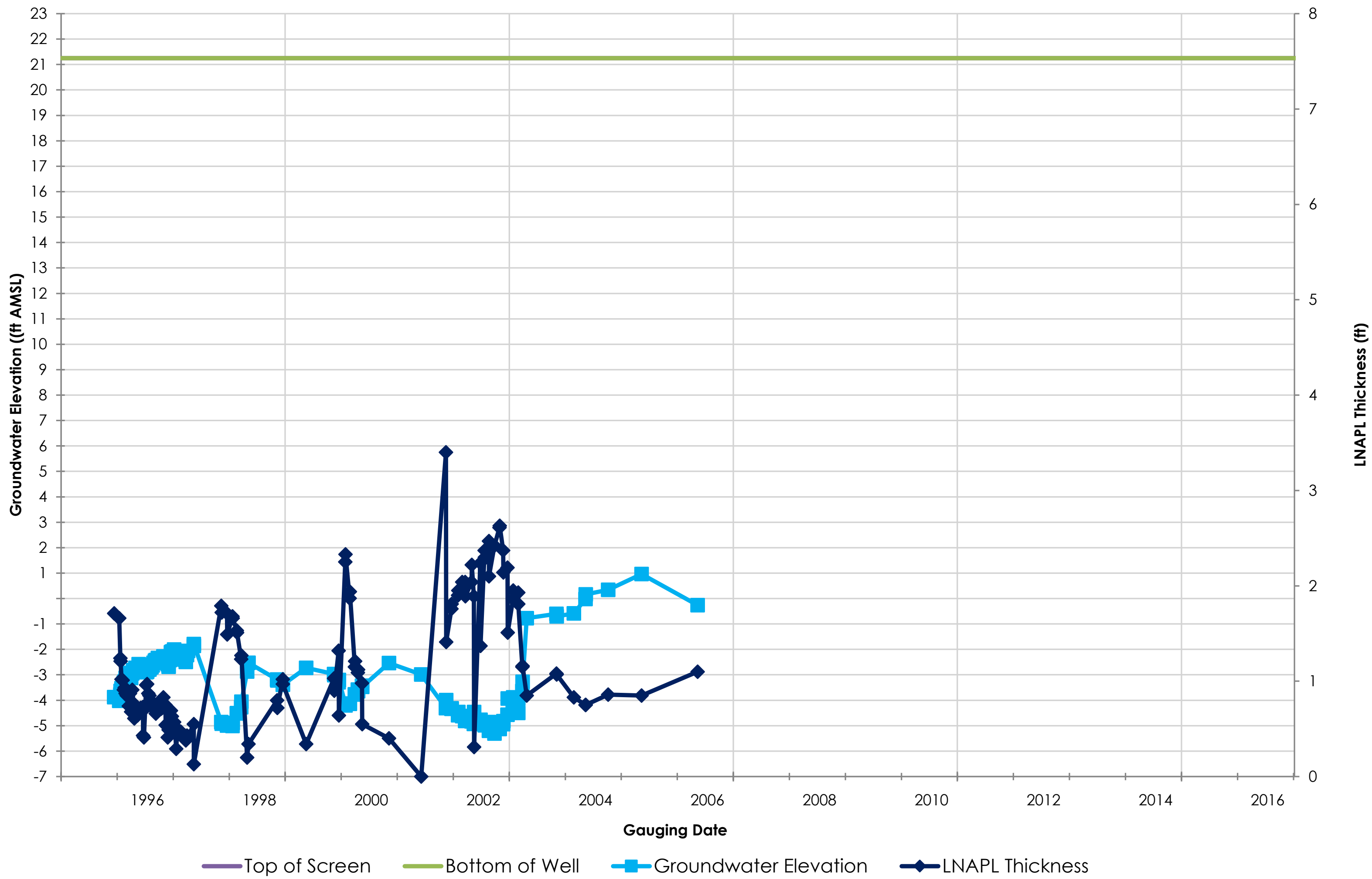
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-32

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

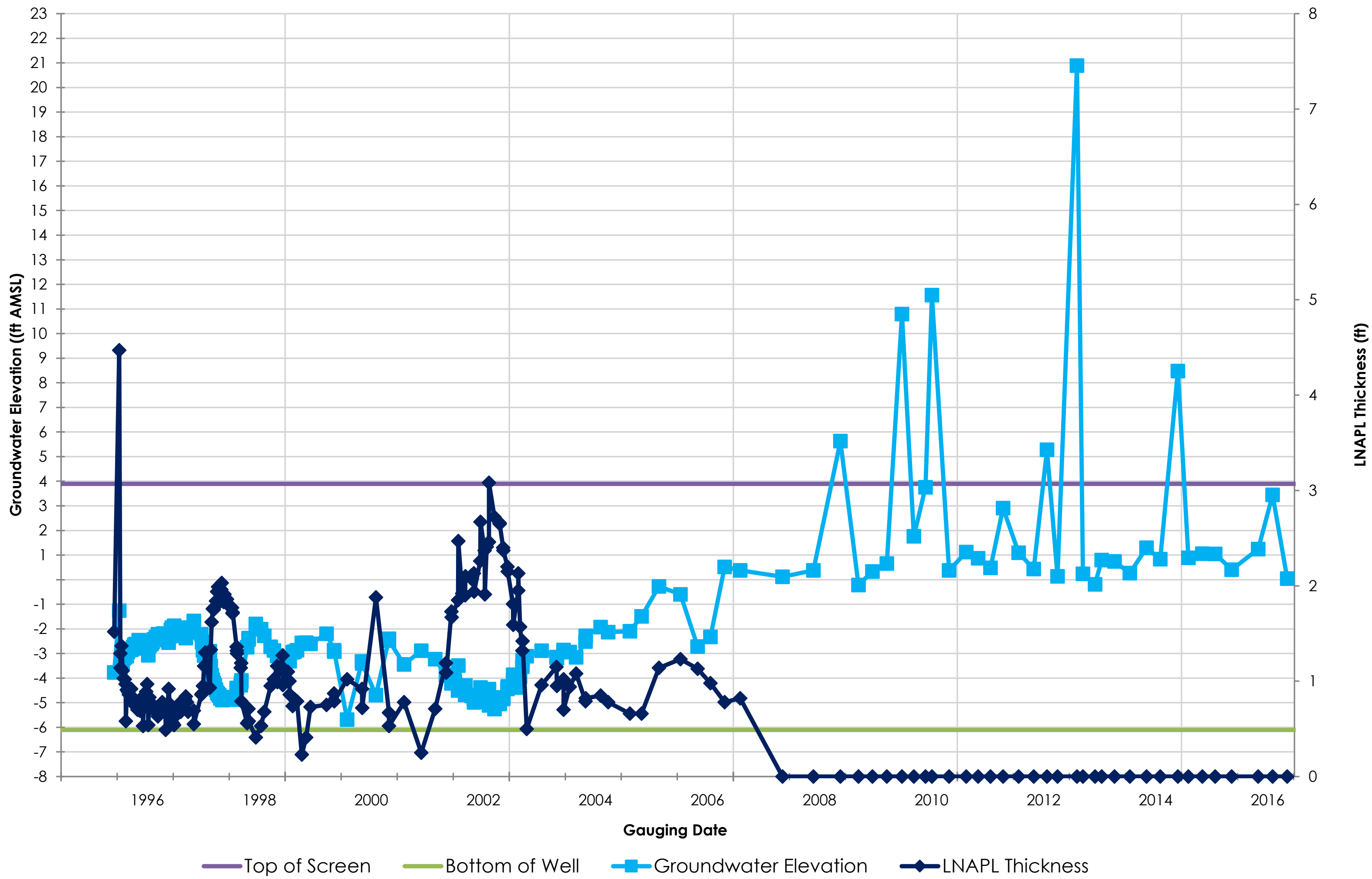
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-33

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

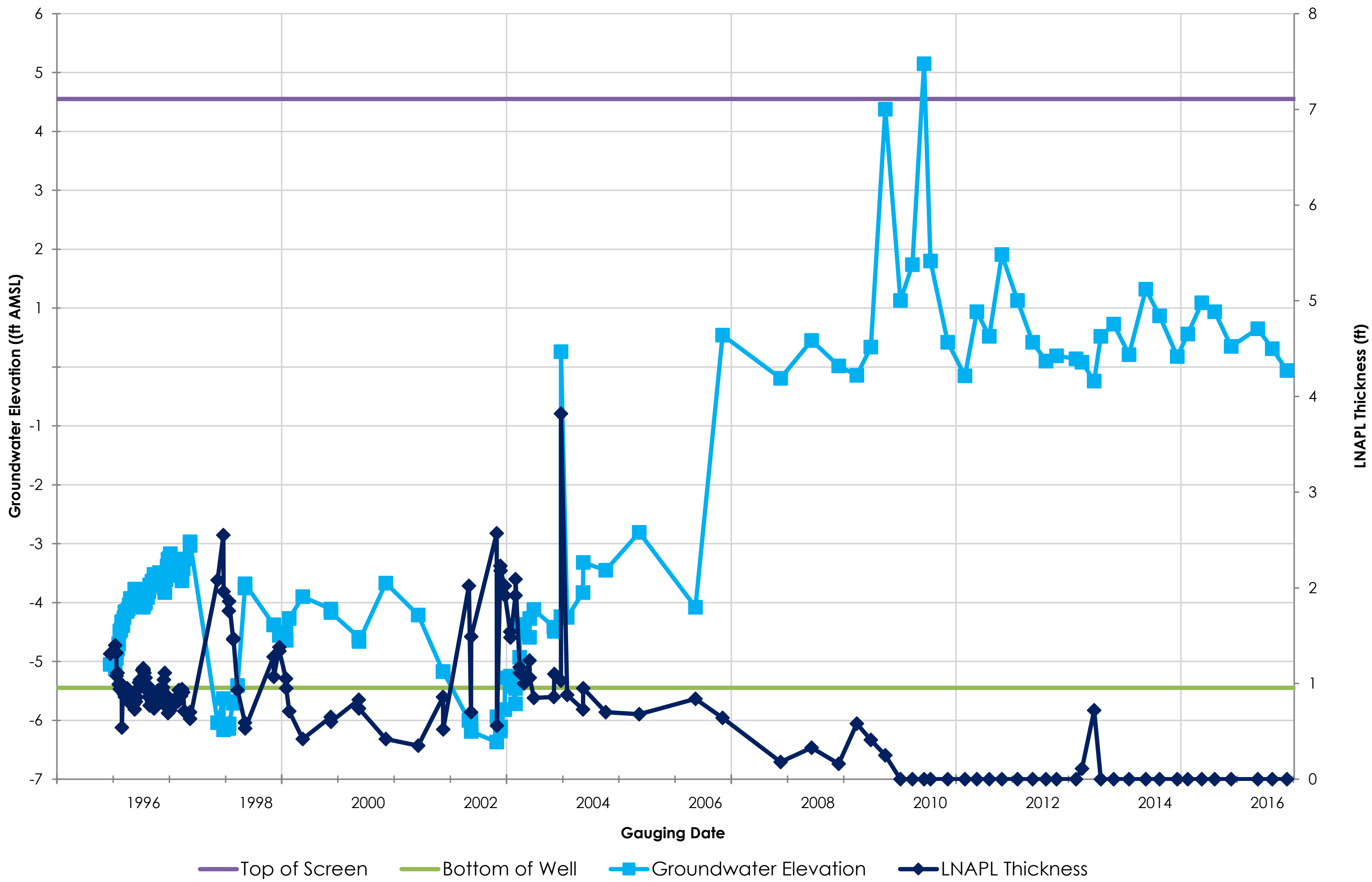
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-34

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

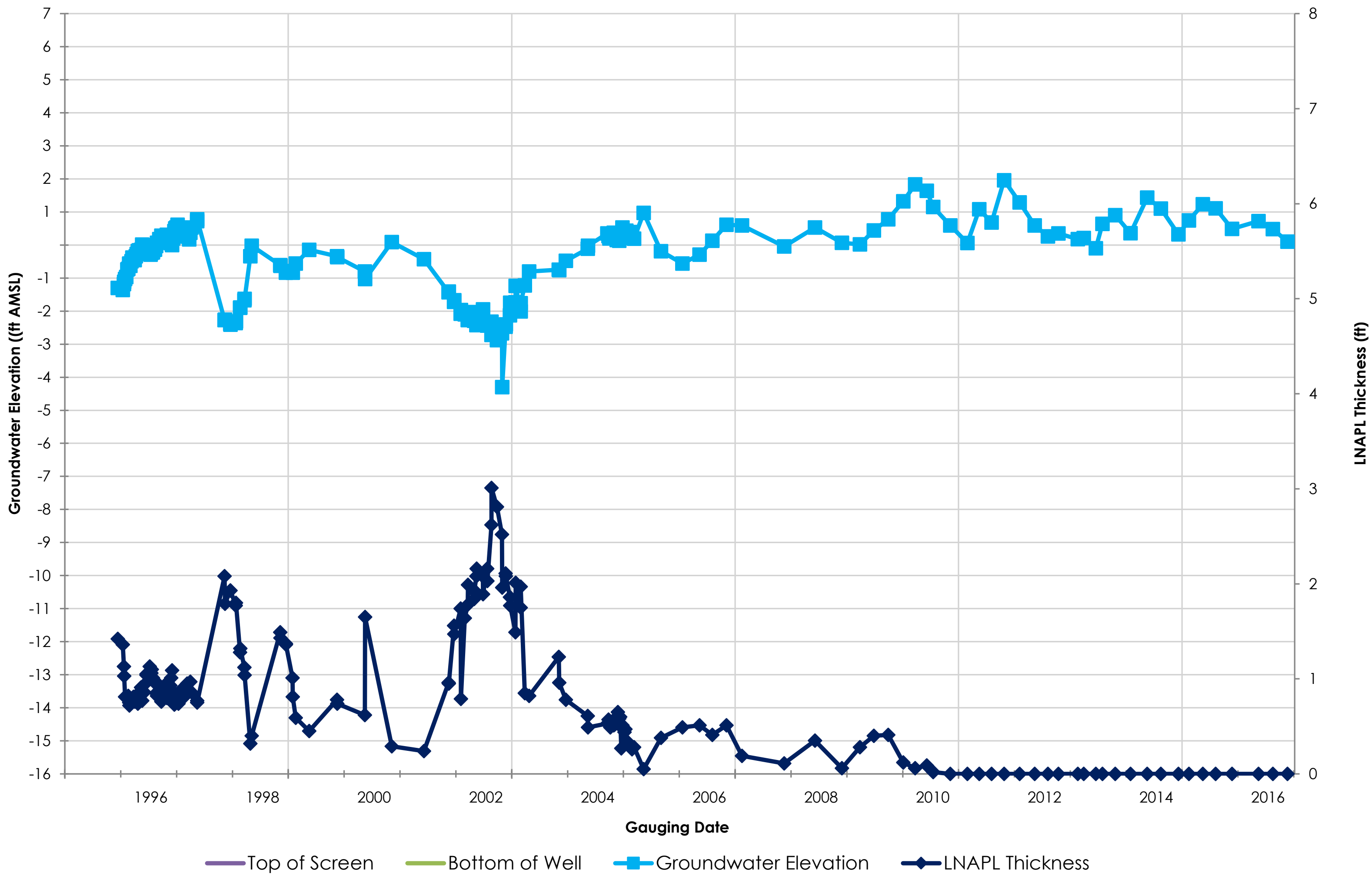
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-35

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

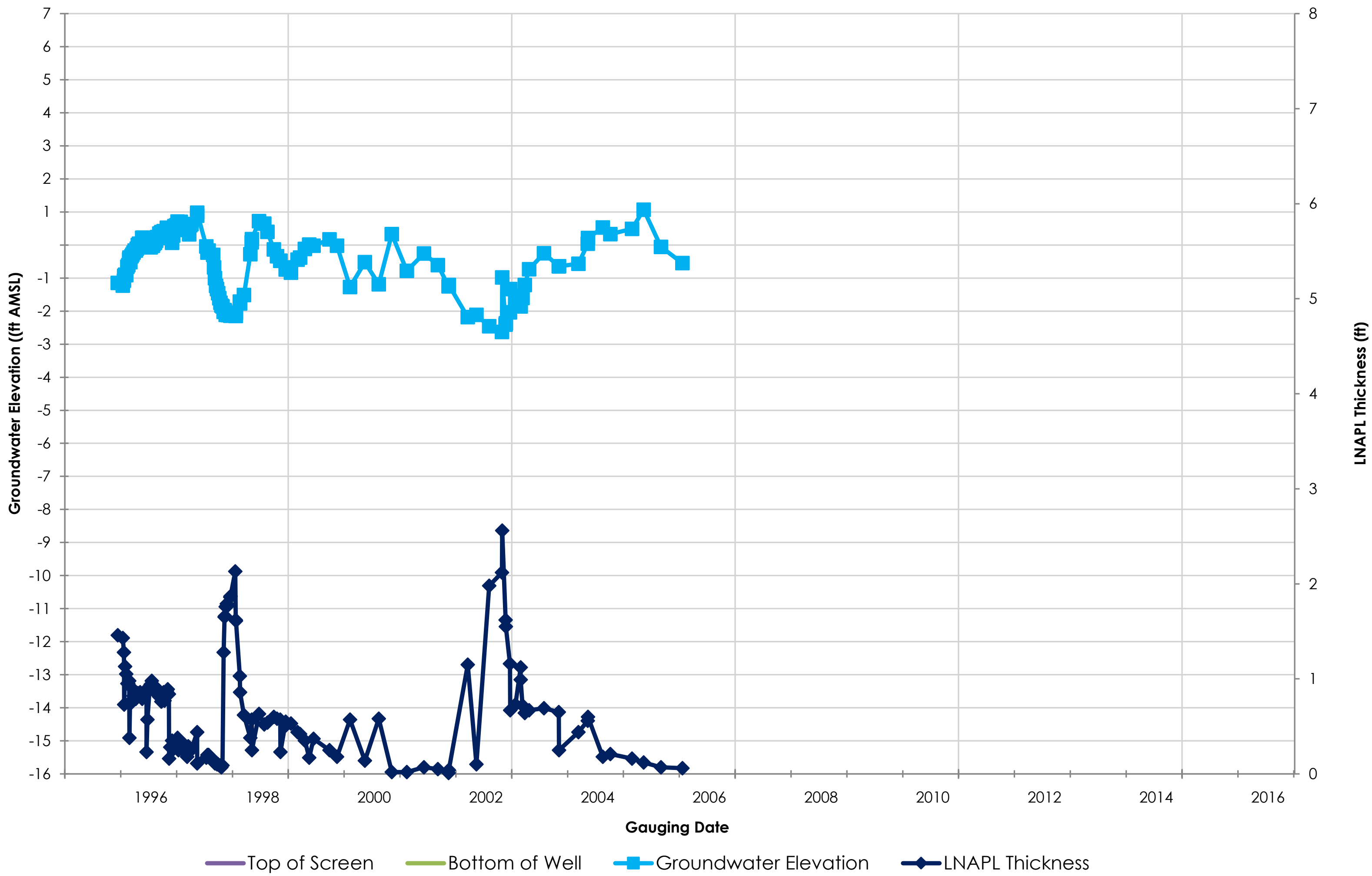
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-36

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

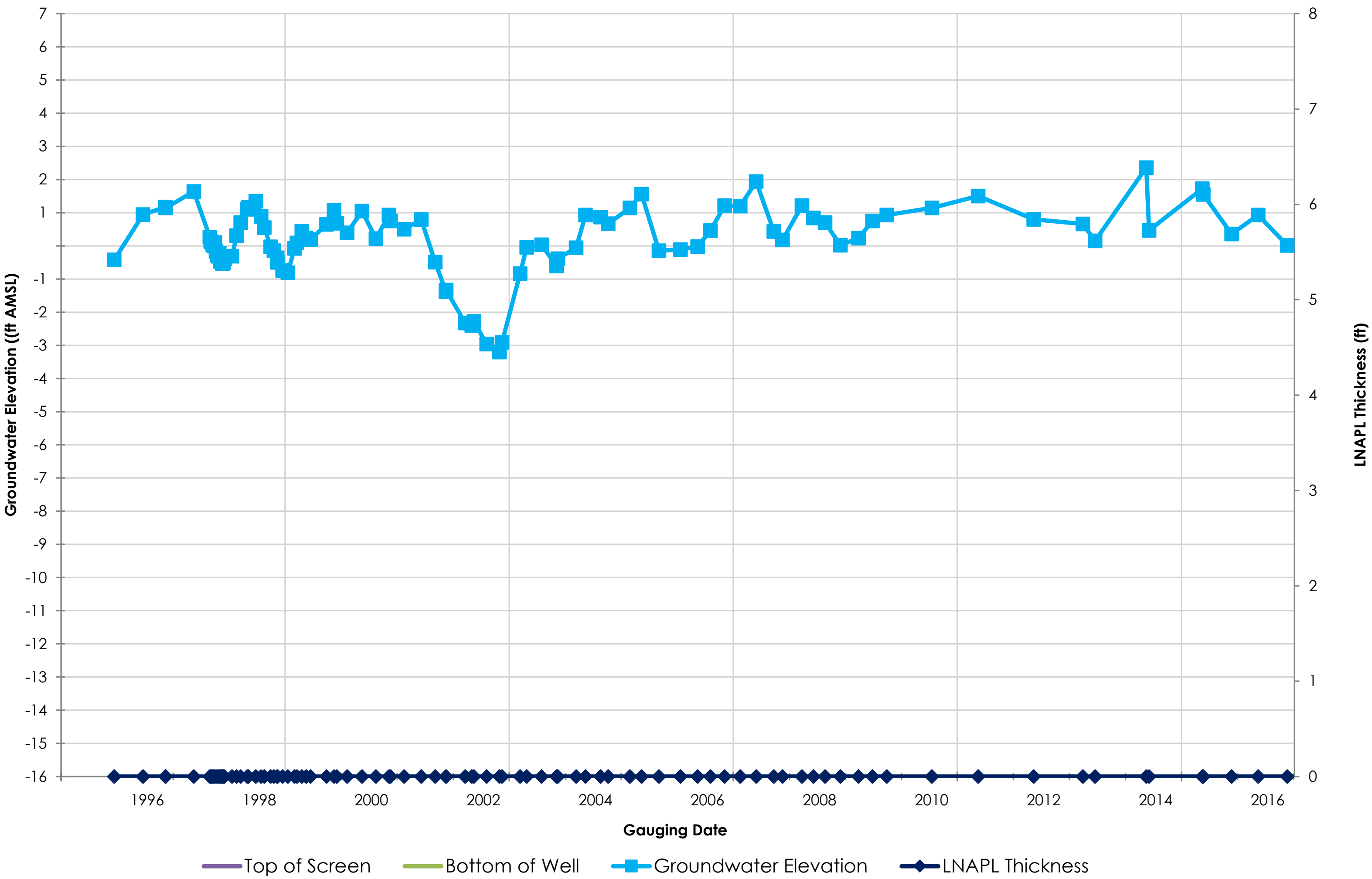
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-37

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

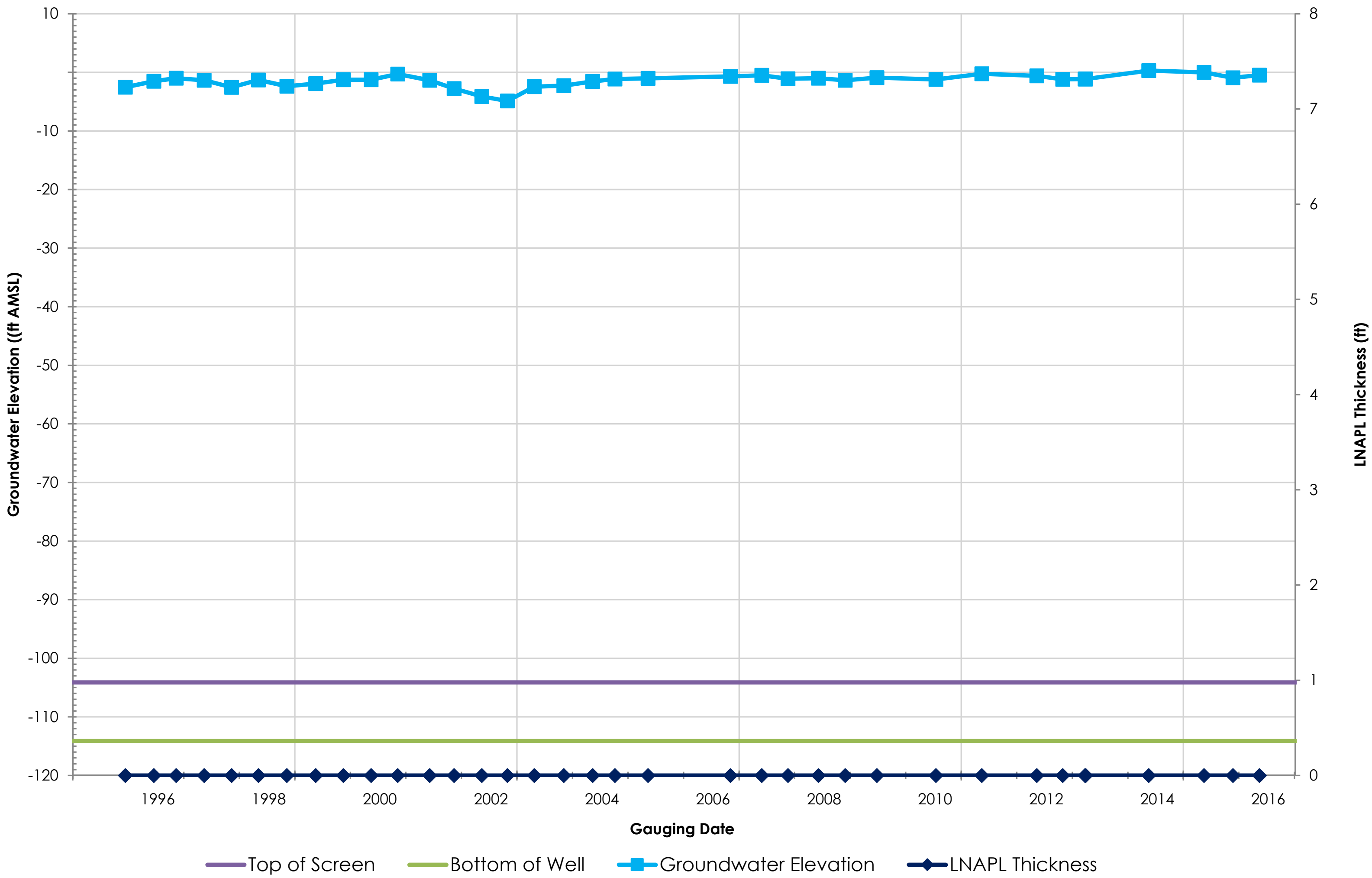
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-38

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

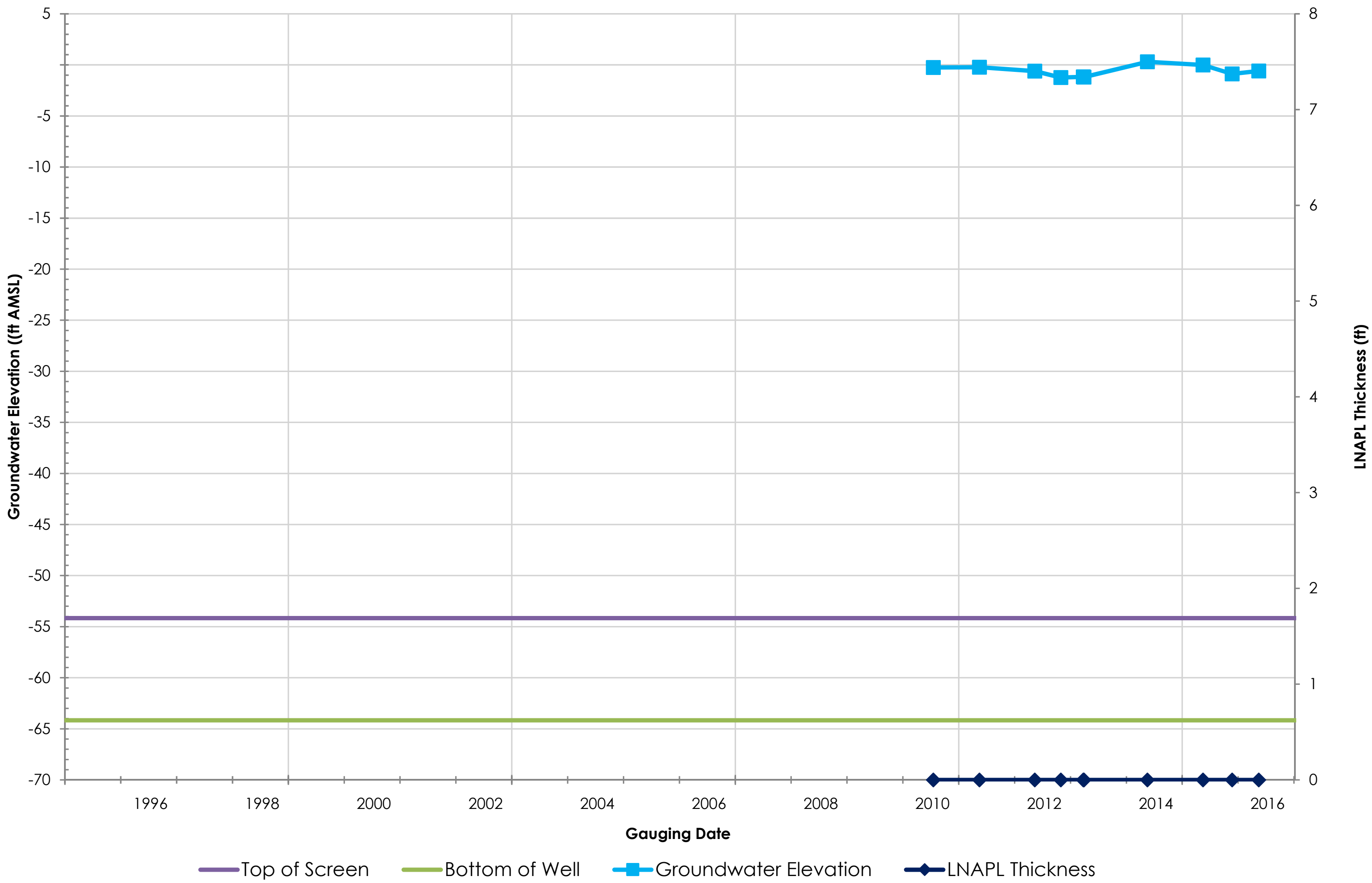
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-38D

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

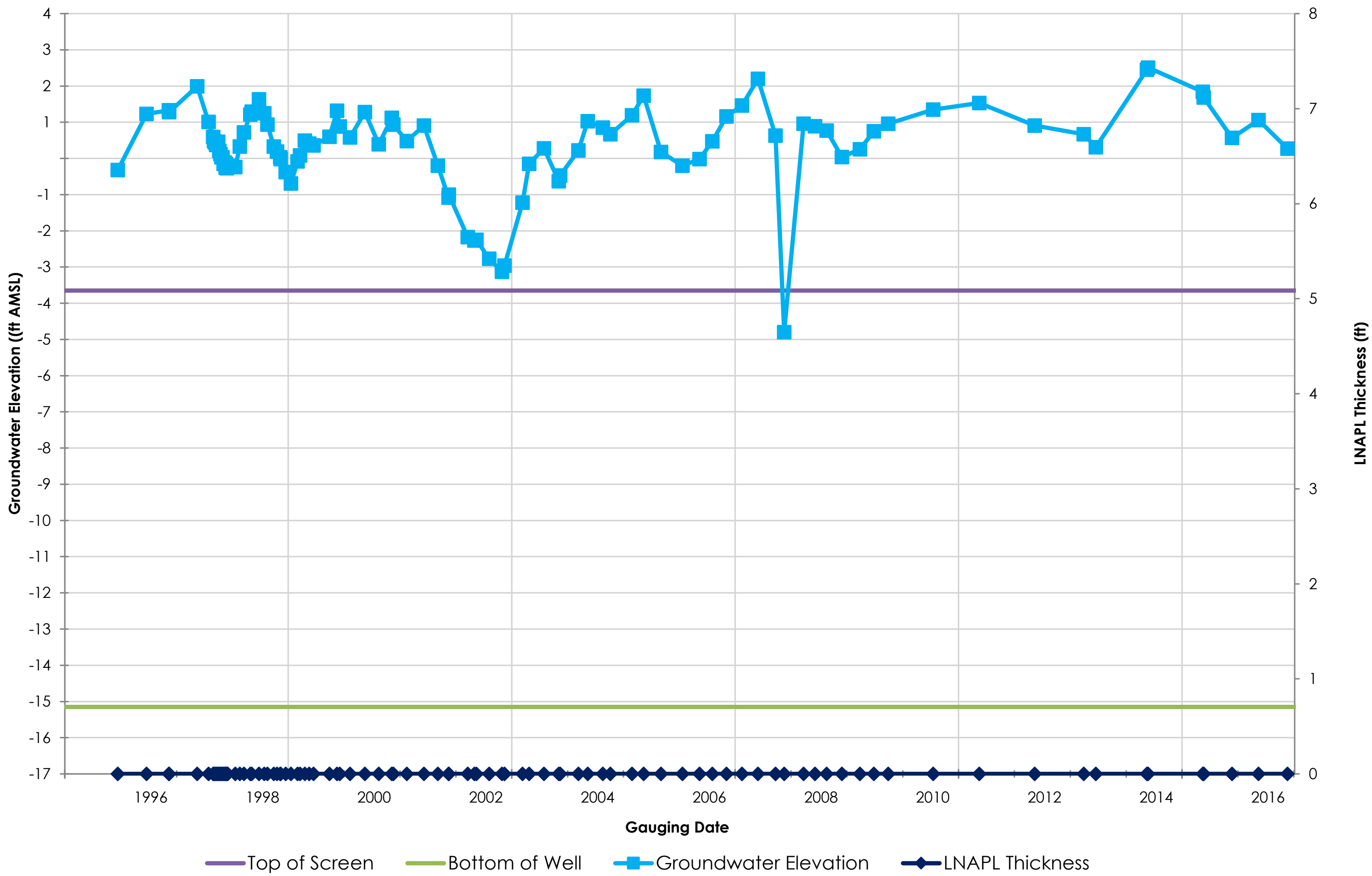
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-38D2

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

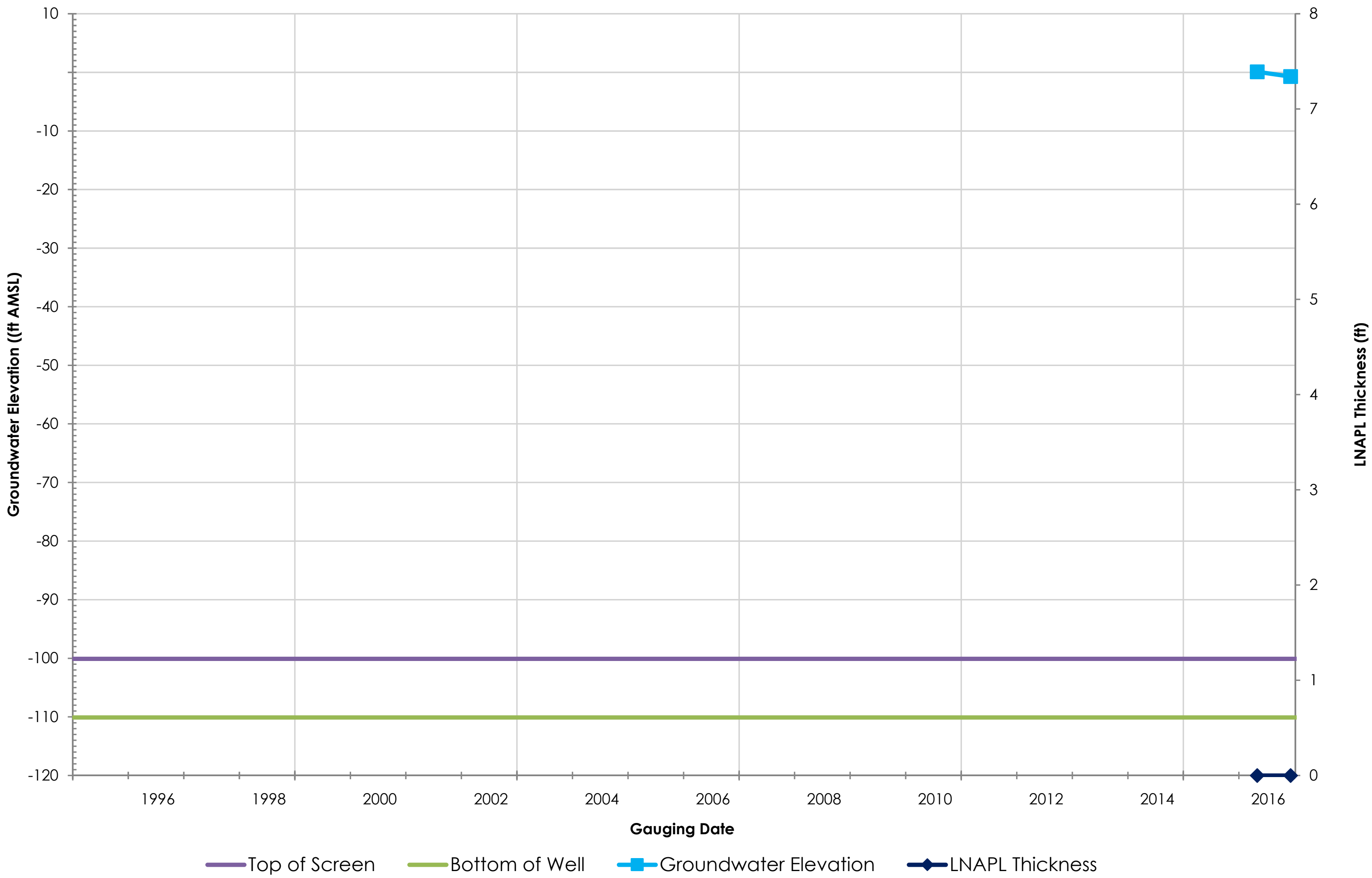
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-39

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

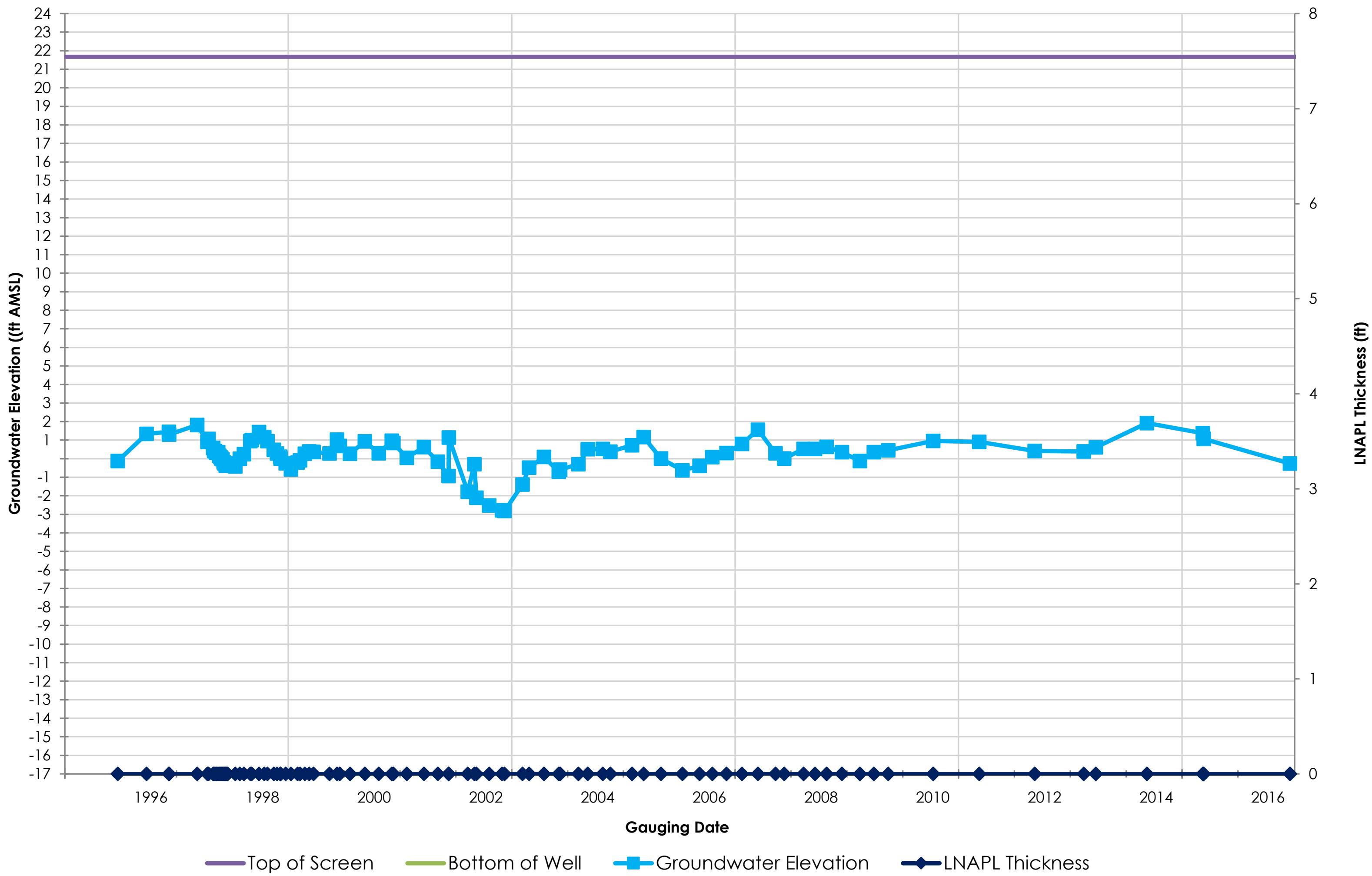
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-39D

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

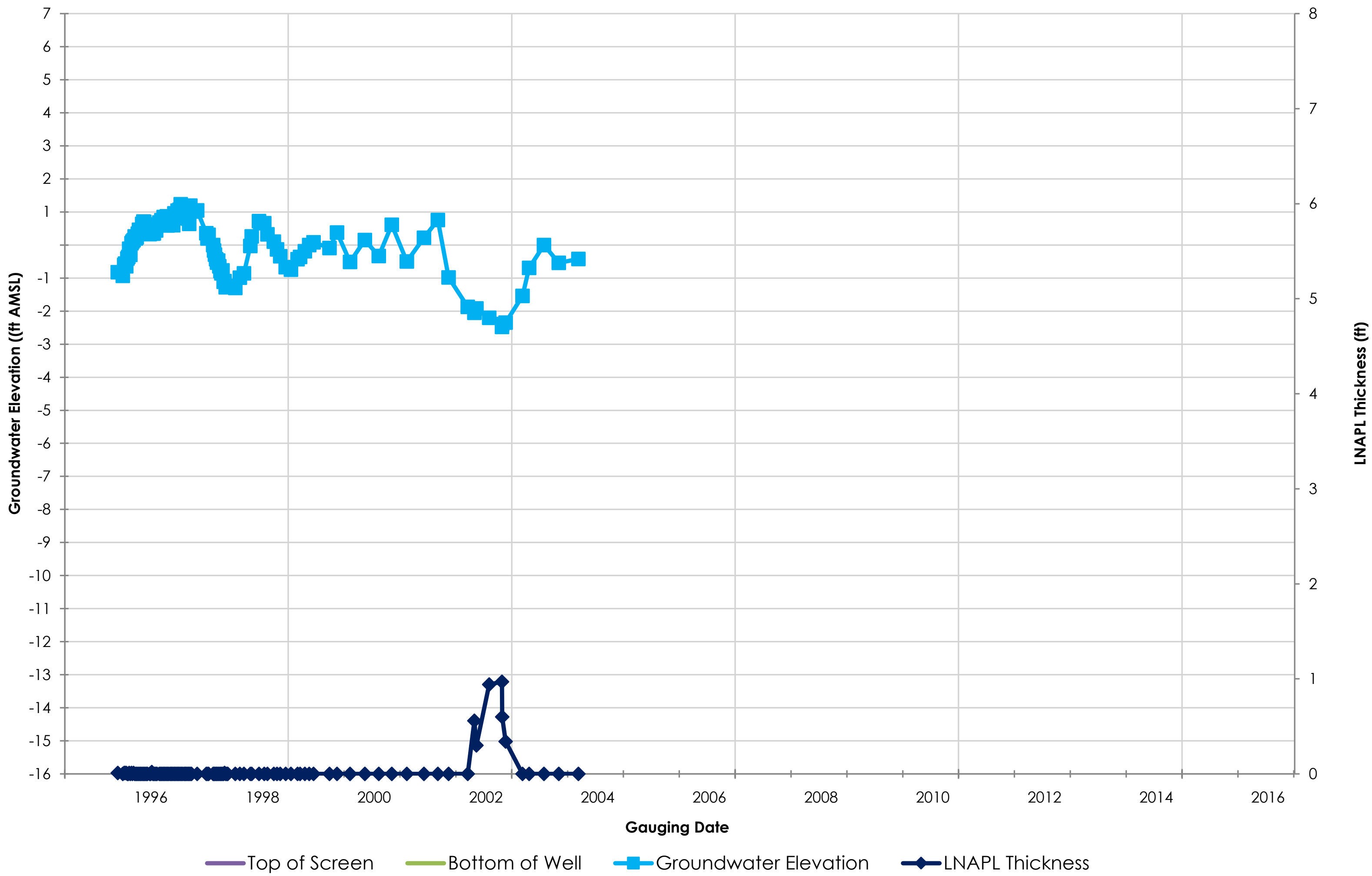
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-40

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

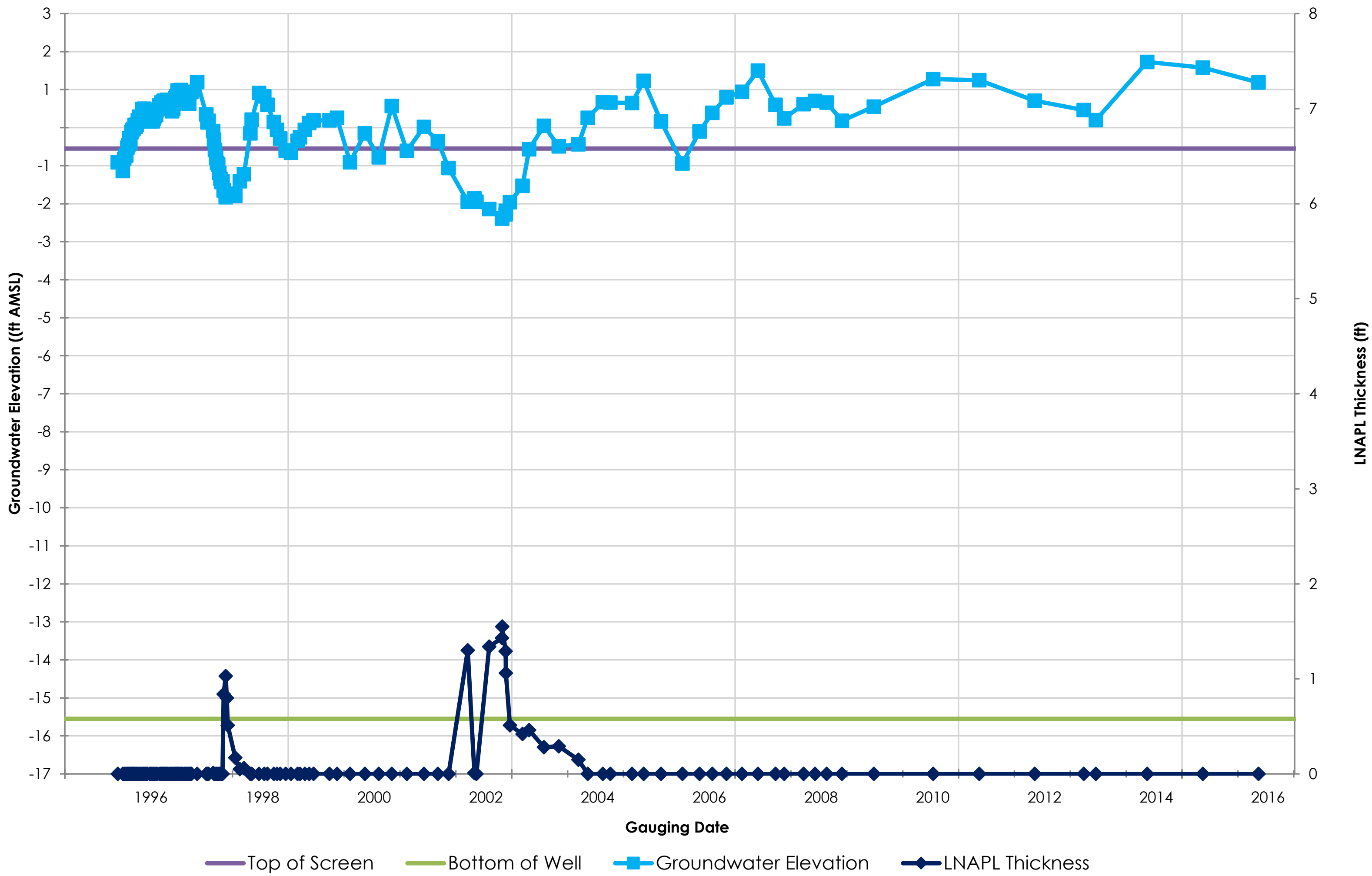
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-55

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

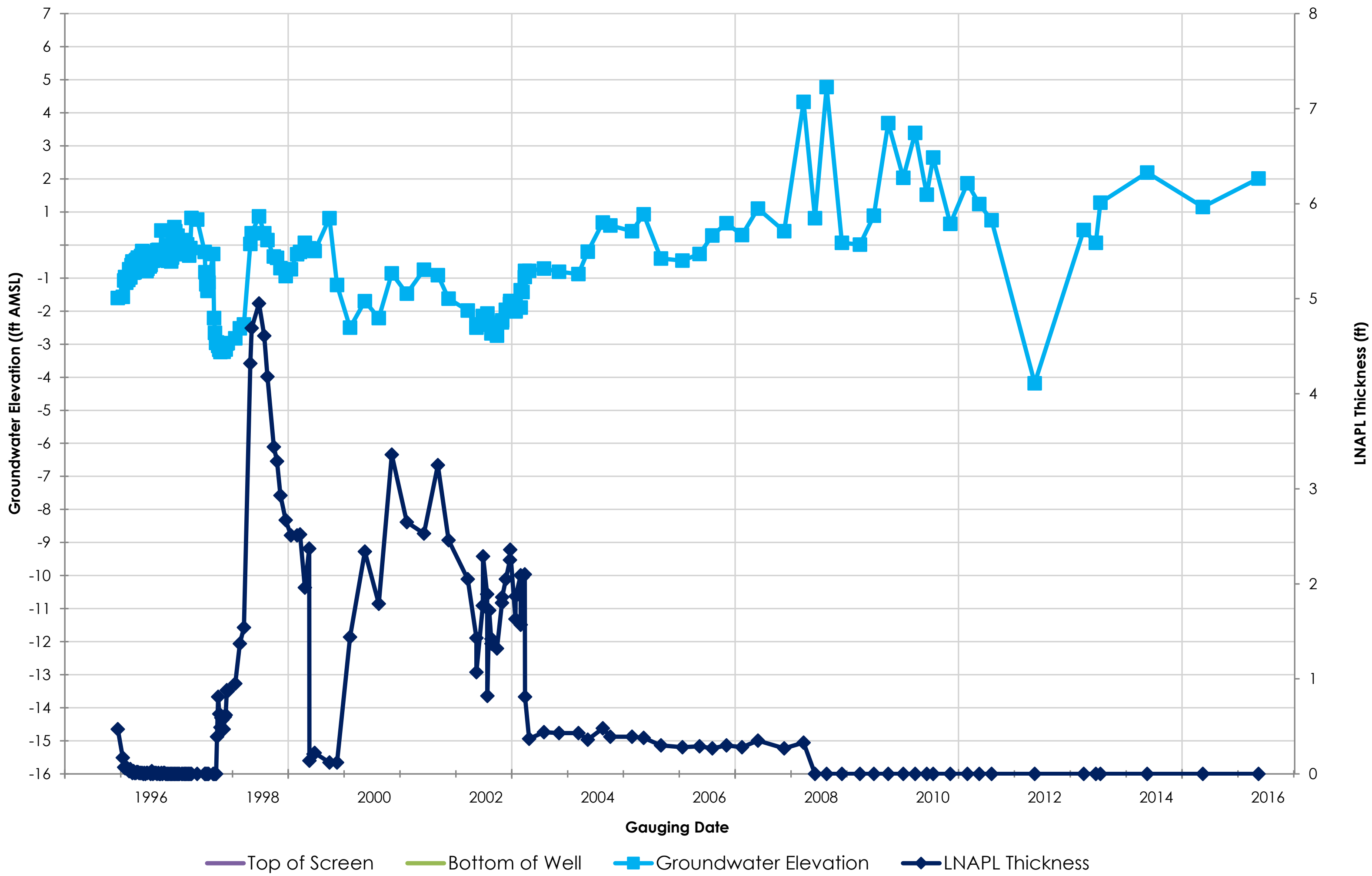
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-56

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

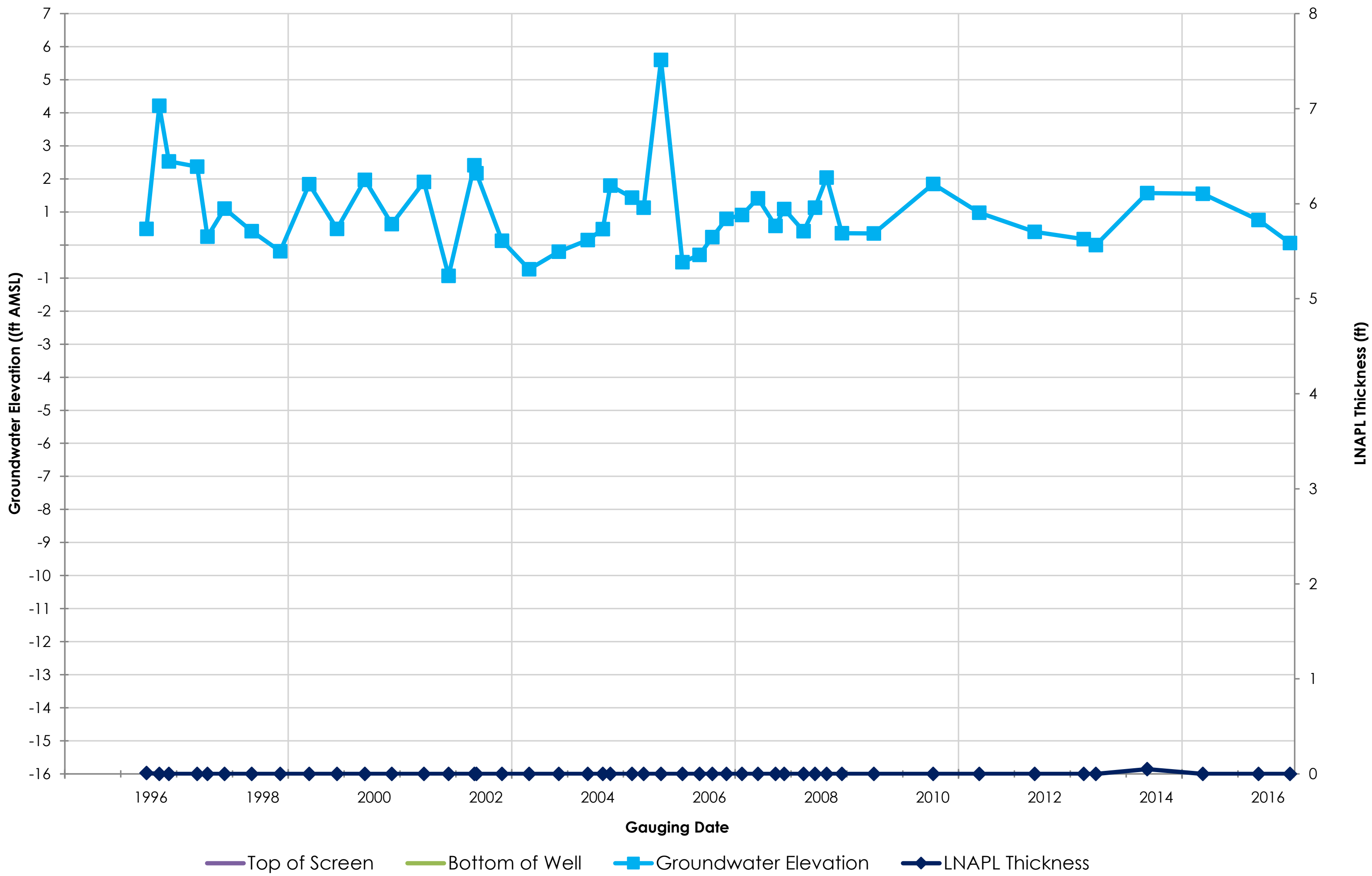
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-57

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

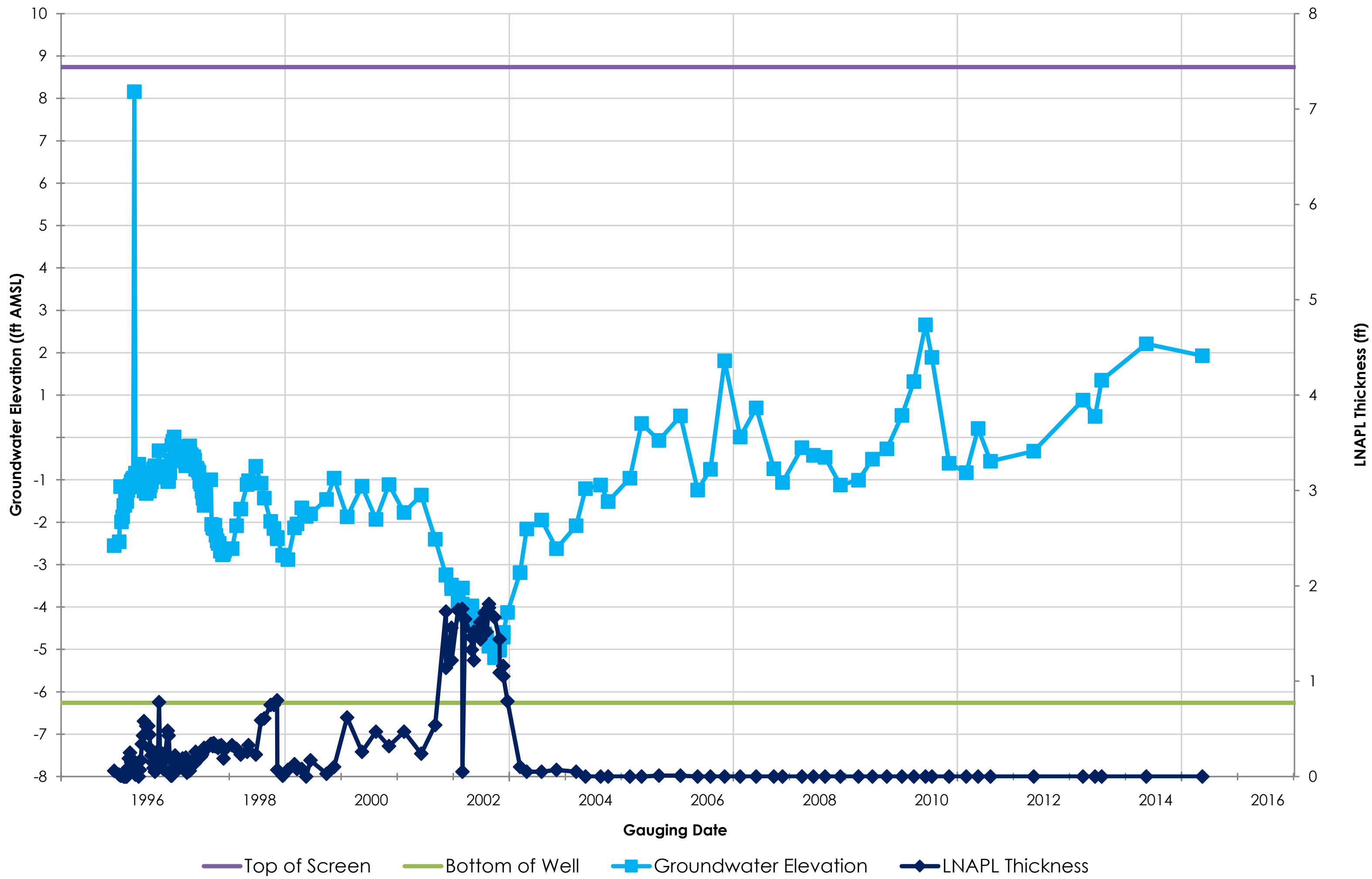
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-96

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

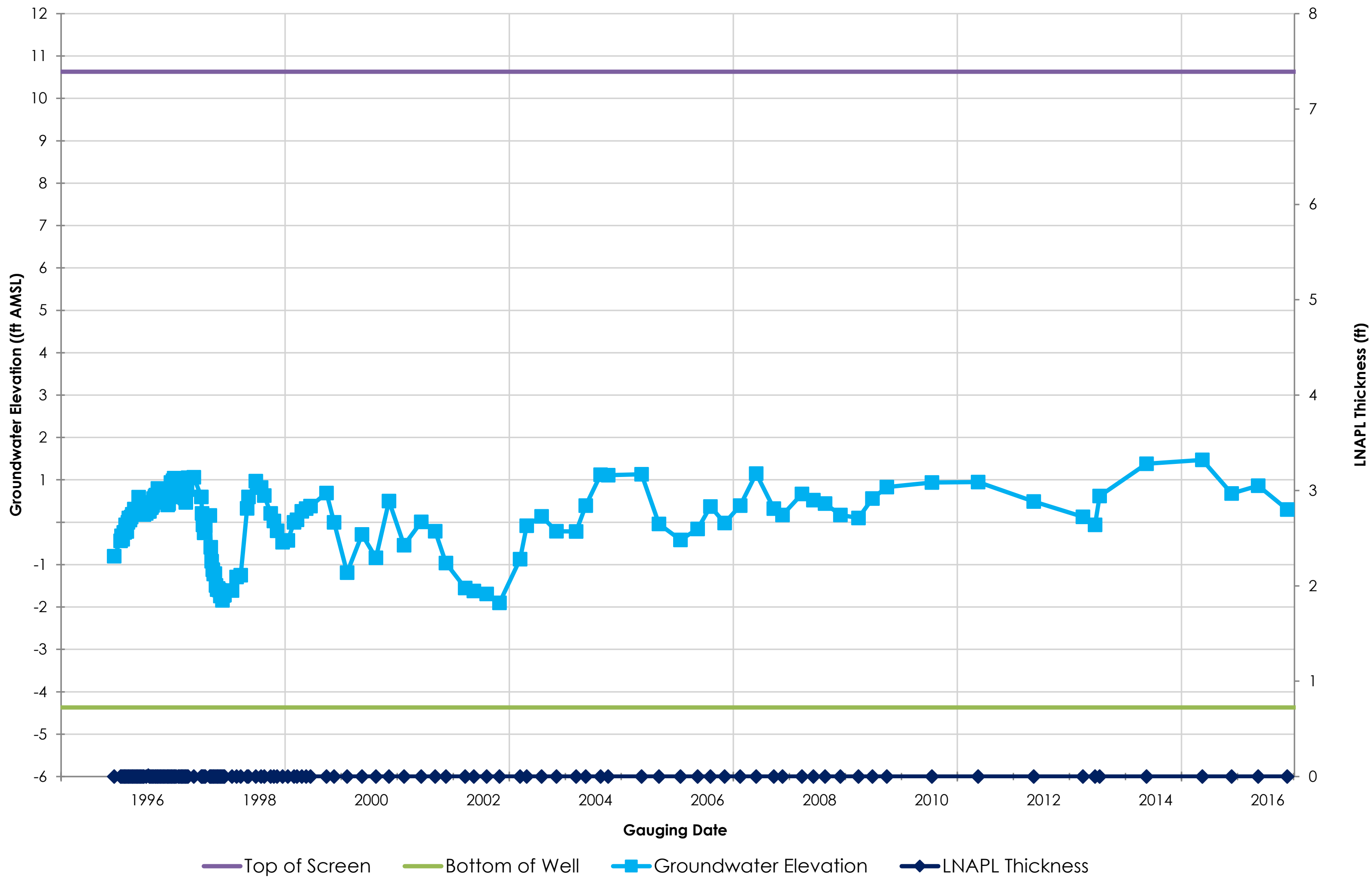
Stantec

Figure/Well No.

S-97

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

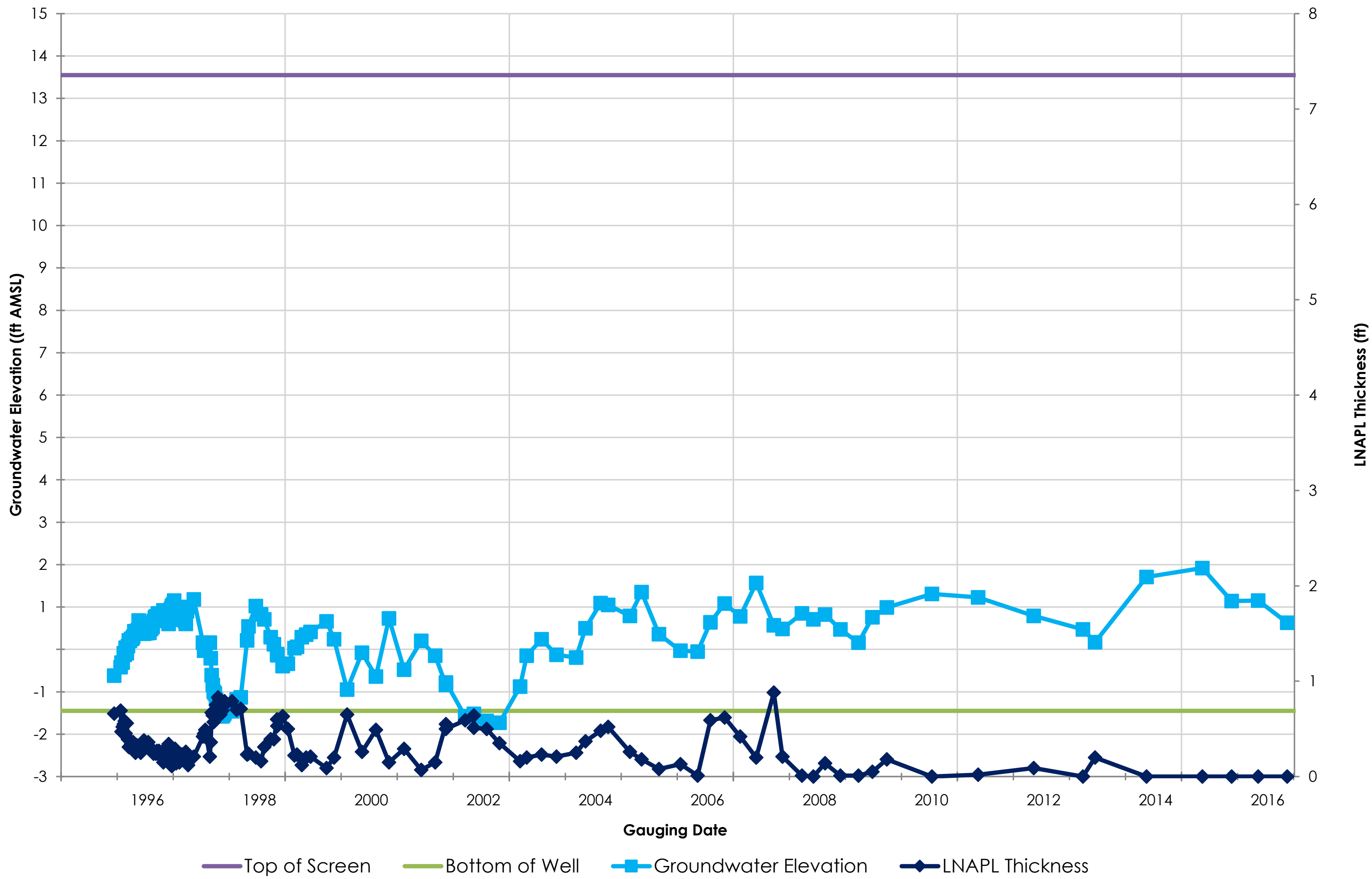
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-102

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

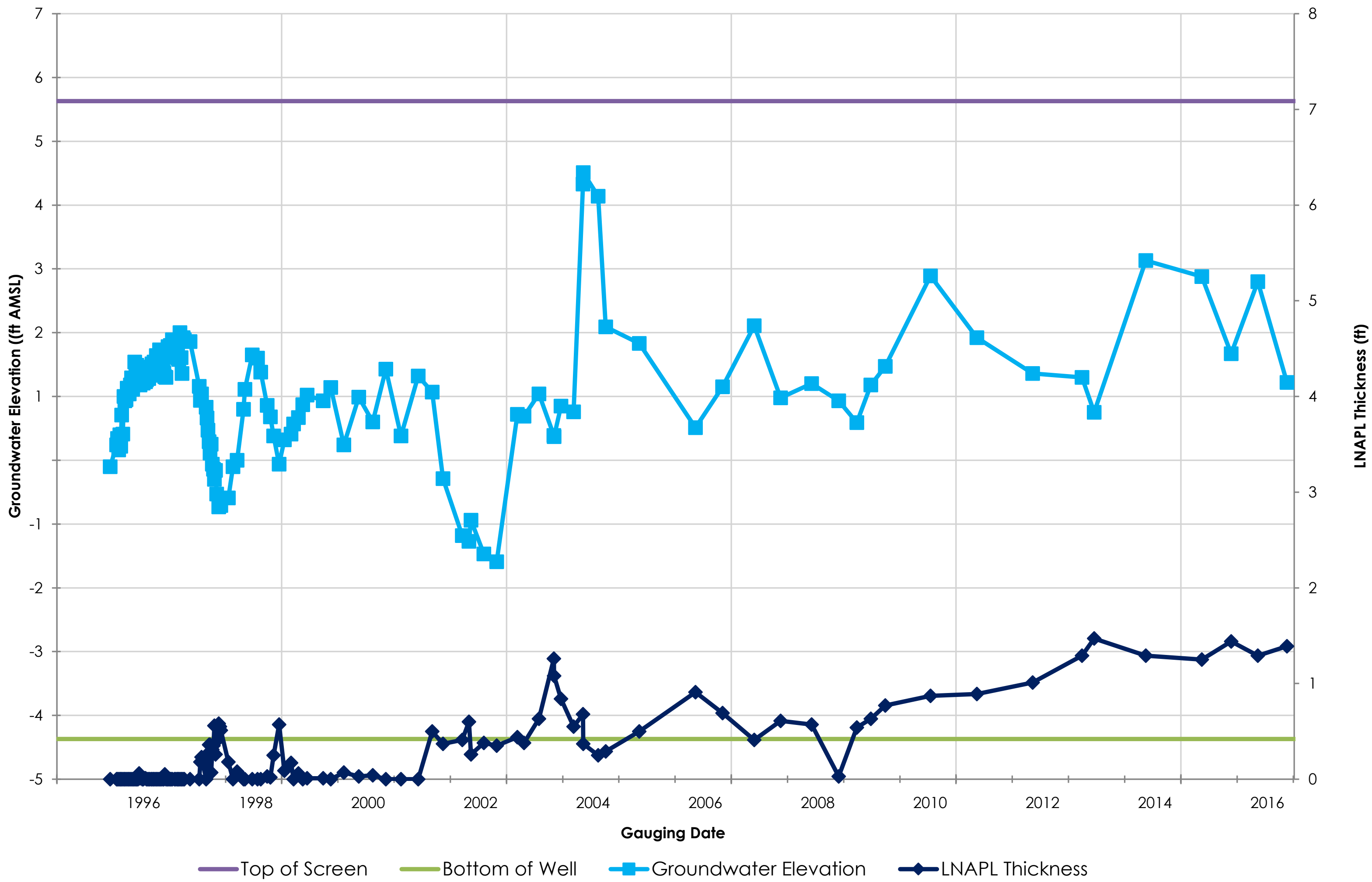
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-103

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

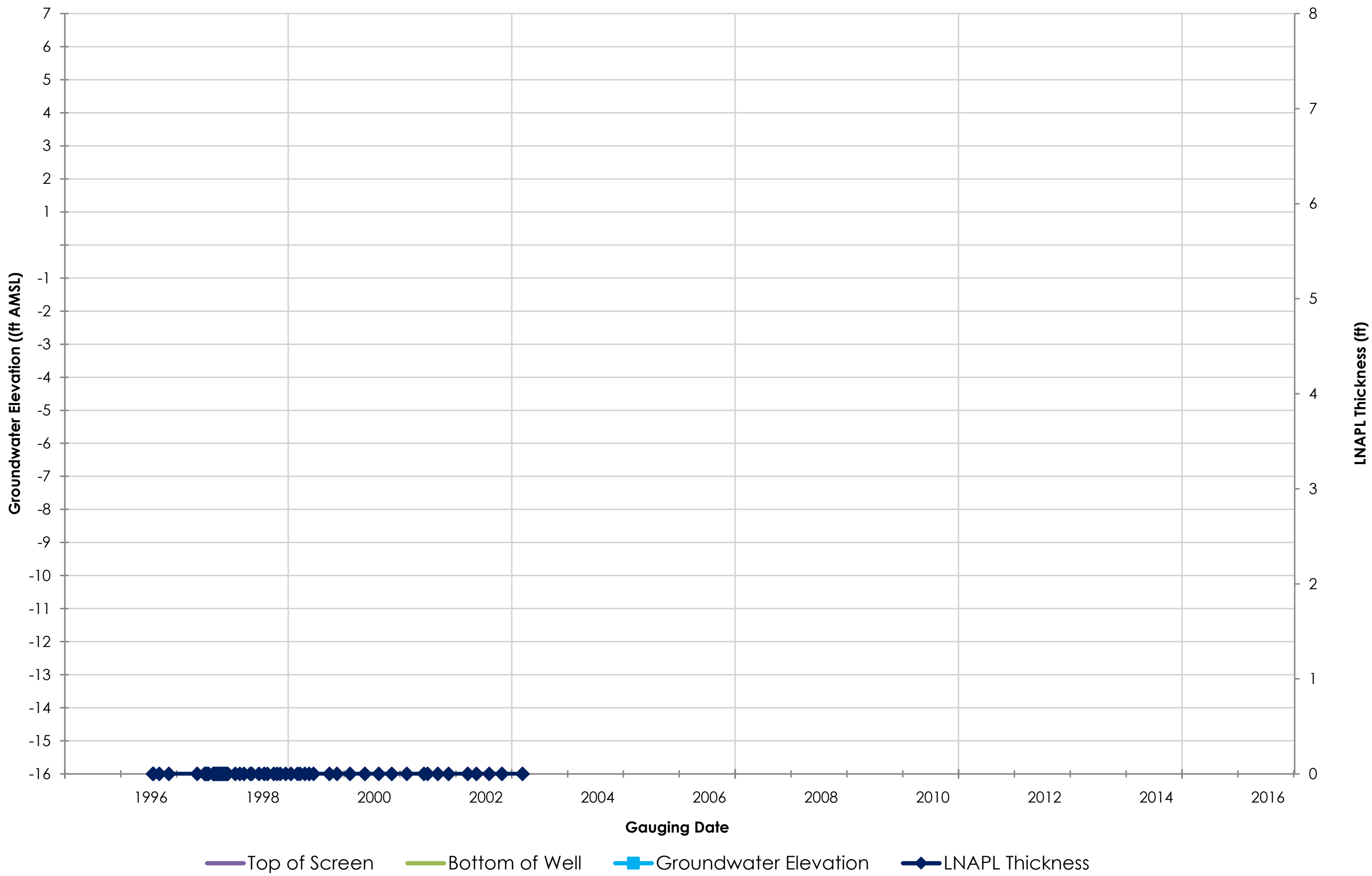
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-104

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

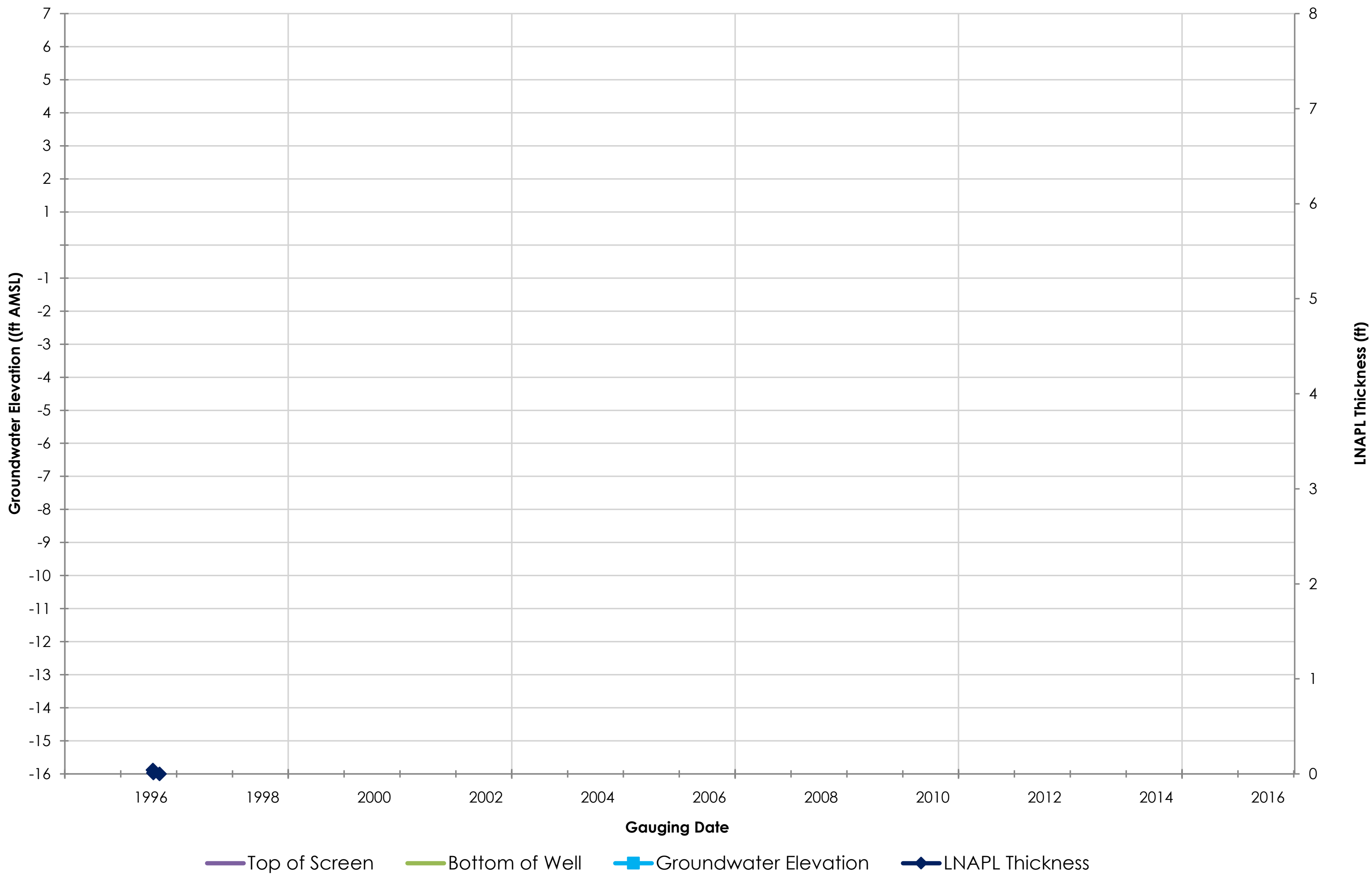
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-111

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

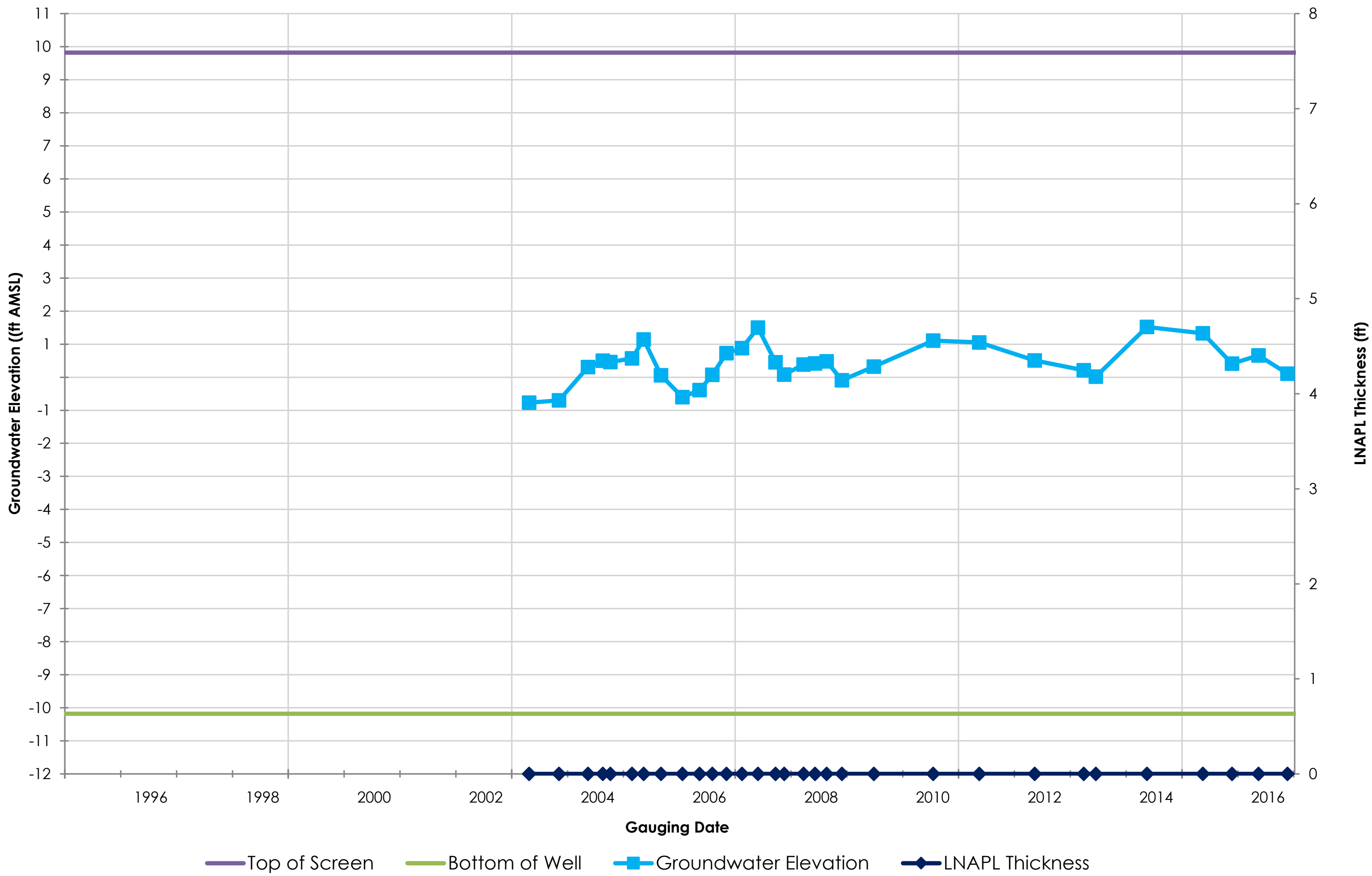
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-115

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

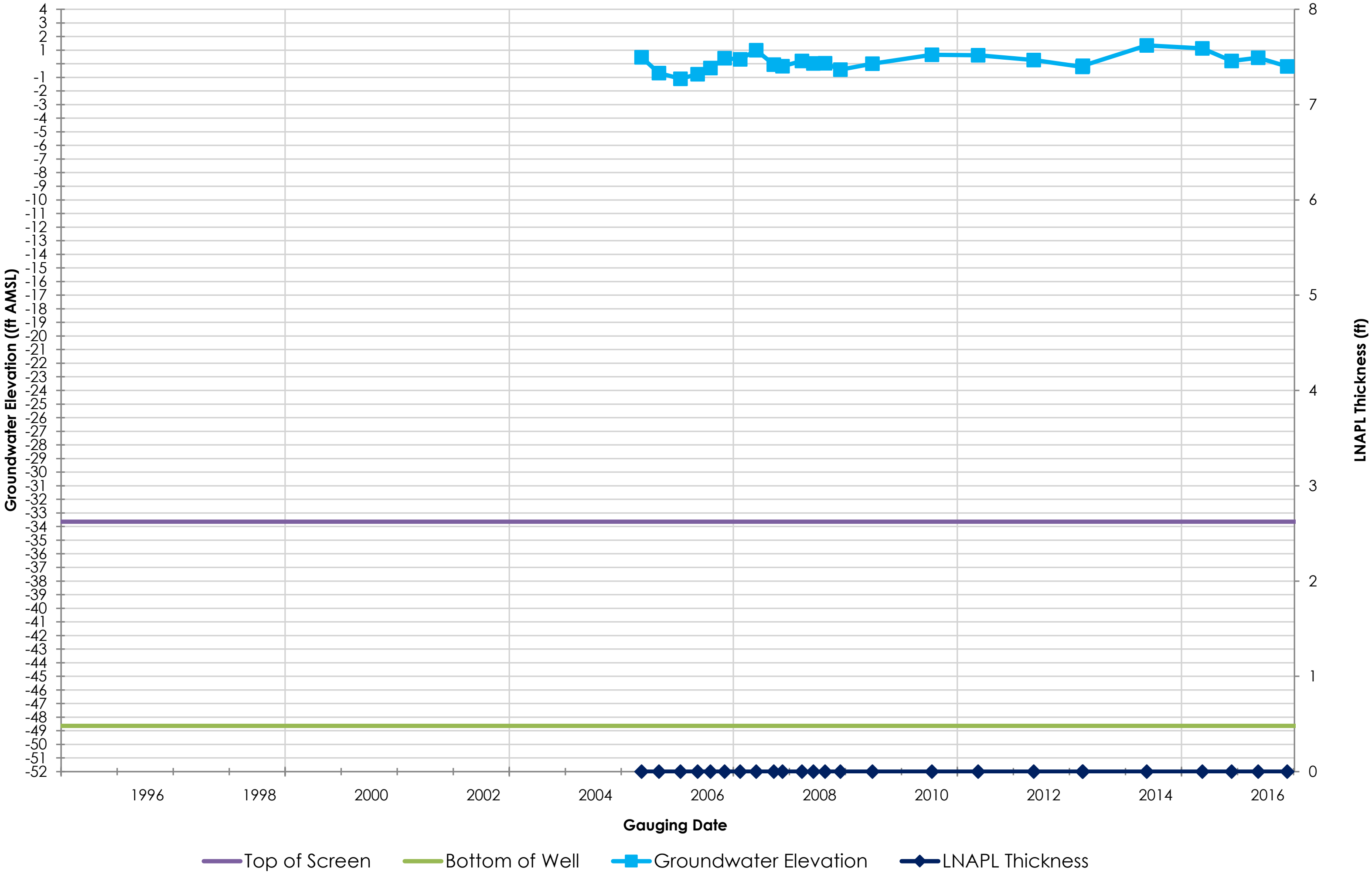
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-119

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

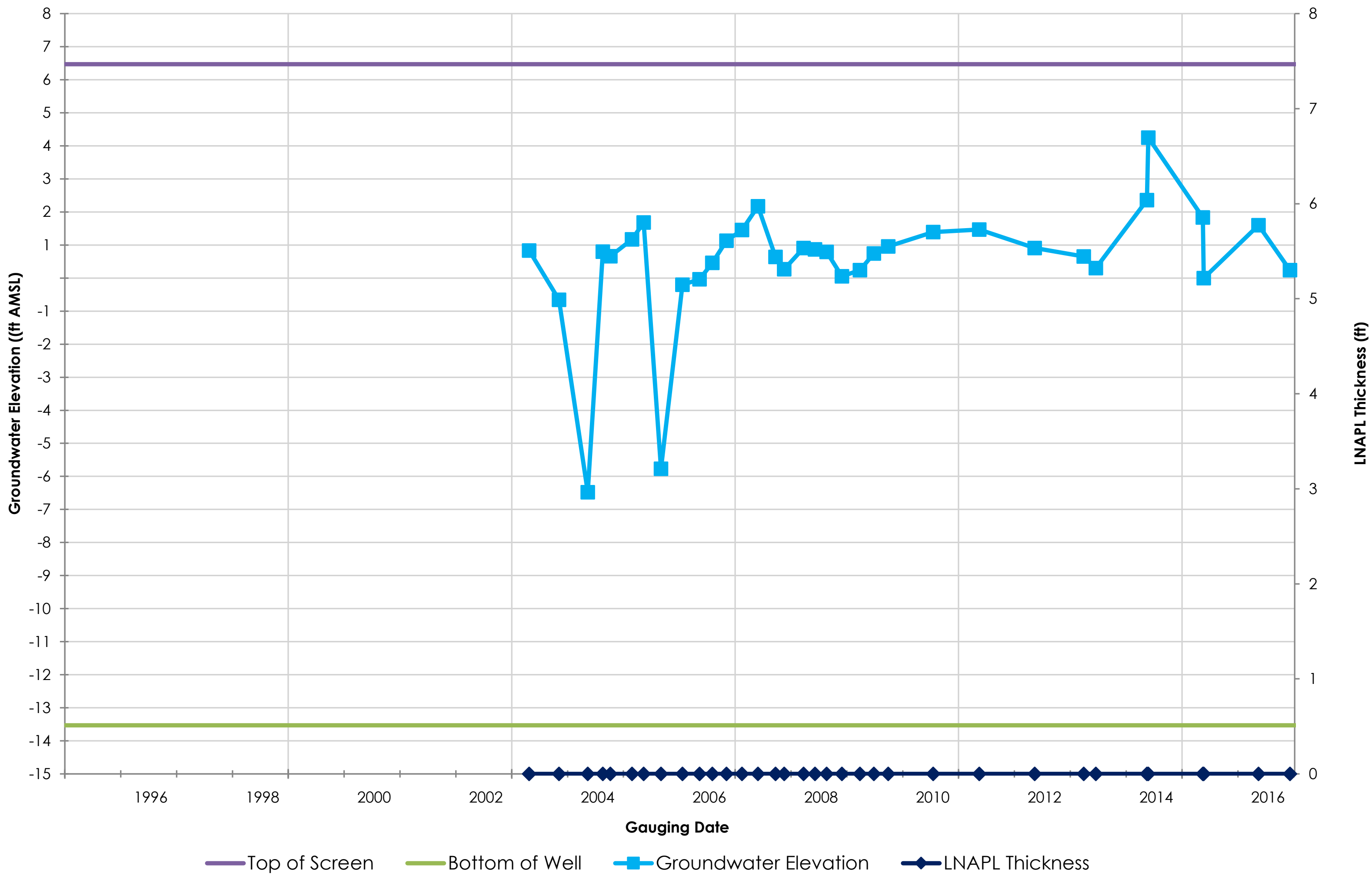
Stantec

Figure/Well No.

S-119D

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

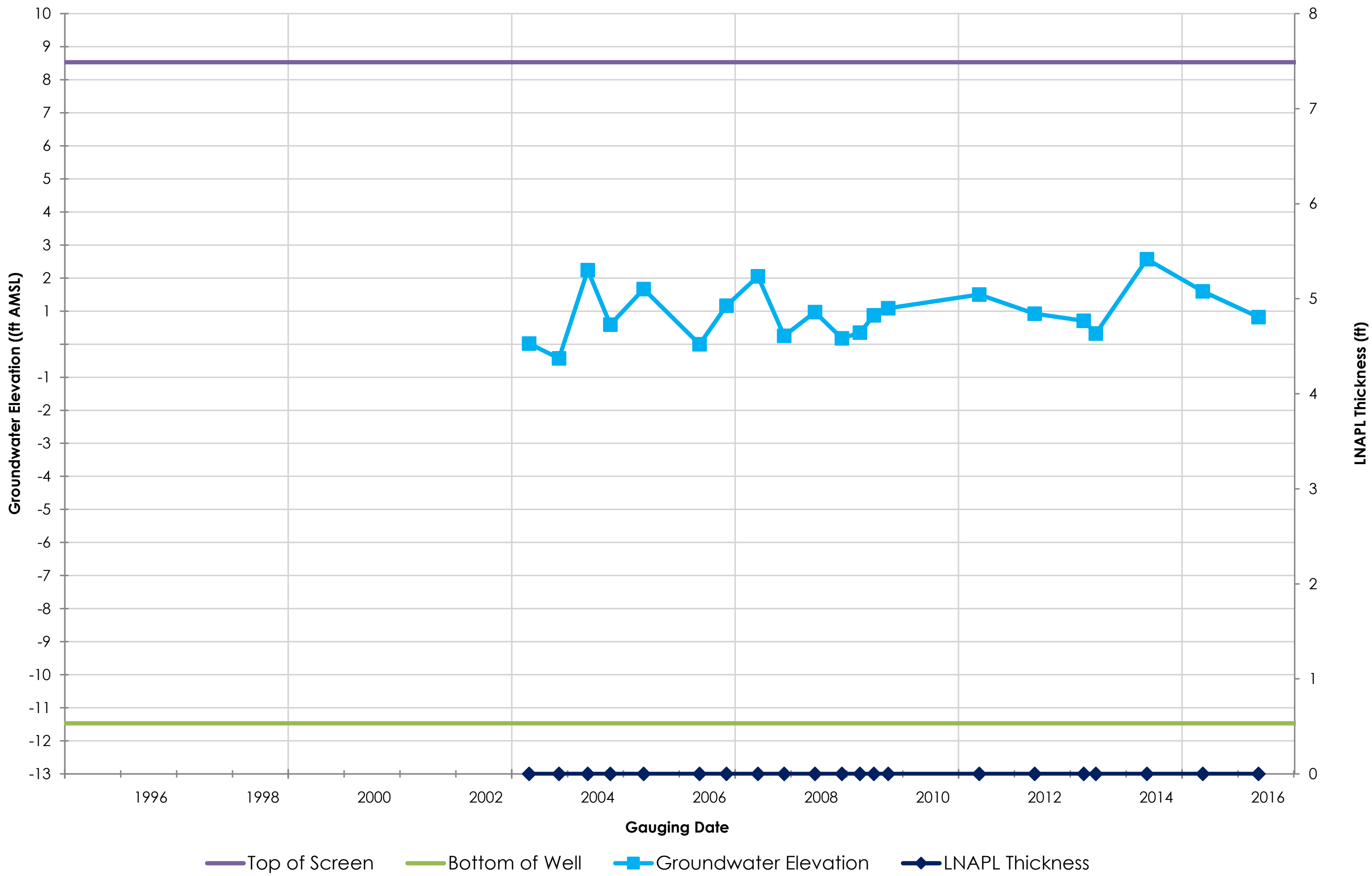
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-120

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

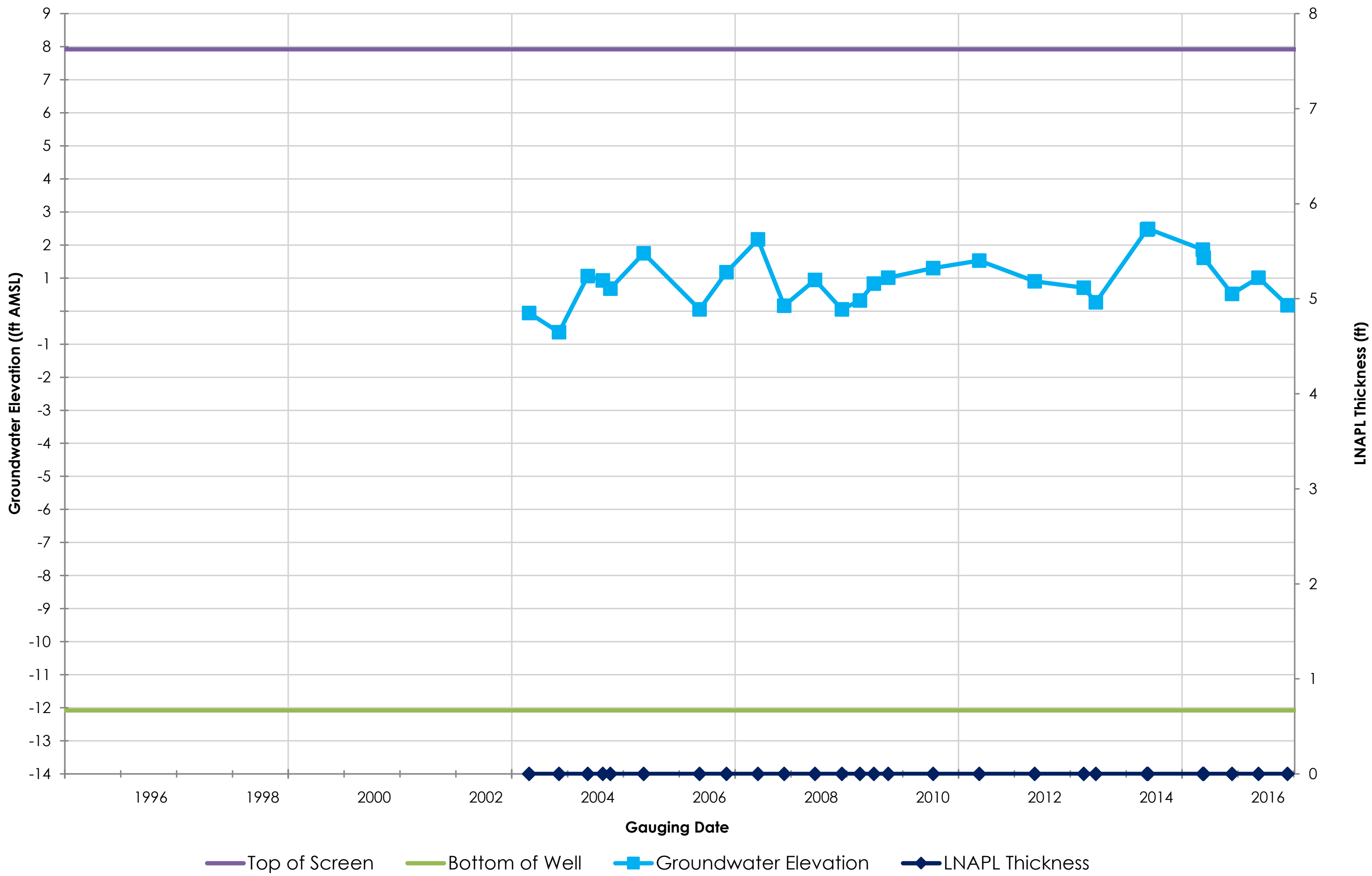
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-121

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

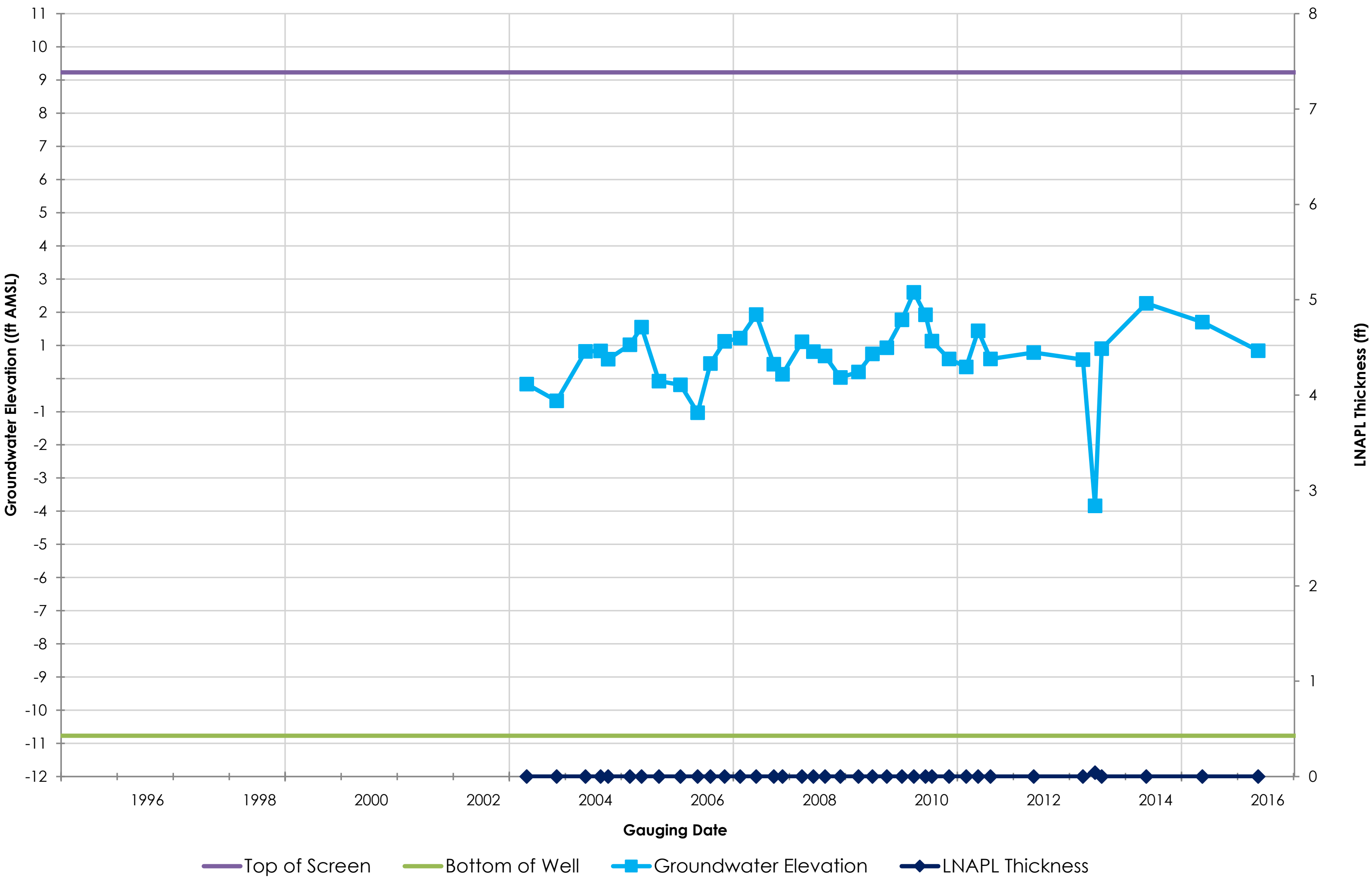
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-122

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

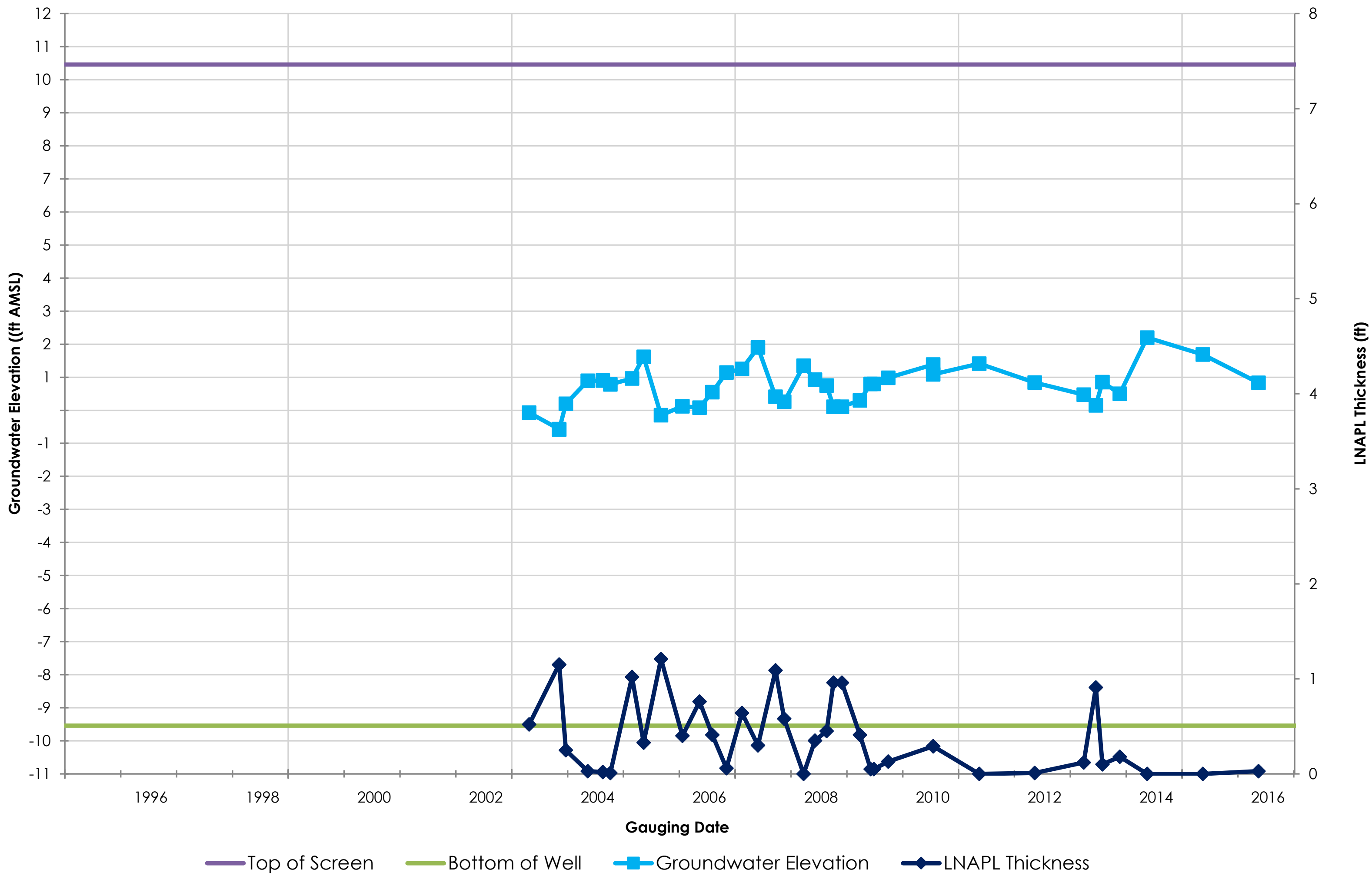
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-123

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

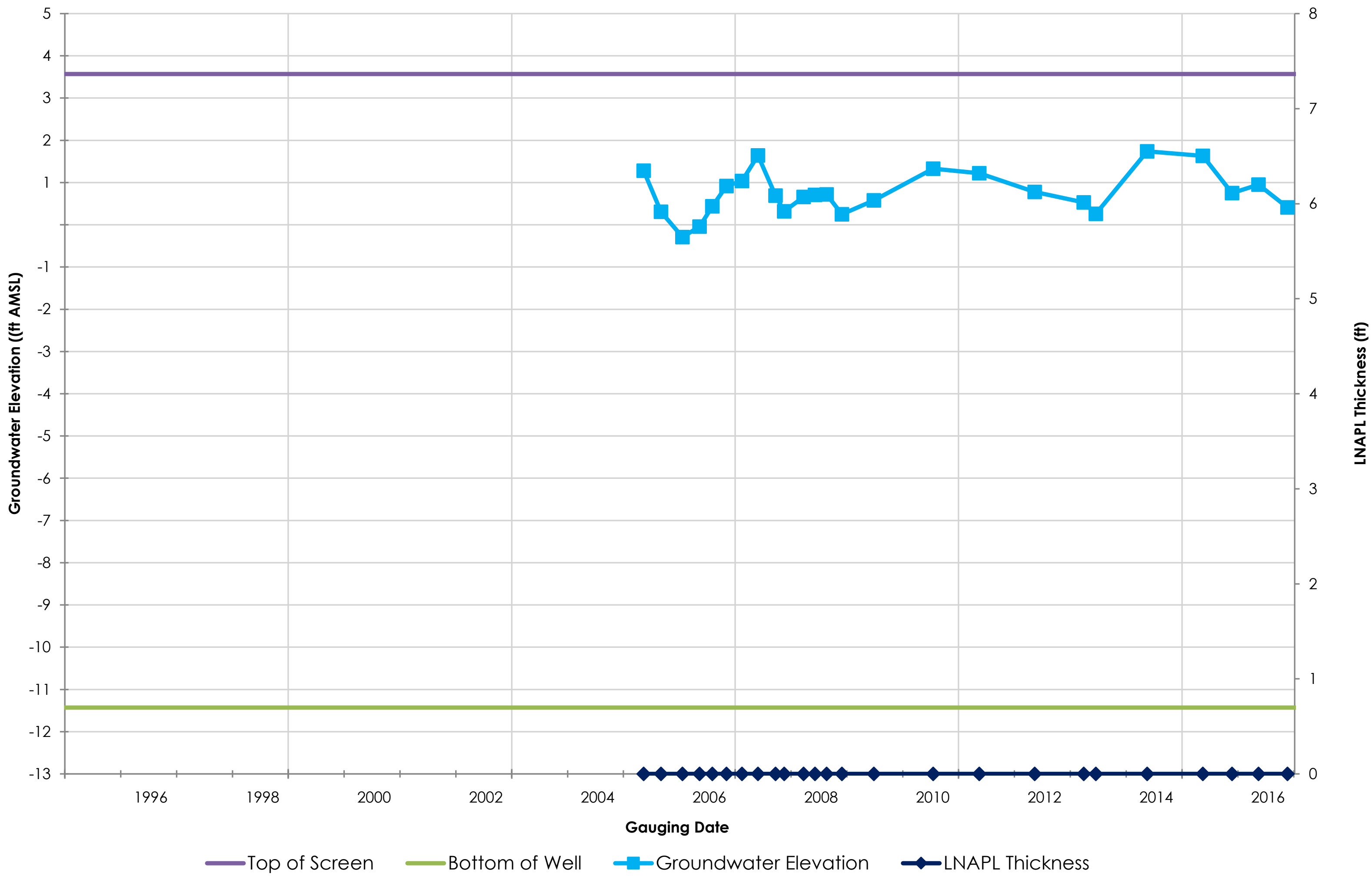
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-124

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

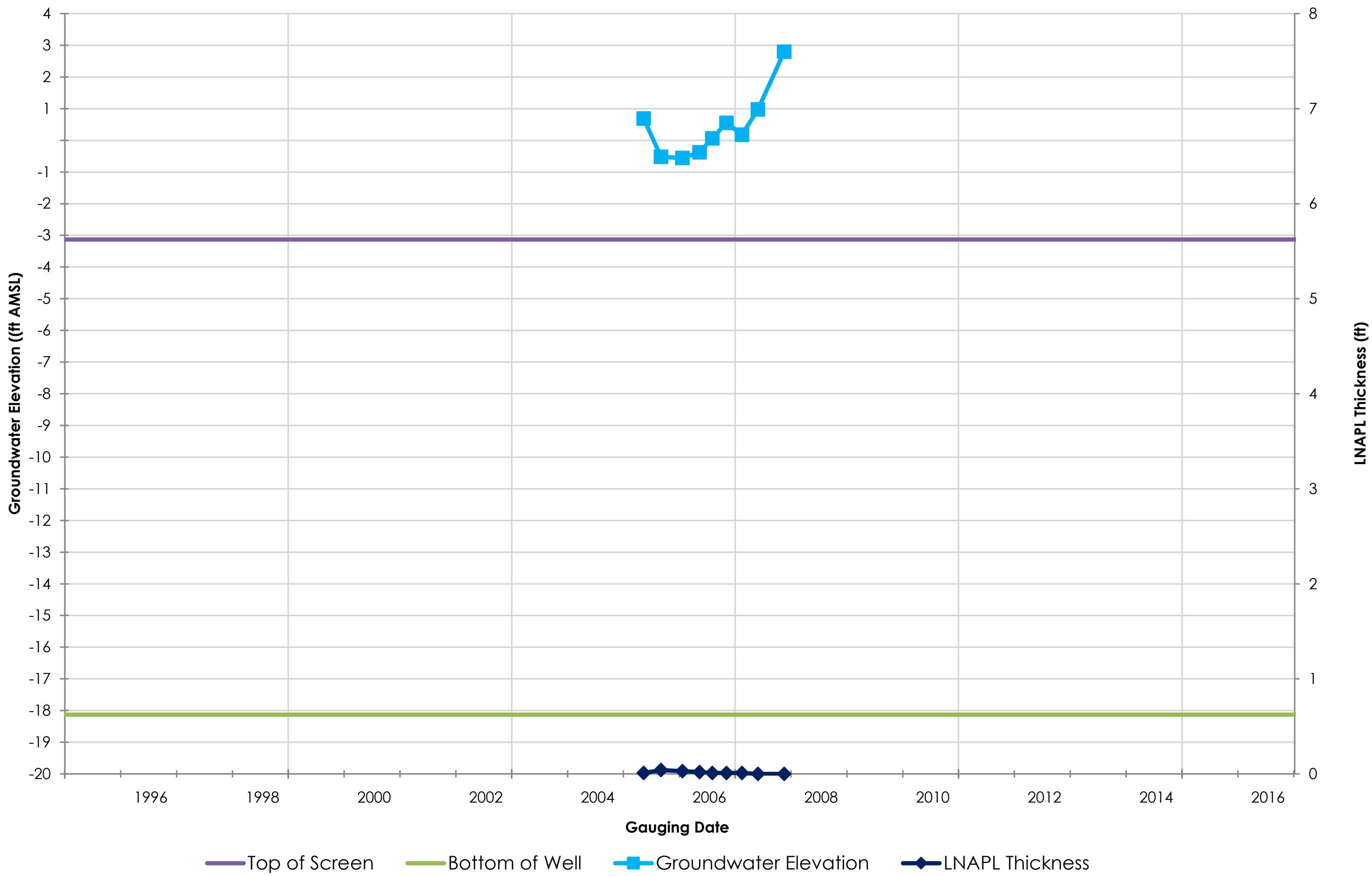
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-216

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

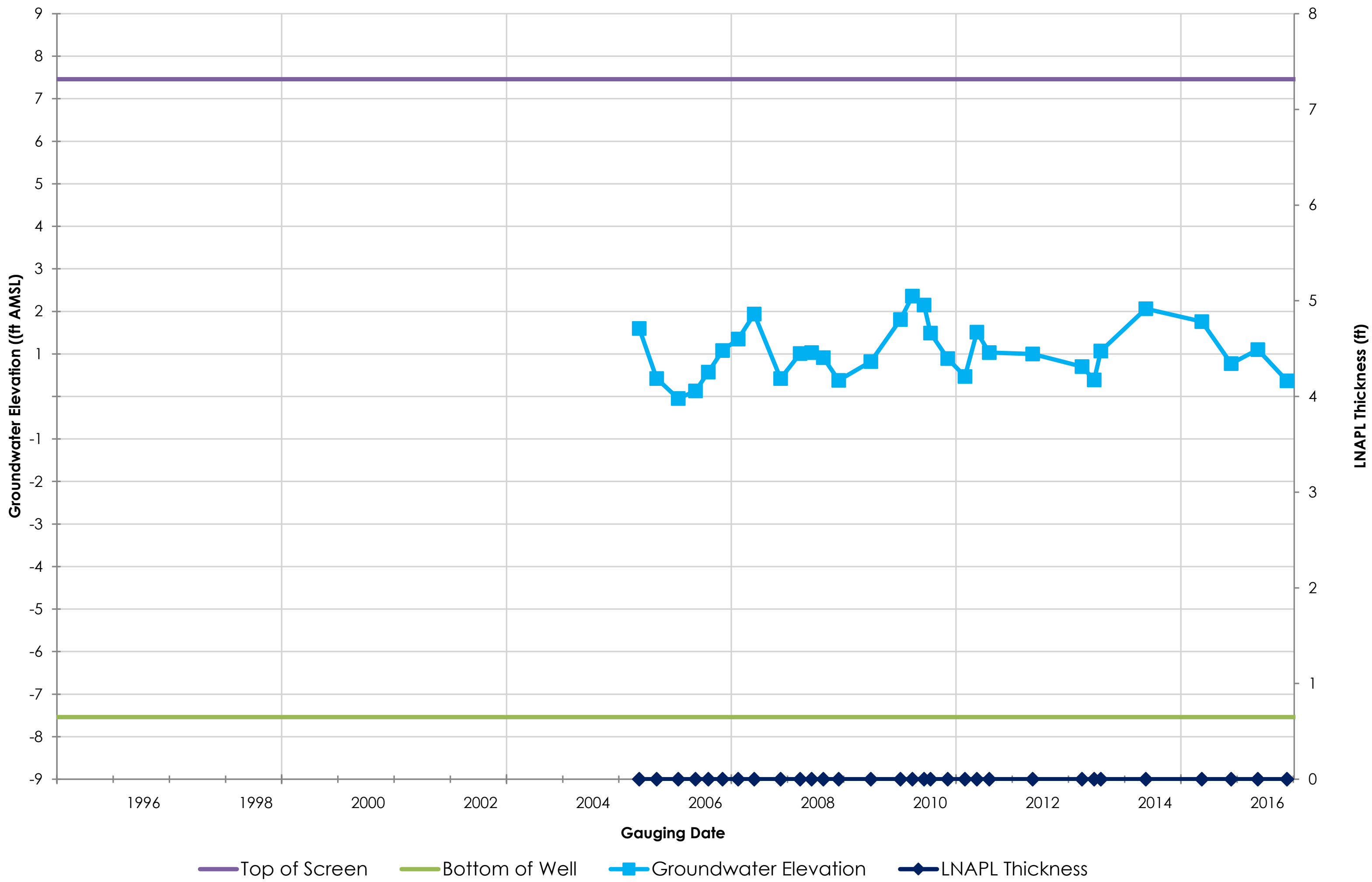
Stantec

Figure/Well No.

S-217

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

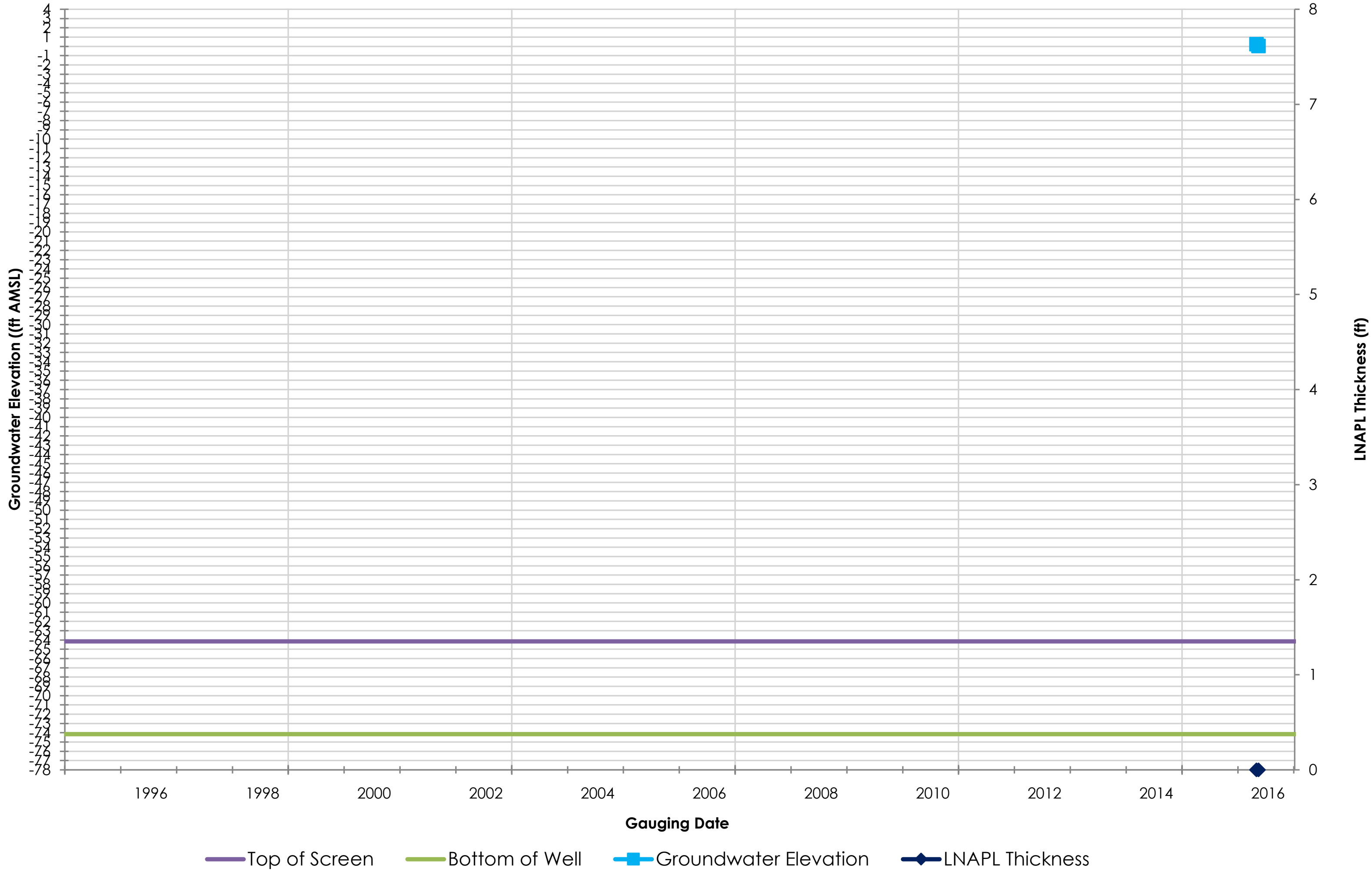
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-218

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

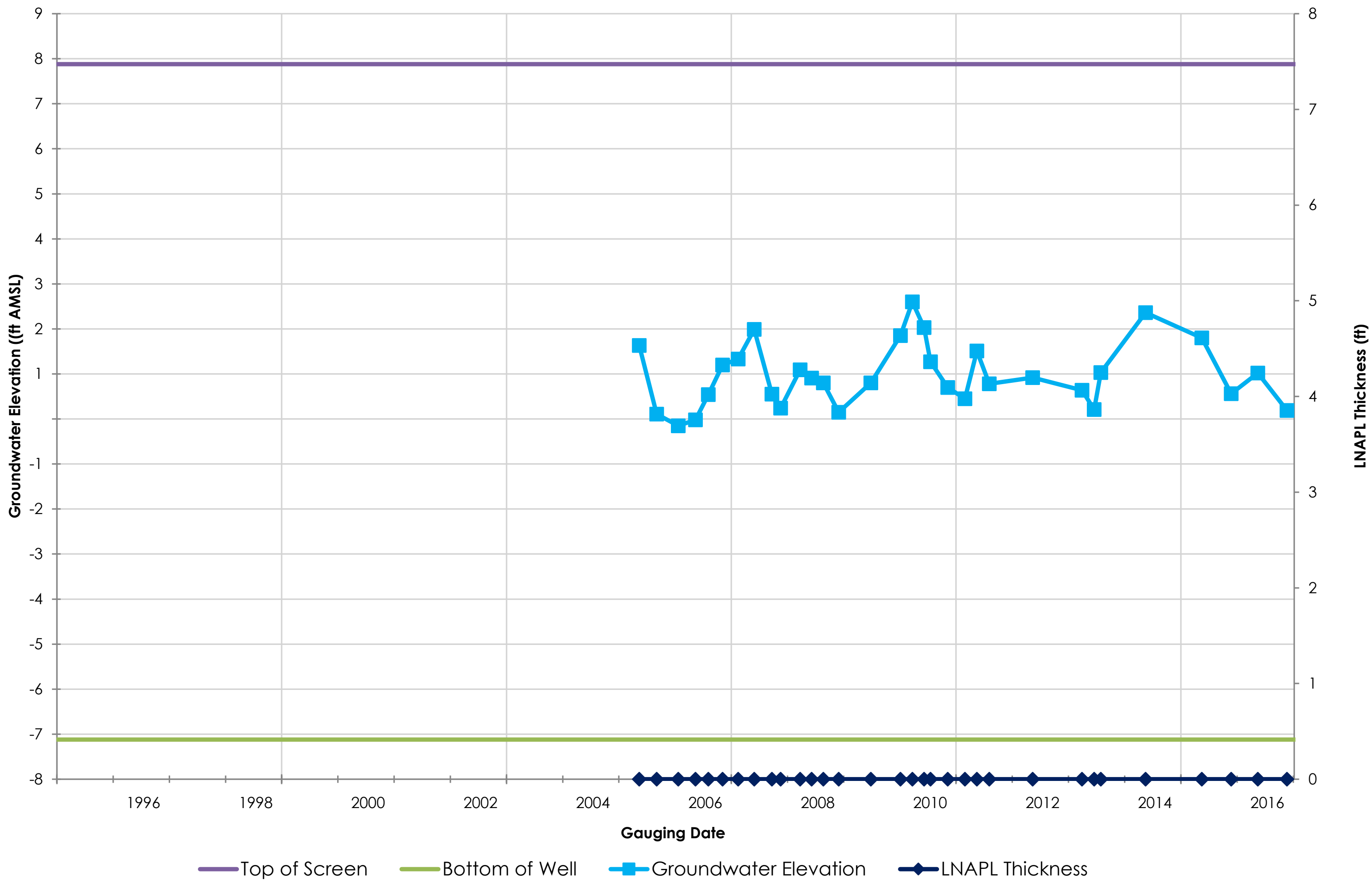
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-218D

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

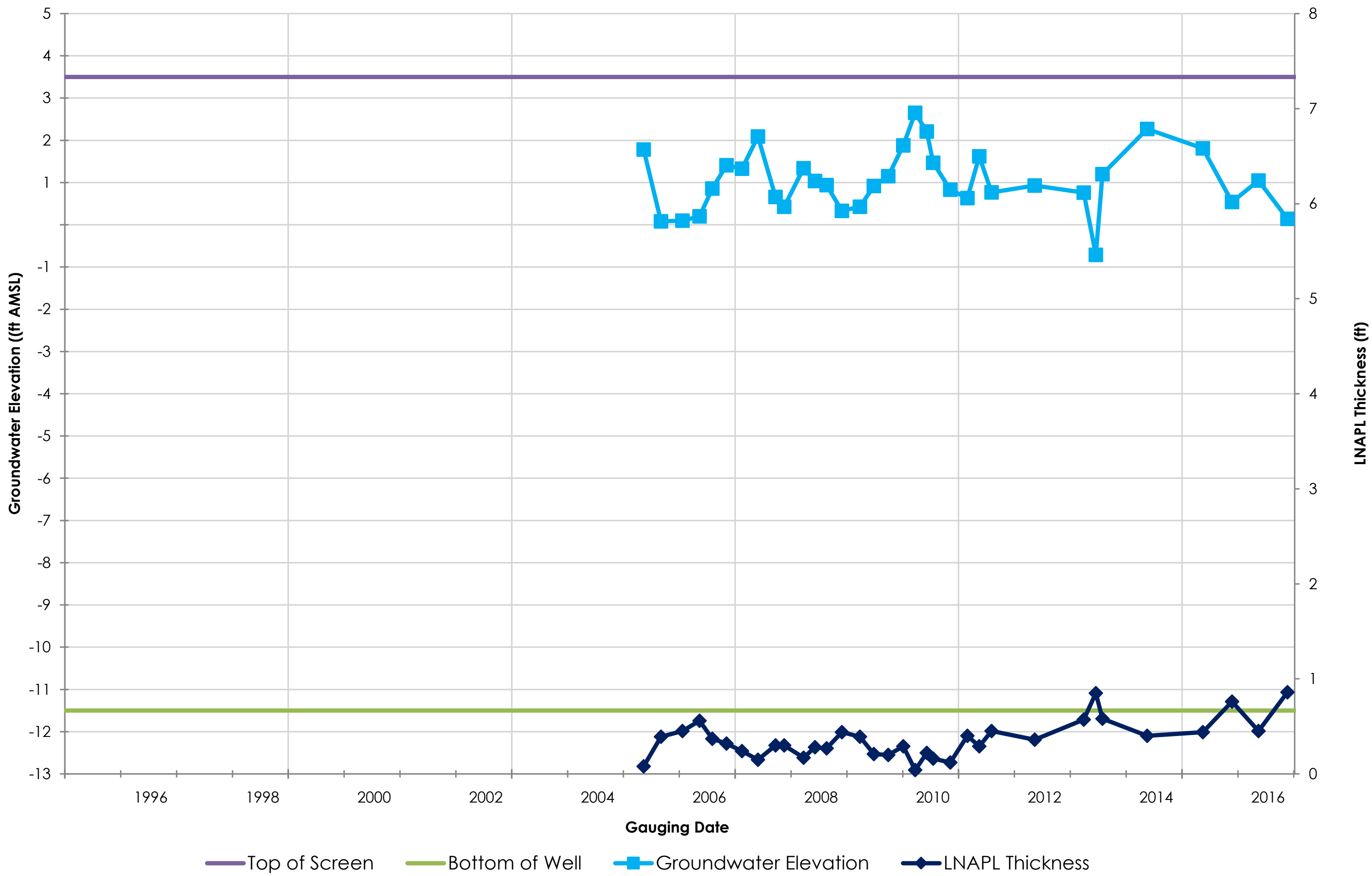
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-219

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

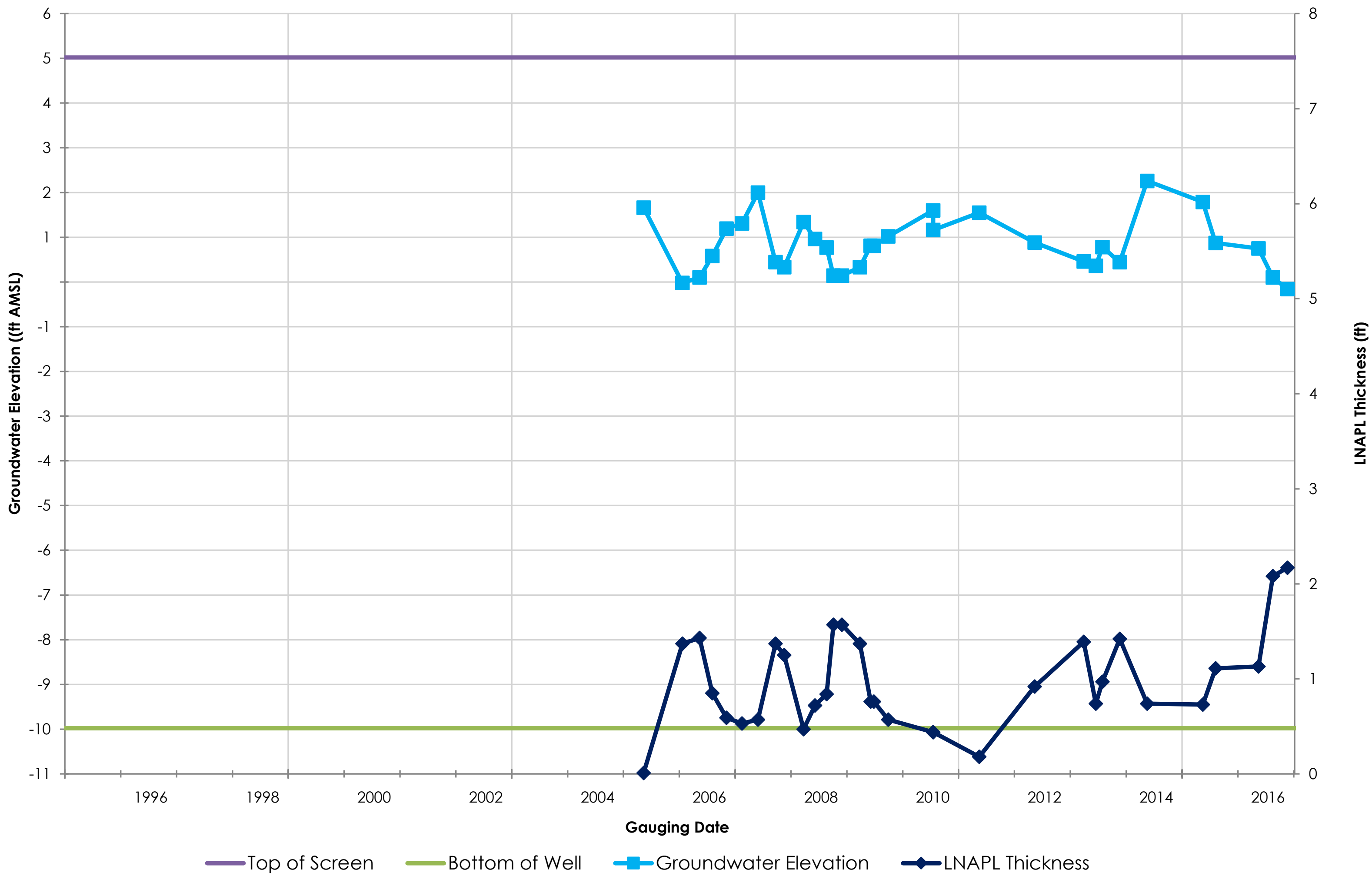
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-220

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

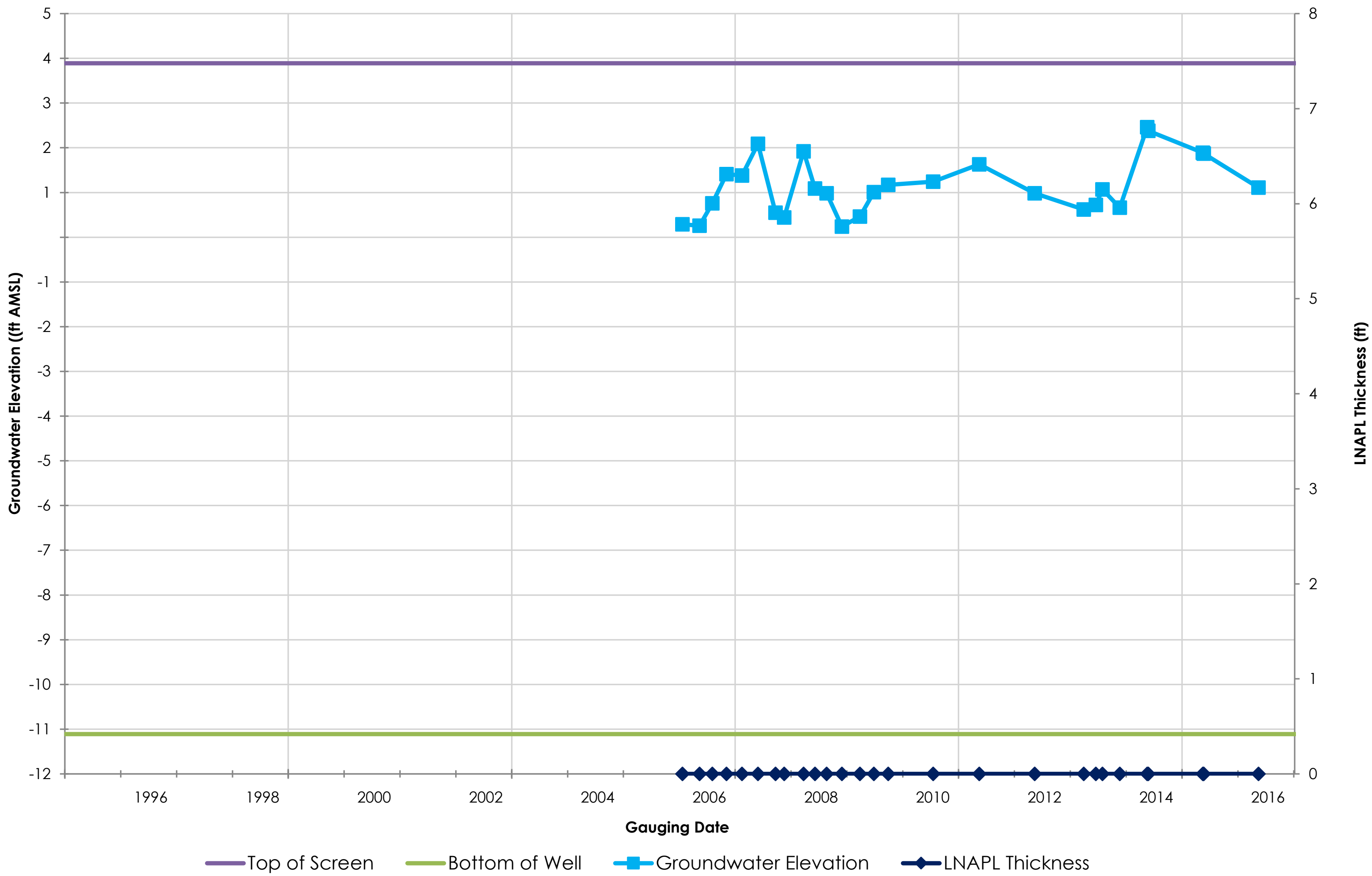
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-221

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

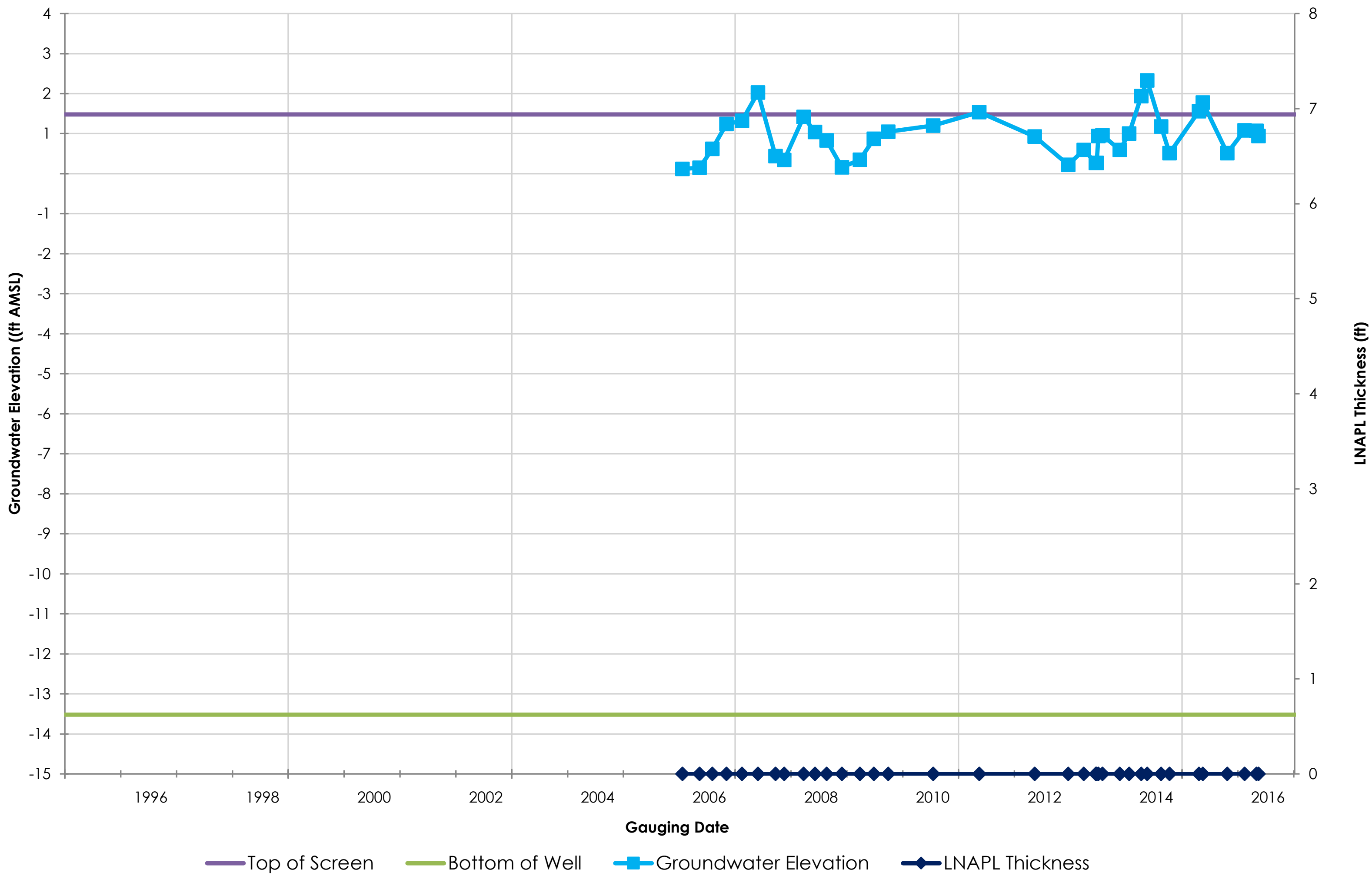
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-222

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

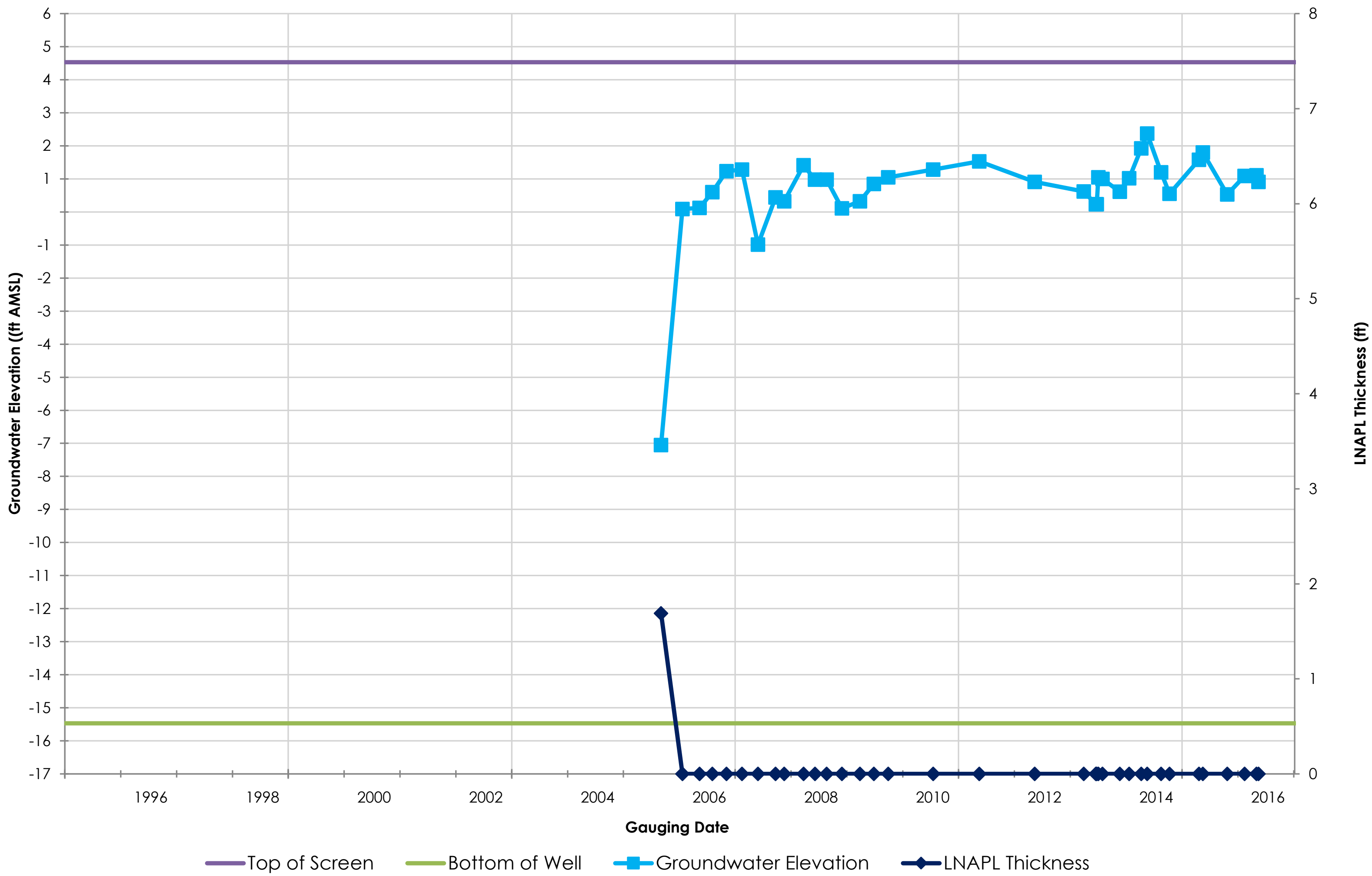
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-223

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

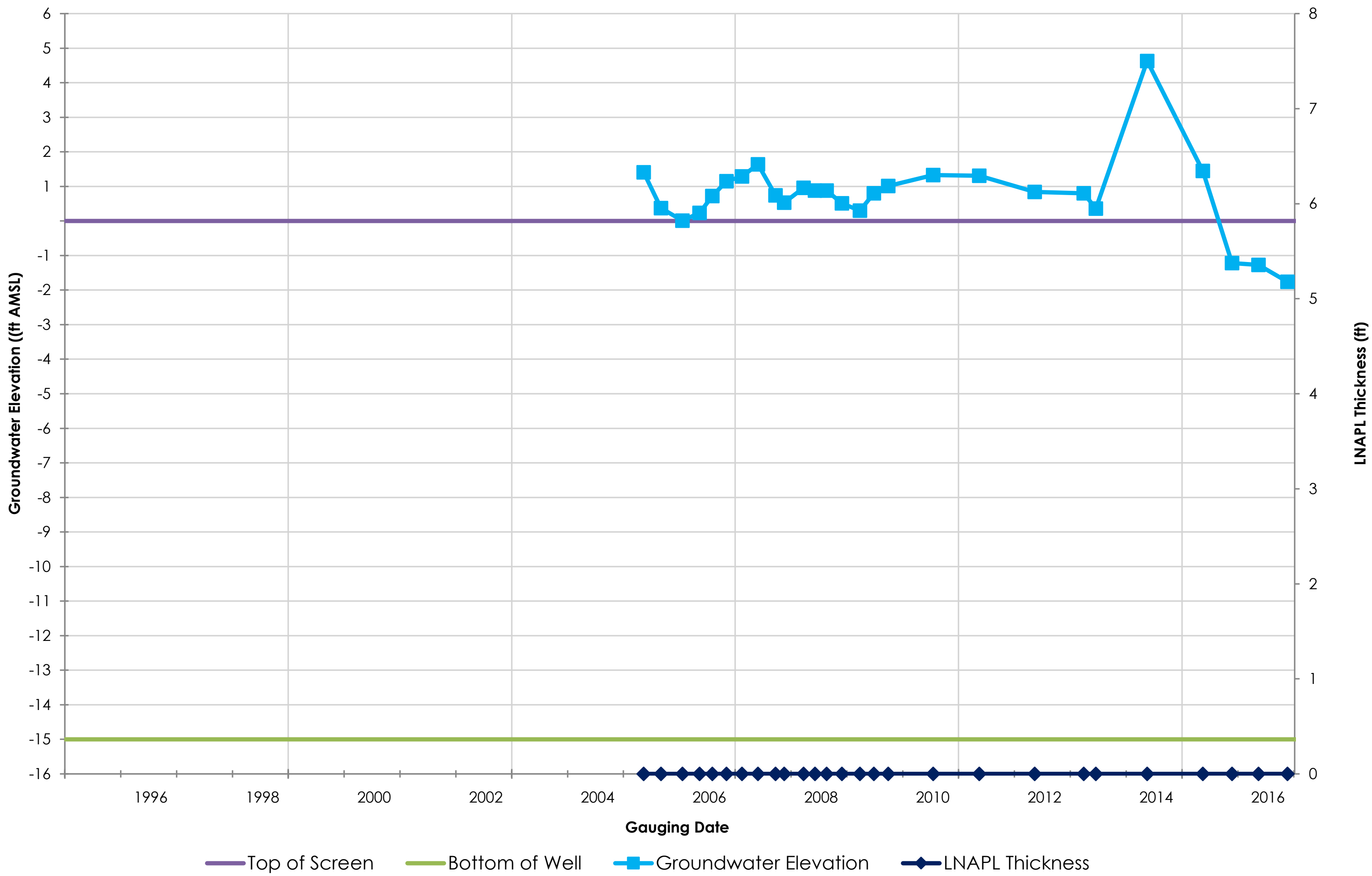
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-224

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

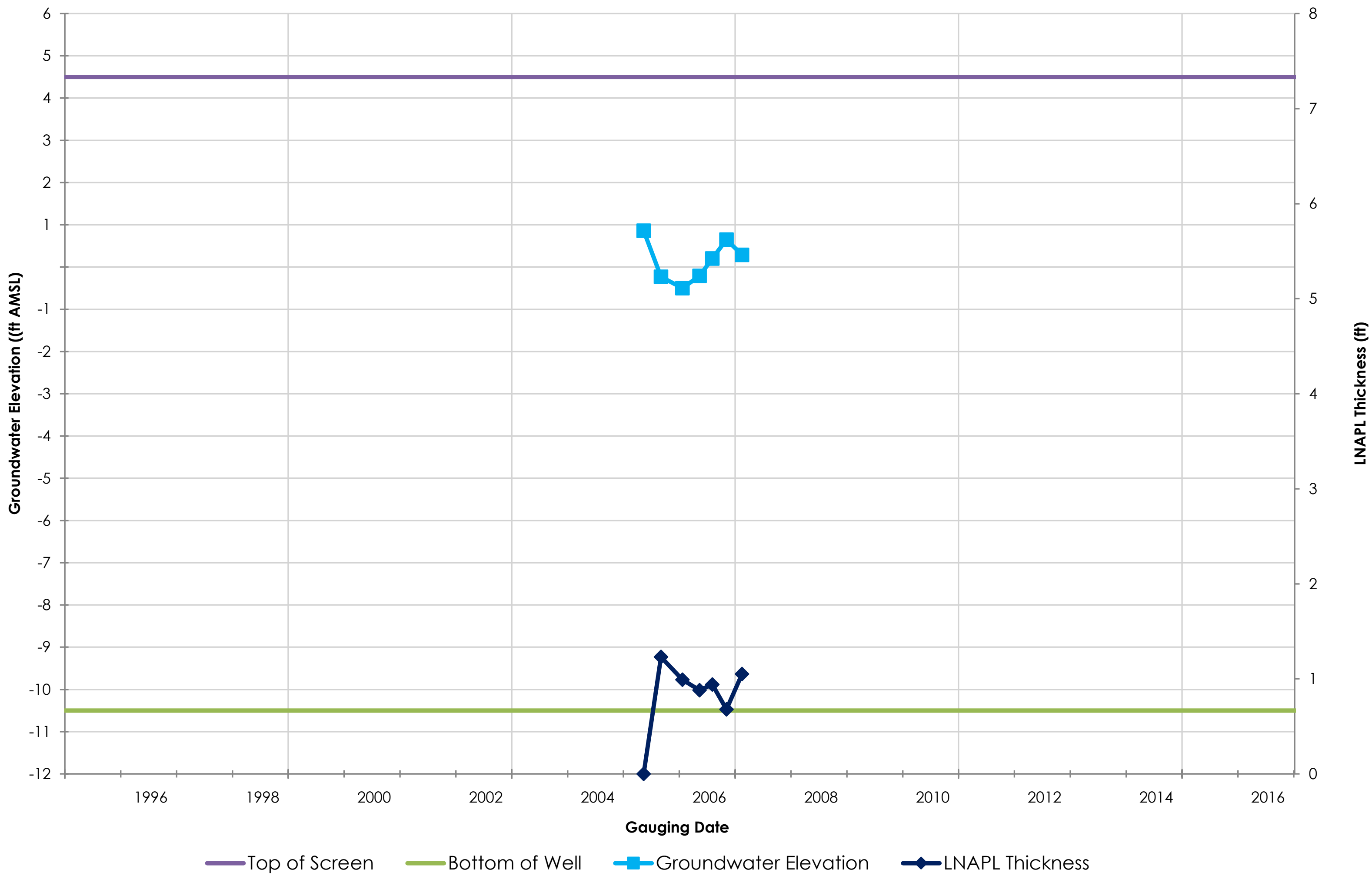
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-225

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

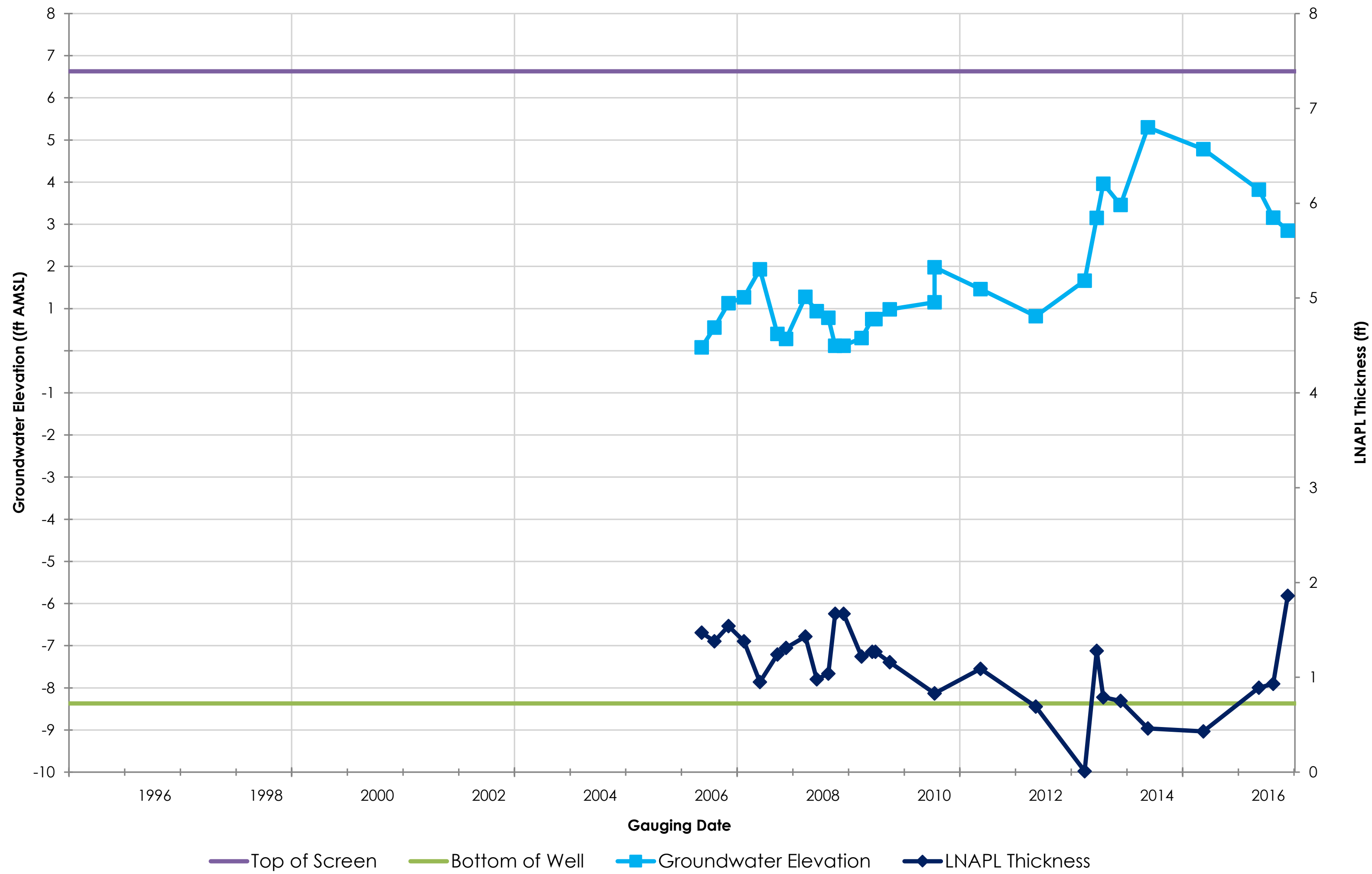
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-229

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

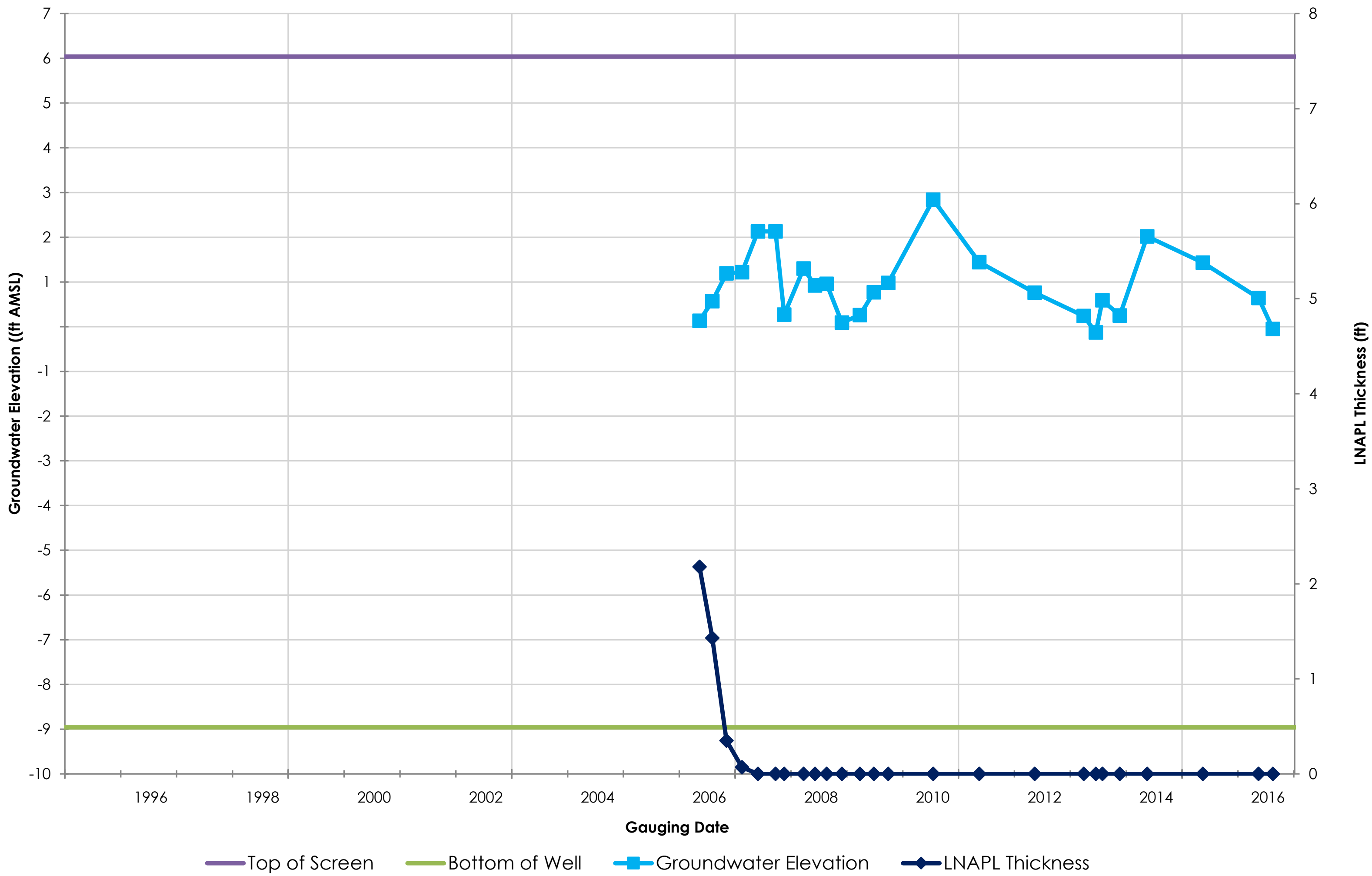
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-233

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

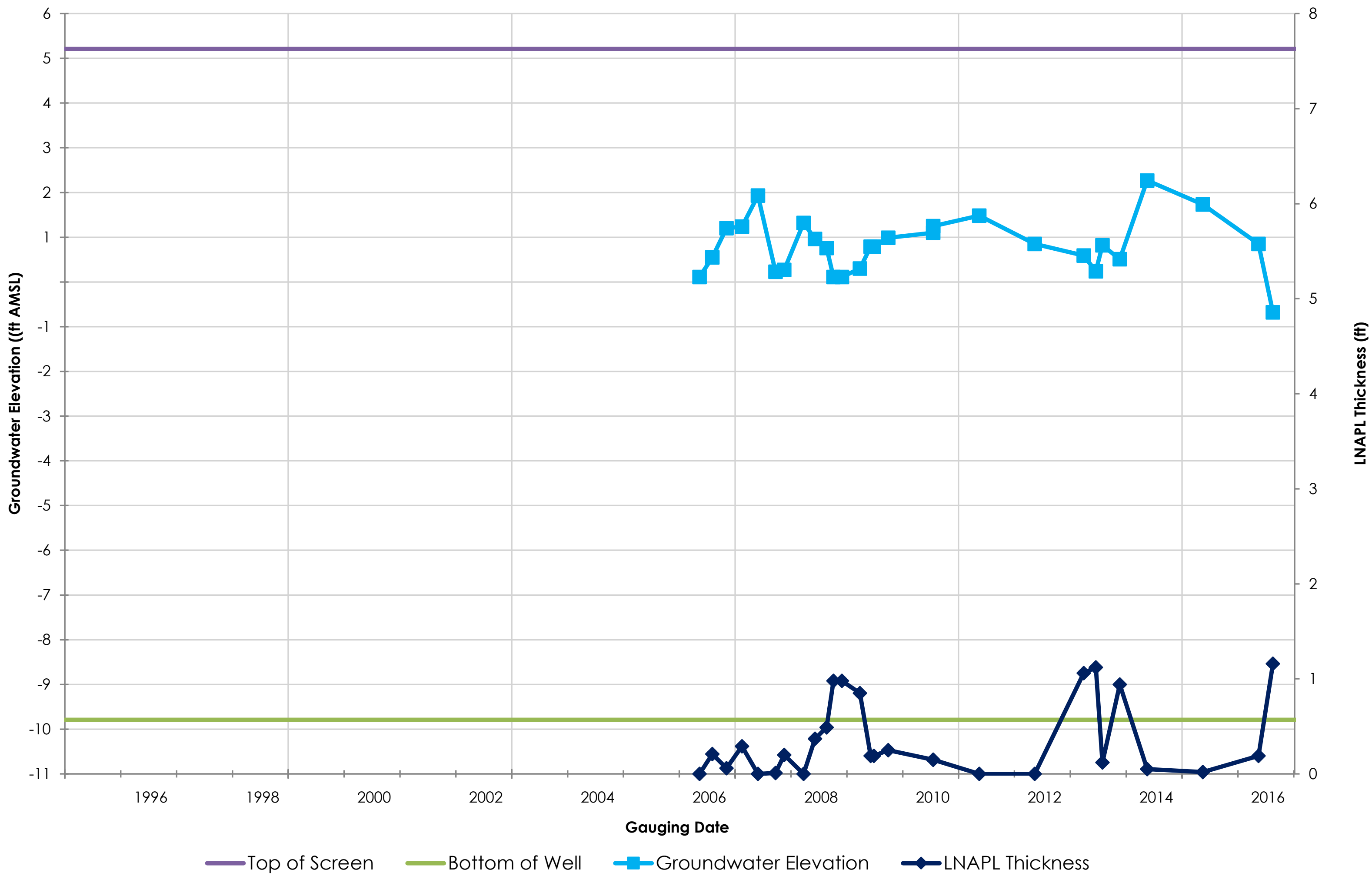
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-234

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

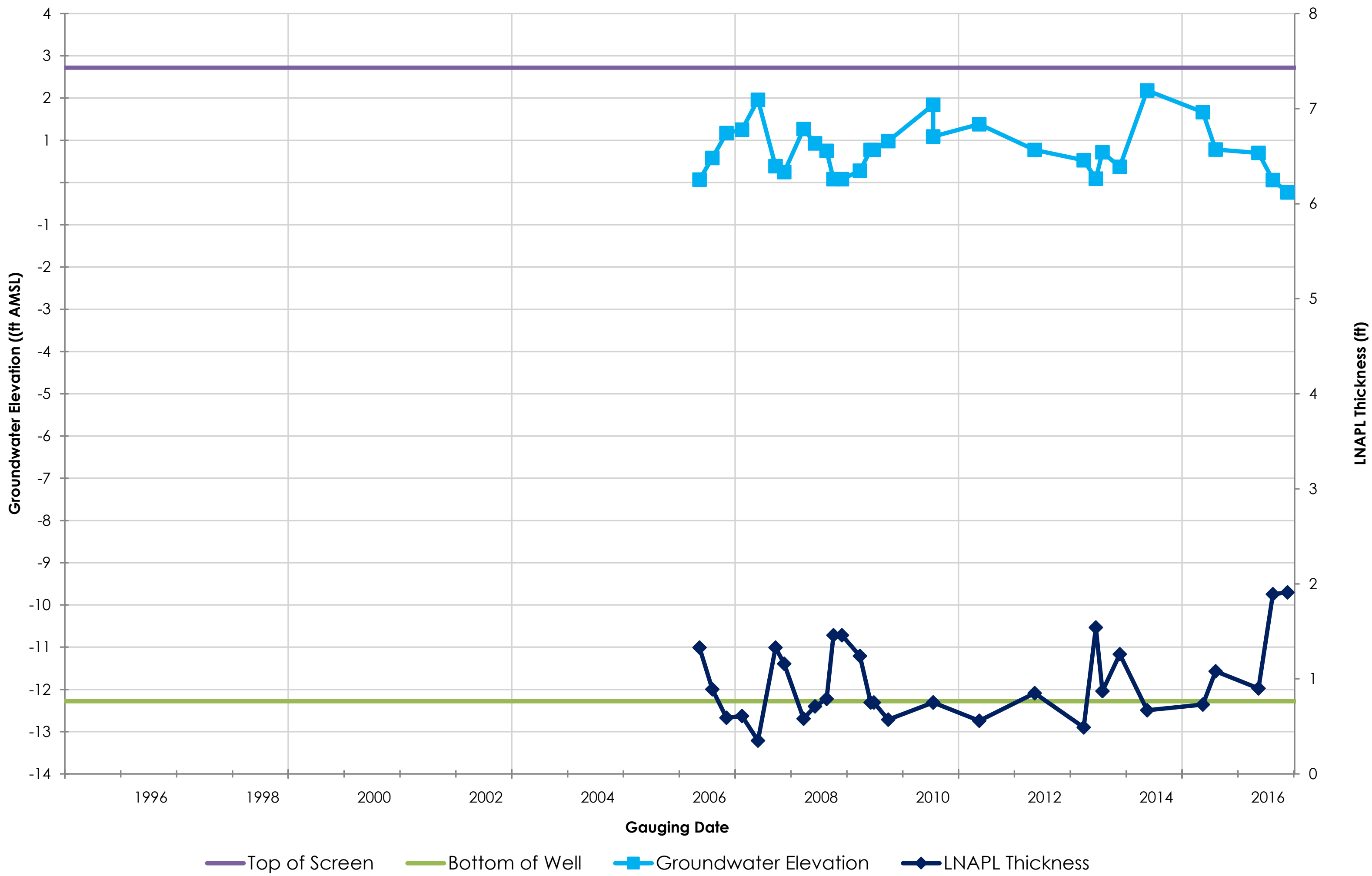
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-235

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

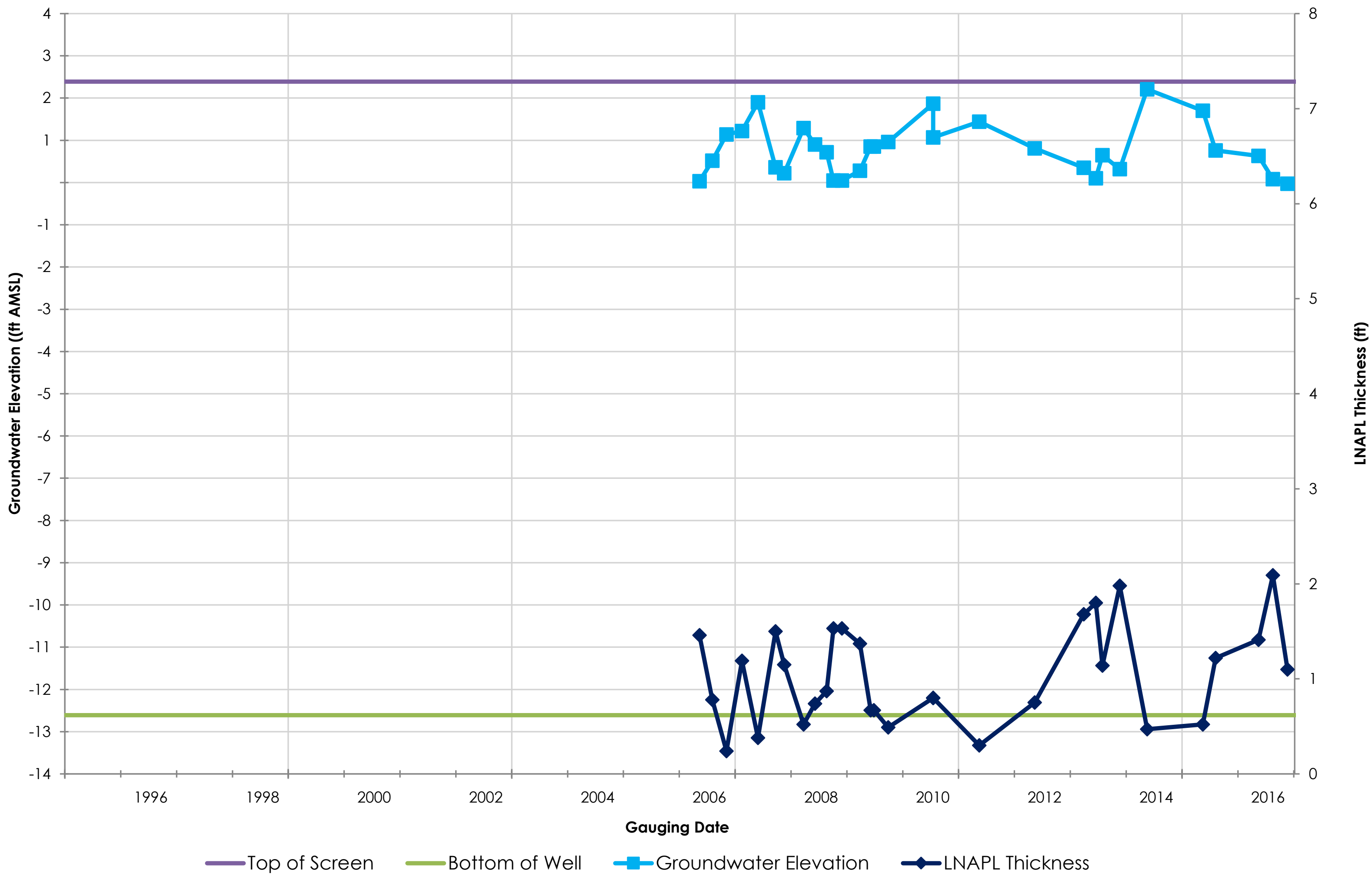
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-236

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

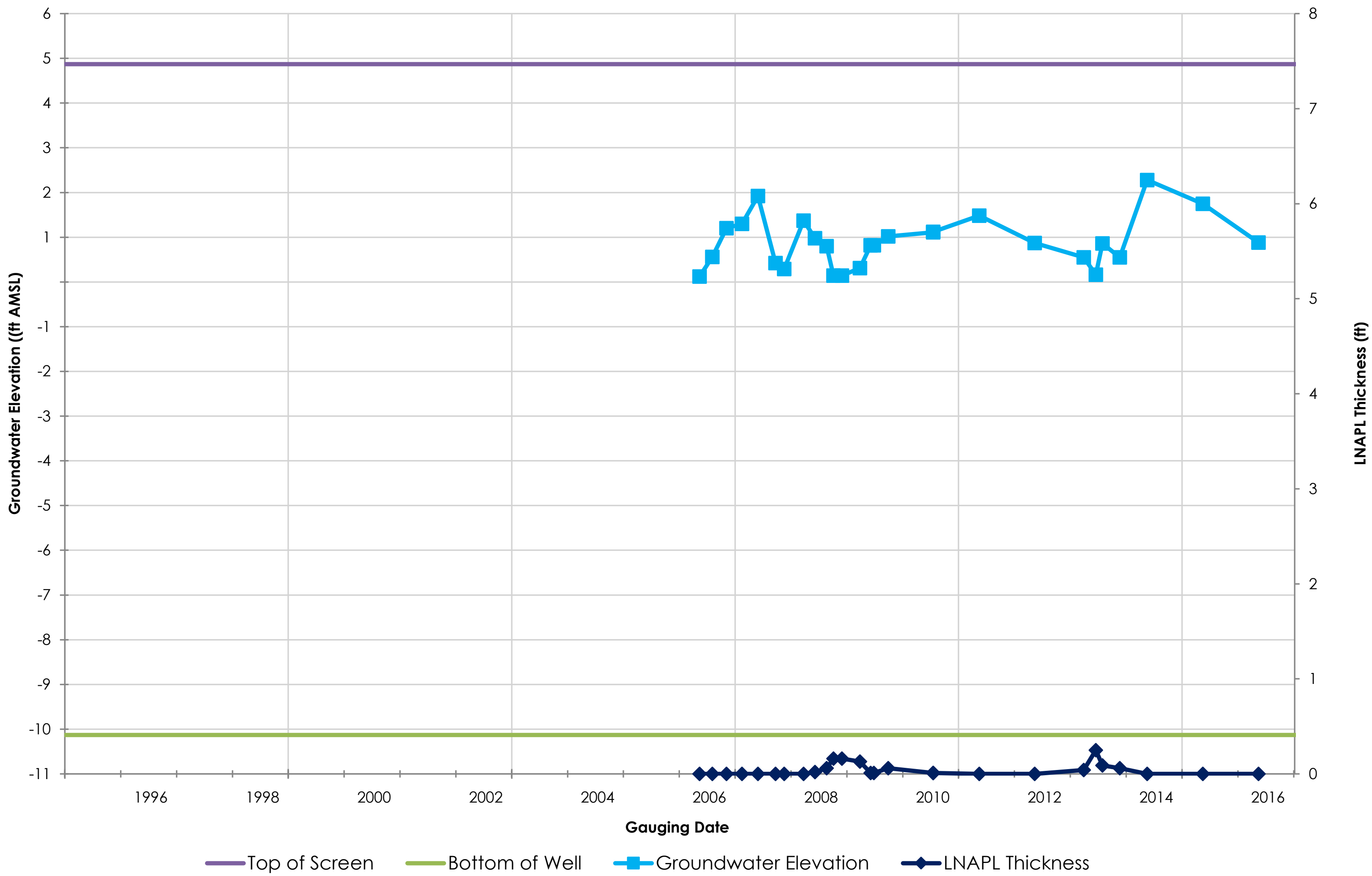
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-237

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

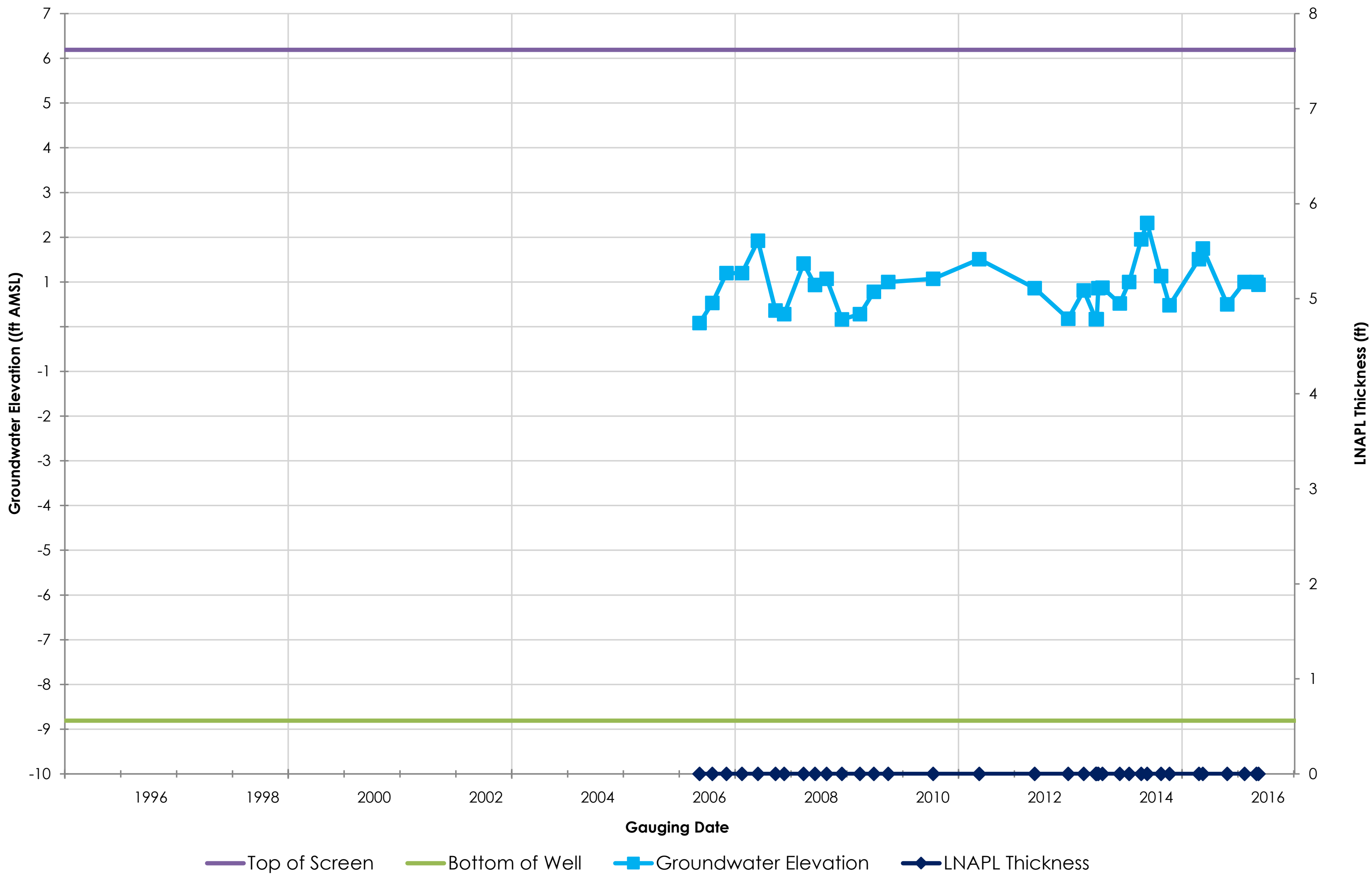
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-238

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

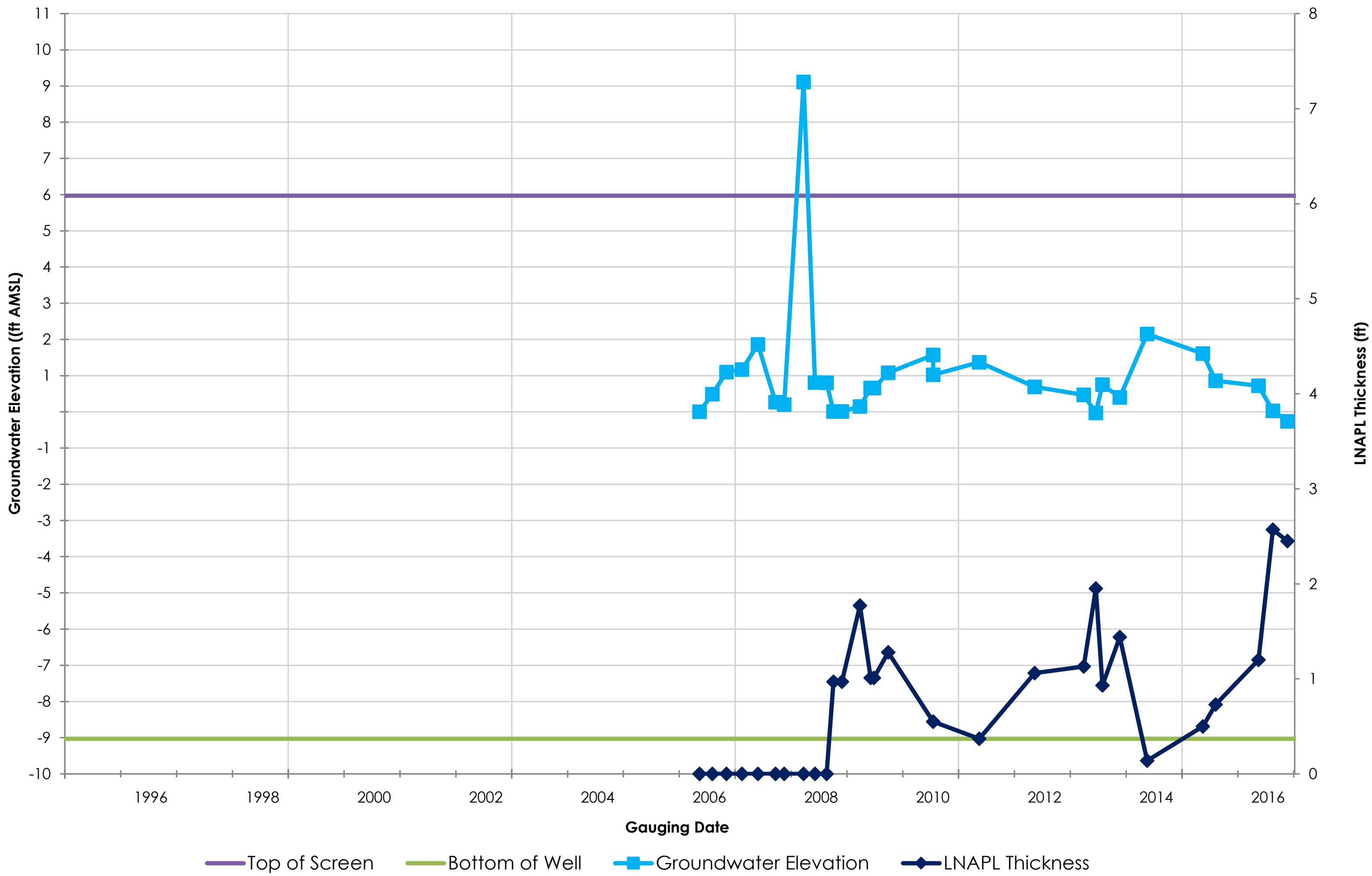
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-239

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

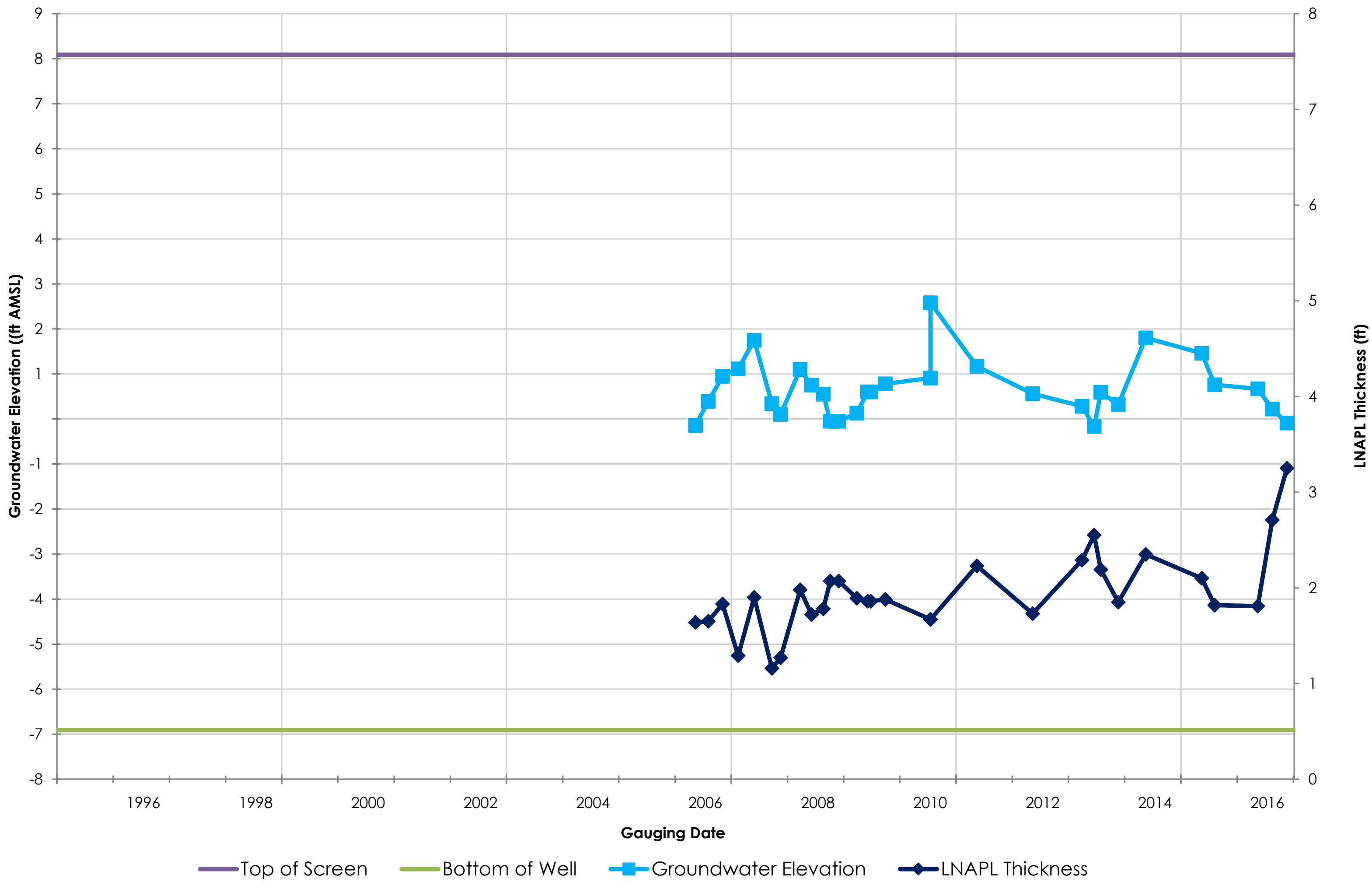
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-240

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

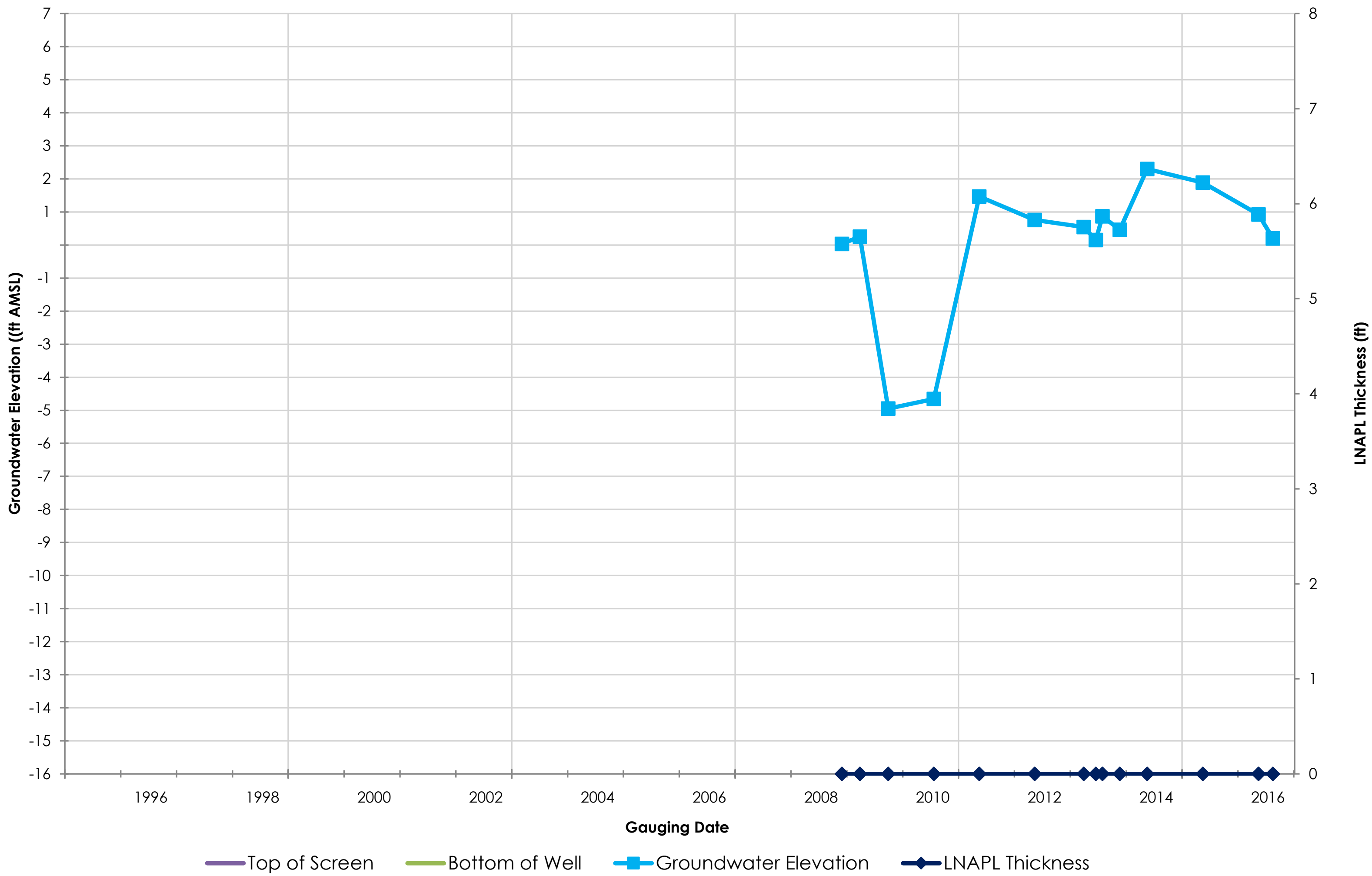
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-241

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

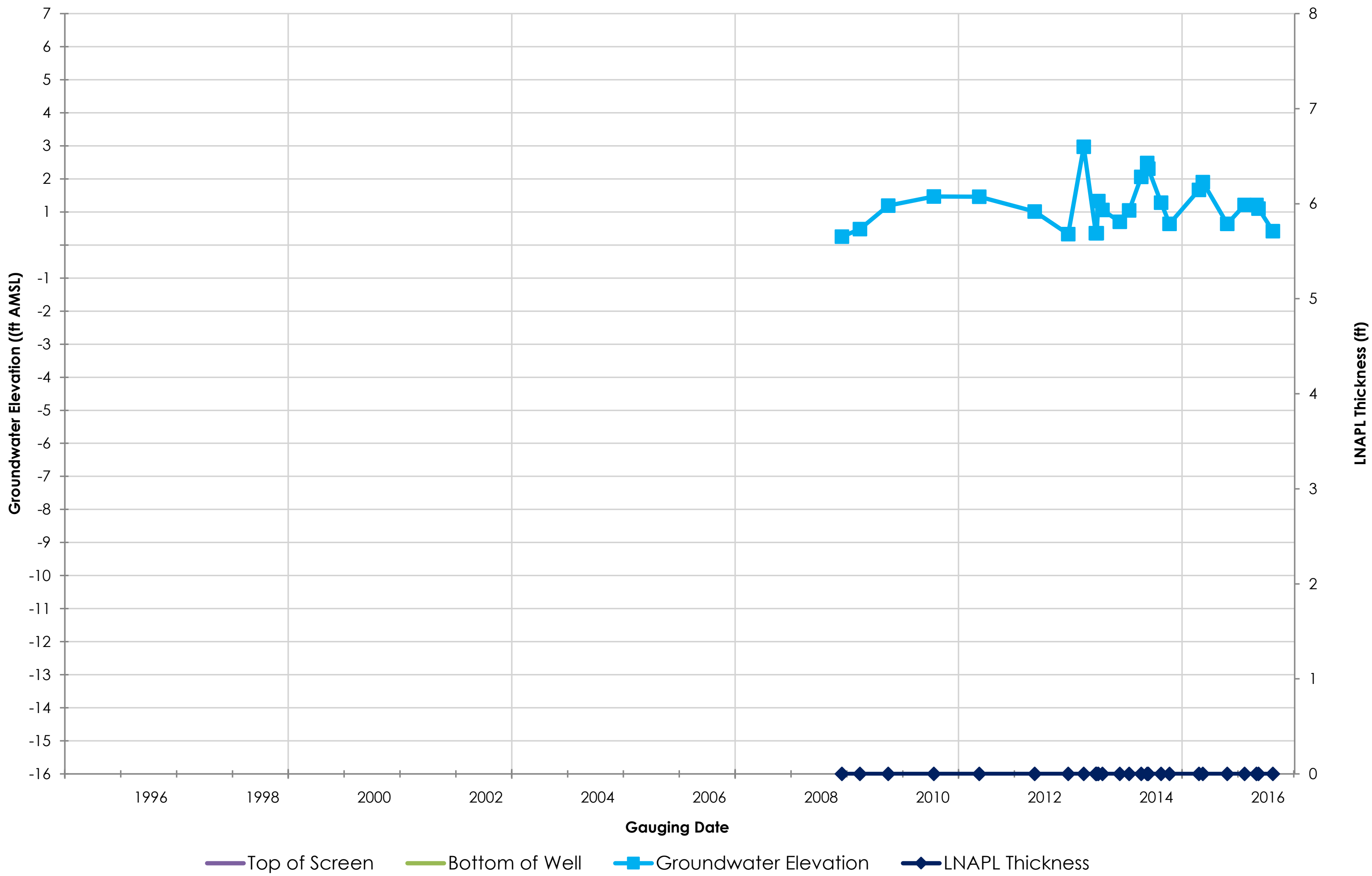
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-242

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

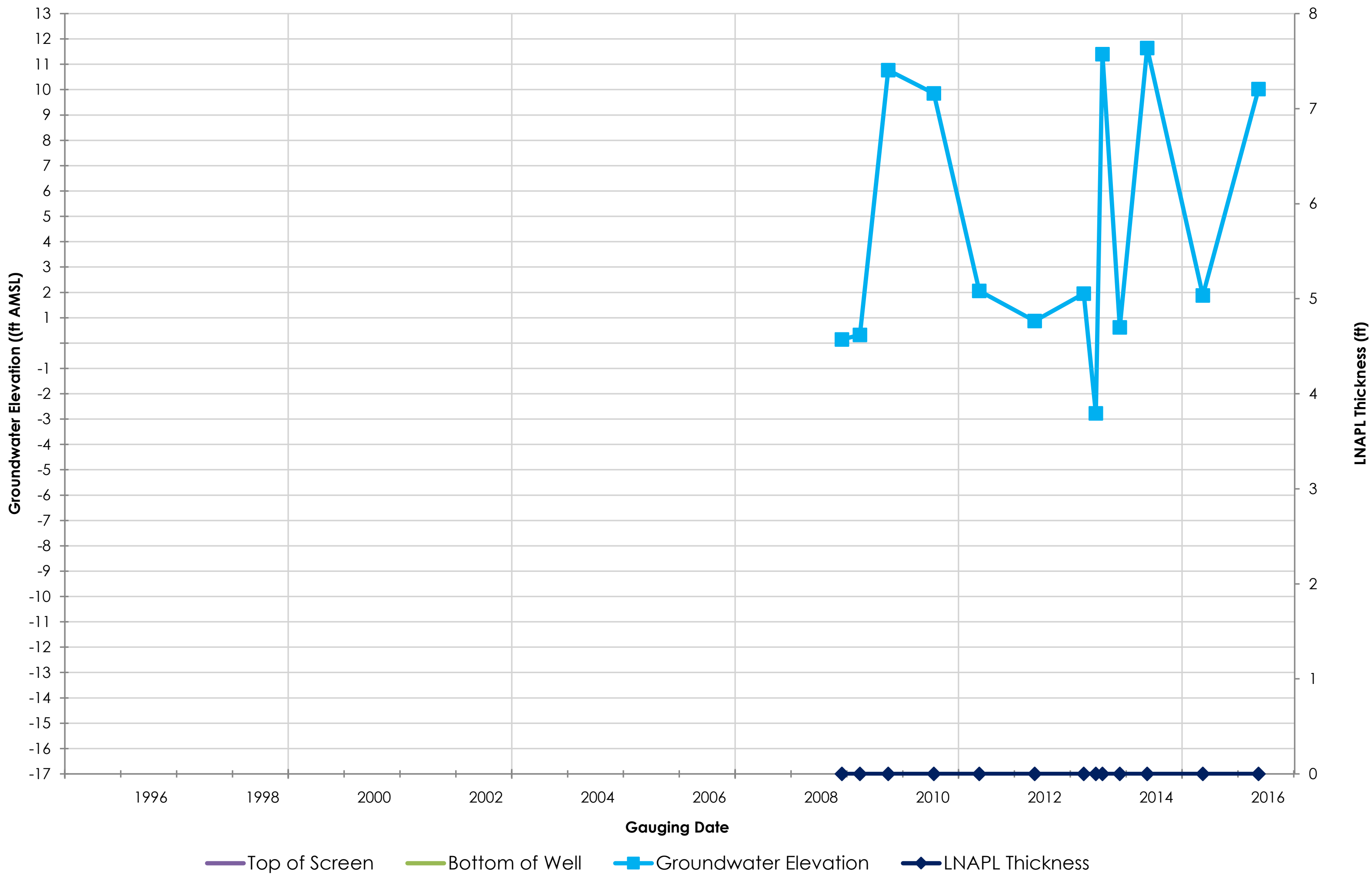
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-243

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

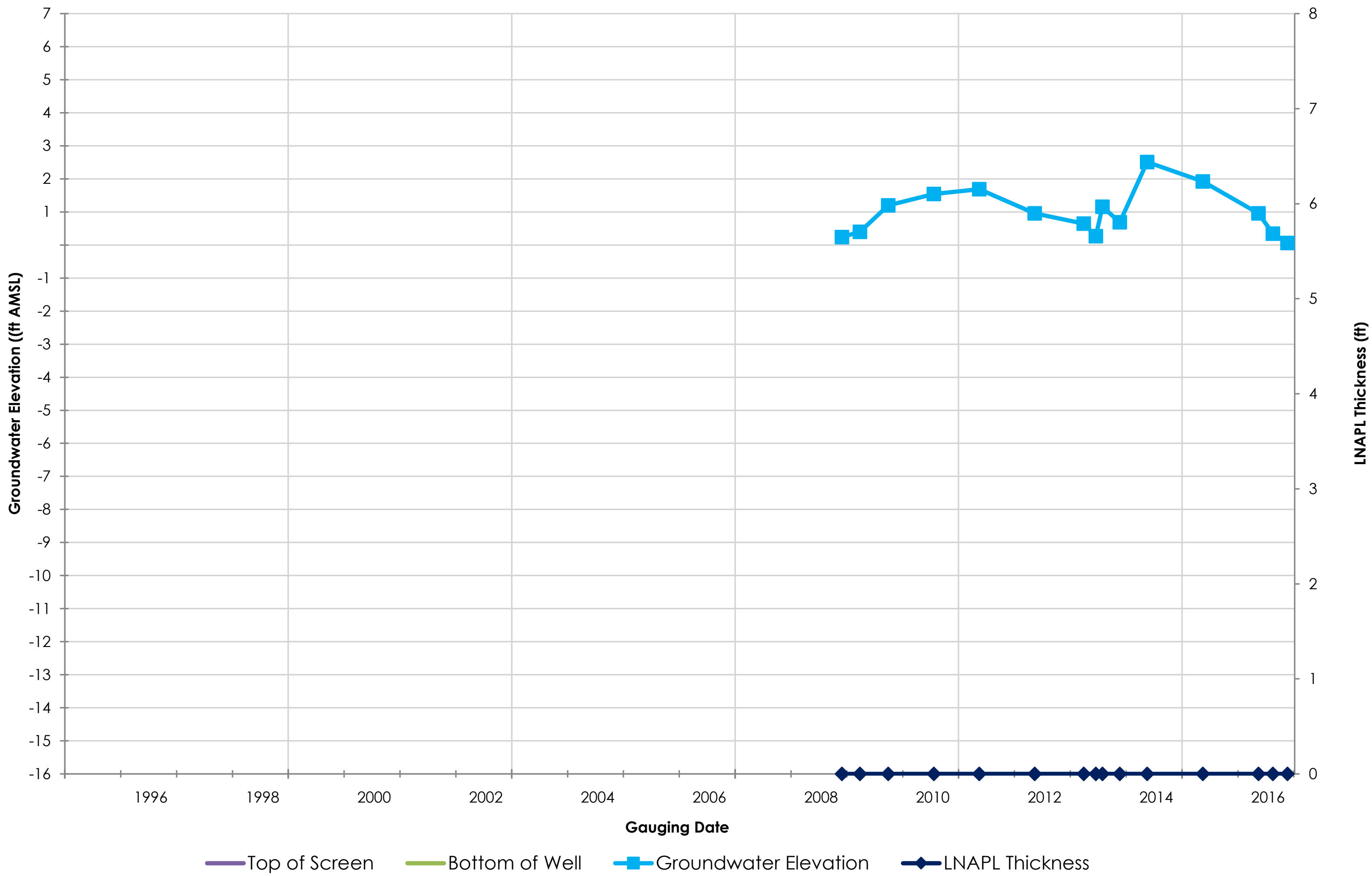
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-244

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

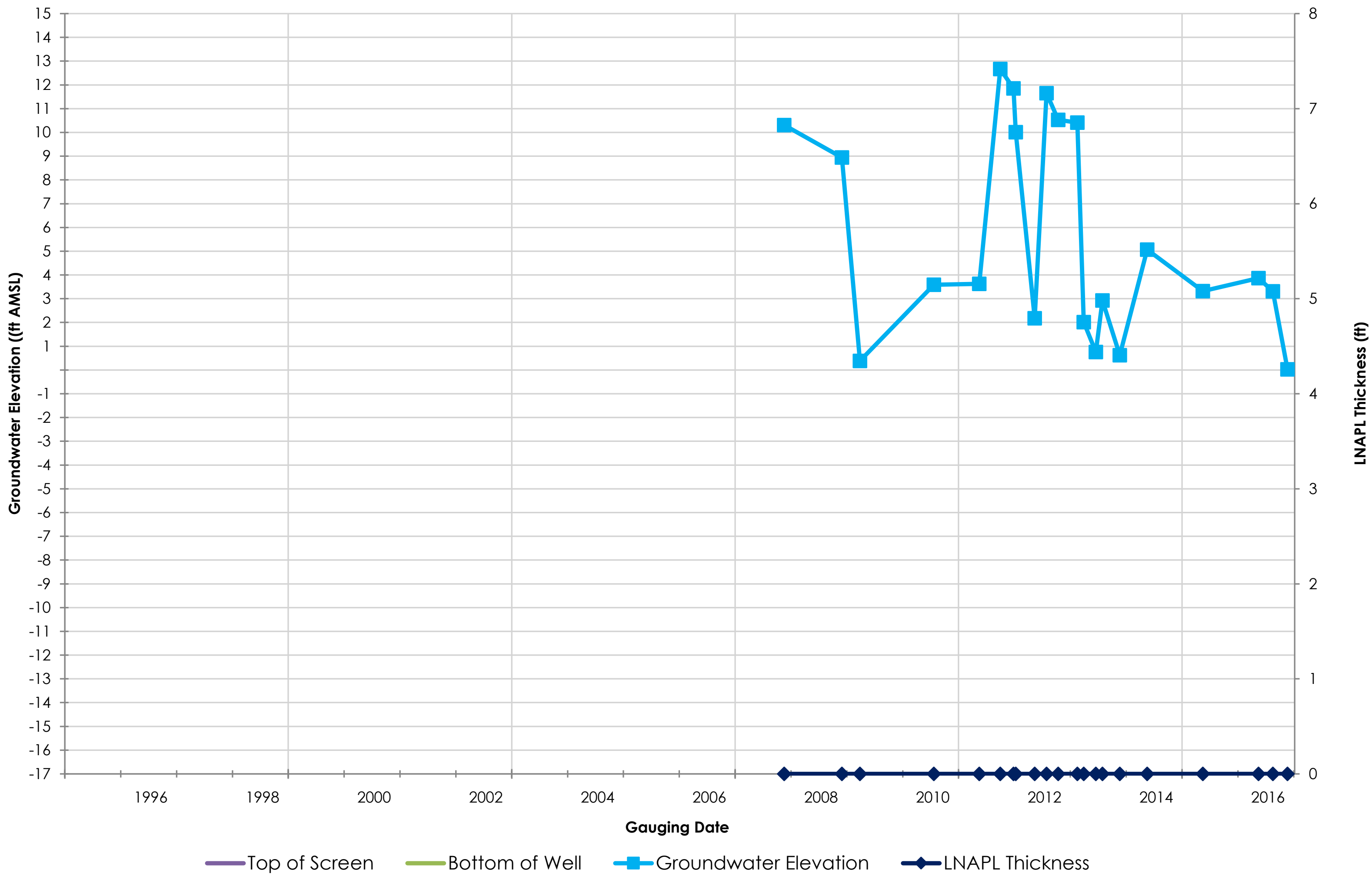
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-245

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

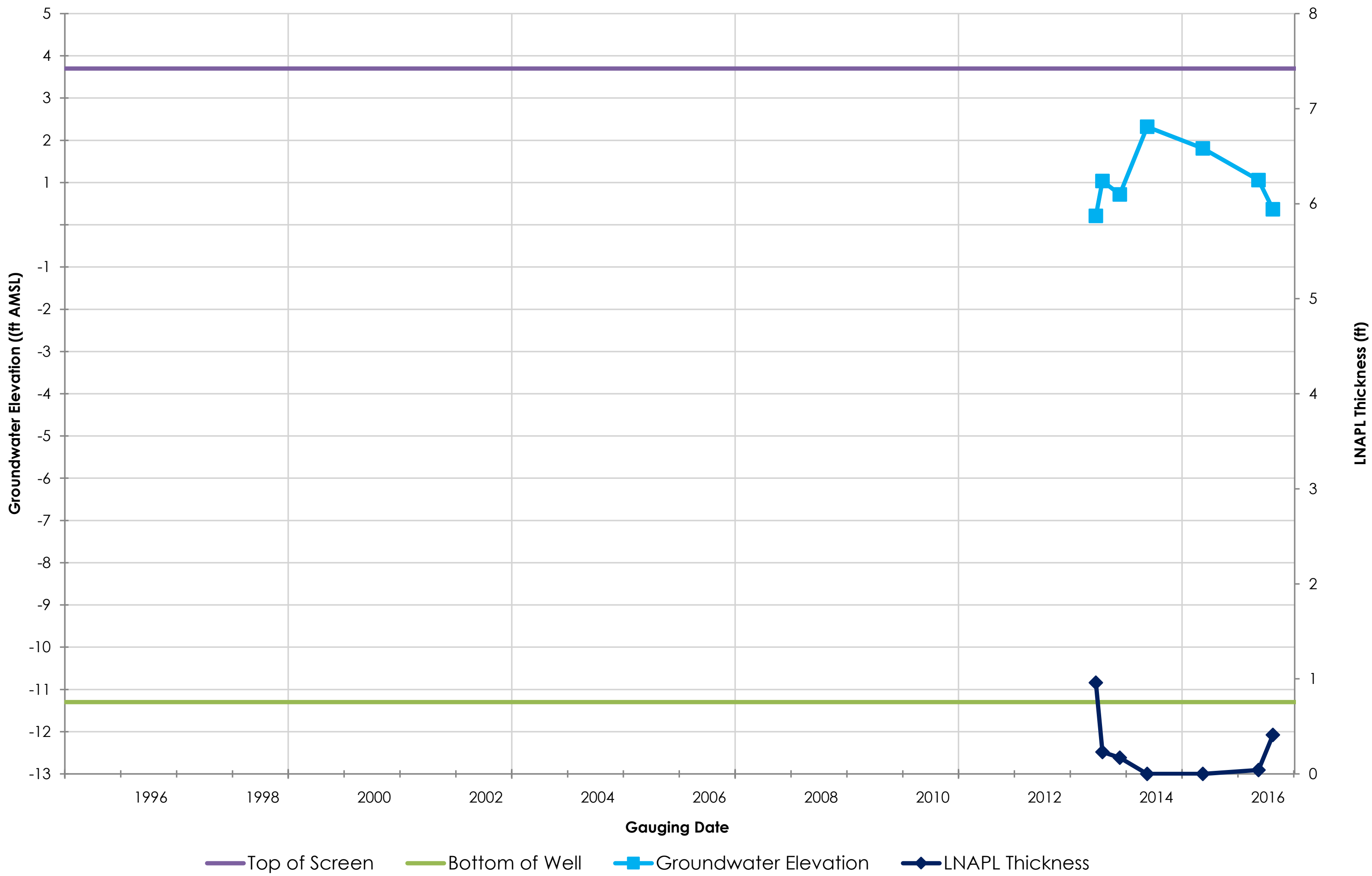
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-246

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

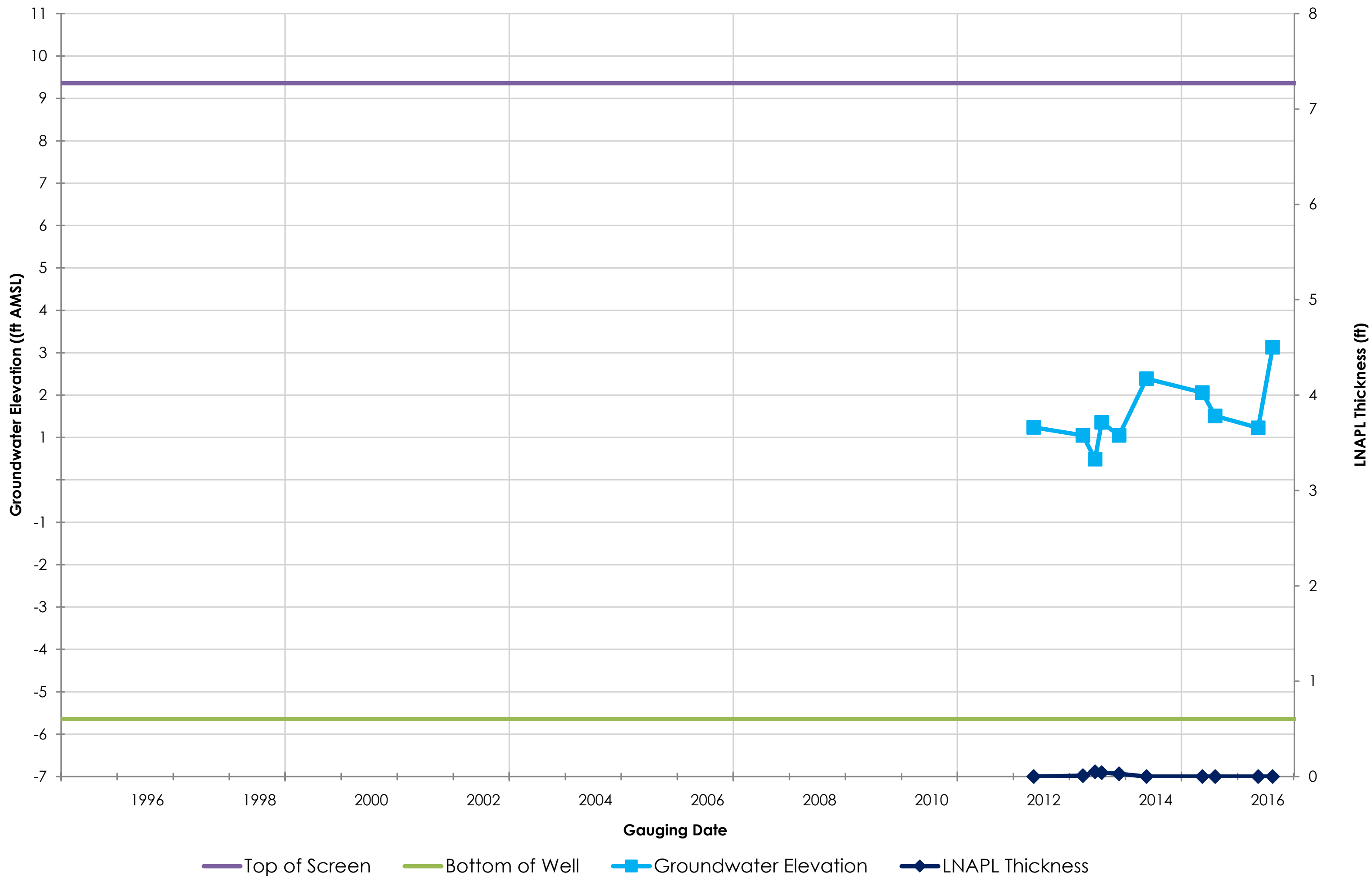
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-278

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

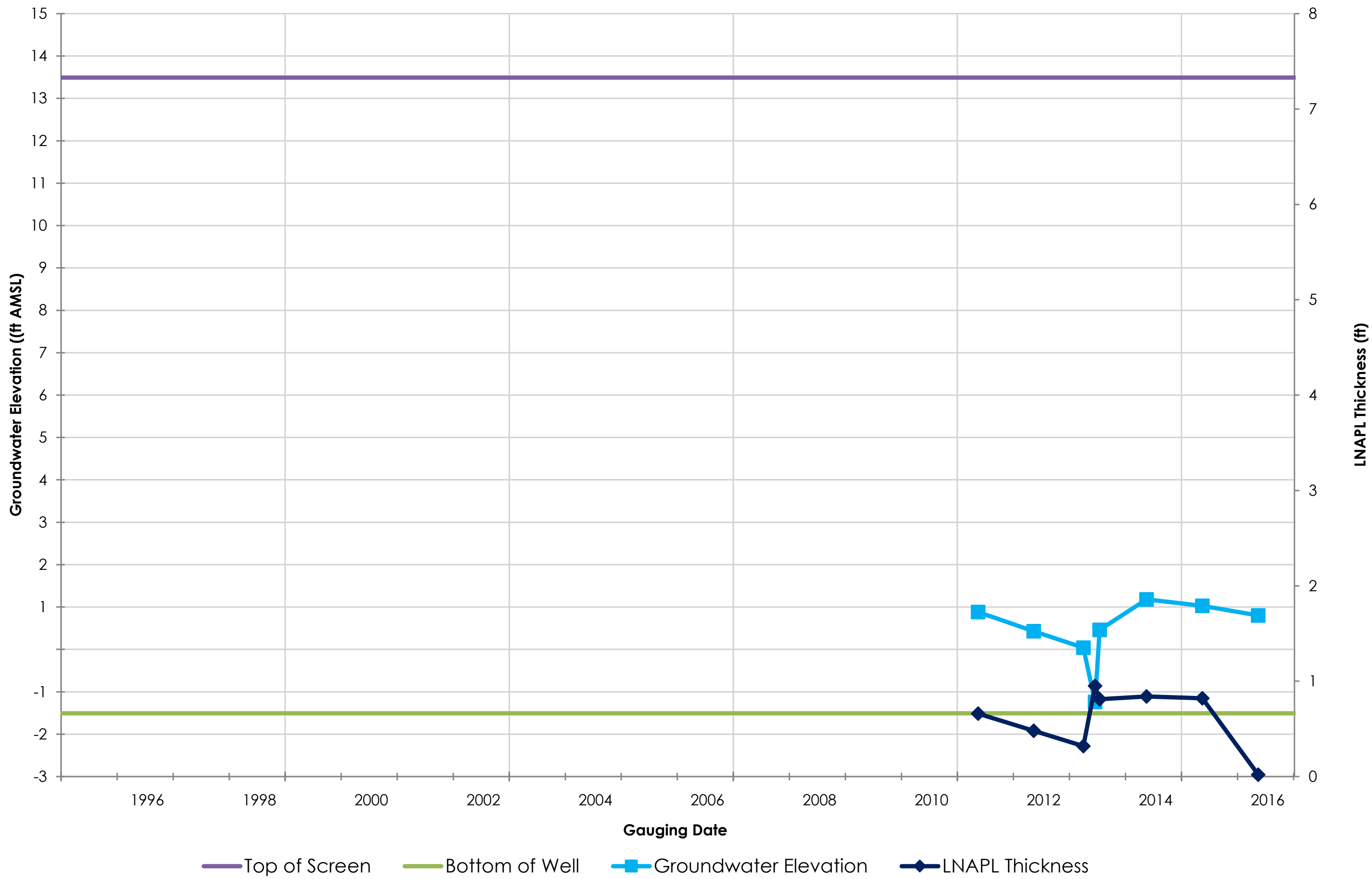
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-279

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

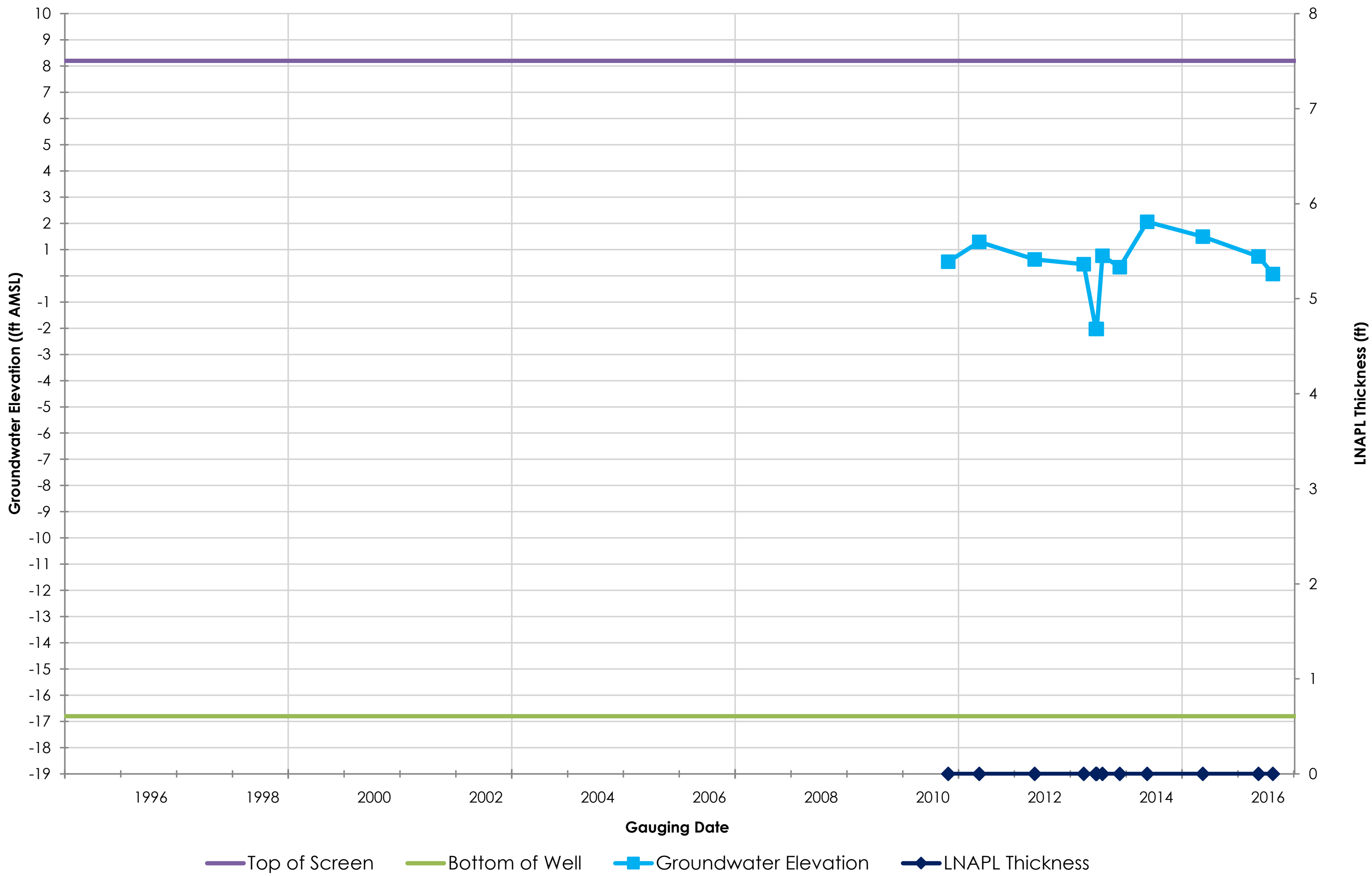
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-282

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

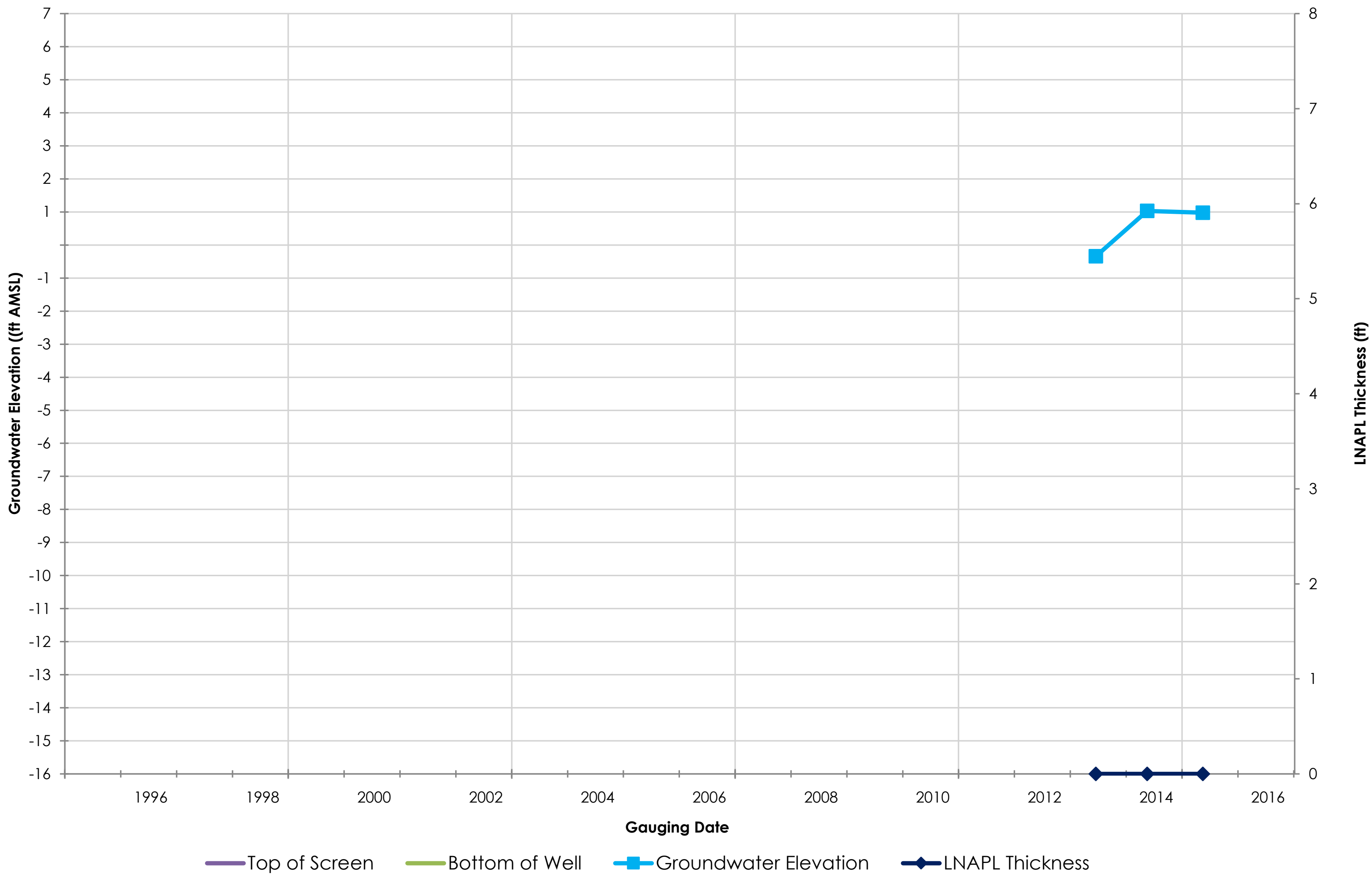
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-329

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

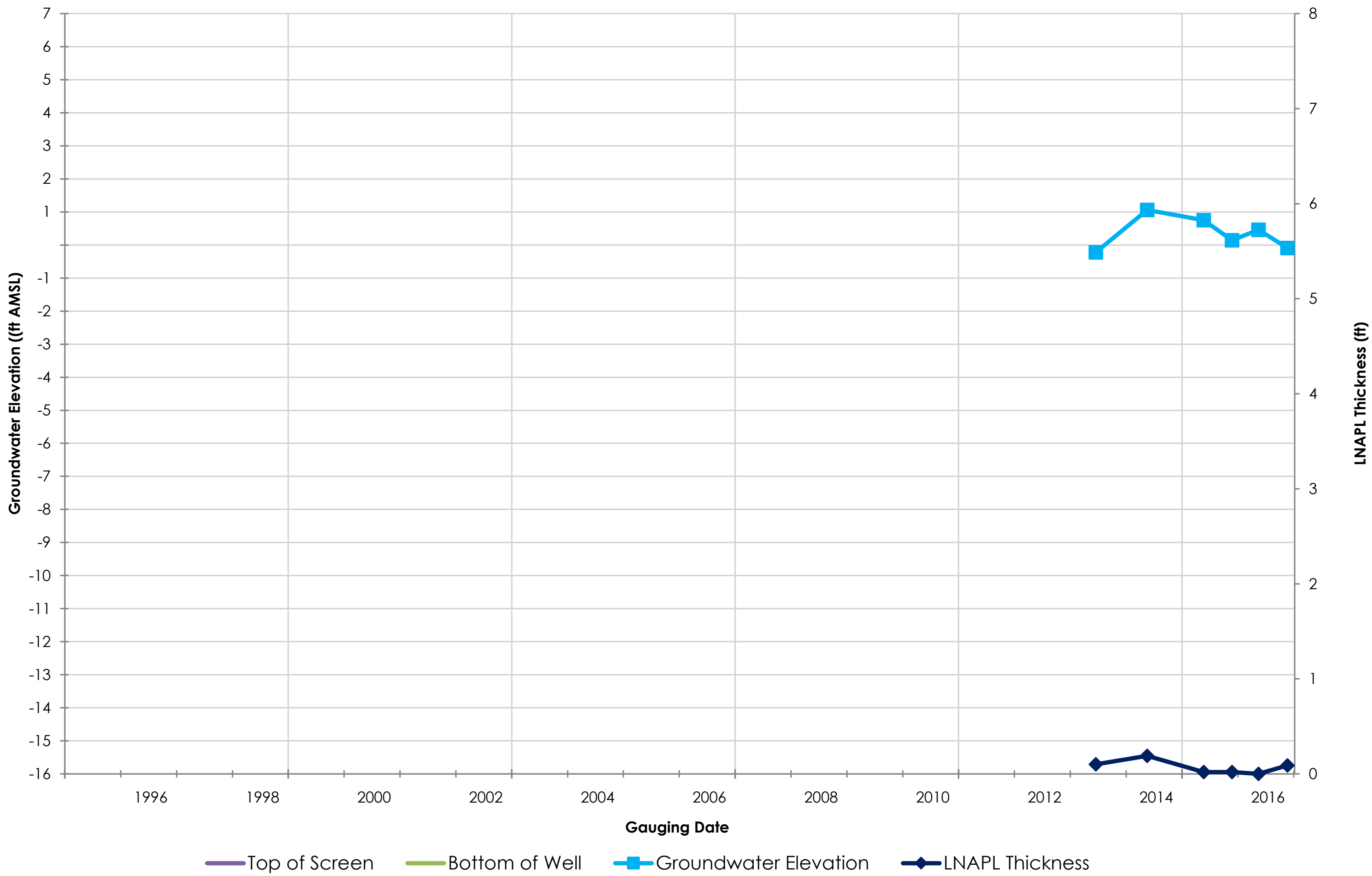
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-364

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

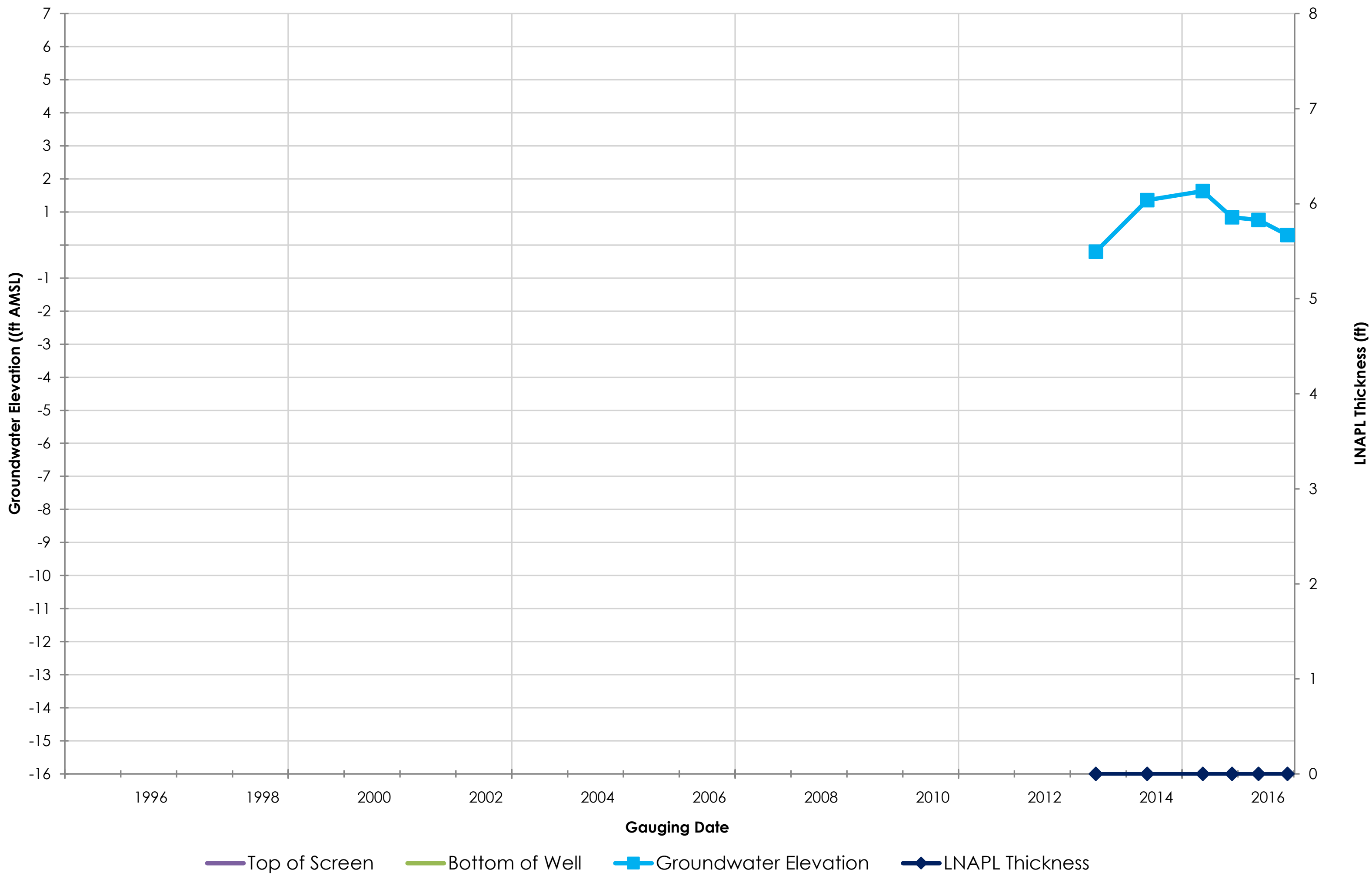
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-365

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

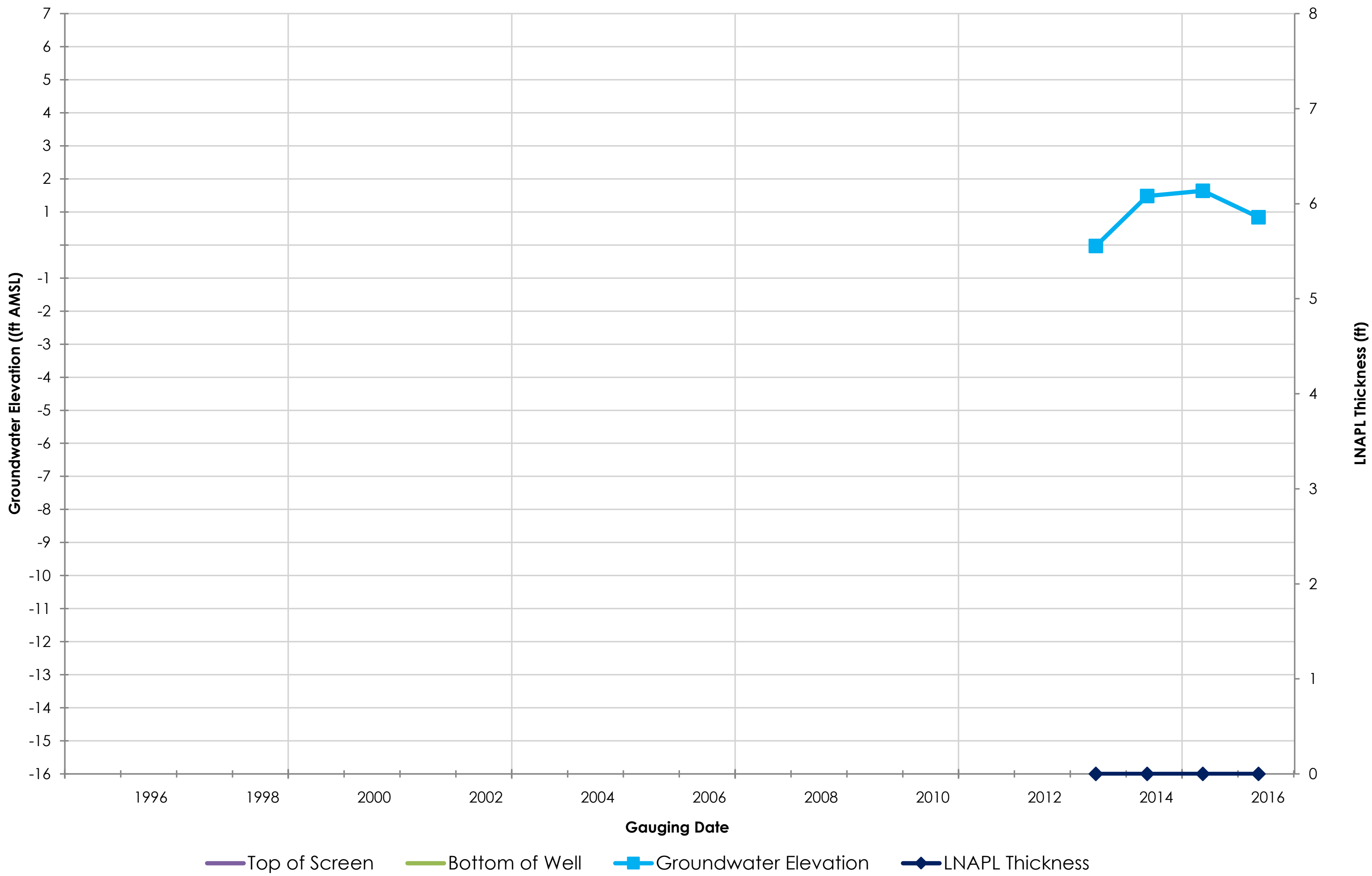
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-366

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

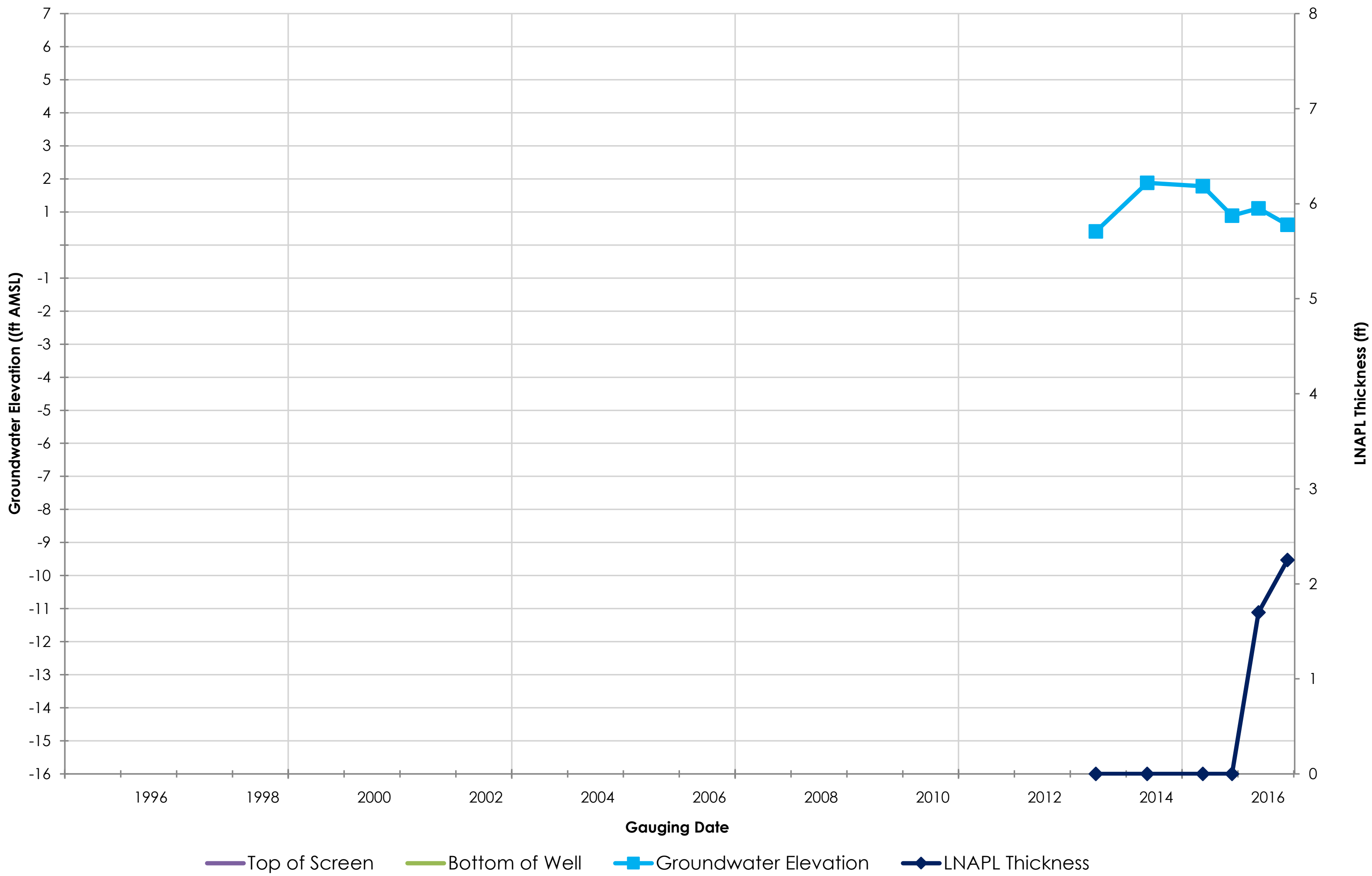
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-367

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

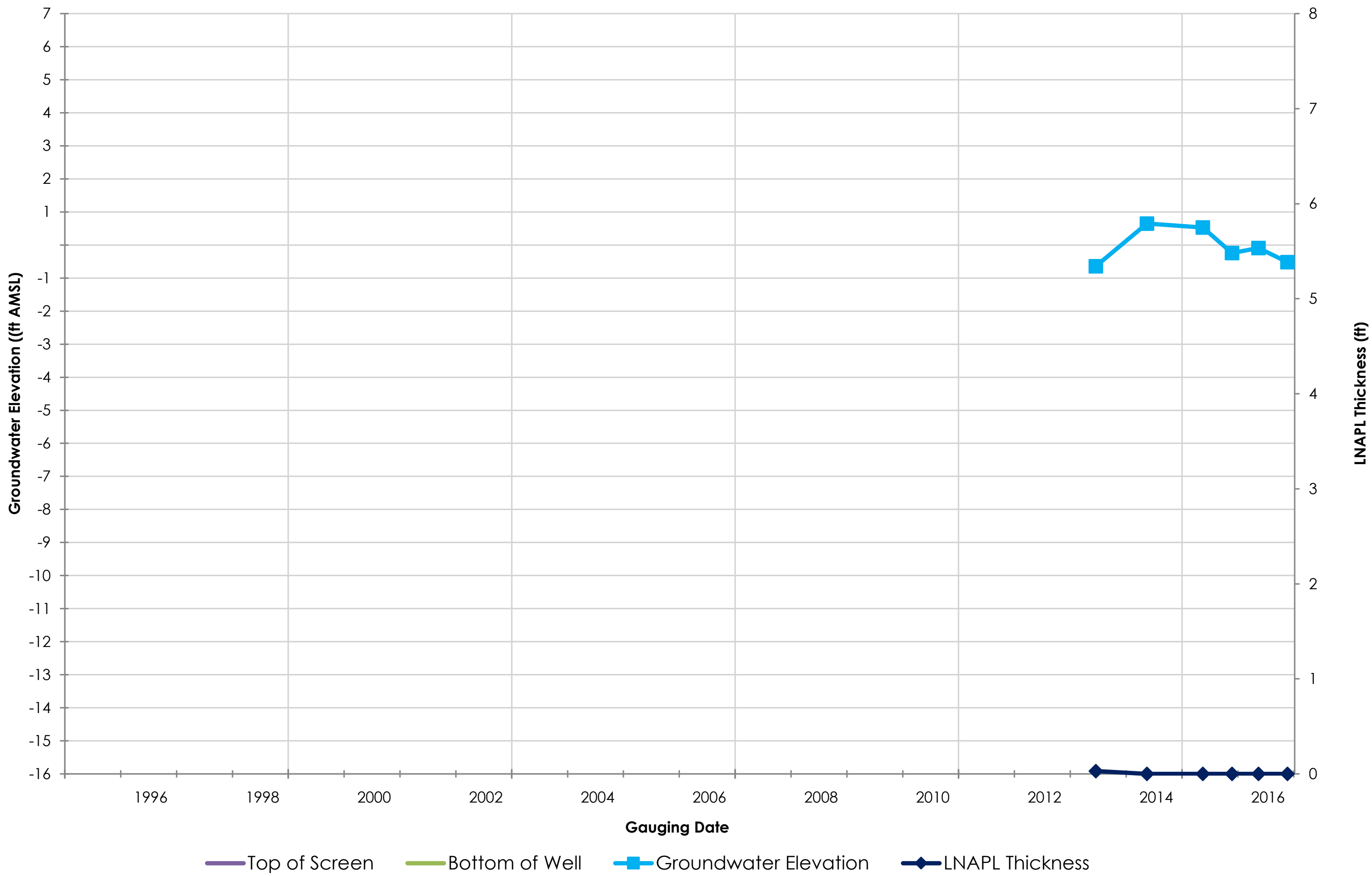
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-368

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

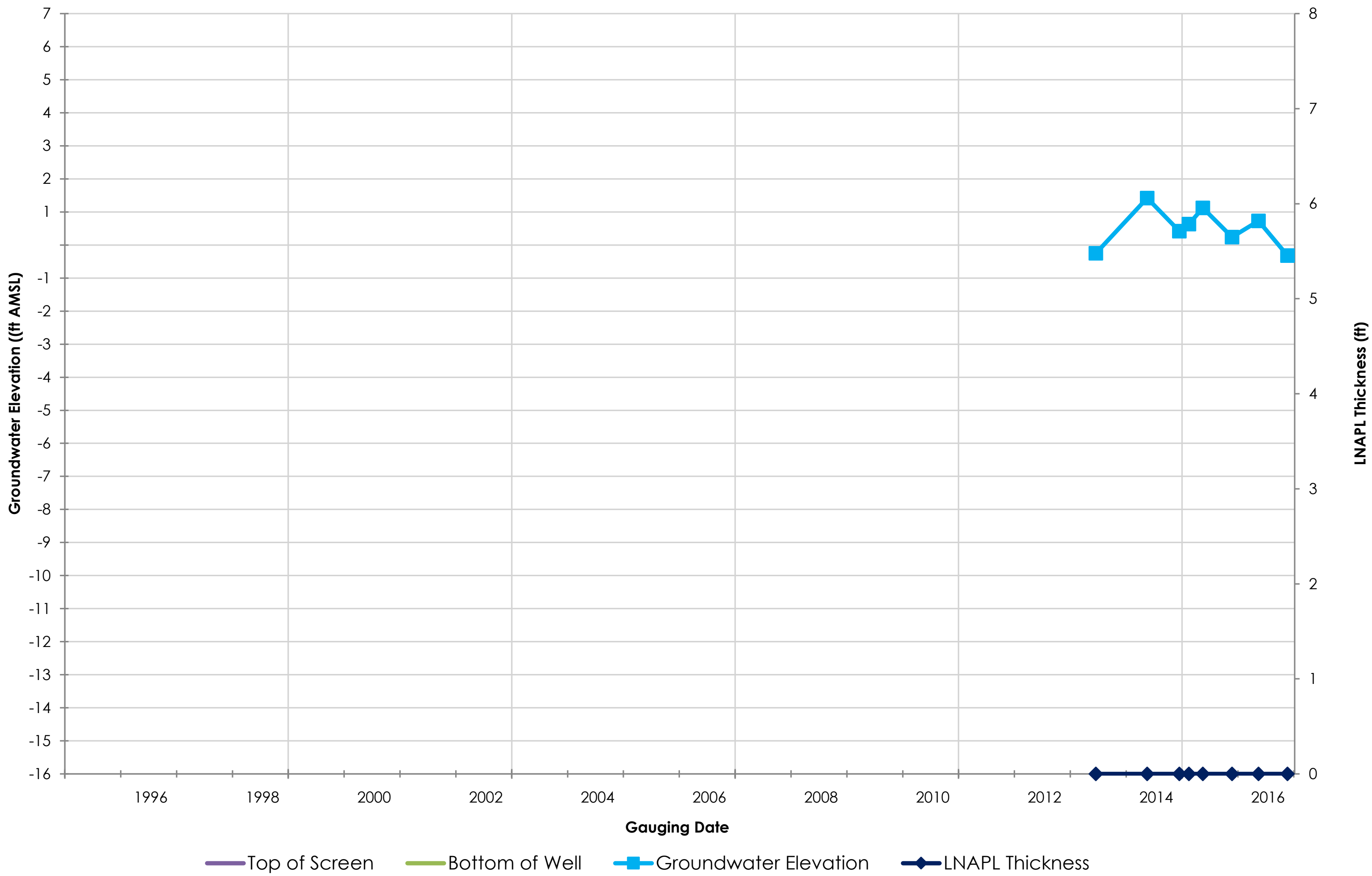
Stantec

Figure/Well No.

S-369

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

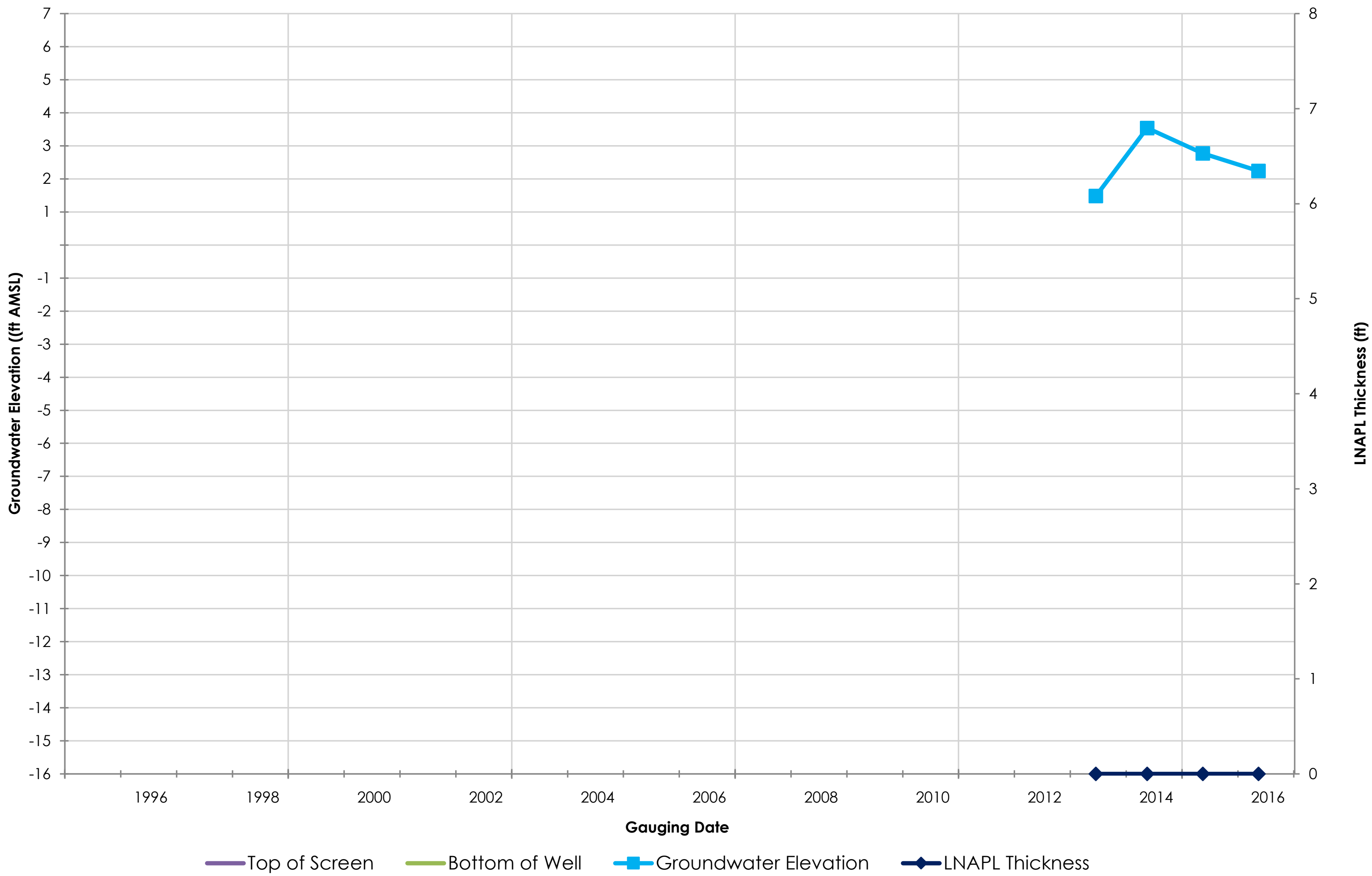
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-370

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

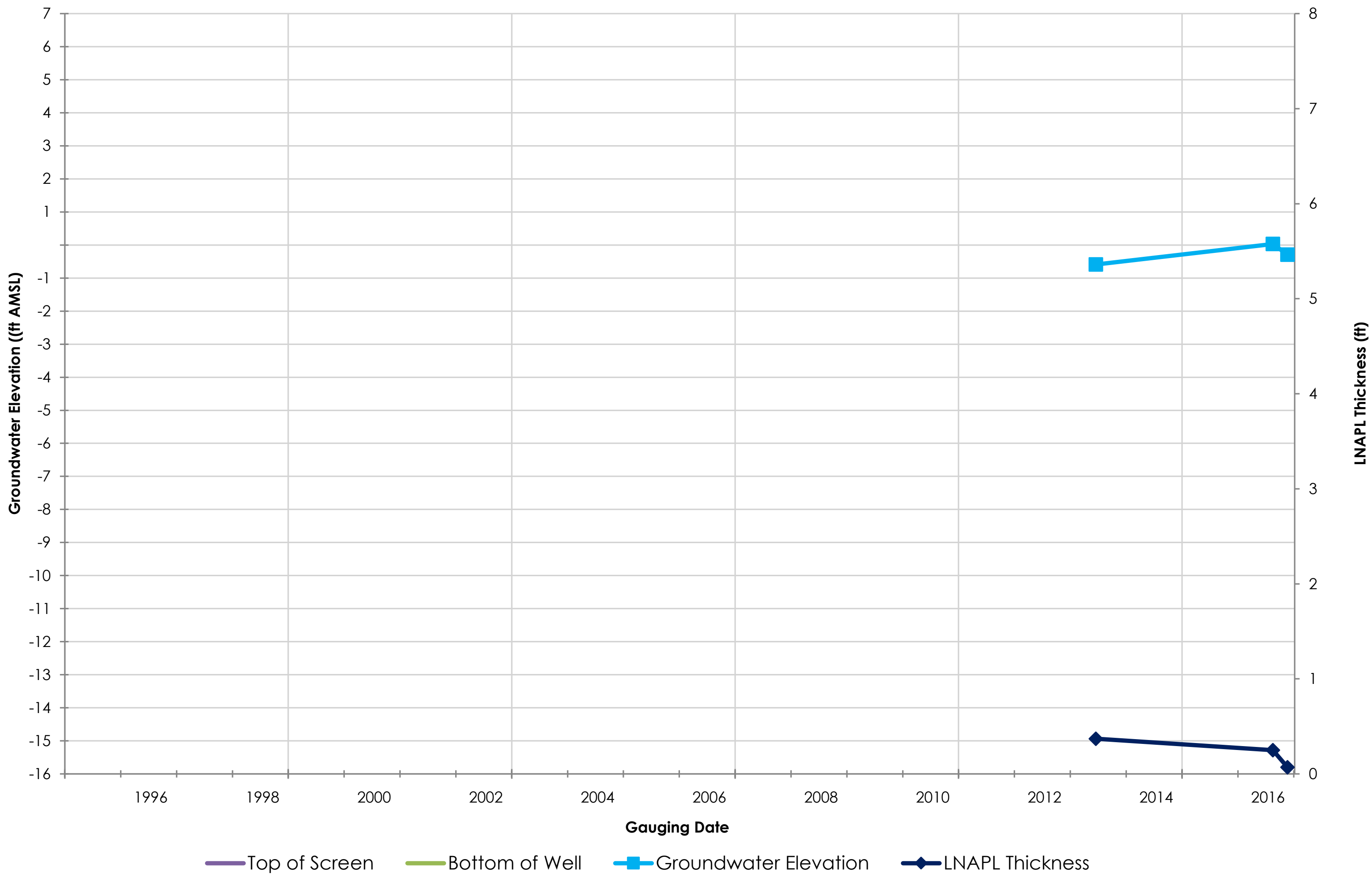
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-371

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

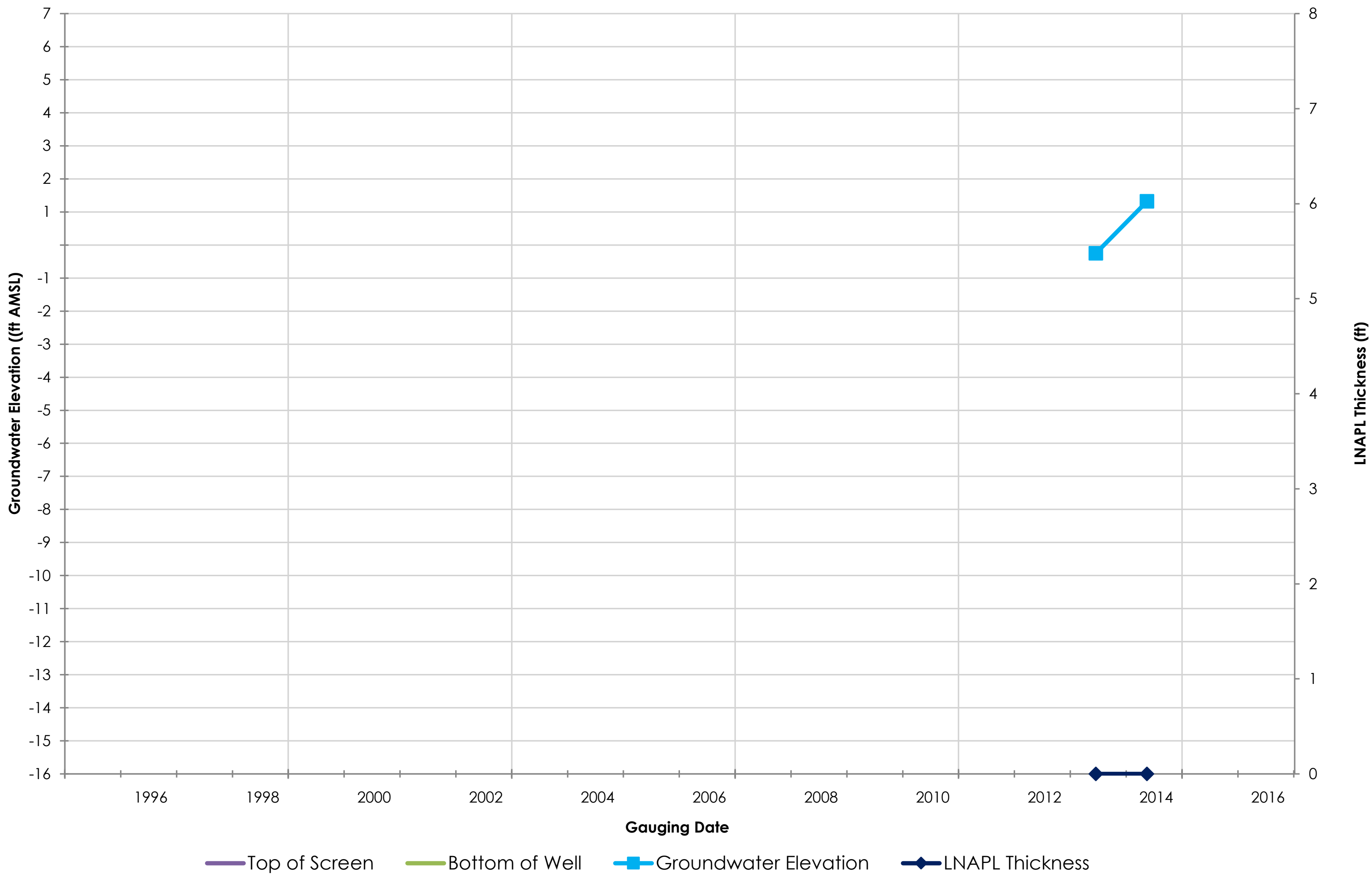
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-373

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

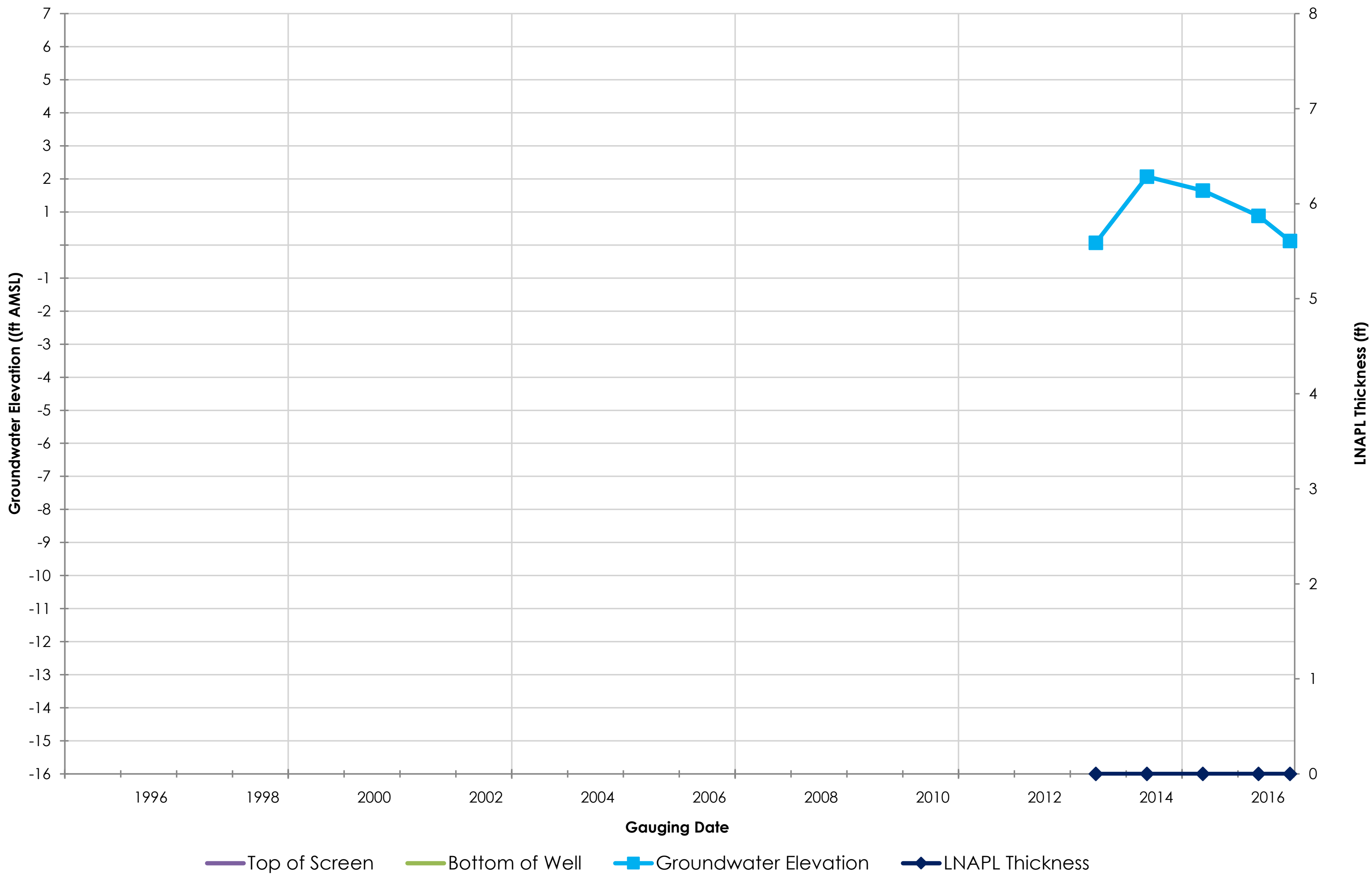
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-379

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

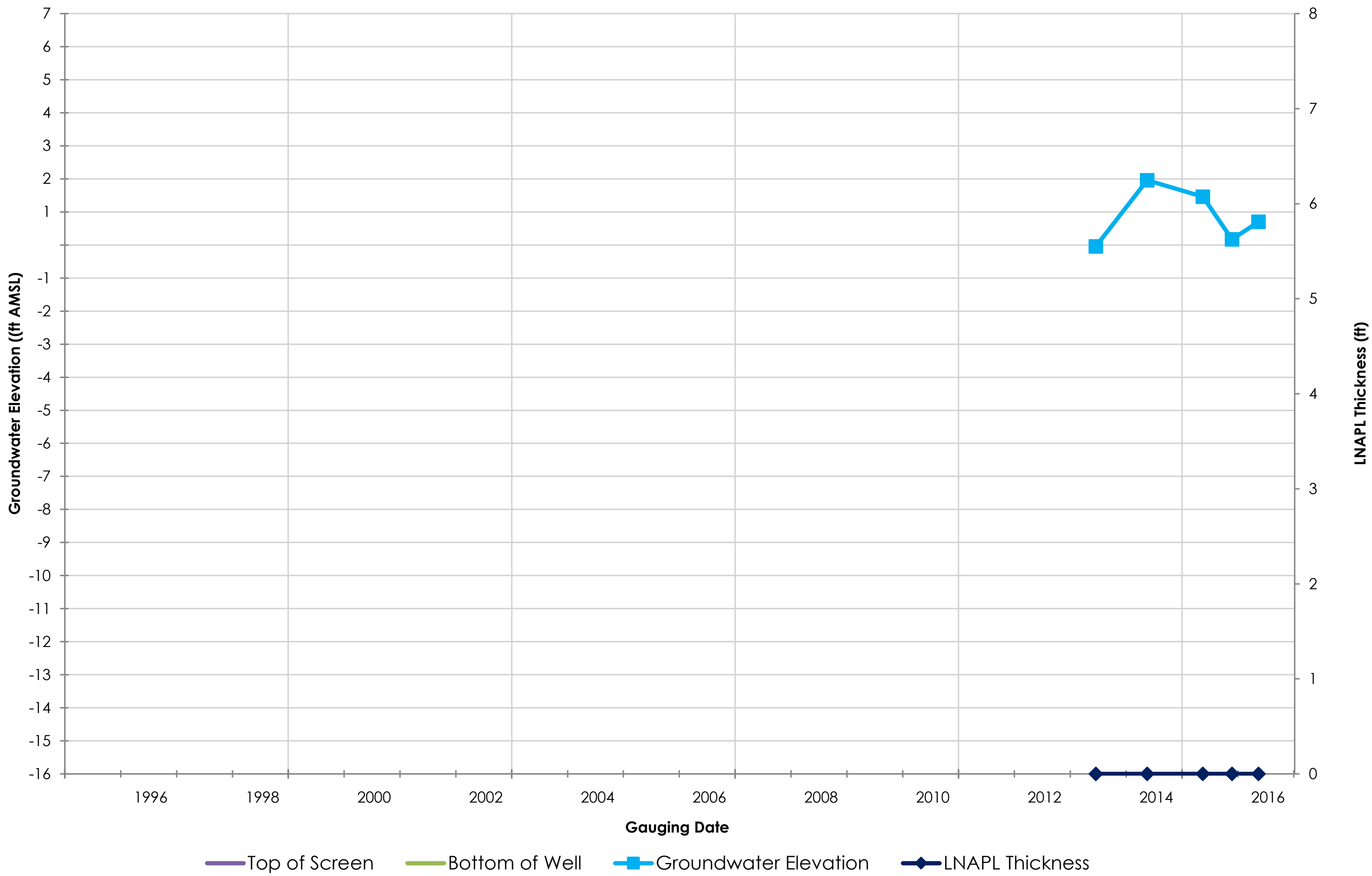
Stantec

Figure/Well No.

S-380

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

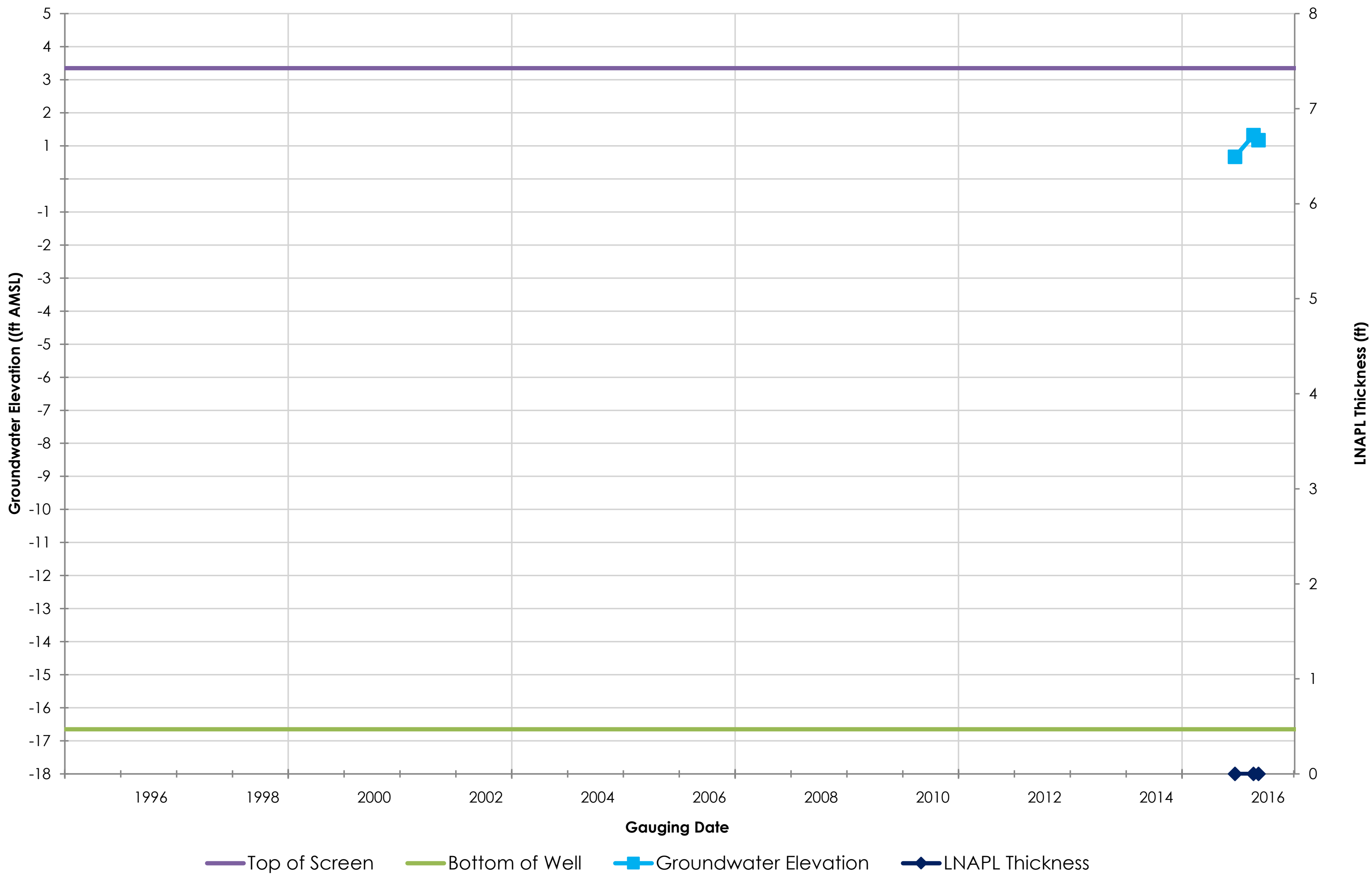
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-381

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Stantec

Client/Project

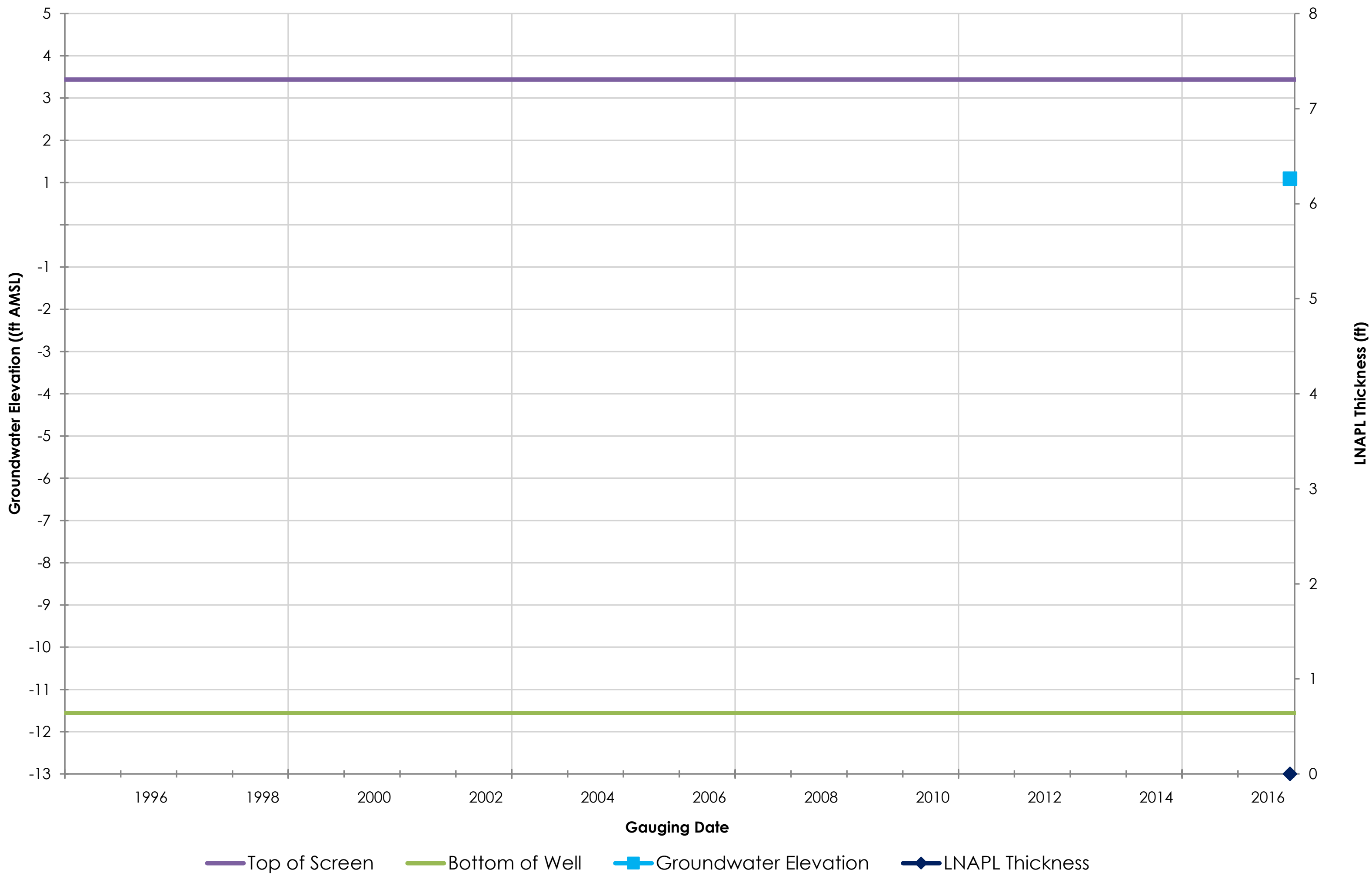
Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-408

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval



Client/Project

Philadelphia Refinery Operations,
A series of Evergreen Resources Group, LLC
3144 Passyunk Avenue, Philadelphia, PA

Figure/Well No.

S-416

Title

Groundwater Elevation Hydrograph with LNAPL Thickness and Screened Interval

APPENDIX II
LNAPL SAMPLE DATA PACKAGES (CD-ROM)

PHILADELPHIA REFINING COMPLEX
3144 WEST PASSYUNK AVENUE
PHILADELPHIA, PENNSYLVANIA
SITEWIDE PADEP FACILITY ID NO. 780190
AREA OF INTEREST 4 PADEP FACILITY NO. 770318

Torkelson Geochemistry, Inc.
2528 S. Columbia Place
Tulsa, OK 74114-3233
Phone: 918-749-8441
Fax: 918-749-6005
e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Project: Evergreen Corrective Measures - AOI 4 Remedial Investigation
Location:
Philadelphia Refining Complex
Philadelphia, PA
Proj. No.: 213402602.300
P.O.: 213402602.300
Sampled By: Tim Delk

Report/Bill To: Andrew Klingbeil
Address:
1060 Andrew Drive, Suite 140
West Chester, PA 19380
Phone: 610-840-2525
Fax:
e-mail: andrew.klingbeil@stantec.com

Additional Instructions
please provide a basic interpretation that includes assigning the LNAPL sample to a generalized distillate type or mixture (e.g., light, middle or heavy distillate; residuum or crude oil)
please also indicate the general degree of weathering

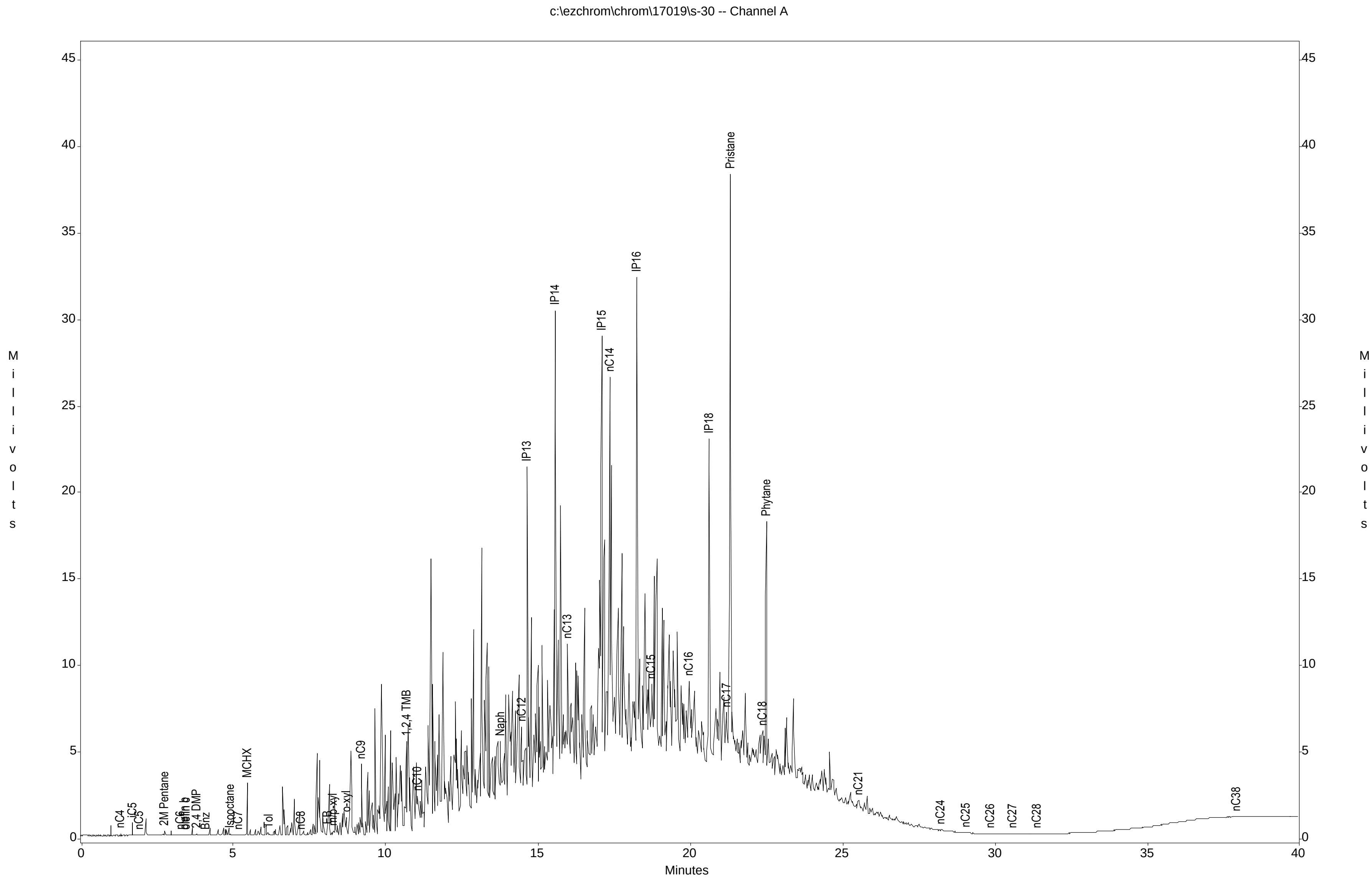
Requested Turn-Around Time: Standard

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None	ANALYSES REQUESTED: GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur	REMARKS
1	S-30	2/16/17	NAPL		3	X	X	X							Collected at 1245; basic interpretation requested
2															
3															
4															
5															
6															
7															
8															
9															
10															

RELINQUISHED BY	DATE	TIME	ACCEPTED BY	DATE	TIME
[signature]	2/23/17	0734	[signature]	2/23/17	0735
[signature] / Aquaterra	2/24/17	1500	FED EX	2/24/17	1500
			[signature]	3-1-17	1535

Torkelson Geochemistry, Inc.

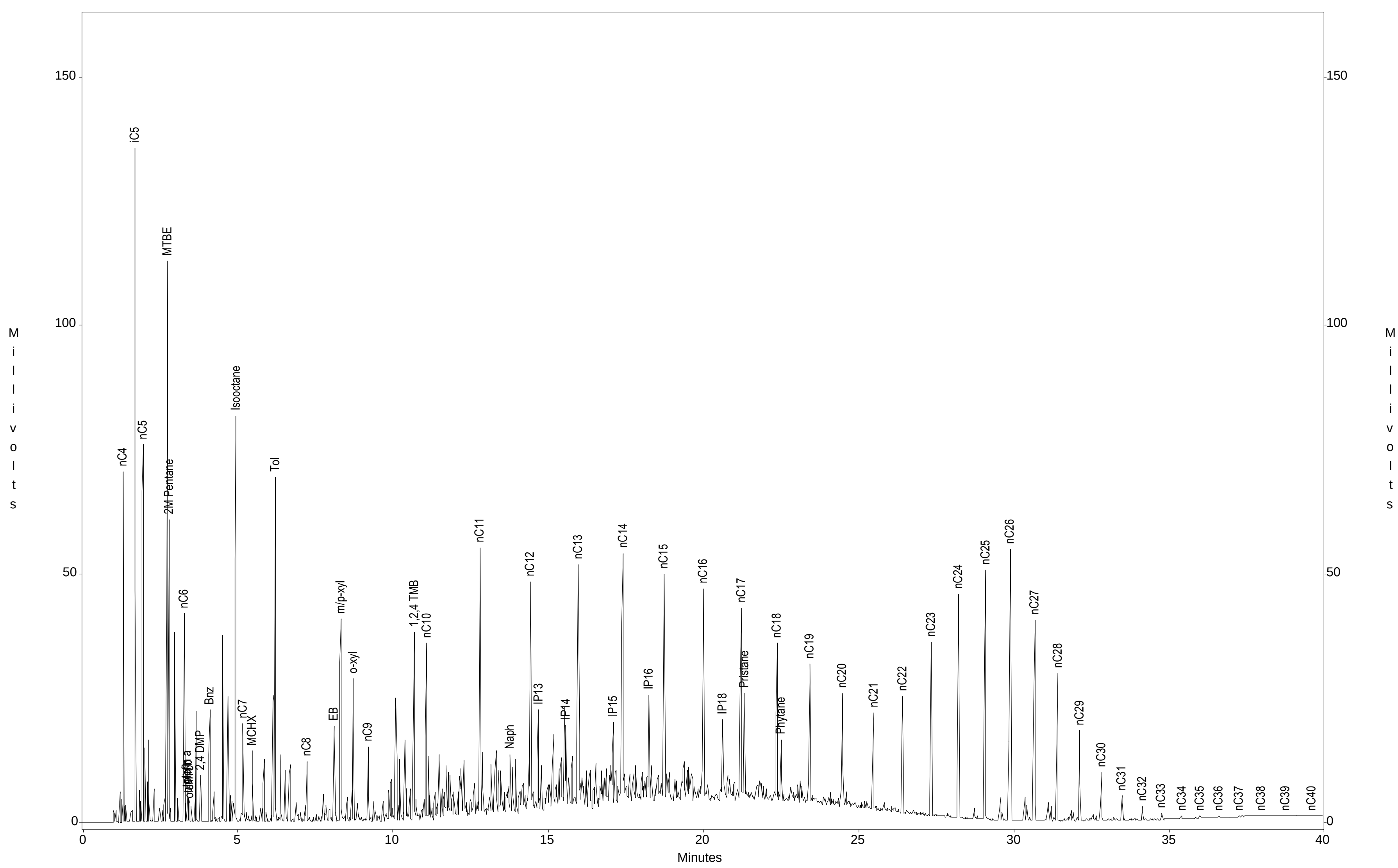
Evergreen Corrective Measures - AOI4 Remedial Investigation, Philadelphia Refining Complex
Sample ID : S-30
Acquired : Mar 06, 2017 13:41:01



Torkelson Geochemistry, Inc.

Evergreen Corrective Measures - AOI4 Remedial Investigation, Philadelphia Refining Complex
Sample ID : Gas/Dies/Wax std
Acquired : Mar 06, 2017 11:19:03

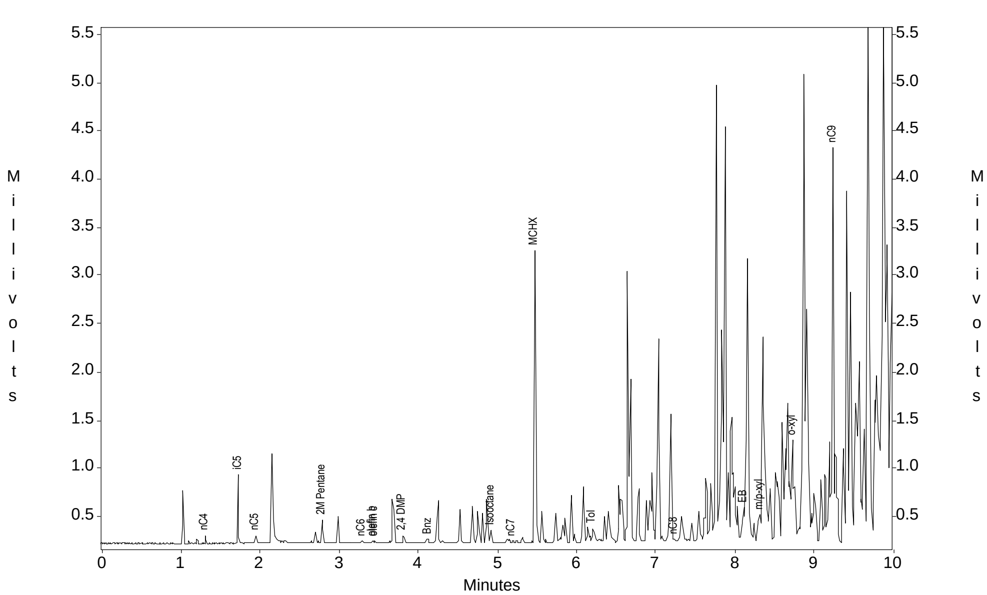
c:\ezchrom\chrom\17019\gadiwax2 -- Channel A



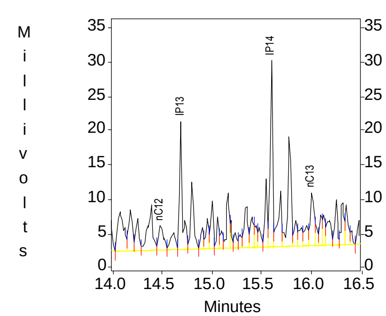
Torkelson Geochemistry, Inc.

Evergreen Corrective Measures - AOI4 Remedial Investigation, Philadelphia Refining Complex
Sample ID : S-30
Acquired : Mar 06, 2017 13:41:01

c:\ezchrom\chrom\17019\s-30 -- Channel A



c:\ezchrom\chrom\17019\s-30 -- Channel A



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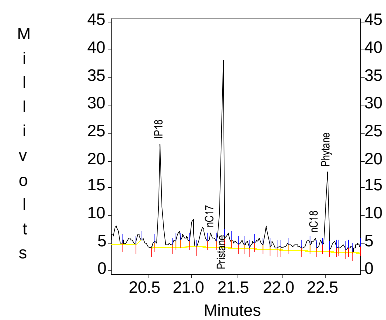
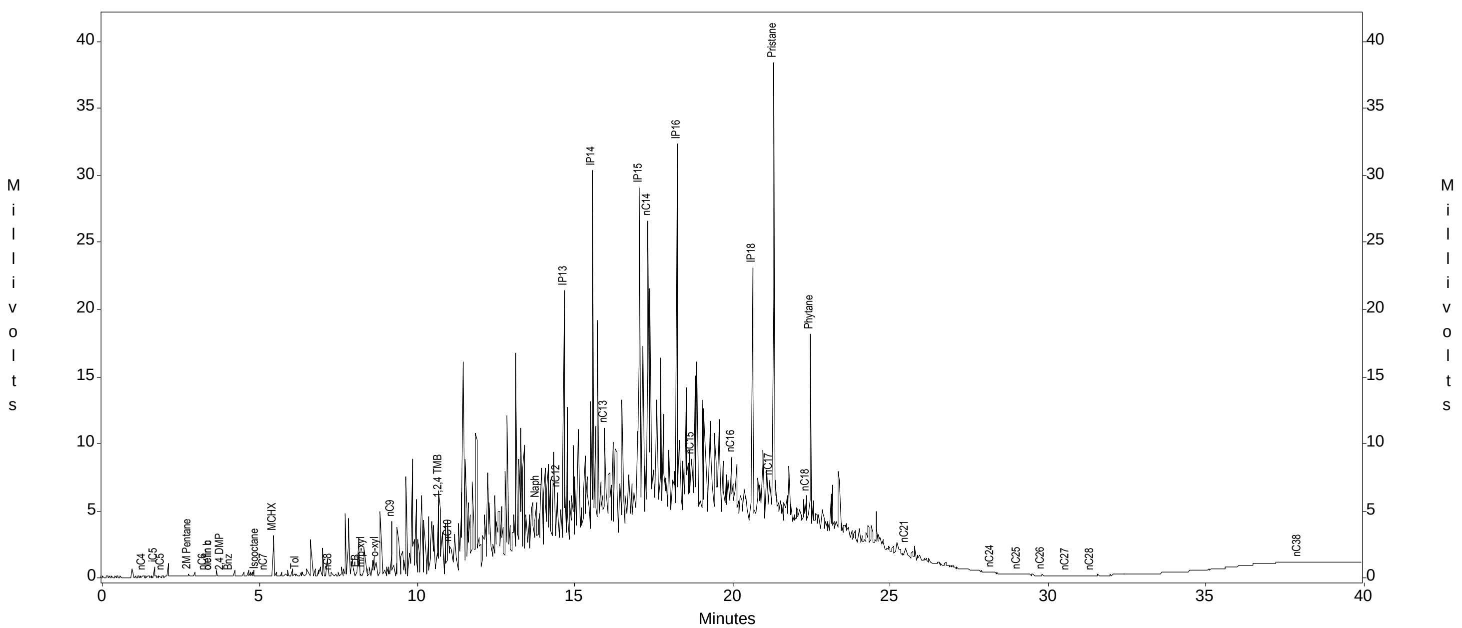


c:\ezchrom\chrom\17019\s-30 -- Channel A



Channel A Results

Peak	Area	Height
nC4	61	93
iC5	493	704
nC5	63	73
MTBE	0	0
2M Pentane	226	239
nC6	34	28
olefin a	0	0
olefin b	28	26
olefin c	37	25
2,4 DMP	92	73
Bnz	60	38
Isooctane	167	128
nC7	33	15
MCHX	3650	3037
Tol	297	137
nC8	59	39
EB	580	357
m/p-xyl	540	291
o-xyl	1592	1055
nC9	6302	4092
1,2,4 TMB	15104	5228
nC10	5412	1681
nC11	0	0
Naph	3364	2535
nC12	12418	3736
IP13	38199	18745
IP14	42887	27359
nC13	20956	7933
IP15	39294	24116
nC14	33055	18452
IP16	60972	27275
nC15	14108	3630
nC16	12297	4006
IP18	49116	18686
nC17	10171	2887
Pristane	78763	34082
nC18	8535	2521
Phytane	31486	14670
nC19	0	0
nC20	0	0
nC21	2222	541
nC22	0	0
nC23	0	0
nC24	481	50
nC25	305	42
nC26	115	32
nC27	85	31
nC28	72	19
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	315	15
nC39	0	0
nC40	0	0

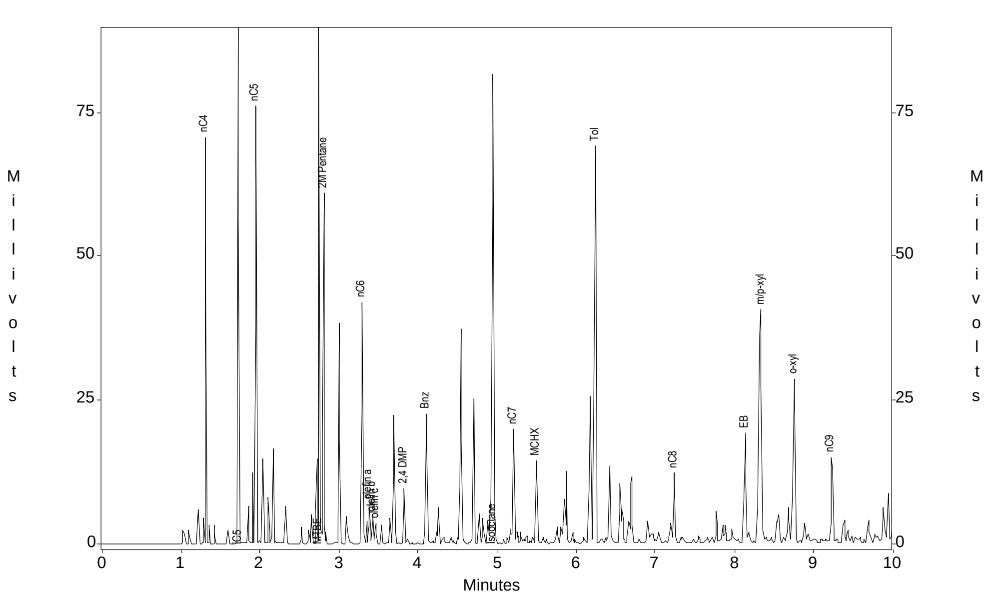
Torkelson Geochemistry, Inc.

Evergreen Corrective Measures - AOI4 Remedial Investigation, Philadelphia Refining Complex

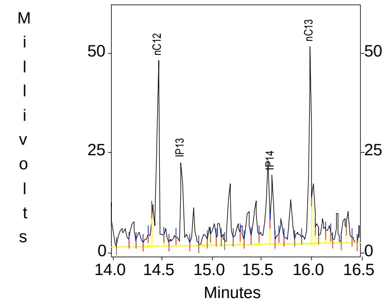
Sample ID : Gas/Dies/Wax std

Acquired : Mar 06, 2017 11:19:03

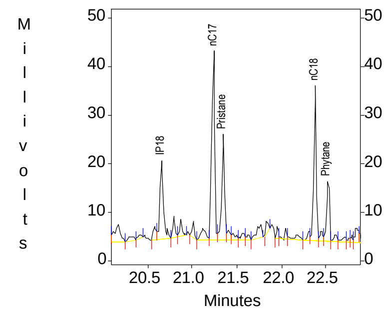
c:\ezchrom\chrom\17019\gadiwax2 -- Channel A



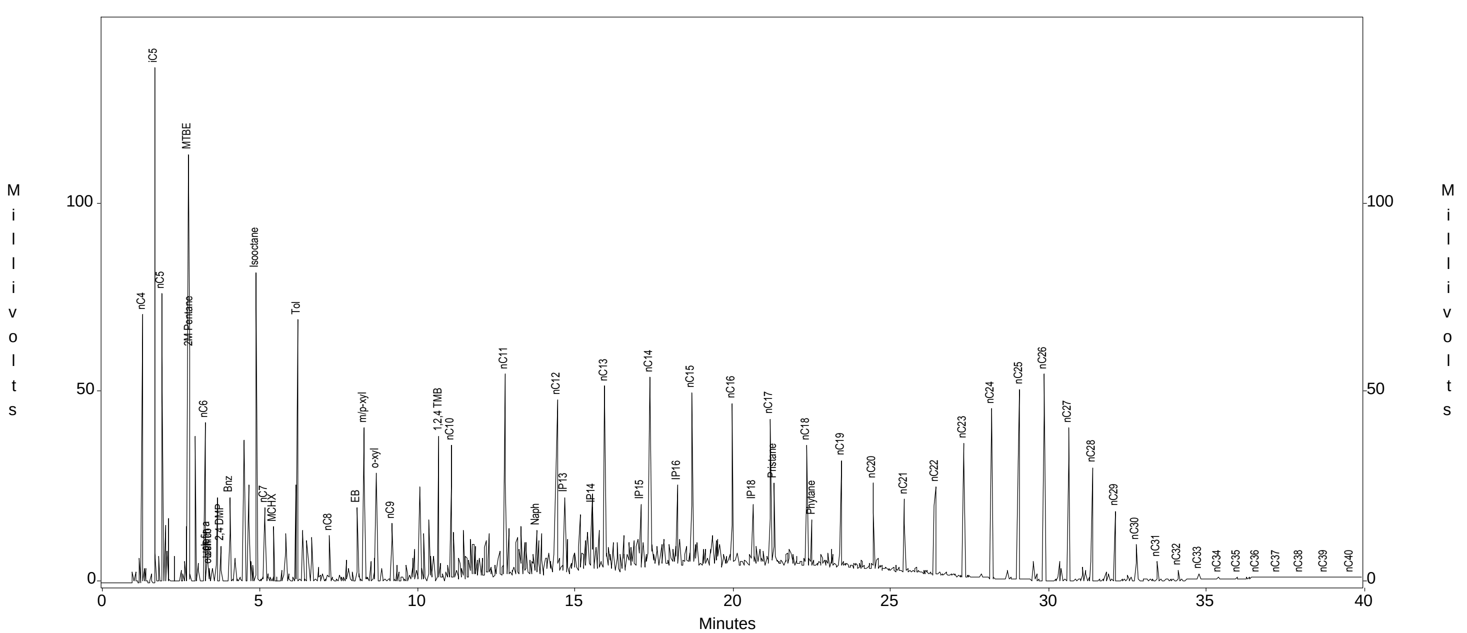
c:\ezchrom\chrom\17019\gadiwax2 -- Channel A



c:\ezchrom\chrom\17019\gadiwax2 -- Channel A



c:\ezchrom\chrom\17019\gadiwax2 -- Channel A



Channel A Results

Peak	Area	Height
nC4	37696	70600
iC5	90255	135788
nC5	53785	76021
MTBE	109576	112822
2M Pentane	54065	60990
nC6	41740	42007
olefin a	7689	6816
olefin b	4748	4847
olefin c	4111	3633
2,4 DMP	9862	9524
Bnz	27590	22515
Isooctane	118415	81627
nC7	24541	19755
MCHX	17989	14288
Tol	107844	69256
nC8	15057	12167
EB	26882	19313
m/p-xyl	94631	40772
o-xyl	42276	28687
nC9	23910	15086
1,2,4 TMB	64607	37920
nC10	52994	35439
nC11	95876	53745
Naph	22621	11779
nC12	100896	46380
IP13	42158	20494
IP14	25911	17315
nC13	98503	49366
IP15	33746	16795
nC14	125692	50136
IP16	48529	21363
nC15	87416	44818
nC16	95083	42906
IP18	43076	16062
nC17	79104	38871
Pristane	47236	21637
nC18	62242	31943
Phytane	26563	12347
nC19	64534	28234
nC20	45162	22868
nC21	34380	19493
nC22	44345	23592
nC23	71572	35169
nC24	110103	45159
nC25	132406	50322
nC26	135998	54465
nC27	103240	40392
nC28	64074	29784
nC29	34595	18145
nC30	16523	9468
nC31	8595	4859
nC32	4353	2616
nC33	2262	1370
nC34	1244	692
nC35	675	361
nC36	316	165
nC37	276	95
nC38	144	48
nC39	66	26
nC40	75	20

Torkelson Geochemistry, Inc.							
Physical Properties Measurements							
Sample	TGI Job Number	Density of NAPL (gm/ml)	Viscosity of NAPL (centipoise)	Surface Tension Air/Water (dynes/cm)	Interfacial Tension NAPL/Water (dynes/cm)	Surface Tension Air/NAPL (dynes/cm)	Temperature of Measurements
S-30	17019	0.8680	NR	NR	NR	NR	60F

NR = Not Requested

August 25, 2016

formerly ZymaX Forensics

Andrew Bradley
Stantec
1060 Andrew Drive; Suite 160
West Chester, PA 19380

RE: 2134
Project Number: 213402429

Pace Analytical received 5 sample(s) received on July 28th, 2016 for analysis S-382, S-410, S-368, S-348, and C-97. Per client request, the following analyses were performed:

1. C3-C36 Whole Oil (ASTM 3328)
2. Density/Specific Gravity (ASTM D1217)

The sample was performed in house under laboratory number **19752-2**.

Please call the lab at 412-826-4481, or you may email any questions or concerns to taryn.mancine@pacelabs.com regarding any analytical data reports.

Respectfully submitted,

Taryn Mancine

Taryn Mancine
Project Manager/Scientist

19752-2

Pace Analytical

ZymaX Forensics Division
220 William Pitt Way
Pittsburgh, PA 15238
Phone: 412-826-5245
Fax: 412-826-3433

Samples will be disposed of after 30 days unless requested otherwise

Chain of Custody

Report To:	Andrew Bradley	Email To:	Andrew.Bradley@stantec.com
Company:	Stantec Consulting	Phone:	610-840-2541
Address:	1060 Andrew Drive, Siute 160 West Chester, PA	Project:	2134
		Project #:	213402429

ZymaX use only	Sample Description	Date Sampled	Time	Matrix	Preserve	C3-C36 Whole Oil	Oxygenates	Organic Lead/Scavengers	Density/Specific Gravity	C3-C10 PIANO	C8-C40 Full Scan	Simulated Distillation	# of containers
	S-382	7/25/16	1200	LNALP	None	x			x				
	S-410	↓	1240	LNAPL	None	x			x				
	~~S-386~~ S-368	↓	1315	LNAPL	None	x			x				
	S-348	↓	1330	LNAPL	None	x			x				
	C-97	7/25/16	1000										

Bill To: Same as Above ☑ Yes
Company:
Address:

PO Number:
Invoice Email:

Sample Comments:

Laboratory Remarks: Temperature: ______ °C Courier Method: ______

sample integrity upon receipt:
samples received intact ☐ Yes
samples received cold/on ice ☐ Yes
custody seals ☐ Yes
correct container types ☐ Yes

Turnaround Time
ASAP ☐ 1wk ☐
48 hr ☐ STD (2wks) ☐
72 hr ☐
quicker TAT may result in additional surcharges

Print Name of Sampler:	William T Delk				
Signature of Sampler:	[signature]	Date:	7/25/16		
Relinquished By:	[signature]	Date:	7/26/16	Time:	1315
Relinquished By:	[signature]	Date:	7/26/16	Time:	1915
Relinquished By:	[signature]	Date:	7/26/16	Time:	1830
Received by Lab:	[signature]	Date:	7/26/16	Time:	2145

PAES 7.28.16 1530
2°C

Page ____ of ____

Cooler Receipt Form

Client Name: Stantec Project: 2134-02429 Lab Work Order: 19752

A. **Shipping/Container Information** (circle appropriate response)

Courier: FedEx UPS USPS Client (Other:) Pace G Air bill Present: Yes No

Tracking Number:

Custody Seal on Cooler/Box Present: Yes (No) Seals Intact: Yes No

Cooler/Box Packing Material: Bubble Wrap Absorbent Foam (Other:)

Type of Ice: (Wet) Blue None Ice Intact: (Yes) Melted

Cooler Temperature: 2°C Radiation Screened: Yes (No) Chain of Custody Present: (Yes) No

Comments:

B. **Laboratory Assignment/Log-in** (check appropriate response)

	YES	NO	N/A	Comment Reference non-Conformance
Chain of Custody properly filled out	✓			
Chain of Custody relinquished	✓			
Sampler Name & Signature on COC	✓			
Containers intact	✓			
Were samples in separate bags	✓			
Sample container labels match COC Sample name/date and time collected		✓		
Sufficient volume provided	✓			
PAES containers used			✓	
Are containers properly preserved for the requested testing? (as labeled)			✓	
If an unknown preservation state, were containers checked? Exception: VOA's coliform			✓	If yes, see pH form.
Was volume for dissolved testing field filtered, as noted on the COC? Was volume received in a preserved container?			✓	

Comments:

Cooler contents examined/received by : LY Date: 7.28.16

Project Manager Review : TM Date: 7.29.16

F-PAE-Q-009-rev.00, 20 Nov2014

ZymaX ID	19752-5
Sample ID	S-382
Evaporation	
n-Pentane / n-Heptane	1.08
2-Methylpentane / 2-Methylheptane	0.00
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	0.00
Aromatics / Total Paraffins (n+iso+cyc)	0.32
Aromatics / Naphthenes	10.90
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	34.28
3-Methylhexane / n-Heptane	1.89
Methylcyclohexane / n-Heptane	0.00
Isoparaffins + Naphthenes / Paraffins	2.48
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.00
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	21.33
% Isoparaffinic	50.84
% Aromatic	23.57
% Naphthenic	2.16
% Olefinic	2.11

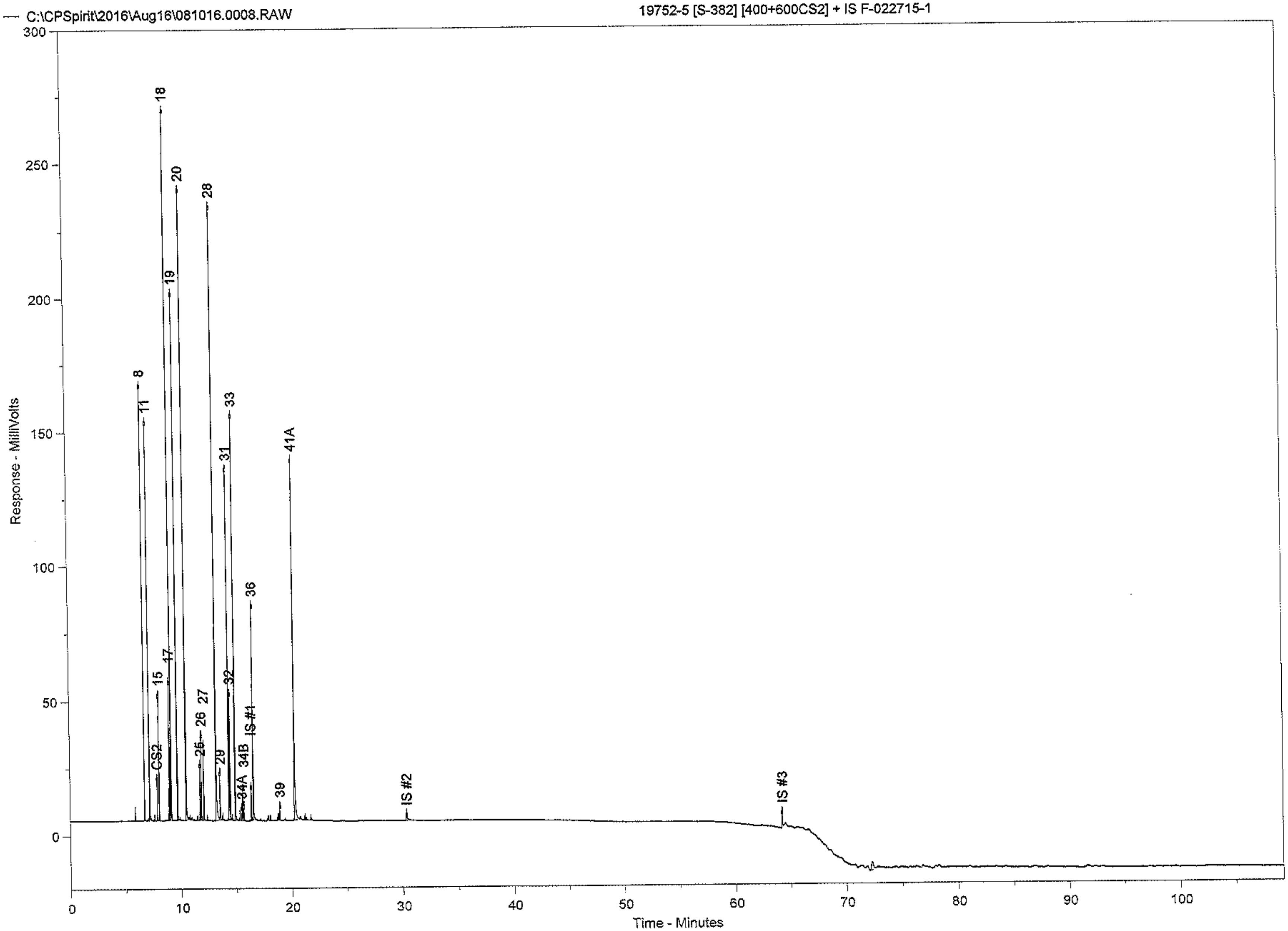
8/10/2016

ZymaX ID		19752-5
Sample ID		S-382
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.00
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	5.09
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	5.02
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	1.80
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	2.28
18	2-Methylpentane	11.73
19	3-Methylpentane	9.24
20	Hexane	11.66
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	1.07
26	Methylcyclopentane	1.66
27	2,4-Dimethylpentane	1.51
28	Benzene	13.75
29	5-Methyl-1-hexene	1.04
30	Cyclohexane	0.00
31	2-Methylhexane/TAME	7.44
32	2,3-Dimethylpentane	2.73
33	3-Methylhexane	8.77
34A	1-trans-3-Dimethylcyclopentane	0.23
34B	1-cis-3-Dimethylcyclopentane	0.27
35	2,2,4-Trimethylpentane	0.00
I.S. #1	à,à,à-Trifluorotoluene	0.00

	ZymaX ID	19752-5
	Sample ID	S-382
		Relative Area %
36	n-Heptane	4.65
37	Methylcyclohexane	0.00
38	2,5-Dimethylhexane	0.00
39	2,4-Dimethylhexane	0.26
40	2,3,4-Trimethylpentane	0.00
41	Toluene/2,3,3-Trimethylpentane	9.81
42	2,3-Dimethylhexane	0.00
43	2-Methylheptane	0.00
44	4-Methylheptane	0.00
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	0.00
46B	1,4-Dimethylcyclohexane	0.00
47	3-Methylheptane	0.00
48	2,2,5-Trimethylhexane	0.00
49	n-Octane	0.00
50	2,2-Dimethylheptane	0.00
51	2,4-Dimethylheptane	0.00
52	Ethylcyclohexane	0.00
53	2,6-Dimethylheptane	0.00
54	Ethylbenzene	0.00
55	m+p Xylenes	0.00
56	4-Methyloctane	0.00
57	2-Methyloctane	0.00
58	3-Ethylheptane	0.00
59	3-Methyloctane	0.00
60	o-Xylene	0.00
61	1-Nonene	0.00
62	n-Nonane	0.00
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.00
64	3,3,5-Trimethylheptane	0.00
65	2,4,5-Trimethylheptane	0.00
66	n-Propylbenzene	0.00
67	1-Methyl-3-ethylbenzene	0.00
68	1-Methyl-4-ethylbenzene	0.00
69	1,3,5-Trimethylbenzene	0.00
70	3,3,4-Trimethylheptane	0.00

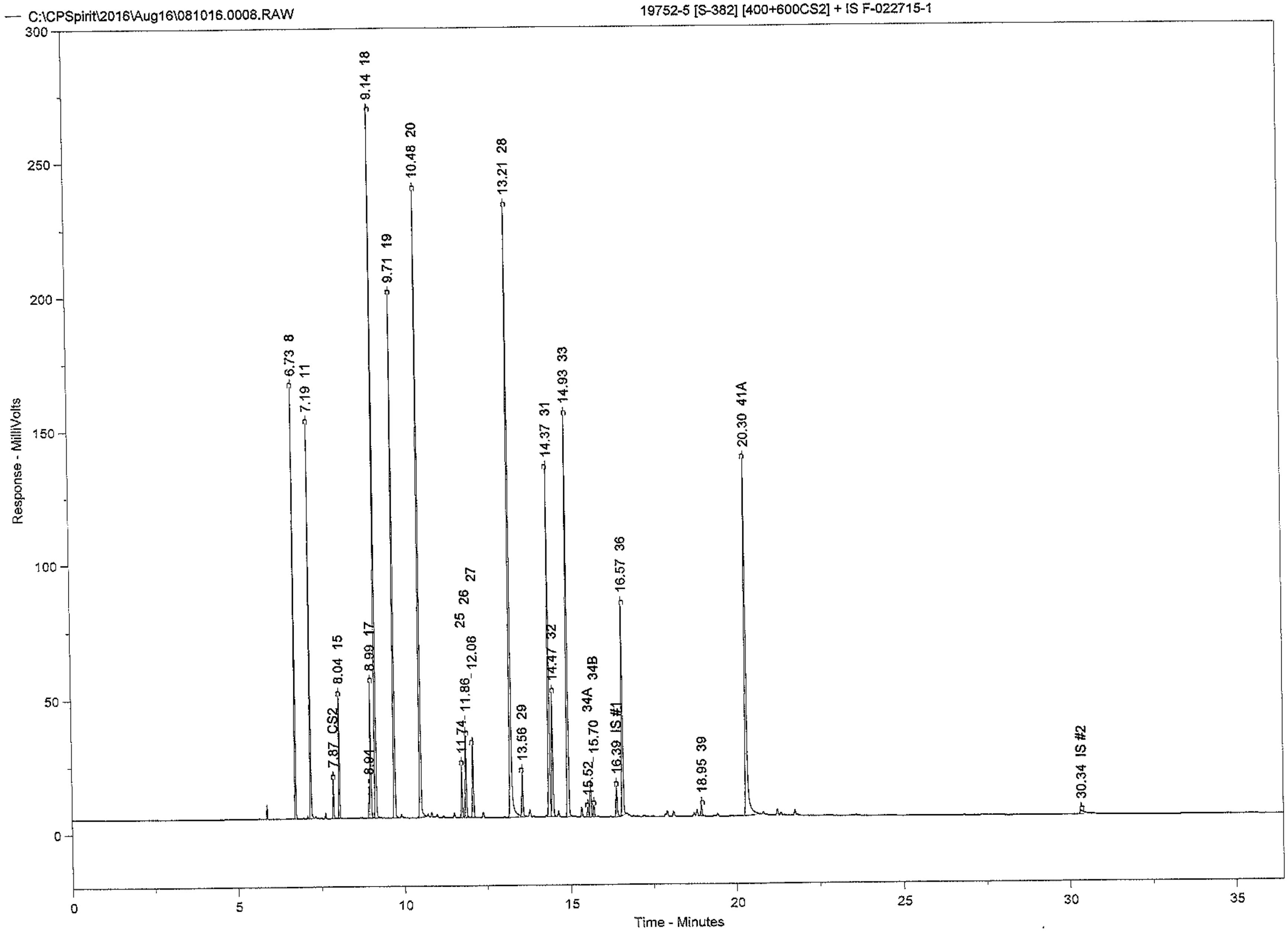
ZymaX ID		19752-5
Sample ID		S-382
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.00
72	3-Methylnonane	0.00
73	1,2,4-Trimethylbenzene	0.00
74	Isobutylbenzene	0.00
75	sec-Butylbenzene	0.00
76	n-Decane	0.00
77	1,2,3-Trimethylbenzene	0.00
78	Indan	0.00
79	1,3-Diethylbenzene	0.00
80	1,4-Diethylbenzene	0.00
81	n-Butylbenzene	0.00
82	1,3-Dimethyl-5-ethylbenzene	0.00
83	1,4-Dimethyl-2-ethylbenzene	0.00
84	1,3-Dimethyl-4-ethylbenzene	0.00
85	1,2-Dimethyl-4-ethylbenzene	0.00
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	0.00
88	1,2,3,5-Tetramethylbenzene	0.00
89	1,2,3,4-Tetramethylbenzene	0.00
90	Naphthalene	0.00
91	2-Methyl-naphthalene	0.00
92	1-Methyl-naphthalene	0.00

Chrom Perfect Chromatogram Report



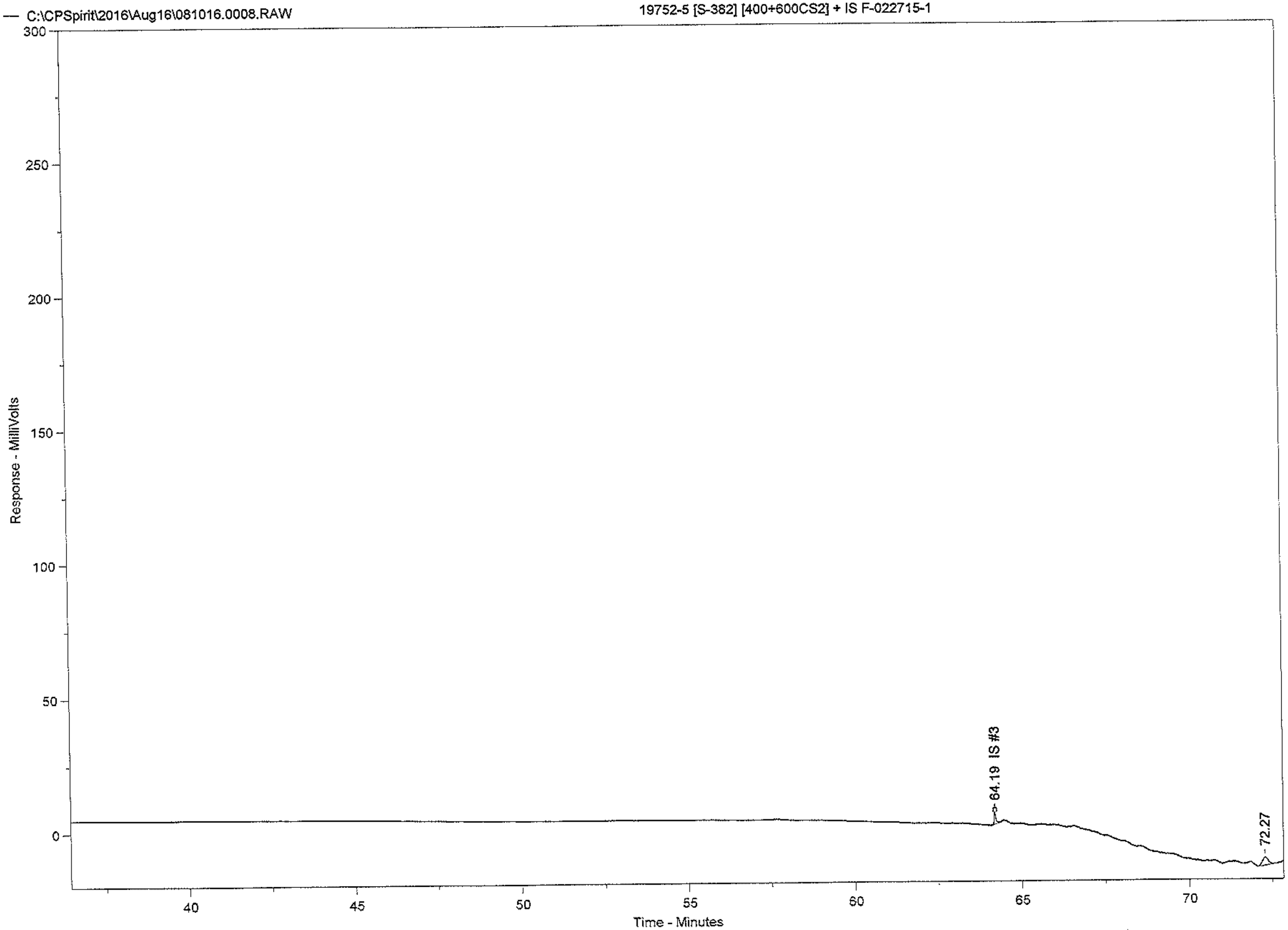
Printed on 8/24/2016 2:01:31 PM

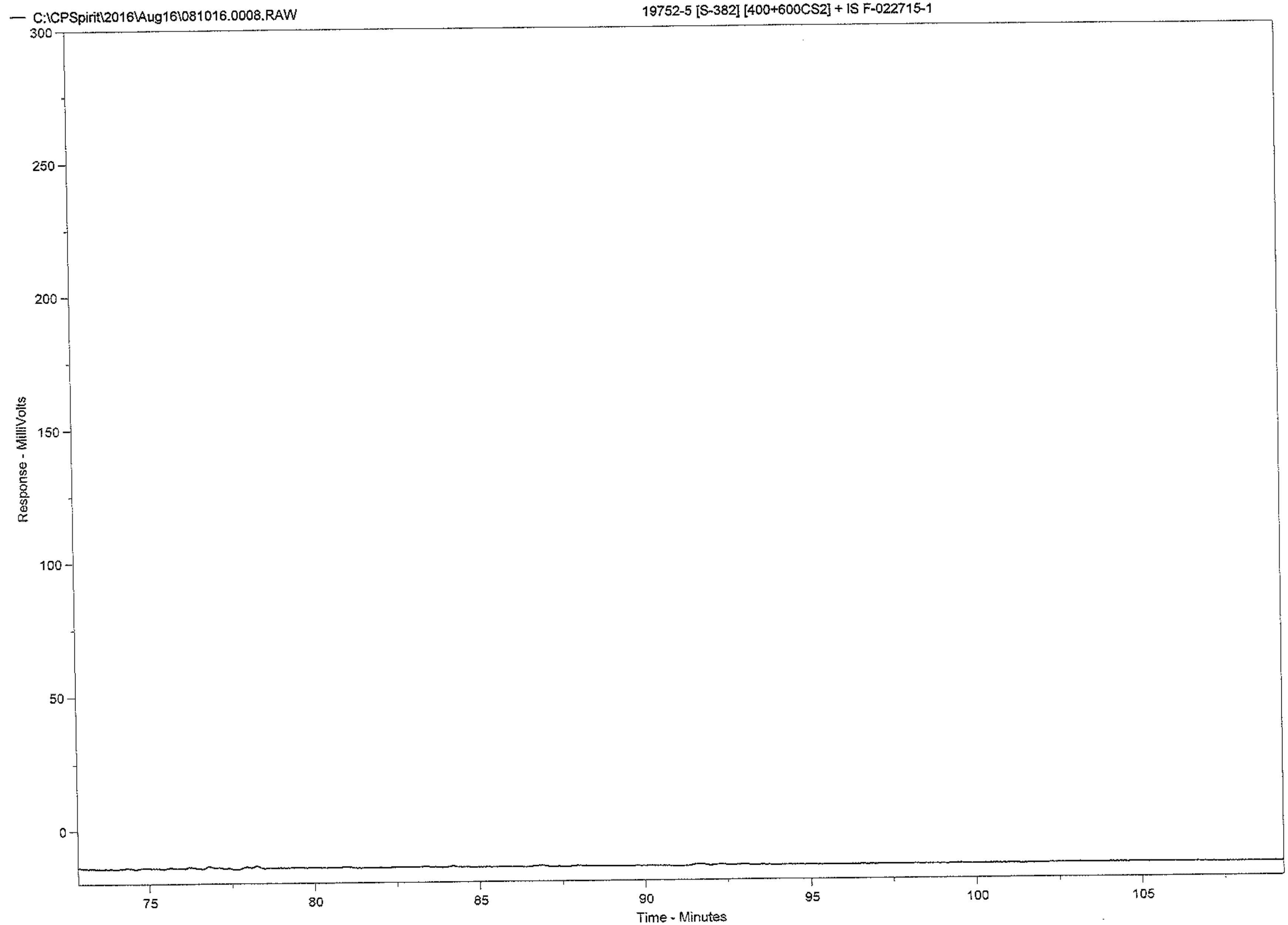
Chrom Perfect Chromatogram Report



— C:\CPSpirit\2016\Aug16\081016.0008.RAW

19752-5 [S-382] [400+600CS2] + IS F-022715-1




— C:\CPSpirit\2016\Aug16\081016.0008.RAW
19752-5 [S-382] [400+600CS2] + IS F-022715-1
Response - MilliVolts
300
250
200
150
100
50
0
75
80
85
90
95
100
105
Time - Minutes

Sample Name = **19752-5 [S-382] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016.0008.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/22/2016 2:23:20 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
8	6.73	4.9163	212815.80
11	7.19	4.8498	209937.50
CS2	7.87	0.6013	26029.82
15	8.04	1.7385	75255.43
	8.94	0.4881	21128.75
17	8.99	2.2041	95410.88
18	9.14	11.3257	490267.60
19	9.71	8.9257	386375.50
20	10.48	11.2649	487636.50
25	11.74	1.0289	44541.30
26	11.86	1.6030	69390.37
27	12.08	1.4572	63081.29
28	13.21	13.2831	574999.40
29	13.56	1.0042	43470.81
31	14.37	7.1815	310873.20
32	14.47	2.6327	113963.50
33	14.93	8.4663	366488.70
34A	15.52	0.2212	9576.04
34B	15.70	0.2632	11395.49
IS #1	16.39	0.7227	31285.07
36	16.57	4.4891	194324.90
39	18.95	0.2497	10810.29
41A	20.30	9.4770	410242.00
IS #2	30.34	0.3235	14004.70
IS #3	64.19	0.4014	17376.46
	72.27	0.8809	38133.27

Total Area = 4328815 Total Height = 2019167 Total Amount = 0

ZymaX ID	19752-6
Sample ID	S-410
Evaporation	
n-Pentane / n-Heptane	0.05
2-Methylpentane / 2-Methylheptane	0.22
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	0.15
Aromatics / Total Paraffins (n+iso+cyc)	1.20
Aromatics / Naphthenes	4.54
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	239.19
3-Methylhexane / n-Heptane	0.71
Methylcyclohexane / n-Heptane	1.69
Isoparaffins + Naphthenes / Paraffins	5.47
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.21
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	6.97
% Isoparaffinic	26.23
% Aromatic	53.95
% Naphthenic	11.88
% Olefinic	0.97

8/10/2016

ZymaX ID		19752-6
Sample ID		S-410
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.00
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.12
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	0.09
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.13
18	2-Methylpentane	0.54
19	3-Methylpentane	0.53
20	Hexane	0.69
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.07
26	Methylcyclopentane	0.44
27	2,4-Dimethylpentane	0.21
28	Benzene	0.00
29	5-Methyl-1-hexene	0.06
30	Cyclohexane	0.41
31	2-Methylhexane/TAME	1.02
32	2,3-Dimethylpentane	0.56
33	3-Methylhexane	1.39
34A	1-trans-3-Dimethylcyclopentane	0.49
34B	1-cis-3-Dimethylcyclopentane	0.77
35	2,2,4-Trimethylpentane	0.69
I.S. #1	à,à,à-Trifluorotoluene	0.00

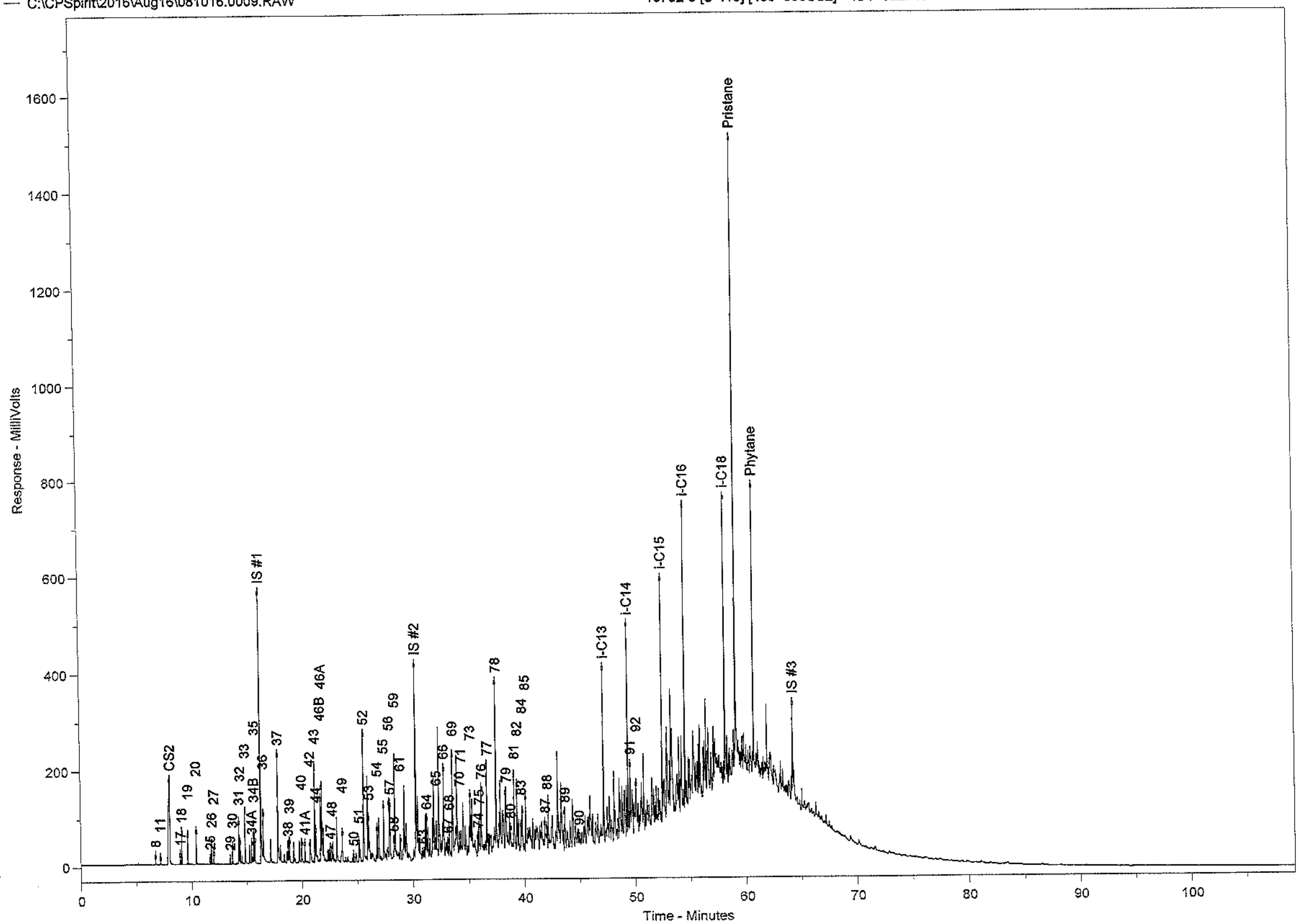
	ZymaX ID	19752-6
	Sample ID	S-410
		Relative Area %
36	n-Heptane	1.97
37	Methylcyclohexane	3.33
38	2,5-Dimethylhexane	0.44
39	2,4-Dimethylhexane	0.72
40	2,3,4-Trimethylpentane	0.63
41	Toluene/2,3,3-Trimethylpentane	0.49
42	2,3-Dimethylhexane	0.93
43	2-Methylheptane	2.45
44	4-Methylheptane	0.69
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	2.84
46B	1,4-Dimethylcyclohexane	1.64
47	3-Methylheptane	0.34
48	2,2,5-Trimethylhexane	0.27
49	n-Octane	1.30
50	2,2-Dimethylheptane	0.13
51	2,4-Dimethylheptane	0.52
52	Ethylcyclohexane	4.80
53	2,6-Dimethylheptane	1.26
54	Ethylbenzene	0.95
55	m+p Xylenes	1.50
56	4-Methyloctane	1.49
57	2-Methyloctane	1.30
58	3-Ethylheptane	0.36
59	3-Methyloctane	2.99
60	o-Xylene	0.00
61	1-Nonene	0.84
62	n-Nonane	0.00
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.18
64	3,3,5-Trimethylheptane	1.33
65	2,4,5-Trimethylheptane	1.51
66	n-Propylbenzene	2.93
67	1-Methyl-3-ethylbenzene	0.54
68	1-Methyl-4-ethylbenzene	1.09
69	1,3,5-Trimethylbenzene	4.63
70	3,3,4-Trimethylheptane	0.85

ZymaX ID		19752-6
Sample ID		S-410
		Relative Area %
71	1-Methyl-2-ethylbenzene	1.06
72	3-Methylnonane	0.00
73	1,2,4-Trimethylbenzene	1.87
74	Isobutylbenzene	0.66
75	sec-Butylbenzene	1.47
76	n-Decane	2.92
77	1,2,3-Trimethylbenzene	2.97
78	Indan	5.84
79	1,3-Diethylbenzene	3.90
80	1,4-Diethylbenzene	1.08
81	n-Butylbenzene	3.81
82	1,3-Dimethyl-5-ethylbenzene	2.97
83	1,4-Dimethyl-2-ethylbenzene	1.29
84	1,3-Dimethyl-4-ethylbenzene	2.16
85	1,2-Dimethyl-4-ethylbenzene	2.29
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	1.03
88	1,2,3,5-Tetramethylbenzene	1.05
89	1,2,3,4-Tetramethylbenzene	1.90
90	Naphthalene	0.38
91	2-Methyl-naphthalene	3.01
92	1-Methyl-naphthalene	2.87

Chrom Perfect Chromatogram Report

— C:\CPSpirit\2016\Aug16\081016.0009.RAW

19752-6 [S-410] [400+600CS2] + IS F-022715-1



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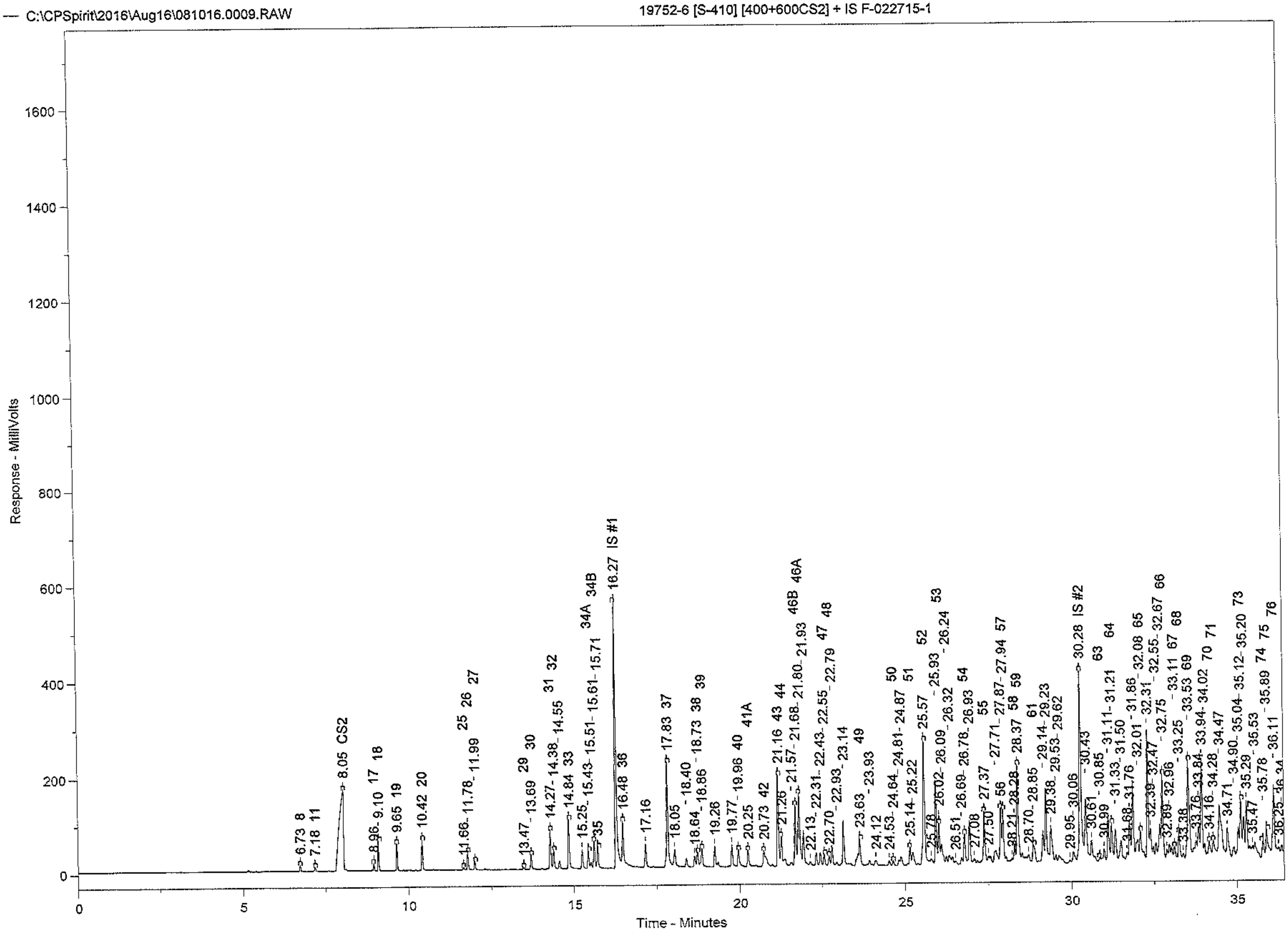
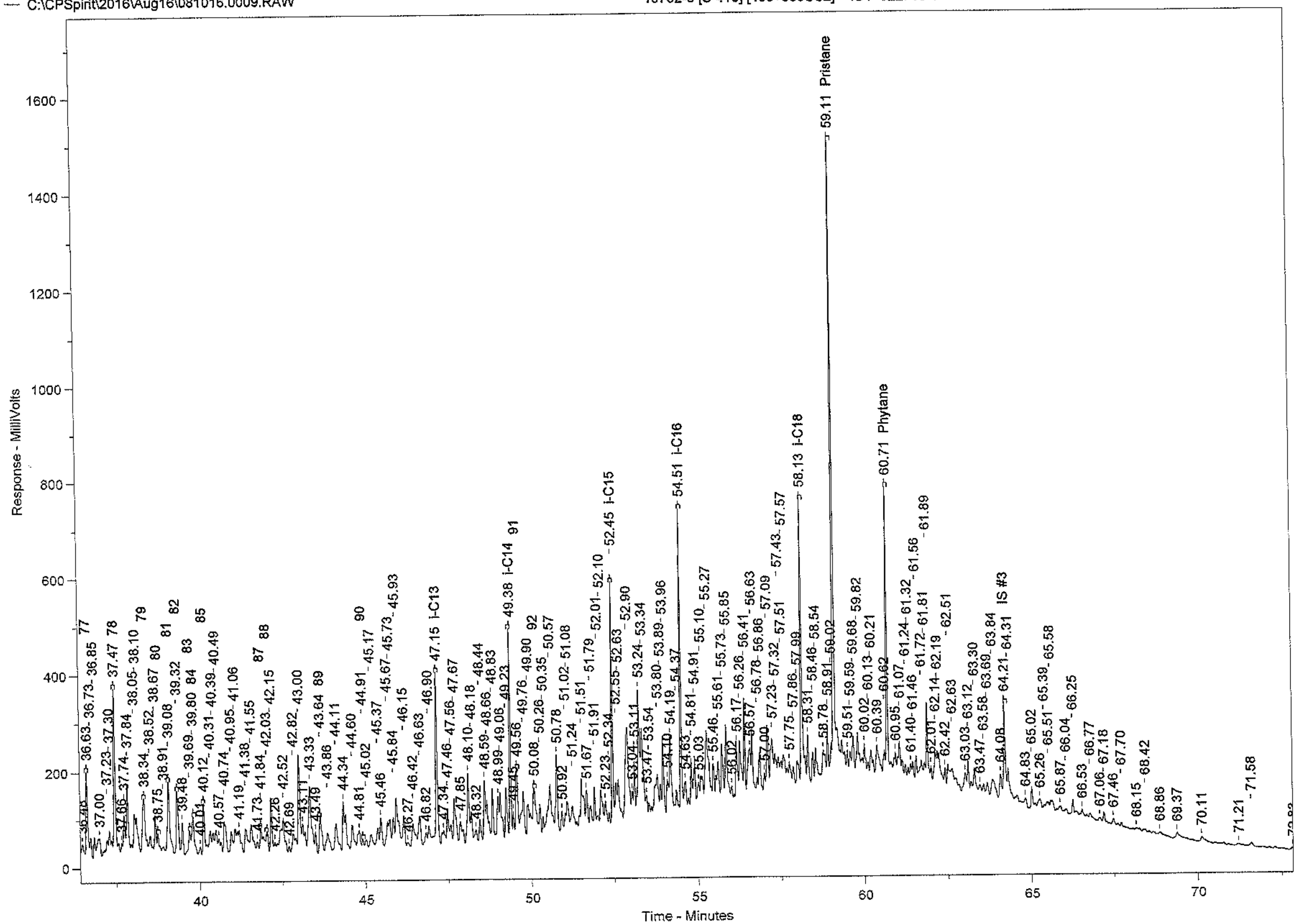
Chrom Perfect Chromatogram Report



Chrom Perfect Chromatogram Report

19752-6 [S-410] [400+600CS2] + IS F-022715-1



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Chrom Perfect Chromatogram Report

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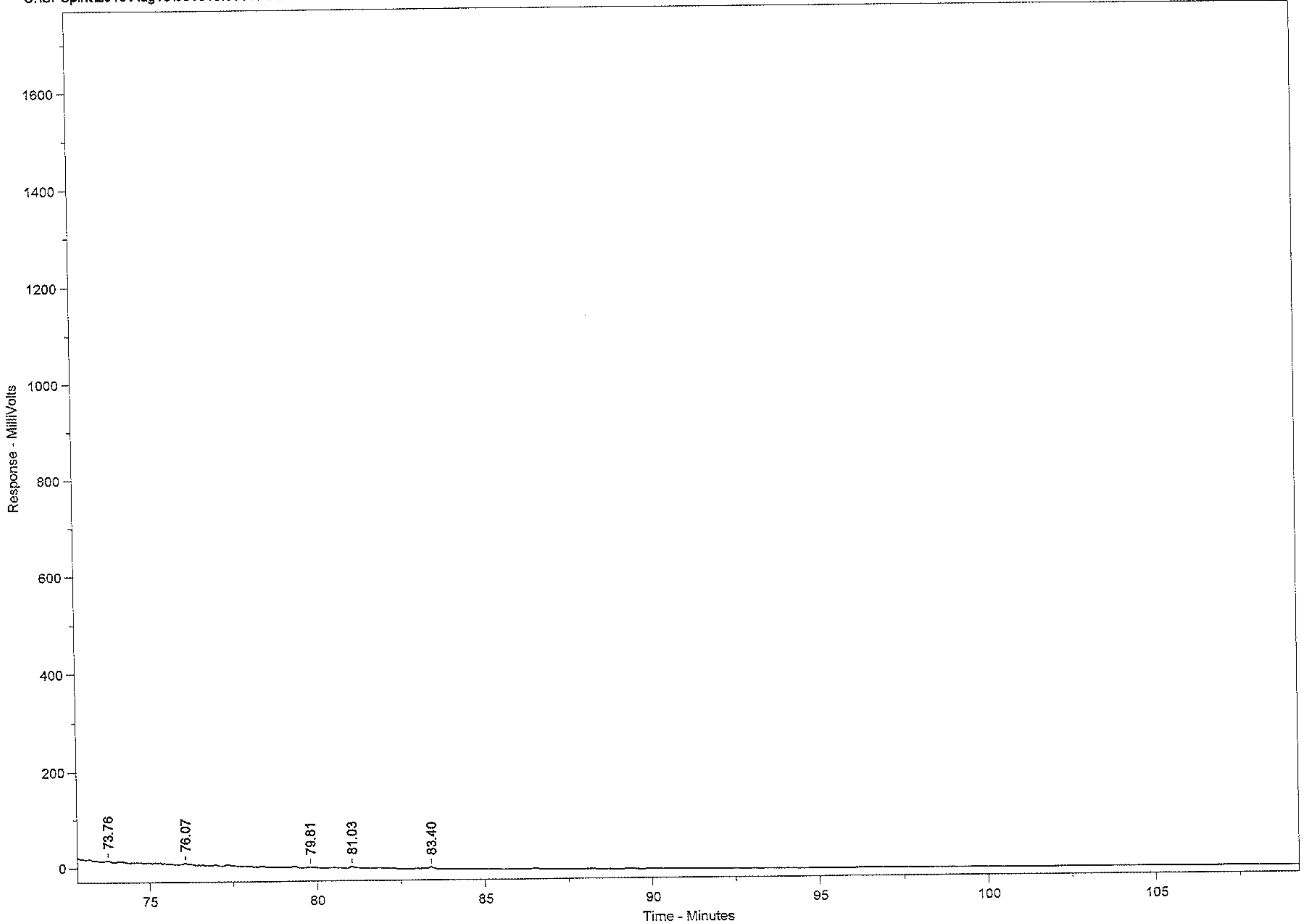
19752-6 [S-410] [400+600CS2] + IS F-022715-1



Sample Name = **19752-6 [S-410] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016.0009.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/22/2016 4:35:15 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
8	6.73	0.0214	25625.03
11	7.18	0.0166	19867.49
CS2	8.05	1.2469	1489700.00
17	8.96	0.0230	27513.78
18	9.10	0.0998	119268.00
19	9.65	0.0978	116822.90
20	10.42	0.1261	150656.30
25	11.66	0.0121	14400.71
26	11.78	0.0809	96645.43
27	11.99	0.0380	45405.43
29	13.47	0.0111	13296.28
30	13.69	0.0756	90309.50
31	14.27	0.1875	223981.60
32	14.38	0.1025	122509.10
	14.55	0.0461	55130.09
33	14.84	0.2543	303876.20
	15.25	0.0973	116236.30
34A	15.43	0.0893	106654.20
	15.51	0.0333	39767.57
34B	15.61	0.1408	168188.70
35	15.71	0.1260	150504.40
IS #1	16.27	1.4201	1696628.00
36	16.48	0.3604	430562.30
	17.16	0.1289	153955.00
37	17.83	0.6095	728153.90
	18.05	0.1365	163046.10
	18.40	0.0532	63598.49
	18.64	0.0576	68844.84
38	18.73	0.0798	95284.73
39	18.86	0.1323	158106.90
	19.26	0.0935	111671.50
	19.77	0.1281	152994.20
40	19.96	0.1153	137807.00
41A	20.25	0.0903	107883.60
42	20.73	0.1695	202469.50
43	21.16	0.4486	535980.30
44	21.26	0.1265	151134.40
	21.57	0.0192	22924.44
46B	21.68	0.2996	357940.10
46A	21.80	0.5199	621142.70
	21.93	0.2032	242796.20
	22.13	0.0238	28487.66
	22.31	0.0641	76600.13
	22.43	0.0659	78767.79
47	22.55	0.0618	73874.90
48	22.70	0.0486	58105.36
	22.79	0.1090	130185.20
	22.93	0.0202	24132.69
	23.14	0.2400	286775.30
49	23.63	0.2381	284416.40
	23.93	0.0353	42154.98
	24.12	0.0401	47874.46
	24.53	0.0289	34582.61
50	24.64	0.0240	28685.13
	24.81	0.0281	33568.38

Peak Name	Ret. Time	Area %	Area
	24.87	0.0589	70388.91
51	25.14	0.0948	113270.10
	25.22	0.1008	120386.90
52	25.57	0.8798	1051125.00
	25.78	0.0575	68718.67
	25.93	0.4454	532098.50
53	26.02	0.2313	276313.50
	26.09	0.1589	189888.40
	26.24	0.0487	58146.50
	26.32	0.0711	84968.52
	26.51	0.0235	28080.18
	26.69	0.0345	41252.00
54	26.78	0.1748	208819.00
	26.93	0.2432	290519.20
	27.08	0.0266	31763.51
55	27.37	0.2755	329208.00
	27.50	0.0110	13140.26
	27.71	0.1204	143795.20
56	27.87	0.2735	326727.50
57	27.94	0.2377	284022.50
	28.21	0.0086	10292.89
58	28.28	0.0653	78008.95
59	28.37	0.5478	654451.80
	28.70	0.0214	25553.22
61	28.85	0.1541	184056.60
	29.14	0.1870	223374.40
	29.23	0.4454	532148.90
	29.38	0.2699	322474.30
	29.53	0.0446	53313.44
	29.62	0.0878	104877.20
	29.95	0.0186	22220.66
	30.06	0.0952	113771.60
IS #2	30.28	1.3793	1647852.00
	30.43	0.5217	623331.70
	30.61	0.1910	228247.80
63	30.85	0.0337	40215.53
	30.99	0.0821	98050.17
	31.11	0.2774	331481.20
64	31.21	0.2442	291711.80
	31.33	0.2192	261862.30
	31.50	0.2036	243294.50
	31.68	0.0562	67153.15
	31.76	0.2435	290860.20
	31.86	0.4896	584966.90
	32.01	0.2164	258547.20
65	32.08	0.2769	330883.50
	32.31	0.7107	849111.20
	32.39	0.2025	241980.50
	32.47	0.0792	94611.59
	32.55	0.1148	137147.10
	32.67	0.2668	318729.50
66	32.75	0.5369	641400.80
	32.89	0.0645	77078.55
	32.96	0.0967	115577.20
67	33.11	0.0997	119112.10
68	33.25	0.1993	238143.60
	33.38	0.0390	46652.81
69	33.53	0.8475	1012597.00
	33.76	0.2121	253458.60
	33.84	0.2329	278210.40
	33.94	0.5624	671893.80
	34.02	0.1186	141672.70
70	34.16	0.1556	185896.90
71	34.28	0.1945	232328.40
	34.47	0.6733	804394.10
	34.71	0.2520	301107.80
	34.90	0.0978	116876.50

Peak Name	Ret. Time	Area %	Area
	35.04	0.2135	255054.30
73	35.12	0.3417	408258.80
	35.20	0.2618	312833.70
	35.29	0.3523	420907.20
	35.47	0.0878	104846.10
	35.53	0.1663	198674.70
74	35.78	0.1216	145235.60
75	35.89	0.2684	320645.10
76	36.11	0.5354	639677.50
	36.25	0.0687	82088.52
	36.34	0.0933	111445.80
	36.48	0.1684	201145.80
77	36.63	0.5447	650830.70
	36.73	0.1313	156837.80
	36.85	0.1373	164087.50
	37.00	0.2755	329134.00
	37.23	0.2237	267295.70
	37.30	0.1767	211156.50
78	37.47	1.0697	1278015.00
	37.66	0.0864	103211.30
	37.74	0.2957	353269.70
	37.84	0.5357	640061.70
	38.05	0.3024	361337.50
	38.10	0.3492	417225.00
79	38.34	0.7138	852810.80
	38.52	0.2504	299120.30
	38.67	0.2678	319949.80
80	38.75	0.1983	236929.10
	38.91	0.1270	151766.90
81	39.08	0.6973	833123.90
82	39.32	0.5447	650721.20
	39.48	0.2253	269154.10
83	39.69	0.2369	283010.40
84	39.80	0.3952	472111.30
	40.01	0.0763	91195.11
85	40.12	0.4201	501943.30
	40.31	0.2013	240538.70
	40.39	0.1676	200262.40
	40.49	0.2175	259813.90
	40.57	0.1843	220204.50
	40.74	0.3481	415852.40
	40.95	0.2223	265649.20
	41.06	0.1955	233599.70
	41.19	0.2338	279338.90
	41.38	0.3172	378988.00
	41.55	0.3547	423716.30
	41.73	0.1049	125281.60
87	41.84	0.1892	226068.80
88	42.03	0.1922	229570.10
	42.15	0.3622	432749.70
	42.26	0.0834	99666.80
	42.52	0.5485	655341.60
	42.69	0.0449	53681.57
	42.82	0.1824	217971.70
	43.00	0.7033	840239.10
	43.11	0.2043	244119.20
	43.33	0.7491	895021.50
	43.49	0.1266	151272.90
89	43.64	0.3473	414879.80
	43.86	0.2599	310494.70
	44.11	0.3308	395184.70
	44.34	0.5537	661501.40
	44.60	0.2585	308891.40
	44.81	0.2118	253000.20
90	44.91	0.0703	83972.94
	45.02	0.0893	106646.50
	45.17	0.1802	215247.30

Peak Name	Ret. Time	Area %	Area
	45.37	0.1829	218480.50
	45.46	0.2323	277536.60
	45.67	0.2193	261977.00
	45.73	0.1894	226306.30
	45.84	0.2177	260099.30
	45.93	0.5492	656189.40
	46.15	0.2457	293494.20
	46.27	0.0322	38515.48
	46.42	0.2611	311914.50
	46.63	0.2571	307190.40
	46.82	0.1016	121437.10
	46.90	0.1676	200238.80
i-C13	47.15	1.0372	1239181.00
	47.34	0.1456	173915.70
	47.46	0.2262	270267.80
	47.56	0.1043	124553.80
	47.67	0.3671	438540.50
	47.85	0.0890	106331.00
	48.10	0.4976	594525.90
	48.18	0.1784	213134.00
	48.32	0.1008	120403.10
	48.44	0.1384	165339.30
	48.59	0.3906	466661.60
	48.66	0.2987	356821.00
	48.83	0.3025	361407.20
	48.99	0.2924	349288.00
	49.06	0.3647	435702.10
	49.23	0.3504	418625.80
i-C14	49.38	0.9467	1131059.00
	49.45	0.1156	138133.10
91	49.56	0.5511	658398.40
	49.76	0.4672	558229.90
	49.90	0.2383	284749.80
92	50.08	0.5253	627599.40
	50.26	0.1748	208897.10
	50.35	0.0729	87148.87
	50.57	0.6789	811106.70
	50.78	0.4749	567341.90
	50.92	0.1144	136716.50
	51.02	0.0875	104503.90
	51.08	0.2332	278663.80
	51.24	0.2833	338465.00
	51.51	0.5395	644580.60
	51.67	0.2681	320293.00
	51.79	0.1656	197831.10
	51.91	0.2009	239983.20
	52.01	0.0748	89353.00
	52.10	0.3073	367191.10
	52.23	0.1722	205790.30
	52.34	0.0452	53971.56
i-C15	52.45	1.0395	1241974.00
	52.55	0.2777	331836.70
	52.63	0.3447	411812.40
	52.90	1.1982	1431585.00
	53.04	0.1796	214568.60
	53.11	0.2807	335307.20
	53.24	0.9753	1165276.00
	53.34	0.8216	981631.10
	53.47	0.1496	178792.30
	53.54	0.0955	114156.90
	53.80	0.5848	698719.90
	53.89	0.1956	233719.30
	53.96	0.4533	541521.90
	54.10	0.2752	328828.30
	54.19	0.6285	750894.20
	54.37	0.1785	213233.90
i-C16	54.51	1.3529	1616316.00

Peak Name	Ret. Time	Area %	Area
	54.63	0.2678	319939.10
	54.81	0.2980	356031.80
	54.91	0.3629	433545.80
	55.03	0.2398	286522.00
	55.10	0.3723	444828.80
	55.27	1.1385	1360181.00
	55.46	0.3223	385100.60
	55.61	0.5199	621126.40
	55.73	0.4950	591372.70
	55.85	0.7119	850512.30
	56.02	0.1461	174515.10
	56.17	0.4555	544183.50
	56.26	0.5896	704458.30
	56.41	0.5293	632368.40
	56.57	0.6682	798362.30
	56.63	0.5076	606510.20
	56.78	0.1534	183332.30
	56.86	0.4439	530318.00
	57.00	0.1984	237091.10
	57.09	0.5861	700275.40
	57.23	0.7126	851420.30
	57.32	0.3971	474473.20
	57.43	0.2827	337720.60
	57.51	0.3055	364991.80
	57.57	0.4643	554774.40
	57.75	0.3179	379800.90
	57.86	0.2707	323448.00
	57.99	0.3945	471337.40
i-C18	58.13	1.8774	2243005.00
	58.31	0.4596	549076.30
	58.46	0.3345	399593.20
	58.54	0.5717	683025.20
	58.78	0.5650	675011.30
	58.91	0.4294	513035.40
	59.02	0.3522	420761.10
Pristane	59.11	4.3485	5195348.00
	59.51	0.2879	343933.30
	59.59	0.2664	318249.30
	59.68	0.4403	526057.80
	59.82	0.9097	1086899.00
	60.02	0.3330	397803.20
	60.13	0.1714	204733.00
	60.21	0.4502	537895.90
	60.39	0.6365	760493.30
	60.62	0.2969	354745.40
Phytane	60.71	1.5935	1903789.00
	60.95	0.3099	370194.20
	61.07	0.3809	455128.50
	61.24	0.1303	155657.80
	61.32	0.0891	106476.10
	61.40	0.1161	138730.00
	61.46	0.1179	140810.50
	61.56	0.1777	212290.30
	61.72	0.1987	237436.80
	61.81	0.1167	139424.90
	61.89	0.4019	480179.00
	62.01	0.0534	63851.41
	62.14	0.0999	119308.10
	62.19	0.0385	45947.96
	62.42	0.0520	62178.71
	62.51	0.1369	163589.20
	62.63	0.1025	122456.10
	63.03	0.1682	200962.00
	63.12	0.1723	205828.90
	63.30	0.2117	252868.20
	63.47	0.0831	99283.90
	63.58	0.0742	88707.04

Peak Name	Ret. Time	Area %	Area
	63.69	0.1005	120119.90
	63.84	0.2452	292921.80
	64.08	0.1654	197650.20
IS #3	64.21	0.6406	765331.10
	64.31	0.2487	297161.10
	64.83	0.0517	61714.72
	65.02	0.1298	155068.90
	65.26	0.1324	158178.30
	65.39	0.0398	47557.46
	65.51	0.1034	123530.50
	65.58	0.1418	169456.40
	65.87	0.0773	92406.05
	66.04	0.0472	56383.23
	66.25	0.0635	75897.50
	66.53	0.0292	34915.65
	66.77	0.0404	48219.18
	67.06	0.0282	33660.16
	67.18	0.0658	78568.05
	67.46	0.0453	54064.94
	67.70	0.0181	21599.23
	68.15	0.0300	35871.09
	68.42	0.0244	29115.32
	68.86	0.0299	35686.36
	69.37	0.1301	155390.80
	70.11	0.0805	96220.77
	71.21	0.0332	39697.93
	71.58	0.0431	51551.51
	72.83	0.0385	45938.86
	73.76	0.0151	18027.88
	76.07	0.0142	17000.35
	79.81	0.0265	31626.85
	81.03	0.0340	40596.18
	83.40	0.0223	26587.43

Total Area = 1.194742E+08   Total Height = 2.848703E+07   Total Amount = 0

ZymaX ID	19752-7
Sample ID	S-368
Evaporation	
n-Pentane / n-Heptane	0.63
2-Methylpentane / 2-Methylheptane	1.05
Waterwashing	
Benzene / Cyclohexane	1.22
Toluene / Methylcyclohexane	0.61
Aromatics / Total Paraffins (n+iso+cyc)	2.06
Aromatics / Naphthenes	16.20
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	13.78
3-Methylhexane / n-Heptane	0.58
Methylcyclohexane / n-Heptane	1.82
Isoparaffins + Naphthenes / Paraffins	0.93
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.15
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	16.75
% Isoparaffinic	11.50
% Aromatic	66.59
% Naphthenic	4.11
% Olefinic	1.04

ZymaX ID		19752-7
Sample ID		S-368
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.04
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.54
9	1-Pentene	0.06
10	2-Methyl-1-butene	0.11
11	Pentane	0.41
12	trans-2-Pentene	0.17
13	cis-2-Pentene/t-Butanol	0.09
14	2-Methyl-2-butene	0.25
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.04
17	2,3-Dimethylbutane/MTBE	0.15
18	2-Methylpentane	0.51
19	3-Methylpentane	0.34
20	Hexane	0.49
21	trans-2-Hexene	0.09
22	3-Methylcyclopentene	0.09
23	3-Methyl-2-pentene	0.05
24	cis-2-Hexene	0.08
25	3-Methyl-trans-2-pentene	0.02
26	Methylcyclopentane	0.36
27	2,4-Dimethylpentane	0.09
28	Benzene	0.27
29	5-Methyl-1-hexene	0.02
30	Cyclohexane	0.22
31	2-Methylhexane/TAME	0.28
32	2,3-Dimethylpentane	0.19
33	3-Methylhexane	0.38
34A	1-trans-3-Dimethylcyclopentane	0.18
34B	1-cis-3-Dimethylcyclopentane	0.29
35	2,2,4-Trimethylpentane	0.18
I.S. #1	à,à,à-Trifluorotoluene	0.00

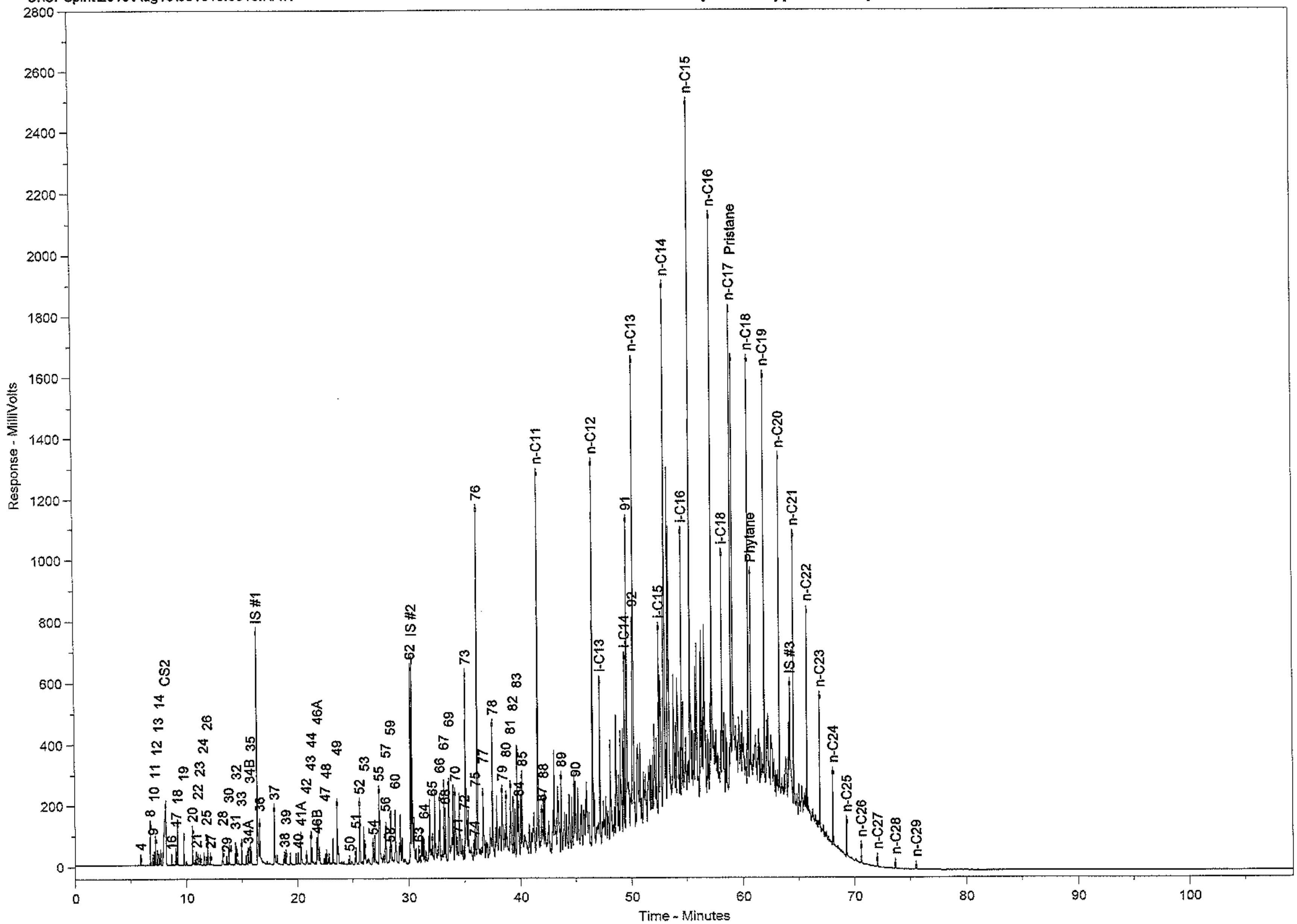
ZymaX ID		19752-7
Sample ID		S-368
		Relative Area %
36	n-Heptane	0.65
37	Methylcyclohexane	1.18
38	2,5-Dimethylhexane	0.13
39	2,4-Dimethylhexane	0.17
40	2,3,4-Trimethylpentane	0.12
41	Toluene/2,3,3-Trimethylpentane	0.72
42	2,3-Dimethylhexane	0.28
43	2-Methylheptane	0.48
44	4-Methylheptane	0.14
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	0.95
46B	1,4-Dimethylcyclohexane	0.36
47	3-Methylheptane	0.06
48	2,2,5-Trimethylhexane	0.14
49	n-Octane	1.28
50	2,2-Dimethylheptane	0.03
51	2,4-Dimethylheptane	0.23
52	Ethylcyclohexane	1.47
53	2,6-Dimethylheptane	0.20
54	Ethylbenzene	0.68
55	m+p Xylenes	2.57
56	4-Methyloctane	0.52
57	2-Methyloctane	0.68
58	3-Ethylheptane	0.18
59	3-Methyloctane	1.17
60	o-Xylene	1.49
61	1-Nonene	0.00
62	n-Nonane	4.25
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.26
64	3,3,5-Trimethylheptane	0.44
65	2,4,5-Trimethylheptane	0.52
66	n-Propylbenzene	1.47
67	1-Methyl-3-ethylbenzene	1.73
68	1-Methyl-4-ethylbenzene	1.23
69	1,3,5-Trimethylbenzene	3.36
70	3,3,4-Trimethylheptane	2.30

ZymaX ID		19752-7
Sample ID		S-368
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.53
72	3-Methylnonane	0.13
73	1,2,4-Trimethylbenzene	5.44
74	Isobutylbenzene	0.36
75	sec-Butylbenzene	0.85
76	n-Decane	9.63
77	1,2,3-Trimethylbenzene	2.66
78	Indan	3.26
79	1,3-Diethylbenzene	2.81
80	1,4-Diethylbenzene	2.42
81	n-Butylbenzene	3.02
82	1,3-Dimethyl-5-ethylbenzene	1.26
83	1,4-Dimethyl-2-ethylbenzene	2.80
84	1,3-Dimethyl-4-ethylbenzene	1.67
85	1,2-Dimethyl-4-ethylbenzene	2.36
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	1.71
88	1,2,3,5-Tetramethylbenzene	1.64
89	1,2,3,4-Tetramethylbenzene	2.19
90	Naphthalene	2.13
91	2-Methyl-naphthalene	10.09
92	1-Methyl-naphthalene	5.58

Chrom Perfect Chromatogram Report

— C:\CPSpirit\2016\Aug16\081016.0010.RAW

19752-7 [S-368 DUP] [400+600CS2] + IS F-022715-1



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Chrom Perfect Chromatogram Report

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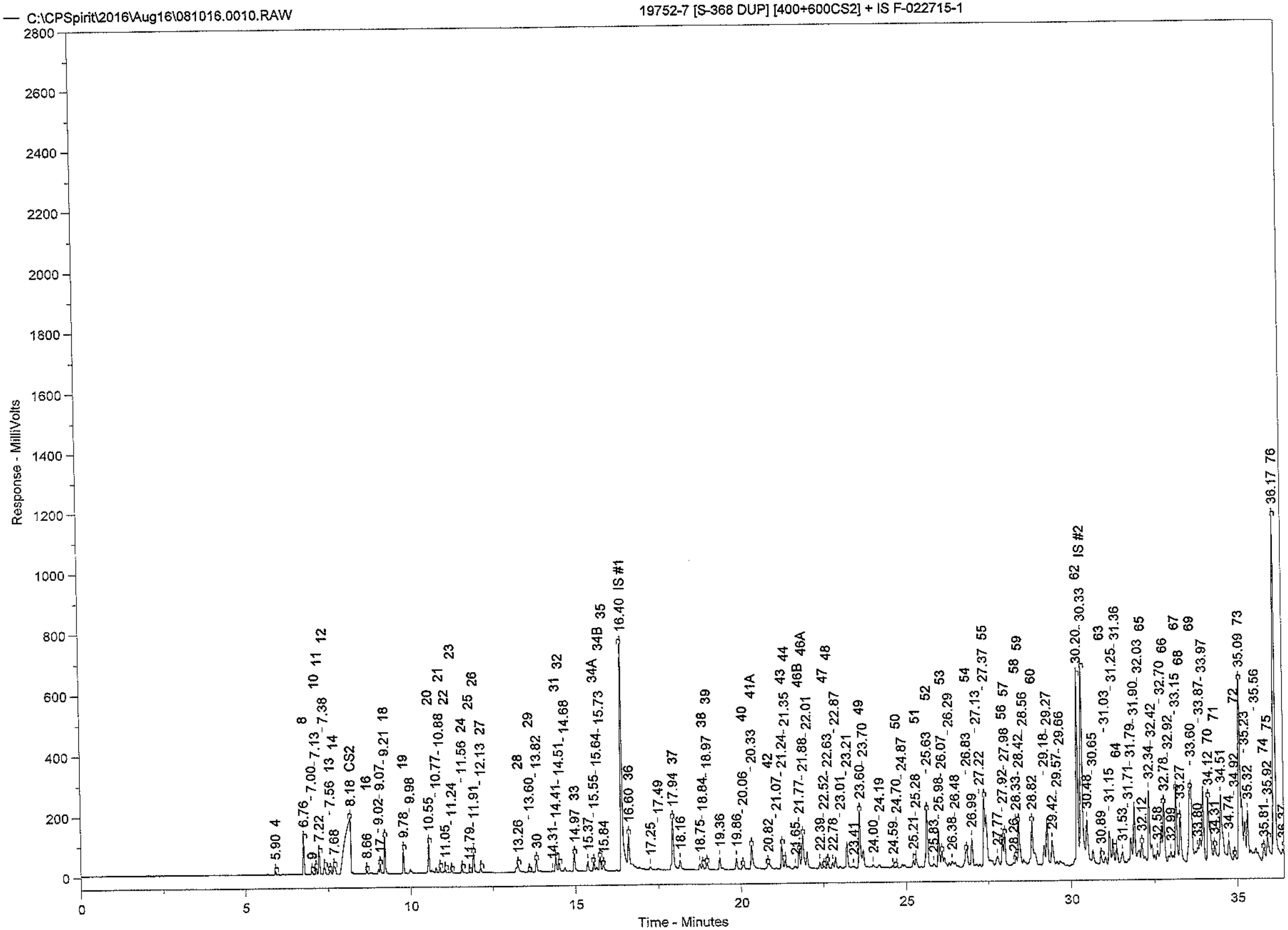
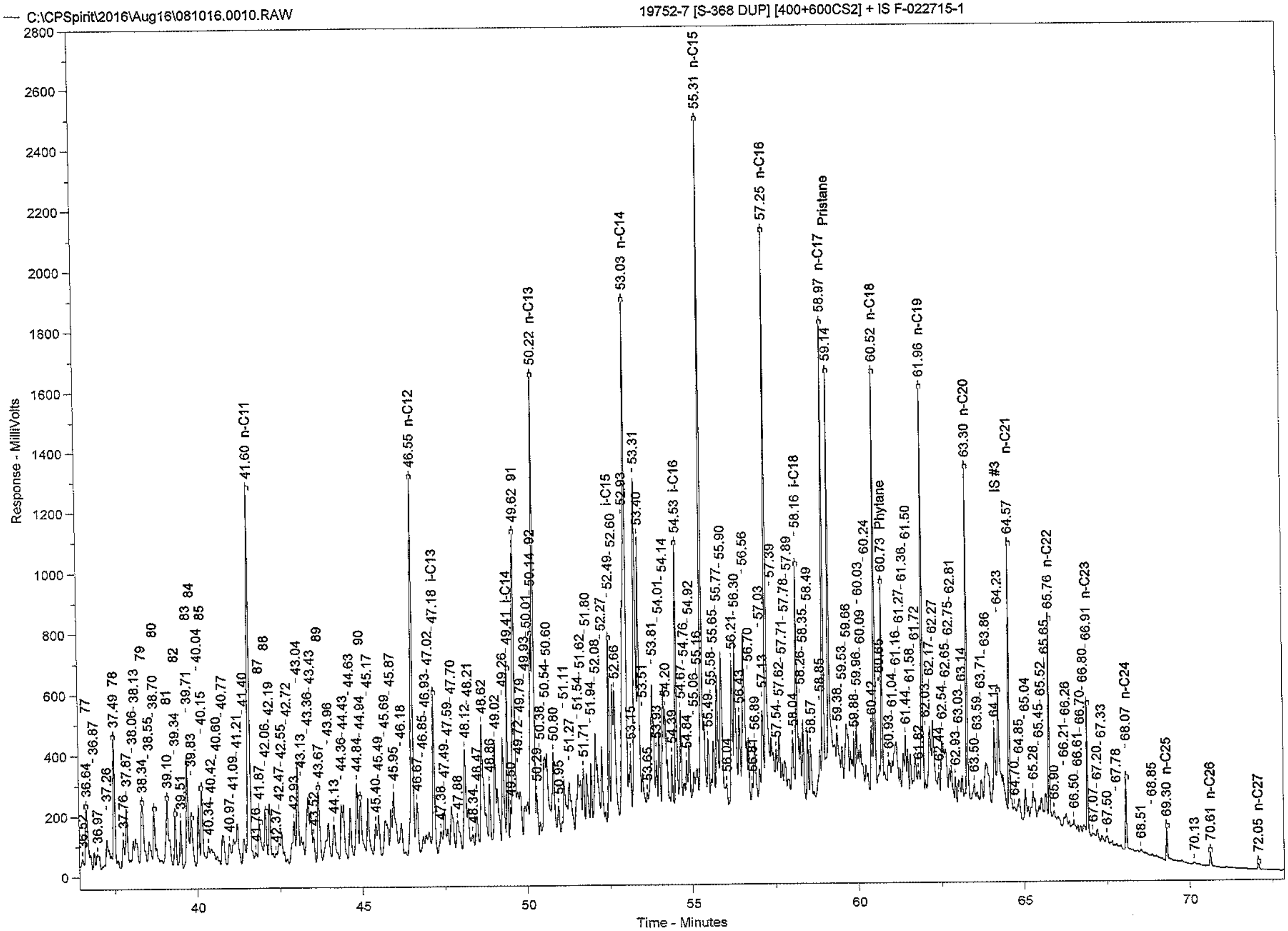
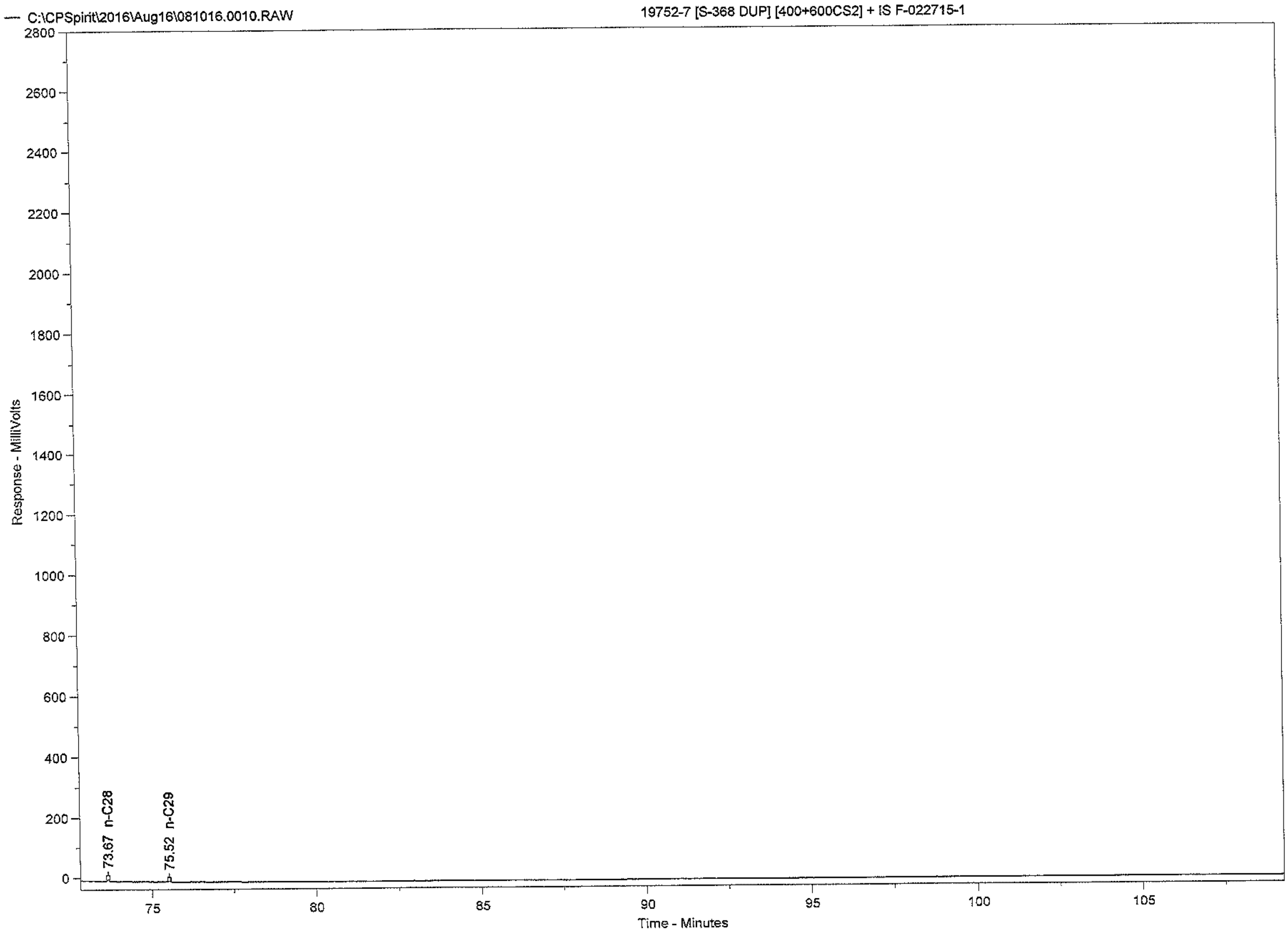
19752-7 [S-368 DUP] [400+600CS2] + IS F-022715-1



Chrom Perfect Chromatogram Report





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19752-7 [S-368 DUP] [400+600CS2] + IS F-022715-1
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Response - MilliVolts
73.67 n-C28
75.52 n-C29
75
80
85
90
95
100
105
Time - Minutes

Sample Name = **19752-7 [S-368 DUP] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016.0010.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/22/2016 6:44:09 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
4	5.90	0.0070	19920.91
8	6.76	0.0950	269654.40
9	7.00	0.0101	28649.39
10	7.13	0.0202	57204.73
11	7.22	0.0725	205747.00
12	7.38	0.0295	83697.60
13	7.56	0.0163	46313.36
14	7.68	0.0435	123446.40
CS2	8.18	0.7672	2177303.00
16	8.66	0.0068	19346.57
	9.02	0.0104	29598.70
17	9.07	0.0258	73097.18
18	9.21	0.0892	253098.90
19	9.78	0.0599	170071.80
	9.98	0.0175	49705.62
20	10.55	0.0863	245021.00
	10.77	0.0166	47058.91
21	10.88	0.0166	47074.23
22	11.05	0.0163	46249.62
23	11.24	0.0095	27100.05
24	11.56	0.0145	41038.09
25	11.79	0.0035	9805.24
26	11.91	0.0644	182683.60
27	12.13	0.0163	46277.81
28	13.26	0.0483	137156.90
29	13.60	0.0044	12378.62
30	13.82	0.0397	112658.40
	14.31	0.0037	10632.78
31	14.41	0.0500	141982.80
32	14.51	0.0333	94374.22
	14.68	0.0154	43833.91
33	14.97	0.0667	189353.80
	15.37	0.0347	98502.65
34A	15.55	0.0319	90471.97
	15.64	0.0139	39347.76
34B	15.73	0.0504	143082.30
35	15.84	0.0320	90788.63
IS #1	16.40	0.8601	2440980.00
36	16.60	0.1152	326927.30
	17.25	0.0113	31999.19
	17.49	0.0060	17019.64
37	17.94	0.2093	593882.00
	18.16	0.0400	113452.00
	18.75	0.0197	55931.59
38	18.84	0.0222	63077.02
39	18.97	0.0300	85076.50
	19.36	0.0354	100524.10
	19.86	0.0377	106995.30
40	20.06	0.0204	58034.57
41A	20.33	0.1278	362608.50
42	20.82	0.0489	138828.00
	21.07	0.0056	15759.86
43	21.24	0.0846	240045.50
44	21.35	0.0250	71078.07
	21.65	0.0112	31669.96

Peak Name	Ret. Time	Area %	Area
46B	21.77	0.0630	178767.00
46A	21.88	0.1684	477880.70
	22.01	0.0635	180261.50
	22.39	0.0223	63333.88
47	22.52	0.0099	28163.52
48	22.63	0.0254	72134.74
	22.78	0.0204	57994.81
	22.87	0.0399	113178.90
	23.01	0.0083	23421.33
	23.21	0.1017	288721.20
	23.41	0.0136	38709.47
49	23.60	0.2263	642305.90
	23.70	0.0777	220540.80
	24.00	0.0187	52969.58
	24.19	0.0196	55537.51
	24.59	0.0089	25212.24
50	24.70	0.0052	14720.01
	24.87	0.0069	19589.98
	25.21	0.0229	65018.29
51	25.28	0.0405	114863.80
52	25.63	0.2605	739361.60
	25.83	0.0143	40481.79
	25.98	0.1179	334748.00
53	26.07	0.0353	100290.50
	26.29	0.0107	30284.80
	26.38	0.0224	63482.61
	26.48	0.0127	35987.05
54	26.83	0.1196	339520.00
	26.99	0.1121	318132.40
	27.13	0.0124	35088.86
	27.22	0.0071	20223.09
55	27.37	0.4542	1289067.00
	27.77	0.0492	139742.40
56	27.92	0.0921	261511.80
57	27.98	0.1201	340759.00
	28.26	0.0130	36823.19
58	28.33	0.0315	89259.40
59	28.42	0.2058	584055.60
	28.56	0.0341	96734.30
60	28.82	0.2638	748786.40
	29.18	0.0821	232971.30
	29.27	0.1873	531604.00
	29.42	0.1128	320063.40
	29.57	0.0107	30493.47
	29.66	0.0115	32639.87
62	30.20	0.7512	2131816.00
IS #2	30.33	0.9985	2833792.00
	30.48	0.2452	695906.40
	30.65	0.0787	223416.10
63	30.89	0.0463	131384.70
	31.03	0.0323	91540.12
	31.15	0.1328	376922.80
	31.25	0.1046	296981.60
64	31.36	0.0772	219195.70
	31.53	0.0725	205693.60
	31.71	0.0182	51555.22
	31.79	0.1048	297552.30
	31.90	0.2530	717994.50
	32.03	0.0864	245339.80
65	32.12	0.0914	259313.00
	32.34	0.2791	791983.90
	32.42	0.0772	219218.50
	32.58	0.0519	147436.00
	32.70	0.1476	418969.20
66	32.78	0.2602	738536.40
	32.92	0.0254	72227.80
	32.99	0.0439	124553.00

Peak Name	Ret. Time	Area %	Area
67	33.15	0.3059	868097.60
68	33.27	0.2164	614282.00
69	33.60	0.5939	1685484.00
	33.80	0.0580	164662.70
	33.87	0.1199	340301.70
	33.97	0.3052	866289.30
70	34.12	0.4062	1152747.00
71	34.31	0.0940	266723.40
	34.51	0.4384	1244207.00
	34.74	0.1010	286542.30
72	34.92	0.0236	67094.66
73	35.09	0.9602	2725097.00
	35.23	0.1292	366677.30
	35.32	0.1509	428368.60
	35.56	0.0416	118098.90
74	35.81	0.0644	182755.80
75	35.92	0.1502	426201.00
76	36.17	1.7003	4825470.00
	36.37	0.0612	173714.70
	36.52	0.0743	210817.60
77	36.64	0.4703	1334785.00
	36.87	0.0740	209941.70
	36.97	0.1286	365085.70
	37.26	0.3043	863499.00
78	37.49	0.5753	1632809.00
	37.76	0.1458	413648.30
	37.87	0.3091	877276.80
	38.06	0.1295	367655.00
	38.13	0.2323	659292.70
79	38.34	0.4961	1407842.00
	38.55	0.1993	565767.90
80	38.70	0.4279	1214443.00
81	39.10	0.5339	1515290.00
82	39.34	0.2234	634038.30
	39.51	0.1960	556323.20
83	39.71	0.4953	1405636.00
84	39.83	0.2955	838552.40
	40.04	0.2468	700570.60
85	40.15	0.4164	1181806.00
	40.34	0.1139	323167.10
	40.42	0.1785	506698.90
	40.60	0.0467	132607.40
	40.77	0.2114	599842.50
	40.97	0.1334	378617.10
	41.09	0.1396	396114.00
	41.21	0.3130	888264.70
	41.40	0.1594	452419.60
n-C11	41.60	1.9062	5410046.00
	41.76	0.0705	200143.60
87	41.87	0.3024	858167.20
88	42.06	0.2893	821120.30
	42.19	0.2912	826538.90
	42.37	0.0482	136804.50
	42.47	0.1288	365427.90
	42.55	0.1777	504221.80
	42.72	0.0178	50508.07
	42.93	0.2871	814837.10
	43.04	0.4801	1362616.00
	43.13	0.2041	579211.10
	43.36	0.4463	1266489.00
	43.43	0.2368	672042.40
	43.52	0.0967	274447.70
89	43.67	0.3872	1098874.00
	43.96	0.3259	924970.30
	44.13	0.2561	726905.00
	44.36	0.2450	695438.50
	44.43	0.2347	666175.70

Peak Name	Ret. Time	Area %	Area
	44.63	0.2441	692843.60
	44.84	0.3785	1074264.00
90	44.94	0.3761	1067327.00
	45.17	0.3242	920010.00
	45.40	0.1758	499042.60
	45.49	0.1944	551622.40
	45.69	0.1950	553285.00
	45.87	0.2120	601605.40
	45.95	0.4431	1257430.00
	46.18	0.1813	514554.20
n-C12	46.55	1.8143	5149226.00
	46.67	0.3117	884749.60
	46.85	0.0982	278581.40
	46.93	0.0912	258716.20
	47.02	0.1347	382404.00
i-C13	47.18	0.7031	1995346.00
	47.38	0.1344	381355.40
	47.49	0.2183	619420.10
	47.59	0.0996	282737.90
	47.70	0.2970	842889.70
	47.88	0.2235	634213.90
	48.12	0.5300	1504075.00
	48.21	0.1526	432964.20
	48.34	0.0752	213542.40
	48.47	0.1619	459519.10
	48.62	0.9185	2606642.00
	48.86	0.2243	636446.20
	49.02	0.7309	2074383.00
	49.26	0.4769	1353446.00
i-C14	49.41	0.5281	1498921.00
	49.50	0.1072	304309.10
91	49.62	1.7829	5060122.00
	49.72	0.2390	678164.30
	49.79	0.2354	668136.90
	49.93	0.1715	486776.80
	50.01	0.1817	515550.30
92	50.14	0.9849	2795340.00
n-C13	50.22	1.7256	4897476.00
	50.29	0.1593	452015.10
	50.38	0.0436	123707.20
	50.54	0.4735	1343939.00
	50.60	0.4648	1319212.00
	50.80	0.4370	1240271.00
	50.95	0.1143	324314.70
	51.11	0.3669	1041326.00
	51.27	0.3708	1052215.00
	51.54	0.3057	867687.00
	51.62	0.2431	689903.50
	51.71	0.2510	712222.90
	51.80	0.2870	814557.20
	51.94	0.2251	638854.60
	52.08	0.7258	2059855.00
	52.27	0.3677	1043571.00
i-C15	52.49	0.5773	1638348.00
	52.60	0.6593	1871113.00
	52.66	0.6553	1859742.00
	52.93	1.1674	3313090.00
n-C14	53.03	2.4453	6939868.00
	53.15	0.2162	613725.20
	53.31	1.9323	5484003.00
	53.40	1.1495	3262326.00
	53.51	0.2702	766756.90
	53.65	0.0922	261608.50
	53.81	1.0353	2938341.00
	53.93	0.1938	550150.30
	54.01	0.3944	1119283.00
	54.14	0.5754	1632960.00

Peak Name	Ret. Time	Area %	Area
	54.20	0.5837	1656677.00
	54.39	0.2279	646856.70
i-C16	54.53	0.9688	2749641.00
	54.67	0.3960	1123817.00
	54.76	0.1348	382685.50
	54.84	0.1868	530083.80
	54.92	0.3222	914288.50
	55.06	0.1931	548062.00
	55.16	0.2559	726155.50
n-C15	55.31	2.8445	8072832.00
	55.49	0.2872	815071.90
	55.58	0.0993	281908.50
	55.65	0.2752	780920.10
	55.77	0.6300	1787856.00
	55.90	0.8157	2314963.00
	56.04	0.0914	259450.40
	56.21	0.6007	1704918.00
	56.30	0.7488	2125010.00
	56.43	0.3811	1081708.00
	56.56	1.1523	3270335.00
	56.70	0.1695	481111.80
	56.81	0.0436	123660.30
	56.89	0.2782	789416.70
	57.03	0.0698	198167.80
	57.13	0.3288	933253.40
n-C16	57.25	1.8407	5224138.00
	57.39	0.0441	125076.40
	57.54	0.0620	175974.10
	57.62	0.1547	439077.30
	57.71	0.0449	127541.40
	57.78	0.0997	283019.10
	57.89	0.0378	107238.10
	58.04	0.2511	712710.90
i-C18	58.16	0.8756	2485063.00
	58.26	0.1988	564139.60
	58.35	0.2645	750797.20
	58.49	0.2117	600865.60
	58.57	0.2063	585573.40
	58.85	0.2648	751502.10
n-C17	58.97	1.6405	4655888.00
Pristane	59.14	2.1486	6097746.00
	59.38	0.4196	1190792.00
	59.53	0.2291	650203.50
	59.66	0.5816	1650753.00
	59.88	0.3998	1134568.00
	59.96	0.2430	689562.50
	60.03	0.1505	427041.50
	60.09	0.2606	739583.60
	60.24	0.1449	411205.80
	60.42	0.2541	721049.10
n-C18	60.52	1.1815	3353222.00
	60.65	0.0588	166914.20
Phytane	60.73	0.5188	1472367.00
	60.93	0.1219	345919.90
	61.04	0.0743	210735.80
	61.16	0.3380	959267.70
	61.27	0.0426	120874.30
	61.36	0.1304	370094.00
	61.44	0.1655	469643.30
	61.50	0.1105	313582.20
	61.58	0.1445	410043.30
	61.72	0.1640	465308.40
	61.82	0.1043	295901.00
n-C19	61.96	1.2123	3440656.00
	62.03	0.0390	110638.70
	62.17	0.4391	1246197.00
	62.27	0.4103	1164457.00

Peak Name	Ret. Time	Area %	Area
	62.44	0.1098	311748.60
	62.54	0.4035	1145112.00
	62.65	0.2527	717111.40
	62.75	0.1163	330183.50
	62.81	0.1374	389962.00
	62.93	0.0692	196364.70
	63.03	0.1279	363065.80
	63.14	0.1065	302186.30
n-C20	63.30	0.9578	2718327.00
	63.50	0.1448	410928.90
	63.59	0.1011	286951.10
	63.71	0.1468	416553.40
	63.86	0.5325	1511334.00
	64.11	0.4649	1319368.00
IS #3	64.23	1.0250	2908981.00
n-C21	64.57	0.7833	2223197.00
	64.70	0.0655	185907.20
	64.85	0.1370	388900.90
	65.04	0.1930	547677.60
	65.28	0.2749	780212.10
	65.45	0.0977	277420.70
	65.52	0.1710	485305.10
	65.65	0.1842	522646.30
n-C22	65.76	0.5710	1620528.00
	65.90	0.1553	440620.80
	66.21	0.0660	187217.40
	66.26	0.0922	261553.20
	66.50	0.1187	336798.20
	66.61	0.0314	89133.59
	66.70	0.0523	148557.20
	66.80	0.0798	226537.70
n-C23	66.91	0.3746	1063202.00
	67.07	0.0485	137555.10
	67.20	0.0558	158313.30
	67.33	0.0307	87124.41
	67.50	0.0430	121996.90
	67.78	0.0066	18773.21
n-C24	68.07	0.1948	552927.20
	68.51	0.0273	77388.13
	68.85	0.0063	17987.86
n-C25	69.30	0.0925	262598.90
	70.13	0.0096	27158.09
n-C26	70.61	0.0503	142740.00
n-C27	72.05	0.0206	58576.03
n-C28	73.67	0.0115	32724.20
n-C29	75.52	0.0048	13665.93

Total Area = 2.838064E+08 Total Height = 7.043614E+07 Total Amount = 0

ZymaX ID	19752-8
Sample ID	S-348
Evaporation	
n-Pentane / n-Heptane	0.00
2-Methylpentane / 2-Methylheptane	0.00
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	0.00
Aromatics / Total Paraffins (n+iso+cyc)	0.97
Aromatics / Naphthenes	9.98
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	0.00
3-Methylhexane / n-Heptane	0.00
Methylcyclohexane / n-Heptane	0.00
Isoparaffins + Naphthenes / Paraffins	0.83
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.00
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	27.50
% Isoparaffinic	17.85
% Aromatic	48.68
% Naphthenic	4.88
% Olefinic	1.10

ZymaX ID		19752-8
Sample ID		S-348
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.00
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.00
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	0.00
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.00
18	2-Methylpentane	0.00
19	3-Methylpentane	0.00
20	Hexane	0.00
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.00
26	Methylcyclopentane	0.00
27	2,4-Dimethylpentane	0.00
28	Benzene	0.00
29	5-Methyl-1-hexene	0.00
30	Cyclohexane	0.00
31	2-Methylhexane/TAME	0.00
32	2,3-Dimethylpentane	0.00
33	3-Methylhexane	0.00
34A	1-trans-3-Dimethylcyclopentane	0.00
34B	1-cis-3-Dimethylcyclopentane	0.00
35	2,2,4-Trimethylpentane	0.00
I.S. #1	à,à,à-Trifluorotoluene	0.00

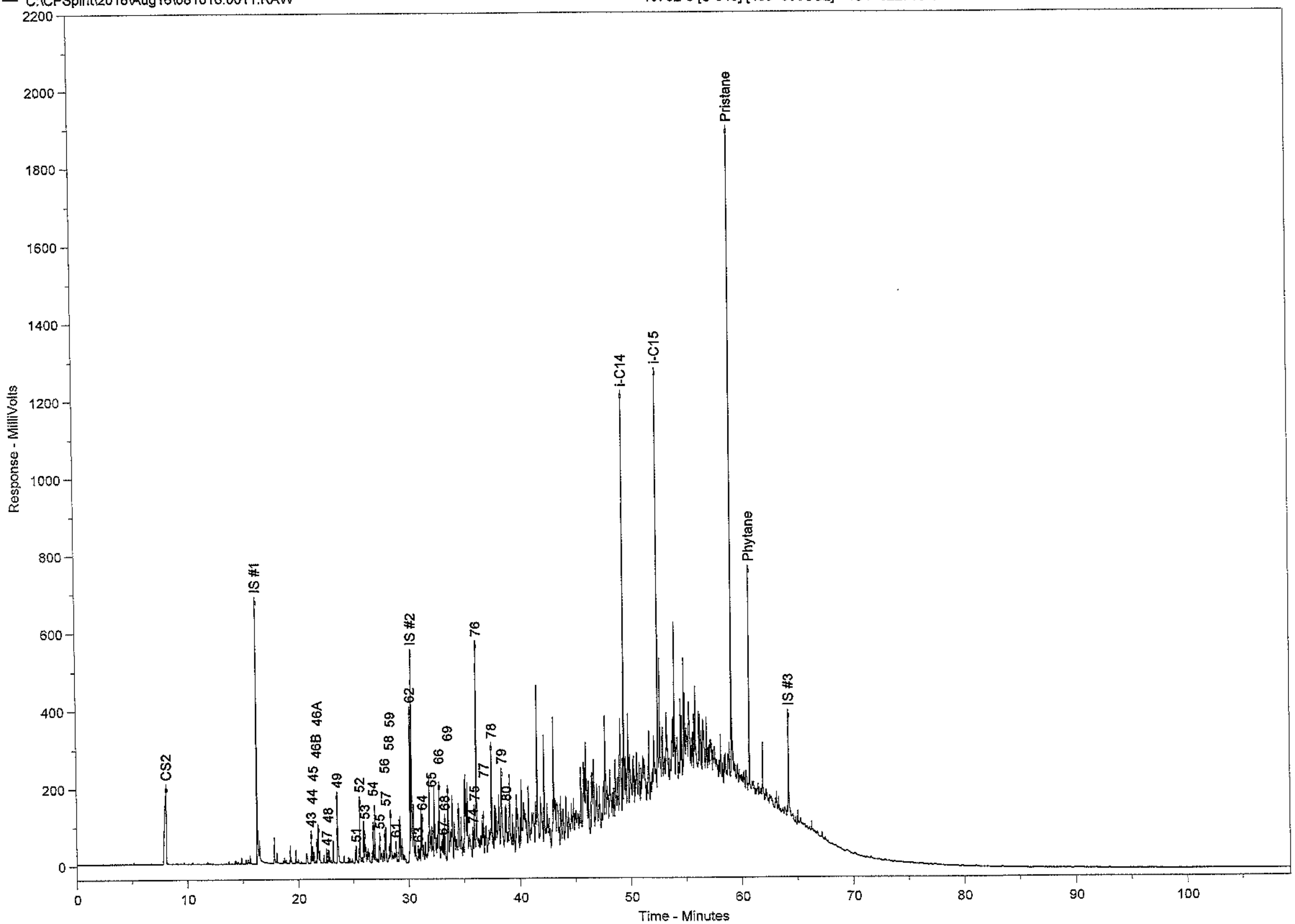
ZymaX ID		19752-8
Sample ID		S-348
		Relative Area %
36	n-Heptane	0.00
37	Methylcyclohexane	0.00
38	2,5-Dimethylhexane	0.00
39	2,4-Dimethylhexane	0.00
40	2,3,4-Trimethylpentane	0.00
41	Toluene/2,3,3-Trimethylpentane	0.00
42	2,3-Dimethylhexane	0.00
43	2-Methylheptane	1.27
44	4-Methylheptane	0.51
45	3,4-Dimethylhexane	0.36
46A	3-Ethyl-3-methylpentane	2.37
46B	1,4-Dimethylcyclohexane	0.85
47	3-Methylheptane	0.35
48	2,2,5-Trimethylhexane	0.31
49	n-Octane	5.11
50	2,2-Dimethylheptane	0.00
51	2,4-Dimethylheptane	0.76
52	Ethylcyclohexane	4.02
53	2,6-Dimethylheptane	1.27
54	Ethylbenzene	1.90
55	m+p Xylenes	1.99
56	4-Methyloctane	1.37
57	2-Methyloctane	1.44
58	3-Ethylheptane	0.55
59	3-Methyloctane	2.98
60	o-Xylene	0.00
61	1-Nonene	1.10
62	n-Nonane	7.94
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.71
64	3,3,5-Trimethylheptane	2.48
65	2,4,5-Trimethylheptane	1.84
66	n-Propylbenzene	4.71
67	1-Methyl-3-ethylbenzene	0.77
68	1-Methyl-4-ethylbenzene	2.95
69	1,3,5-Trimethylbenzene	6.27
70	3,3,4-Trimethylheptane	0.00

ZymaX ID		19752-8
Sample ID		S-348
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.00
72	3-Methylnonane	0.00
73	1,2,4-Trimethylbenzene	0.00
74	Isobutylbenzene	1.80
75	sec-Butylbenzene	3.95
76	n-Decane	14.46
77	1,2,3-Trimethylbenzene	2.24
78	Indan	7.47
79	1,3-Diethylbenzene	10.44
80	1,4-Diethylbenzene	3.46
81	n-Butylbenzene	0.00
82	1,3-Dimethyl-5-ethylbenzene	0.00
83	1,4-Dimethyl-2-ethylbenzene	0.00
84	1,3-Dimethyl-4-ethylbenzene	0.00
85	1,2-Dimethyl-4-ethylbenzene	0.00
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	0.00
88	1,2,3,5-Tetramethylbenzene	0.00
89	1,2,3,4-Tetramethylbenzene	0.00
90	Naphthalene	0.00
91	2-Methyl-naphthalene	0.00
92	1-Methyl-naphthalene	0.00

Chrom Perfect Chromatogram Report

— C:\CPSpirit\2016\Aug16\081016.0011.RAW

19752-8 [S-348] [400+600CS2] + IS F-022715-1



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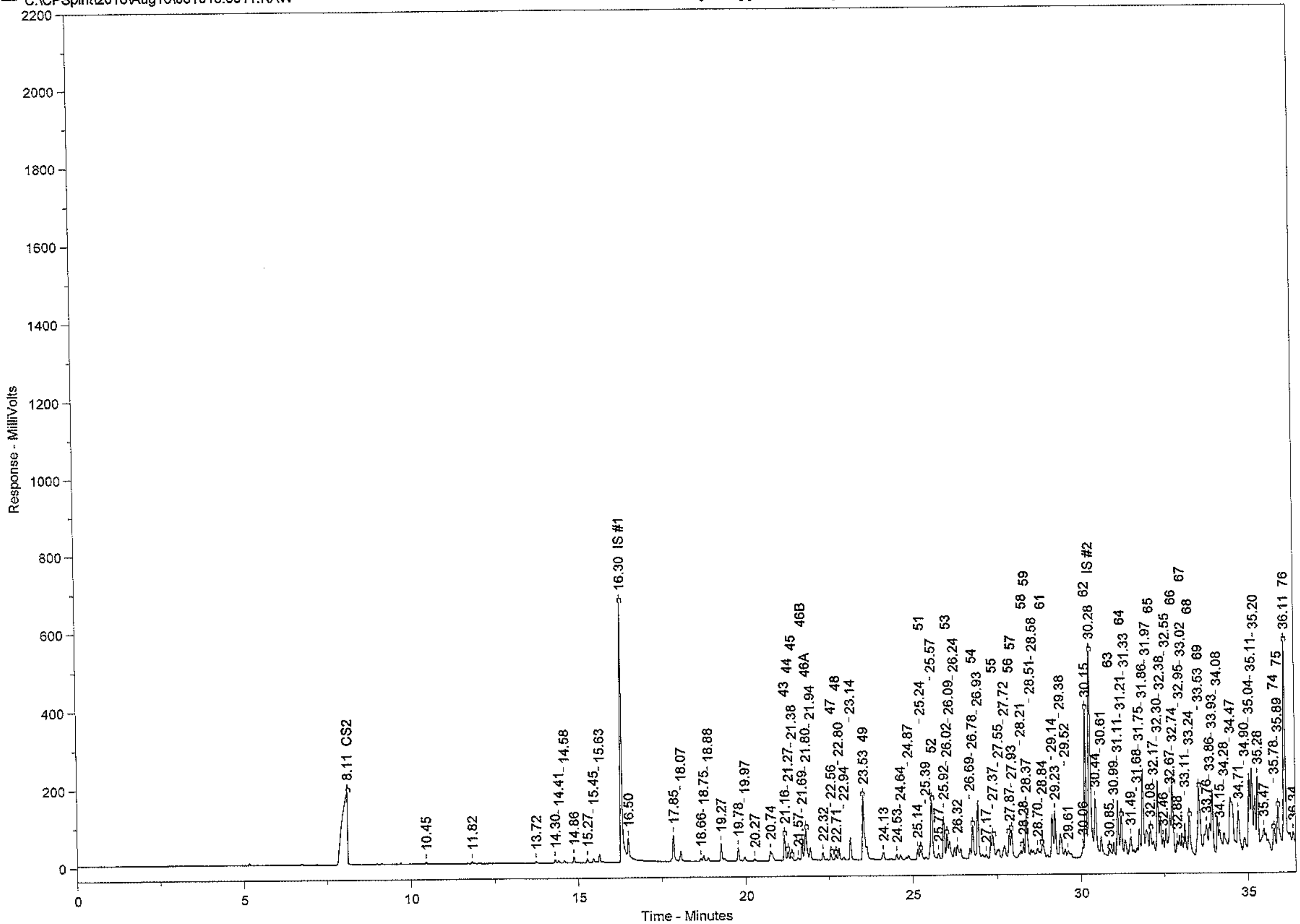
19752-8 [S-348] [400+600CS2] + IS F-022715-1



Chrom Perfect Chromatogram Report

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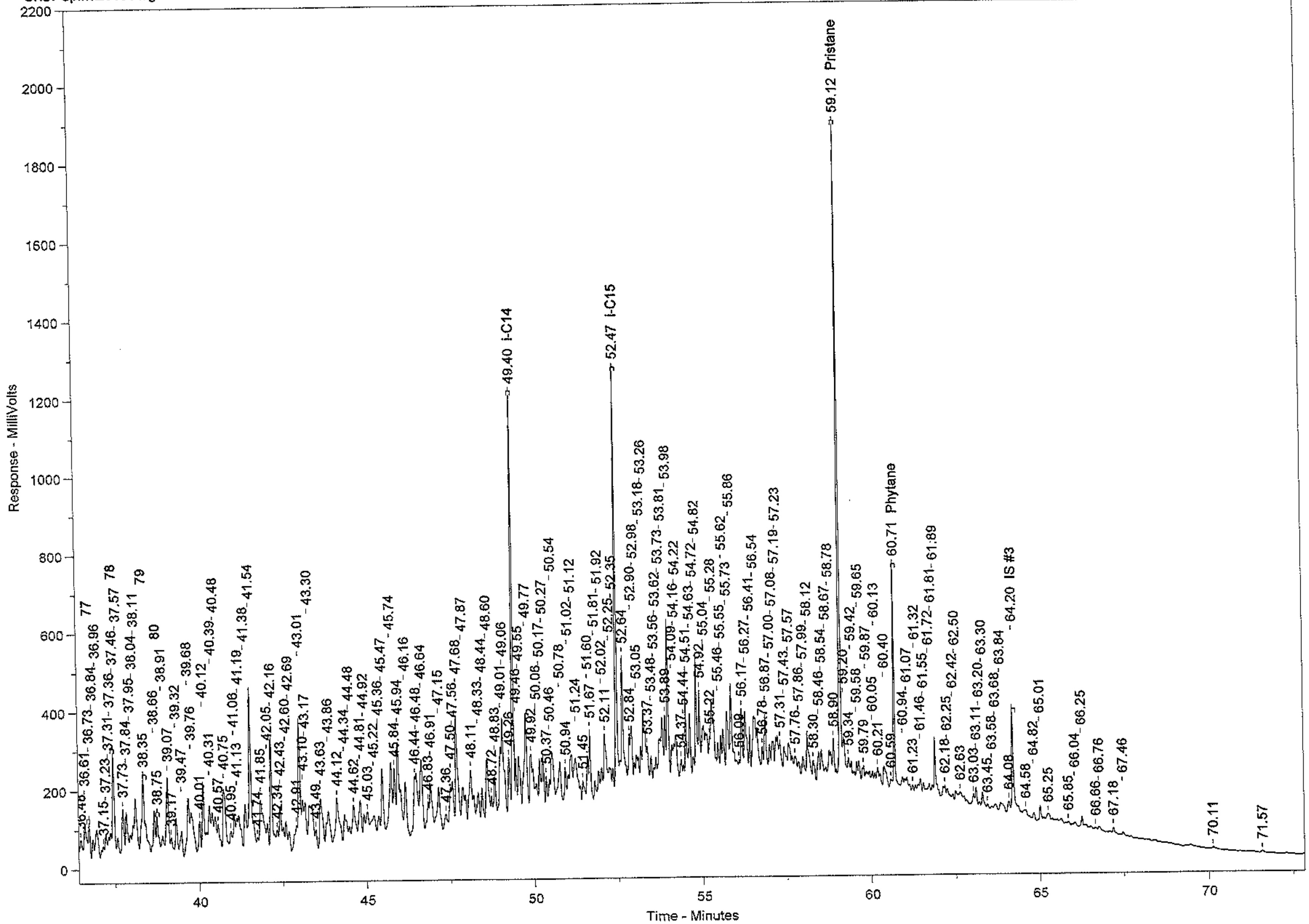
19752-8 [S-348] [400+600CS2] + IS F-022715-1



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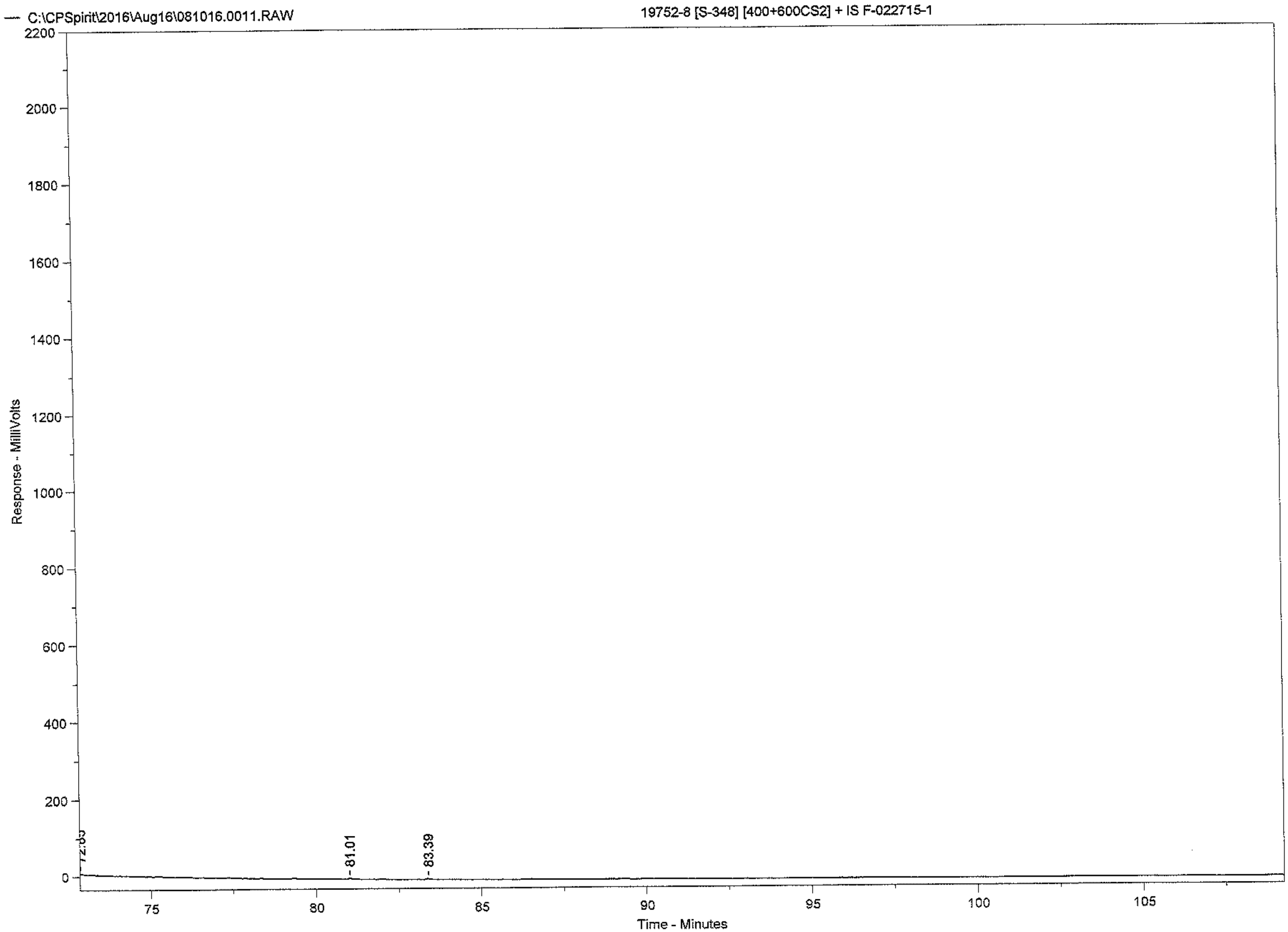
Chrom Perfect Chromatogram Report



Sample Name = **19752-8 [S-348] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016.0011.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/22/2016 8:50:30 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
CS2	8.11	1.2227	2103475.00
	10.45	0.0077	13239.38
	11.82	0.0077	13285.21
	13.72	0.0099	17077.22
	14.30	0.0142	24373.88
	14.41	0.0119	20548.53
	14.58	0.0117	20144.76
	14.86	0.0277	47664.29
	15.27	0.0167	28696.93
	15.45	0.0142	24491.37
	15.63	0.0313	53919.91
IS #1	16.30	1.2574	2163044.00
	16.50	0.2621	450809.70
	17.85	0.1422	244544.90
	18.07	0.0713	122708.80
	18.66	0.0141	24221.86
	18.75	0.0288	49482.40
	18.88	0.0194	33437.31
	19.27	0.0692	119025.60
	19.78	0.0594	102253.60
	19.97	0.0208	35767.05
	20.27	0.0092	15829.86
	20.74	0.0857	147389.10
43	21.16	0.1142	196497.90
44	21.27	0.0458	78784.24
45	21.38	0.0323	55618.23
	21.57	0.0172	29508.57
46B	21.69	0.0769	132337.10
46A	21.80	0.2133	366946.80
	21.94	0.0758	130329.50
	22.32	0.0381	65534.00
47	22.56	0.0320	55069.78
48	22.71	0.0277	47612.38
	22.80	0.0588	101182.90
	22.94	0.0177	30420.63
	23.14	0.1145	197020.90
49	23.53	0.4606	792428.10
	24.13	0.0450	77445.40
	24.53	0.0248	42734.95
	24.64	0.0222	38181.93
	24.87	0.0292	50230.95
	25.14	0.0455	78271.58
51	25.24	0.0683	117452.90
	25.39	0.0108	18547.79
52	25.57	0.3628	624154.90
	25.77	0.0268	46137.93
	25.92	0.1840	316507.10
53	26.02	0.1141	196262.00
	26.09	0.0916	157520.50
	26.24	0.0327	56252.04
	26.32	0.0421	72361.71
	26.69	0.0463	79660.86
54	26.78	0.1714	294822.40
	26.93	0.2883	495999.80
	27.17	0.0077	13324.66

Peak Name	Ret. Time	Area %	Area
55	27.37	0.1795	308815.30
	27.55	0.0136	23461.95
	27.72	0.0903	155320.80
56	27.87	0.1235	212403.20
57	27.93	0.1297	223151.00
	28.21	0.0469	80651.18
58	28.28	0.0496	85384.99
59	28.37	0.2689	462645.20
	28.51	0.0350	60125.41
	28.58	0.0332	57036.76
	28.70	0.0535	91958.48
61	28.84	0.0989	170155.00
	29.14	0.2164	372245.10
	29.23	0.2268	390184.60
	29.38	0.1592	273824.00
	29.52	0.0277	47711.47
	29.61	0.0188	32305.02
	30.06	0.0551	94704.59
62	30.15	0.7159	1231530.00
IS #2	30.28	1.3409	2306813.00
	30.44	0.4238	729111.30
	30.61	0.1513	260223.40
63	30.85	0.0644	110824.10
	30.99	0.0761	130836.10
	31.11	0.2864	492670.40
64	31.21	0.2236	384660.80
	31.33	0.1179	202833.80
	31.49	0.1402	241110.00
	31.68	0.0453	77985.34
	31.75	0.1403	241335.90
	31.86	0.4506	775086.40
	31.97	0.2287	393361.00
65	32.08	0.1663	286161.80
	32.17	0.0944	162417.10
	32.30	0.3804	654403.90
	32.38	0.2098	361004.40
	32.46	0.0843	144944.10
	32.55	0.1561	268549.30
	32.67	0.2489	428121.80
66	32.74	0.4247	730581.90
	32.88	0.0758	130460.50
	32.95	0.1037	178421.60
67	33.02	0.0697	119856.70
	33.11	0.1864	320610.20
68	33.24	0.2664	458244.70
69	33.53	0.5655	972747.10
	33.76	0.2956	508491.00
	33.86	0.1763	303210.00
	33.93	0.3477	598097.30
	34.08	0.1797	309057.30
	34.15	0.1670	287300.60
	34.28	0.2043	351490.60
	34.47	0.7141	1228512.00
	34.71	0.2980	512658.30
	34.90	0.1262	217016.90
	35.04	0.4192	721192.20
	35.11	0.4486	771720.90
	35.20	0.2960	509214.30
	35.28	0.4002	688379.50
	35.47	0.3984	685387.90
74	35.78	0.1625	279631.00
75	35.89	0.3565	613353.80
76	36.11	1.3040	2243276.00
	36.34	0.1297	223038.00
	36.48	0.1946	334813.90
	36.61	0.3055	525580.30
77	36.73	0.2023	347941.70

Peak Name	Ret. Time	Area %	Area
	36.84	0.1146	197101.80
	36.96	0.2921	502430.30
	37.15	0.1116	192042.70
	37.23	0.1633	280871.50
	37.31	0.1088	187157.30
	37.36	0.1293	222429.50
78	37.46	0.6738	1159081.00
	37.57	0.1503	258566.50
	37.73	0.3408	586300.90
	37.84	0.3382	581863.10
	37.95	0.1419	244188.50
	38.04	0.1889	325023.90
	38.11	0.4895	842140.40
79	38.35	0.9412	1619065.00
	38.66	0.3233	556116.10
80	38.75	0.3124	537397.30
	38.91	0.1851	318368.90
	39.07	0.6023	1036061.00
	39.17	0.1431	246128.40
	39.32	0.2452	421744.00
	39.47	0.1879	323194.40
	39.68	0.4325	743969.30
	39.76	0.4730	813624.60
	40.01	0.2125	365565.10
	40.12	0.5571	958352.90
	40.31	0.3621	622866.10
	40.39	0.2676	460346.40
	40.48	0.2653	456337.50
	40.57	0.2557	439873.30
	40.75	0.6146	1057333.00
	40.95	0.1611	277206.50
	41.06	0.2535	436084.50
	41.13	0.1941	333971.50
	41.19	0.3357	577422.80
	41.38	0.3667	630840.40
	41.54	1.2864	2212961.00
	41.74	0.0937	161223.80
	41.85	0.6717	1155506.00
	42.05	0.1542	265235.30
	42.16	0.7606	1308529.00
	42.34	0.1425	245084.80
	42.43	0.3009	517581.50
	42.60	0.1787	307455.60
	42.69	0.1112	191268.10
	42.91	0.2234	384235.20
	43.01	0.8047	1384294.00
	43.10	0.3098	532868.40
	43.17	0.2765	475577.60
	43.30	0.6562	1128826.00
	43.49	0.0961	165244.30
	43.63	0.4492	772755.10
	43.86	0.4053	697247.80
	44.12	0.5855	1007217.00
	44.34	0.3024	520192.80
	44.48	0.0974	167544.40
	44.62	0.4038	694725.50
	44.81	0.3445	592564.80
	44.92	0.1618	278425.70
	45.03	0.2609	448743.30
	45.22	0.3711	638413.60
	45.36	0.1777	305763.20
	45.47	0.5079	873742.40
	45.74	0.7374	1268612.00
	45.84	0.4422	760671.00
	45.94	0.9108	1566783.00
	46.16	0.3930	676137.40
	46.44	0.3474	597599.60

Peak Name	Ret. Time	Area %	Area
	46.48	0.3995	687178.40
	46.64	0.6367	1095301.00
	46.83	0.2156	370862.90
	46.91	0.4016	690859.70
	47.15	0.4564	785084.40
	47.36	0.1514	260418.60
	47.50	0.2840	488635.10
	47.56	0.2689	462647.80
	47.68	0.8369	1439733.00
	47.87	0.5007	861276.50
	48.11	0.5417	931814.00
	48.33	0.2781	478353.00
	48.44	0.2426	417286.90
	48.60	0.5844	1005369.00
	48.72	0.1379	237144.20
	48.83	0.3268	562274.40
	49.01	0.5496	945455.00
	49.06	0.8009	1377765.00
	49.26	0.4406	757949.70
i-C14	49.40	1.9479	3350982.00
	49.46	0.2634	453209.80
	49.55	0.5151	886137.30
	49.77	1.0034	1726133.00
	49.92	0.7129	1226370.00
	50.06	0.2825	485987.20
	50.17	0.3539	608782.10
	50.27	0.3966	682201.90
	50.37	0.2041	351145.20
	50.46	0.2293	394503.50
	50.54	0.5925	1019327.00
	50.78	0.6162	1060096.00
	50.94	0.2980	512638.20
	51.02	0.2103	361828.30
	51.12	0.5230	899680.60
	51.24	0.8057	1386111.00
	51.45	0.2649	455692.70
	51.60	0.3249	558879.90
	51.67	0.4556	783752.30
	51.81	0.2089	359293.60
	51.92	0.2502	430458.10
	52.02	0.2739	471137.20
	52.11	0.6589	1133511.00
	52.25	0.3918	674085.20
	52.35	0.1940	333749.60
i-C15	52.47	2.1407	3682687.00
	52.64	1.1316	1946757.00
	52.84	0.4235	728514.70
	52.90	0.4779	822049.80
	52.98	0.1927	331577.20
	53.05	0.5122	881073.10
	53.18	0.2770	476475.20
	53.26	0.8215	1413268.00
	53.37	0.3438	591378.30
	53.48	0.2911	500743.50
	53.56	0.1779	306118.90
	53.62	0.2375	408617.30
	53.73	0.5103	877936.50
	53.81	0.5323	915777.60
	53.89	0.4372	752038.30
	53.98	0.9647	1659647.00
	54.09	0.2978	512336.30
	54.16	0.2954	508128.70
	54.22	0.4797	825244.90
	54.37	0.2805	482468.30
	54.44	0.1605	276156.80
	54.51	0.5477	942143.70
	54.63	0.5225	898784.40

Peak Name	Ret. Time	Area %	Area
	54.72	0.2631	452553.80
	54.82	0.7436	1279284.00
	54.92	0.5576	959283.10
	55.04	0.6092	1047962.00
	55.22	0.2156	370866.70
	55.28	1.0915	1877719.00
	55.46	0.3213	552805.20
	55.55	0.2565	441211.90
	55.62	0.4390	755252.30
	55.73	0.6150	1058055.00
	55.86	0.9092	1564049.00
	56.09	0.1270	218474.50
	56.17	0.5132	882930.20
	56.27	0.6721	1156235.00
	56.41	0.2841	488772.80
	56.54	1.2079	2077970.00
	56.78	0.2322	399527.50
	56.87	0.5153	886389.60
	57.00	0.2622	450980.80
	57.08	0.3483	599231.30
	57.19	0.2248	386705.80
	57.23	0.2450	421555.70
	57.31	0.3319	570897.60
	57.43	0.3575	614952.70
	57.57	0.4755	817927.90
	57.76	0.2246	386453.00
	57.86	0.1411	242812.20
	57.99	0.2147	369368.80
	58.12	0.3881	667574.90
	58.30	0.1230	211553.30
	58.46	0.1623	279221.30
	58.54	0.1734	298277.50
	58.67	0.0705	121279.40
	58.78	0.2513	432255.30
	58.90	0.2024	348199.80
Pristane	59.12	2.6305	4525222.00
	59.20	0.2692	463144.80
	59.34	0.0866	148999.80
	59.42	0.0414	71206.46
	59.58	0.0580	99703.85
	59.65	0.0766	131829.20
	59.79	0.0759	130559.90
	59.87	0.0688	118410.90
	60.05	0.0507	87301.36
	60.13	0.0461	79305.79
	60.21	0.1421	244496.30
	60.40	0.1838	316257.30
	60.59	0.0500	86067.91
Phytane	60.71	0.8537	1468577.00
	60.94	0.0817	140591.50
	61.07	0.0633	108968.80
	61.23	0.0291	50008.96
	61.32	0.0341	58622.87
	61.46	0.1162	199926.40
	61.55	0.0783	134691.70
	61.72	0.0759	130620.90
	61.81	0.0584	100398.40
	61.89	0.2999	515903.10
	62.18	0.1010	173829.40
	62.25	0.0714	122807.80
	62.42	0.0232	39952.46
	62.50	0.0530	91196.53
	62.63	0.0452	77672.57
	63.03	0.0593	102076.30
	63.11	0.0787	135424.50
	63.20	0.0205	35197.21
	63.30	0.0852	146530.40

Peak Name	Ret. Time	Area %	Area
	63.45	0.0185	31776.87
	63.58	0.0163	28101.82
	63.68	0.0512	88045.78
	63.84	0.1120	192736.40
	64.08	0.0875	150444.90
IS #3	64.20	0.6924	1191140.00
	64.58	0.1091	187704.80
	64.82	0.0399	68642.51
	65.01	0.0671	115452.80
	65.25	0.0551	94834.94
	65.85	0.0118	20284.46
	66.04	0.0178	30658.70
	66.25	0.0370	63647.53
	66.66	0.0122	20957.04
	66.76	0.0288	49521.21
	67.18	0.0330	56852.06
	67.46	0.0182	31251.57
	70.11	0.0217	37302.43
	71.57	0.0176	30352.92
	72.85	0.0144	24760.88
	81.01	0.0158	27209.44
	83.39	0.0129	22249.59

Total Area = 1.7203E+08 Total Height = 3.799603E+07 Total Amount = 0

ZymaX ID	19752-9
Sample ID	C-97
Evaporation	
n-Pentane / n-Heptane	0.72
2-Methylpentane / 2-Methylheptane	1.21
Waterwashing	
Benzene / Cyclohexane	0.09
Toluene / Methylcyclohexane	0.03
Aromatics / Total Paraffins (n+iso+cyc)	0.25
Aromatics / Naphthenes	0.71
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	292.92
3-Methylhexane / n-Heptane	0.81
Methylcyclohexane / n-Heptane	2.74
Isoparaffins + Naphthenes / Paraffins	4.06
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.00
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	15.72
% Isoparaffinic	36.27
% Aromatic	19.64
% Naphthenic	27.47
% Olefinic	0.89

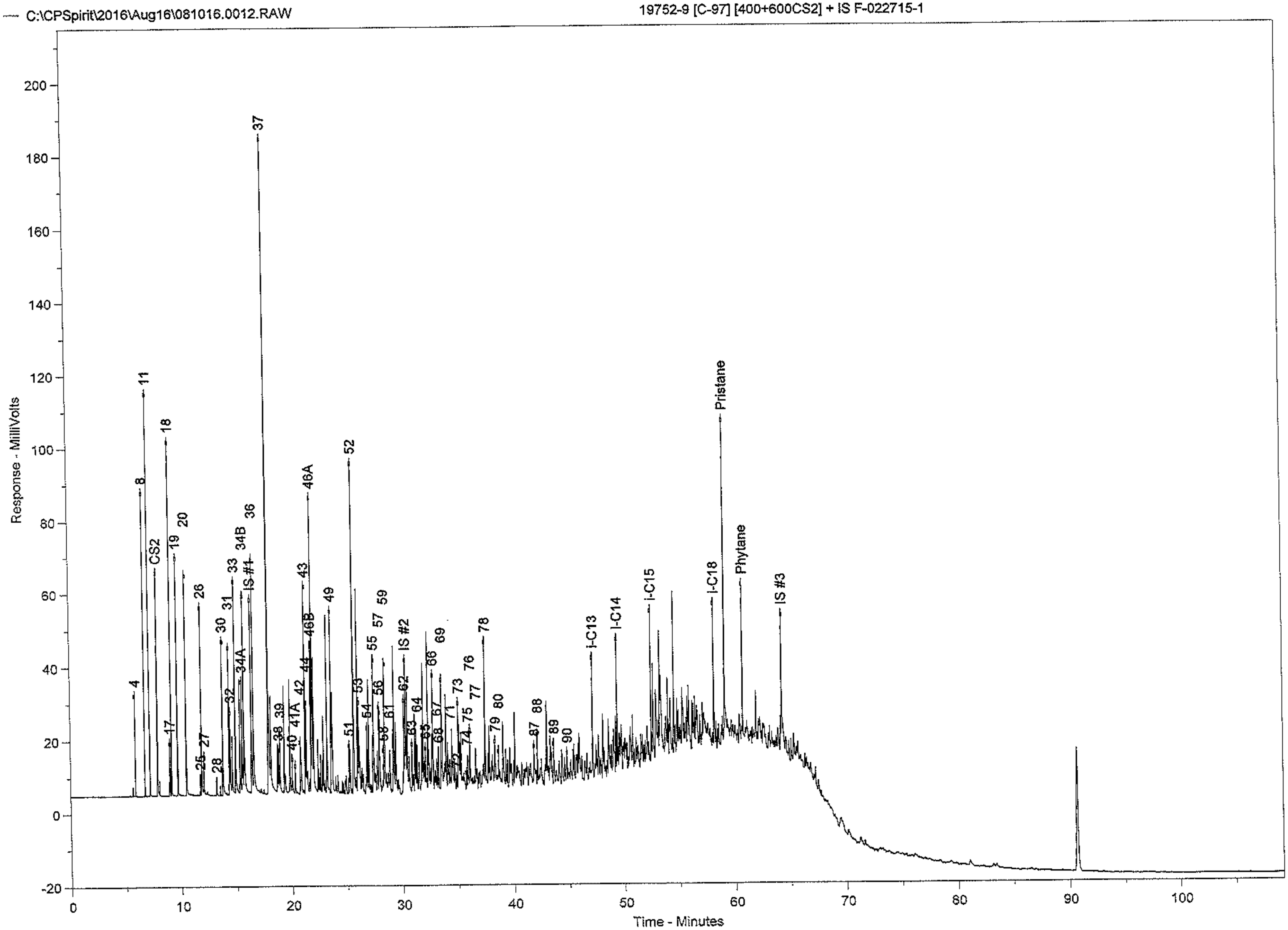
8/10/2016

ZymaX ID		19752-9
Sample ID		C-97
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.57
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	1.99
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	2.87
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.41
18	2-Methylpentane	3.36
19	3-Methylpentane	2.40
20	Hexane	2.49
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.17
26	Methylcyclopentane	2.46
27	2,4-Dimethylpentane	0.54
28	Benzene	0.21
29	5-Methyl-1-hexene	0.00
30	Cyclohexane	2.31
31	2-Methylhexane/TAME	1.96
32	2,3-Dimethylpentane	1.29
33	3-Methylhexane	3.24
34A	1-trans-3-Dimethylcyclopentane	1.27
34B	1-cis-3-Dimethylcyclopentane	2.43
35	2,2,4-Trimethylpentane	0.00
I.S. #1	à,à,à-Trifluorotoluene	0.00

ZymaX ID		19752-9
Sample ID		C-97
		Relative Area %
36	n-Heptane	3.98
37	Methylcyclohexane	10.91
38	2,5-Dimethylhexane	0.62
39	2,4-Dimethylhexane	1.06
40	2,3,4-Trimethylpentane	0.60
41	Toluene/2,3,3-Trimethylpentane	0.38
42	2,3-Dimethylhexane	1.55
43	2-Methylheptane	2.79
44	4-Methylheptane	0.98
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	5.62
46B	1,4-Dimethylcyclohexane	2.00
47	3-Methylheptane	0.00
48	2,2,5-Trimethylhexane	0.00
49	n-Octane	3.18
50	2,2-Dimethylheptane	0.00
51	2,4-Dimethylheptane	0.62
52	Ethylcyclohexane	6.10
53	2,6-Dimethylheptane	1.28
54	Ethylbenzene	1.03
55	m+p Xylenes	2.68
56	4-Methyloctane	1.15
57	2-Methyloctane	0.96
58	3-Ethylheptane	0.41
59	3-Methyloctane	2.14
60	o-Xylene	0.00
61	1-Nonene	0.73
62	n-Nonane	1.71
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.76
64	3,3,5-Trimethylheptane	0.70
65	2,4,5-Trimethylheptane	0.43
66	n-Propylbenzene	1.82
67	1-Methyl-3-ethylbenzene	0.29
68	1-Methyl-4-ethylbenzene	0.61
69	1,3,5-Trimethylbenzene	2.86
70	3,3,4-Trimethylheptane	0.00

ZymaX ID		19752-9
Sample ID		C-97
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.34
72	3-Methylnonane	0.18
73	1,2,4-Trimethylbenzene	1.28
74	Isobutylbenzene	0.25
75	sec-Butylbenzene	0.52
76	n-Decane	0.92
77	1,2,3-Trimethylbenzene	0.45
78	Indan	2.12
79	1,3-Diethylbenzene	0.93
80	1,4-Diethylbenzene	0.33
81	n-Butylbenzene	0.00
82	1,3-Dimethyl-5-ethylbenzene	0.00
83	1,4-Dimethyl-2-ethylbenzene	0.00
84	1,3-Dimethyl-4-ethylbenzene	0.00
85	1,2-Dimethyl-4-ethylbenzene	0.00
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	0.63
88	1,2,3,5-Tetramethylbenzene	0.71
89	1,2,3,4-Tetramethylbenzene	0.89
90	Naphthalene	0.57
91	2-Methyl-naphthalene	0.00
92	1-Methyl-naphthalene	0.00

Chrom Perfect Chromatogram Report



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Chrom Perfect Chromatogram Report

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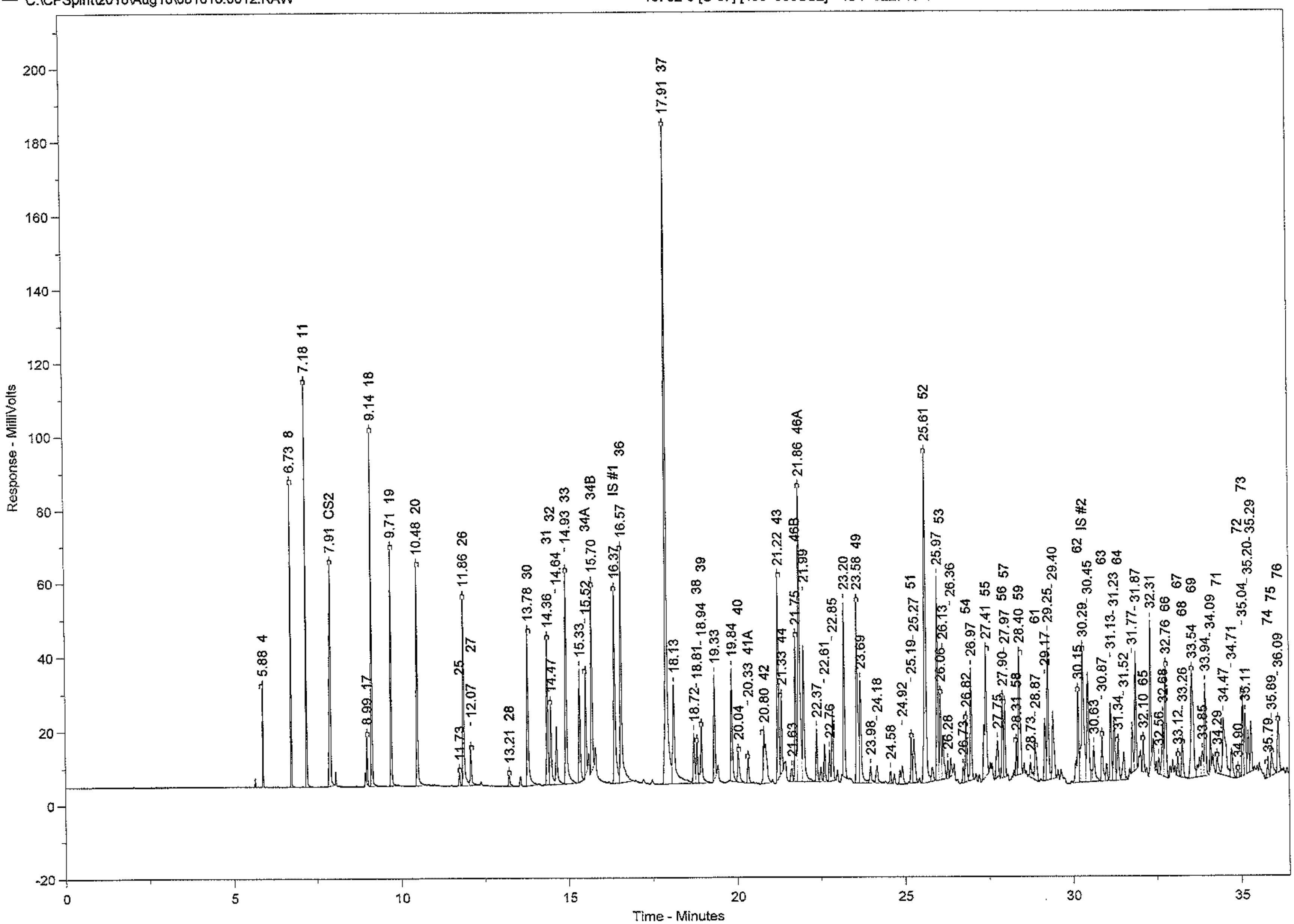

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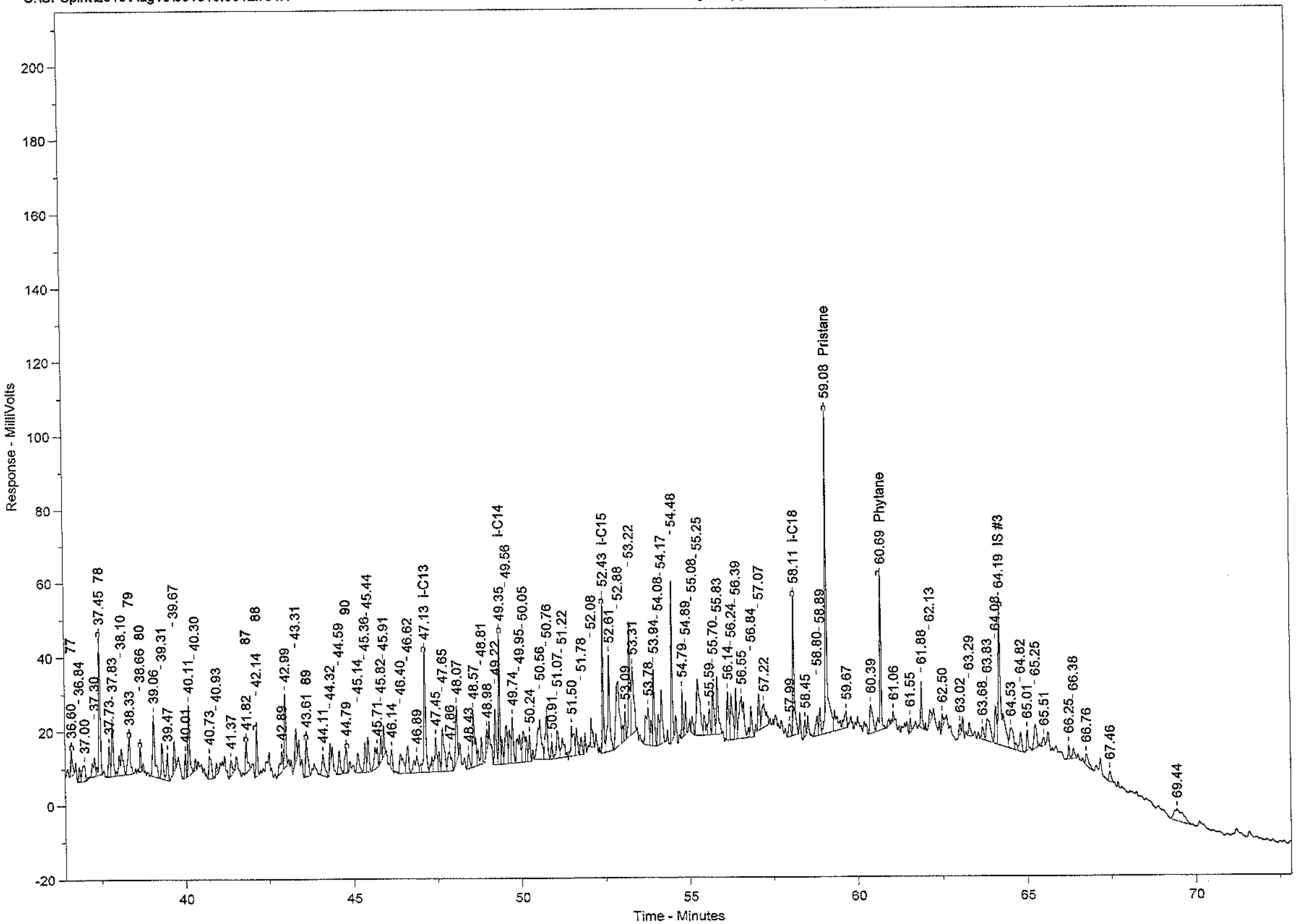
19752-9 [C-97] [400+600CS2] + IS F-022715-1



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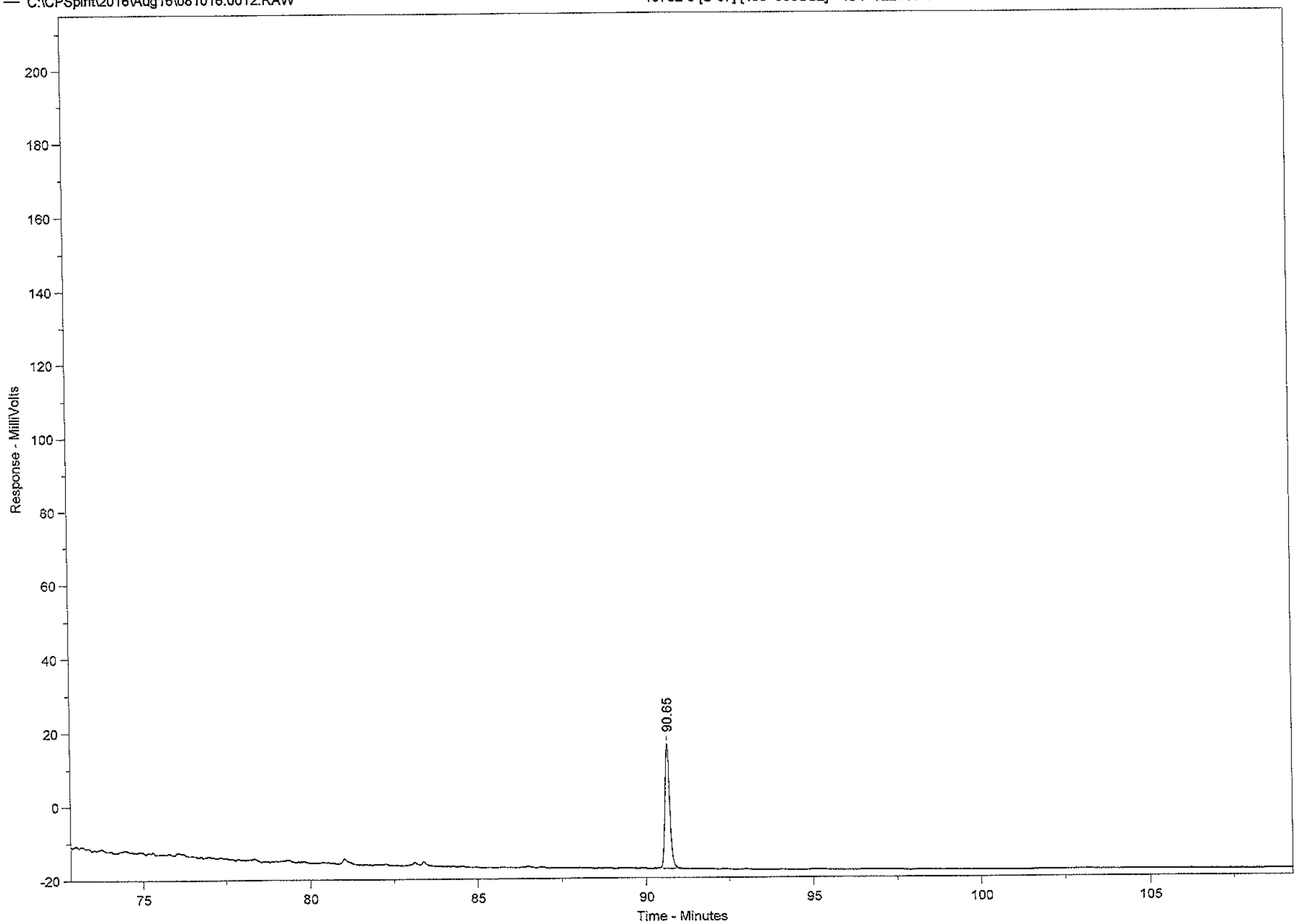


Sample Name = **19752-9 [C-97] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016.0012.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/23/2016 12:12:49 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
4	5.88	0.2184	30447.97
8	6.73	0.7625	106311.70
11	7.18	1.0995	153285.70
CS2	7.91	1.2271	171075.50
17	8.99	0.1571	21900.85
18	9.14	1.2887	179660.20
19	9.71	0.9202	128295.20
20	10.48	0.9553	133187.30
25	11.73	0.0646	9007.17
26	11.86	0.9437	131562.10
27	12.07	0.2061	28733.91
28	13.21	0.0809	11283.97
30	13.78	0.8861	123534.00
31	14.36	0.7522	104872.60
32	14.47	0.4933	68777.17
	14.64	0.3704	51633.58
33	14.93	1.2411	173032.20
	15.33	0.6138	85577.20
34A	15.52	0.4860	67763.16
34B	15.70	0.9311	129815.50
IS #1	16.37	1.1727	163488.00
36	16.57	1.5247	212575.40
37	17.91	4.1810	582905.00
	18.13	0.9733	135693.20
	18.72	0.2799	39028.11
38	18.81	0.2364	32957.18
39	18.94	0.4065	56675.57
	19.33	0.5282	73635.34
	19.84	0.6380	88943.37
40	20.04	0.2301	32079.01
41A	20.33	0.1461	20373.59
42	20.80	0.5951	82963.90
43	21.22	1.0693	149076.30
44	21.33	0.3765	52484.17
	21.63	0.1005	14013.04
46B	21.75	0.7661	106809.20
46A	21.86	2.1560	300577.30
	21.99	0.8490	118359.60
	22.37	0.2884	40212.53
	22.61	0.2016	28103.12
	22.76	0.1618	22551.20
	22.85	0.4147	57819.41
	23.20	0.9248	128938.60
49	23.58	1.2205	170159.50
	23.69	0.6746	94053.52
	23.98	0.1132	15786.24
	24.18	0.1422	19822.25
	24.58	0.0725	10114.27
	24.92	0.1994	27793.14
51	25.19	0.2366	32986.08
	25.27	0.3256	45400.38
52	25.61	2.3376	325893.60
	25.97	1.0985	153156.00
53	26.06	0.4911	68462.48
	26.13	0.3104	43272.93

Peak Name	Ret. Time	Area %	Area
	26.28	0.0838	11684.26
	26.36	0.1021	14236.26
	26.73	0.0951	13252.80
54	26.82	0.3934	54841.11
	26.97	0.6265	87340.40
55	27.41	1.0272	143211.00
	27.75	0.2886	40239.87
56	27.90	0.4397	61296.12
57	27.97	0.3685	51373.54
58	28.31	0.1555	21672.89
59	28.40	0.8196	114260.00
	28.73	0.1178	16417.80
61	28.87	0.2785	38822.61
	29.17	0.3891	54252.37
	29.25	0.8494	118421.80
	29.40	0.4881	68046.11
62	30.15	0.6553	91362.53
IS #2	30.29	1.2487	174090.10
	30.45	0.8345	116338.20
	30.63	0.2689	37491.15
63	30.87	0.2899	40419.71
	31.13	0.4775	66570.85
	31.23	0.3903	54414.56
64	31.34	0.2692	37536.48
	31.52	0.2373	33090.43
	31.77	0.2621	36545.10
	31.87	0.6300	87836.00
65	32.10	0.1634	22783.24
	32.31	0.7071	98586.90
	32.56	0.0833	11606.44
	32.68	0.3668	51138.78
66	32.76	0.6958	97001.21
67	33.12	0.1095	15265.25
68	33.26	0.2340	32625.13
69	33.54	1.0959	152786.80
	33.85	0.1996	27828.19
	33.94	0.5326	74258.45
	34.09	0.1711	23858.08
71	34.29	0.1300	18122.51
	34.47	0.7075	98640.37
	34.71	0.2218	30924.92
72	34.90	0.0709	9885.12
73	35.04	0.4923	68630.27
	35.11	0.3640	50742.06
	35.20	0.2543	35456.45
	35.29	0.2824	39368.96
74	35.79	0.0959	13375.62
75	35.89	0.1985	27671.61
76	36.09	0.3519	49062.27
77	36.60	0.1717	23944.38
	36.84	0.0905	12613.81
	37.00	0.2052	28612.14
	37.30	0.1956	27269.54
78	37.45	0.8138	113457.70
	37.73	0.2044	28492.99
	37.83	0.3644	50807.91
	38.10	0.3542	49385.30
79	38.33	0.3552	49521.15
80	38.66	0.1269	17686.15
	39.06	0.5396	75223.09
	39.31	0.2470	34436.78
	39.47	0.1765	24606.28
	39.67	0.1831	25524.89
	40.01	0.1323	18442.62
	40.11	0.4724	65858.37
	40.30	0.0682	9513.56
	40.73	0.2338	32594.00

Peak Name	Ret. Time	Area %	Area
	40.93	0.0734	10238.10
	41.37	0.1310	18258.03
87	41.82	0.2428	33851.15
88	42.14	0.2707	37739.87
	42.89	0.2171	30269.72
	42.99	0.4663	65008.75
	43.31	0.2190	30527.22
89	43.61	0.3397	47356.61
	44.11	0.2358	32878.50
	44.32	0.1122	15637.42
	44.59	0.1873	26117.16
90	44.79	0.2176	30337.22
	45.14	0.1974	27526.09
	45.36	0.2107	29372.28
	45.44	0.2460	34291.47
	45.71	0.2696	37586.61
	45.82	0.1503	20959.79
	45.91	0.1683	23468.14
	46.14	0.1318	18370.30
	46.40	0.2912	40596.85
	46.62	0.2499	34846.41
	46.89	0.2563	35731.60
i-C13	47.13	0.8331	116151.80
	47.45	0.3088	43052.50
	47.65	0.4314	60142.42
	47.86	0.2838	39561.81
	48.07	0.4012	55927.71
	48.43	0.1158	16141.14
	48.57	0.5337	74410.09
	48.81	0.1669	23275.14
	48.98	0.1284	17902.14
	49.22	0.3874	54003.98
i-C14	49.35	0.6543	91224.03
	49.56	0.3864	53872.43
	49.74	0.2995	41752.25
	49.95	0.4035	56257.11
	50.05	0.3028	42211.95
	50.24	0.1600	22313.45
	50.56	0.6426	89594.23
	50.76	0.3850	53682.16
	50.91	0.1082	15082.03
	51.07	0.2715	37847.71
	51.22	0.2369	33033.20
	51.50	0.3266	45536.45
	51.78	0.1319	18387.92
	52.08	0.2053	28628.92
i-C15	52.43	0.7140	99539.87
	52.61	0.7601	105966.60
	52.88	0.9686	135037.10
	53.09	0.1461	20366.90
	53.22	0.8196	114262.90
	53.31	0.6236	86935.02
	53.78	0.4922	68625.44
	53.94	0.4230	58978.37
	54.08	0.2334	32532.94
	54.17	0.3919	54643.04
	54.48	0.7250	101074.80
	54.79	0.2098	29250.00
	54.89	0.1682	23446.70
	55.08	0.1239	17274.15
	55.25	0.7550	105254.50
	55.59	0.1897	26450.03
	55.70	0.3290	45872.23
	55.83	0.4668	65074.57
	56.14	0.3535	49283.20
	56.24	0.4205	58620.51
	56.39	0.2733	38107.54

Peak Name	Ret. Time	Area %	Area
	56.55	0.7516	104780.00
	56.84	0.2105	29345.34
	57.07	0.2605	36324.93
	57.22	0.3858	53789.15
	57.99	0.1138	15865.52
i-C18	58.11	0.8418	117355.50
	58.45	0.1011	14089.91
	58.80	0.1746	24347.08
	58.89	0.1736	24207.60
Pristane	59.08	2.1250	296260.90
	59.67	0.1535	21403.53
	60.39	0.3437	47923.01
Phytane	60.69	0.8650	120598.00
	61.06	0.1067	14877.99
	61.55	0.0782	10895.54
	61.88	0.2397	33414.13
	62.13	0.1090	15197.66
	62.50	0.0962	13417.65
	63.02	0.0743	10352.01
	63.29	0.1029	14340.17
	63.68	0.1020	14216.84
	63.83	0.3576	49858.16
	64.08	0.3114	43418.78
IS #3	64.19	1.5120	210803.10
	64.53	0.3127	43592.26
	64.82	0.1713	23888.67
	65.01	0.1136	15837.73
	65.25	0.2460	34296.68
	65.51	0.0722	10061.95
	66.25	0.0809	11272.70
	66.38	0.0970	13528.91
	66.76	0.1387	19337.85
	67.46	0.0945	13178.17
	69.44	0.4358	60759.76
	90.65	2.3791	331684.40

Total Area = 1.394167E+07 Total Height = 4085954 Total Amount = 0

REPORT OF ANALYTICAL RESULTS

Client:	Andrew Bradley Stantec Consulting 1060 Andrew Drive; Suite 160 West Chester, PA 19380	Lab Number: Collected: Received: Matrix:	19752-2 7/25/2016 7/28/2016 Product
Project:	2134	Sample Description:	See Below
Project Number:	213402429	Analyzed:	8/24/2016
Collected by:	W. Delk	Method:	ASTM D1217

SPECIFIC GRAVITY

LAB NUMBER	SAMPLE DESCRIPTION	SPECIFIC GRAVITY
19752-2-01	S-382	0.726
19752-2-02	S-410	0.891
19752-2-03	S-368	0.887
19752-2-04	S-348	0.882
19752-2-05	C-97	0.893

REPORT OF ANALYTICAL RESULTS

Client:	Andrew Bradley Stantec Consulting 1060 Andrew Drive; Suite 160 West Chester, PA 19380

Lab Number:	19752-1
Collected:	7/25/2016
Received:	7/28/2016
Matrix:	Product

Project:	2134
Project Number:	213402429
Collected by:	W. Delk

Sample Description:	See Below
Analyzed:	8/24/2016
Method:	ASTM D1217

DENSITY

LAB NUMBER	SAMPLE DESCRIPTION	DENSITY g/cm^3
19752-2-01	S-382	0.725
19752-2-02	S-410	0.890
19752-2-03	S-368	0.886
19752-2-04	S-348	0.881
19752-2-05	C-97	0.892

August 29, 2016

formerly ZymaX Forensics

Andrew Bradley
Stantec
1060 Andrew Drive; Suite 160
West Chester, PA 19380

RE: Pennrose Tank 253 Valve
Project Number: 213402429

Pace Analytical received 2 sample(s) received on August 5th, 2016 for analysis 253 Tank Valve and S-241. Per client request, the following analyses were performed:

1. C3-C36 Whole Oil (ASTM 3328)
2. Density/Specific Gravity (ASTM D1217)

The sample was performed in house under laboratory number **19819**.

Please call the lab at 412-826-4481, or you may email any questions or concerns to taryn.mancine@pacelabs.com regarding any analytical data reports.

Respectfully submitted,

Taryn Mancine

Taryn Mancine
Project Manager/Scientist

Pace Analytical® Energy Services™

ZymaX Forensics Division
220 William Pitt Way
Pittsburgh, PA 15238

Phone: 412-826-5245
Fax: 412-826-3433

19819

Samples will be disposed of after 30 days unless requested otherwise

Chain of Custody

Report To:	Andrew Bradley	Email To:	abradley@stantec.com			Analysis Requested							# of containers
Company:	Stantec Consulting	Phone:	610-840-2541			C3-C36 Whole Oil	Oxygenates	Organic Lead/Scavengers	Density/Specific Gravity	C3-C10 PIANO	C8-C40 Full Scan	Simulated Distillation	
Address:	1060 Andrew Drive, Siute 160 West Chester, PA	Project:	Pennrose Tank 253 Valve										
		Project #:	213402429										
ZymaX use only	Sample Description	Date Sampled	Time	Matrix	Preserve								
	253 Tank Valve	8/2/2016	1300	LNALP	None	x			x				4
	S-241	8/2/2016	1330	LNAPL	None	x			x				4

Bill To: Same as Above ☑ Yes
Company:
Address:

PO Number: 213402429
Invoice Email:abradley@stantec.com

Sample Comments:

Laboratory Remarks: Temperature: ________ °C Courier Method: ________

sample integrity upon receipt:
- samples received intact ☐ Yes
- samples received cold/on ice ☐ Yes
- custody seals ☐ Yes
- correct container types ☐ Yes

Turnaround Time
- ASAP ☐ 1wk ☐
- 48 hr ☐ STD (2wks) ☑
- 72 hr ☐

**quicker TAT may result in additional surcharges*

Print Name of Sampler: Tim Delk

Signature of Sampler:	W Delk	Date:	8/2/16		
Relinquished By:	[illegible]	Date:	[illegible]	Time:	[illegible]
Relinquished By:	[illegible]	Date:	8/3/16	Time:	1115
Relinquished By:		Date:	8/3/16	Time:	1111
Received by Lab:	Ashleigh Rore / Pace	Date:	8-4-16	Time:	0940

Ashleigh Rore / Pace 8-4-16 1550
[illegible] Pace 8-5-16 1040
[illegible] PAES 8.5.16 1045

Page ____ of ____

Cooler Receipt Form

Client Name: Stantec Project: Penrose Tank 253 Valve. Lab Work Order: 19819

A. **Shipping/Container Information** (circle appropriate response)

Courier: FedEx UPS USPS Client (Other:) Pace G Air bill Present: Yes No

Tracking Number: ______

Custody Seal on Cooler/Box Present: Yes (No) Seals Intact: Yes No

Cooler/Box Packing Material: Bubble Wrap Absorbent Foam (Other:) ______

Type of Ice: (Wet) Blue None Ice Intact: (Yes) Melted

Cooler Temperature: 2.1°C Radiation Screened: Yes (No) Chain of Custody Present: (Yes) No

Comments: ______

B. **Laboratory Assignment/Log-in** (check appropriate response)

	YES	NO	N/A	Comment Reference non-Conformance
Chain of Custody properly filled out	✓			
Chain of Custody relinquished	✓			
Sampler Name & Signature on COC		✓		
Containers intact	✓			
Were samples in separate bags		✓		
Sample container labels match COC Sample name/date and time collected	✓			
Sufficient volume provided	✓			
PAES containers used		✓		
Are containers properly preserved for the requested testing? (as labeled)			✓	
If an unknown preservation state, were containers checked? Exception: VOA's coliform			✓	If yes, see pH form.
Was volume for dissolved testing field filtered, as noted on the COC? Was volume received in a preserved container?			✓	

Comments: ______

Cooler contents examined/received by: LY Date: 8.5.14

Project Manager Review: TM Date: 8.5.14

F-PAE-Q-009-rev.00, 20 Nov2014

Sample Condition Upon Receipt Pittsburgh

Pace Analytical

Client Name: Stantec Project # 19819

Courier: ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other ______

Tracking #: 7837 3830 3348

Custody Seal on Cooler/Box Present: ☐ yes ☑ no Seals intact: ☐ yes ☐ no

Thermometer Used 6 Type of Ice: Wet Blue (None) Seperate cooler

Cooler Temperature Observed Temp 14.6 °C Correction Factor: -0.1 °C Final Temp: 14.5 °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: [illegible] 8-4-16

Comments:	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:		X		4.
Sample Labels match COC:	X			5.
-Includes date/time/ID/Analysis Matrix: Oil				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):		X		7.
Rush Turn Around Time Requested:		X		8.
Sufficient Volume:	X			9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:	X			11.
Filtered volume received for Dissolved tests			X	12.
All containers needing preservation have been checked.			X	13.
All containers needing preservation are found to be in compliance with EPA recommendation.			X	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed [illegible] / Date/time of preservation / Lot # of added preservative
Headspace in VOA Vials (>6mm):			X	14.
Trip Blank Present:		X		15.
Trip Blank Custody Seals Present			X	
Rad Aqueous Samples Screened > 0.5 mrem/hr			X	Initial when completed: / Date:

Client Notification/ Resolution:

Person Contacted: ______ Date/Time: ______ Contacted By: ______

Comments/ Resolution: ______

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

***PM review** is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

8/10/2016

ZymaX ID	19819-1
Sample ID	253 TANK VALVE
Evaporation	
n-Pentane / n-Heptane	0.00
2-Methylpentane / 2-Methylheptane	0.00
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	1.44
Aromatics / Total Paraffins (n+iso+cyc)	5.45
Aromatics / Naphthenes	48.08
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	0.00
3-Methylhexane / n-Heptane	0.00
Methylcyclohexane / n-Heptane	0.00
Isoparaffins + Naphthenes / Paraffins	0.44
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.00
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	10.76
% Isoparaffinic	2.97
% Aromatic	84.51
% Naphthenic	1.76
% Olefinic	0.00

ZymaX ID		19819-1
Sample ID		253 TANK VALVE
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.00
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.00
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	0.00
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.00
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.00
18	2-Methylpentane	0.00
19	3-Methylpentane	0.00
20	Hexane	0.00
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.00
26	Methylcyclopentane	0.00
27	2,4-Dimethylpentane	0.00
28	Benzene	0.00
29	5-Methyl-1-hexene	0.00
30	Cyclohexane	0.00
31	2-Methylhexane/TAME	0.00
32	2,3-Dimethylpentane	0.00
33	3-Methylhexane	0.00
34A	1-trans-3-Dimethylcyclopentane	0.00
34B	1-cis-3-Dimethylcyclopentane	0.00
35	2,2,4-Trimethylpentane	0.00
I.S. #1	à,à,à-Trifluorotoluene	0.00

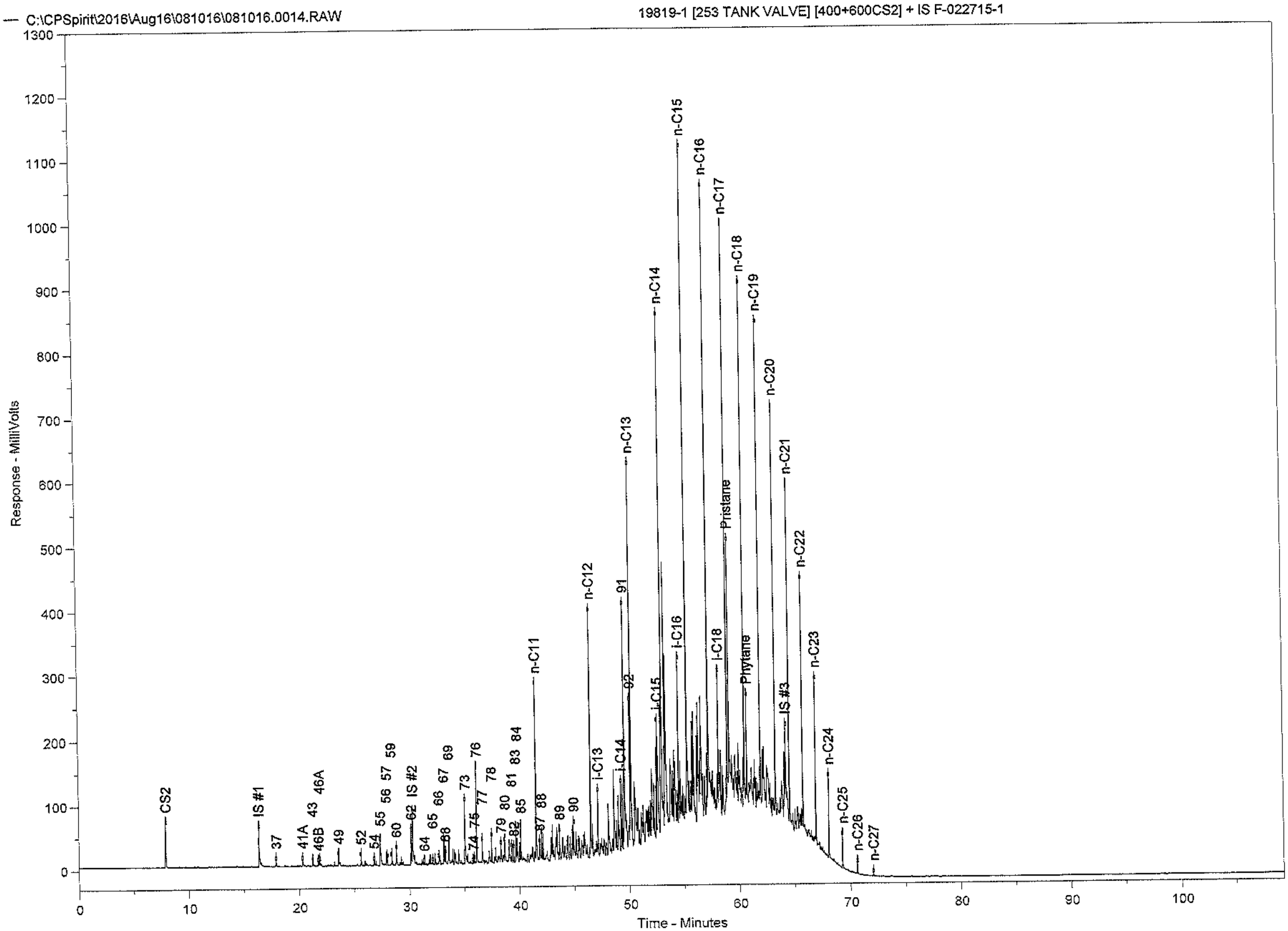
8/10/2016

ZymaX ID		19819-1
Sample ID		253 TANK VALVE
		Relative Area %
36	n-Heptane	0.00
37	Methylcyclohexane	0.58
38	2,5-Dimethylhexane	0.00
39	2,4-Dimethylhexane	0.00
40	2,3,4-Trimethylpentane	0.00
41	Toluene/2,3,3-Trimethylpentane	0.83
42	2,3-Dimethylhexane	0.00
43	2-Methylheptane	0.32
44	4-Methylheptane	0.00
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	0.47
46B	1,4-Dimethylcyclohexane	0.28
47	3-Methylheptane	0.00
48	2,2,5-Trimethylhexane	0.00
49	n-Octane	0.71
50	2,2-Dimethylheptane	0.00
51	2,4-Dimethylheptane	0.00
52	Ethylcyclohexane	0.90
53	2,6-Dimethylheptane	0.00
54	Ethylbenzene	0.73
55	m+p Xylenes	3.46
56	4-Methyloctane	0.44
57	2-Methyloctane	0.62
58	3-Ethylheptane	0.00
59	3-Methyloctane	0.70
60	o-Xylene	1.35
61	1-Nonene	0.00
62	n-Nonane	2.44
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.00
64	3,3,5-Trimethylheptane	0.23
65	2,4,5-Trimethylheptane	0.20
66	n-Propylbenzene	0.57
67	1-Methyl-3-ethylbenzene	1.94
68	1-Methyl-4-ethylbenzene	1.11
69	1,3,5-Trimethylbenzene	2.45
70	3,3,4-Trimethylheptane	0.00

8/10/2016

ZymaX ID		19819-1
Sample ID		253 TANK VALVE
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.00
72	3-Methylnonane	0.00
73	1,2,4-Trimethylbenzene	5.70
74	Isobutylbenzene	0.25
75	sec-Butylbenzene	0.58
76	n-Decane	7.61
77	1,2,3-Trimethylbenzene	2.55
78	Indan	1.99
79	1,3-Diethylbenzene	2.03
80	1,4-Diethylbenzene	1.95
81	n-Butylbenzene	1.16
82	1,3-Dimethyl-5-ethylbenzene	1.12
83	1,4-Dimethyl-2-ethylbenzene	3.20
84	1,3-Dimethyl-4-ethylbenzene	1.94
85	1,2-Dimethyl-4-ethylbenzene	2.82
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	1.90
88	1,2,3,5-Tetramethylbenzene	2.19
89	1,2,3,4-Tetramethylbenzene	3.07
90	Naphthalene	4.02
91	2-Methyl-naphthalene	23.57
92	1-Methyl-naphthalene	12.01

Chrom Perfect Chromatogram Report



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Chrom Perfect Chromatogram Report

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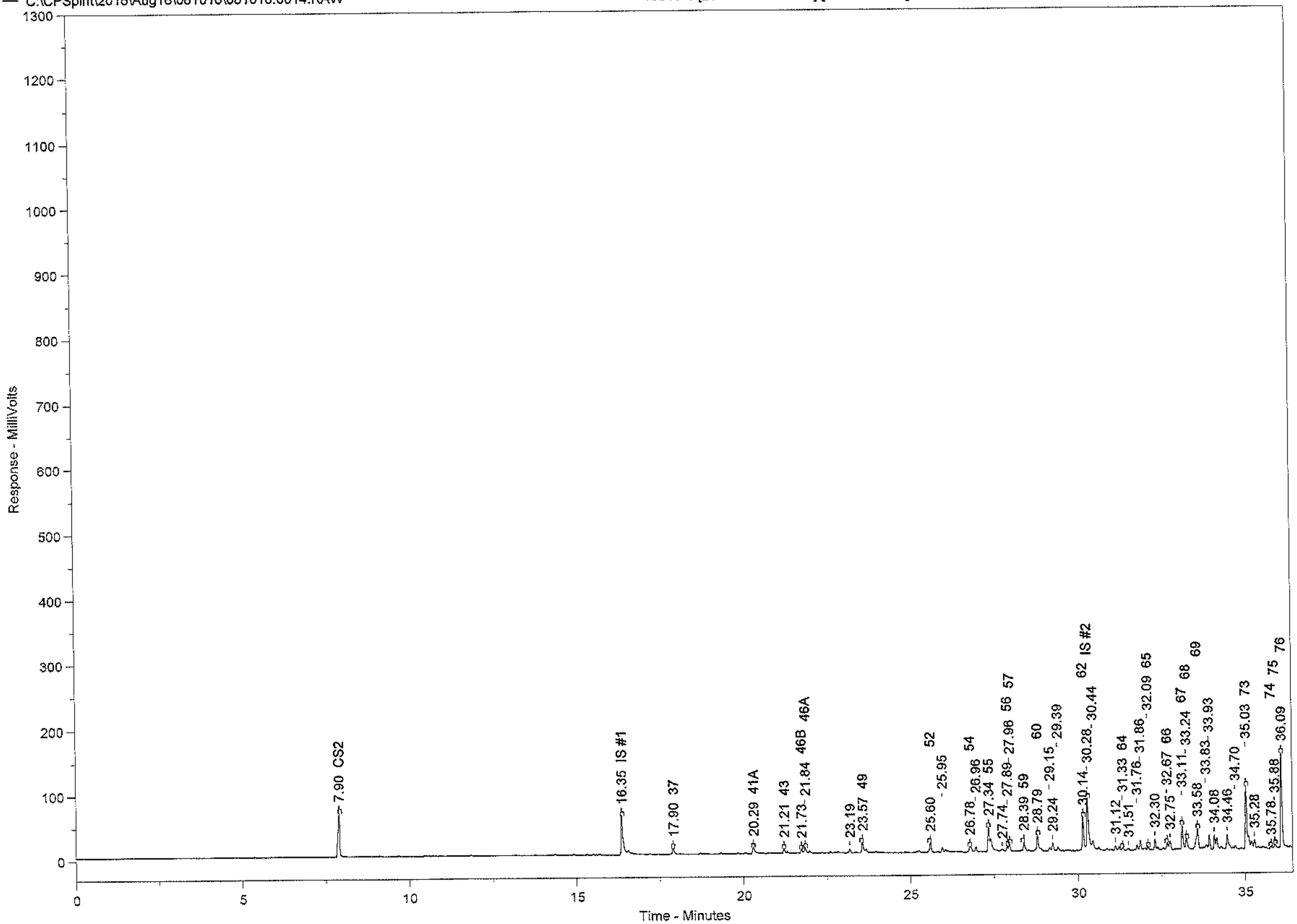
19819-1 [253 TANK VALVE] [400+600CS2] + IS F-022715-1



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Chrom Perfect Chromatogram Report

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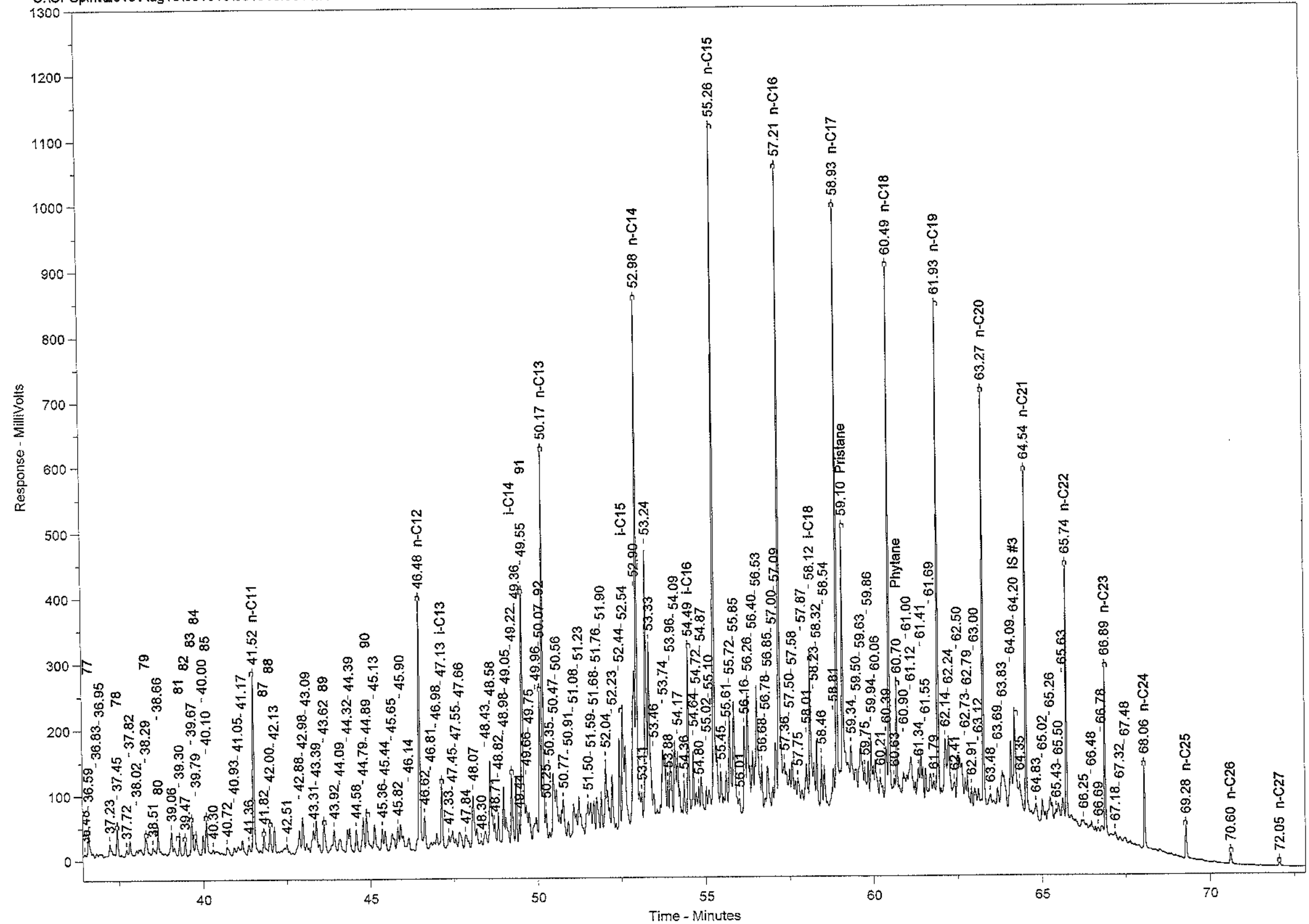
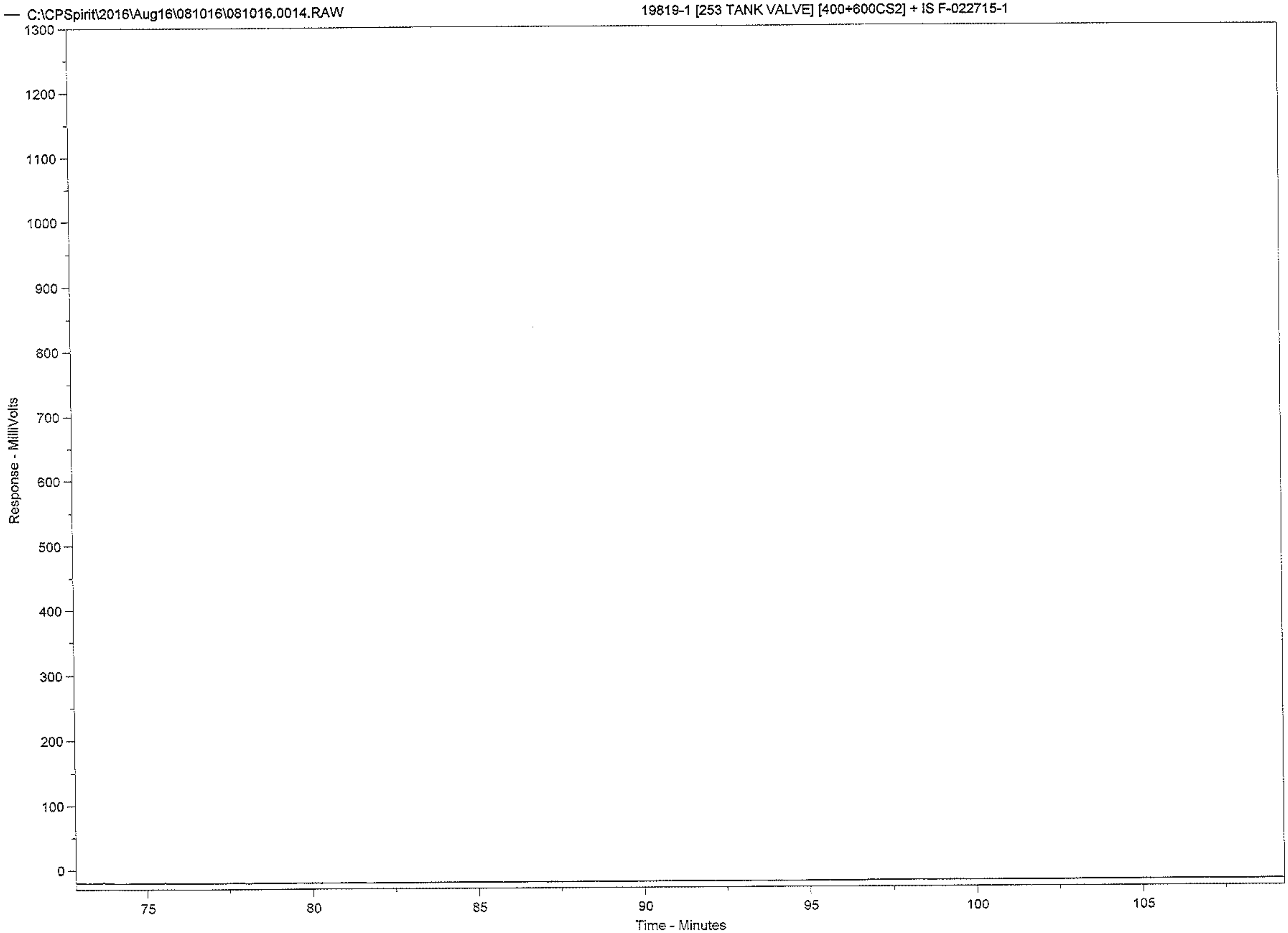
19819-1 [253 TANK VALVE] [400+600CS2] + IS F-022715-1




— C:\CPSpirit\2016\Aug16\081016\081016.0014.RAW
19819-1 [253 TANK VALVE] [400+600CS2] + IS F-022715-1
Response - MilliVolts
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
75
80
85
90
95
100
105
Time - Minutes

Sample Name = **19819-1 [253 TANK VALVE] [400+600CS2] + IS F-022715-1**

Instrument = Instrument 1
Heading 1 =
Heading 2 =

Acquisition Port = DP#

Raw File Name = **C:\CPSpirit\2016\Aug16\081016\081016.0014.RAW**
Method File Name = C:\CPSpirit\C344.met
Calibration File Name = C:\CPSpirit\032416.cal

Date Taken (end) = 8/23/2016 4:35:10 PM
Method Version = 44
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
CS2	7.90	0.2948	240257.30
IS #1	16.35	0.2633	214537.10
37	17.90	0.0447	36429.49
41A	20.29	0.0645	52523.41
43	21.21	0.0246	20028.69
46B	21.73	0.0218	17781.26
46A	21.84	0.0366	29800.67
	23.19	0.0196	15937.17
49	23.57	0.0554	45183.71
52	25.60	0.0697	56804.49
	25.95	0.0227	18465.83
54	26.78	0.0567	46236.01
	26.96	0.0278	22642.44
55	27.34	0.2682	218594.60
	27.74	0.0237	19325.25
56	27.89	0.0338	27576.71
57	27.96	0.0477	38843.44
59	28.39	0.0544	44327.32
60	28.79	0.1044	85101.63
	29.15	0.0193	15714.92
	29.24	0.0476	38761.71
	29.39	0.0272	22163.40
62	30.14	0.1890	153999.00
IS #2	30.28	0.3836	312592.30
	30.44	0.0657	53539.67
	31.12	0.0291	23733.59
64	31.33	0.0179	14585.49
	31.51	0.0149	12178.14
	31.76	0.0240	19525.28
	31.86	0.0500	40728.46
65	32.09	0.0156	12680.15
	32.30	0.0512	41694.25
66	32.67	0.0443	36077.44
	32.75	0.0570	46416.88
67	33.11	0.1502	122376.80
68	33.24	0.0857	69819.34
69	33.58	0.1896	154494.20
	33.83	0.0373	30408.85
	33.93	0.0859	69988.87
	34.08	0.0494	40266.08
	34.46	0.1156	94168.83
	34.70	0.0248	20227.36
73	35.03	0.4416	359870.50
	35.28	0.0486	39584.25
74	35.78	0.0197	16025.65
75	35.88	0.0452	36860.87
76	36.09	0.5899	480705.00
	36.48	0.0224	18215.27
77	36.59	0.1979	161313.50
	36.83	0.0209	17006.71
	36.95	0.0423	34473.97
	37.23	0.0993	80918.73
78	37.45	0.1544	125797.40
	37.72	0.0418	34034.77
	37.82	0.0905	73760.38

Peak Name	Ret. Time	Area %	Area
	38.02	0.0195	15929.96
79	38.29	0.1572	128135.80
	38.51	0.0689	56172.12
80	38.66	0.1514	123364.00
	39.06	0.1643	133924.10
81	39.30	0.0899	73273.12
82	39.47	0.0871	70974.46
83	39.67	0.2483	202390.00
84	39.79	0.1500	122221.10
	40.00	0.1048	85443.58
85	40.10	0.2189	178387.10
	40.30	0.0207	16884.23
	40.72	0.0759	61875.21
	40.93	0.0564	45982.52
	41.05	0.0950	77378.77
	41.17	0.1090	88807.60
	41.36	0.0786	64049.85
n-C11	41.52	1.0627	866071.10
87	41.82	0.1476	120325.20
88	42.00	0.1700	138551.20
	42.13	0.1522	124043.80
	42.51	0.0677	55164.06
	42.88	0.2148	175044.20
	42.98	0.2528	206032.80
	43.09	0.1048	85437.20
	43.31	0.2403	195851.50
	43.39	0.2287	186415.40
89	43.62	0.2378	193780.20
	43.92	0.2419	197155.10
	44.09	0.1678	136718.20
	44.32	0.1448	118026.60
	44.39	0.1513	123330.30
	44.58	0.1522	124053.60
	44.79	0.2433	198313.10
90	44.89	0.3113	253684.80
	45.13	0.2306	187935.00
	45.36	0.1533	124930.90
	45.44	0.1298	105761.70
	45.65	0.1843	150227.60
	45.82	0.1032	84092.85
	45.90	0.0816	66509.37
	46.14	0.0771	62857.07
n-C12	46.48	1.4574	1187687.00
	46.62	0.2692	219361.50
	46.81	0.0758	61782.44
	46.98	0.1817	148100.40
i-C13	47.13	0.4277	348537.50
	47.33	0.0947	77205.95
	47.45	0.1794	146212.50
	47.55	0.0650	52973.88
	47.66	0.1843	150183.60
	47.84	0.1645	134037.90
	48.07	0.4374	356422.30
	48.30	0.0433	35278.71
	48.43	0.1501	122304.30
	48.58	0.7256	591333.40
	48.71	0.1345	109645.10
	48.82	0.1856	151240.50
	48.98	0.3258	265531.70
	49.05	0.2388	194640.30
i-C14	49.22	0.4302	350612.30
	49.36	0.3045	248137.00
	49.44	0.1032	84118.93
91	49.55	1.8269	1488843.00
	49.66	0.2771	225817.40
	49.75	0.2068	168569.20
	49.96	0.3011	245358.30

Peak Name	Ret. Time	Area %	Area
92	50.07	0.9313	758975.40
n-C13	50.17	1.8753	1528274.00
	50.25	0.1728	140824.10
	50.35	0.0356	28995.72
	50.47	0.5710	465362.80
	50.56	0.3716	302859.60
	50.77	0.3853	314026.00
	50.91	0.0952	77584.55
	51.08	0.2171	176948.50
	51.23	0.3655	297891.70
	51.50	0.2697	219772.10
	51.59	0.2214	180392.50
	51.68	0.2026	165121.10
	51.76	0.2767	225498.50
	51.90	0.1929	157184.70
	52.04	0.6952	566582.90
	52.23	0.2889	235444.90
	52.44	0.3847	313540.40
i-C15	52.54	1.2793	1042527.00
	52.90	1.4985	1221174.00
n-C14	52.98	2.5025	2039348.00
	53.11	0.1182	96357.98
	53.24	1.7269	1407335.00
	53.33	1.2355	1006866.00
	53.46	0.1160	94537.30
	53.74	0.4784	389899.30
	53.88	0.1591	129619.80
	53.96	0.3853	313994.70
	54.09	0.5080	413984.80
	54.17	0.4458	363283.90
	54.36	0.1518	123732.30
i-C16	54.49	0.8493	692127.70
	54.64	0.3308	269545.50
	54.72	0.1417	115467.70
	54.80	0.1366	111320.70
	54.87	0.2813	229204.50
	55.02	0.1461	119072.70
	55.10	0.2140	174416.10
n-C15	55.26	3.7206	3032036.00
	55.45	0.3973	323740.10
	55.61	0.2938	239433.80
	55.72	0.7671	625125.90
	55.85	0.9047	737275.90
	56.01	0.1218	99226.00
	56.16	0.6969	567963.20
	56.26	0.9069	739048.70
	56.40	0.4888	398343.90
	56.53	1.4522	1183426.00
	56.68	0.2631	214421.20
	56.78	0.1171	95447.73
	56.85	0.4756	387620.80
	57.00	0.1911	155694.90
	57.09	0.6285	512214.50
n-C16	57.21	3.3553	2734388.00
	57.36	0.7577	617455.90
	57.50	0.3584	292039.80
	57.58	0.4765	388344.90
	57.75	0.3609	294117.90
	57.87	0.2346	191154.60
	58.01	0.5663	461528.30
i-C18	58.12	1.1106	905083.10
	58.23	0.3285	267724.80
	58.32	0.4851	395315.80
	58.46	0.3707	302128.60
	58.54	0.4646	378617.30
	58.81	0.5365	437200.50
n-C17	58.93	3.1304	2551094.00

Peak Name	Ret. Time	Area %	Area
Pristane	59.10	2.1598	1760071.00
	59.34	0.8055	656406.60
	59.50	0.4861	396106.00
	59.63	1.0946	892066.10
	59.75	0.3716	302863.30
	59.86	0.4365	355724.60
	59.94	0.8111	661030.60
	60.06	0.6189	504329.80
	60.21	0.5320	433584.50
	60.39	0.6477	527831.10
n-C18	60.49	2.5898	2110525.00
	60.63	0.2463	200749.60
Phytane	60.70	1.0331	841924.10
	60.90	0.5743	467997.10
	61.00	0.3084	251363.30
	61.12	0.9129	743985.30
	61.34	0.4556	371293.50
	61.41	0.7225	588805.70
	61.55	0.4715	384249.00
	61.69	0.4914	400443.00
	61.79	0.3803	309886.00
n-C19	61.93	2.5495	2077718.00
	62.14	0.8718	710490.40
	62.24	0.9111	742457.80
	62.41	0.4213	343341.00
	62.50	1.3266	1081086.00
	62.73	0.2801	228273.30
	62.79	0.3700	301542.40
	62.91	0.2008	163655.90
	63.00	0.3456	281675.70
	63.12	0.2418	197048.90
n-C20	63.27	1.9132	1559121.00
	63.48	0.3425	279151.60
	63.69	0.3121	254335.50
	63.83	0.9186	748570.40
	64.09	0.7191	586053.50
IS #3	64.20	1.1369	926479.20
	64.35	0.4390	357745.70
n-C21	64.54	1.5249	1242710.00
	64.83	0.1884	153575.10
	65.02	0.1890	154060.20
	65.26	0.2118	172577.60
	65.43	0.0698	56855.71
	65.50	0.1242	101190.40
	65.63	0.1486	121110.90
n-C22	65.74	0.9786	797528.80
	66.25	0.1008	82154.41
	66.48	0.0626	51051.85
	66.69	0.0442	36025.64
	66.78	0.0874	71225.77
n-C23	66.89	0.7254	591121.40
	67.18	0.0579	47182.46
	67.32	0.0336	27346.83
	67.48	0.0488	39742.61
n-C24	68.06	0.3897	317557.30
n-C25	69.28	0.1895	154403.30
n-C26	70.60	0.0681	55469.30
n-C27	72.05	0.0248	20227.55

Total Area = 8.149393E+07　　Total Height = 2.225418E+07　　Total Amount = 0

ZymaX ID	19819-2
Sample ID	S-241
Evaporation	
n-Pentane / n-Heptane	0.25
2-Methylpentane / 2-Methylheptane	0.75
Waterwashing	
Benzene / Cyclohexane	0.00
Toluene / Methylcyclohexane	0.15
Aromatics / Total Paraffins (n+iso+cyc)	2.64
Aromatics / Naphthenes	12.37
Biodegradation	
(C4 - C8 Para + Isopara) / C4 - C8 Olefins	152.96
3-Methylhexane / n-Heptane	0.46
Methylcyclohexane / n-Heptane	1.91
Isoparaffins + Naphthenes / Paraffins	1.32
Octane rating	
2,2,4,-Trimethylpentane / Methylcyclohexane	0.00
Relative percentages - Bulk hydrocarbon composition as PIANO	
% Paraffinic	11.84
% Isoparaffinic	9.74
% Aromatic	72.48
% Naphthenic	5.86
% Olefinic	0.08

8/10/2016

		19819-2
ZymaX ID		
Sample ID		S-241
		Relative Area %
1	Propane	0.00
2	Isobutane	0.00
3	Isobutene	0.00
4	Butane/Methanol	0.00
5	trans-2-Butene	0.00
6	cis-2-Butene	0.00
7	3-Methyl-1-butene	0.00
8	Isopentane	0.46
9	1-Pentene	0.00
10	2-Methyl-1-butene	0.00
11	Pentane	0.29
12	trans-2-Pentene	0.00
13	cis-2-Pentene/t-Butanol	0.00
14	2-Methyl-2-butene	0.08
15	2,2-Dimethylbutane	0.00
16	Cyclopentane	0.00
17	2,3-Dimethylbutane/MTBE	0.10
18	2-Methylpentane	0.50
19	3-Methylpentane	0.37
20	Hexane	0.53
21	trans-2-Hexene	0.00
22	3-Methylcyclopentene	0.00
23	3-Methyl-2-pentene	0.00
24	cis-2-Hexene	0.00
25	3-Methyl-trans-2-pentene	0.00
26	Methylcyclopentane	0.52
27	2,4-Dimethylpentane	0.12
28	Benzene	0.00
29	5-Methyl-1-hexene	0.00
30	Cyclohexane	0.47
31	2-Methylhexane/TAME	0.41
32	2,3-Dimethylpentane	0.23
33	3-Methylhexane	0.54
34A	1-trans-3-Dimethylcyclopentane	0.21
34B	1-cis-3-Dimethylcyclopentane	0.34
35	2,2,4-Trimethylpentane	0.00
I.S. #1	à,à,à-Trifluorotoluene	0.00

ZymaX ID		19819-2
Sample ID		S-241
		Relative Area %
36	n-Heptane	1.17
37	Methylcyclohexane	2.25
38	2,5-Dimethylhexane	0.12
39	2,4-Dimethylhexane	0.13
40	2,3,4-Trimethylpentane	0.16
41	Toluene/2,3,3-Trimethylpentane	0.34
42	2,3-Dimethylhexane	0.29
43	2-Methylheptane	0.67
44	4-Methylheptane	0.19
45	3,4-Dimethylhexane	0.00
46A	3-Ethyl-3-methylpentane	1.19
46B	1,4-Dimethylcyclohexane	0.57
47	3-Methylheptane	0.00
48	2,2,5-Trimethylhexane	0.13
49	n-Octane	1.22
50	2,2-Dimethylheptane	0.00
51	2,4-Dimethylheptane	0.25
52	Ethylcyclohexane	1.49
53	2,6-Dimethylheptane	0.19
54	Ethylbenzene	0.86
55	m+p Xylenes	3.97
56	4-Methyloctane	0.48
57	2-Methyloctane	0.63
58	3-Ethylheptane	0.12
59	3-Methyloctane	0.90
60	o-Xylene	1.56
61	1-Nonene	0.00
62	n-Nonane	2.72
I.S.#2	p-Bromofluorobenzene	0.00
63	Isopropylbenzene	0.21
64	3,3,5-Trimethylheptane	0.36
65	2,4,5-Trimethylheptane	0.22
66	n-Propylbenzene	0.91
67	1-Methyl-3-ethylbenzene	1.84
68	1-Methyl-4-ethylbenzene	1.20
69	1,3,5-Trimethylbenzene	2.37
70	3,3,4-Trimethylheptane	0.87

ZymaX ID		19819-2
Sample ID		S-241
		Relative Area %
71	1-Methyl-2-ethylbenzene	0.33
72	3-Methylnonane	0.10
73	1,2,4-Trimethylbenzene	5.42
74	Isobutylbenzene	0.26
75	sec-Butylbenzene	0.57
76	n-Decane	5.91
77	1,2,3-Trimethylbenzene	2.07
78	Indan	2.05
79	1,3-Diethylbenzene	2.40
80	1,4-Diethylbenzene	2.10
81	n-Butylbenzene	0.00
82	1,3-Dimethyl-5-ethylbenzene	0.89
83	1,4-Dimethyl-2-ethylbenzene	2.48
84	1,3-Dimethyl-4-ethylbenzene	1.56
85	1,2-Dimethyl-4-ethylbenzene	2.18
86	Undecene	0.00
87	1,2,4,5-Tetramethylbenzene	1.58
88	1,2,3,5-Tetramethylbenzene	1.77
89	1,2,3,4-Tetramethylbenzene	2.37
90	Naphthalene	2.61
91	2-Methyl-naphthalene	19.29
92	1-Methyl-naphthalene	9.26

Chrom Perfect Chromatogram Report

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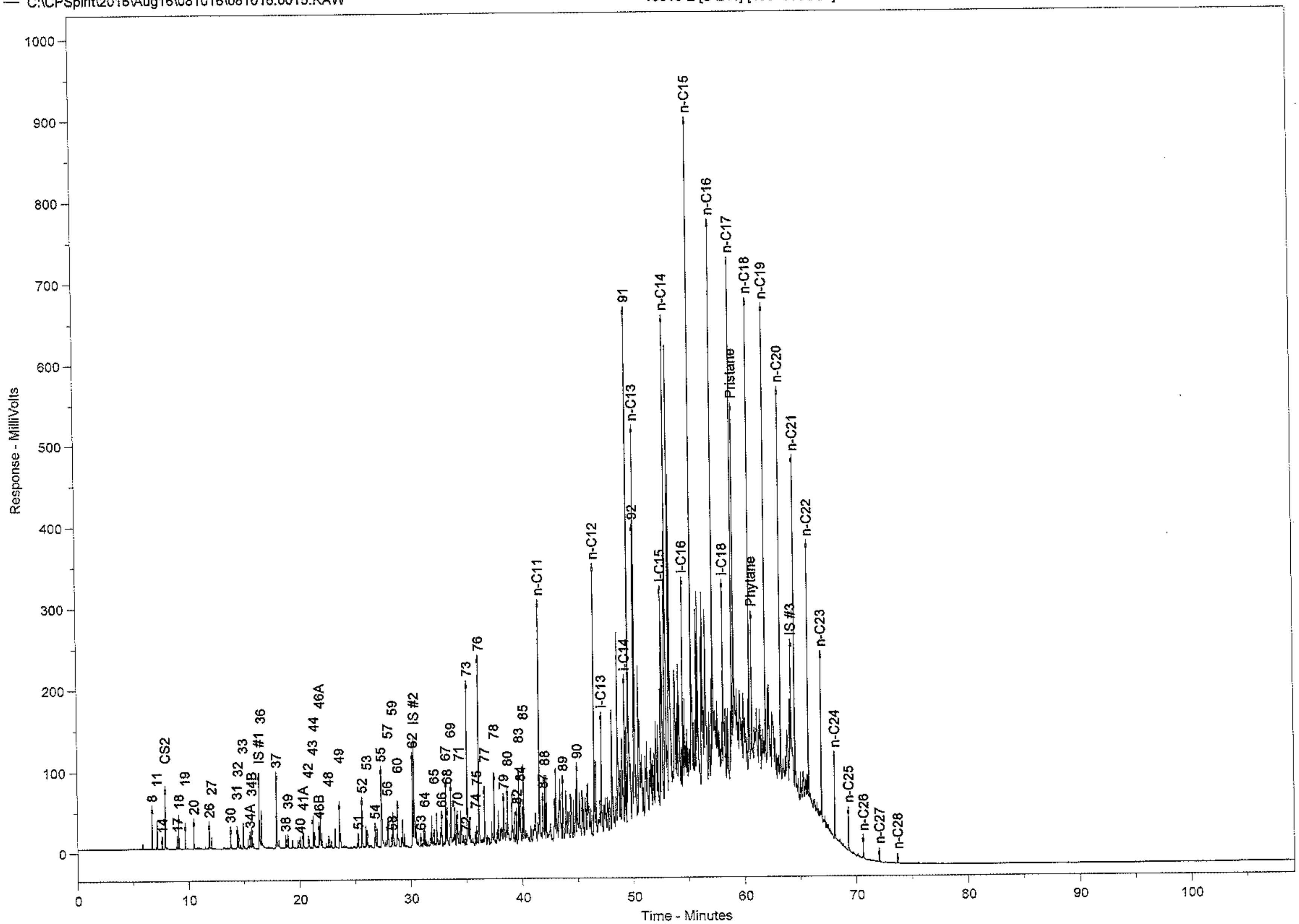
19819-2 [S-241] [400+600CS2] + IS F-022715-1



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Page 1 of 1

Chrom Perfect Chromatogram Report

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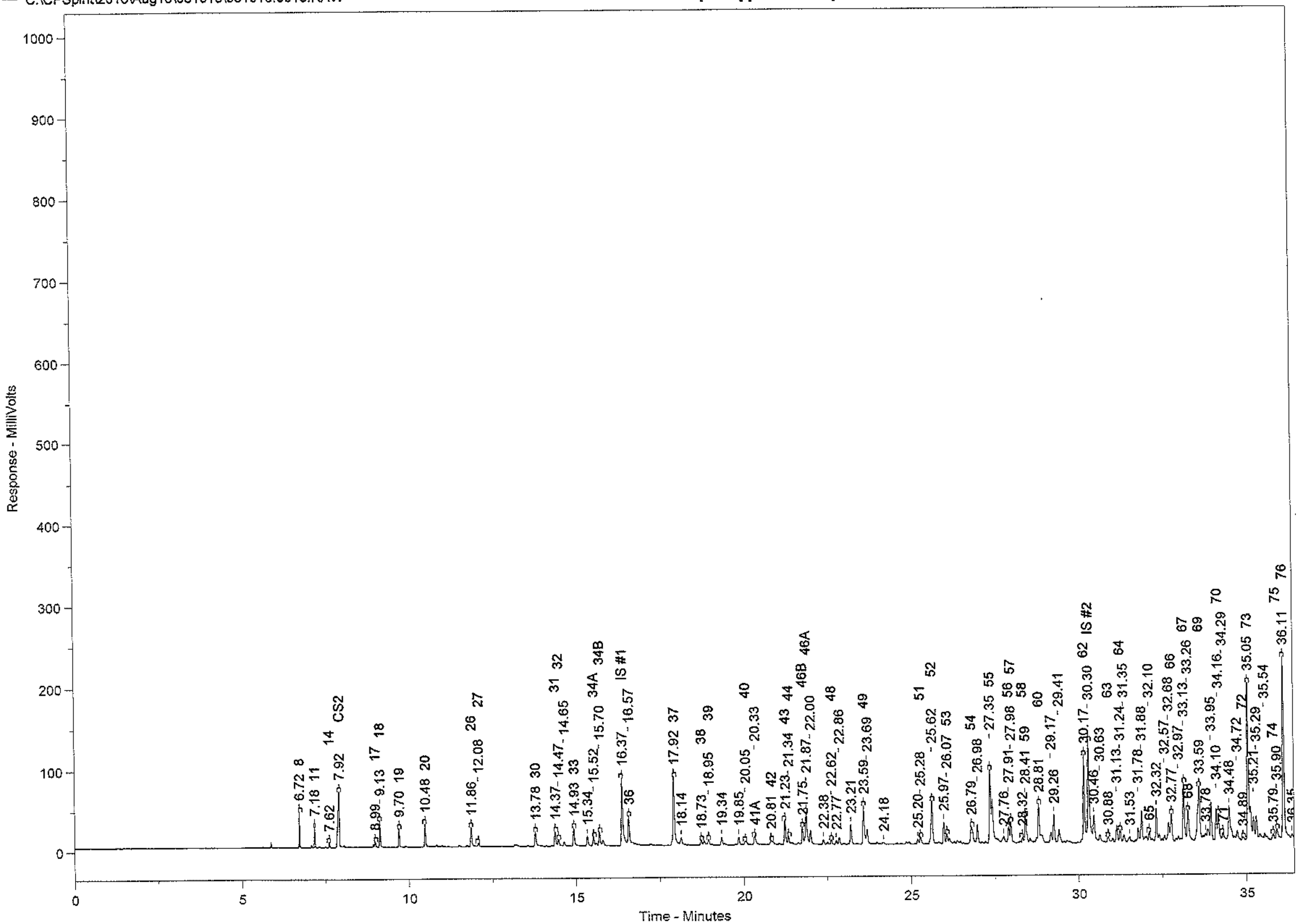

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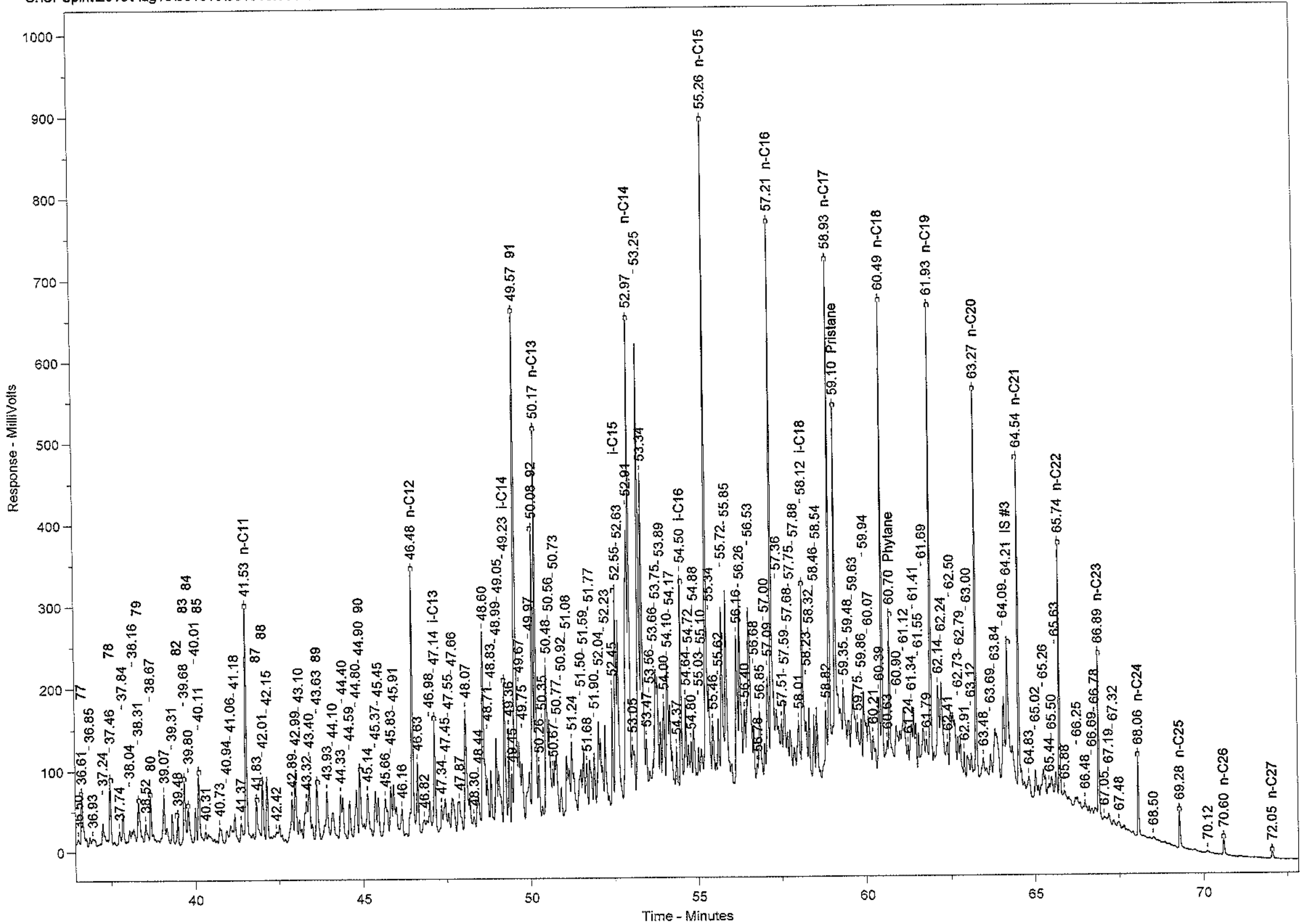

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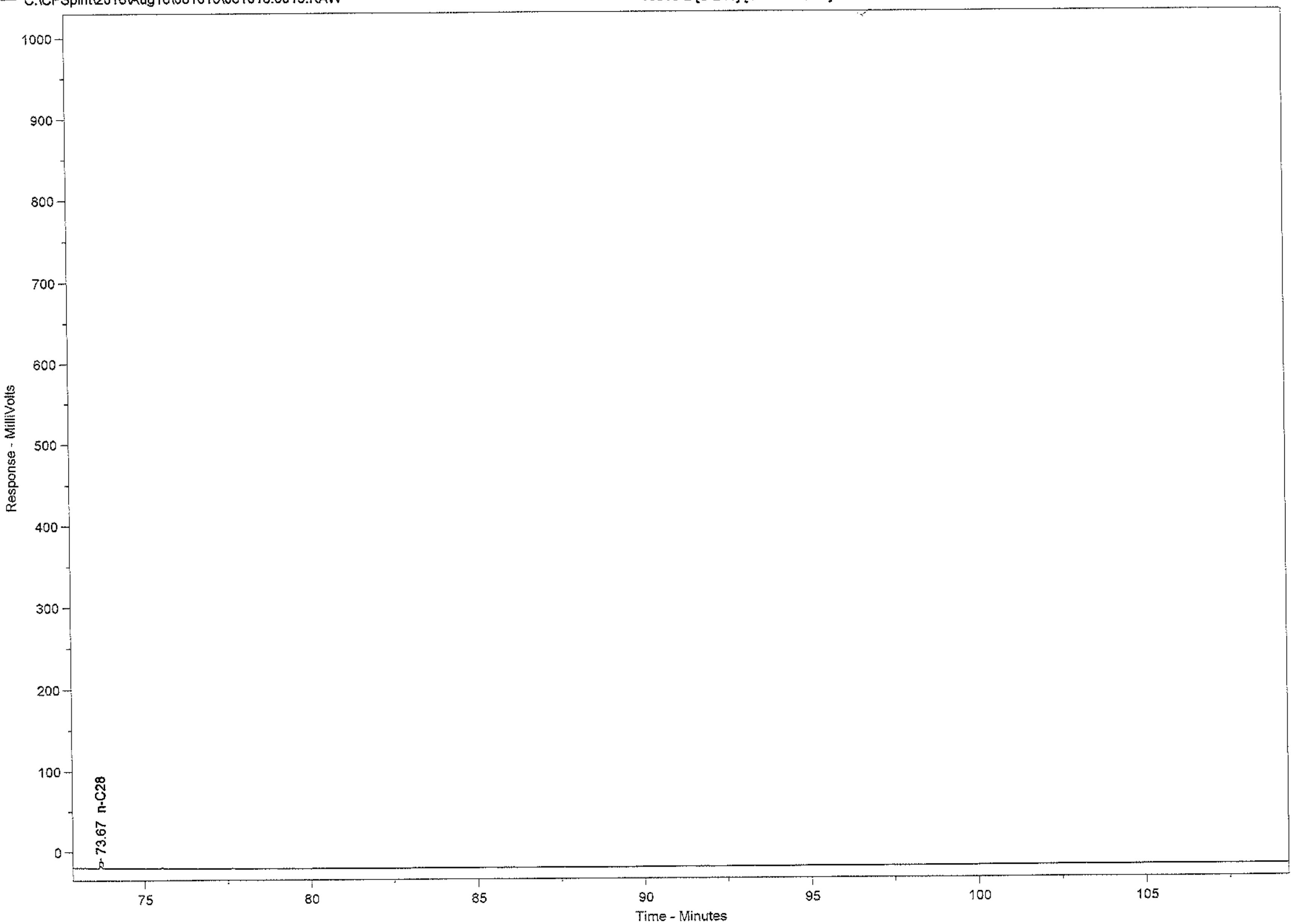

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Acquisition Port = DP#
Heading 1 =
Heading 2 =

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Method Version = 44
Calibration File Name = C:\CPSpirit\032416.cal
Calibration Version = 2

Peak Name	Ret. Time	Area %	Area
8	6.72	0.0600	57390.97
11	7.18	0.0379	36234.89
14	7.62	0.0111	10644.54
CS2	7.92	0.2346	224370.30
17	8.99	0.0128	12199.73
18	9.13	0.0655	62699.32
19	9.70	0.0486	46508.80
20	10.48	0.0695	66488.34
26	11.86	0.0689	65887.75
27	12.08	0.0158	15128.15
30	13.78	0.0623	59640.83
31	14.37	0.0542	51850.29
32	14.47	0.0301	28816.95
	14.65	0.0152	14563.86
33	14.93	0.0715	68361.23
	15.34	0.0370	35364.17
34A	15.52	0.0282	26942.47
34B	15.70	0.0450	43081.25
IS #1	16.37	0.2946	281829.00
36	16.57	0.1543	147625.20
37	17.92	0.2954	282591.60
	18.14	0.0403	38539.77
38	18.73	0.0155	14790.56
39	18.95	0.0169	16183.18
	19.34	0.0266	25456.76
	19.85	0.0302	28848.09
40	20.05	0.0204	19486.32
41A	20.33	0.0451	43174.46
42	20.81	0.0379	36242.56
43	21.23	0.0876	83840.17
44	21.34	0.0254	24344.09
46B	21.75	0.0752	71942.38
46A	21.87	0.1560	149240.50
	22.00	0.0643	61550.92
	22.38	0.0173	16558.42
48	22.62	0.0176	16849.63
	22.77	0.0133	12744.34
	22.86	0.0254	24295.65
	23.21	0.0708	67680.24
49	23.59	0.1606	153637.00
	23.69	0.0655	62677.03
	24.18	0.0100	9595.71
	25.20	0.0164	15677.27
51	25.28	0.0334	31910.39
52	25.62	0.1953	186780.40
	25.97	0.0709	67821.55
53	26.07	0.0252	24146.85
54	26.79	0.1133	108359.40
	26.98	0.0704	67322.09
55	27.35	0.5221	499418.30
	27.76	0.0448	42837.84
56	27.91	0.0636	60811.52
57	27.98	0.0832	79600.04
58	28.32	0.0159	15169.89
59	28.41	0.1178	112686.80

Peak Name	Ret. Time	Area %	Area
60	28.81	0.2052	196320.40
	29.17	0.0423	40498.32
	29.26	0.1052	100606.00
	29.41	0.0607	58052.70
62	30.17	0.3569	341385.10
IS #2	30.30	0.5013	479562.80
	30.46	0.1453	139005.20
	30.63	0.0446	42669.45
63	30.88	0.0274	26242.91
	31.13	0.0671	64221.54
64	31.24	0.0479	45829.70
	31.35	0.0326	31168.30
	31.53	0.0251	23968.42
	31.78	0.0435	41646.72
	31.88	0.1002	95851.55
65	32.10	0.0293	28029.26
	32.32	0.1016	97175.78
	32.57	0.0191	18256.25
	32.68	0.0811	77569.18
66	32.77	0.1202	114985.00
	32.97	0.0318	30404.53
67	33.13	0.2424	231905.10
68	33.26	0.1579	151043.60
69	33.59	0.3116	298074.40
	33.78	0.0090	8606.46
	33.95	0.1168	111739.60
	34.10	0.1091	104406.20
70	34.16	0.1140	109038.80
71	34.29	0.0438	41853.29
	34.48	0.1999	191235.50
	34.72	0.0500	47854.87
72	34.89	0.0137	13090.60
73	35.05	0.7129	681919.00
	35.21	0.0874	83589.29
	35.29	0.0819	78313.73
	35.54	0.0291	27794.64
74	35.79	0.0344	32891.32
75	35.90	0.0753	71994.17
76	36.11	0.7771	743390.40
	36.35	0.0403	38532.68
	36.50	0.0434	41539.66
77	36.61	0.2718	260005.60
	36.85	0.0382	36518.14
	36.93	0.0719	68811.92
	37.24	0.1444	138114.40
78	37.46	0.2698	258095.80
	37.74	0.0766	73244.91
	37.84	0.1548	148056.20
	38.04	0.0731	69909.14
	38.16	0.0955	91322.91
79	38.31	0.3153	301651.80
	38.52	0.1479	141523.90
80	38.67	0.2756	263637.00
	39.07	0.2716	259773.80
	39.31	0.1300	124378.60
82	39.48	0.1170	111940.00
83	39.68	0.3264	312211.10
84	39.80	0.2057	196799.00
	40.01	0.1221	116751.30
85	40.11	0.2860	273621.30
	40.31	0.0272	26028.41
	40.73	0.1071	102466.80
	40.94	0.0665	63588.17
	41.06	0.0965	92282.90
	41.18	0.1418	135662.60
	41.37	0.1058	101246.00
n-C11	41.53	0.9556	914112.30

Peak Name	Ret. Time	Area %	Area
87	41.83	0.2073	198337.90
88	42.01	0.2327	222583.50
	42.15	0.2396	229183.90
	42.42	0.0149	14261.72
	42.89	0.2665	254924.50
	42.99	0.3341	319635.50
	43.10	0.1470	140618.80
	43.32	0.2978	284845.40
	43.40	0.2998	286757.10
89	43.63	0.3113	297788.10
	43.93	0.3319	317462.10
	44.10	0.2300	220032.90
	44.33	0.1925	184168.50
	44.40	0.1834	175388.30
	44.59	0.1821	174200.30
	44.80	0.2571	245968.60
90	44.90	0.3433	328384.70
	45.14	0.2863	273907.60
	45.37	0.2137	204411.30
	45.45	0.1680	160701.20
	45.66	0.2592	247962.20
	45.83	0.1562	149435.10
	45.91	0.1204	115188.50
	46.16	0.1105	105739.30
n-C12	46.48	1.1350	1085679.00
	46.63	0.3569	341428.20
	46.82	0.1058	101174.80
	46.98	0.1595	152553.20
i-C13	47.14	0.5166	494148.20
	47.34	0.1200	114784.00
	47.45	0.2338	223690.00
	47.55	0.0824	78846.20
	47.66	0.2667	255101.50
	47.87	0.2508	239915.80
	48.07	0.8103	775139.30
	48.30	0.0545	52167.57
	48.44	0.2285	218530.90
	48.60	1.1064	1058314.00
	48.71	0.2084	199309.40
	48.83	0.2375	227161.90
	48.99	0.3835	366871.60
	49.05	0.3578	342290.50
i-C14	49.23	0.6364	608741.20
	49.36	0.3094	295970.50
	49.45	0.1608	153810.60
91	49.57	2.5356	2425491.00
	49.67	0.4038	386285.80
	49.75	0.2780	265912.50
	49.97	0.4042	386669.50
92	50.08	1.2178	1164934.00
n-C13	50.17	1.3100	1253131.00
	50.26	0.2256	215809.50
	50.35	0.0481	45984.75
	50.48	0.8238	788043.30
	50.56	0.5110	488781.80
	50.67	0.1776	169900.80
	50.73	0.1889	180684.40
	50.77	0.3134	299806.30
	50.92	0.1320	126306.70
	51.08	0.2830	270752.10
	51.24	0.5177	495258.90
	51.50	0.3115	297938.40
	51.59	0.3141	300461.30
	51.68	0.2387	228320.00
	51.77	0.3616	345901.30
	51.90	0.2279	218041.50
	52.04	0.8496	812747.80

Peak Name	Ret. Time	Area %	Area
	52.23	0.4439	424612.60
	52.45	0.3981	380774.30
i-C15	52.55	0.9658	923866.00
	52.63	0.8658	828229.90
	52.91	1.9341	1850108.00
n-C14	52.97	1.5321	1465564.00
	53.05	0.4922	470845.60
	53.25	2.2320	2135068.00
	53.34	1.6357	1564694.00
	53.47	0.3098	296389.00
	53.56	0.2426	232077.90
	53.66	0.1641	157011.60
	53.75	1.2379	1184152.00
	53.89	0.3088	295397.30
	54.00	0.6081	581731.70
	54.10	0.7297	698010.80
	54.17	0.6492	620993.90
	54.37	0.2770	264951.60
i-C16	54.50	0.8688	831038.40
	54.64	0.4870	465833.40
	54.72	0.2771	265019.20
	54.80	0.2380	227698.30
	54.88	0.4638	443697.60
	55.03	0.2249	215123.30
	55.10	0.3135	299901.90
n-C15	55.26	2.4905	2382359.00
	55.34	0.4996	477939.30
	55.46	0.3921	375114.70
	55.62	0.3769	360524.50
	55.72	0.9910	947976.20
	55.85	1.1229	1074126.00
	56.16	0.8188	783242.80
	56.26	1.0445	999089.10
	56.40	0.4546	434885.30
	56.53	1.6138	1543700.00
	56.68	0.2397	229283.00
	56.78	0.1247	119319.80
	56.85	0.5146	492262.60
	57.00	0.2058	196841.70
	57.09	0.6397	611883.80
n-C16	57.21	2.2718	2173091.00
	57.36	0.7441	711756.80
	57.51	0.3154	301712.80
	57.59	0.4858	464715.60
	57.68	0.2463	235629.70
	57.75	0.3334	318891.60
	57.88	0.2295	219529.50
	58.01	0.4768	456061.60
i-C18	58.12	1.0026	959051.70
	58.23	0.2473	236522.70
	58.32	0.3212	307265.00
	58.46	0.2762	264222.50
	58.54	0.3712	355031.50
	58.82	0.4116	393688.00
n-C17	58.93	1.7343	1658996.00
Pristane	59.10	2.0212	1933380.00
	59.35	0.6615	632786.40
	59.48	0.3688	352823.30
	59.63	0.8791	840927.80
	59.75	0.3262	312041.60
	59.86	0.2233	213605.50
	59.94	0.5665	541851.90
	60.07	0.4131	395132.30
	60.21	0.2886	276103.40
	60.39	0.4127	394791.50
n-C18	60.49	1.3456	1287187.00
	60.63	0.1771	169422.00

Peak Name	Ret. Time	Area %	Area
Phytane	60.70	0.6597	631074.10
	60.90	0.3524	337054.50
	61.12	0.5467	522988.60
	61.24	0.0910	87023.27
	61.34	0.2600	248690.90
	61.41	0.3883	371435.50
	61.55	0.1344	128539.30
	61.69	0.2903	277657.60
	61.79	0.1656	158376.30
n-C19	61.93	1.3856	1325463.00
	62.14	0.4751	454500.00
	62.24	0.5177	495218.80
	62.41	0.1225	117150.70
	62.50	0.1195	114291.10
	62.73	0.0884	84560.93
	62.79	0.0969	92660.46
	62.91	0.0609	58209.42
	63.00	0.1282	122626.90
	63.12	0.1006	96210.59
n-C20	63.27	1.0857	1038520.00
	63.48	0.1845	176520.70
	63.69	0.1716	164151.90
	63.84	0.6848	655013.70
	64.09	0.5227	500020.80
IS #3	64.21	1.3394	1281217.00
n-C21	64.54	1.0300	985223.40
	64.83	0.1527	146080.00
	65.02	0.1371	131158.50
	65.26	0.2714	259575.80
	65.44	0.0872	83434.83
	65.50	0.1319	126202.10
	65.63	0.1584	151508.20
n-C22	65.74	0.7145	683467.40
	65.88	0.0544	52021.91
	66.25	0.1140	109012.20
	66.48	0.0710	67942.23
	66.69	0.0324	30963.45
	66.78	0.0632	60410.14
n-C23	66.89	0.4679	447586.20
	67.05	0.0373	35637.53
	67.19	0.0507	48520.34
	67.32	0.0279	26714.78
	67.48	0.0365	34958.57
n-C24	68.06	0.2816	269415.80
	68.50	0.0362	34614.93
n-C25	69.28	0.1454	139085.50
	70.12	0.0120	11464.75
n-C26	70.60	0.0679	64989.54
n-C27	72.05	0.0305	29176.85
n-C28	73.67	0.0146	13994.90

Total Area = 9.5657E+07 Total Height = 2.555765E+07 Total Amount = 0.9999999

REPORT OF ANALYTICAL RESULTS

Client:	**Andrew Bradley** **Stantec Consulting** **1060 Andrew Drive; Suite 160** **West Chester, PA 19380**
Project:	**Pennrose Tank 253 Valve**
Project Number:	**213402429**
Collected by:	**W. Delk**

Lab Number:	**19819**
Collected:	**8/2/2016**
Received:	**8/5/2016**
Matrix:	**Product**
Sample Description:	**See Below**
Analyzed:	**8/24/2016**
Method:	**ASTM D1217**

SPECIFIC GRAVITY

LAB NUMBER	SAMPLE DESCRIPTION	SPECIFIC GRAVITY
19819-01	253 Tank Valve	0.891
19819-02	S-241	0.893

REPORT OF ANALYTICAL RESULTS

Client:	**Andrew Bradley** **Stantec Consulting** **1060 Andrew Drive; Suite 160** **West Chester, PA 19380**	**Lab Number:** **Collected:** **Received:** **Matrix:**	**19819** **8/2/2016** **8/5/2016** **Product**

Project:	**Pennrose Tank 253 Valve**	**Sample Description:**	**See Below**
Project Number:	**213402429**	**Analyzed:**	**8/24/2016**
Collected by:	**W. Delk**	**Method:**	**ASTM D1217**

DENSITY

LAB NUMBER	SAMPLE DESCRIPTION	DENSITY g/cm^3
19819-01	253 Tank Valve	0.890
19819-02	S-241	0.892

Analysis Request/ Environmental Services Chain of Custody

Acct. #: ________ Sample #: ________

Client: Langan Engineering | Acct. #:
Project Name/#: Sun - Philadelphia Refinery/~~Belmont Terminal~~ Point | PWSID #:
Project Manager: K. Martin (Aquaterra) J. Hanna (Langan Eng) | P.O; #:
Sampler: M. Brad Spancake | Quote #:
Name of State where samples were collected: PA

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water (Potable / NPDES)	Other	Total # of Containers	GC Finger print									Remarks	Temperature of samples upon receipt (if applicable)
S198-LNAPL-042005	4/20/05	1035	X				X	1	X										
S199-LNAPL-042005	↓	1045	X				X	1	X										
S200-LNAPL-042005	↓	1100	X				X	1	X										
S77-LNAPL-042005	↓	1110	X				X	1	X										
S201-LNAPL-042005	↓	1130	X				X	1	X										
S83-LNAPL-042005	↓	1140	X				X	1	X										
S126-LNAPL-042005	↓	1325	X				X	1	X										
S205-LNAPL-042005	↓	1340	X				X	1	X										
S208-LNAPL-042005	↓	1350	X				X	1	X										
S213-LNAPL-042005	↓	1400	X				X	1	X										

For Lab Use Only
FSC:
SCR:

Turnaround Time Requested (TAT) (please Ccircle): (Normal) Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.
Date results are needed: ______________
Rush results requested by (please circle): Phone Fax
Phone #: ______________ Fax #: ______________

Relinquished by:	Date	Time	Received by:	Date	Time
M. Brad [signature]	4/22/05		Bruce [signature]	4-22-05	1000

SDG Complete? Yes No

State-specific QC required? Yes No
(If yes, indicated QC sample and submit triplicate volume)
Internal Chain-of-Custody required? Yes No

Analysis Request/ Environmental Services Chain of Custody

Acct. #: ________ Sample #: ________

Client: Langan Engineering — Acct. #:

Project Name/#: Sun - Philadelphia Refinery/~~Belmont Terminal~~ (PHR3) — PWSID #:

Project Manager: K. Martin (Aquaterra) J. Hanna (Langan Eng) — P.O; #:

Sampler: M. Brad Spancake — Quote #:

Name of State where samples were collected: PA

For Lab Use Only — FSC: — SCR:

Sample Identification	Date Collected	Time Collected	Grab	Composite	Matrix: Soil	Matrix: Water (Potable / NPDES)	Matrix: Other	Total # of Containers	Analyses Requested: QC Fingerprint										Remarks	Temperature of samples upon receipt (if applicable)
S160-LNAPL-042005	4/20/05	1410	X				X	1	X											
S161-LNAPL-042005	4/20/05	1420	X				X	1	X											
S35-LNAPL-042105	4/21/05	1110	X				X	1	X											
S57-LNAPL-042105	4/21/05	1150	X				X	1	X											
S37-LNAPL-042105	4/21/05	1200	X				X	1	X											
			X				X	1												
			X				X	1												
			X				X	1												
			X				X	1												
			X				X	1												

Turnaround Time Requested (TAT) (please Ccircle): Normal Rush

(Rush TAT is subject to Lancaster Laboratories approval and surcharge.

Date results are needed: ____________

Rush results requested by (please circle): Phone Fax

Phone #: ____________ Fax #: ____________

SDG Complete?

Yes No

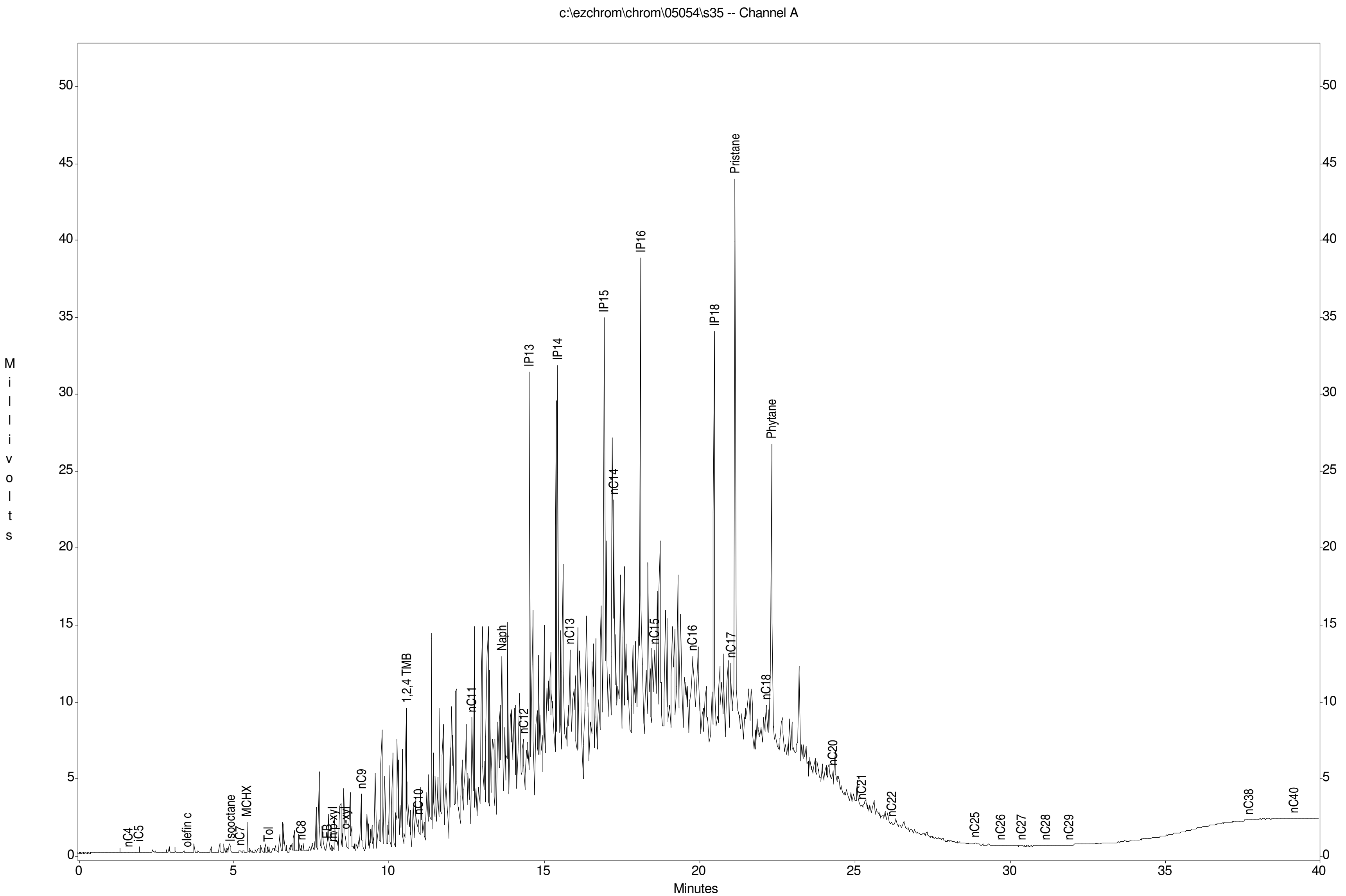
State-specific QC required? Yes No

(If yes, indicated QC sample and submit triplecate volume)

Internal Chain-of-Custody required? Yes No

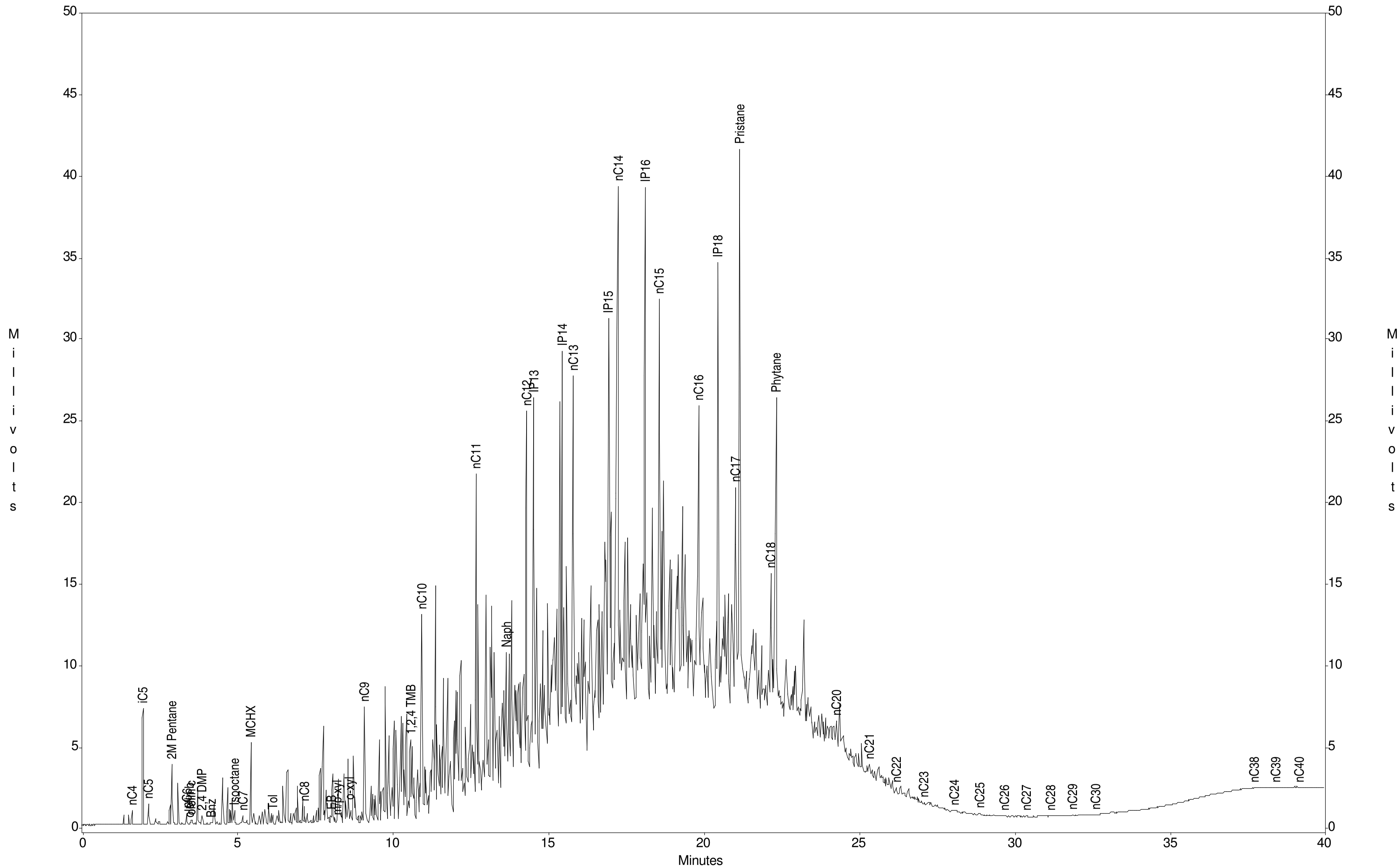
Relinquished by:	Date	Time	Received by:	Date	Time
			Bruce Torbolen	4-22-05	1000

Sun - Philadelphia Refinery
Sample ID : S35-LNAPL-042105
Acquired : Apr 26, 2005 10:07:40

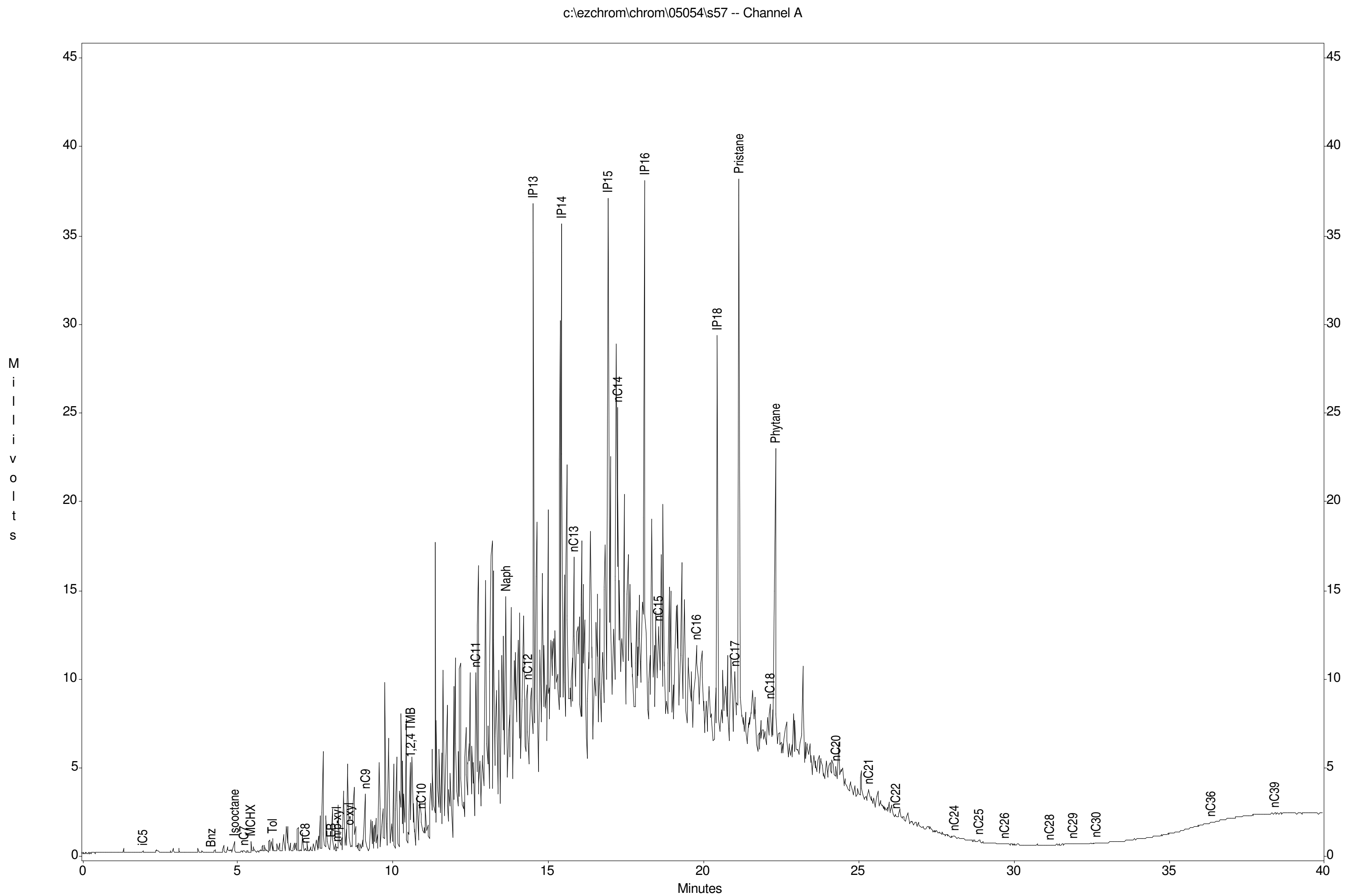


Sun - Philadelphia Refinery
Sample ID : S37-LNAPL-042105
Acquired : Apr 25, 2005 18:27:23

c:\ezchrom\chrom\05054\s37 -- Channel A

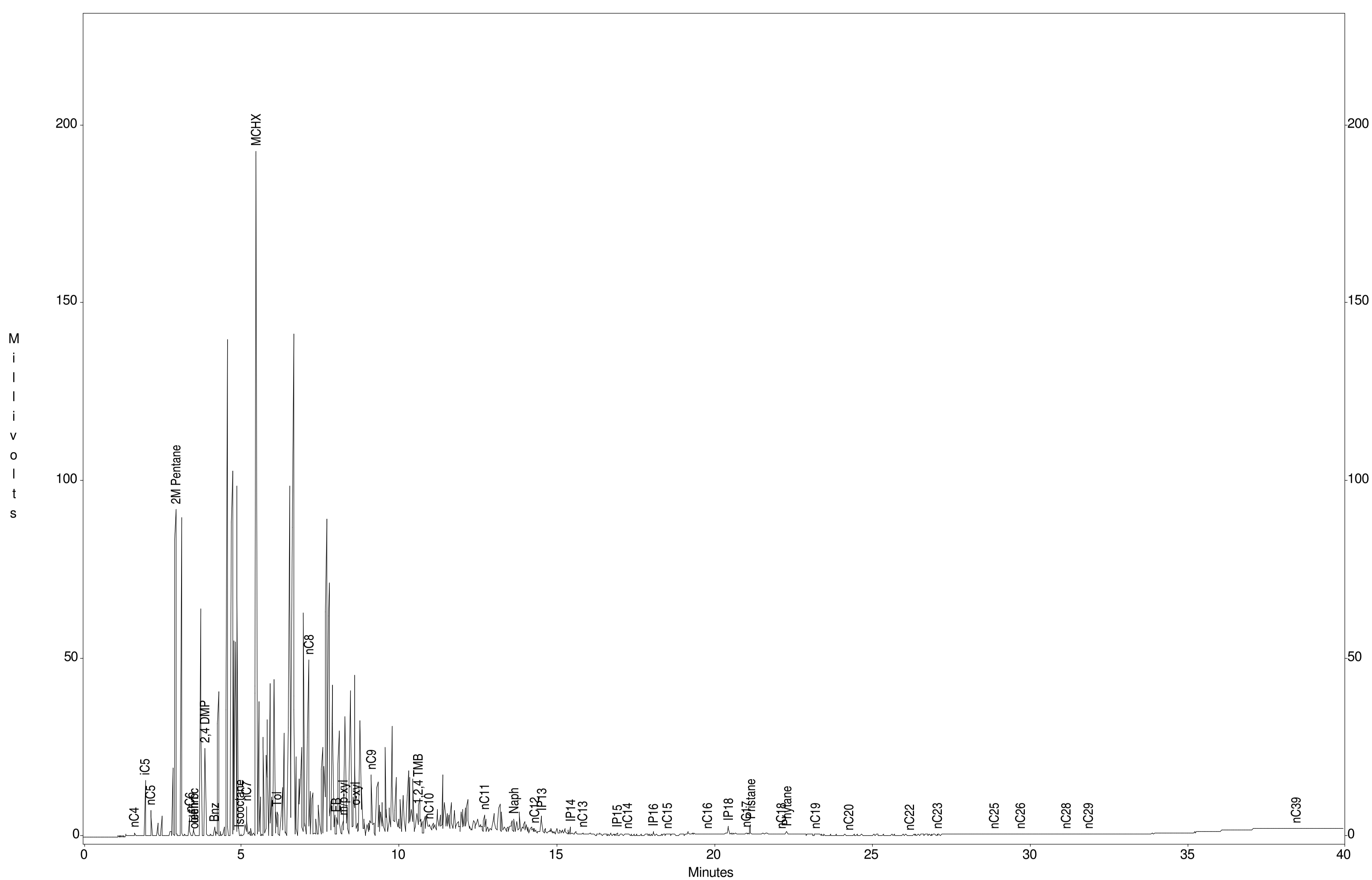


Sun - Philadelphia Refinery
Sample ID : S57-LNAPL-042105
Acquired : Apr 25, 2005 13:27:24

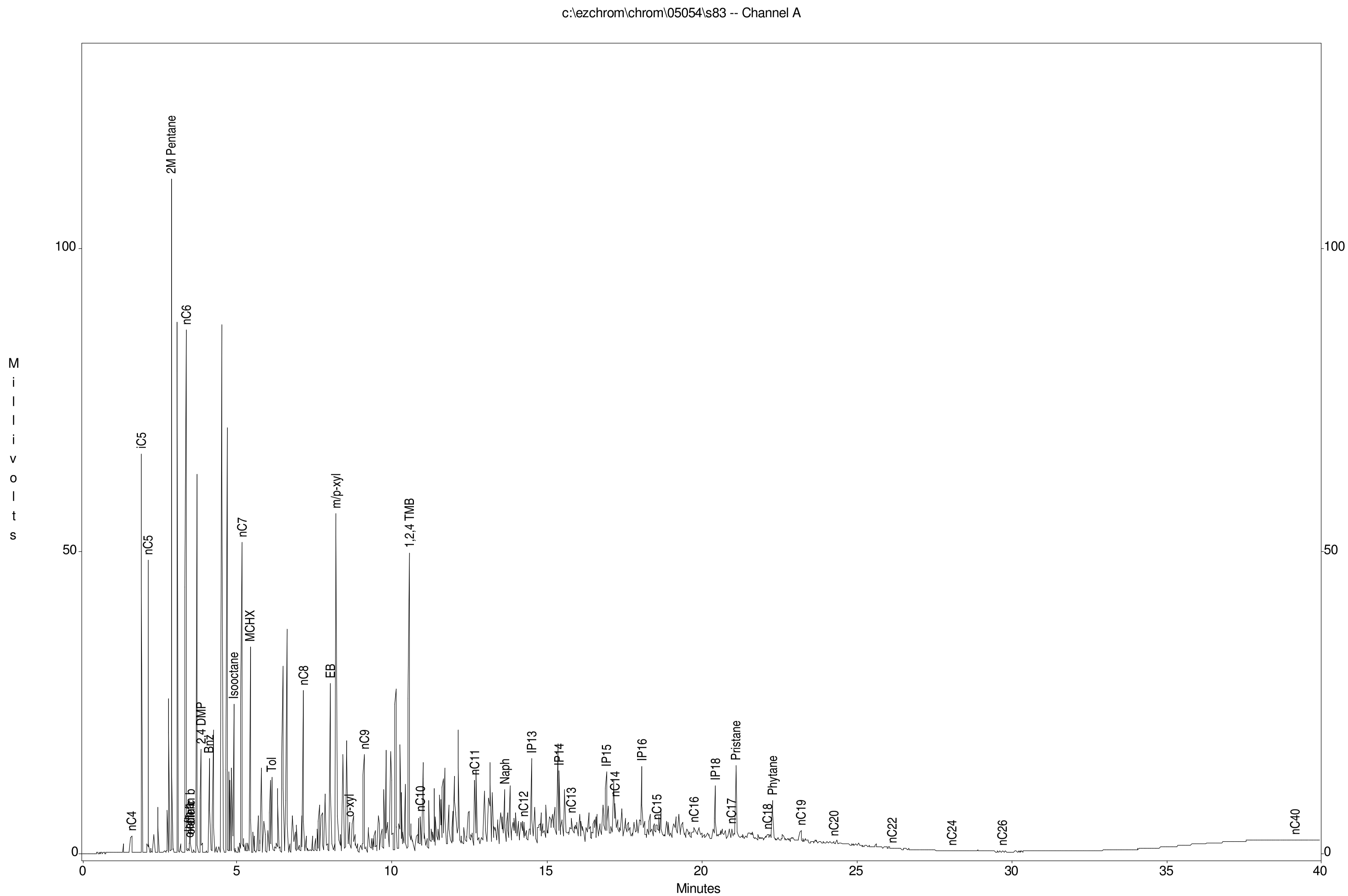


Sun - Philadelphia Refinery
Sample ID : S77-LNAPL-042005
Acquired : Apr 26, 2005 09:19:05

c:\ezchrom\chrom\05054\s77 -- Channel A

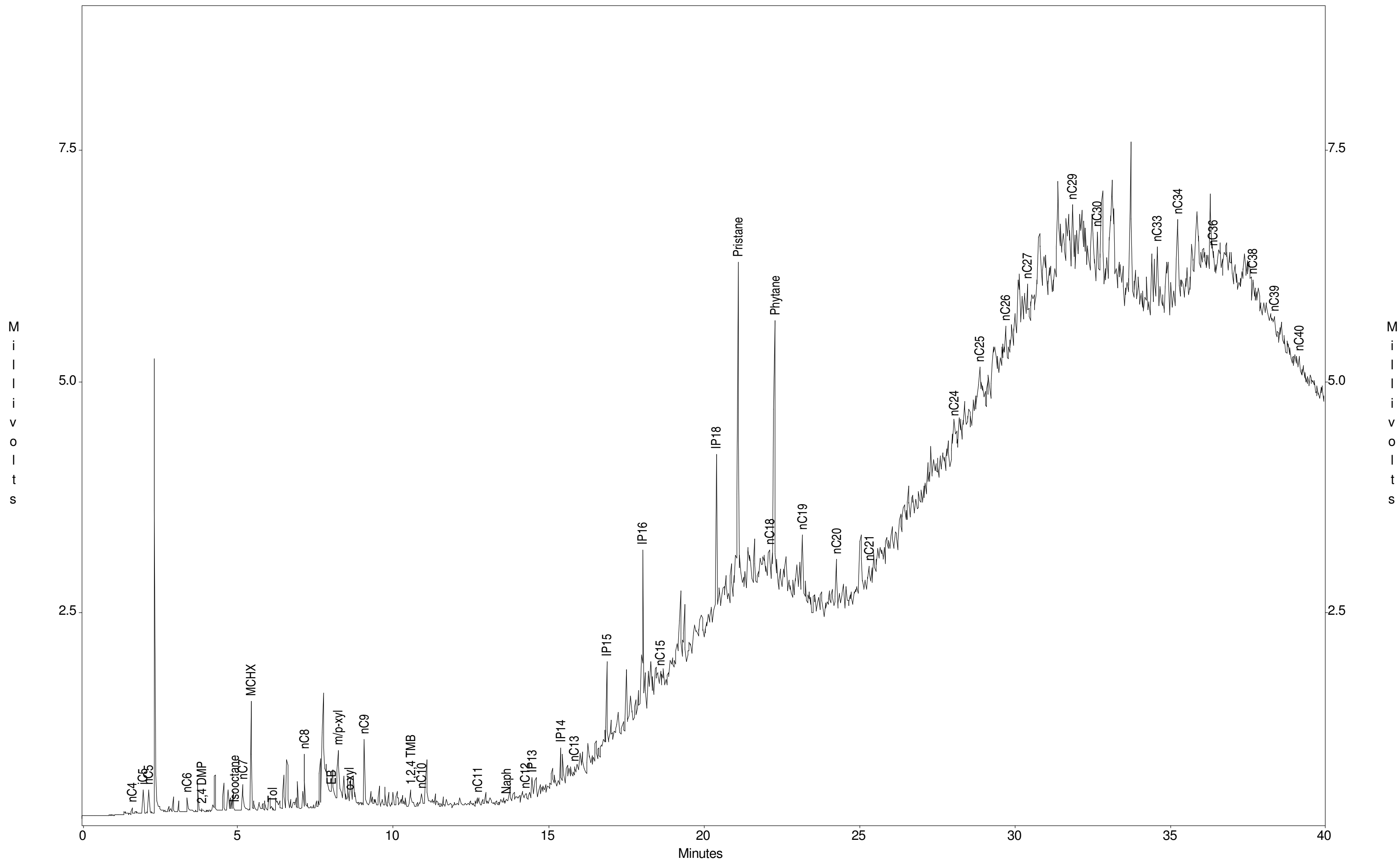


Sun - Philadelphia Refinery
Sample ID : S83-LNAPL-042005
Acquired : Apr 25, 2005 15:59:15



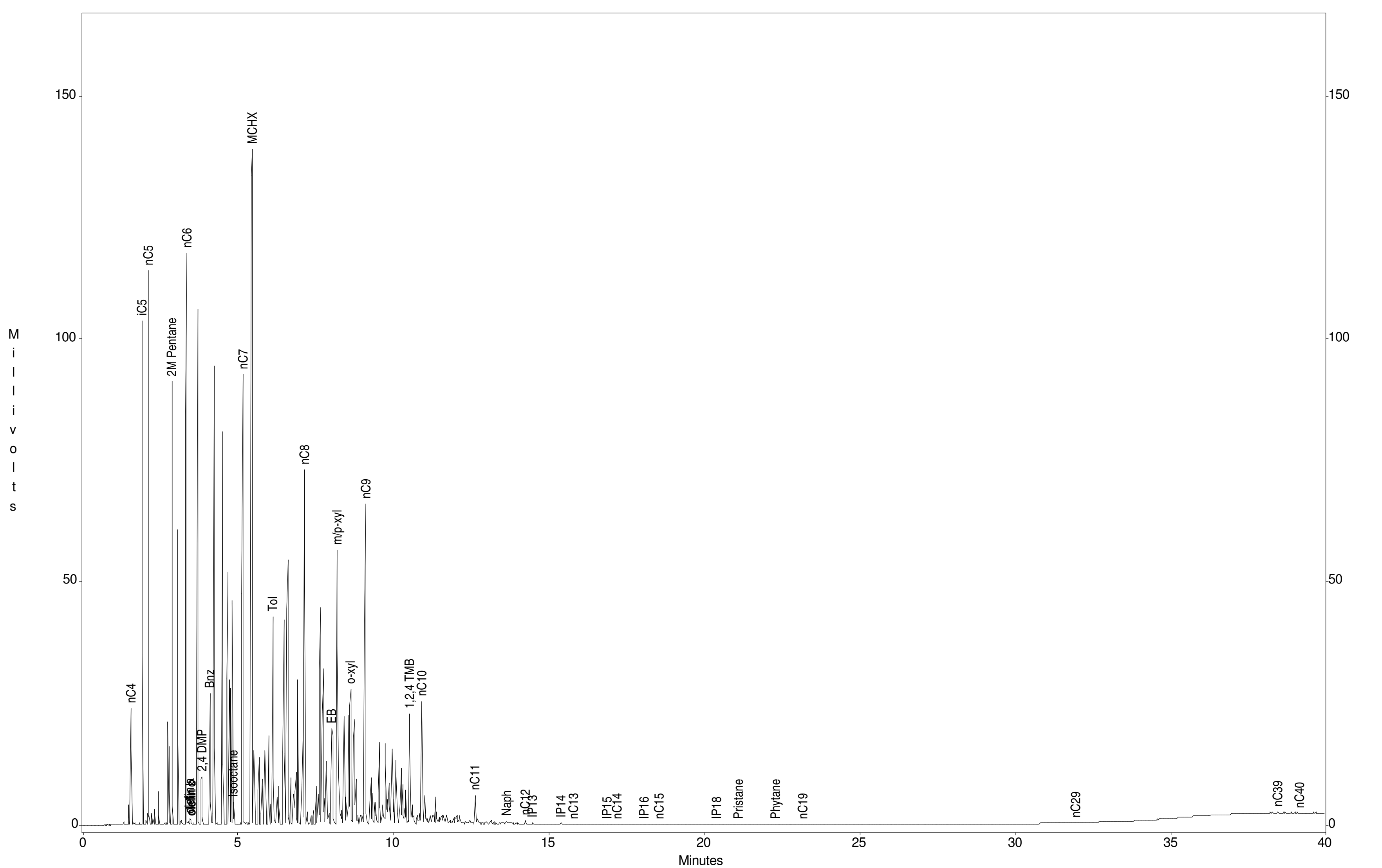
Sun - Philadelphia Refinery
Sample ID : S126-LNAPL-042005
Acquired : Apr 26, 2005 11:46:25

c:\ezchrom\chrom\05054\s126 -- Channel A



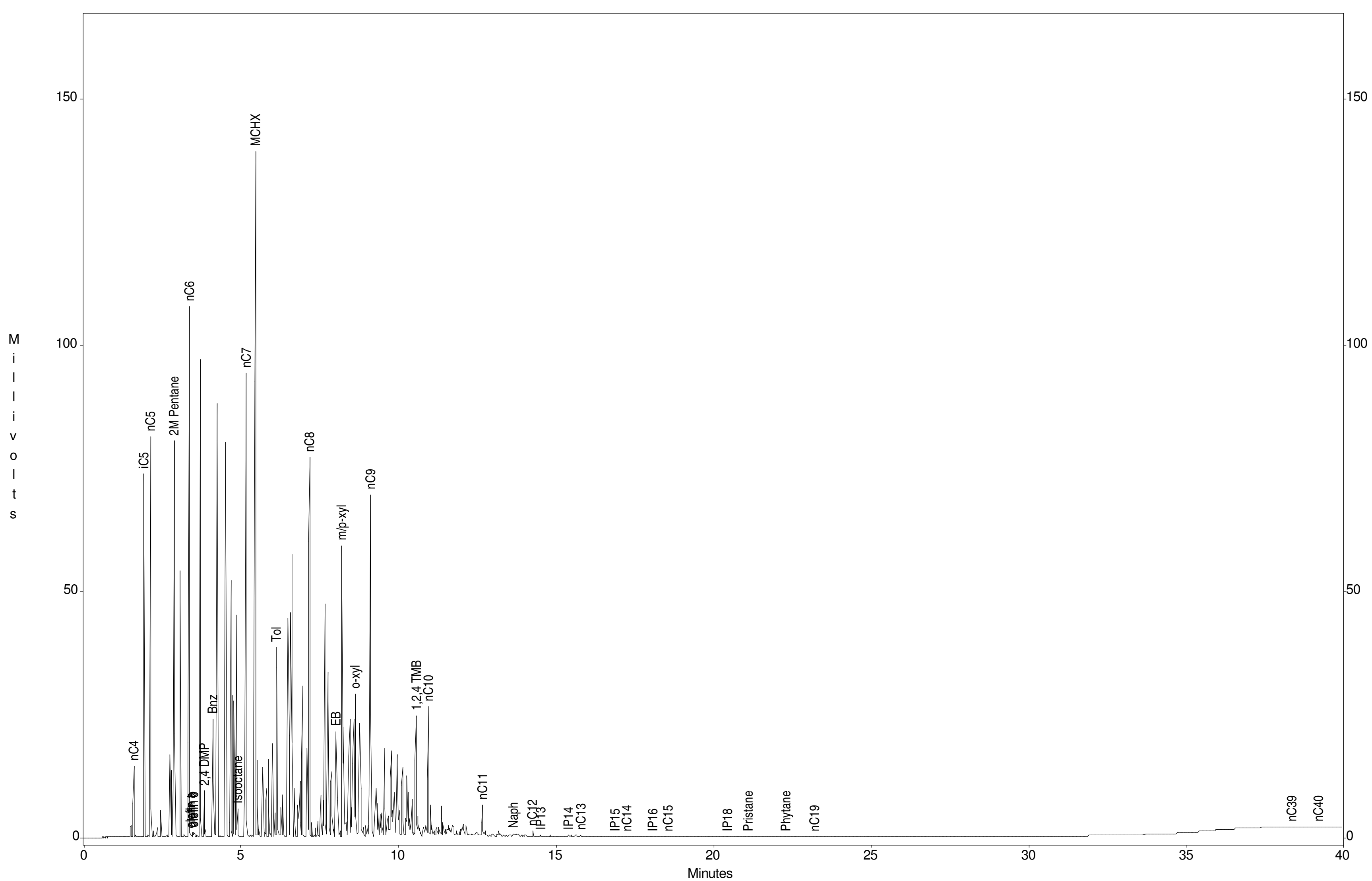
Sun - Philadelphia Refinery
Sample ID : S160-LNAPL-042005
Acquired : Apr 26, 2005 12:42:54

c:\ezchrom\chrom\05054\s160 -- Channel A



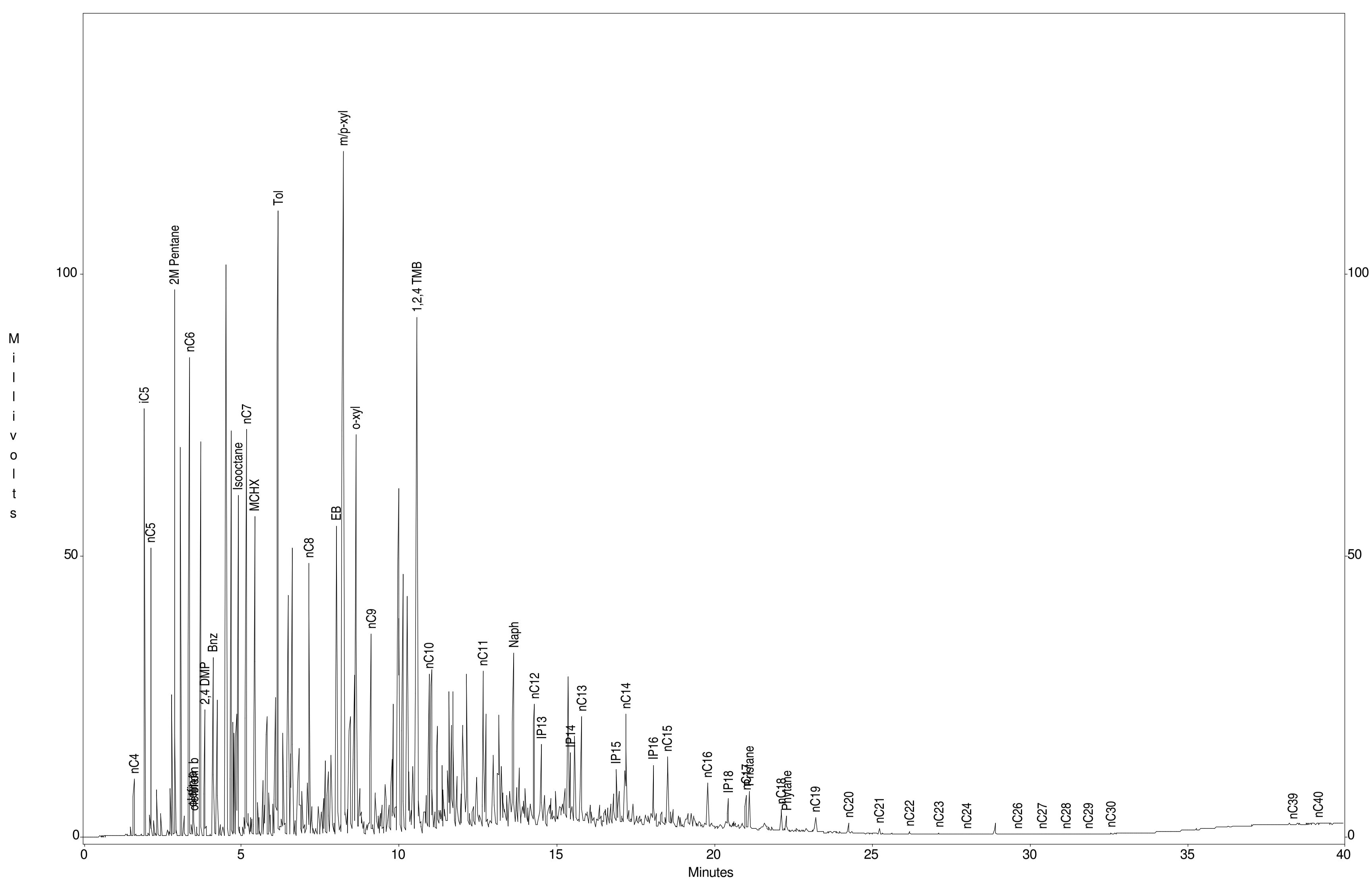
Sun - Philadelphia Refinery
Sample ID : S161-LNAPL-042005
Acquired : Apr 26, 2005 10:58:03

c:\ezchrom\chrom\05054\s161 -- Channel A



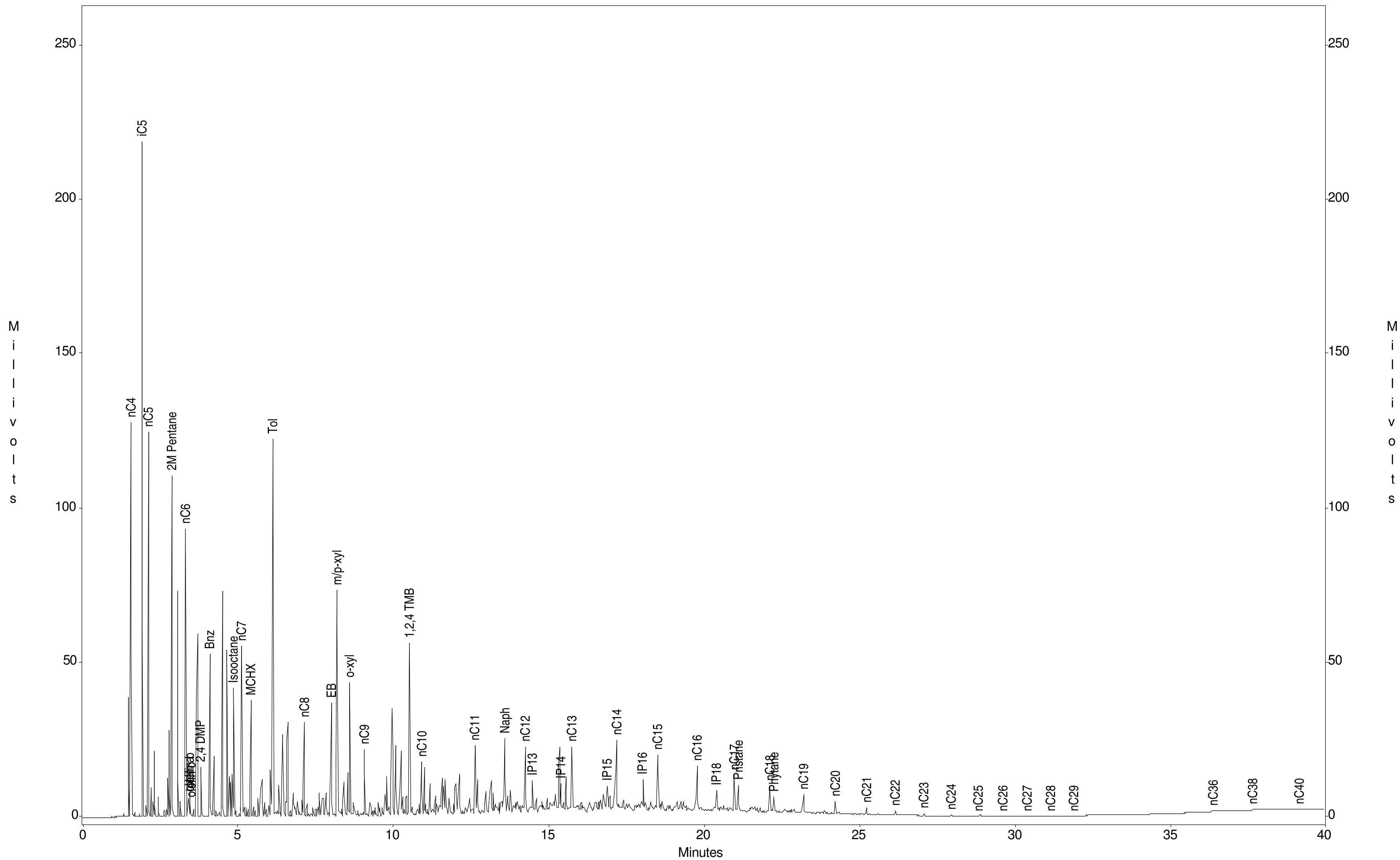
Sun - Philadelphia Refinery
Sample ID : S198-LNAPL-042005
Acquired : Apr 25, 2005 15:11:04

c:\ezchrom\chrom\05054\s198 -- Channel A



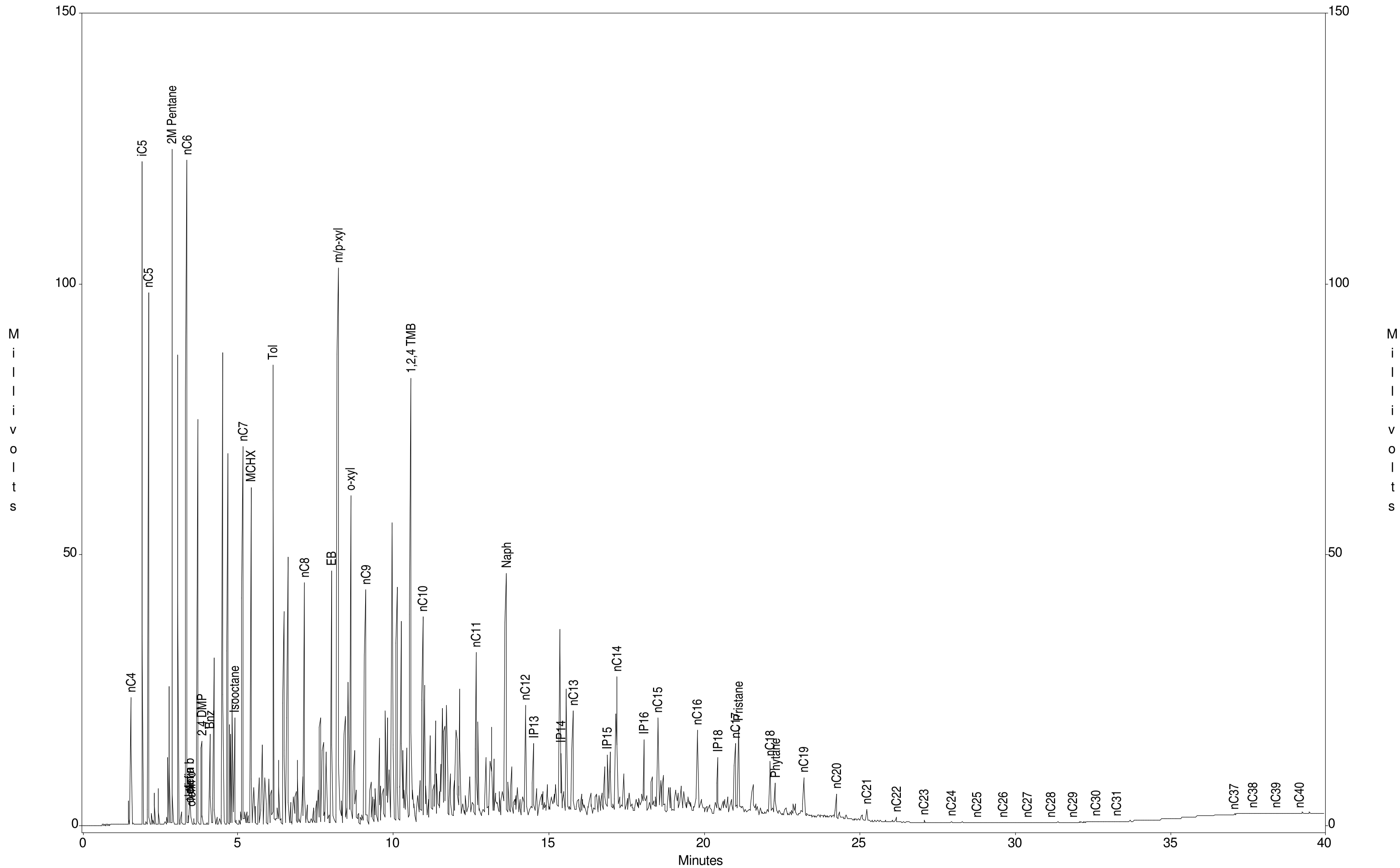
Sun - Philadelphia Refinery
Sample ID : S199-LNAPL-042005
Acquired : Apr 26, 2005 14:20:57

c:\ezchrom\chrom\05054\s199 -- Channel A



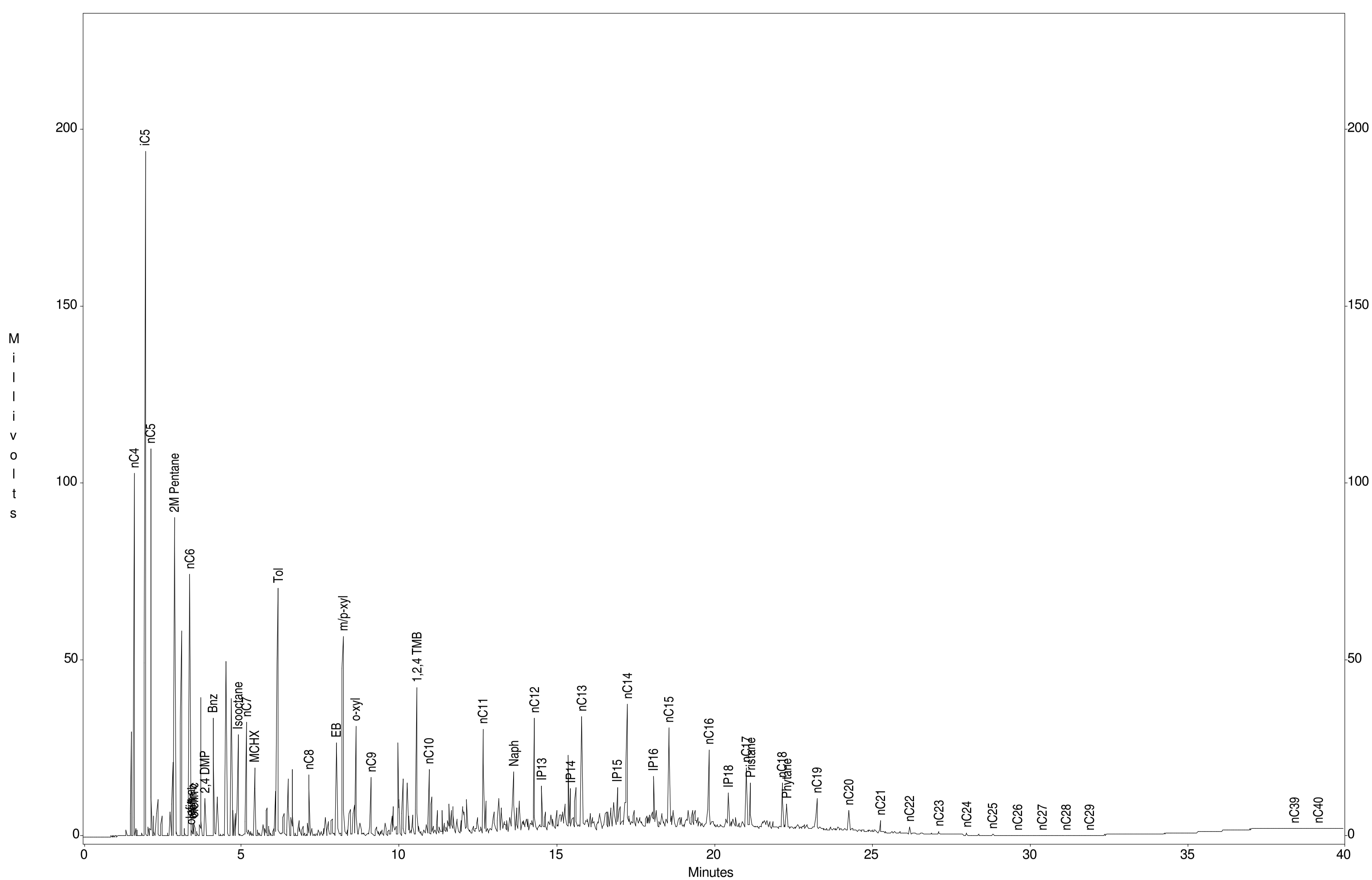
Sun - Philadelphia Refinery
Sample ID : S200-LNAPL-042005
Acquired : Apr 25, 2005 12:38:28

c:\ezchrom\chrom\05054\s200 -- Channel A



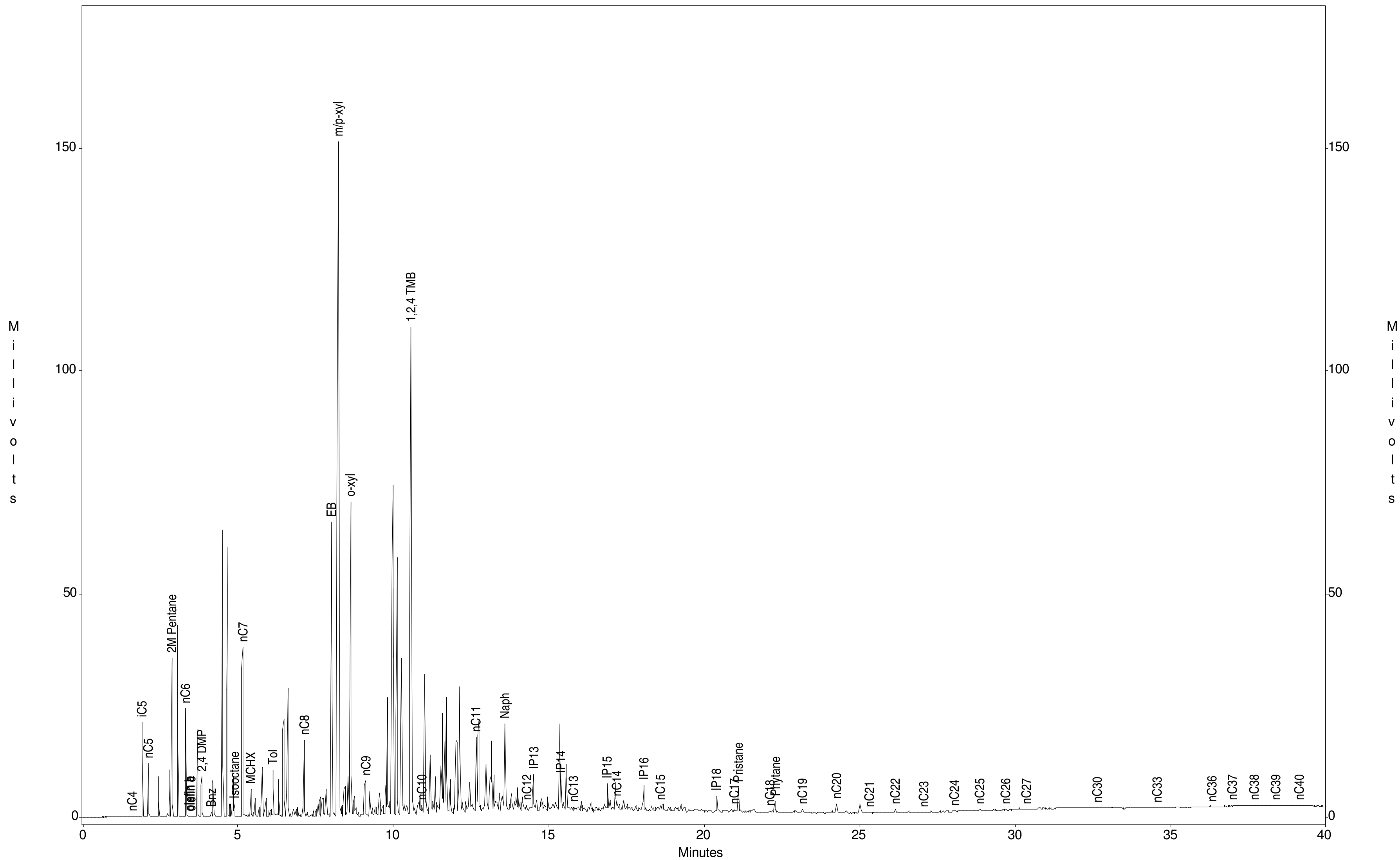
Sun - Philadelphia Refinery
Sample ID : S201-LNAPL-042005
Acquired : Apr 26, 2005 15:10:11

c:\ezchrom\chrom\05054\s201 -- Channel A



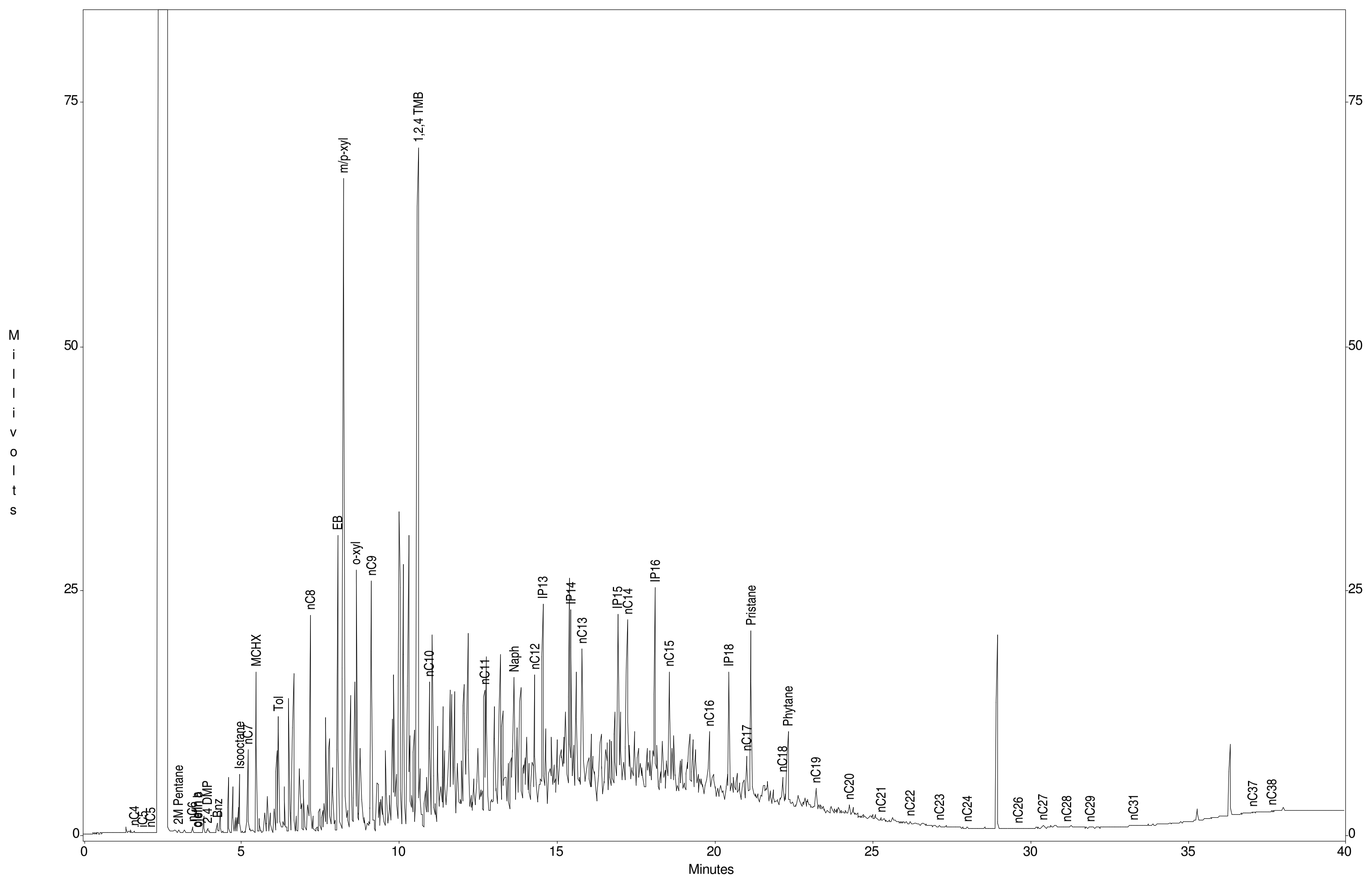
Sun - Philadelphia Refinery
Sample ID : S205-LNAPL-042005
Acquired : Apr 25, 2005 17:38:08

c:\ezchrom\chrom\05054\s205.2 -- Channel A



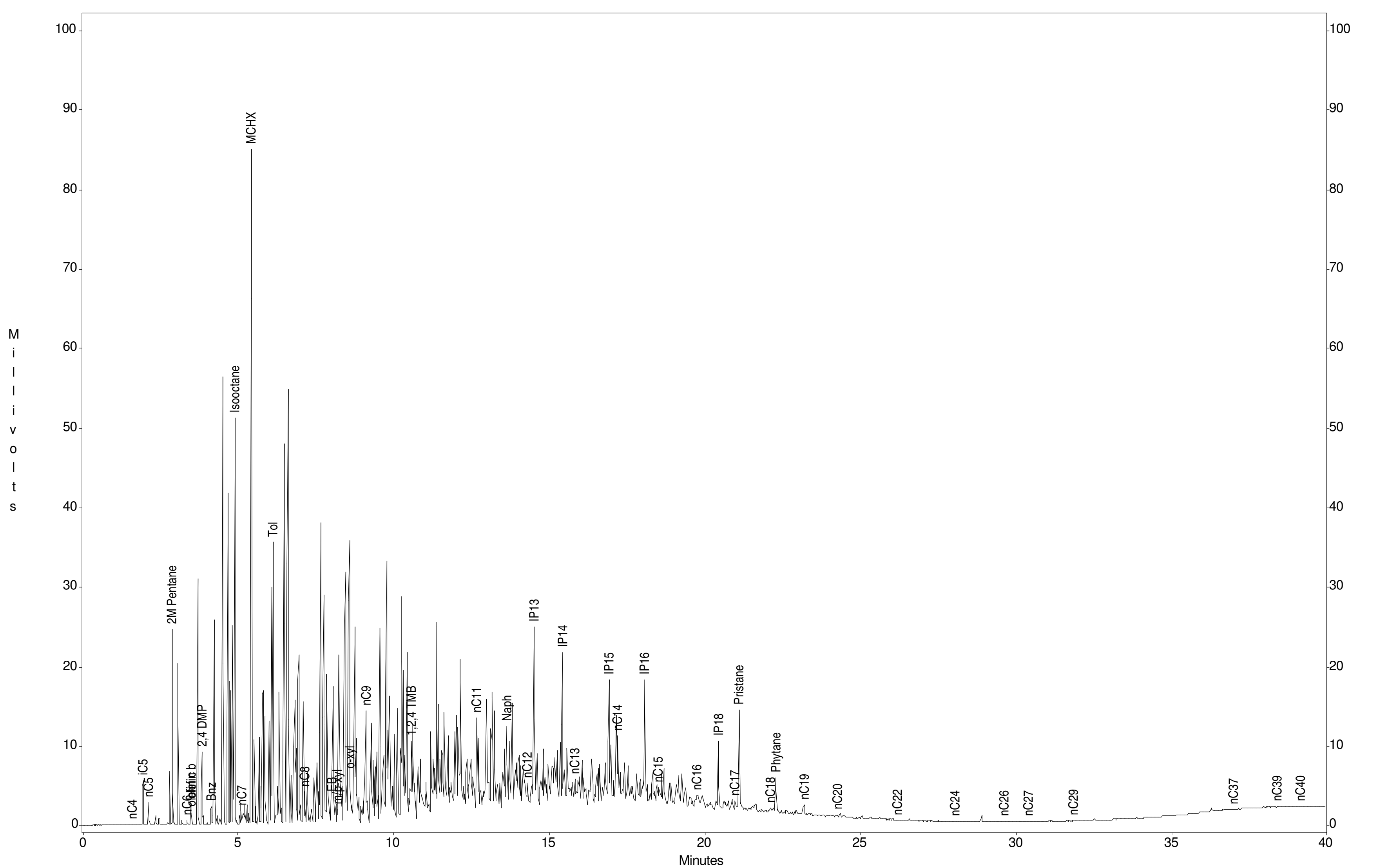
Sun - Philadelphia Refinery
Sample ID : S208-LNAPL-042005
Acquired : Apr 26, 2005 16:47:57

c:\ezchrom\chrom\05054\s208.s -- Channel A



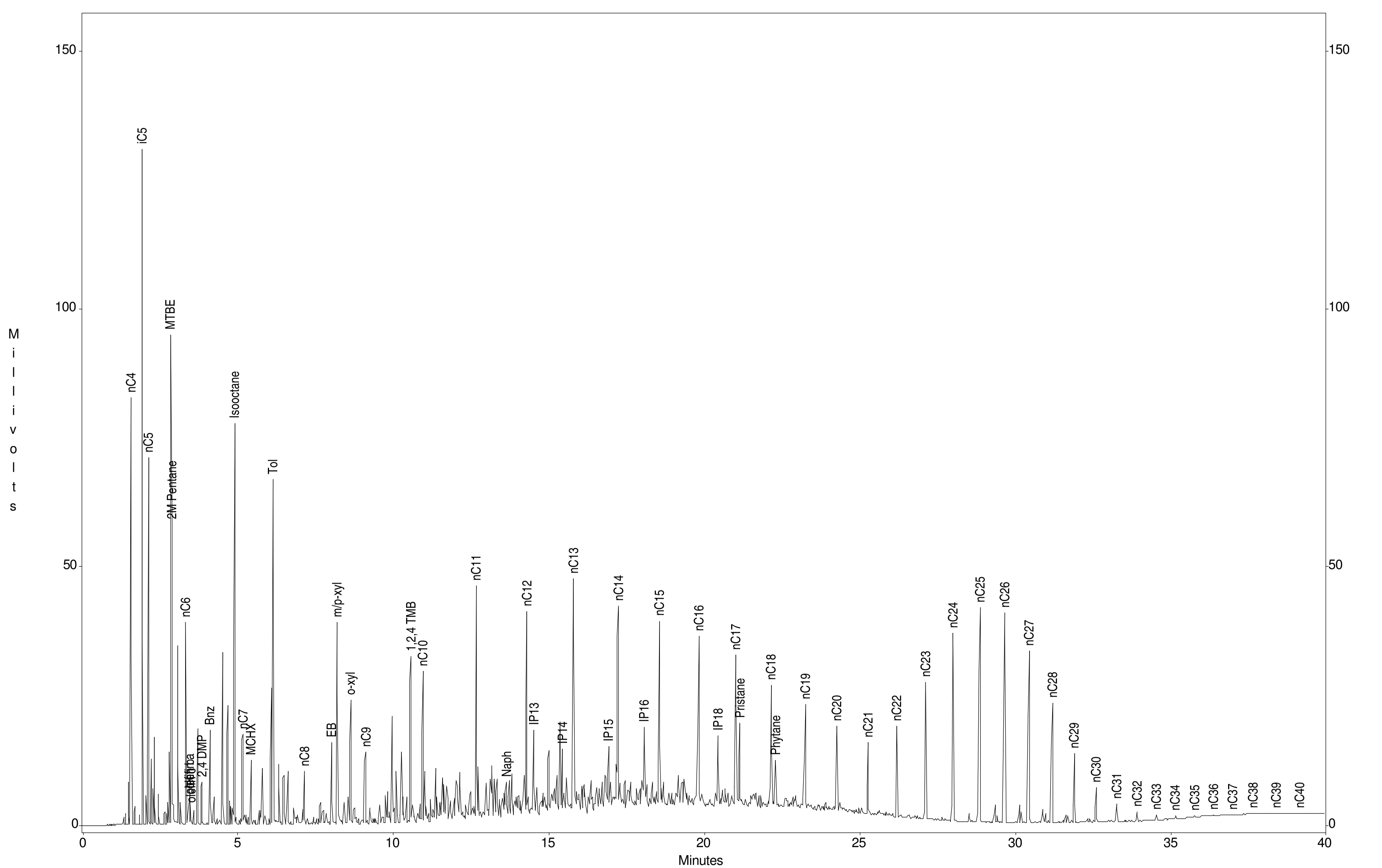
Sun - Philadelphia Refinery
Sample ID : S213-LNAPL-042005
Acquired : Apr 25, 2005 14:19:36

c:\ezchrom\chrom\05054\s213 -- Channel A



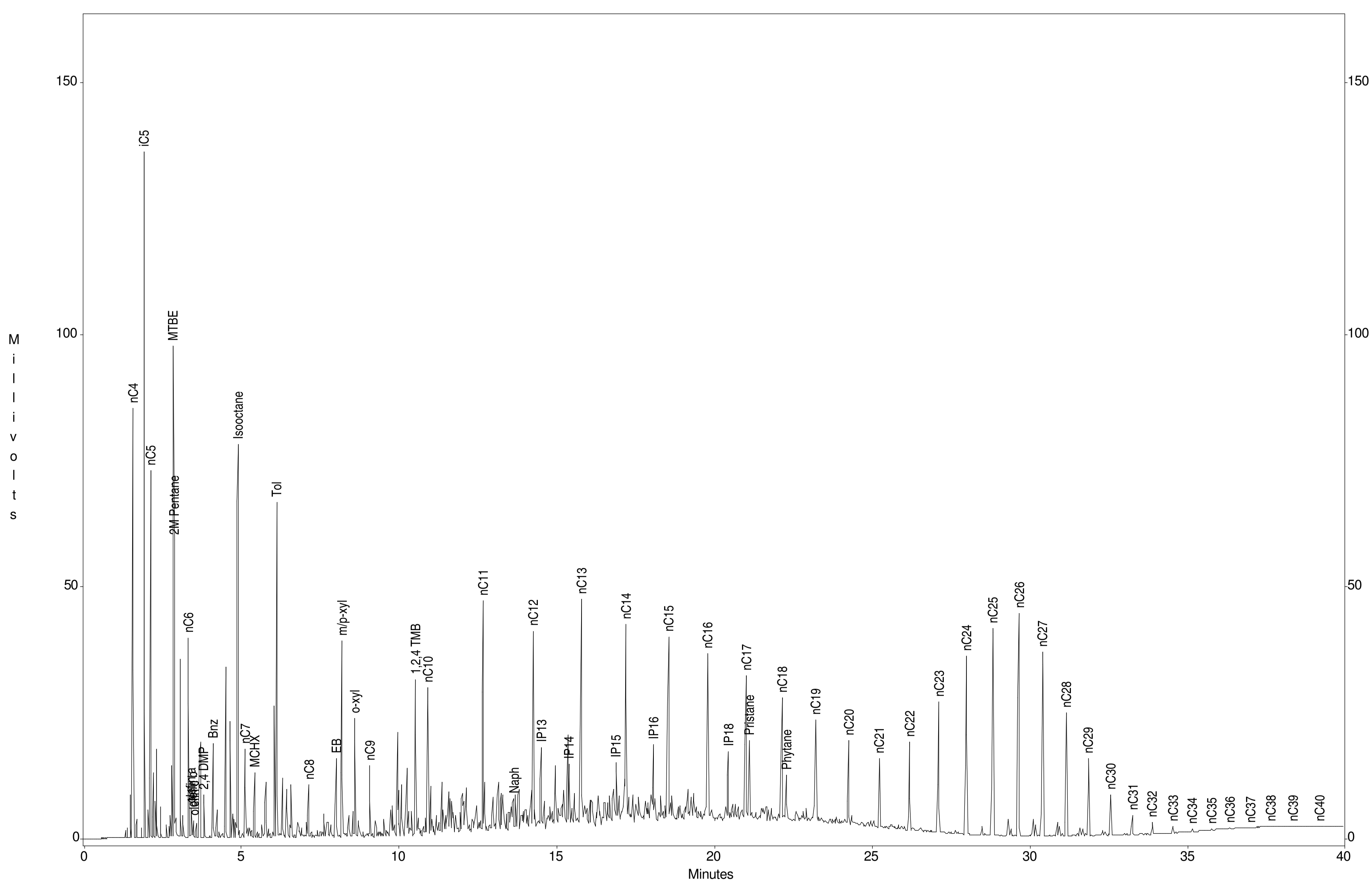
Sun - Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
Acquired : Apr 25, 2005 11:00:43

c:\ezchrom\chrom\05054\gadiwax2 -- Channel A



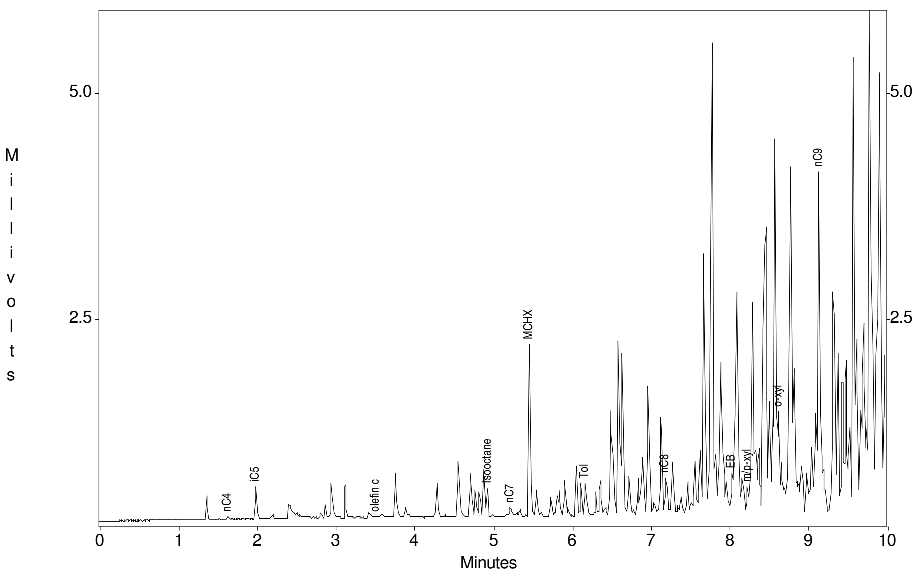
Sun - Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
Acquired : Apr 26, 2005 13:31:55

c:\ezchrom\chrom\05054\gadiwax.2 -- Channel A

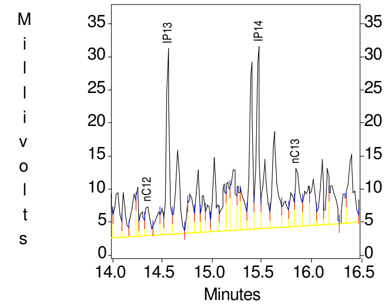


Sun - Philadelphia Refinery
Sample ID : S35-LNAPL-042105
Acquired : Apr 26, 2005 10:07:40

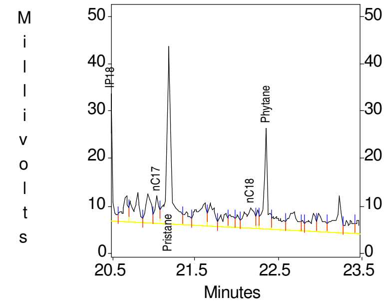
c:\ezchrom\chrom\05054\s35 -- Channel A



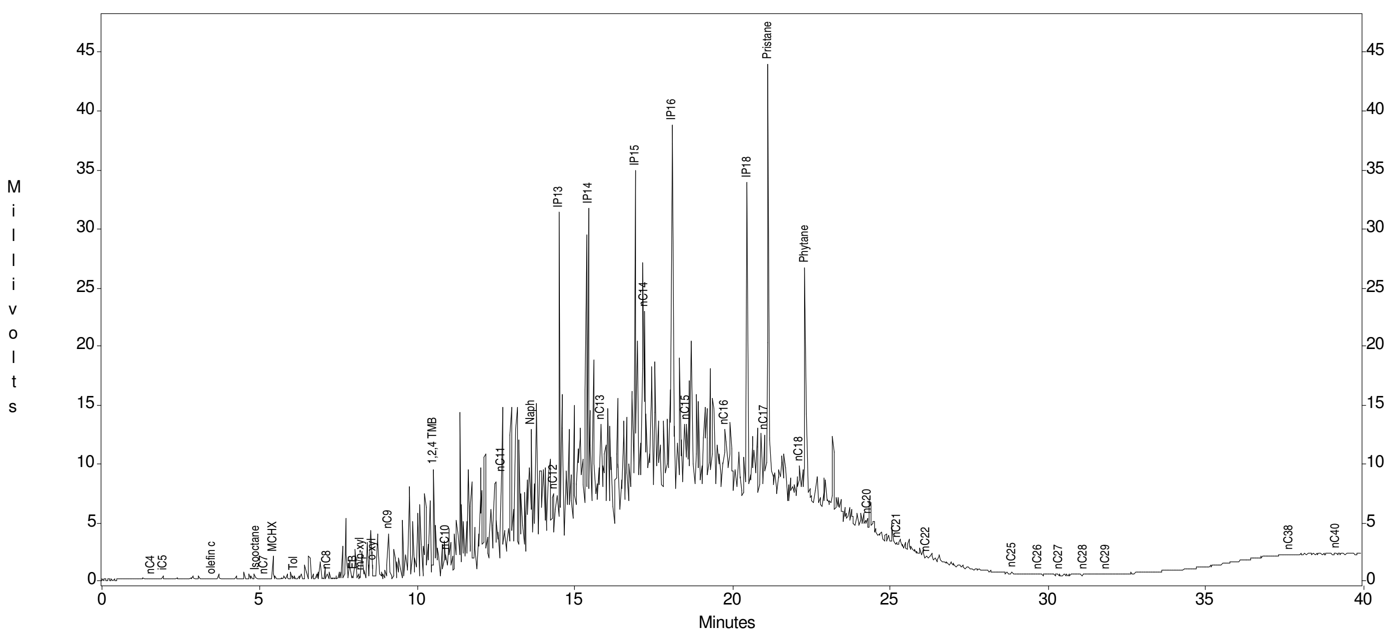
c:\ezchrom\chrom\05054\s35 -- Channel A



c:\ezchrom\chrom\05054\s35 -- Channel A



c:\ezchrom\chrom\05054\s35 -- Channel A



Channel A Results

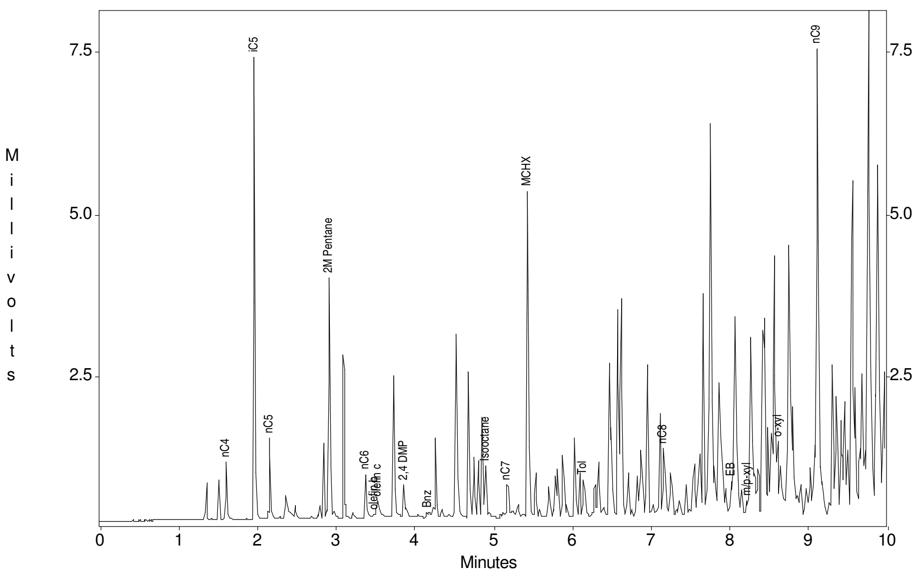
Peak	Area	Height
nC4	41	34
iC5	406	360
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	18	11
2,4 DMP	0	0
Bnz	0	0
Isooctane	466	322
nC7	284	96
MCHX	2769	1919
Tol	626	361
nC8	866	397
EB	729	459
m/p-xyl	484	292
o-xyl	1585	1120
nC9	9779	3771
1,2,4 TMB	22309	9072
nC10	6760	1645
nC11	15135	7186
Naph	26883	10245
nC12	15285	4283
IP13	54748	27961
IP14	50997	27544
nC13	29918	8784
IP15	54293	29055
nC14	39758	16795
IP16	80530	31411
nC15	20820	5379
nC16	38935	5163
IP18	65014	26798
nC17	15677	5743
Pristane	130209	37401
nC18	31460	4108
Phytane	62087	21228
nC19	0	0
nC20	5066	1762
nC21	2131	463
nC22	627	183
nC23	0	0
nC24	0	0
nC25	652	97
nC26	154	57
nC27	118	21
nC28	84	23
nC29	324	21
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	76	17
nC39	0	0
nC40	128	36

Sun - Philadelphia Refinery

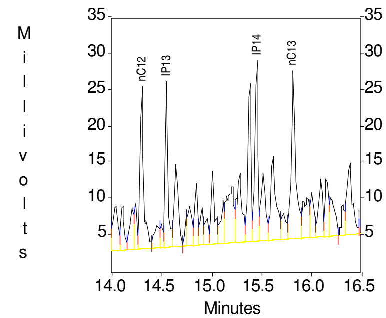
Sample ID : S37-LNAPL-042105

Acquired : Apr 25, 2005 18:27:23

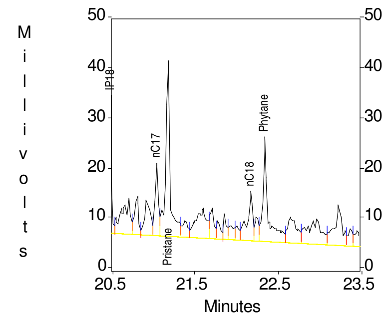
c:\ezchrom\chrom\05054\s37 -- Channel A



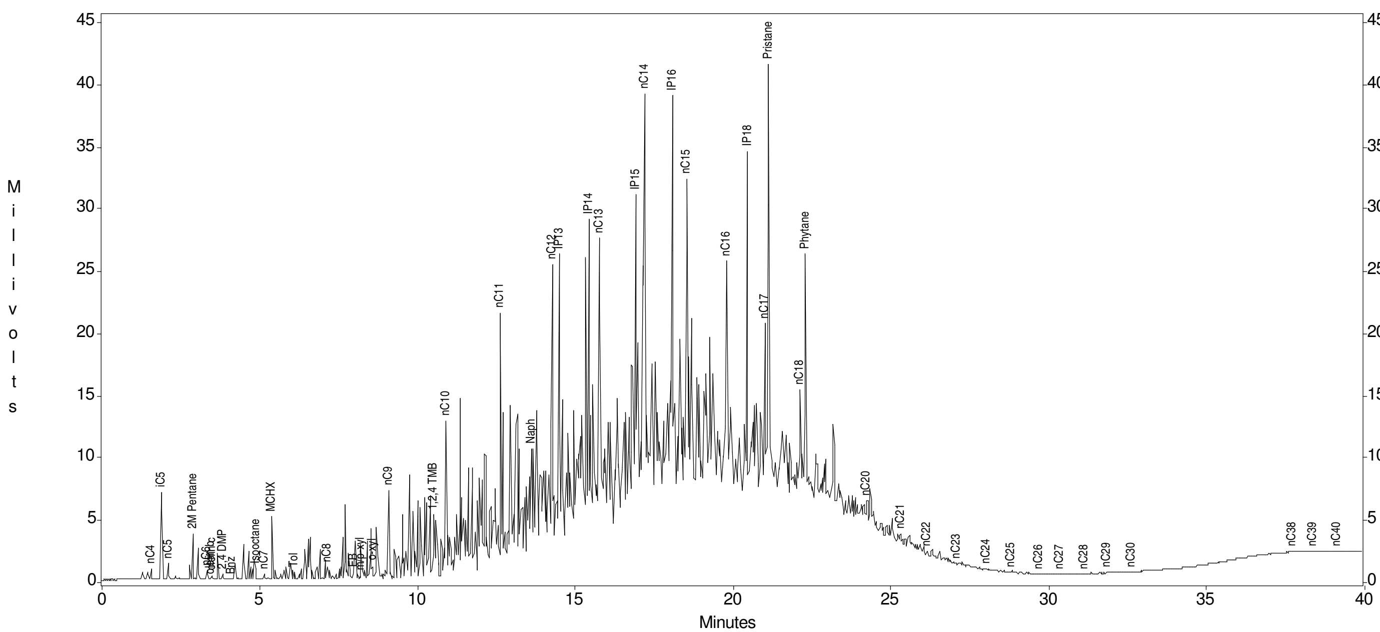
c:\ezchrom\chrom\05054\s37 -- Channel A



c:\ezchrom\chrom\05054\s37 -- Channel A



c:\ezchrom\chrom\05054\s37 -- Channel A

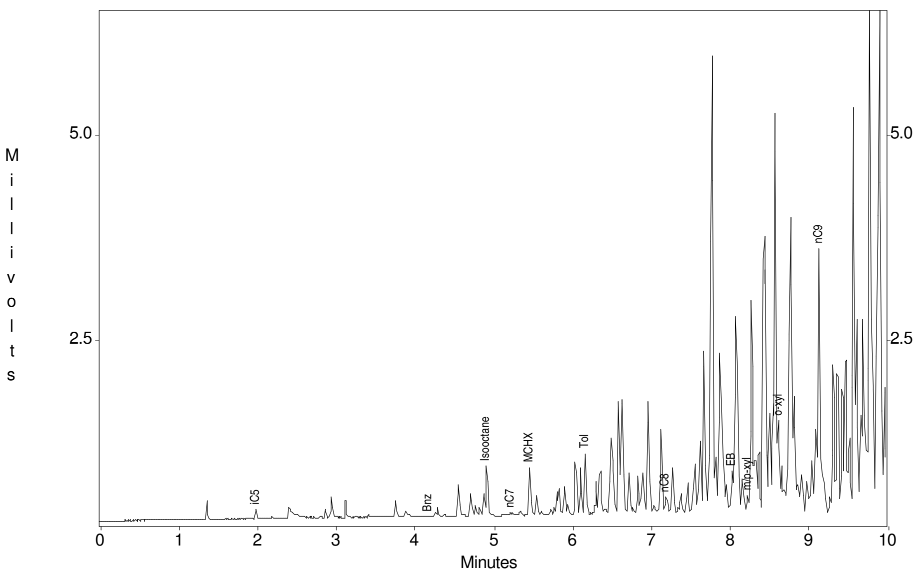


Channel A Results

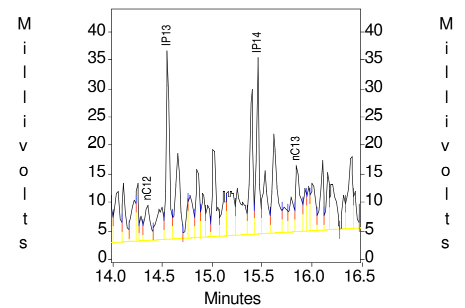
Peak	Area	Height
nC4	696	862
iC5	5974	7102
nC5	1458	1229
MTBE	0	0
2M Pentane	3971	3676
nC6	960	666
olefin a	0	0
olefin b	81	54
olefin c	268	247
2,4 DMP	651	511
Bnz	311	84
Isooctane	1040	792
nC7	995	490
MCHX	6694	4997
Tol	971	557
nC8	1810	1033
EB	824	511
m/p-xyl	325	214
o-xyl	1594	1136
nC9	14633	7149
1,2,4 TMB	15276	4858
nC10	21903	12425
nC11	38135	20066
Naph	19522	8247
nC12	50142	22469
IP13	47283	23108
IP14	45359	25177
nC13	71744	23324
IP15	47838	25543
nC14	73977	33261
IP16	73456	31971
nC15	58566	24531
nC16	64308	18143
IP18	65398	27484
nC17	36514	14196
Pristane	128561	35040
nC18	44957	9884
Phytane	88650	20881
nC19	0	0
nC20	7475	2775
nC21	6968	1053
nC22	1135	364
nC23	240	123
nC24	929	100
nC25	777	104
nC26	144	46
nC27	94	23
nC28	91	30
nC29	409	27
nC30	78	19
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	94	20
nC39	14	8
nC40	11	8

Sun - Philadelphia Refinery
Sample ID : S57-LNAPL-042105
Acquired : Apr 25, 2005 13:27:24

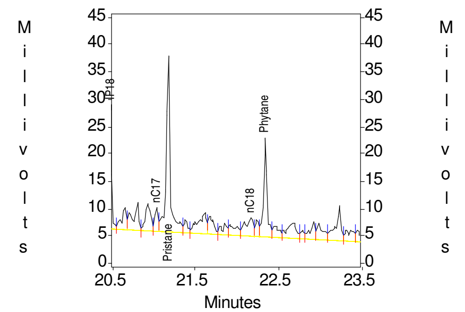
c:\ezchrom\chrom\05054\s57 -- Channel A



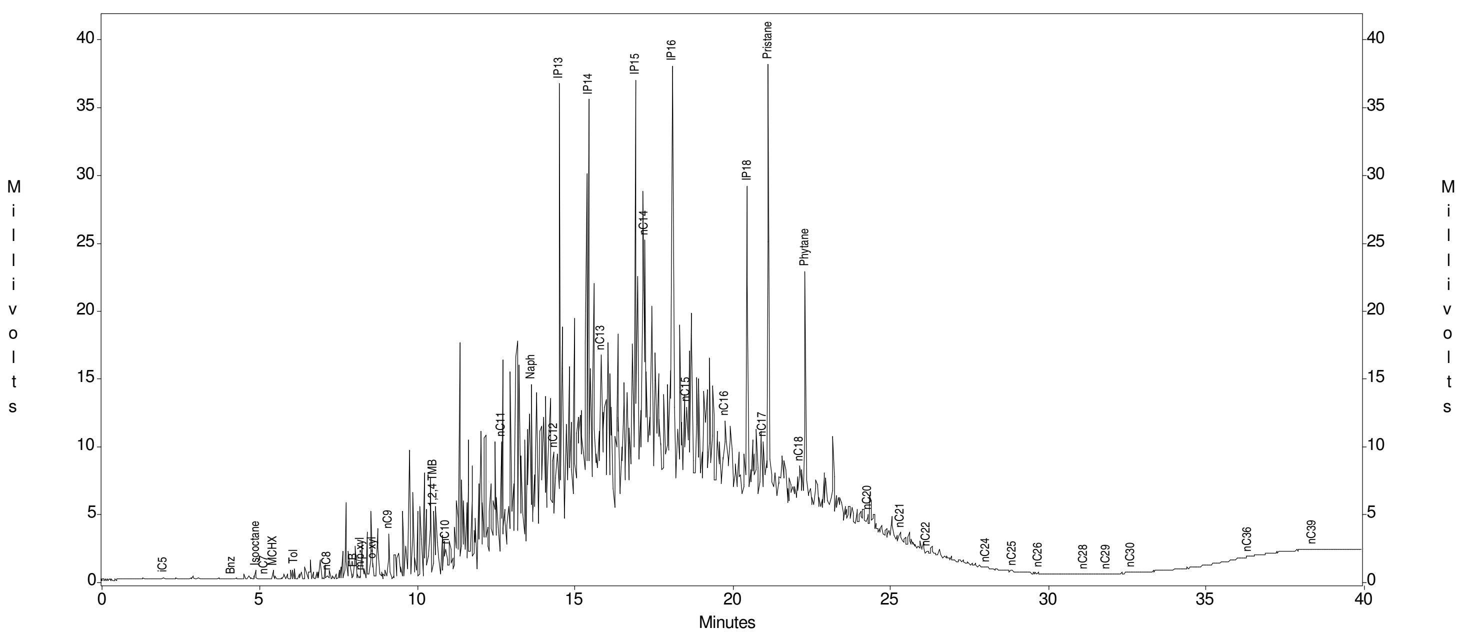
c:\ezchrom\chrom\05054\s57 -- Channel A



c:\ezchrom\chrom\05054\s57 -- Channel A



c:\ezchrom\chrom\05054\s57 -- Channel A

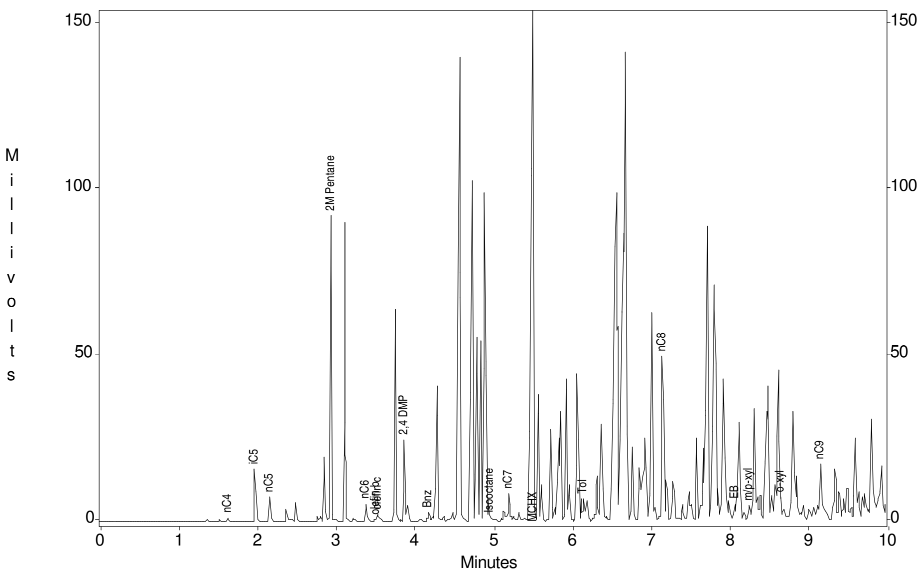


Channel A Results

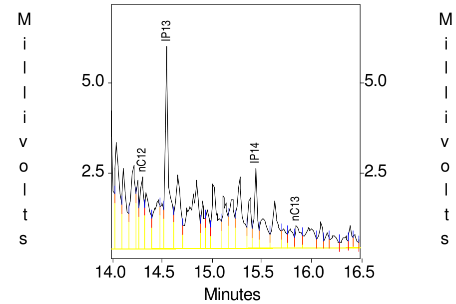
Peak	Area	Height
nC4	0	0
iC5	122	107
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	16	8
Isooctane	883	623
nC7	103	25
MCHX	927	580
Tol	1124	752
nC8	501	215
EB	861	517
m/p-xyl	351	218
o-xyl	1618	1141
nC9	8667	3248
1,2,4 TMB	12775	4769
nC10	6265	1719
nC11	18000	8477
Naph	28717	11767
nC12	21884	6134
IP13	68810	33052
IP14	57673	30993
nC13	39734	11800
IP15	58968	30891
nC14	43998	18867
IP16	100213	30750
nC15	20690	5153
nC16	36083	4848
IP18	54395	22906
nC17	12130	4448
Pristane	106010	32285
nC18	23752	3403
Phytane	50764	17975
nC19	0	0
nC20	4373	1476
nC21	6350	942
nC22	930	201
nC23	0	0
nC24	936	135
nC25	765	105
nC26	167	48
nC27	0	0
nC28	77	26
nC29	212	17
nC30	66	18
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	77	29
nC37	0	0
nC38	0	0
nC39	31	14
nC40	0	0

Sun - Philadelphia Refinery
Sample ID : S77-LNAPL-042005
Acquired : Apr 26, 2005 09:19:05

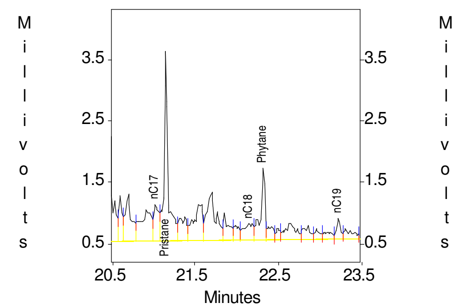
c:\ezchrom\chrom\05054\s77 -- Channel A



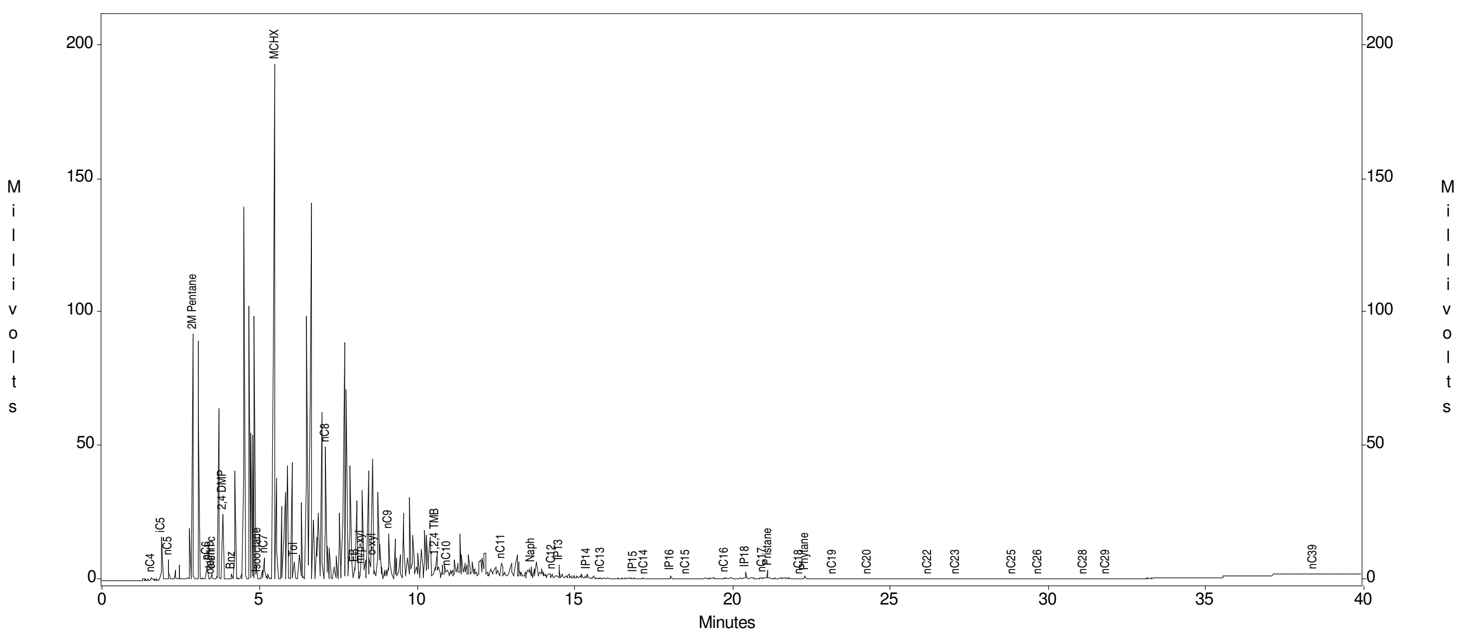
c:\ezchrom\chrom\05054\s77 -- Channel A



c:\ezchrom\chrom\05054\s77 -- Channel A



c:\ezchrom\chrom\05054\s77 -- Channel A

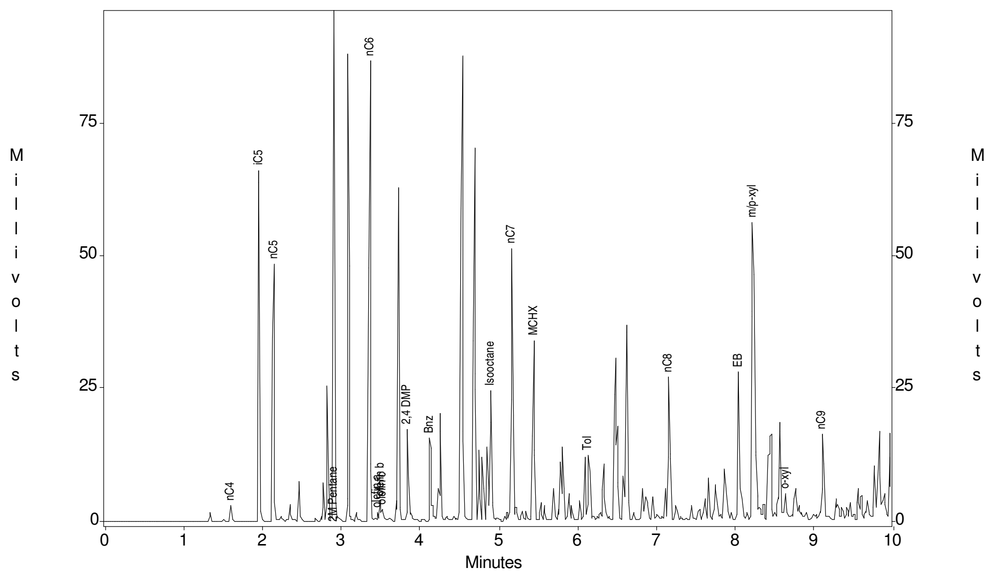


Channel A Results

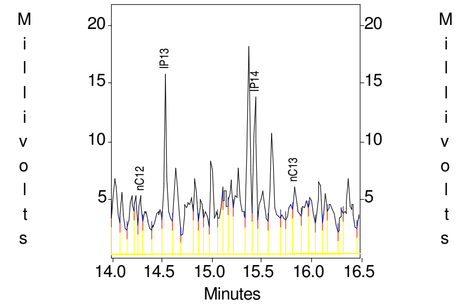
Peak	Area	Height
nC4	745	844
iC5	13689	15662
nC5	7651	7314
MTBE	0	0
2M Pentane	91837	91850
nC6	6466	5229
olefin a	0	0
olefin b	484	462
olefin c	2620	2034
2,4 DMP	27698	24597
Bnz	3899	2383
Isooctane	943	986
nC7	13129	8196
MCHX	295413	192682
Tol	8617	6738
nC8	74654	49515
EB	8110	5042
m/p-xyl	8029	4457
o-xyl	8655	7248
nC9	51732	17271
1,2,4 TMB	24982	7530
nC10	11074	3189
nC11	15690	5922
Naph	10905	4571
nC12	4414	1969
IP13	14023	5603
IP14	4145	2198
nC13	2453	604
IP15	2007	937
nC14	793	351
IP16	3087	1278
nC15	1064	246
nC16	5553	462
IP18	11604	2649
nC17	2320	608
Pristane	10665	3093
nC18	2095	267
Phytane	4157	1173
nC19	1147	352
nC20	436	67
nC21	0	0
nC22	116	35
nC23	106	24
nC24	0	0
nC25	587	86
nC26	379	65
nC27	0	0
nC28	102	26
nC29	70	18
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	110	31
nC40	0	0

Sun - Philadelphia Refinery
Sample ID : S83-LNAPL-042005
Acquired : Apr 25, 2005 15:59:15

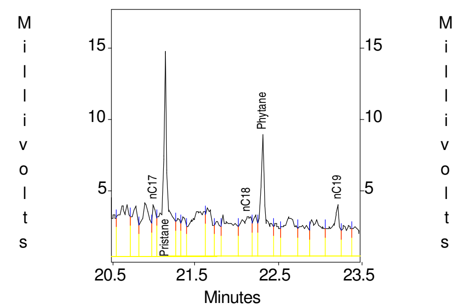
c:\ezchrom\chrom\05054\s83 -- Channel A



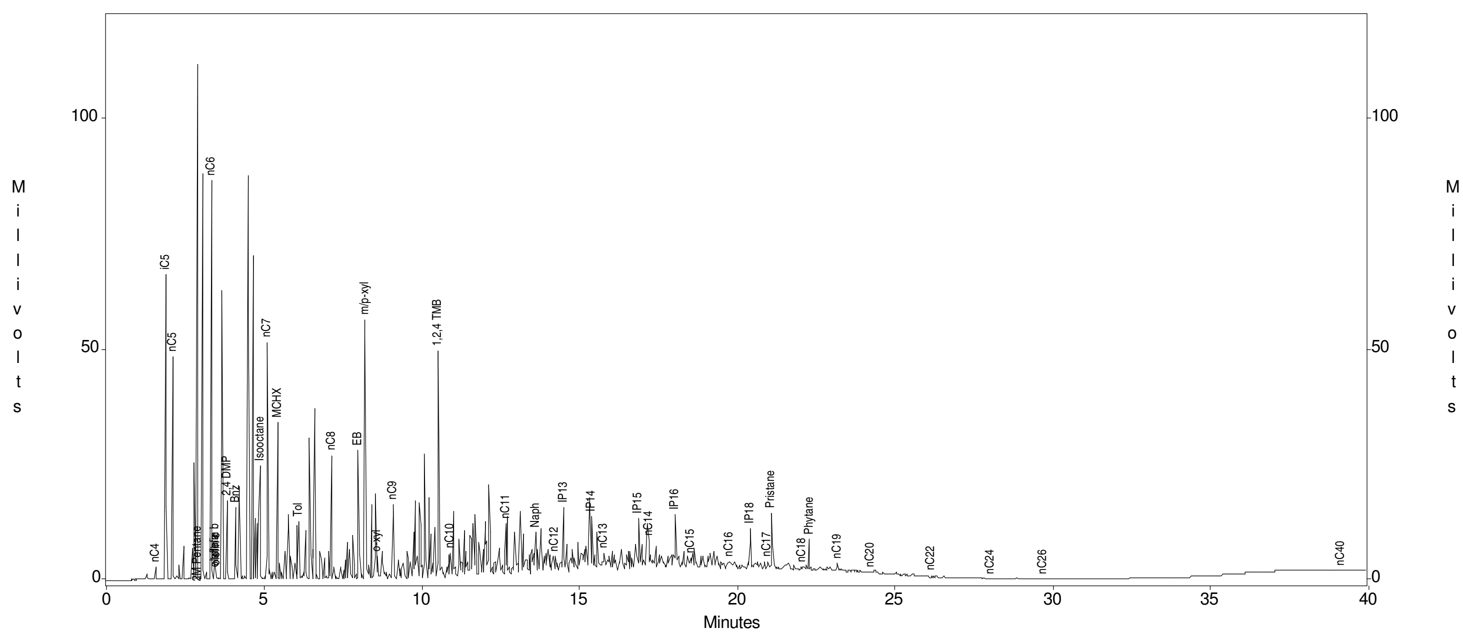
c:\ezchrom\chrom\05054\s83 -- Channel A



c:\ezchrom\chrom\05054\s83 -- Channel A



c:\ezchrom\chrom\05054\s83 -- Channel A



Channel A Results

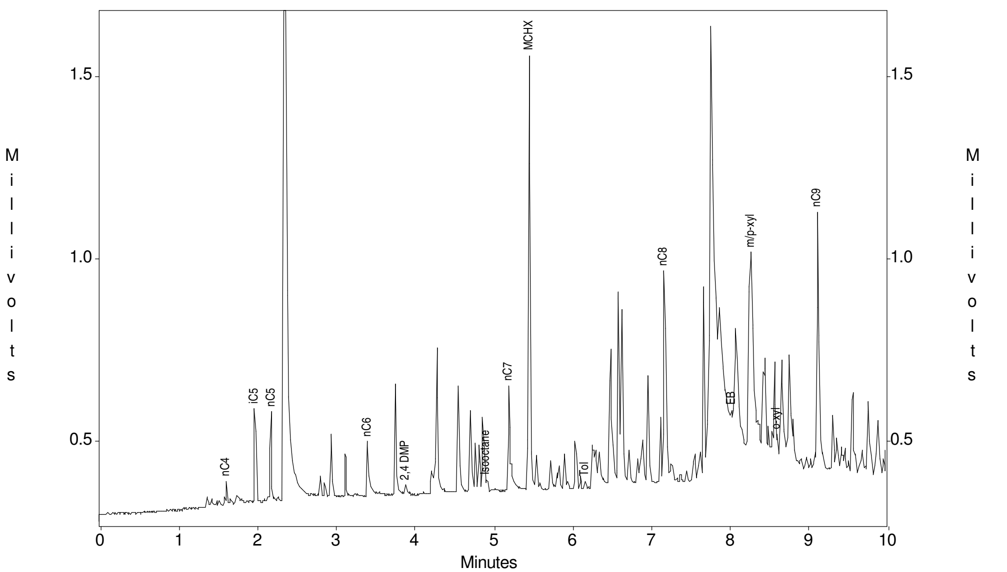
Peak	Area	Height
nC4	2066	2854
iC5	50374	65890
nC5	40293	48420
MTBE	0	0
2M Pentane	107642	111457
nC6	90152	86494
olefin a	1667	1600
olefin b	4285	3836
olefin c	3676	2184
2,4 DMP	18936	17273
Bnz	23057	15537
Isooctane	28806	24518
nC7	67125	51384
MCHX	44103	33989
Tol	17135	12474
nC8	35807	26899
EB	50895	27882
m/p-xyl	140132	56086
o-xyl	9989	4963
nC9	27834	16313
1,2,4 TMB	95389	49607
nC10	12208	5858
nC11	26959	12025
Naph	26773	10298
nC12	10404	4951
IP13	37806	15492
IP14	25358	13482
nC13	21475	5724
IP15	26086	13307
nC14	23563	8254
IP16	31742	14153
nC15	20552	4545
nC16	43438	3967
IP18	56442	10970
nC17	11306	3697
Pristane	64122	14441
nC18	25754	2801
Phytane	39174	8532
nC19	26953	3600
nC20	9039	1648
nC21	0	0
nC22	3337	581
nC23	0	0
nC24	1950	171
nC25	0	0
nC26	147	18
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	61	14

Sun - Philadelphia Refinery

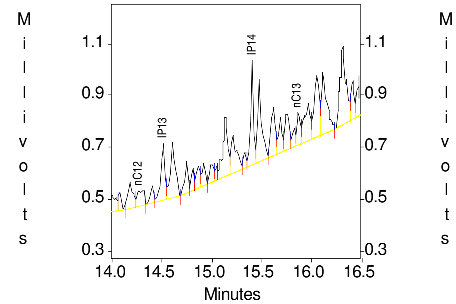
Sample ID : S126-LNAPL-042005

Acquired : Apr 26, 2005 11:46:25

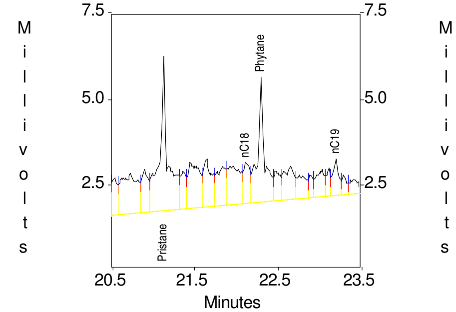
c:\ezchrom\chrom\05054\s126 -- Channel A



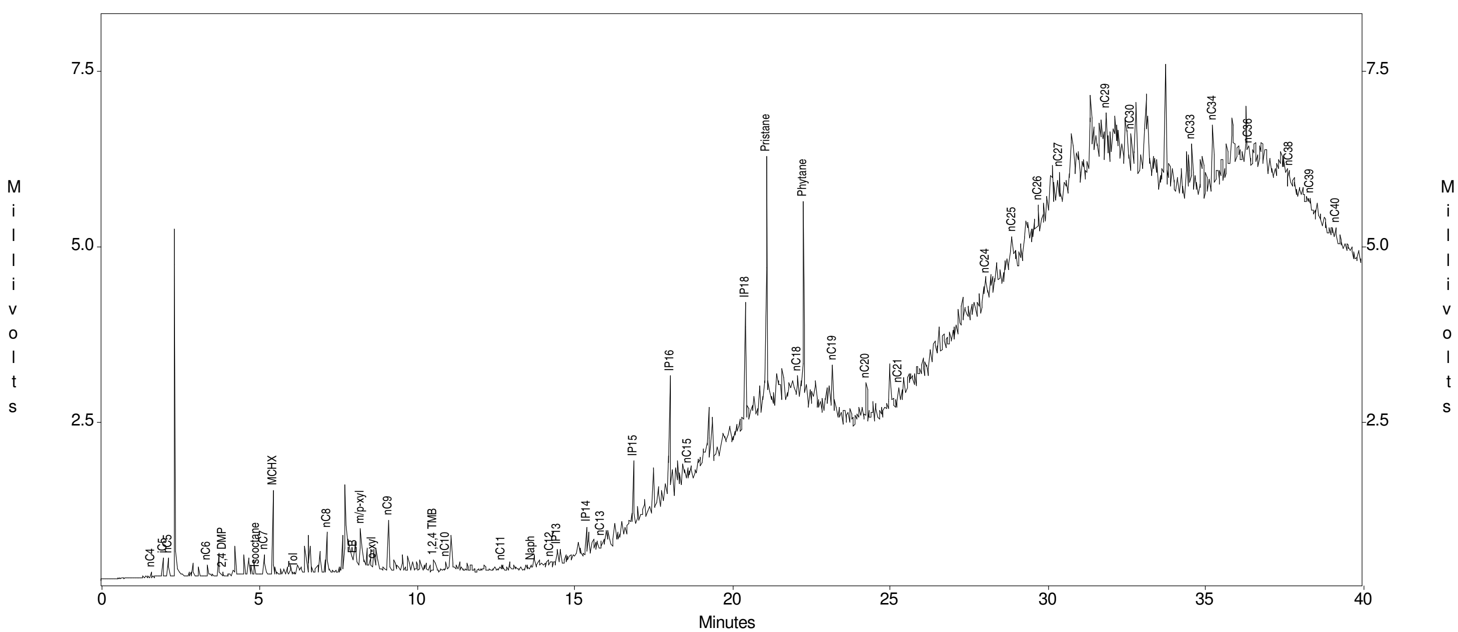
c:\ezchrom\chrom\05054\s126 -- Channel A



c:\ezchrom\chrom\05054\s126 -- Channel A



c:\ezchrom\chrom\05054\s126 -- Channel A

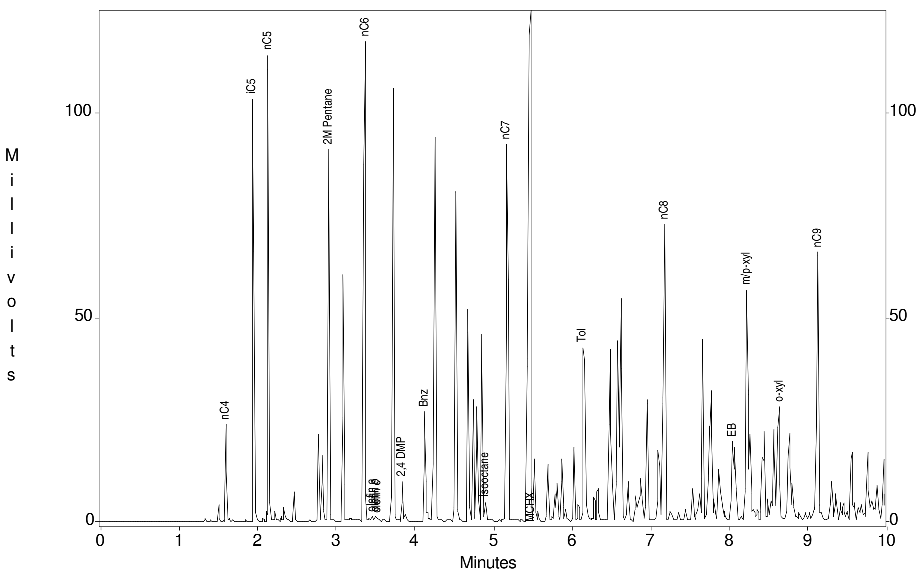


Channel A Results

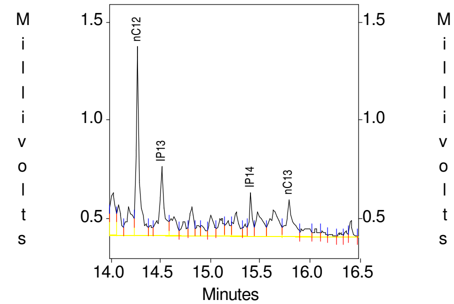
Peak	Area	Height
nC4	55	64
iC5	224	255
nC5	248	241
MTBE	0	0
2M Pentane	0	0
nC6	314	148
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	57	28
Bnz	0	0
Isooctane	41	29
nC7	664	284
MCHX	1696	1184
Tol	44	23
nC8	1076	590
EB	369	206
m/p-xyl	2912	638
o-xyl	229	139
nC9	1823	744
1,2,4 TMB	805	189
nC10	503	150
nC11	201	92
Naph	122	47
nC12	308	64
IP13	585	220
IP14	811	407
nC13	314	130
IP15	2429	1062
nC14	0	0
IP16	7943	2021
nC15	2373	598
nC16	0	0
IP18	13607	2558
nC17	0	0
Pristane	32400	4496
nC18	6948	1171
Phytane	20520	3600
nC19	4828	1090
nC20	1972	600
nC21	798	230
nC22	0	0
nC23	0	0
nC24	3887	427
nC25	8620	587
nC26	5793	579
nC27	3081	676
nC28	0	0
nC29	2833	753
nC30	1569	512
nC31	0	0
nC32	0	0
nC33	1447	589
nC34	3994	877
nC35	0	0
nC36	179	121
nC37	0	0
nC38	632	198
nC39	102	102
nC40	374	147

Sun - Philadelphia Refinery
Sample ID : S160-LNAPL-042005
Acquired : Apr 26, 2005 12:42:54

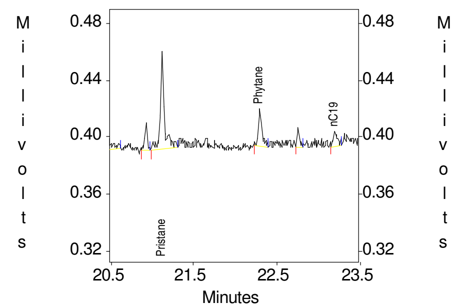
c:\ezchrom\chrom\05054\s160 -- Channel A



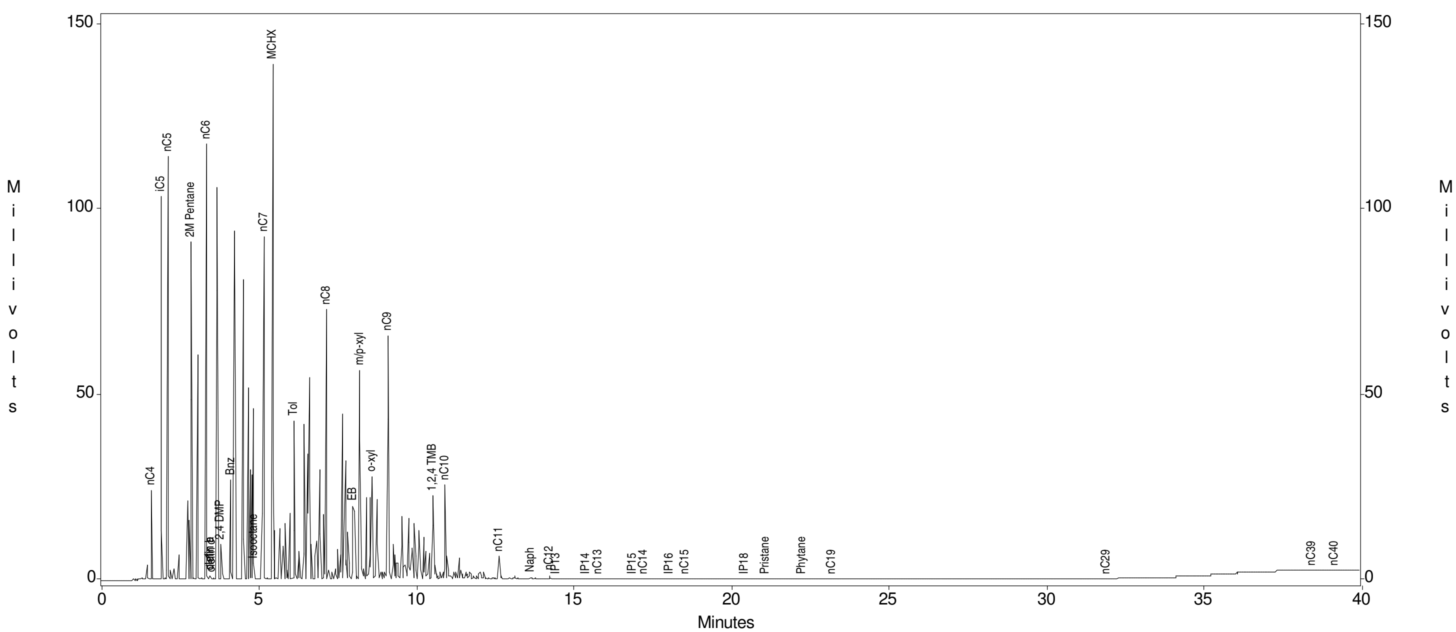
c:\ezchrom\chrom\05054\s160 -- Channel A



c:\ezchrom\chrom\05054\s160 -- Channel A



c:\ezchrom\chrom\05054\s160 -- Channel A

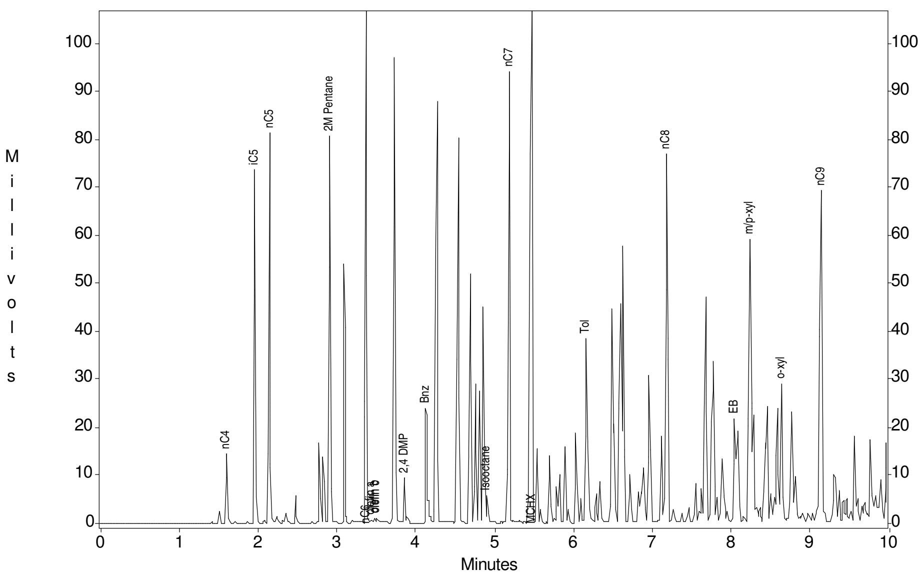


Channel A Results

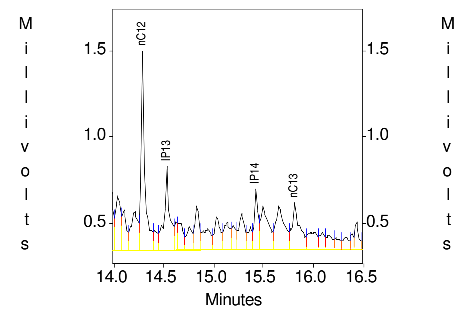
Peak	Area	Height
nC4	17505	23967
iC5	83014	103747
nC5	94147	114170
MTBE	0	0
2M Pentane	88607	91232
nC6	131411	117762
olefin a	1453	1132
olefin b	1311	1029
olefin c	1231	736
2,4 DMP	10702	9792
Bnz	37030	26891
Isooctane	6020	4629
nC7	135672	92543
MCHX	247161	139058
Tol	57997	42316
nC8	115677	72908
EB	36725	19658
m/p-xyl	120755	56499
o-xyl	48502	27868
nC9	130150	65886
1,2,4 TMB	42571	22635
nC10	39030	25359
nC11	10567	6046
Naph	1503	535
nC12	2110	968
IP13	1120	354
IP14	456	228
nC13	819	190
IP15	217	116
nC14	168	49
IP16	289	99
nC15	151	23
nC16	0	0
IP18	111	37
nC17	0	0
Pristane	221	69
nC18	0	0
Phytane	69	25
nC19	38	11
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	190	25
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	143	33
nC40	24	18

Sun - Philadelphia Refinery
Sample ID : S161-LNAPL-042005
Acquired : Apr 26, 2005 10:58:03

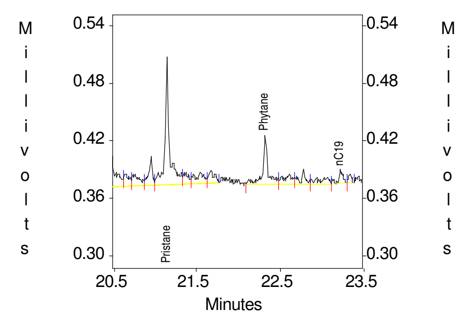
c:\ezchrom\chrom\05054\s161 -- Channel A



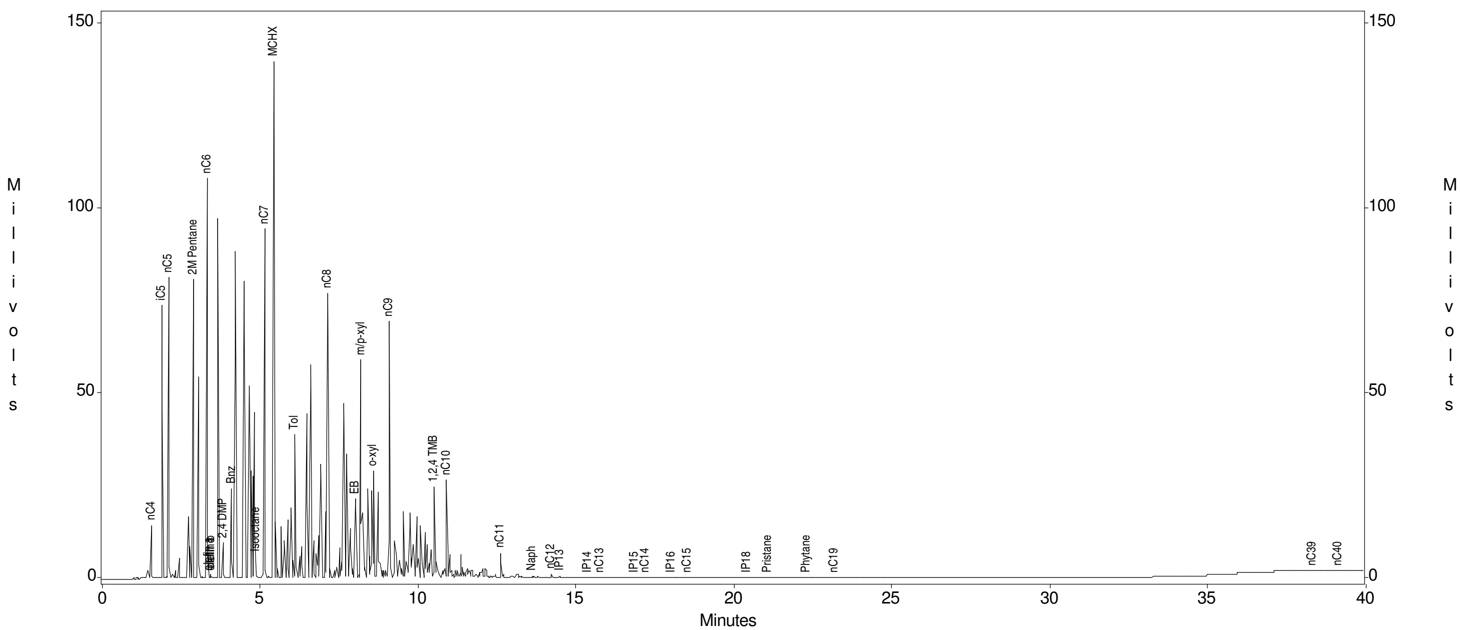
c:\ezchrom\chrom\05054\s161 -- Channel A



c:\ezchrom\chrom\05054\s161 -- Channel A



c:\ezchrom\chrom\05054\s161 -- Channel A

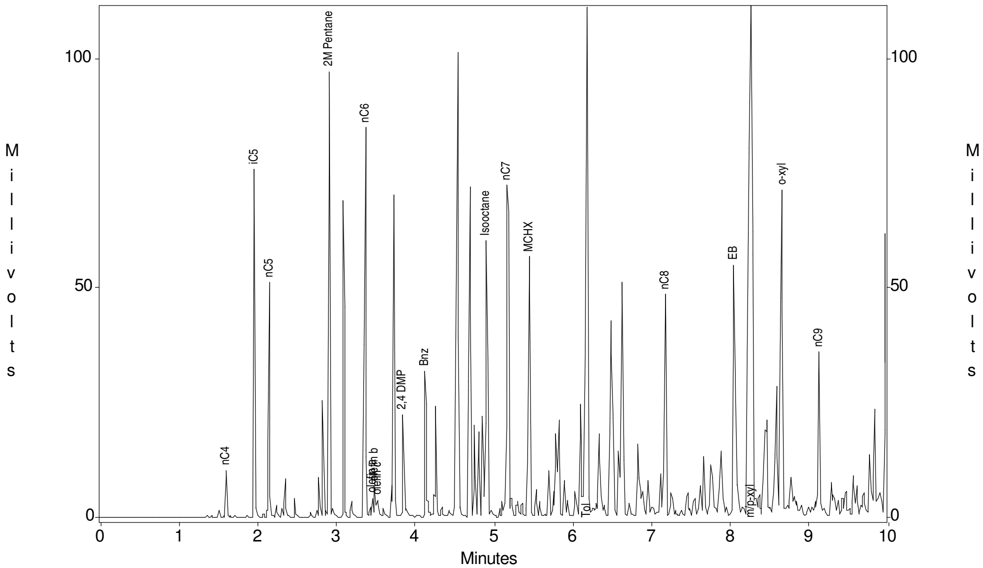


Channel A Results

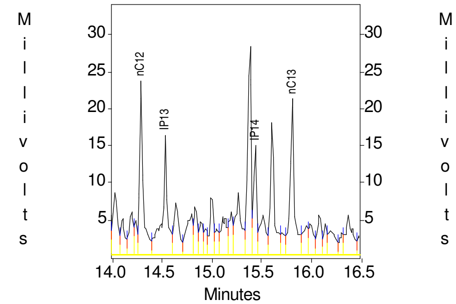
Peak	Area	Height
nC4	10594	14390
iC5	58797	73717
nC5	70252	81340
MTBE	0	0
2M Pentane	77472	80619
nC6	119053	107947
olefin a	888	592
olefin b	1274	946
olefin c	1181	922
2,4 DMP	10474	9443
Bnz	34391	24024
Isooctane	7607	5712
nC7	139225	94243
MCHX	248410	139452
Tol	57001	38639
nC8	124388	77219
EB	40561	21603
m/p-xyl	130505	59076
o-xyl	51681	29167
nC9	139055	69551
1,2,4 TMB	46970	24607
nC10	42072	26548
nC11	12049	6640
Naph	2042	685
nC12	2854	1154
IP13	1850	486
IP14	797	353
nC13	1372	268
IP15	581	215
nC14	1088	136
IP16	746	183
nC15	513	58
nC16	0	0
IP18	281	72
nC17	0	0
Pristane	490	133
nC18	0	0
Phytane	229	51
nC19	60	13
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	21	15
nC40	37	17

Sun - Philadelphia Refinery
Sample ID : S198-LNAPL-042005
Acquired : Apr 25, 2005 15:11:04

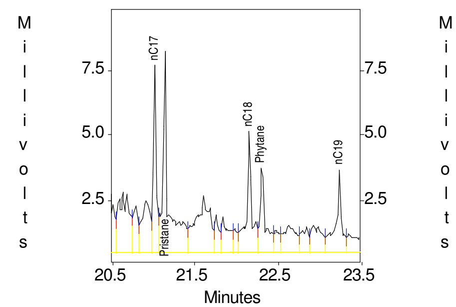
c:\ezchrom\chrom\05054\s198 -- Channel A



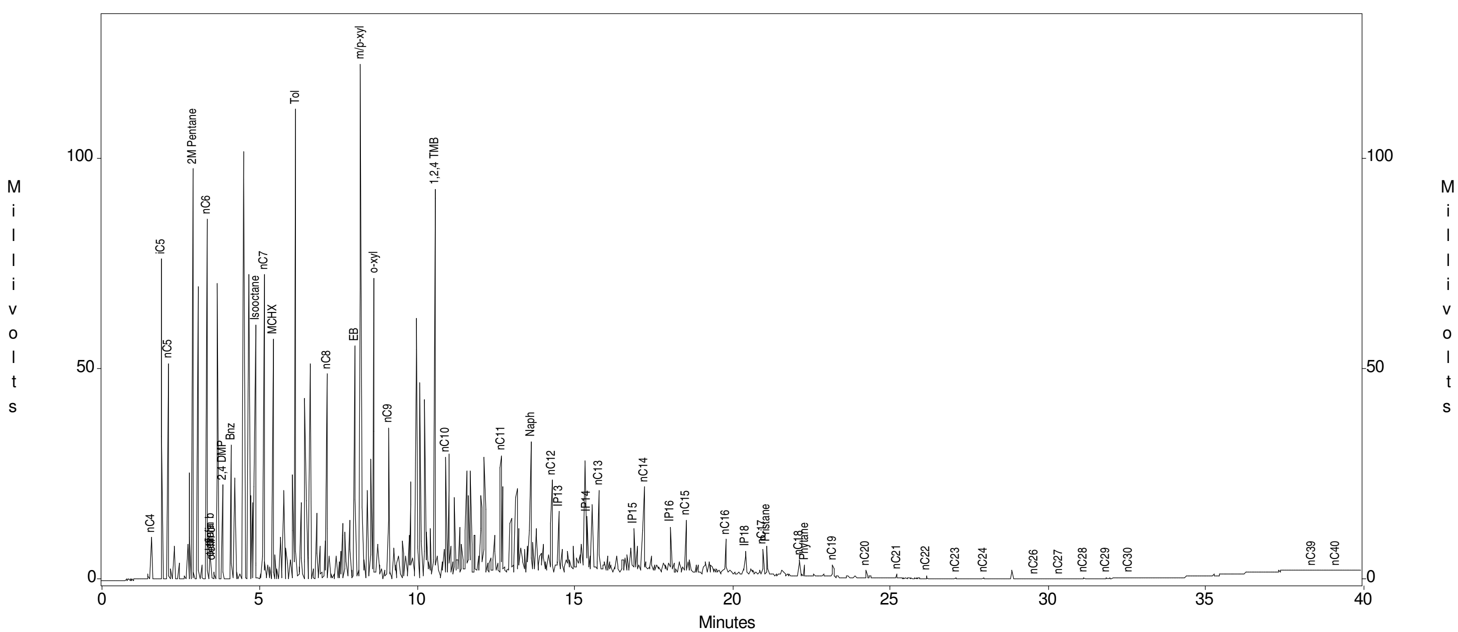
c:\ezchrom\chrom\05054\s198 -- Channel A



c:\ezchrom\chrom\05054\s198 -- Channel A



c:\ezchrom\chrom\05054\s198 -- Channel A

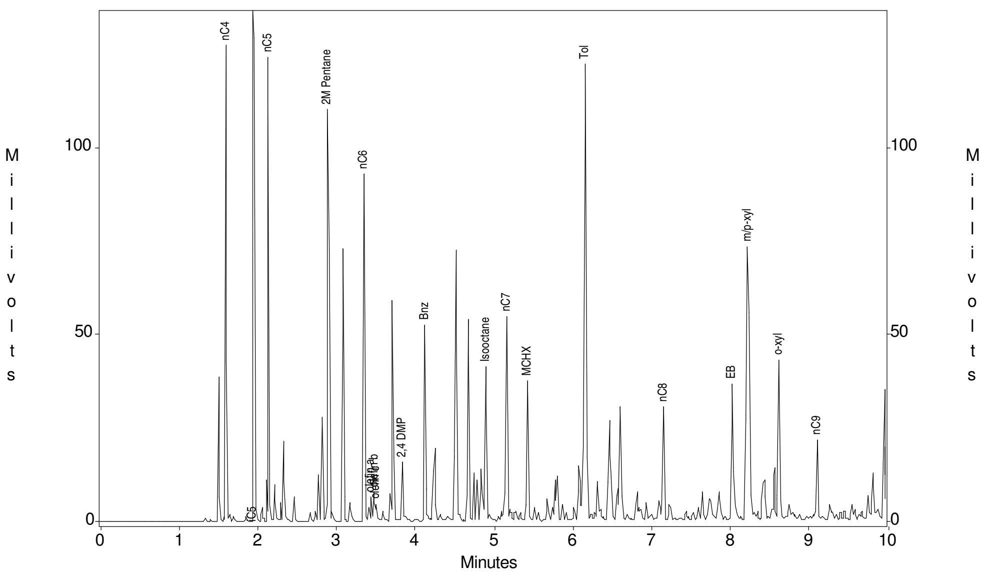


Channel A Results

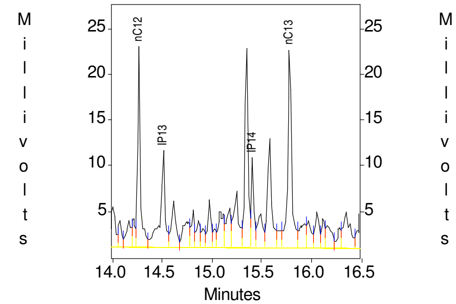
Peak	Area	Height
nC4	6805	10193
iC5	56062	76092
nC5	41370	51174
MTBE	0	0
2M Pentane	94987	97341
nC6	88612	85212
olefin a	4768	4149
olefin b	7273	6670
olefin c	5630	3602
2,4 DMP	24785	22357
Bnz	43426	31804
Isooctane	77664	60425
nC7	103956	72263
MCHX	76887	56499
Tol	185088	111104
nC8	70463	48501
EB	105627	55069
m/p-xyl	386115	121810
o-xyl	135212	71315
nC9	63724	35758
1,2,4 TMB	228975	92309
nC10	47999	28685
nC11	69618	29135
Naph	92168	32466
nC12	55621	23365
IP13	60906	16191
IP14	27028	14790
nC13	59351	21028
IP15	23022	11823
nC14	46462	21673
IP16	27950	12557
nC15	43063	13846
nC16	37188	9376
IP18	35271	6482
nC17	16510	7152
Pristane	39417	7725
nC18	19805	4642
Phytane	14102	3240
nC19	15548	3172
nC20	6030	2032
nC21	2868	1132
nC22	1681	622
nC23	802	316
nC24	377	172
nC25	0	0
nC26	340	94
nC27	405	102
nC28	407	90
nC29	213	46
nC30	197	29
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	47	15
nC40	18	11

Sun - Philadelphia Refinery
Sample ID : S199-LNAPL-042005
Acquired : Apr 26, 2005 14:20:57

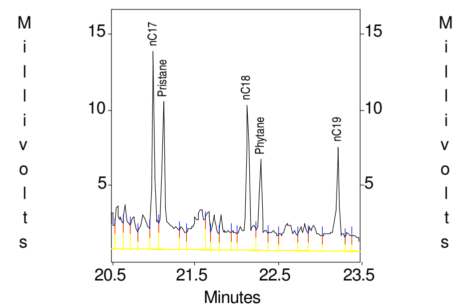
c:\ezchrom\chrom\05054\s199 -- Channel A



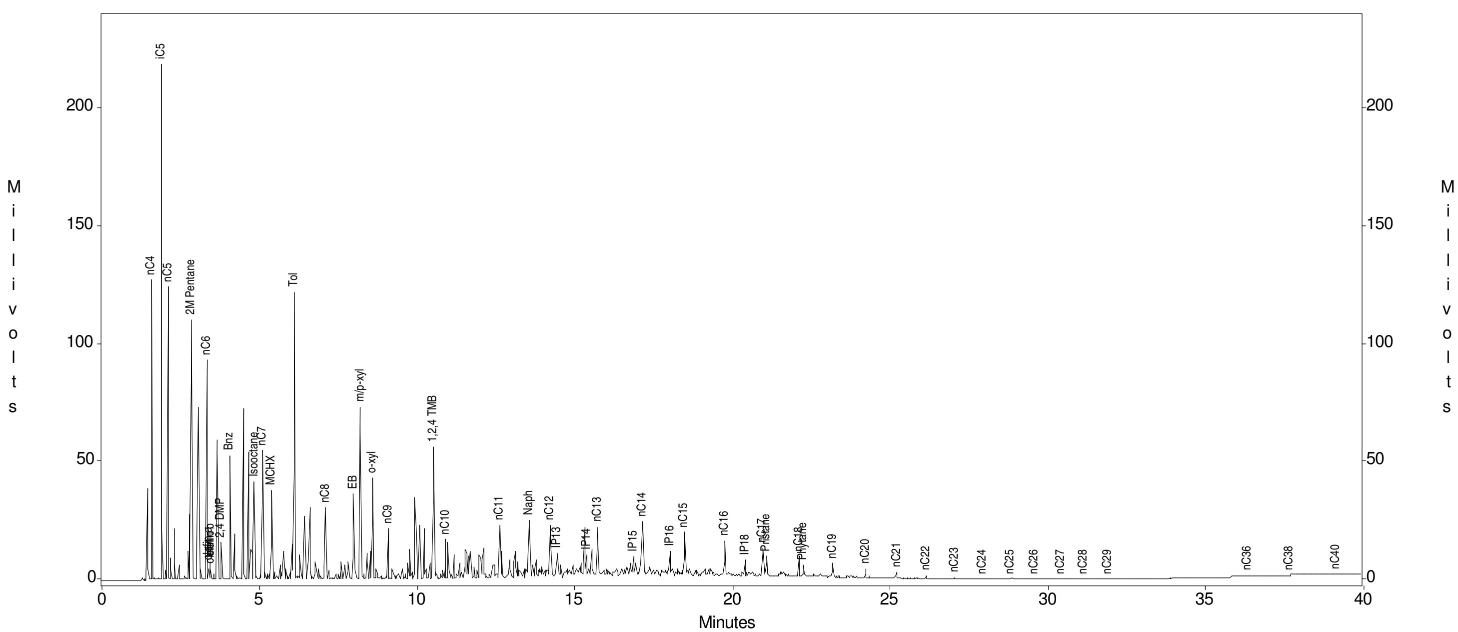
c:\ezchrom\chrom\05054\s199 -- Channel A



c:\ezchrom\chrom\05054\s199 -- Channel A



c:\ezchrom\chrom\05054\s199 -- Channel A



Channel A Results

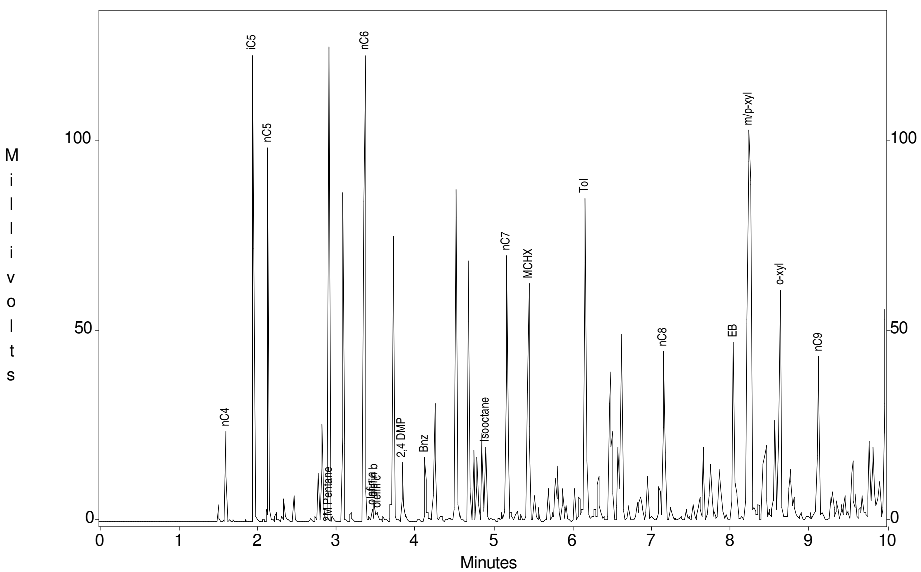
Peak	Area	Height
nC4	90952	127676
iC5	174049	218801
nC5	105932	124673
MTBE	0	0
2M Pentane	111384	110654
nC6	100959	93398
olefin a	7664	6471
olefin b	8672	7759
olefin c	6643	4393
2,4 DMP	19267	15861
Bnz	67979	52520
Isooctane	50589	41492
nC7	76748	55080
MCHX	50195	37642
Tol	218179	122448
nC8	41461	30343
EB	61977	36401
m/p-xyl	200649	73193
o-xyl	72197	43297
nC9	35760	21523
1,2,4 TMB	108568	56012
nC10	26484	17172
nC11	45669	21932
Naph	65046	24279
nC12	48352	21951
IP13	35607	10592
IP14	18471	9848
nC13	57127	21692
IP15	19234	9096
nC14	52138	24282
IP16	25743	11150
nC15	65275	19244
nC16	50196	15849
IP18	38985	7814
nC17	32388	13022
Pristane	38462	9661
nC18	33914	9513
Phytane	19600	5918
nC19	28849	6862
nC20	11066	4407
nC21	6730	2562
nC22	3572	1436
nC23	1769	669
nC24	666	329
nC25	320	167
nC26	274	108
nC27	217	63
nC28	148	46
nC29	148	26
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	111	36
nC37	0	0
nC38	71	25
nC39	0	0
nC40	42	14

Sun - Philadelphia Refinery

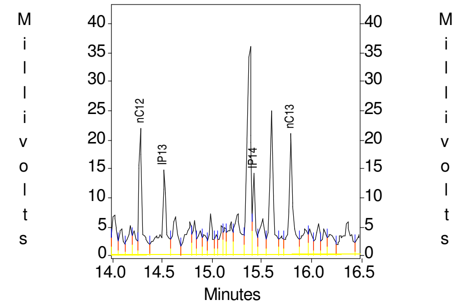
Sample ID : S200-LNAPL-042005

Acquired : Apr 25, 2005 12:38:28

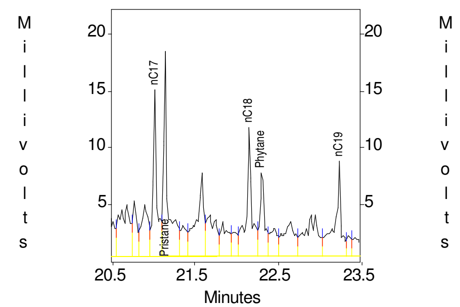
c:\ezchrom\chrom\05054\s200 -- Channel A



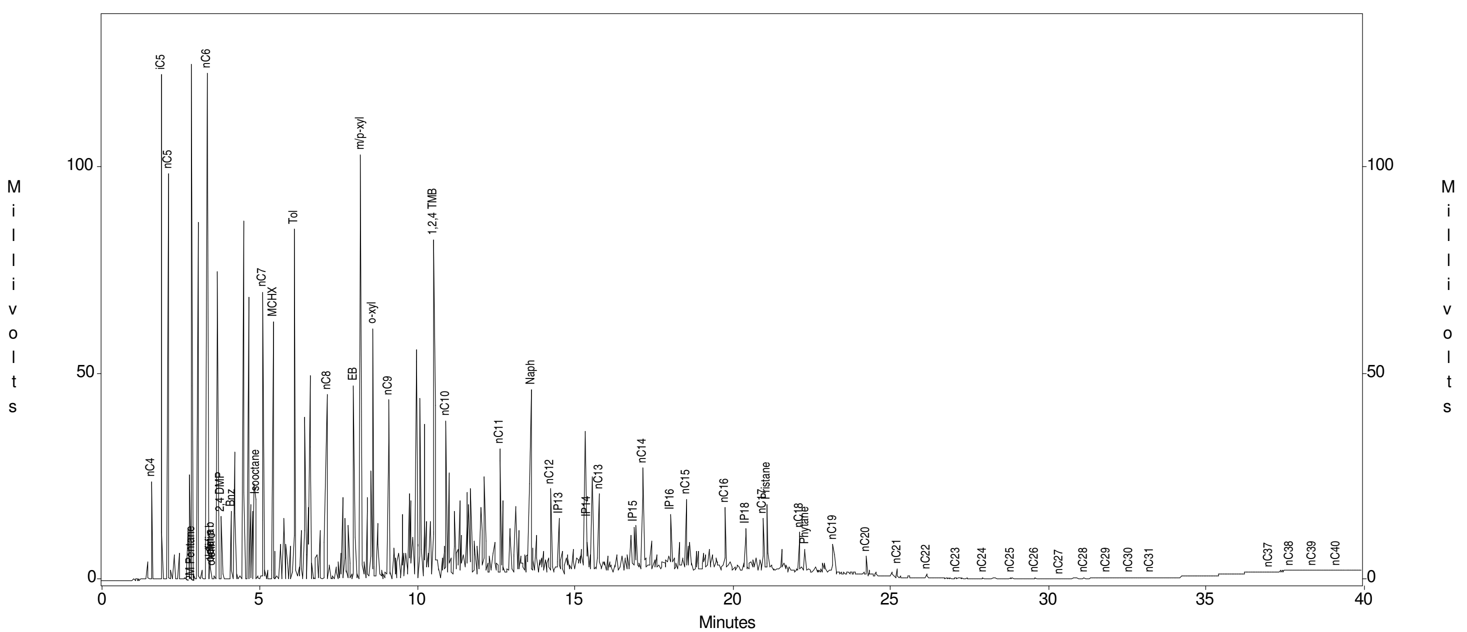
c:\ezchrom\chrom\05054\s200 -- Channel A



c:\ezchrom\chrom\05054\s200 -- Channel A



c:\ezchrom\chrom\05054\s200 -- Channel A

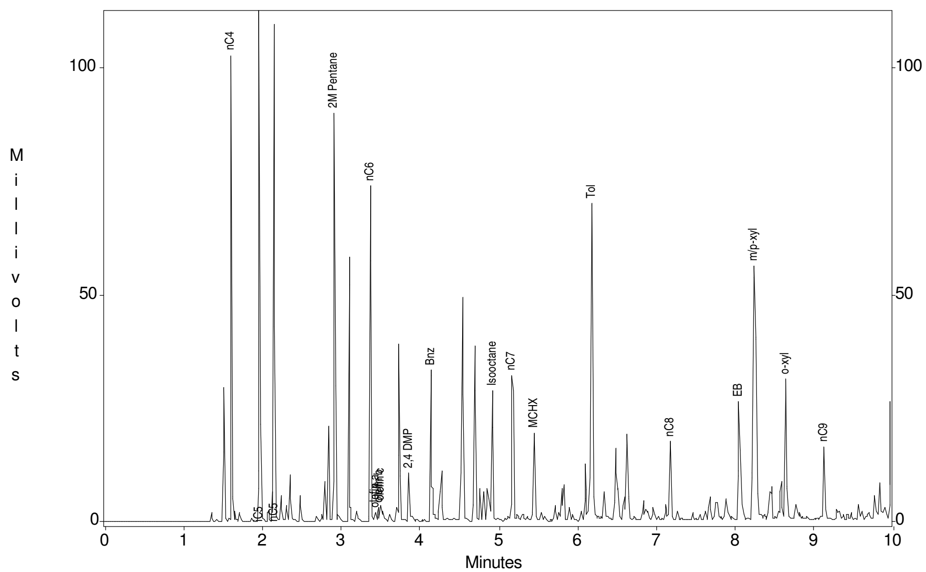


Channel A Results

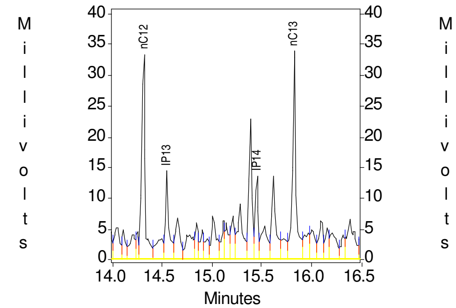
Peak	Area	Height
nC4	16094	23632
iC5	91867	122447
nC5	77629	98267
MTBE	0	0
2M Pentane	121485	124853
nC6	136260	122849
olefin a	3729	3198
olefin b	5525	4796
olefin c	3834	2320
2,4 DMP	17005	15364
Bnz	24234	16753
Isooctane	23458	19688
nC7	96123	69846
MCHX	85197	62395
Tol	128873	84891
nC8	61885	44711
EB	76024	46895
m/p-xyl	317056	102873
o-xyl	107360	60808
nC9	76170	43414
1,2,4 TMB	196559	82409
nC10	66263	38390
nC11	68489	31827
Naph	114598	46216
nC12	50728	21971
IP13	54349	14767
IP14	23915	13977
nC13	58441	20836
IP15	25198	12872
nC14	59443	27047
IP16	36665	15429
nC15	63031	19457
nC16	65512	17290
IP18	61249	12308
nC17	43221	14781
Pristane	69846	18152
nC18	49528	11390
Phytane	28371	7322
nC19	44870	8358
nC20	13731	5358
nC21	11620	2633
nC22	3027	1188
nC23	1747	517
nC24	626	249
nC25	418	134
nC26	581	107
nC27	216	58
nC28	235	51
nC29	80	32
nC30	230	34
nC31	255	25
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	1371	20
nC38	247	40
nC39	31	16
nC40	50	14

Sun - Philadelphia Refinery
Sample ID : S201-LNAPL-042005
Acquired : Apr 26, 2005 15:10:11

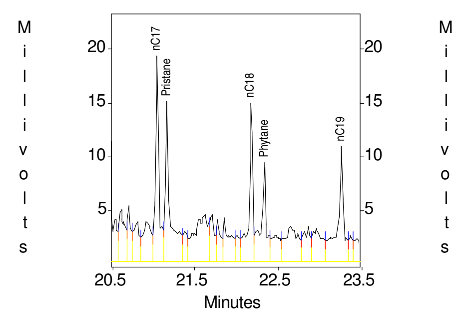
c:\ezchrom\chrom\05054\s201 -- Channel A



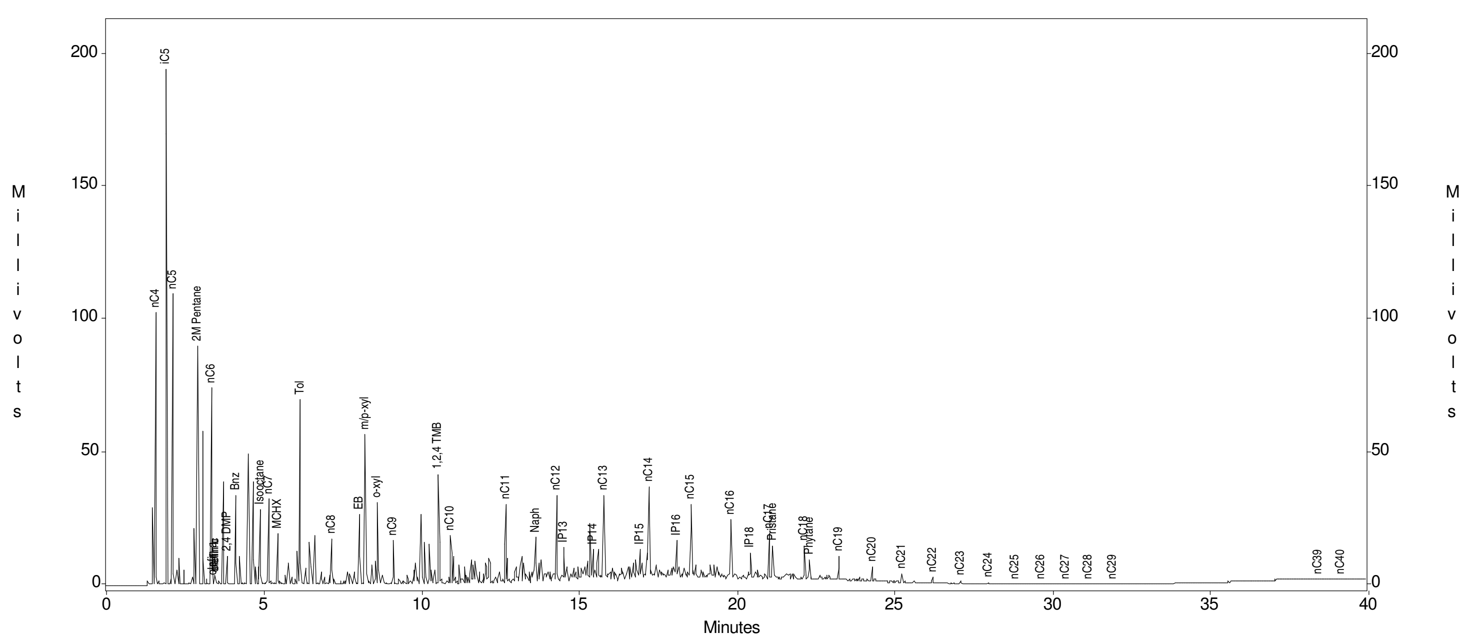
c:\ezchrom\chrom\05054\s201 -- Channel A



c:\ezchrom\chrom\05054\s201 -- Channel A



c:\ezchrom\chrom\05054\s201 -- Channel A

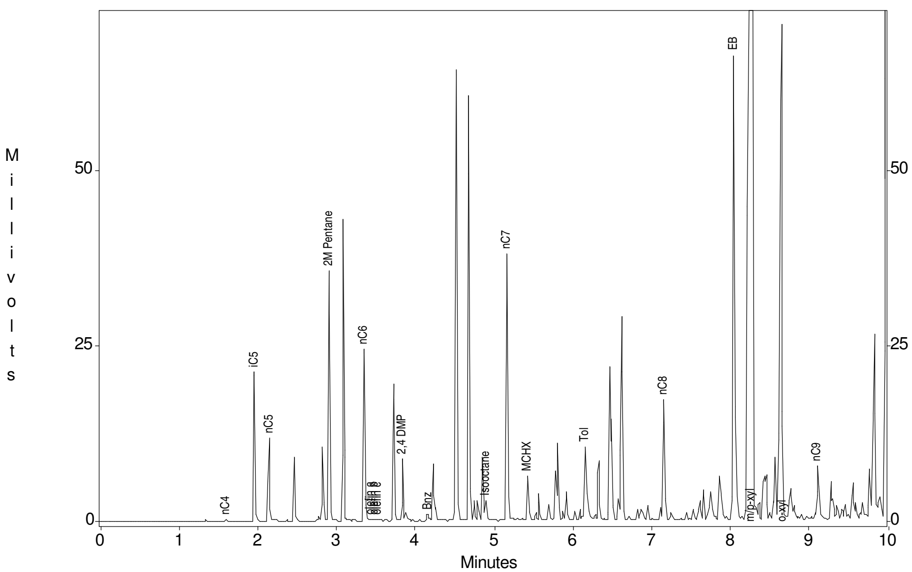


Channel A Results

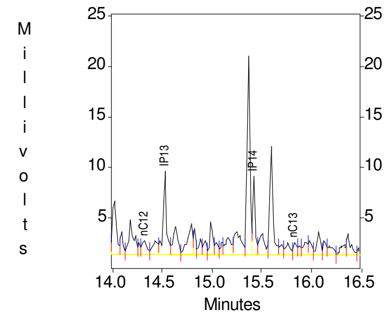
Peak	Area	Height
nC4	68792	102692
iC5	143867	193951
nC5	87884	109676
MTBE	0	0
2M Pentane	85546	90001
nC6	75128	74038
olefin a	2111	1846
olefin b	3942	3141
olefin c	4020	3521
2,4 DMP	11817	10555
Bnz	44718	33420
Isooctane	34262	28657
nC7	41504	32134
MCHX	25788	19423
Tol	105969	69952
nC8	22589	17270
EB	43298	26367
m/p-xyl	140769	56192
o-xyl	49082	31075
nC9	25181	16387
1,2,4 TMB	74115	41736
nC10	28657	18756
nC11	56326	30255
Naph	61462	17868
nC12	71983	33352
IP13	33811	14260
IP14	24419	13340
nC13	83454	33833
IP15	26663	13533
nC14	76434	37111
IP16	44752	16669
nC15	87372	30605
nC16	80114	24201
IP18	63981	12207
nC17	51179	19052
Pristane	63474	14796
nC18	46824	14724
Phytane	42353	9107
nC19	49739	10672
nC20	18390	6889
nC21	11344	4196
nC22	6343	2441
nC23	4992	1246
nC24	1626	590
nC25	1236	253
nC26	509	139
nC27	180	65
nC28	140	41
nC29	182	20
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	22	14
nC40	189	31

Sun - Philadelphia Refinery
Sample ID : S205-LNAPL-042005
Acquired : Apr 25, 2005 17:38:08

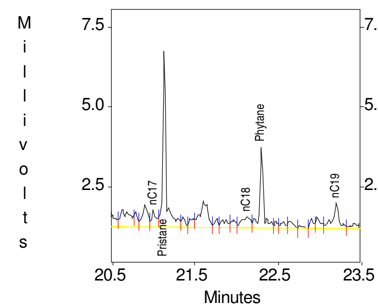
c:\ezchrom\chrom\05054\s205.2 -- Channel A



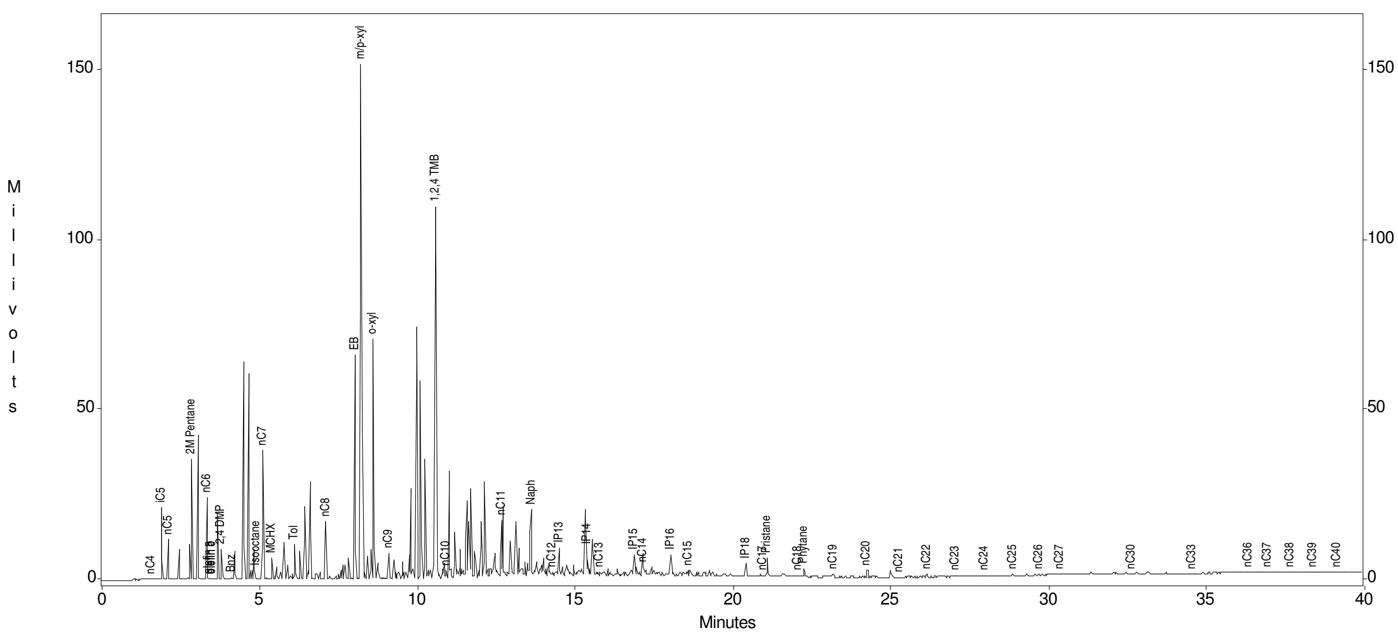
c:\ezchrom\chrom\05054\s205.2 -- Channel A



c:\ezchrom\chrom\05054\s205.2 -- Channel A



c:\ezchrom\chrom\05054\s205.2 -- Channel A



Channel A Results

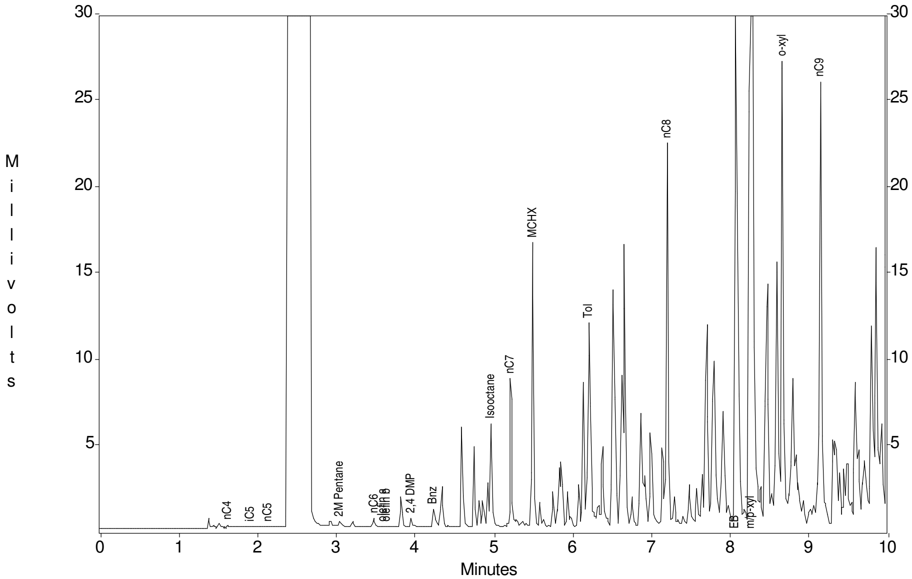
Peak	Area	Height
nC4	204	253
iC5	16906	21225
nC5	11104	11895
MTBE	0	0
2M Pentane	34500	35496
nC6	25682	24268
olefin a	153	100
olefin b	170	115
olefin c	299	240
2,4 DMP	9544	8853
Bnz	1711	901
Isooctane	4048	2865
nC7	45624	38063
MCHX	8580	6248
Tol	19741	10392
nC8	22260	17140
EB	109573	65993
m/p-xyl	496002	151358
o-xyl	125750	70567
nC9	16041	7812
1,2,4 TMB	284981	109548
nC10	6043	2257
nC11	28798	16591
Naph	44906	19685
nC12	4503	1445
IP13	20152	8378
IP14	12613	7765
nC13	3056	1260
IP15	11100	6527
nC14	6947	2561
IP16	17804	6161
nC15	3758	1681
nC16	0	0
IP18	11724	3711
nC17	1953	589
Pristane	16037	5499
nC18	2607	396
Phytane	7675	2560
nC19	4351	853
nC20	5036	2140
nC21	780	112
nC22	1751	697
nC23	279	61
nC24	1439	248
nC25	2842	298
nC26	829	218
nC27	825	165
nC28	0	0
nC29	0	0
nC30	378	108
nC31	0	0
nC32	0	0
nC33	371	116
nC34	0	0
nC35	0	0
nC36	21	21
nC37	28	11
nC38	137	24
nC39	34	8
nC40	48	22

Sun - Philadelphia Refinery

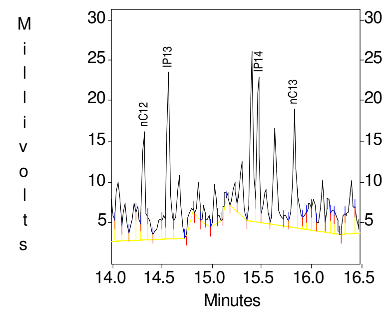
Sample ID : S208-LNAPL-042005

Acquired : Apr 26, 2005 16:47:57

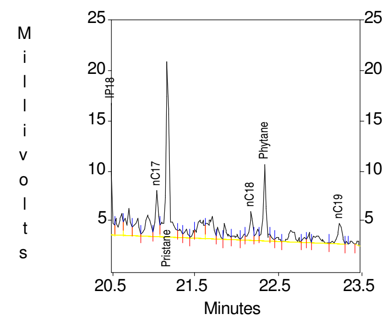
c:\ezchrom\chrom\05054\s208.s -- Channel A



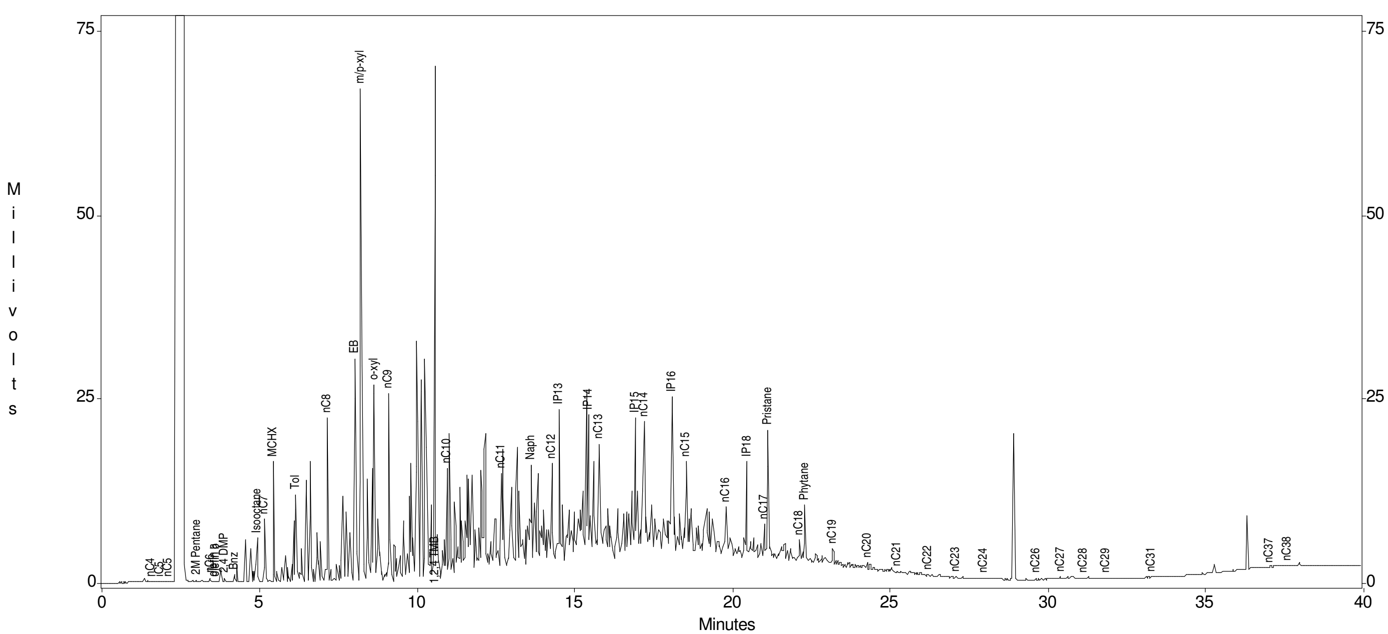
c:\ezchrom\chrom\05054\s208.s -- Channel A



c:\ezchrom\chrom\05054\s208.s -- Channel A



c:\ezchrom\chrom\05054\s208.s -- Channel A

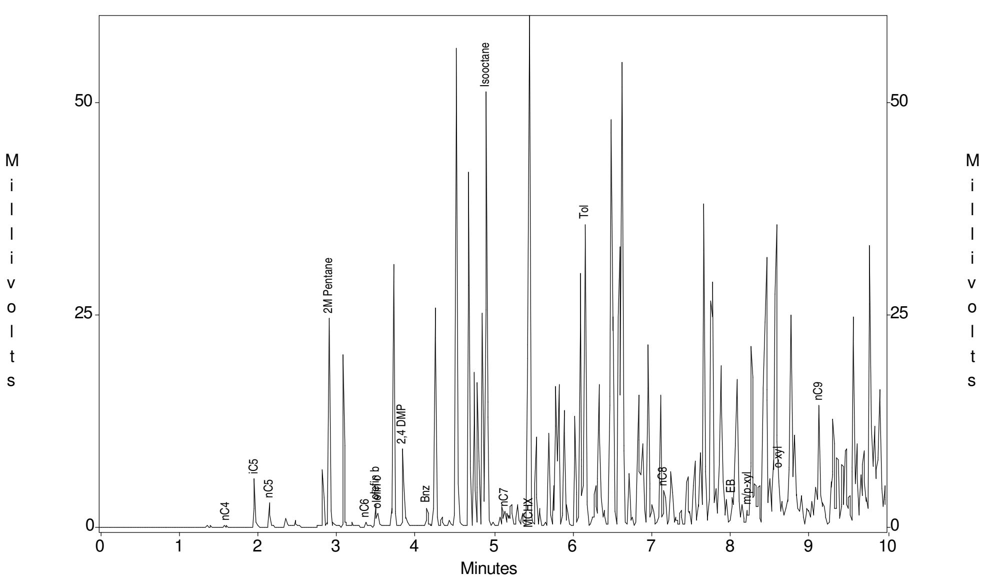


Channel A Results

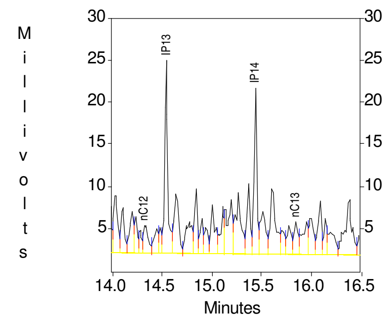
Peak	Area	Height
nC4	174	119
iC5	20	10
nC5	30	14
MTBE	0	0
2M Pentane	522	227
nC6	914	490
olefin a	34	22
olefin b	131	43
olefin c	0	0
2,4 DMP	757	483
Bnz	2122	1034
Isooctane	9321	5918
nC7	13670	8542
MCHX	25149	16442
Tol	23584	11792
nC8	36187	22166
EB	54597	30320
m/p-xyl	193165	66902
o-xyl	52529	26770
nC9	47366	25594
1,2,4 TMB	157499	69554
nC10	28645	14798
nC11	39542	12935
Naph	45490	13611
nC12	28900	13467
IP13	46827	20611
IP14	30669	17915
nC13	33488	14700
IP15	34292	18450
nC14	44519	17659
IP16	47906	20613
nC15	22023	11159
nC16	22629	6481
IP18	32847	13050
nC17	11022	4633
Pristane	49324	17595
nC18	8214	2891
Phytane	18197	7653
nC19	8044	2056
nC20	2505	1038
nC21	1048	359
nC22	668	275
nC23	643	154
nC24	256	132
nC25	0	0
nC26	218	98
nC27	1501	315
nC28	1315	183
nC29	129	34
nC30	0	0
nC31	361	35
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	122	31
nC38	318	21
nC39	0	0
nC40	0	0

Sun - Philadelphia Refinery
Sample ID : S213-LNAPL-042005
Acquired : Apr 25, 2005 14:19:36

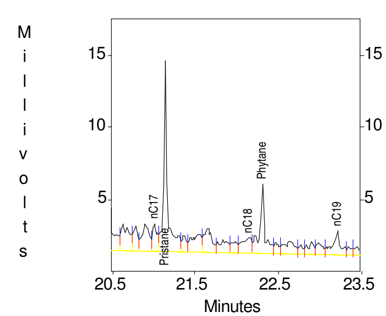
c:\ezchrom\chrom\05054\s213 -- Channel A



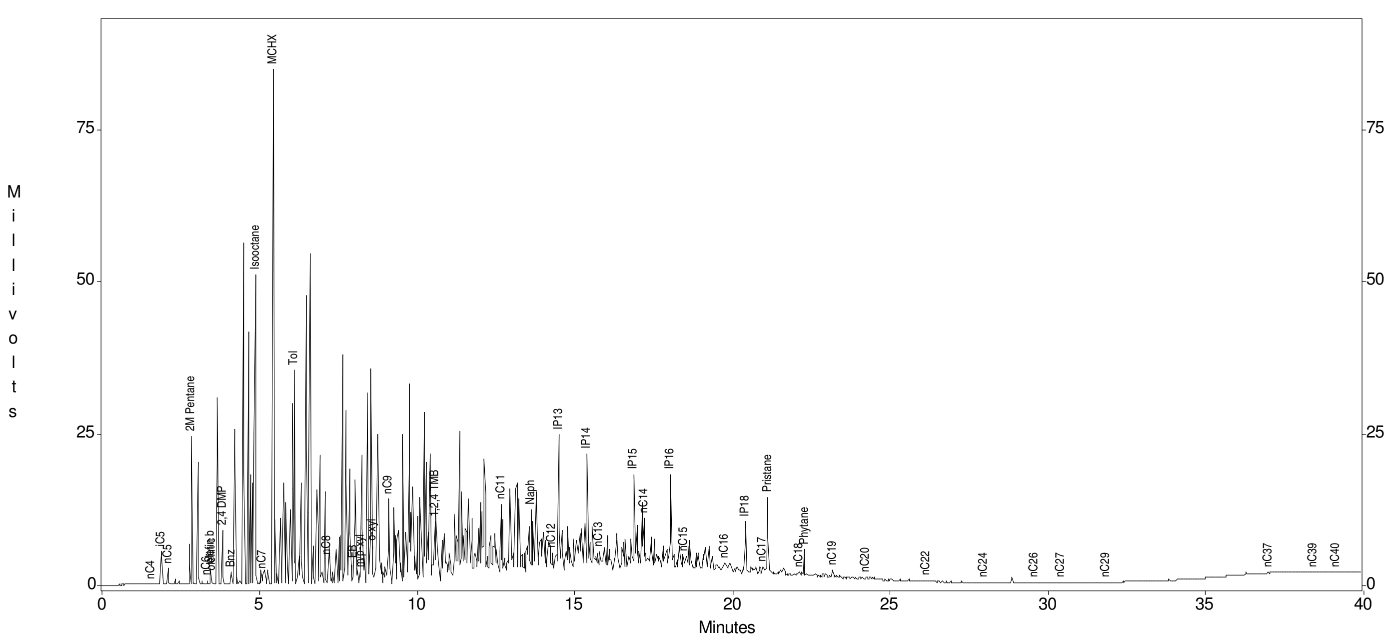
c:\ezchrom\chrom\05054\s213 -- Channel A



c:\ezchrom\chrom\05054\s213 -- Channel A



c:\ezchrom\chrom\05054\s213 -- Channel A



Channel A Results

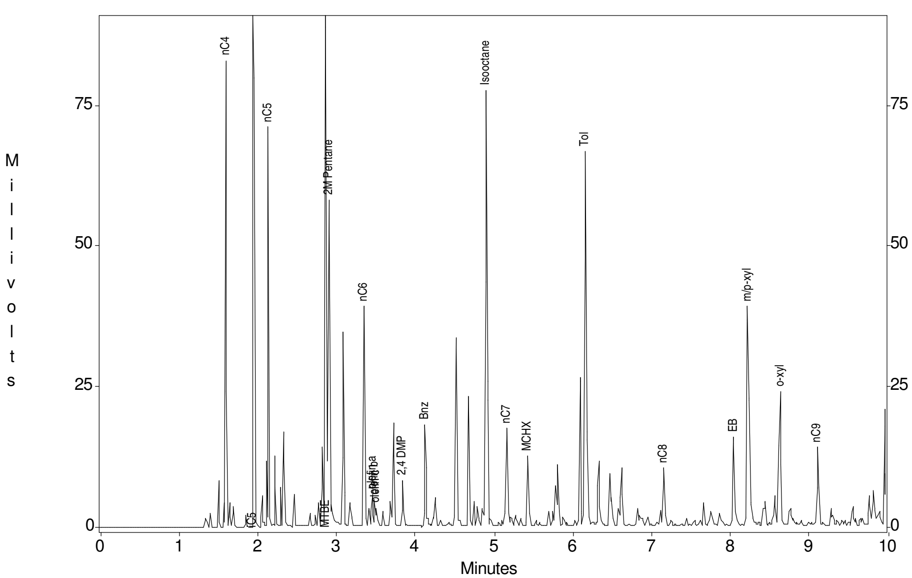
Peak	Area	Height
nC4	94	106
iC5	4592	5561
nC5	2791	2721
MTBE	0	0
2M Pentane	24136	24521
nC6	866	570
olefin a	0	0
olefin b	2886	2570
olefin c	2582	1541
2,4 DMP	10333	9088
Bnz	3686	2190
Isooctane	63352	51067
nC7	2321	1640
MCHX	125047	84842
Tol	47929	35344
nC8	6218	4005
EB	5604	3322
m/p-xyl	3034	1795
o-xyl	7513	6101
nC9	32049	13986
1,2,4 TMB	28623	9748
nC10	0	0
nC11	21032	11341
Naph	21025	10434
nC12	11633	3350
IP13	47928	23076
IP14	35852	19873
nC13	10652	3995
IP15	31192	16605
nC14	24150	9564
IP16	50710	16679
nC15	19279	3257
nC16	24288	2354
IP18	36379	9287
nC17	7271	1876
Pristane	43616	13342
nC18	8340	1081
Phytane	19781	4826
nC19	10329	1609
nC20	2502	451
nC21	0	0
nC22	274	59
nC23	0	0
nC24	499	52
nC25	0	0
nC26	216	71
nC27	234	58
nC28	0	0
nC29	455	51
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	103	28
nC38	0	0
nC39	71	31
nC40	112	29

Sun - Philadelphia Refinery

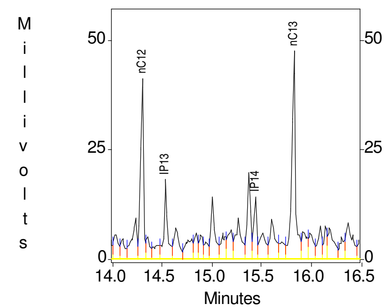
Sample ID : Gas/Dies/Wax std

Acquired : Apr 25, 2005 11:00:43

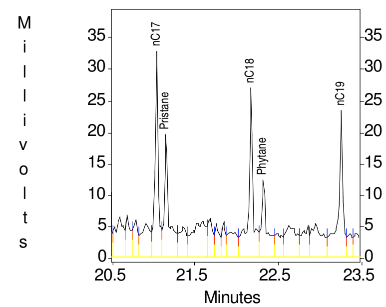
c:\ezchrom\chrom\05054\gadiwax2 -- Channel A



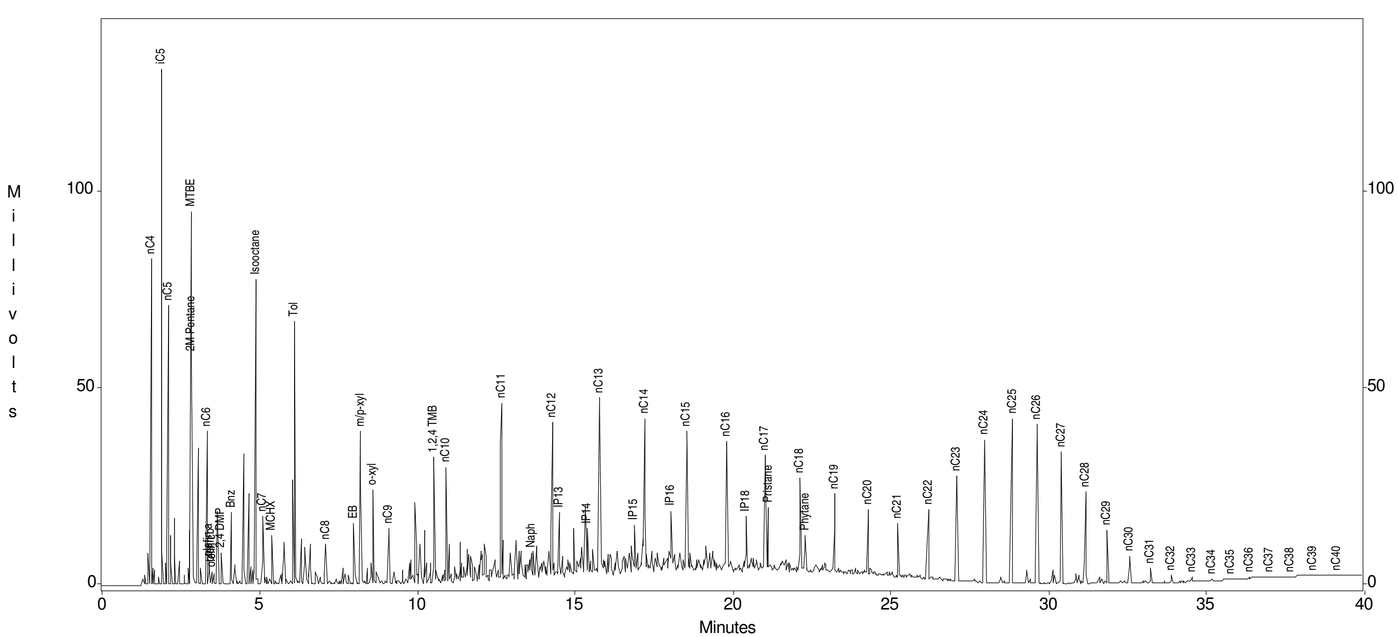
c:\ezchrom\chrom\05054\gadiwax2 -- Channel A



c:\ezchrom\chrom\05054\gadiwax2 -- Channel A



c:\ezchrom\chrom\05054\gadiwax2 -- Channel A

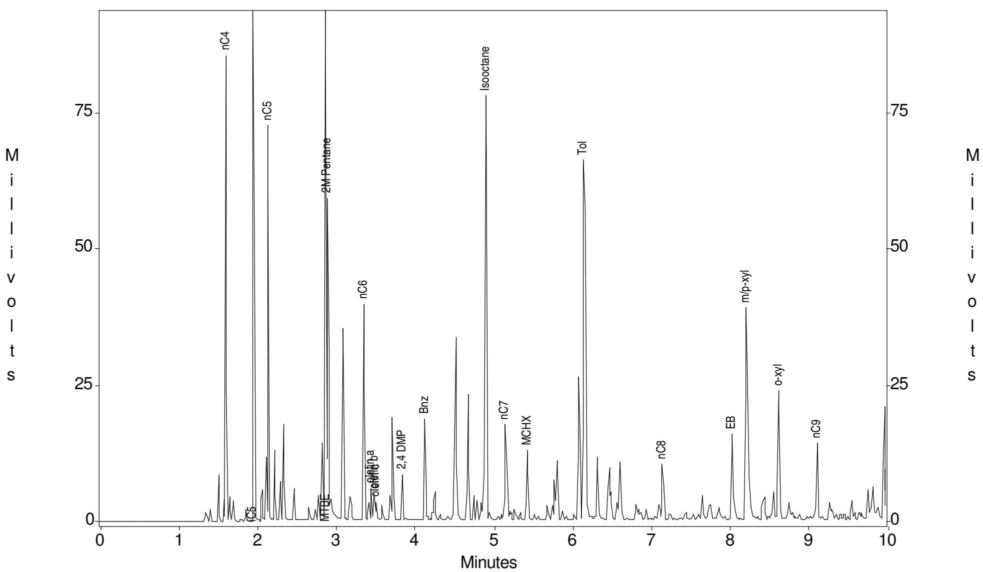


Channel A Results

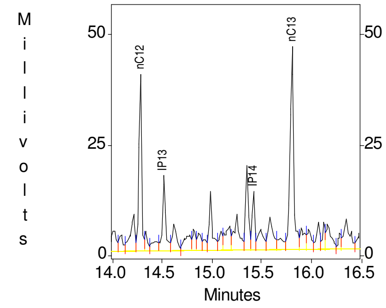
Peak	Area	Height
nC4	52712	82761
iC5	94084	131011
nC5	54568	71060
MTBE	82655	95046
2M Pentane	58774	58171
nC6	38824	39111
olefin a	6742	5840
olefin b	5214	4757
olefin c	4416	3160
2,4 DMP	8961	8315
Bnz	25452	18232
Isooctane	104367	77711
nC7	22494	17473
MCHX	17140	12448
Tol	97052	66784
nC8	13511	10241
EB	26743	15774
m/p-xyl	86073	39006
o-xyl	37782	23980
nC9	21437	14073
1,2,4 TMB	58401	32456
nC10	46420	29528
nC11	84142	46151
Naph	26657	8023
nC12	78431	41082
IP13	46228	18036
IP14	27609	14349
nC13	118993	47537
IP15	58525	15083
nC14	94325	42255
IP16	42113	18718
nC15	108937	39145
nC16	122429	36447
IP18	48206	17030
nC17	87727	32674
Pristane	76104	19285
nC18	101016	26820
Phytane	55545	12309
nC19	89924	23110
nC20	47803	18726
nC21	54916	15553
nC22	40896	18918
nC23	59034	27401
nC24	91857	36738
nC25	105012	41788
nC26	105659	40667
nC27	79570	33417
nC28	49673	23146
nC29	28543	13552
nC30	14195	6831
nC31	7309	3492
nC32	3575	1865
nC33	1869	963
nC34	1049	552
nC35	543	284
nC36	341	147
nC37	677	86
nC38	248	53
nC39	134	36
nC40	140	35

Sun - Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
Acquired : Apr 26, 2005 13:31:55

c:\ezchrom\chrom\05054\gadiwax.2 -- Channel A



c:\ezchrom\chrom\05054\gadiwax.2 -- Channel A



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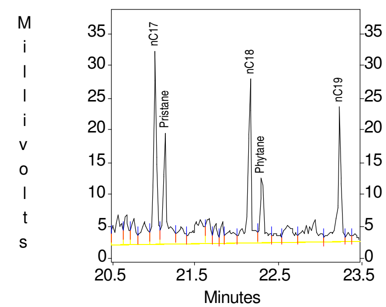
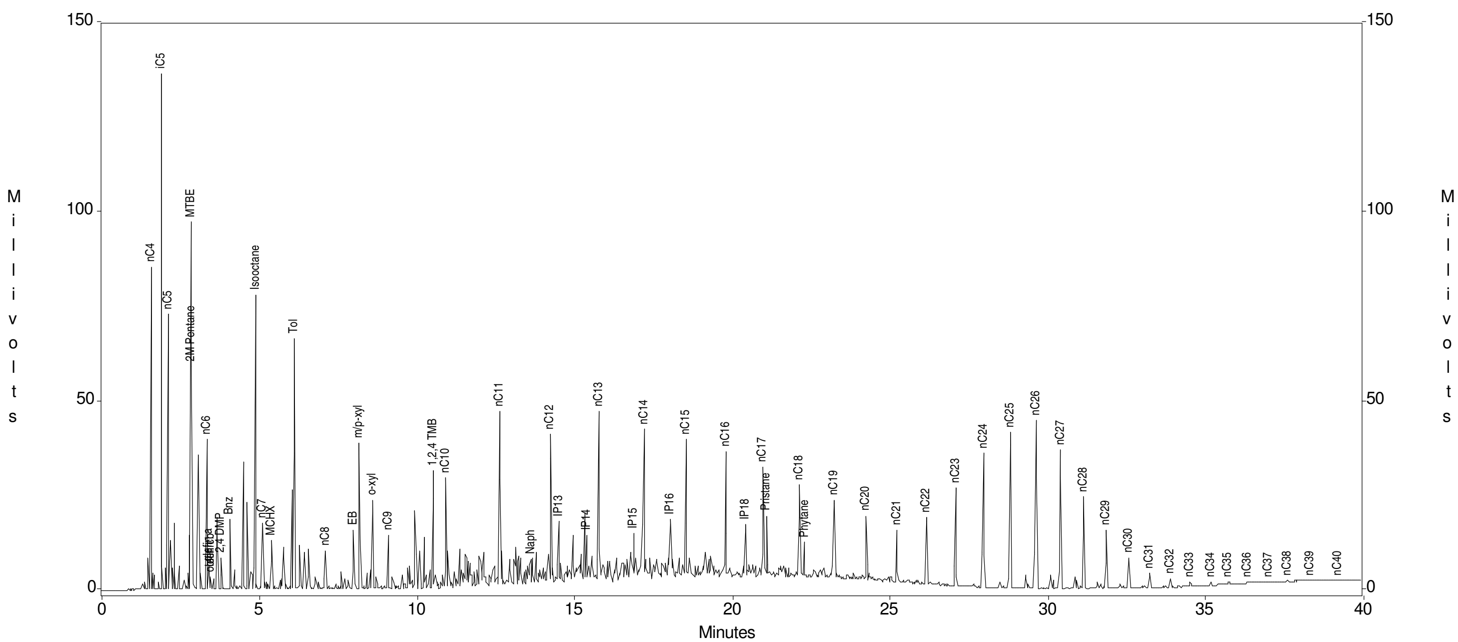


c:\ezchrom\chrom\05054\gadiwax.2 -- Channel A



Channel A Results

Peak	Area	Height
nC4	53084	85426
iC5	95817	136245
nC5	55893	72926
MTBE	85734	97515
2M Pentane	59383	59281
nC6	39608	39784
olefin a	6897	5973
olefin b	5292	4883
olefin c	4618	3278
2,4 DMP	9213	8629
Bnz	26172	18623
Isooctane	105503	78057
nC7	22798	17641
MCHX	17693	12823
Tol	96494	66386
nC8	13752	10396
EB	26529	15612
m/p-xyl	84051	38909
o-xyl	36817	23669
nC9	21189	14199
1,2,4 TMB	54943	31131
nC10	44584	29262
nC11	79918	46298
Naph	22170	6892
nC12	73338	39882
IP13	38492	16965
IP14	23623	13275
nC13	106713	45994
IP15	47725	13441
nC14	87170	40892
IP16	36490	16857
nC15	93901	38074
nC16	100974	34524
IP18	37357	15030
nC17	72725	29974
Pristane	52776	17091
nC18	68286	25333
Phytane	30874	9955
nC19	56538	20896
nC20	29938	16591
nC21	28896	13911
nC22	33440	17715
nC23	54953	25864
nC24	86914	35299
nC25	106002	41117
nC26	111313	44296
nC27	86445	36681
nC28	55291	24341
nC29	32329	15374
nC30	16254	8048
nC31	8376	3932
nC32	4202	2234
nC33	2232	1172
nC34	1267	636
nC35	733	343
nC36	453	184
nC37	252	104
nC38	254	66
nC39	98	35
nC40	32	20

Analysis Request/ Environmental Services Chain of Custody

Acct. #: ________ Sample #: ________

Client: AQUATERRA/LANCAN | Acct. #:
Project Name/#: Sun - Philly Refinery AOI-4 | PWSID #:
Project Manager: K. Martin / J. Hanna | P.O; #:
Sampler: M. Brad Spancake | Quote #:
Name of State where samples were collected: PA

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water (Potable / NPDES)	Other	Total # of Containers	CC Fingerprint										Remarks	Temperature of samples upon receipt (if applicable)
S217-LNAPL-042705	4/27/05	1245	X				X	1											Swab	
S220-LNAPL-042705	↓	1300	X				X	1											Swab	
S221-LNAPL-042705	↓	1315	X				X	1											Swab	

For Lab Use Only
FSC:
SCR:

Turnaround Time Requested (TAT) (please Ccircle): (Normal) Rush 5 DAY TAT
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.
Date results are needed: ____________
Rush results requested by (please circle): Phone Fax
Phone #: ____________ Fax #: ____________

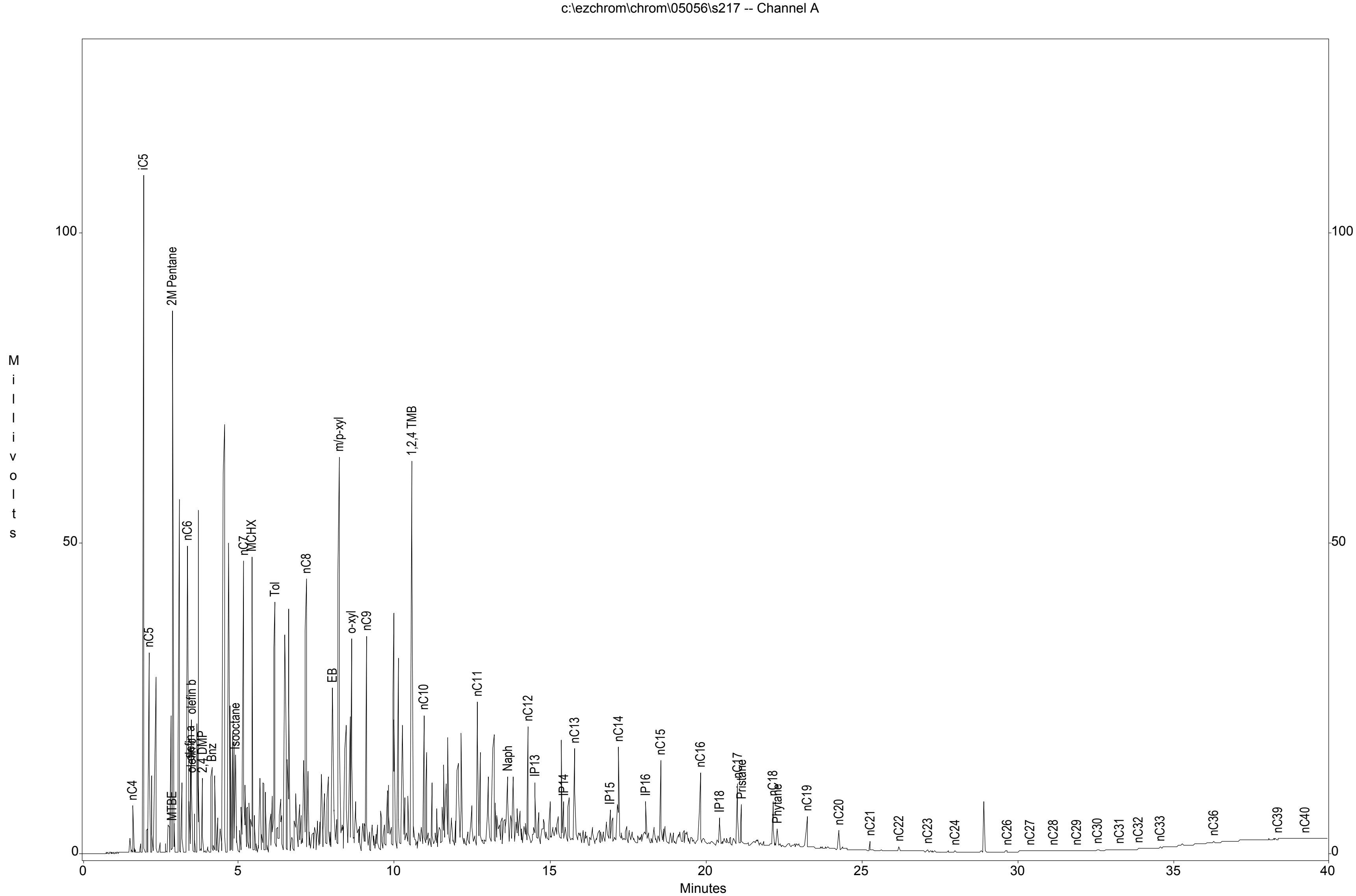
SDG Complete? (Yes) No

State-specific QC required? Yes (No)
(If yes, indicated QC sample and submit triplicate volume)
Internal Chain-of-Custody required? Yes (No)

Relinquished by:	Date	Time	Received by:	Date	Time
M. Brad Spancake	4/28/05		FedEx	4/28/05	
Relinquished by:	Date	Time	Received by: Bruce [illegible]	4/29/05	1000
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

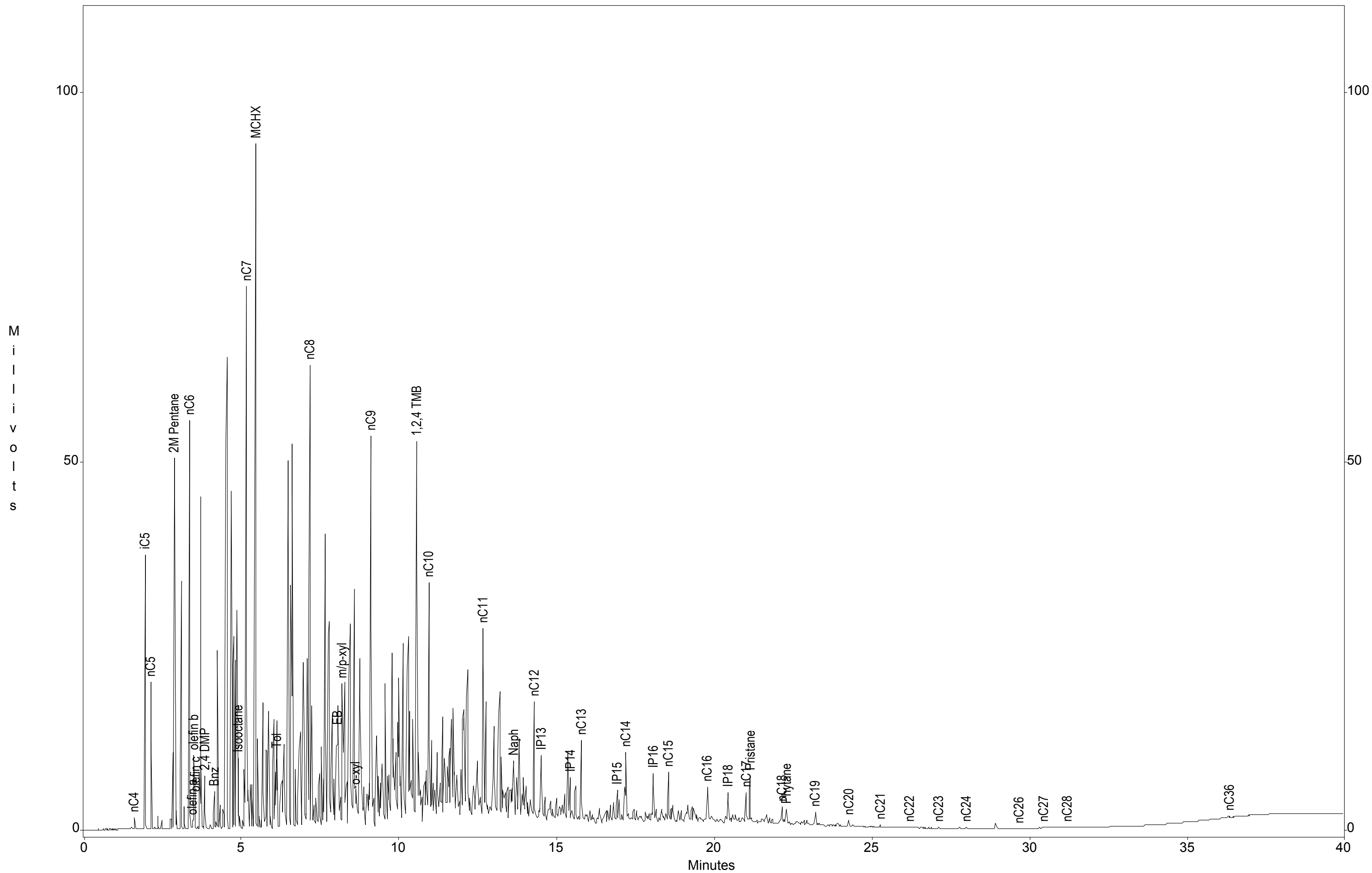
Sun - Philly Refinery AOI-4
Sample ID : S217-LNAPL-042705
Acquired : May 02, 2005 16:08:36

c:\ezchrom\chrom\05056\s217 -- Channel A

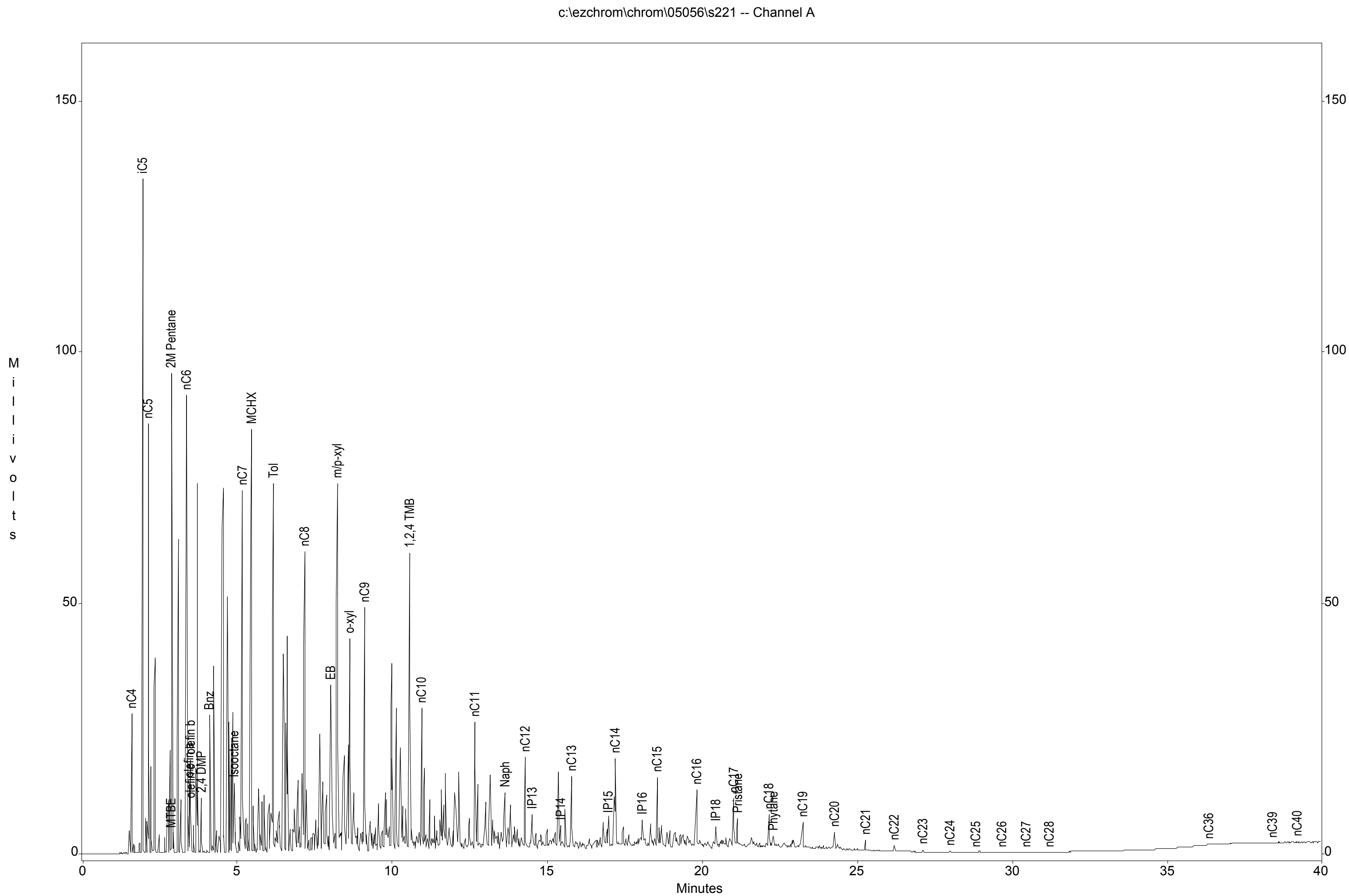


Sun - Philly Refinery AOI-4
Sample ID : S220-LNAPL-042705
Acquired : May 02, 2005 16:57:29

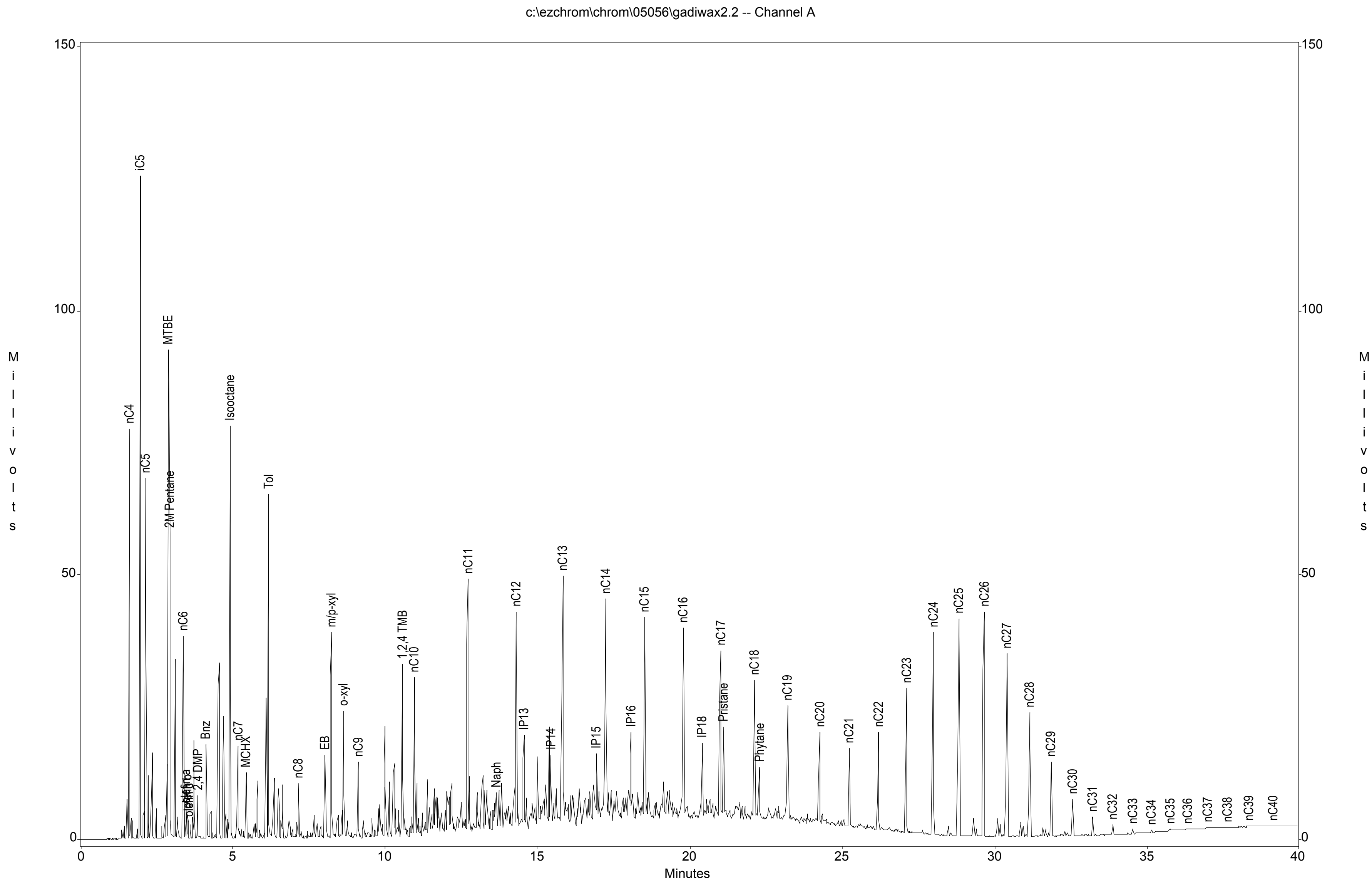
c:\ezchrom\chrom\05056\s220 -- Channel A



Sun - Philly Refinery AOI-4
Sample ID : S221-LNAPL-042705
Acquired : May 02, 2005 17:46:44



Sun - Philly Refinery AOI-4
Sample ID : Gas/Dies/Wax std
Acquired : May 02, 2005 14:22:33

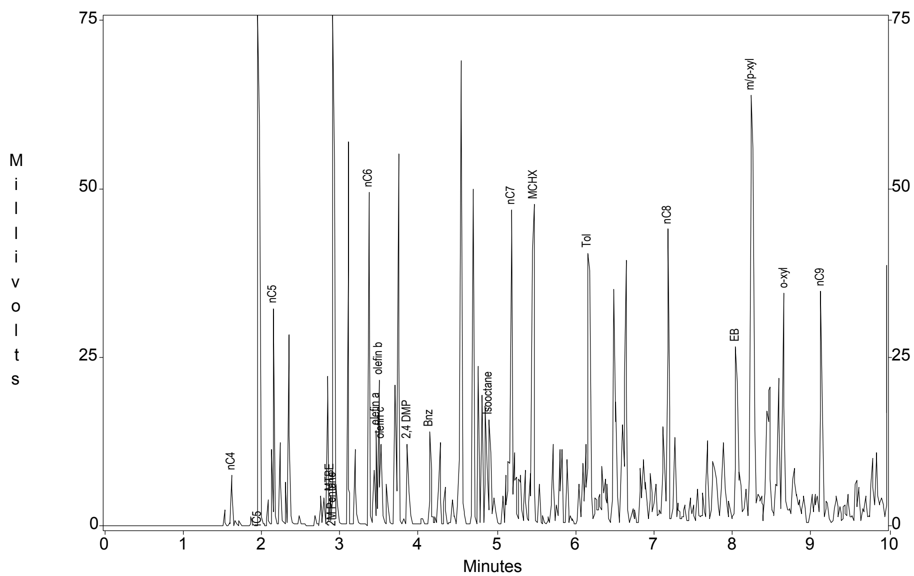


Sun - Philly Refinery AOI-4

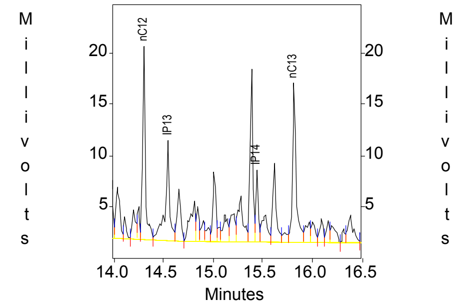
Sample ID : S217-LNAPL-042705

Acquired : May 02, 2005 16:08:36

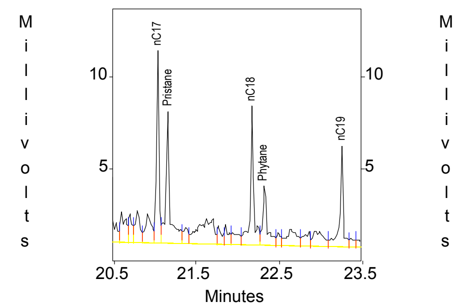
c:\ezchrom\chrom\05056\s217 -- Channel A



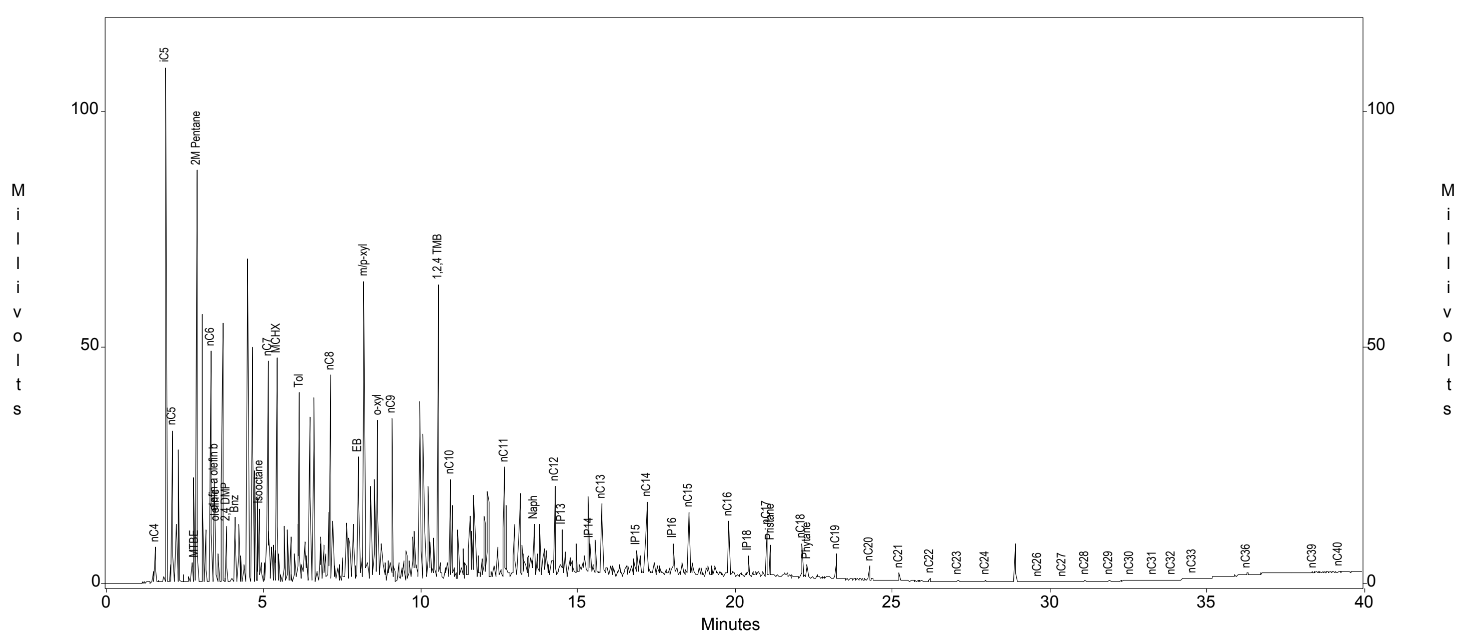
c:\ezchrom\chrom\05056\s217 -- Channel A



c:\ezchrom\chrom\05056\s217 -- Channel A



c:\ezchrom\chrom\05056\s217 -- Channel A



Channel A Results

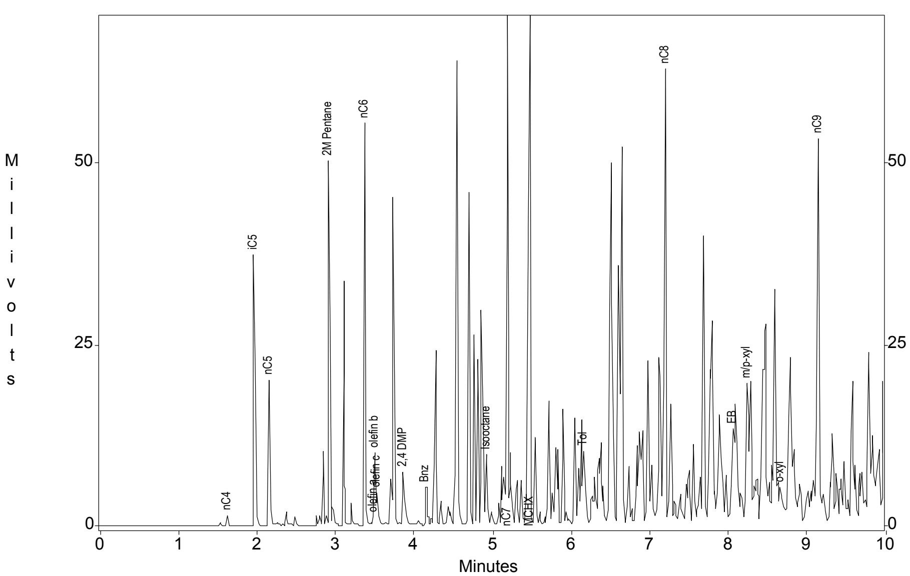
Peak	Area	Height
nC4	5312	7532
iC5	82090	109089
nC5	27278	32164
MTBE	4204	4150
2M Pentane	84575	87290
nC6	50401	49300
olefin a	16550	13968
olefin b	22085	21436
olefin c	15838	11970
2,4 DMP	18126	11964
Bnz	19761	13704
Isooctane	20030	15564
nC7	69278	46763
MCHX	65367	47425
Tol	61872	40276
nC8	62688	43837
EB	46202	26279
m/p-xyl	179497	63428
o-xyl	60130	34170
nC9	45218	33282
1,2,4 TMB	122565	62366
nC10	32246	21330
nC11	49061	23204
Naph	35610	10677
nC12	34941	18801
IP13	28502	9761
IP14	11489	6981
nC13	36794	15539
IP15	9717	5695
nC14	31797	15955
IP16	23711	7263
nC15	32583	13868
nC16	32137	12043
IP18	20323	4879
nC17	20303	10365
Pristane	25746	7049
nC18	21674	7495
Phytane	12041	3183
nC19	16412	5385
nC20	6995	3155
nC21	2885	1556
nC22	1387	777
nC23	711	353
nC24	464	199
nC25	0	0
nC26	206	94
nC27	801	138
nC28	887	120
nC29	136	57
nC30	373	101
nC31	100	48
nC32	271	60
nC33	213	44
nC34	0	0
nC35	0	0
nC36	768	222
nC37	0	0
nC38	0	0
nC39	80	21
nC40	58	22

Sun - Philly Refinery AOI-4

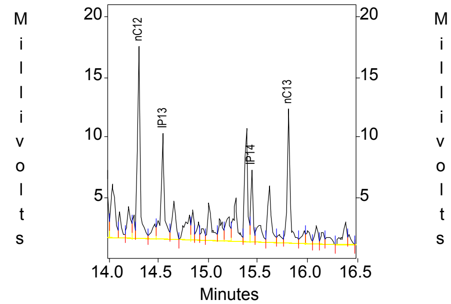
Sample ID : S220-LNAPL-042705

Acquired : May 02, 2005 16:57:29

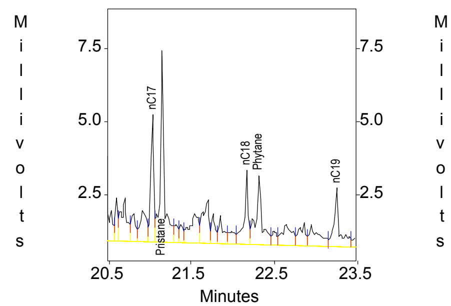
c:\ezchrom\chrom\05056\s220 -- Channel A



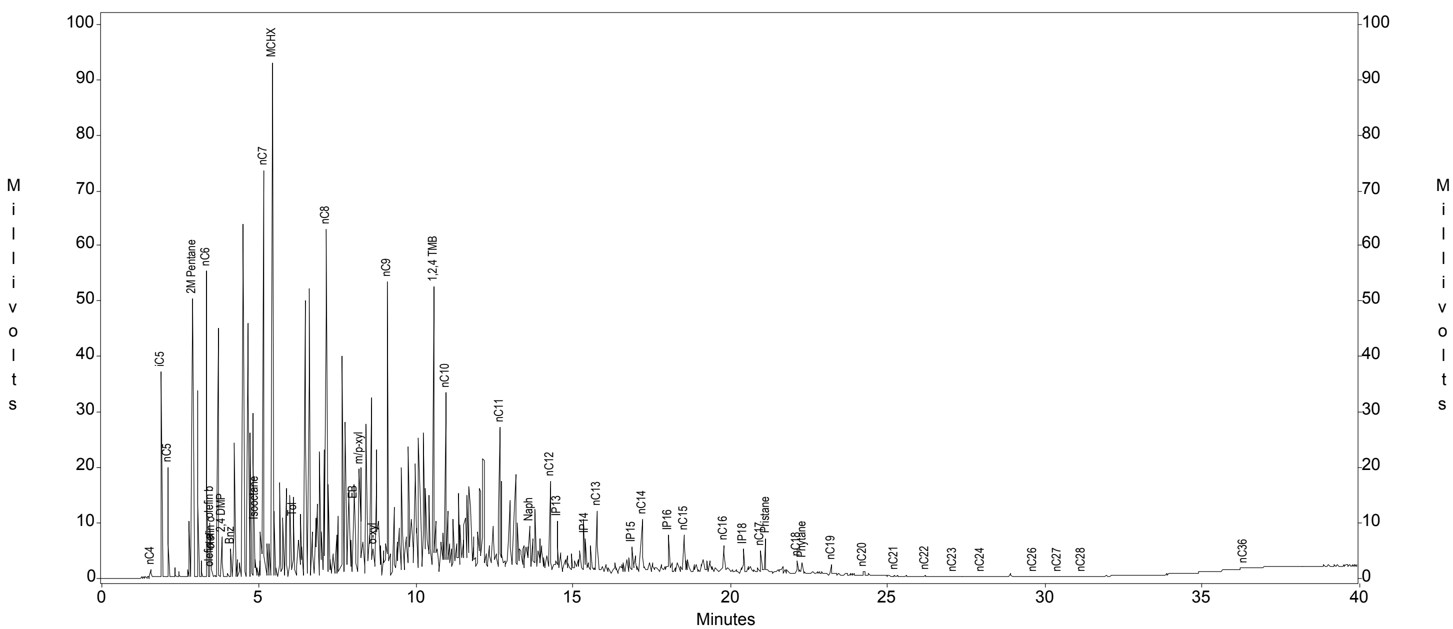
c:\ezchrom\chrom\05056\s220 -- Channel A



c:\ezchrom\chrom\05056\s220 -- Channel A



c:\ezchrom\chrom\05056\s220 -- Channel A



Channel A Results

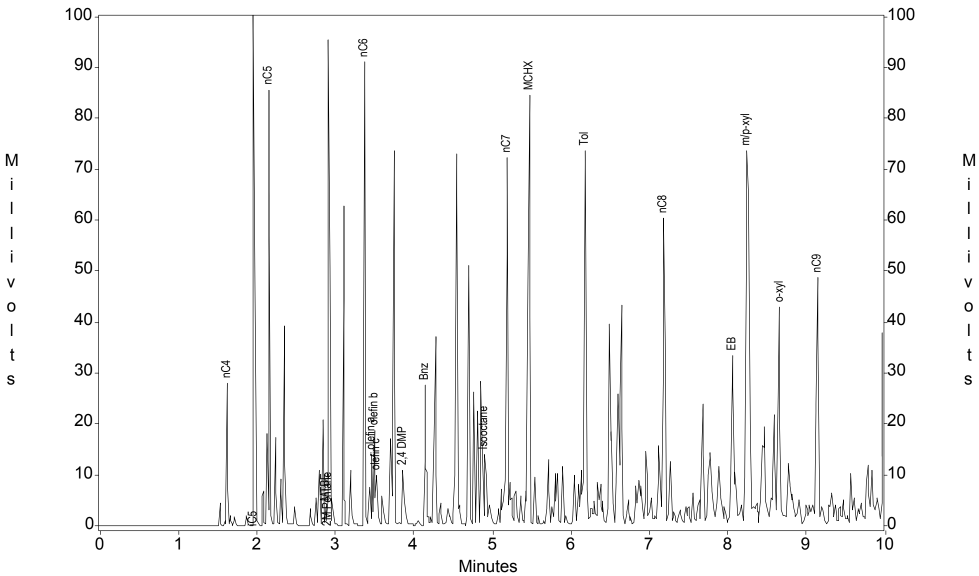
Peak	Area	Height
nC4	1242	1497
iC5	31355	37222
nC5	19617	19956
MTBE	0	0
2M Pentane	50132	50228
nC6	57807	55340
olefin a	477	1140
olefin b	11457	9898
olefin c	6832	4337
2,4 DMP	10742	7203
Bnz	8292	5120
Isooctane	12401	9633
nC7	106802	73182
MCHX	142408	92457
Tol	15282	9953
nC8	97846	62526
EB	28868	12969
m/p-xyl	28852	19252
o-xyl	15796	4838
nC9	86505	52845
1,2,4 TMB	104642	51476
nC10	54962	32146
nC11	52507	25375
Naph	22465	7741
nC12	28752	15938
IP13	20537	8776
IP14	9732	5943
nC13	21910	11117
IP15	8022	4572
nC14	20498	9576
IP16	18775	6939
nC15	19804	7041
nC16	18301	5101
IP18	19241	4459
nC17	9702	4377
Pristane	21090	6605
nC18	8400	2539
Phytane	11673	2345
nC19	9150	2003
nC20	2693	891
nC21	689	337
nC22	325	156
nC23	275	99
nC24	193	62
nC25	0	0
nC26	116	35
nC27	93	33
nC28	156	34
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	939	156
nC37	0	0
nC38	0	0
nC39	0	0
nC40	0	0

Sun - Philly Refinery AOI-4

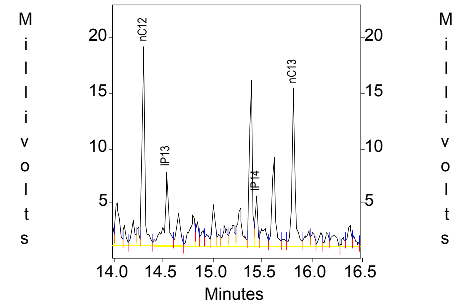
Sample ID : S221-LNAPL-042705

Acquired : May 02, 2005 17:46:44

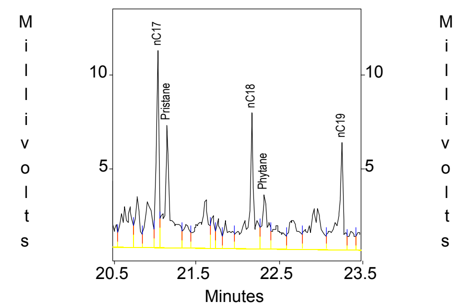
c:\ezchrom\chrom\05056\s221 -- Channel A



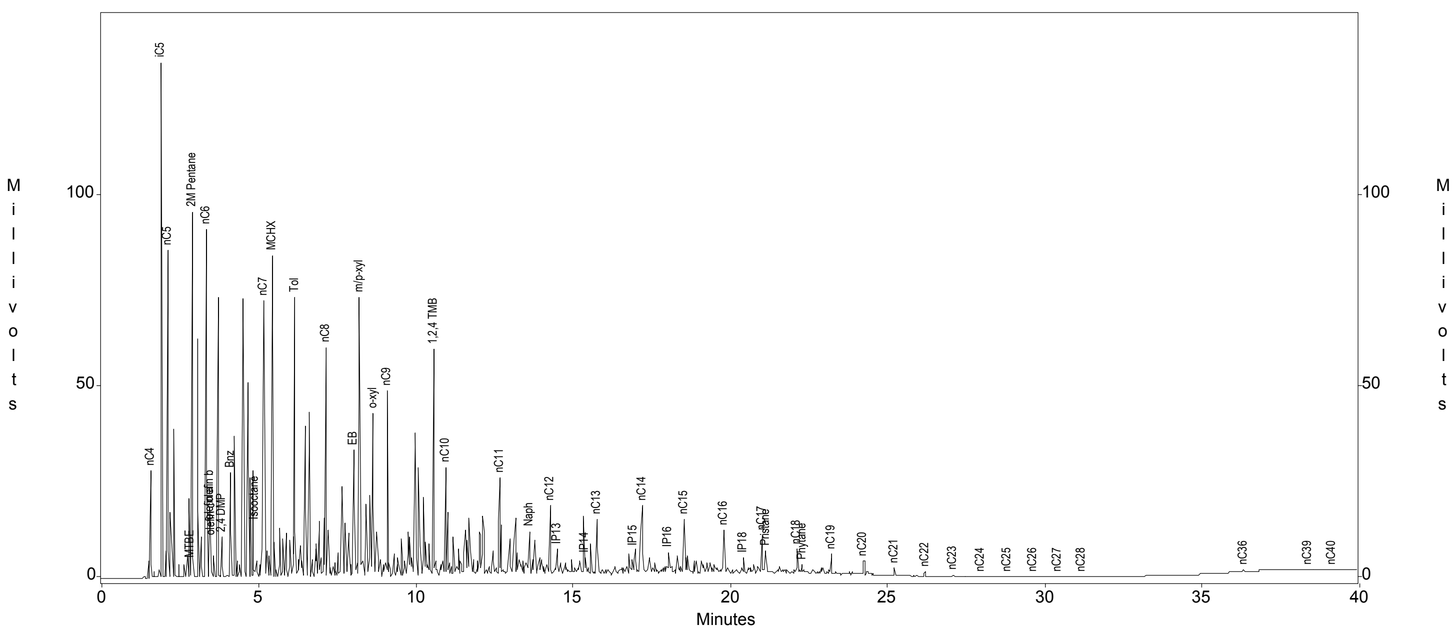
c:\ezchrom\chrom\05056\s221 -- Channel A



c:\ezchrom\chrom\05056\s221 -- Channel A



c:\ezchrom\chrom\05056\s221 -- Channel A



Channel A Results

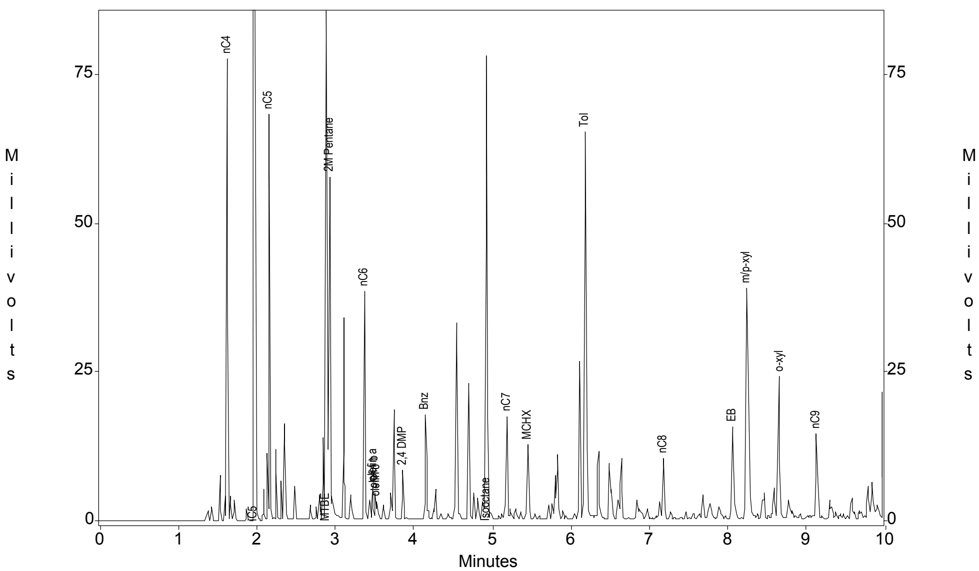
Peak	Area	Height
nC4	18763	27794
iC5	101329	134513
nC5	70101	85677
MTBE	3825	3802
2M Pentane	93345	95565
nC6	95802	91162
olefin a	16545	13924
olefin b	19489	18484
olefin c	13768	9801
2,4 DMP	16643	10825
Bnz	37603	27471
Isooctane	17580	13850
nC7	111999	72201
MCHX	126593	84259
Tol	111593	73397
nC8	90353	59968
EB	55919	33153
m/p-xyl	208252	73243
o-xyl	74740	42496
nC9	76850	48501
1,2,4 TMB	112799	58889
nC10	43515	27939
nC11	49443	25123
Naph	34112	11114
nC12	33028	18161
IP13	20516	6737
IP14	7621	4580
nC13	29187	14400
IP15	23983	6182
nC14	35704	18132
IP16	30489	5927
nC15	27158	14321
nC16	34465	11910
IP18	22392	4622
nC17	21621	10455
Pristane	30878	6428
nC18	30158	7193
Phytane	13121	2837
nC19	25197	5702
nC20	12964	3785
nC21	4972	2274
nC22	2599	1182
nC23	1038	450
nC24	479	174
nC25	198	69
nC26	143	43
nC27	99	31
nC28	106	22
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	1181	271
nC37	0	0
nC38	0	0
nC39	32	14
nC40	61	23

Sun - Philly Refinery AOI-4

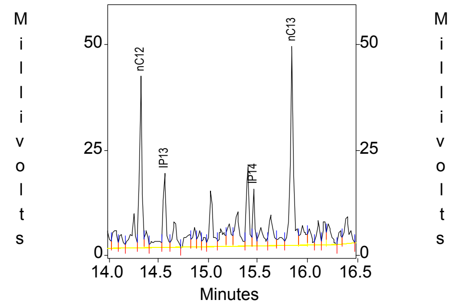
Sample ID : Gas/Dies/Wax std

Acquired : May 02, 2005 14:22:33

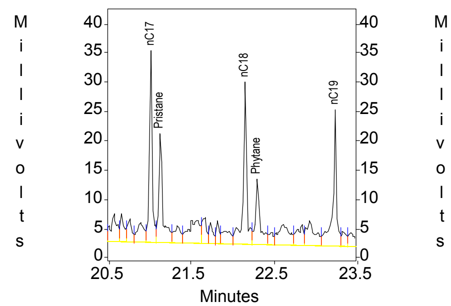
c:\ezchrom\chrom\05056\gadiwax2.2 -- Channel A



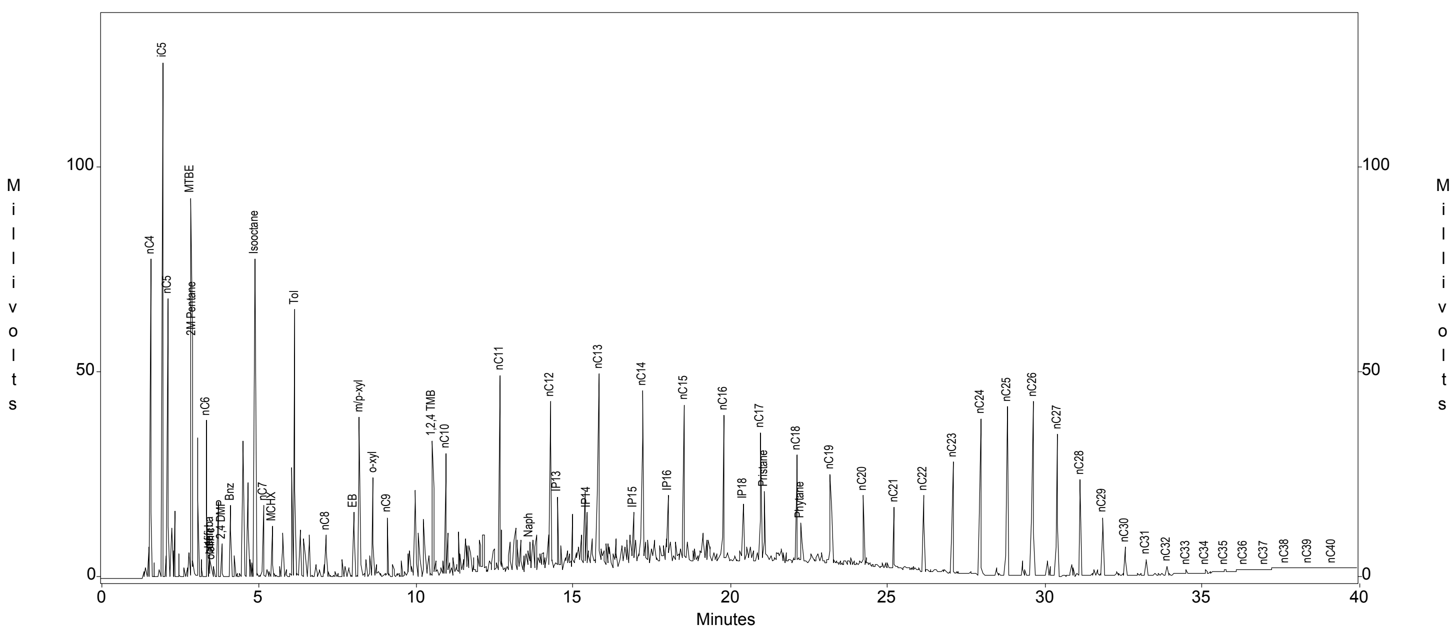
c:\ezchrom\chrom\05056\gadiwax2.2 -- Channel A



c:\ezchrom\chrom\05056\gadiwax2.2 -- Channel A



c:\ezchrom\chrom\05056\gadiwax2.2 -- Channel A



Channel A Results

Peak	Area	Height
nC4	50911	77665
iC5	92467	125502
nC5	53701	68026
MTBE	82102	92474
2M Pentane	58250	57758
nC6	38482	38353
olefin a	6616	5648
olefin b	5050	4575
olefin c	4401	3104
2,4 DMP	8901	8190
Bnz	25387	17698
Isooctane	104545	77906
nC7	22416	17428
MCHX	17182	12529
Tol	96080	65185
nC8	13479	10248
EB	26557	15600
m/p-xyl	59984	38981
o-xyl	37420	24035
nC9	21429	14237
1,2,4 TMB	57320	32734
nC10	46335	29893
nC11	83455	48070
Naph	21402	7152
nC12	76553	41198
IP13	34358	17917
IP14	23251	13757
nC13	109508	47554
IP15	15652	10901
nC14	86097	41533
IP16	34996	16847
nC15	81385	38795
nC16	97583	36860
IP18	40308	15471
nC17	77757	32889
Pristane	58572	18551
nC18	80146	27662
Phytane	39841	11245
nC19	73038	23201
nC20	41859	18379
nC21	39739	15674
nC22	37899	18771
nC23	59042	27380
nC24	90762	38208
nC25	108197	41028
nC26	110543	42472
nC27	83155	34660
nC28	51681	23452
nC29	29592	14097
nC30	14605	7049
nC31	7416	3609
nC32	3606	1797
nC33	1944	996
nC34	1064	517
nC35	581	284
nC36	794	145
nC37	491	78
nC38	160	50
nC39	127	36
nC40	124	26

Table F.1
LNAPL Characterization Summary Table
AOI-4
PES Faciltiy
Philadelphia, Pennsylvania

Interpretation of Product Types, Proportions, and Weathering

Characterization Results Compiled for CCR (TGI Job No. 04046 - Analyzed in March 2004)

Well ID	Density g/cc (60°F)	LNAPL Type(s)	Torkelson LNAPL Type(s)	Proportion (%)	Weathering	Fairly Similar To	Somewhat Similar To
S-103	0.7978	Gasoline	Avation Gasoline	70	Extreme		
		Middle Distillate	Middle Distillate	30	Extreme		
S-104	0.8787	Middle Distillate	Middle Distillate	100	Extreme		
S-124	0.8223	Light End Feed Stock	Coker Naphtha	40	High		
		Middle Distillate	Middle Distillate	60	Moderate		
S-29	0.8550	Middle Distillate	Middle Distillate	100	High		
S-32	0.8665	Middle Distillate	Middle Distillate	100	Severely		
S-33	0.8578	Gasoline	Gasoline	5	Extreme		
		Middle Distillate	Middle Distillate	95	Extreme		
S-56	0.8684	Gasoline	Gasoline	2	Extreme		
		Middle Distillate	Middle Distillate	98	Extreme		
S-97	0.8653	Middle Distillate	Middle Distillate	100	Severely		

Characterization Results Compiled for AOI 4 Site Characterization 2005
Interpretation of Product Type(s), Proportions and Weathering

Well ID	Density (gm/ml @ 60°F)	LNAPL Type(s)	Torkleson LNAPL Type(s)	Proportions (%)	Weathering	Fairly Similar To	Somewhat Similar To
S-35	0.8665	Middle Distillate	Middle Distillate	100	Extreme		
S-37	0.8639	Gasoline	Gasoline	2	Unknown		
		Middle Distillate	Middle Distillate	98	High		
S-57	0.8620	Middle Distillate	Middle Distillate	100	Extreme		
S-217	QNS	Gasoline and Light End Feed	Gasoline and Heavy Virgin Naptha	61	Slight		
		Middle Distillate	Middle Distillate	39	Slight		
S-220	QNS	Gasoline and Light End Feed	Gasoline and Heavy Virgin Naptha	70	Moderate		
		Middle Distillate	Middle Distillate	30	High		
S-221	QNS	Gasoline and Light End Feed	Gasoline and Heavy Virgin Naptha	67	Slight		
		Middle Distillate	Middle Distillate	33	Slight		

Characterization Results Compiled for AOI 4 Repackaged Site Characterization Remedial Investigations Report
Interpretation of Product Type(s), Proportions and Weathering

Well ID	Density (gm/ml @ 60°F)	LNAPL Type(s)	Torkleson LNAPL Type(s)	Proportions (%)	Weathering	Fairly Similar To	Somewhat Similar To
S-365	0.8158	Gasoline	Unknown Light Material	48	Unknown		
		Middle Distillate	Middle Distillate	52	Extreme	S-369	S-382
S-369	QNS	Middle Distillate	Middle Distillate	80	Extreme	S-365	S-382
		Alkylate	Alkylate	20	Unknown		S-360 and S-363

Notes:
1. Characterization Data Provided by Torkelson Geochemistry of Tulsa, OK
2. QNS = Quantity Not Sufficient for Density Determination
3. Characterization Data from wells S-365 and S-369 collected June 2013

Torkelson Geochemistry, Inc.			
Density Measurements			
Paar DMA 512 / DMA 60		ASTM Method 4052	
Sample	Density gm/ml @ 60F	Job Number	Date
A-13	0.9015	04046	3/8/04
A-14	0.9143	04046	3/9/04
A-22	0.9356	04046	3/9/04
A-47	0.8926	04046	3/8/04
A-133	qns	04046	3/9/04
B-39	0.8734	04046	3/8/04
B-43	0.9161	04046	3/9/04
B-129	0.8645	04046	3/9/04
B-130	0.9306	04046	3/8/04
B-144	0.8654	04046	3/9/04
BF-106	0.8199	04046	3/9/04
BF-107	0.8671	04046	3/8/04
C-65	0.9162	04046	3/9/04
C-106	0.9306	04046	3/9/04
C-107	0.9371	04046	3/8/04
N-14	0.9299	04046	3/9/04
N-25	0.0402	04046	3/8/04
N-35	0.9205	04046	3/9/04
N-48	0.9049	04046	3/9/04
N-52	0.8613	04046	3/8/04
N-68	0.9211	04046	3/9/04
N-79	0.8169	04046	3/9/04
PZ-204	0.9016	04046	3/8/04
PZ-502	0.9155	04046	3/9/04
S-21	0.9281	04046	3/9/04
S-29	0.8550	04046	3/8/04
S-32	0.8665	04046	3/8/04
S-33	0.8578	04046	3/9/04
S-50	0.7508	04046	3/8/04
S-56	0.8684	04046	3/9/04
S-59	0.8039	04046	3/9/04
S-60	0.7898	04046	3/8/04
S-76	0.7851	04046	3/8/04
S-79	0.8406	04046	3/8/04
S-81	0.7948	04046	3/9/04
S-89	0.8523	04046	3/8/04
S-92	0.9156	04046	3/9/04
S-97	0.8653	04046	3/8/04
S-100	0.7930	04046	3/9/04
S-103	0.7978	04046	3/9/04
S-104	0.8787	04046	3/8/04
S-117	0.8236	04046	3/9/04
S-124	0.8223	04046	3/9/04
S-130	0.8623	04046	3/8/04
S-138	0.8957	04046	3/9/04
S-158	0.8692	04046	3/9/04
S-162	0.7498	04046	3/8/04
SRTF MW-1	0.7705	04046	3/9/04
West Yard W8	0.9121	04046	3/9/04

WP 9-2	0.8114	04046	3/9/04

Torkelson Geochemistry, Inc.

2528 S. Columbia Place
Tulsa, OK 74114-3233
Phone: 918-749-8441 e-mail: BTorkelson@aol.com
Fax: 918-749-6005

CHAIN-OF-CUSTODY RECORD

Project: Sun- Philadelphia Refinery COA
Location: Philadelphia, PA

Proj. No.:
P.O.:
Sampled By: M. Brad Spancake & Tim Delk

Report/Bill To: Colleen Costell0
Address: 30 South 17th St, Suite 1500
Philadelphia, PA 19103

Phone: 215.864.0640
Fax: 215.864.0671
e-mail:

Additional Instructions

Requested Turn-Around Time:

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None					ANALYSES REQUESTED: GC Characterization	Specific Gravity											REMARKS
1	B-130	2/27/04	Product		1	X					X	X											
2	A - 14	↓	↓		1	X					X	X											
3	SRTF MW-1	↓	↓		1	X					X	X											
4	B-129	↓	↓		1	X					X	X											
5	WP 9-2	3/1/04	↓		1	X					X	X											
6	BF-107	↓	↓		1	X					X	X											
7	S-33	↓	↓		1	X					X	X											
8	BF-1016	↓	↓		1	X					X	X											
9	A-22	↓	↓		1	X					X	X											
10	S-100	↓	↓		1	X					X	X											

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M. Brad [signature]	FedEx	3/1/04	
	[signature]	3-2-04	1705

Torkelson Geochemistry, Inc.

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Tulsa, OK 74114-3233
Phone: 918-749-8441
Fax: 918-749-6005
e-mail: BTorkelson@aol.com

CHAIN-OF-CUSTODY RECORD

Project: Sun- Philadelphia Refinery COA
Location: Philadelphia, PA

Proj. No.:
P.O.:
Sampled By: M. Brad Spancake & Tim Delk

Report/Bill To: Colleen Costell0
Address: 30 South 17th St, Suite 1500
Philadelphia, PA 19103

Phone: 215.864.0640
Fax: 215.864.0671
e-mail:

Additional Instructions

Requested Turn-Around Time:

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None	ANALYSES REQUESTED: GC Characterization	ANALYSES REQUESTED: Specific Gravity	REMARKS
1	West Yard W8	2/27/04	Product		1	X	X	X	
2	A-13	↓	↓		1	X	X	X	
3	B-144	↓	↓		1	X	X	X	
4	C-106	↓	↓		1	X	X	X	
5	A-133	↓	↓		1	X	X	X	
6	C-65	↓	↓		1	X	X	X	
7	B-43	↓	↓		1	X	X	X	
8	B-39	↓	↓		1	X	X	X	
9	A-136	↓	↓		1	X	X	X	Sorbent Pad Sample
10	C-107				1	X	X	X	

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M. Brad [signature]	FED EX	3/1/04	
	[signature]	3-2-04	1705

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Tulsa, OK 74114-3233

Phone: 918-749-8441 e-mail: BTorkelson@aol.com
Fax: 918-749-6005

CHAIN-OF-CUSTODY RECORD

Project: Sun- Philadelphia Refinery COA
Location: Philadelphia, PA

Proj. No.:
P.O.:
Sampled By: M. Brad Spancake & Tim Delk

Report/Bill To: Colleen Costell0
Address: 30 South 17th St, Suite 1500
Philadelphia, PA 19103

Phone: 215.864.0640
Fax: 215.864.0671
e-mail:

Additional Instructions

Requested Turn-Around Time:

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None					ANALYSES REQUESTED: GC Characterization	Specific Gravity											REMARKS
1	S-68	2/27/04	Product		1	X					X	X											Sorbent Pad Sample
2	S-64	↓	↓		1	X					X	X											" " "
3	S-158				1	X					X	X											
4	S-142				1	X					X	X											Sorbent Pad Sample
5	S-138				1	X					X	X											
6	S-130				1	X					X	X											
7	S-92				1	X					X	X											
8	S-162				1	X					X	X											
9	S-82				1	X					X	X											Sorbent Pad Sample
10	S-89	↓	↓		1	X					X	X											

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M. Brad [signature]	FED EX	3/1/04	
[signature]	Bruce Torkelson	3-2-04	1705

Torkelson Geochemistry, Inc.

2528 S. Columbia Place
Tulsa, OK 74114-3233
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CHAIN-OF-CUSTODY RECORD

Project: Sun- Philadelphia Refinery COA
Location: Philadelphia, PA

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P.O.:
Sampled By: M. Brad Spancake & Tim Delk

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Fax: 215.864.0671
e-mail:

Additional Instructions

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ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None					ANALYSES REQUESTED: GC Characterization	Specific Gravity											REMARKS
1	S-29	2/27/04	Product		1	X					X	X											
2	S-32	↓	↓		1	X					X	X											
3	S-56				1	X					X	X											
4	S-97				1	X					X	X											
5	S-103				1	X					X	X											
6	S-104				1	X					X	X											
7	S-124				1	X					X	X											
8	S-21				1	X					X	X											
9	S-59				1	X					X	X											
10	S-60	↓	↓		1	X					X	X											

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M Brad [signature]	FED EX	3/1/04	
	[signature]	3-2-04	1705

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Fax: 215.864.0671
e-mail:

Additional Instructions

Requested Turn-Around Time:

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None					ANALYSES REQUESTED: GC Characterization	Specific Gravity											REMARKS
1	S-50	2/27/04	Product		1	X					X	X											
2	S-117	↓	↓		1	X					X	X											
3	S-78				1	X					X	X											Sorbent Pad Sample
4	S-79				1	X					X	X											
5	S-81	↓			1	X					X	X											
6	N-31	3/1/04			1	X					X	X											Sorbent Pad Sample
7	N-48	↓			1	X					X	X											
8	PZ-204				1	X					X	X											
9	N-52				1	X					X	X											
10	PZ-502	↓	↓		1	X					X	X											

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M. Brad [signature]	Fed Ex	3/1/04	
	Bruce Torkelson [signature]	3-2-04	1705

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Additional Instructions

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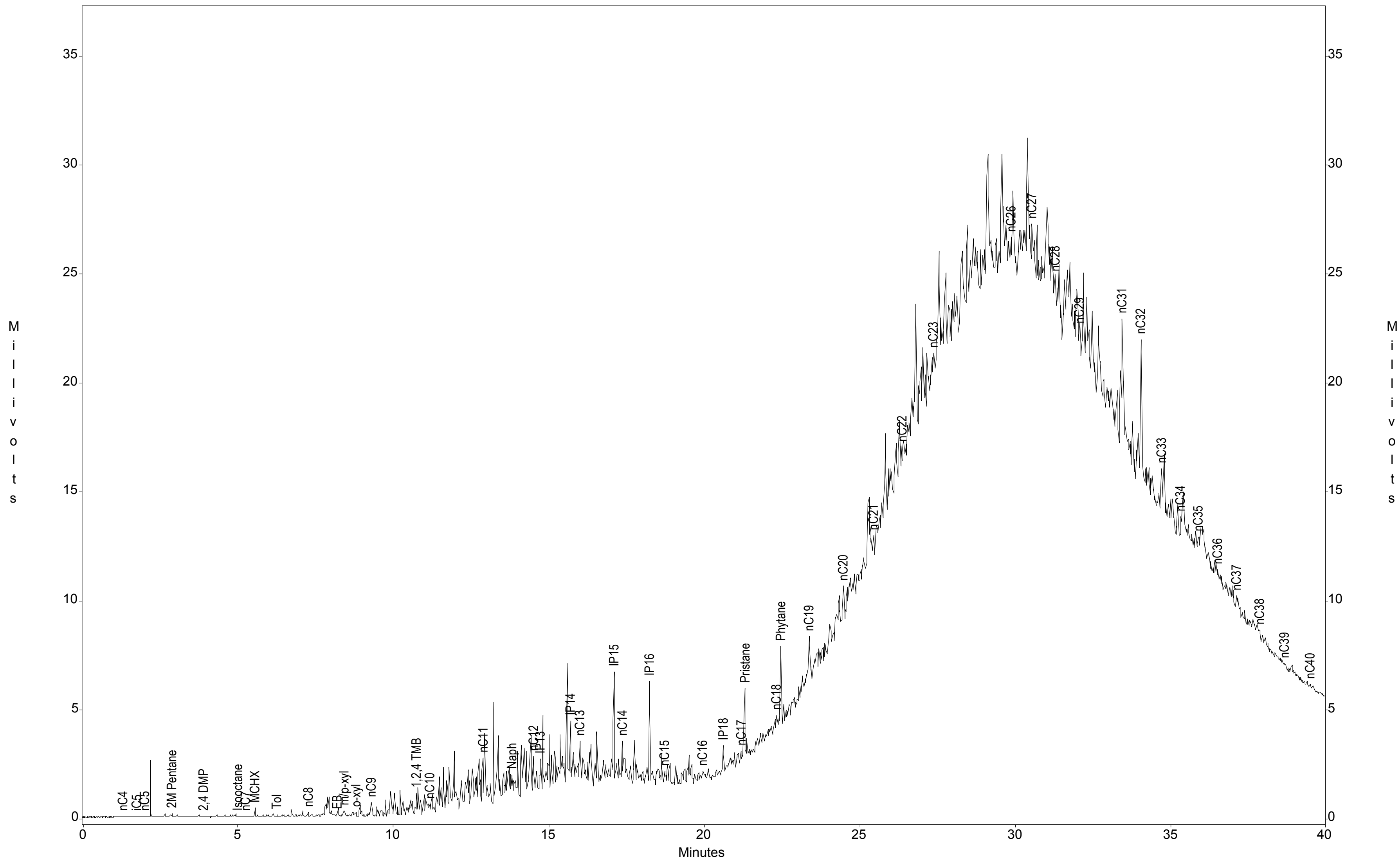
ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None	ANALYSES REQUESTED: GC Characterization	ANALYSES REQUESTED: Specific Gravity	REMARKS
1	S-76	3/1/04	Product		1	X	X	X	
2	N-35	↓	↓		1	X	X	X	
3	N-14	↓	↓		1	X	X	X	
4	N-79	↓	↓		1	X	X	X	
5	N-78	↓	↓		1	X	X	X	Sorbent Pad Sample
6	N-25	↓	↓		1	X	X	X	
7	N-68	↓	↓		1	X	X	X	
8	A-47	↓	↓		1	X	X	X	
9									
10									

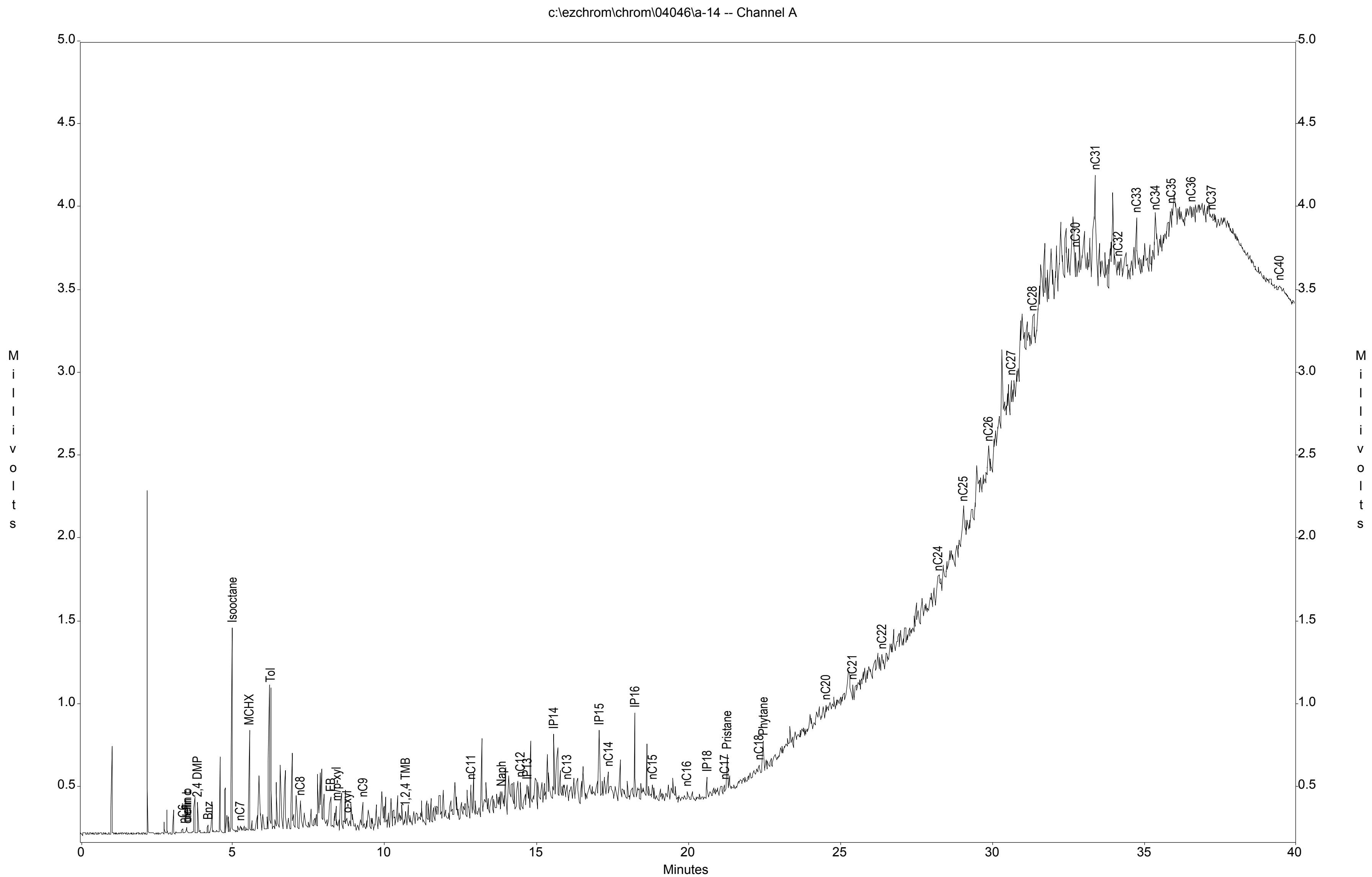
RELINQUISHED BY	ACCEPTED BY	DATE	TIME
M. Brad [signature]	FED EX	3/1/04	
	[signature]	3-2-04	1705

Sun - Philadelphia Refinery COA
Sample ID : A-13
Acquired : Mar 06, 2004 18:55:23

c:\ezchrom\chrom\04046\a-13 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : A-14
Acquired : Mar 08, 2004 08:38:23



Sun - Philadelphia Refinery COA
Sample ID : A-22
Acquired : Mar 07, 2004 14:51:46

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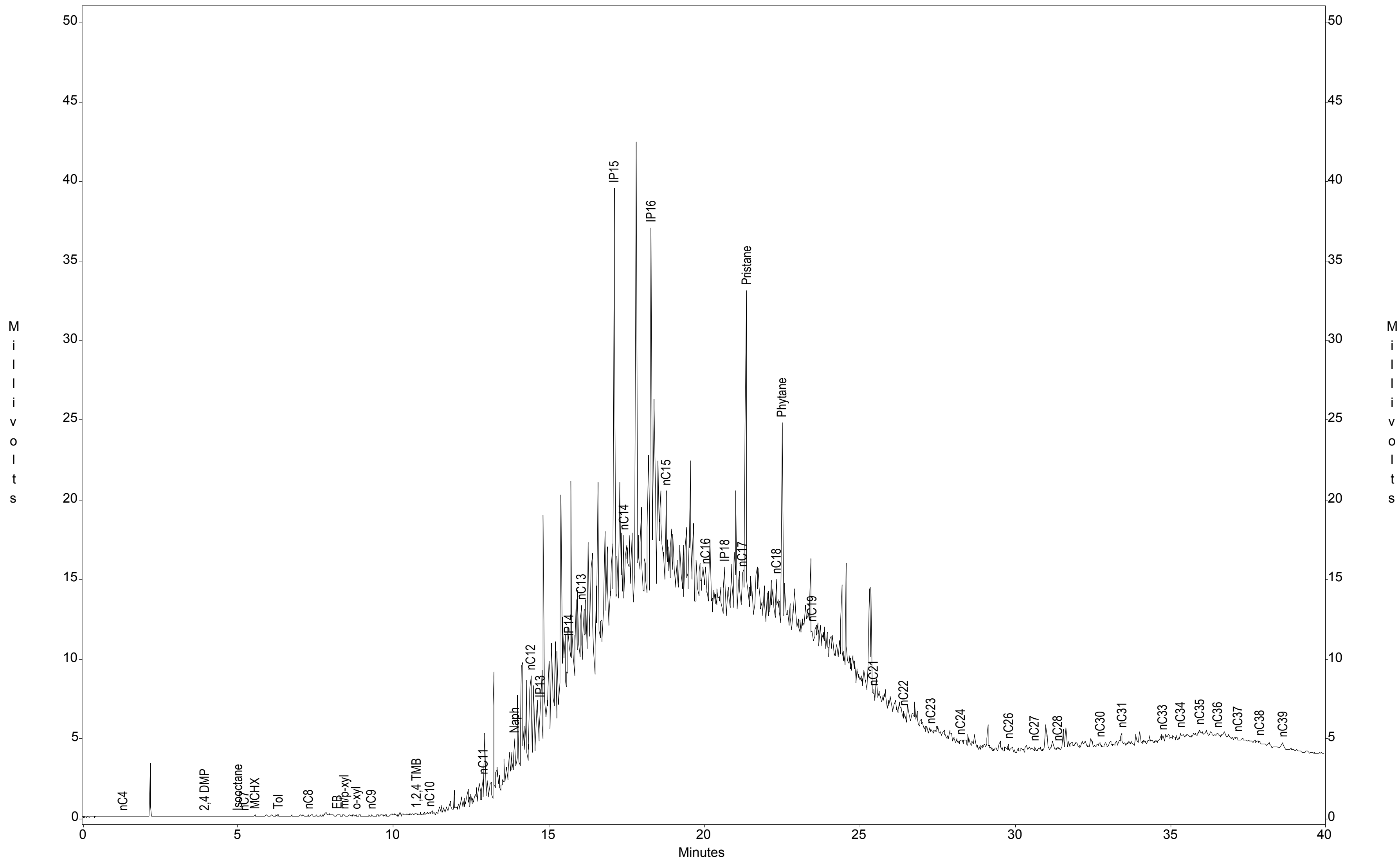
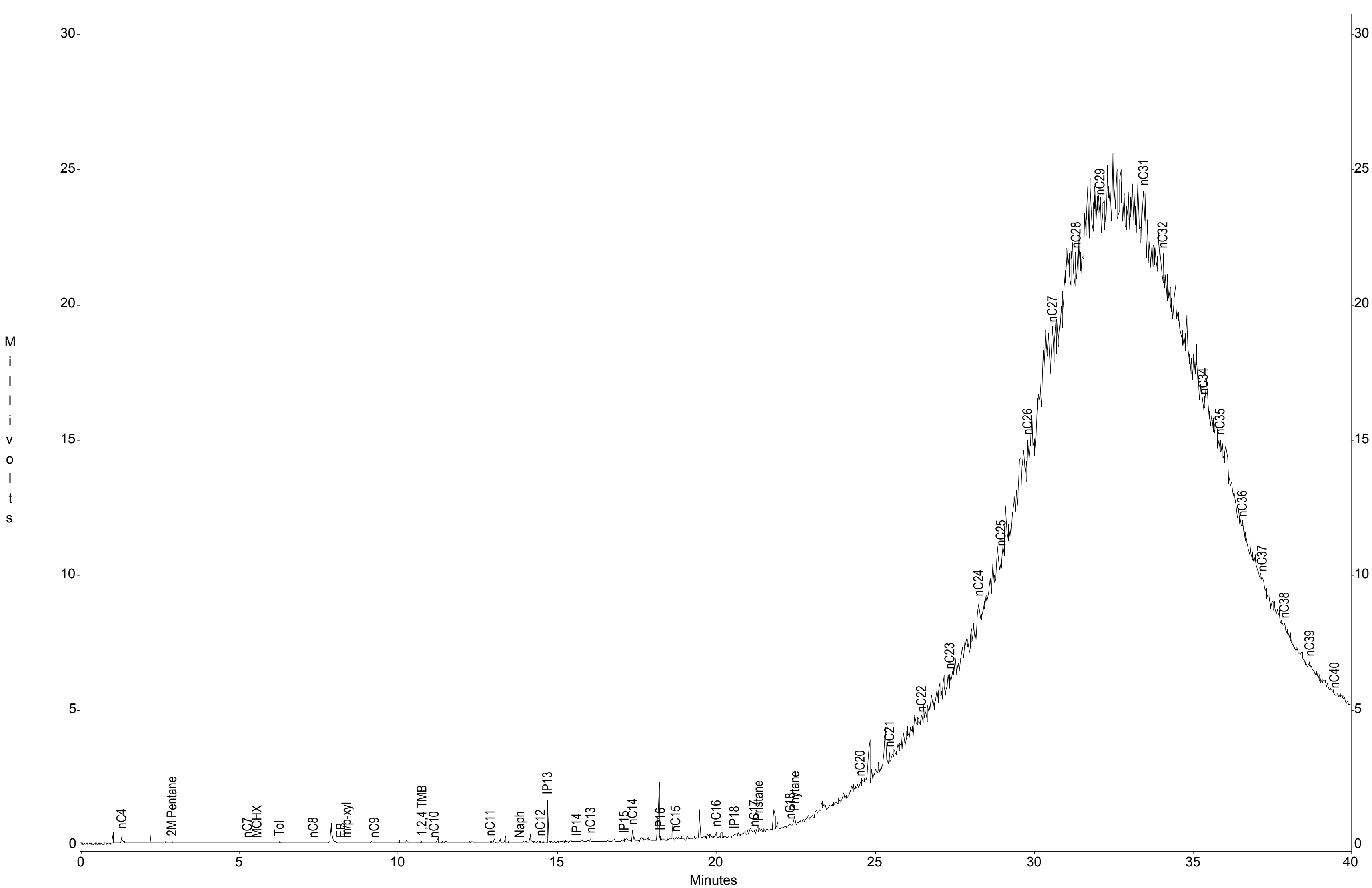


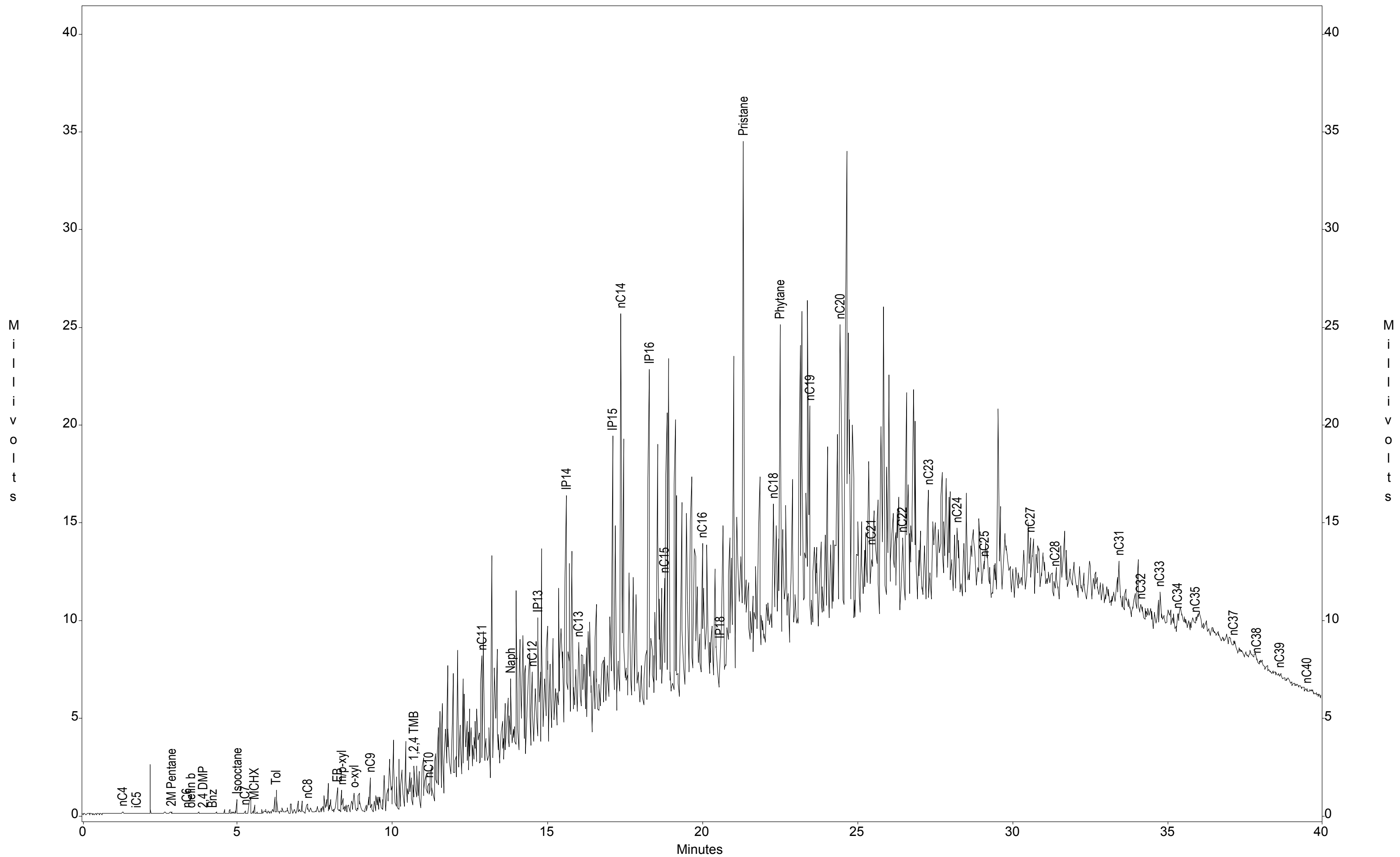
Sun - Philadelphia Refinery COA
Sample ID : A-47
Acquired : Mar 05, 2004 18:23:47

c:\ezchrom\chrom\04046\a47 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : A-133
Acquired : Mar 08, 2004 11:04:46

c:\ezchrom\chrom\04046\a-133 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : A-136 Pad
Acquired : Mar 09, 2004 14:59:57

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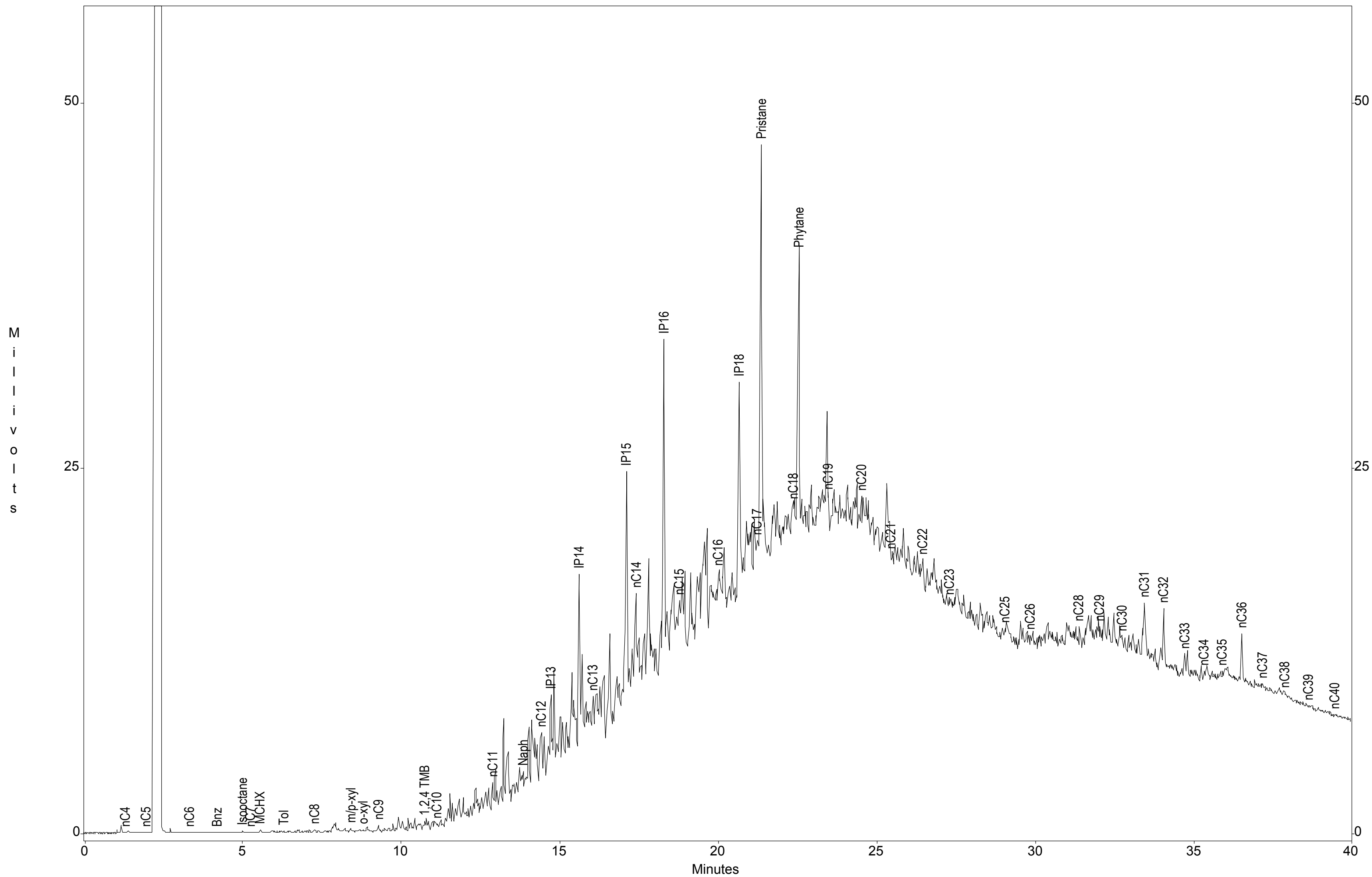

Sun - Philadelphia Refinery COA
Sample ID : B-39
Acquired : Mar 06, 2004 14:44:39

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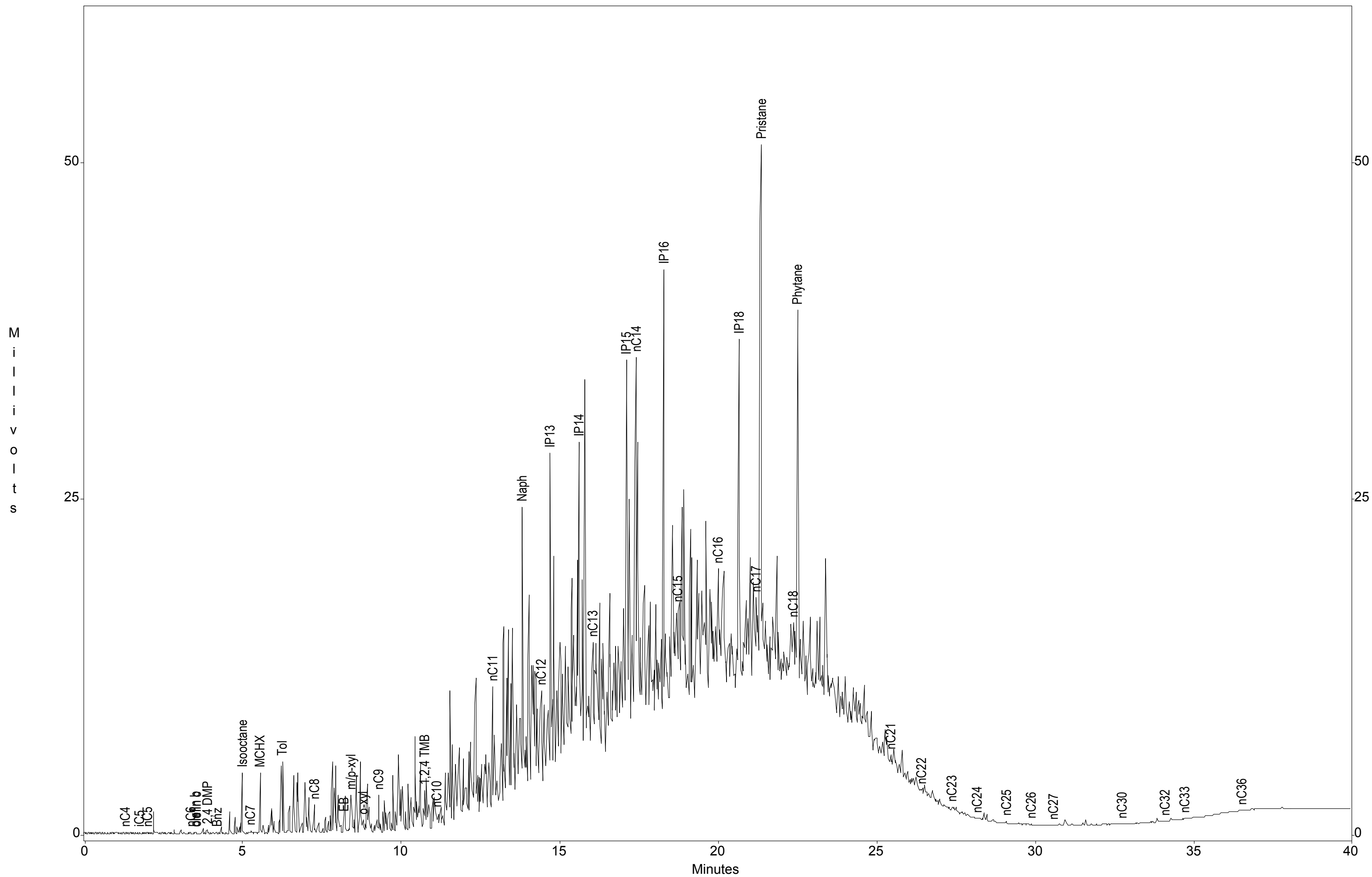
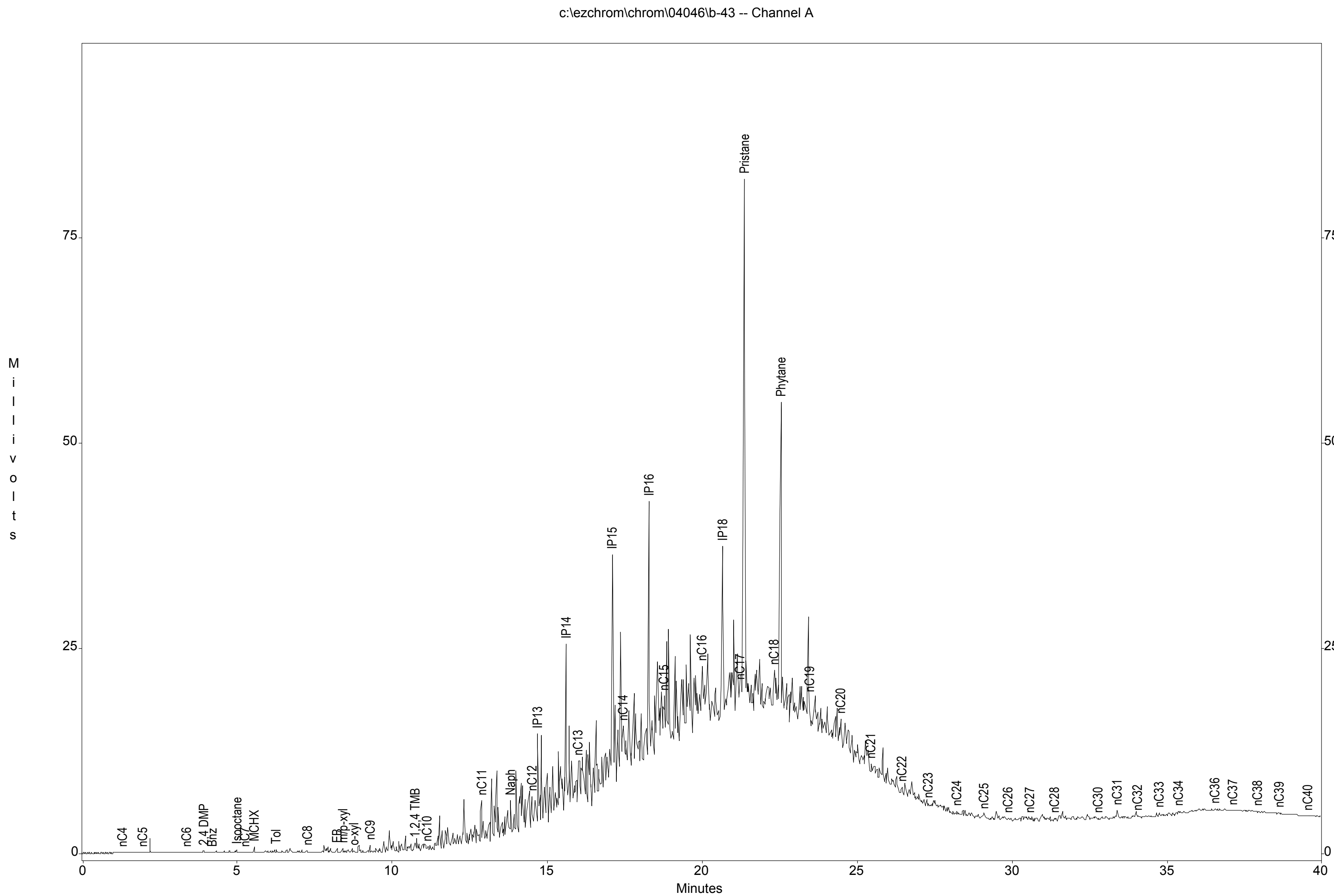
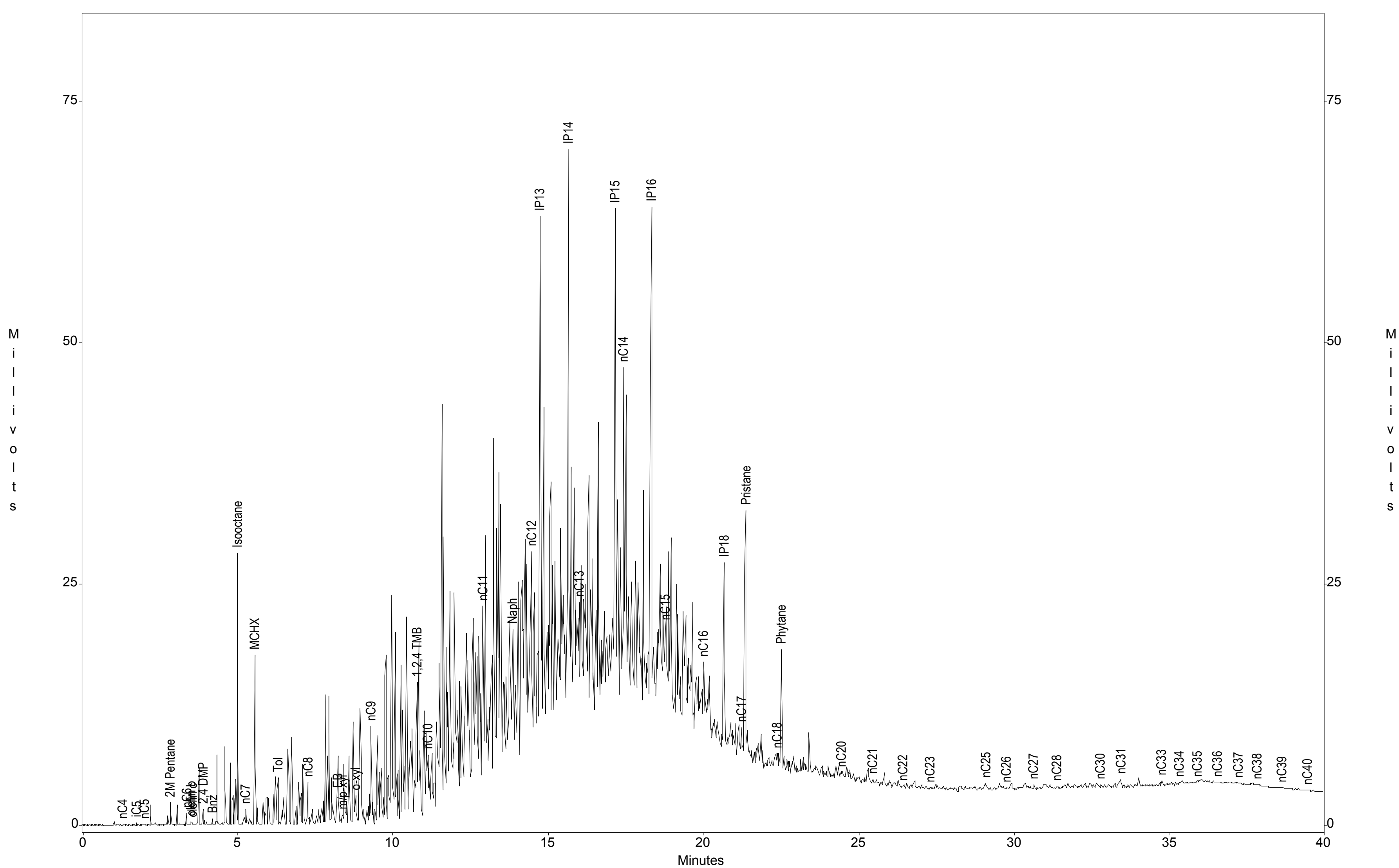


Sun - Philadelphia Refinery COA
Sample ID : B-43
Acquired : Mar 08, 2004 12:42:07

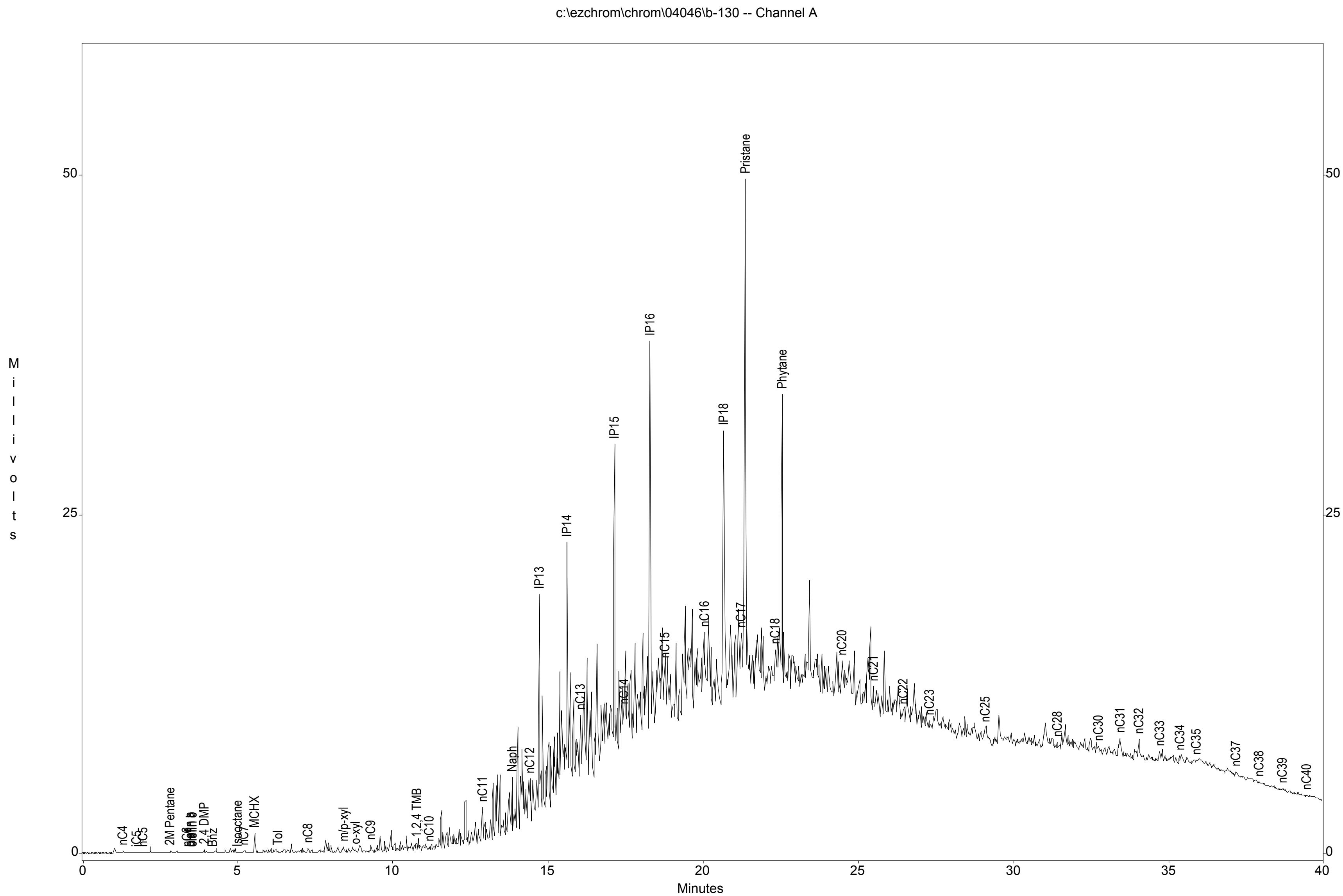


Sun - Philadelphia Refinery COA
Sample ID : B-129
Acquired : Mar 07, 2004 13:12:49

c:\ezchrom\chrom\04046\b-129 -- Channel A

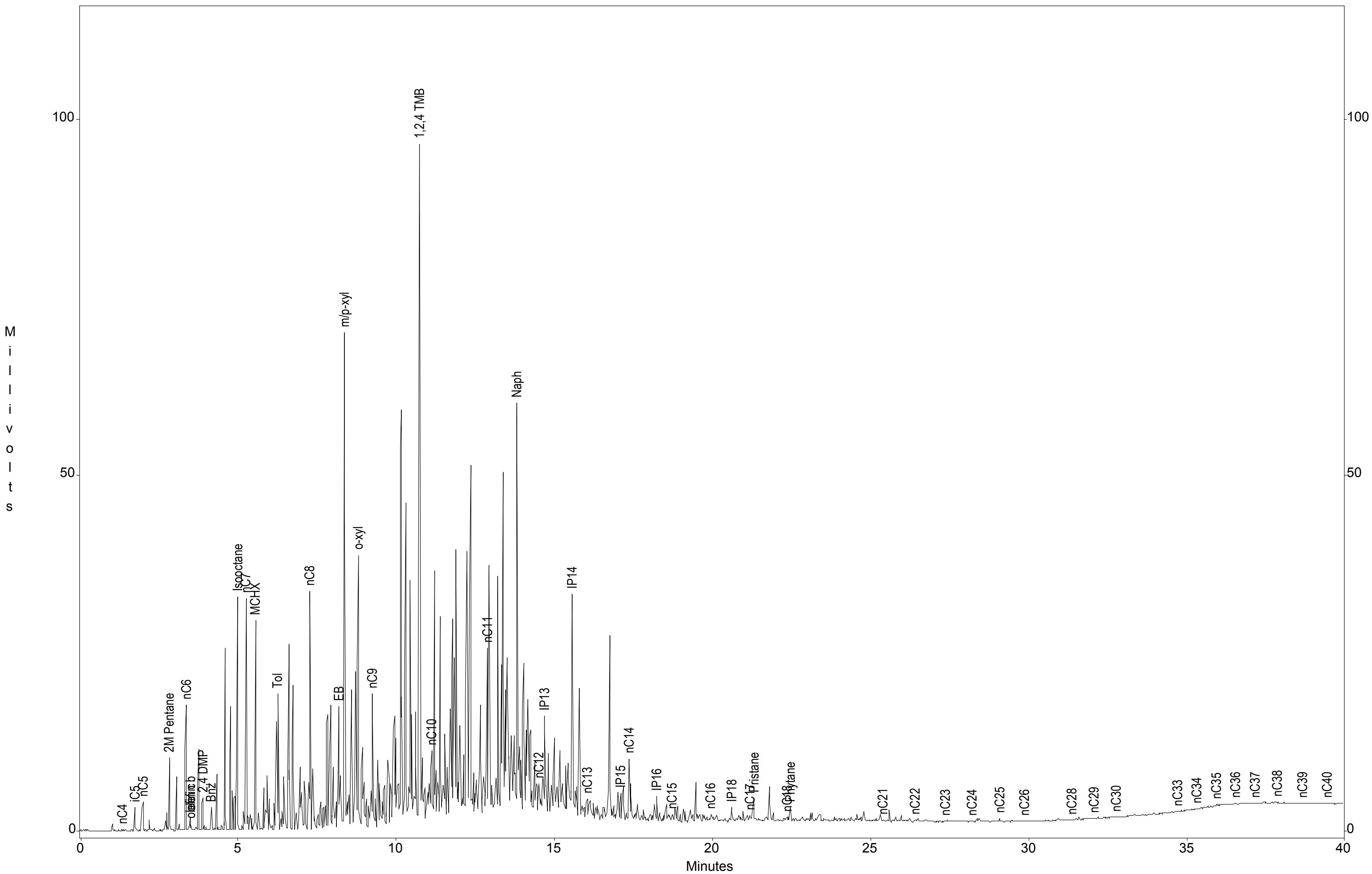


Sun - Philadelphia Refinery COA
Sample ID : B-130
Acquired : Mar 05, 2004 17:35:01



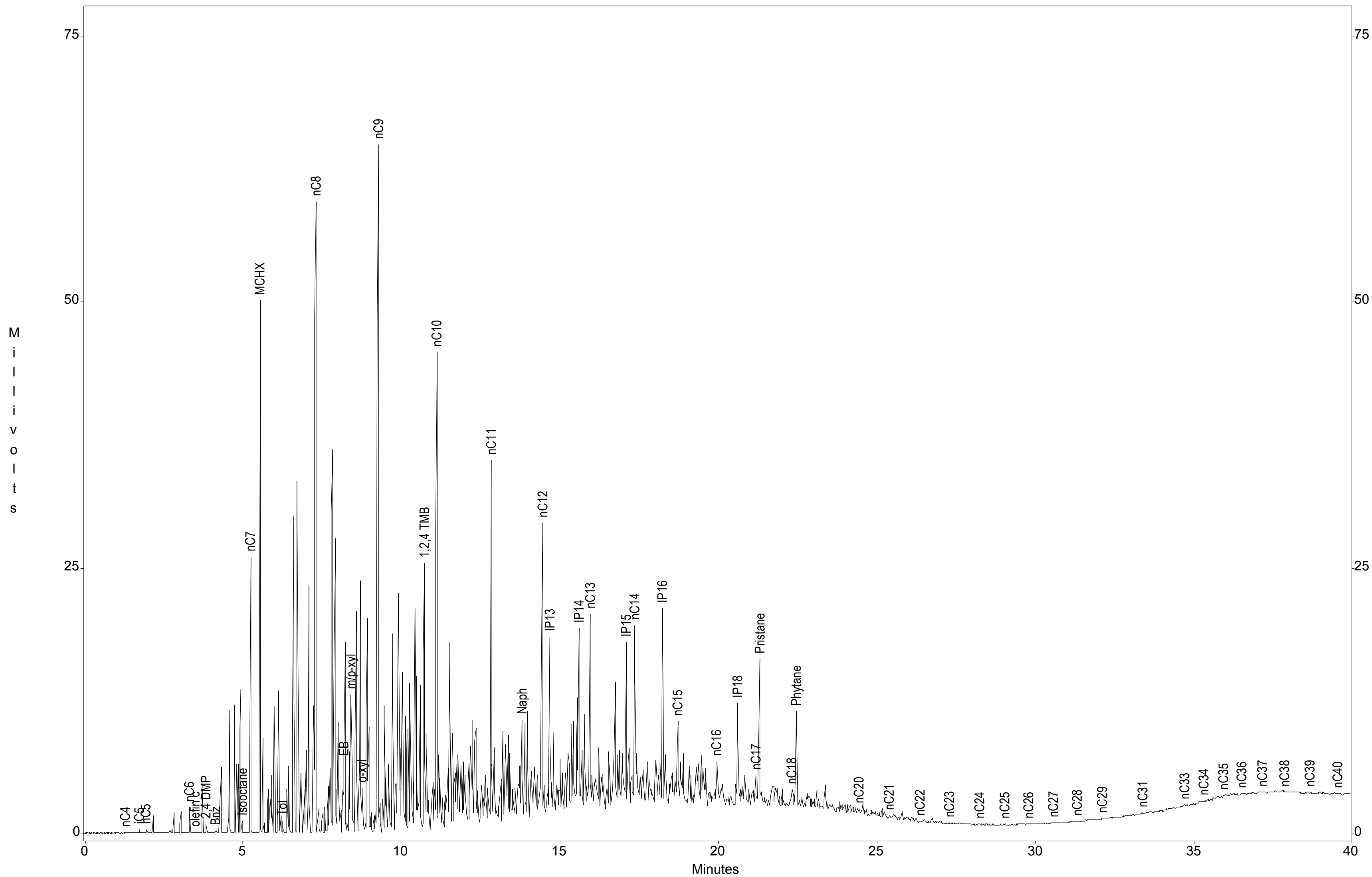
Sun - Philadelphia Refinery COA
Sample ID : B-144
Acquired : Mar 08, 2004 10:15:49

c:\ezchrom\chrom\04046\b-144 -- Channel A



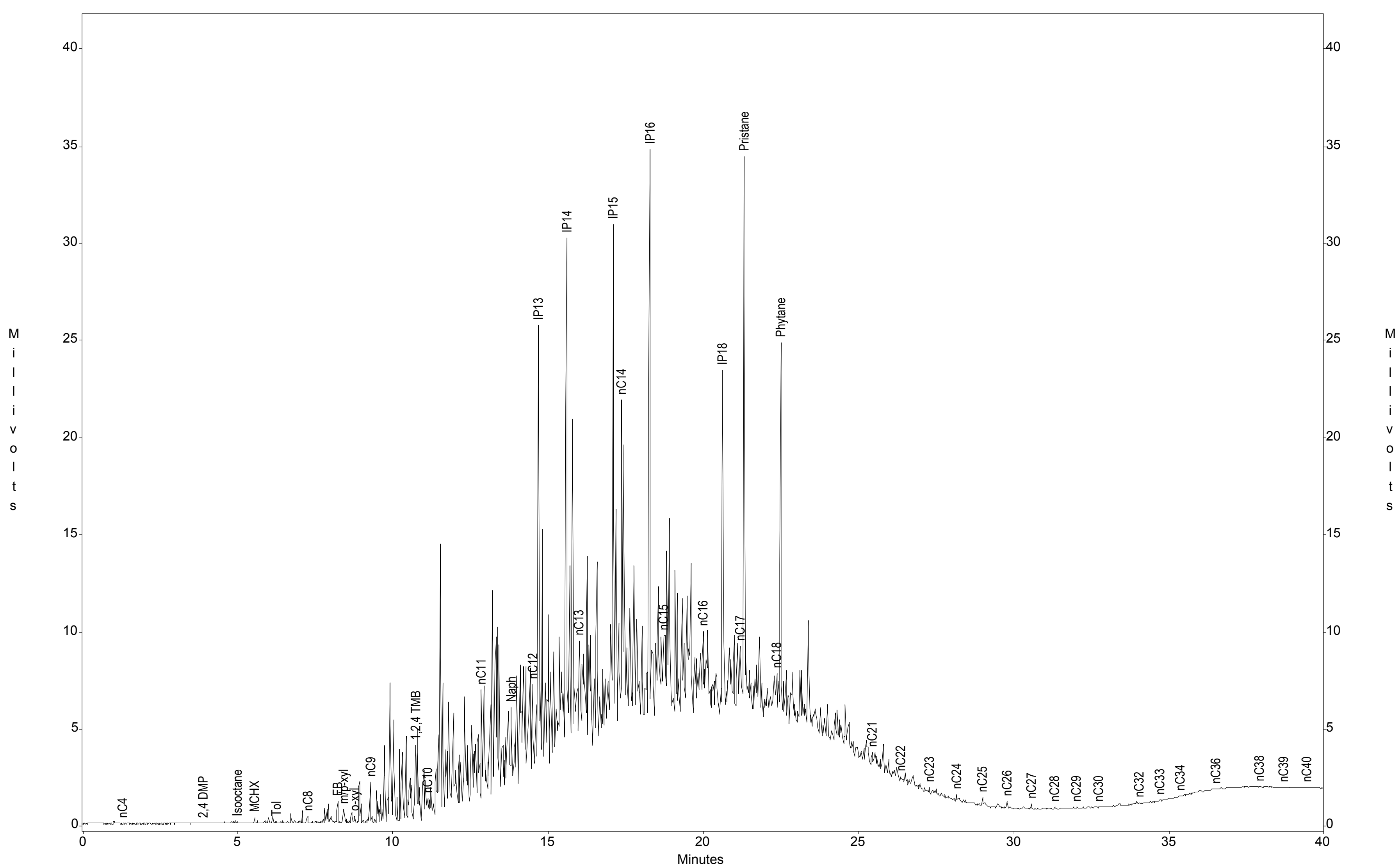
Sun - Philadelphia Refinery COA
Sample ID : BF-106
Acquired : Mar 07, 2004 18:06:23

c:\ezchrom\chrom\04046\bf-106 -- Channel A

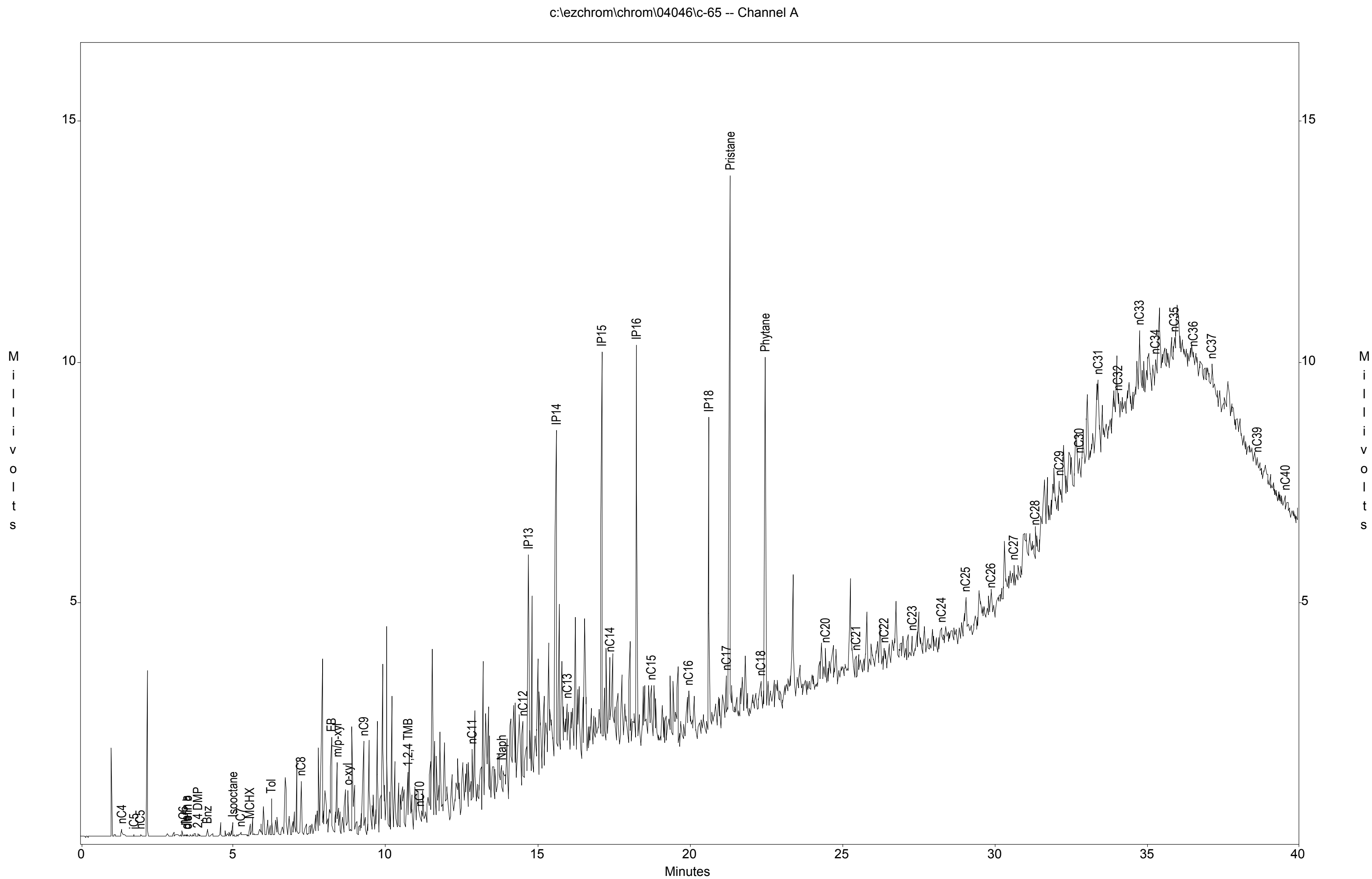


Sun - Philadelphia Refinery COA
Sample ID : BF-107
Acquired : Mar 06, 2004 07:21:31

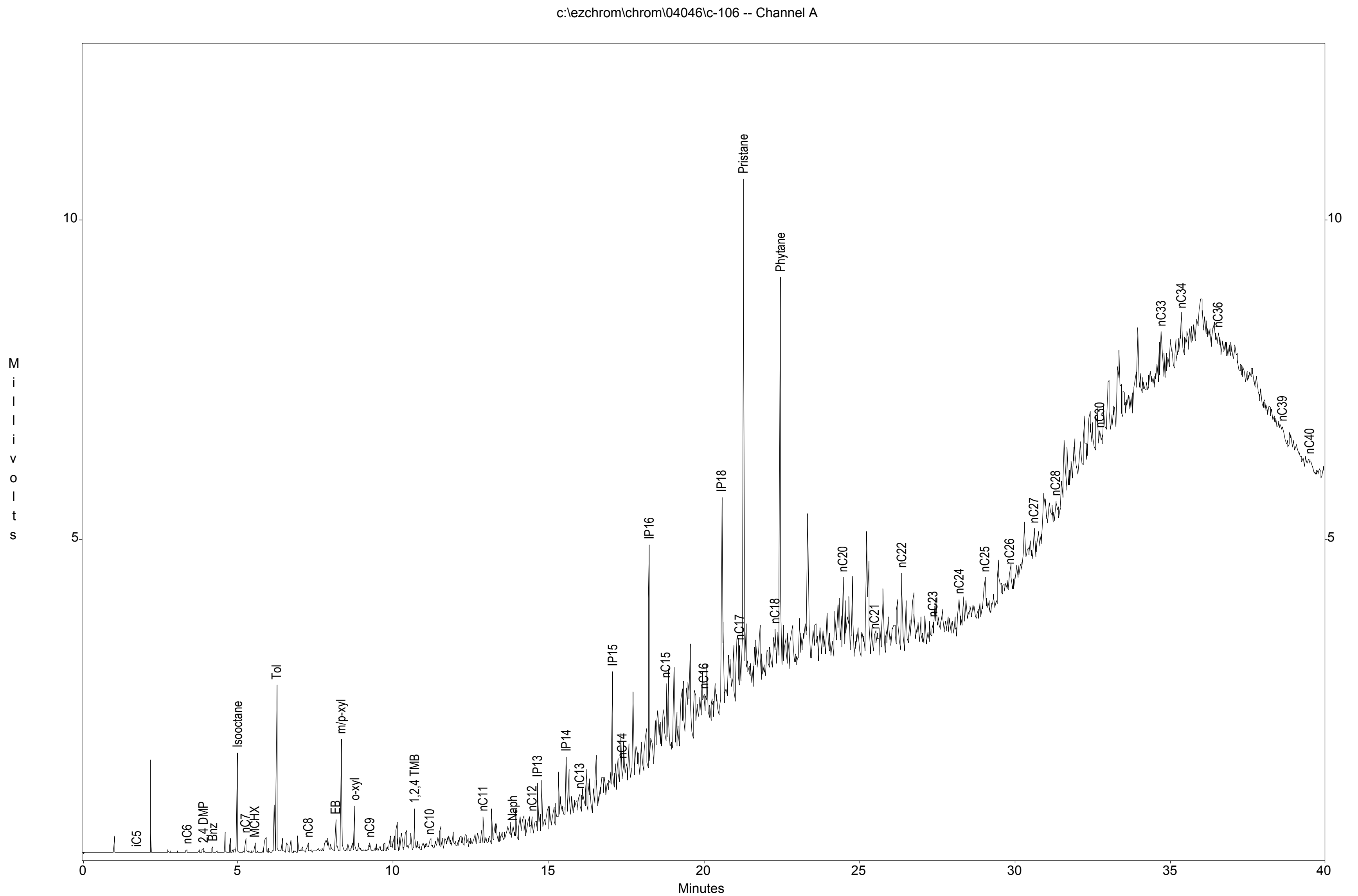
c:\ezchrom\chrom\04046\bf-107 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : C-65
Acquired : Mar 07, 2004 17:16:51

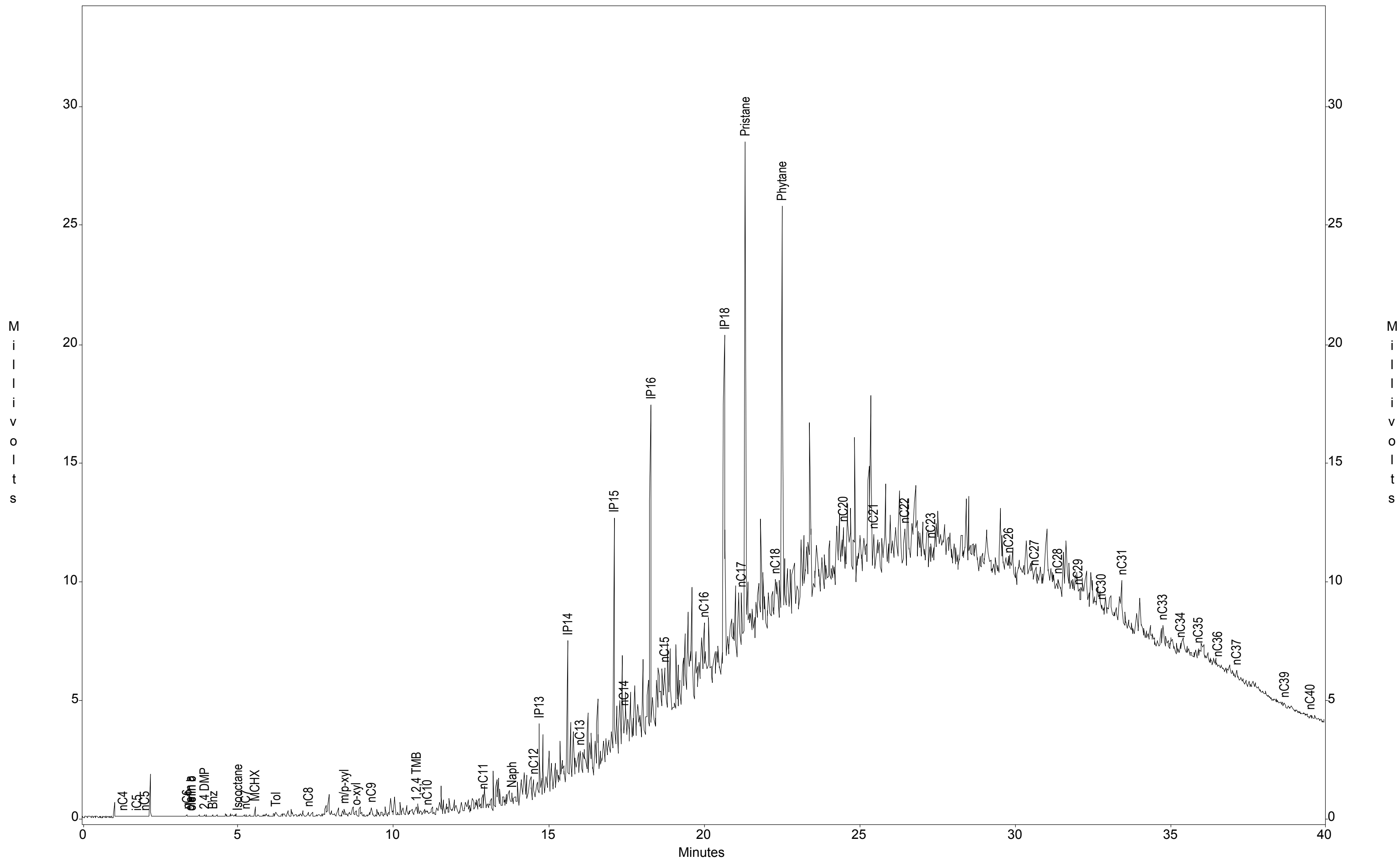


Sun - Philadelphia Refinery COA
Sample ID : C-106
Acquired : Mar 08, 2004 17:35:42



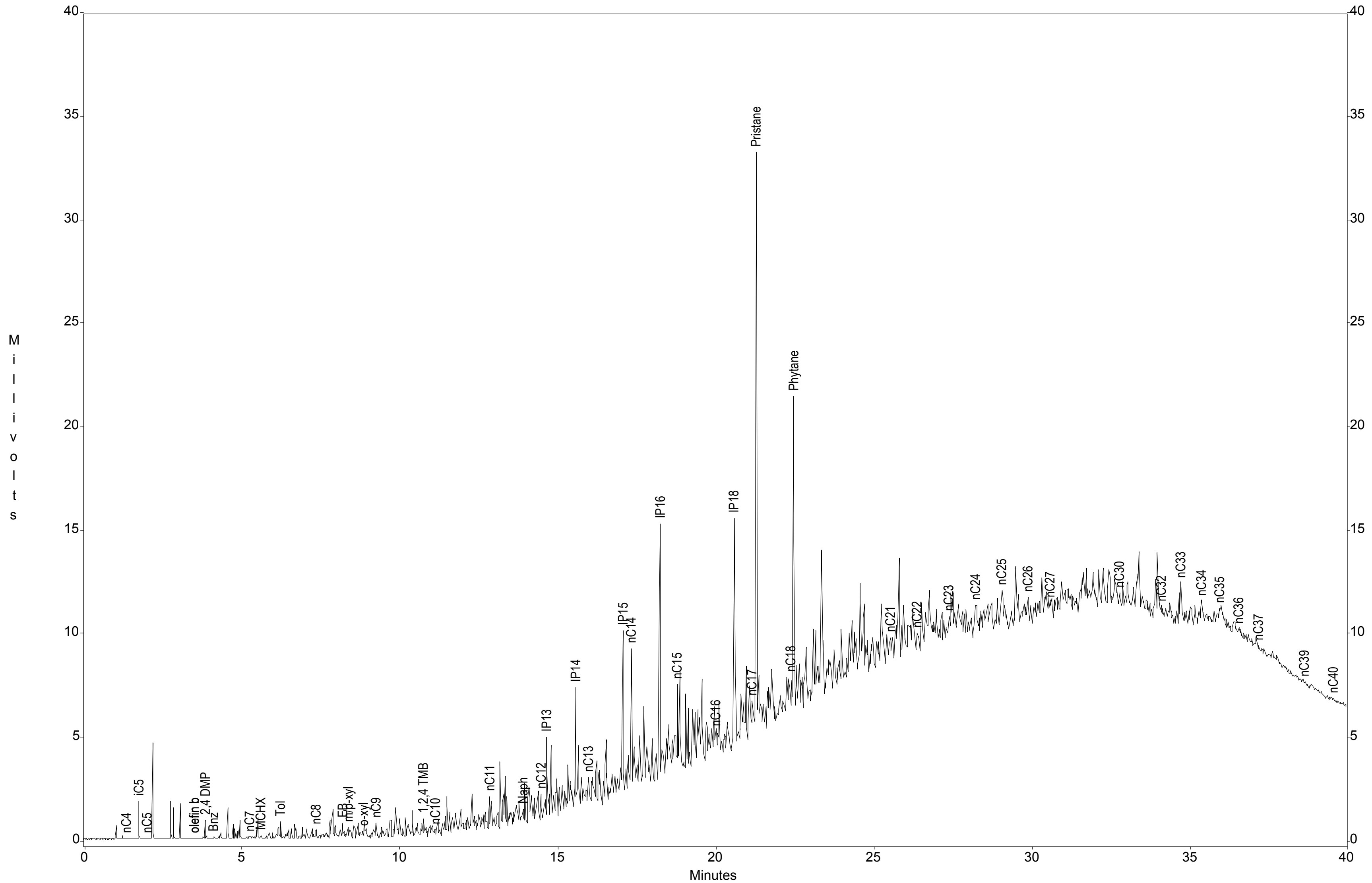
Sun - Philadelphia Refinery COA
Sample ID : C-107
Acquired : Mar 06, 2004 18:02:57

c:\ezchrom\chrom\04046\c-107 -- Channel A



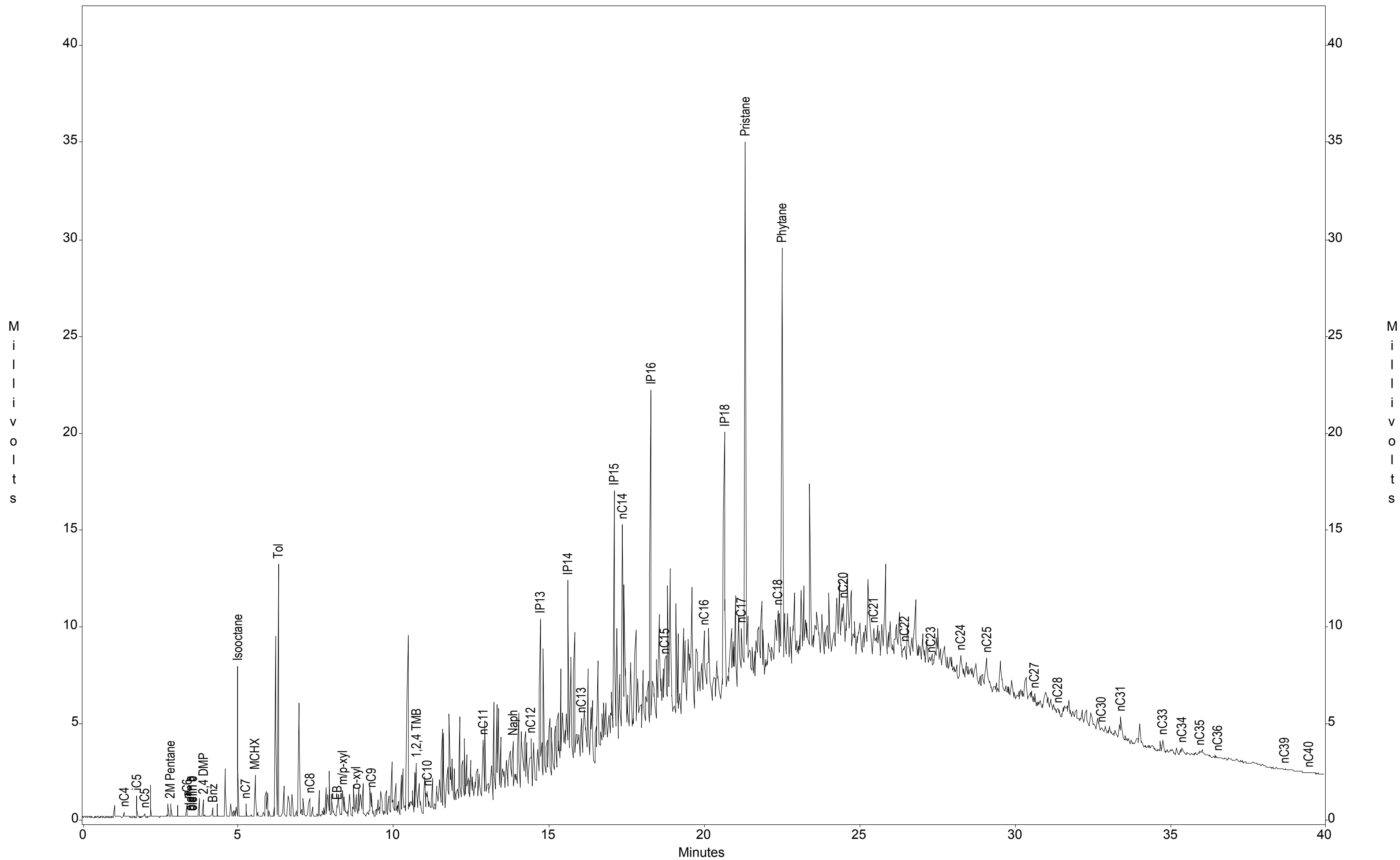
Sun - Philadelphia Refinery COA
Sample ID : N-14
Acquired : Mar 08, 2004 14:19:28

c:\ezchrom\chrom\04046\n-14 -- Channel A



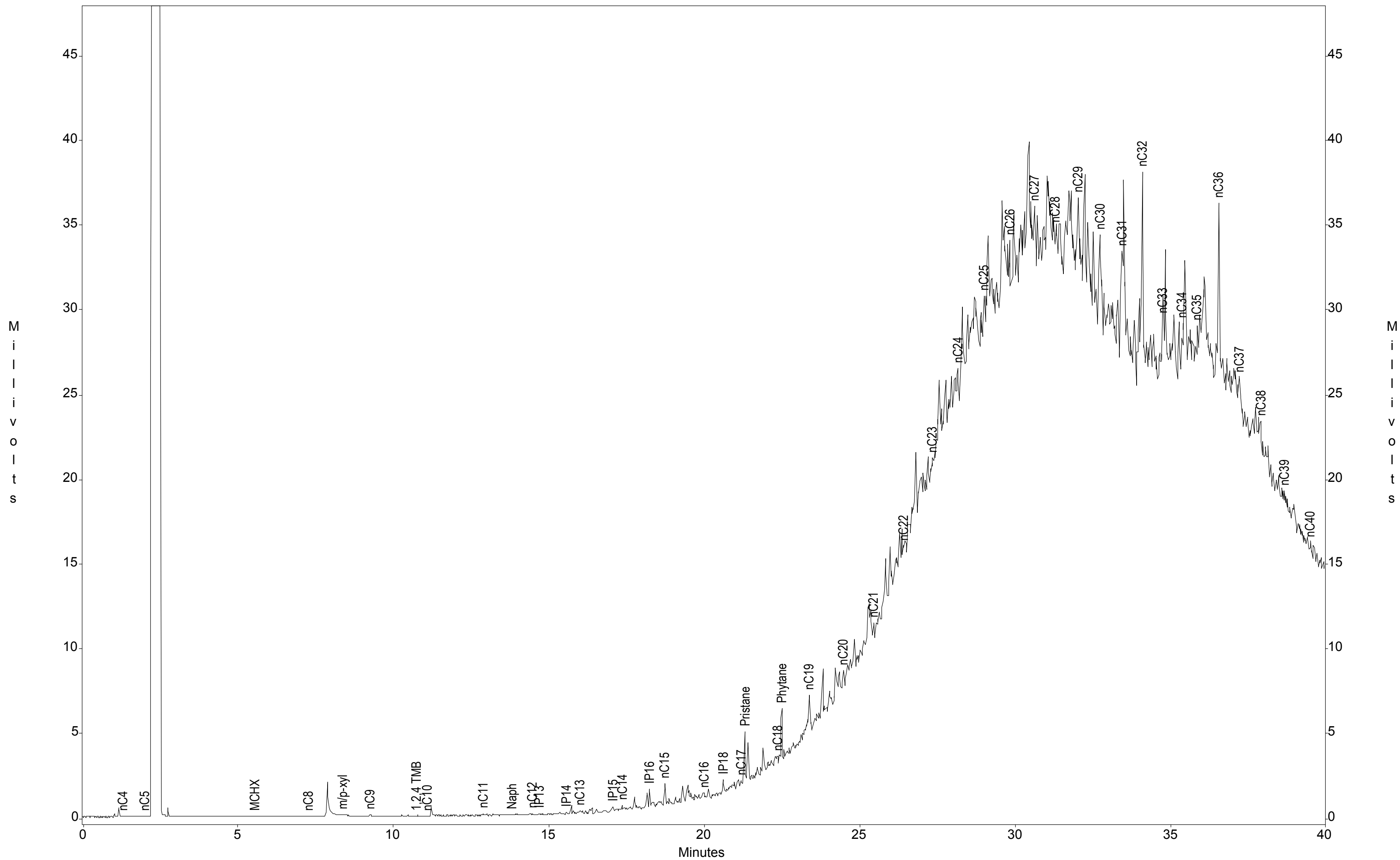
Sun - Philadelphia Refinery COA
Sample ID : N-25
Acquired : Mar 06, 2004 09:00:33

c:\ezchrom\chrom\04046\n-25 -- Channel A



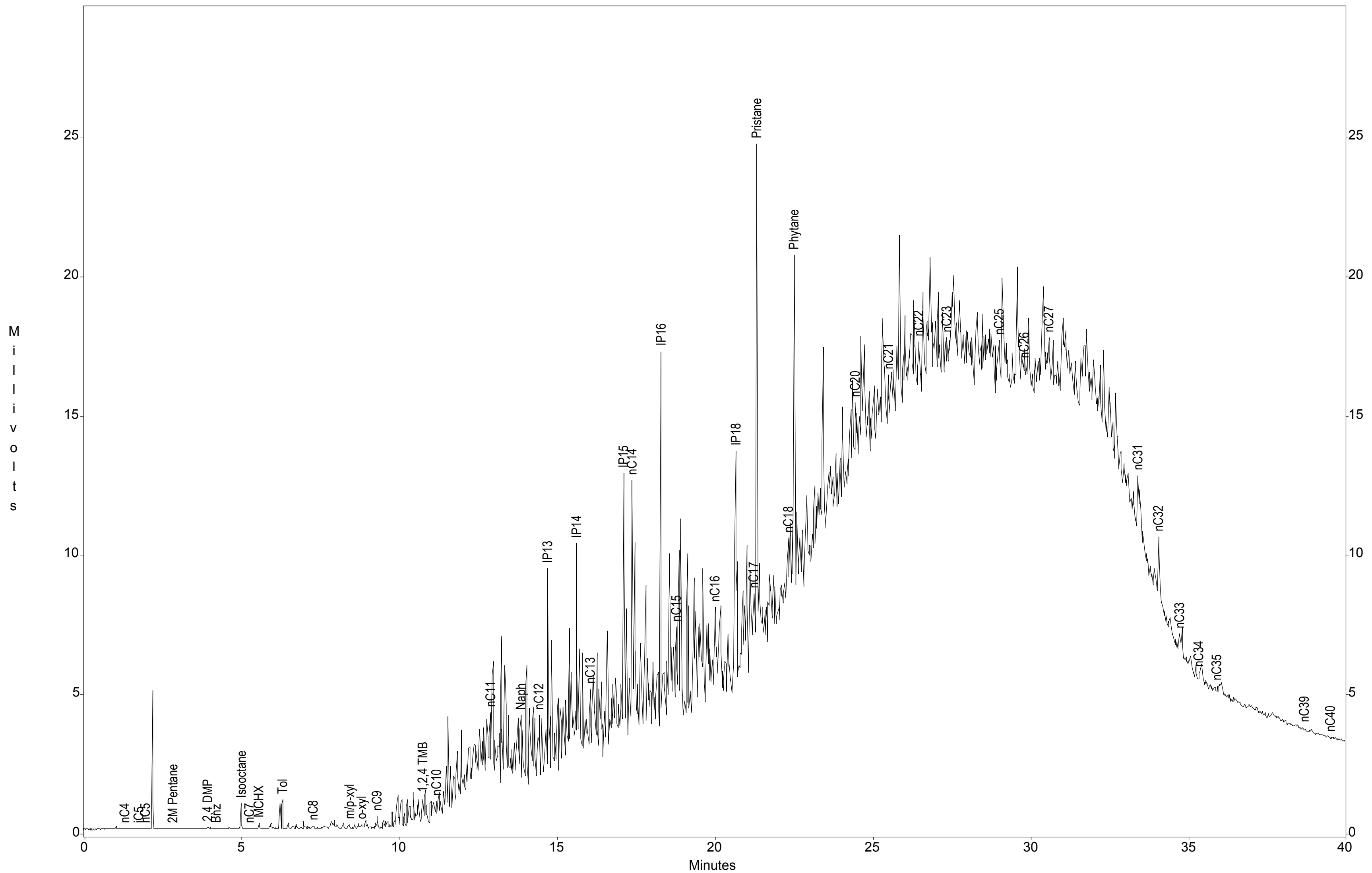
Sun - Philadelphia Refinery COA
Sample ID : N-31 Pad
Acquired : Mar 09, 2004 11:40:50

c:\ezchrom\chrom\04046\n-31pad -- Channel A



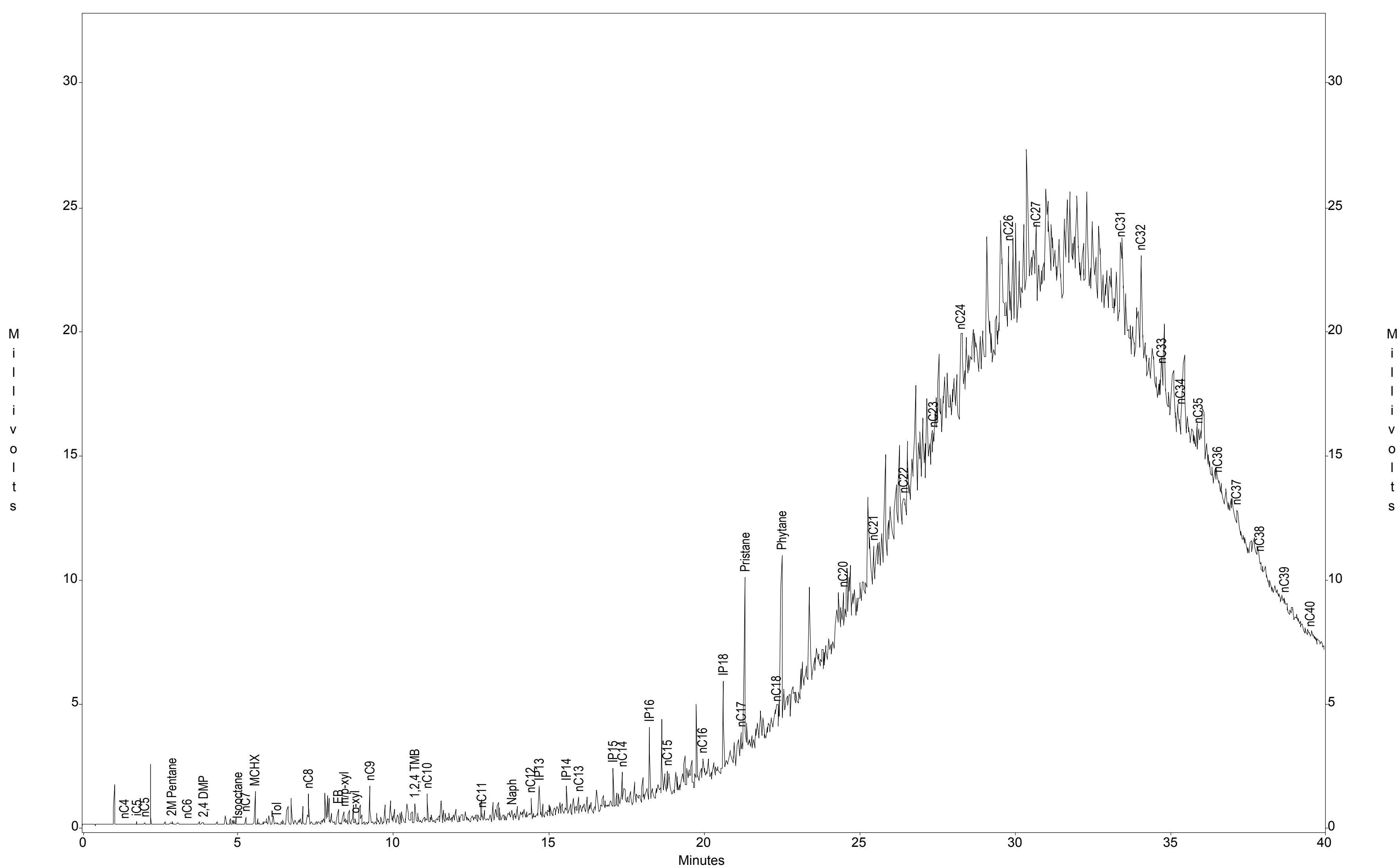
Sun - Philadelphia Refinery COA
Sample ID : N-35
Acquired : Mar 07, 2004 12:24:39

c:\ezchrom\chrom\04046\n-35 -- Channel A



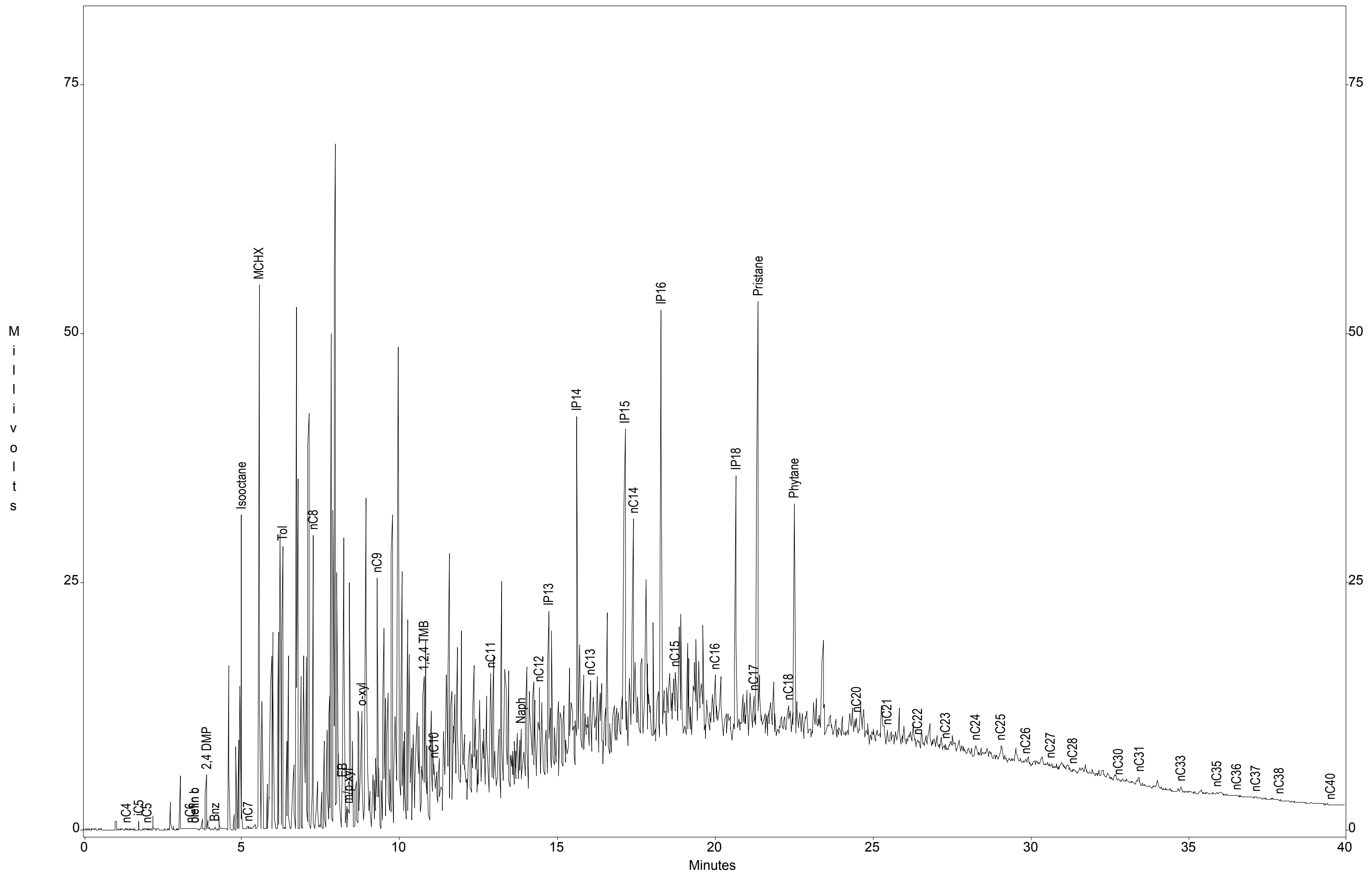
Sun - Philadelphia Refinery COA
Sample ID : N-48
Acquired : Mar 07, 2004 18:54:39

c:\ezchrom\chrom\04046\n-48 -- Channel A



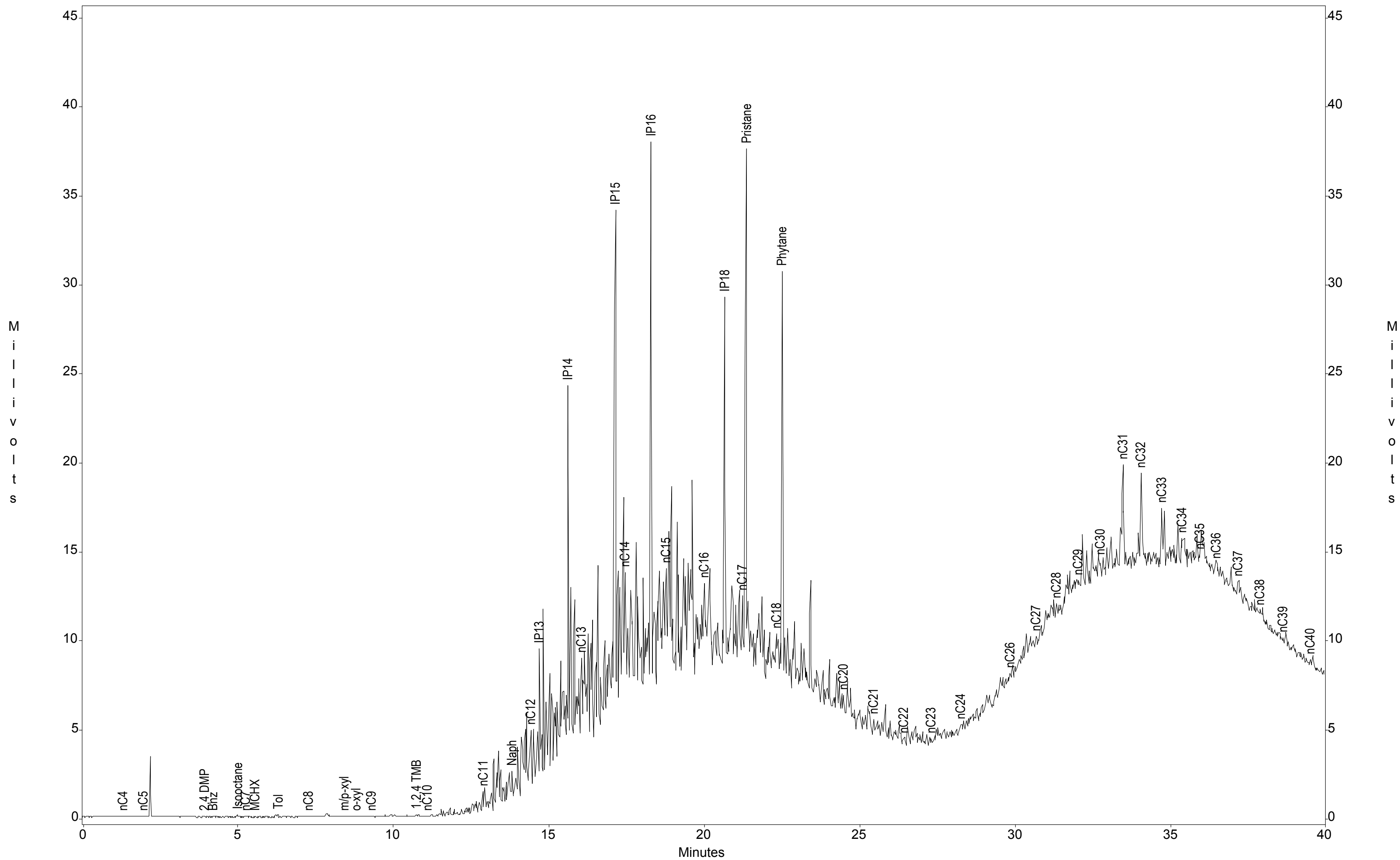
Sun - Philadelphia Refinery COA
Sample ID : N-52
Acquired : Mar 06, 2004 12:18:31

c:\ezchrom\chrom\04046\n-52 -- Channel A



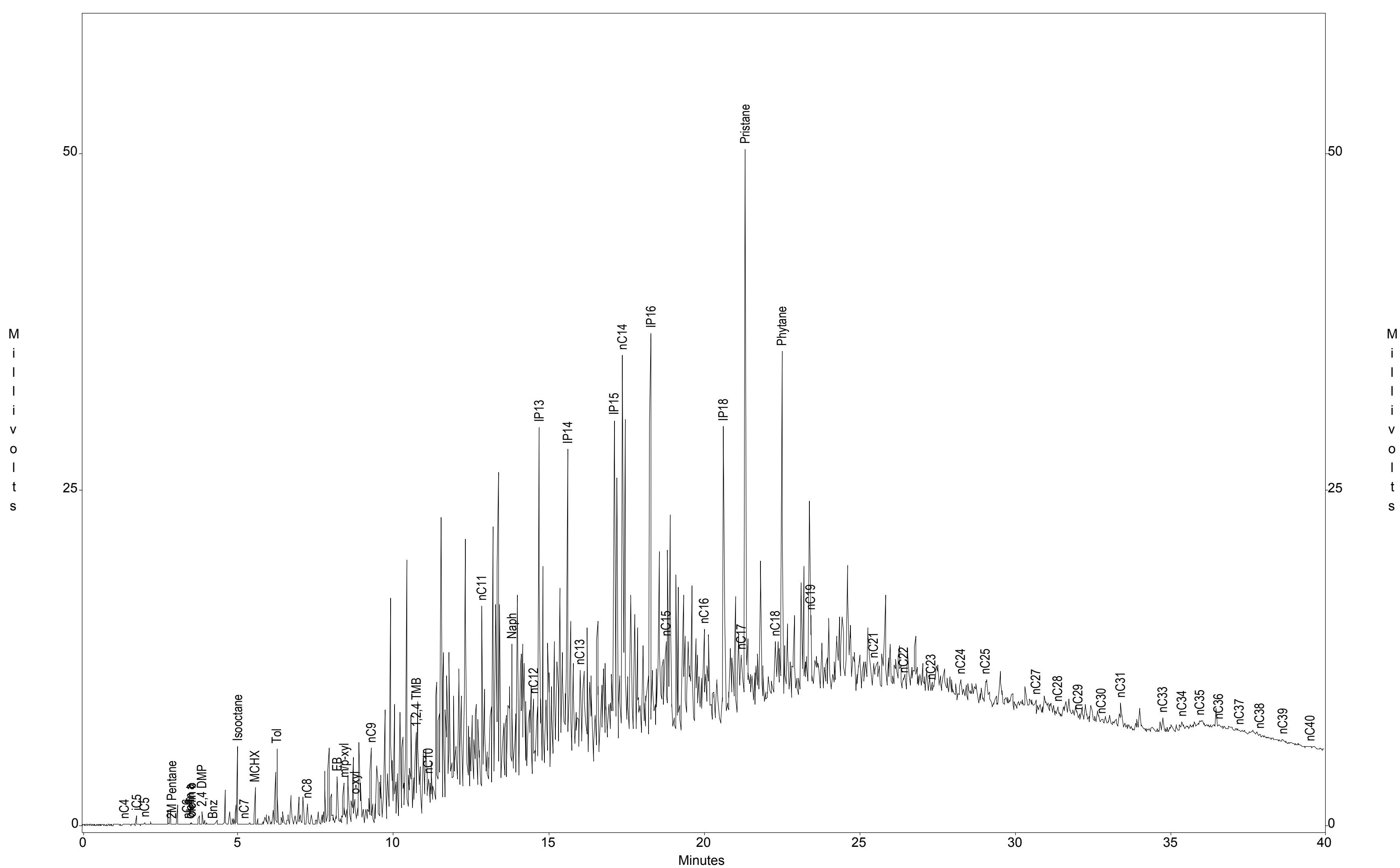
Sun - Philadelphia Refinery COA
Sample ID : N-68
Acquired : Mar 07, 2004 14:02:21

c:\ezchrom\chrom\04046\n-68 -- Channel A

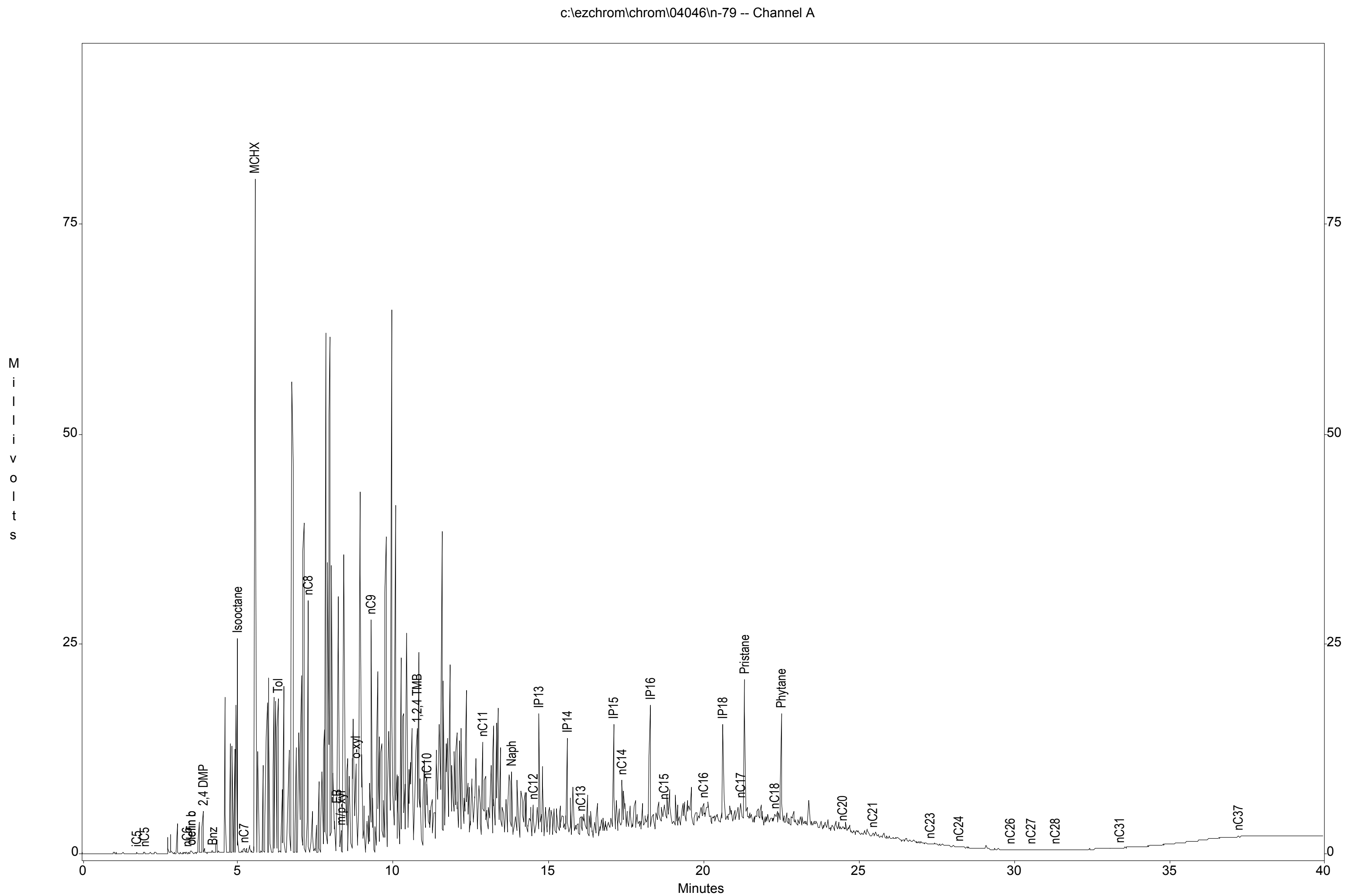


Sun - Philadelphia Refinery COA
Sample ID : N-78 Pad
Acquired : Mar 09, 2004 10:52:06

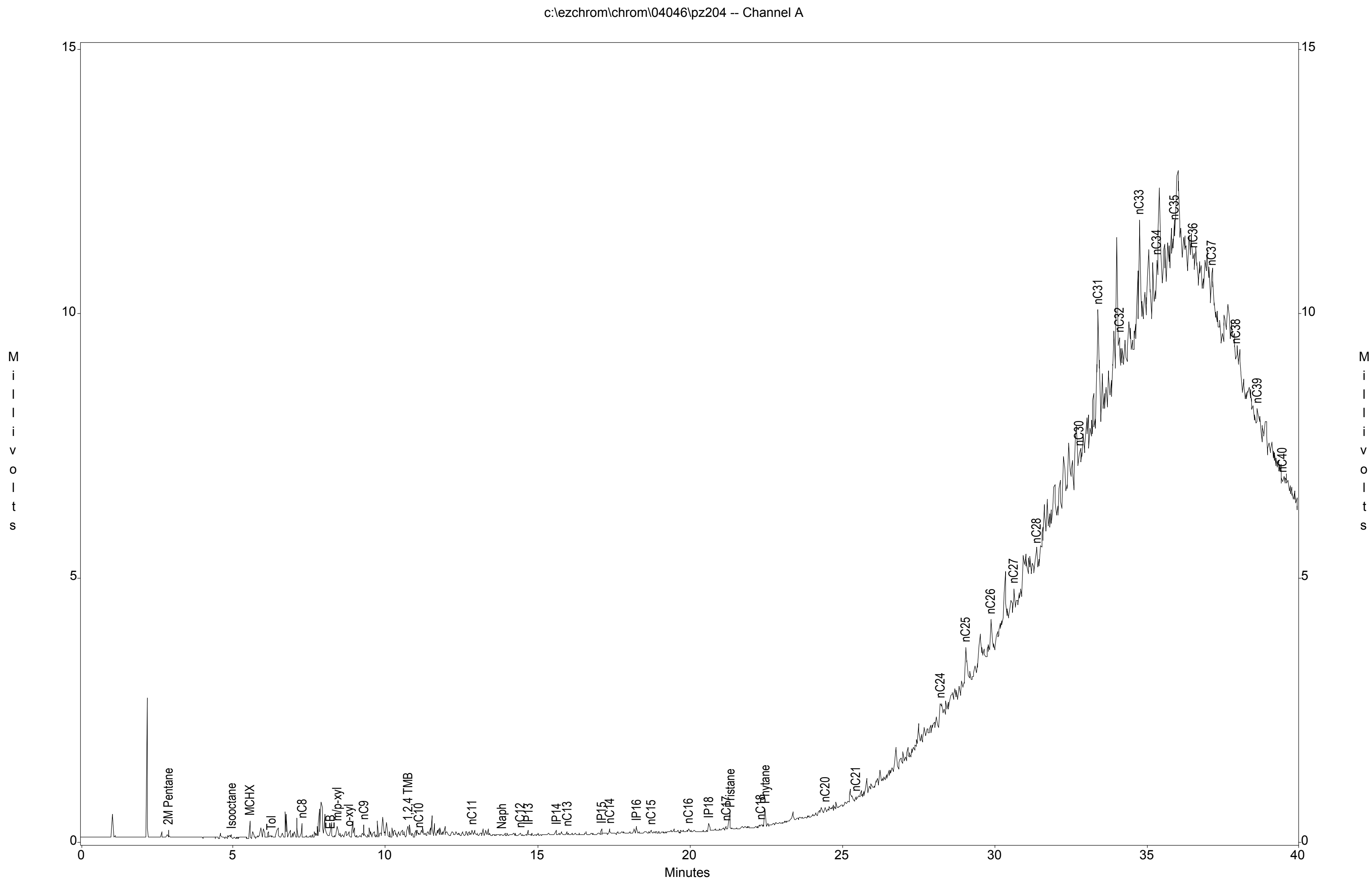
c:\ezchrom\chrom\04046\n-78.2 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : N-79
Acquired : Mar 07, 2004 07:17:27

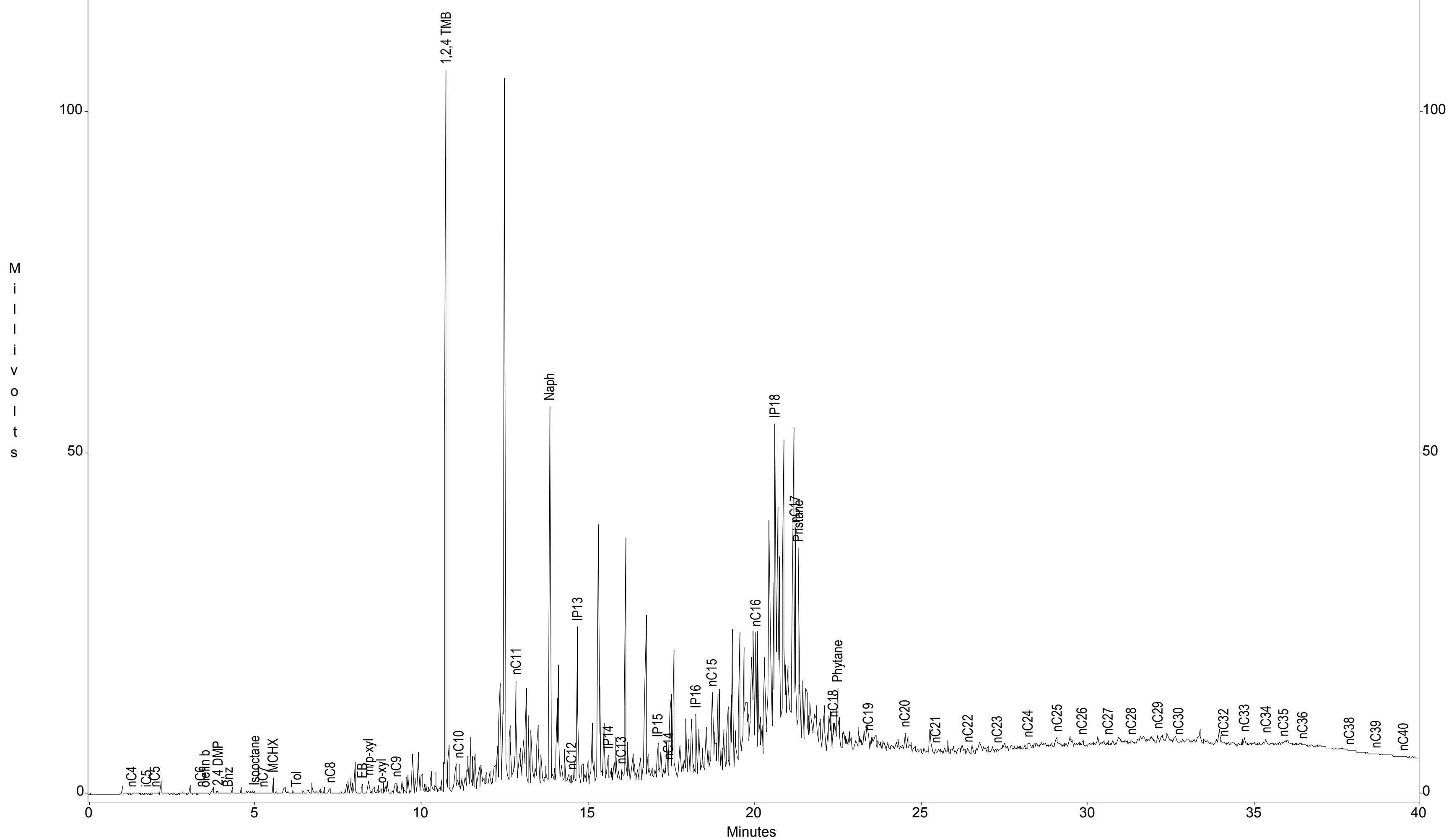


Sun - Philadelphia Refinery COA
Sample ID : PZ-204
Acquired : Mar 05, 2004 19:15:35



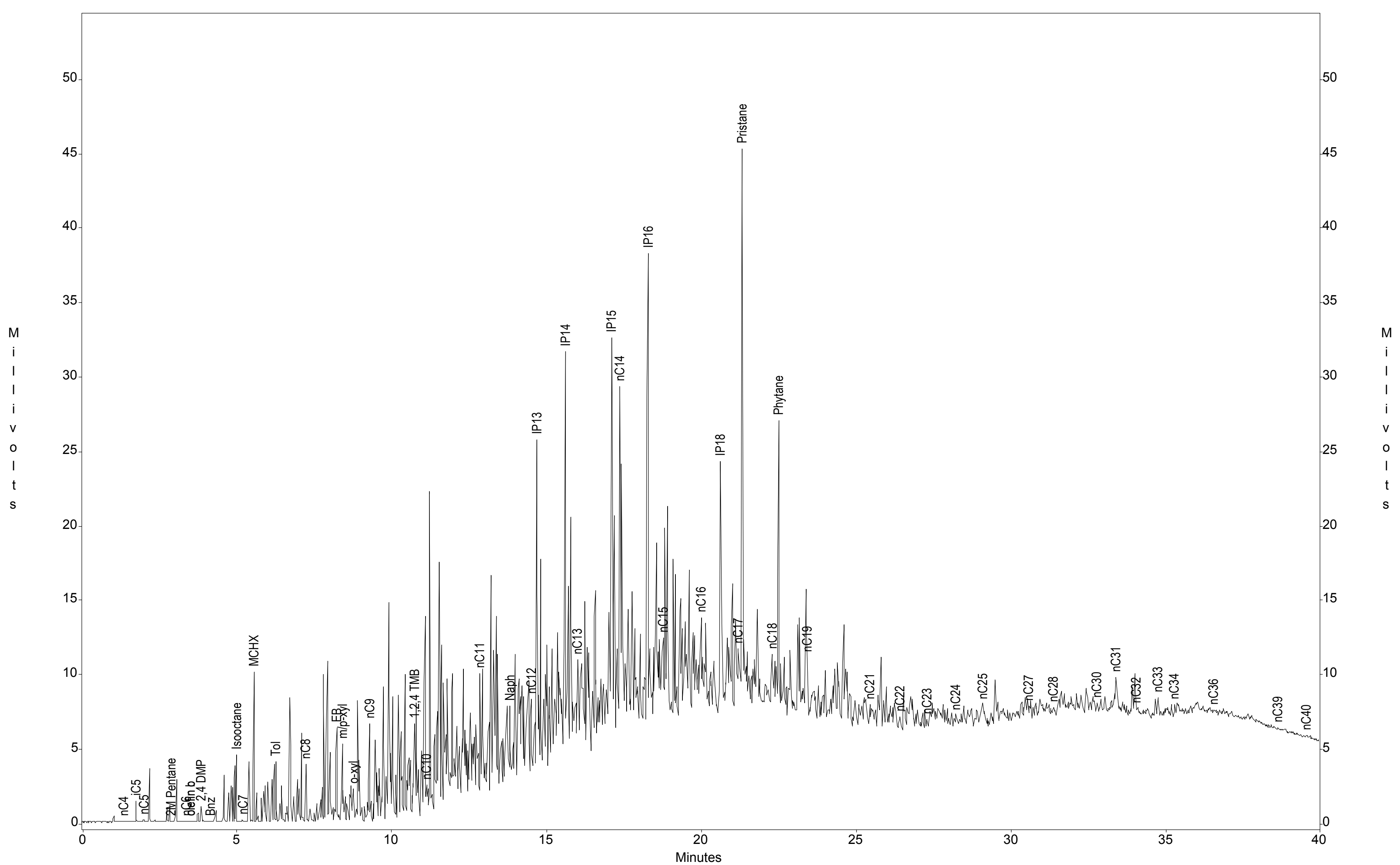
Sun - Philadelphia Refinery COA
Sample ID : PZ-502
Acquired : Mar 08, 2004 13:31:07

c:\ezchrom\chrom\04046\pz-502 -- Channel A



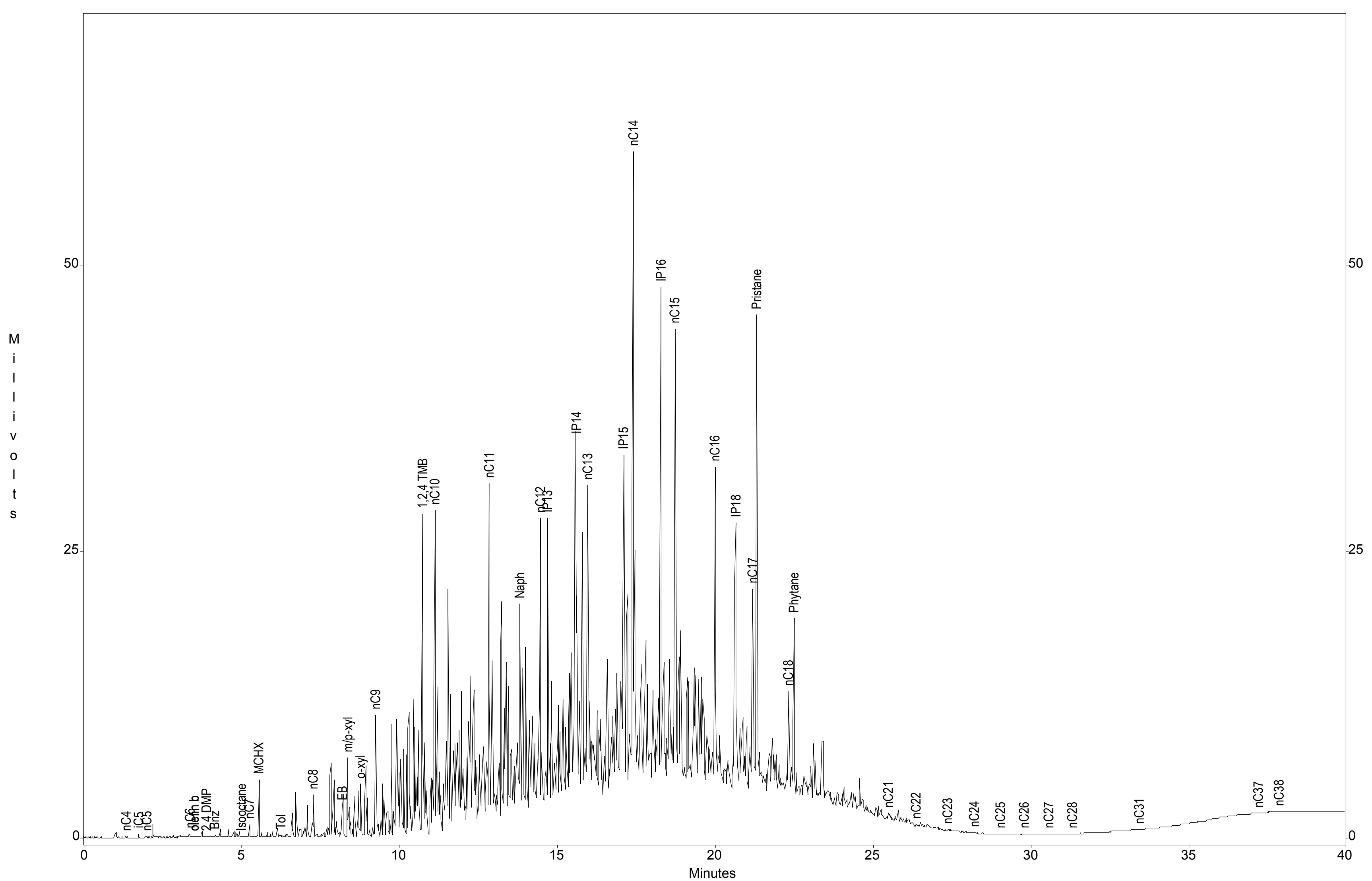
Sun - Philadelphia Refinery COA
Sample ID : S-21
Acquired : Mar 08, 2004 09:27:02

c:\ezchrom\chrom\04046\s-21 -- Channel A



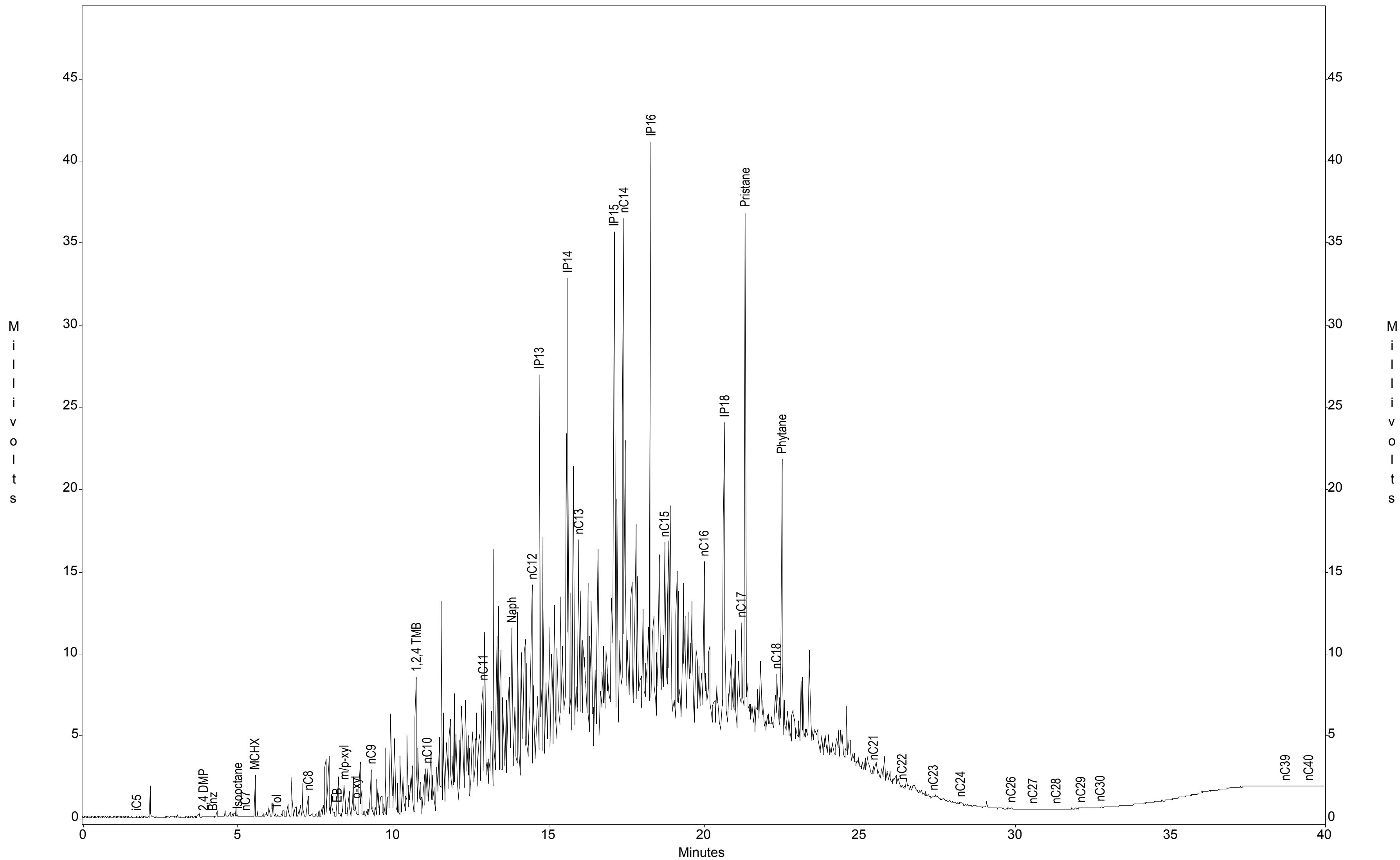
Sun - Philadelphia Refinery COA
Sample ID : S-29
Acquired : Mar 06, 2004 21:24:57

c:\ezchrom\chrom\04046\s-29 -- Channel A

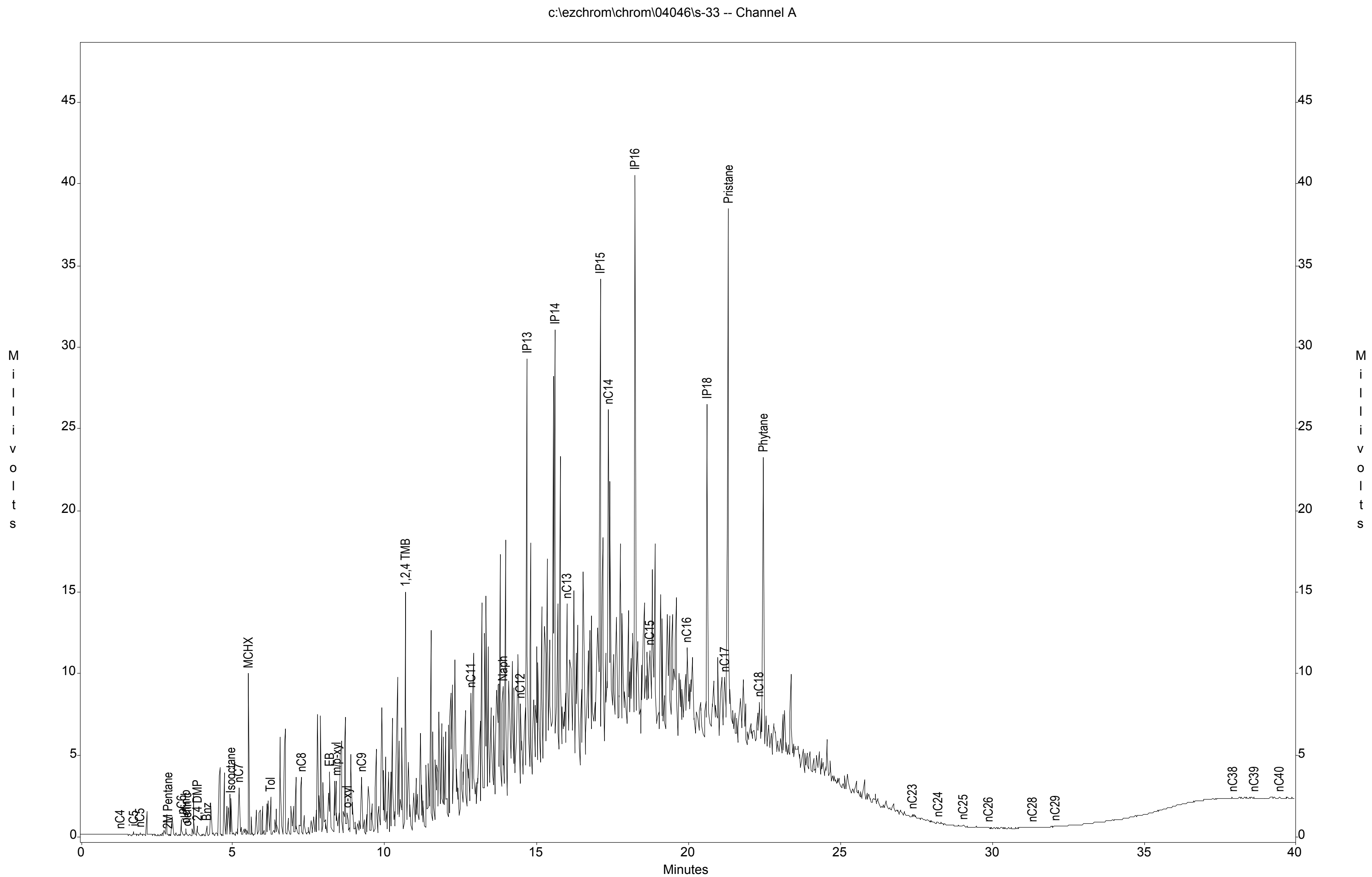


Sun - Philadelphia Refinery COA
Sample ID : S-32
Acquired : Mar 06, 2004 17:12:40

c:\ezchrom\chrom\04046\s-32 -- Channel A

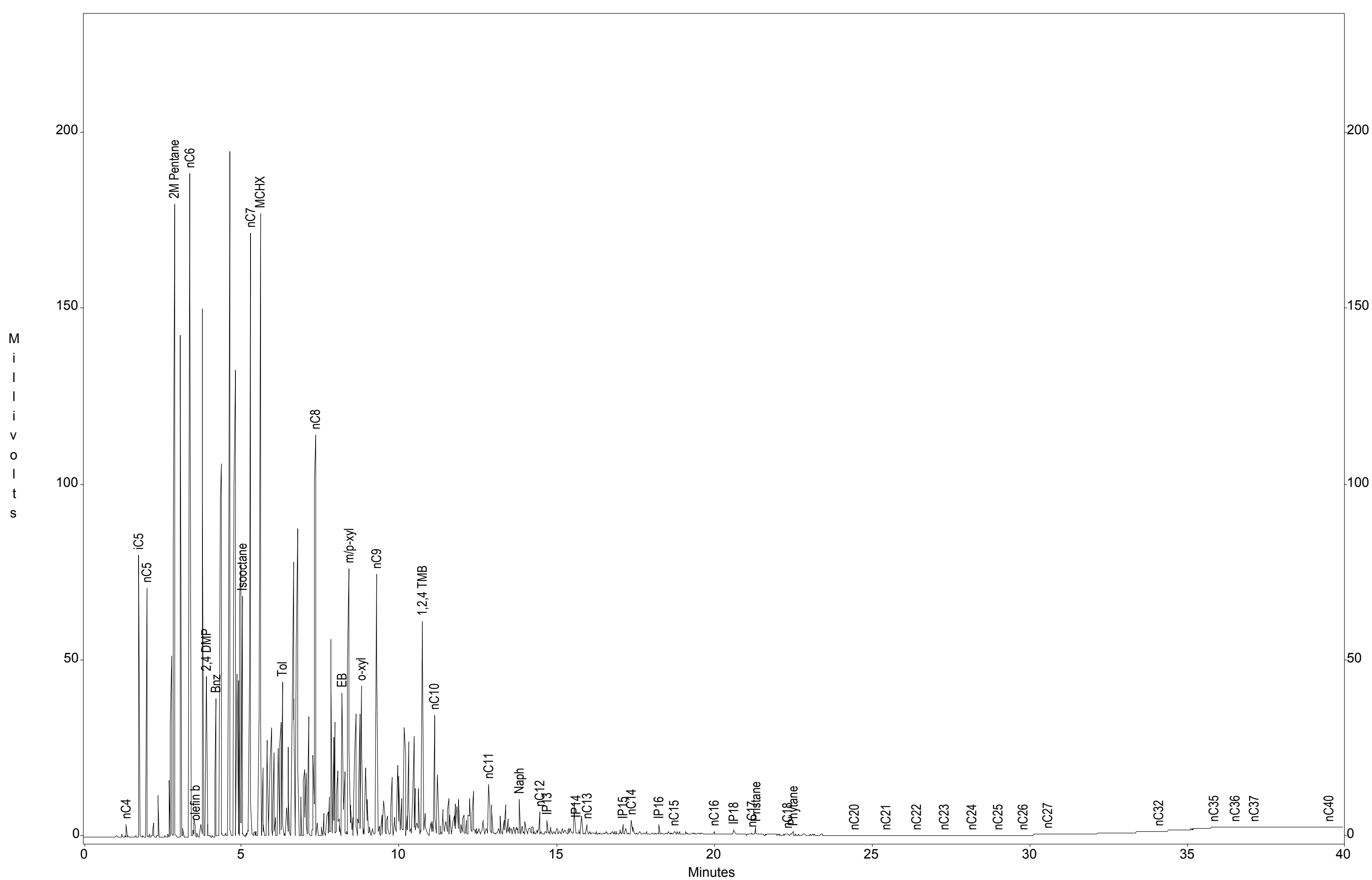


Sun - Philadelphia Refinery COA
Sample ID : S-33
Acquired : Mar 07, 2004 11:36:22



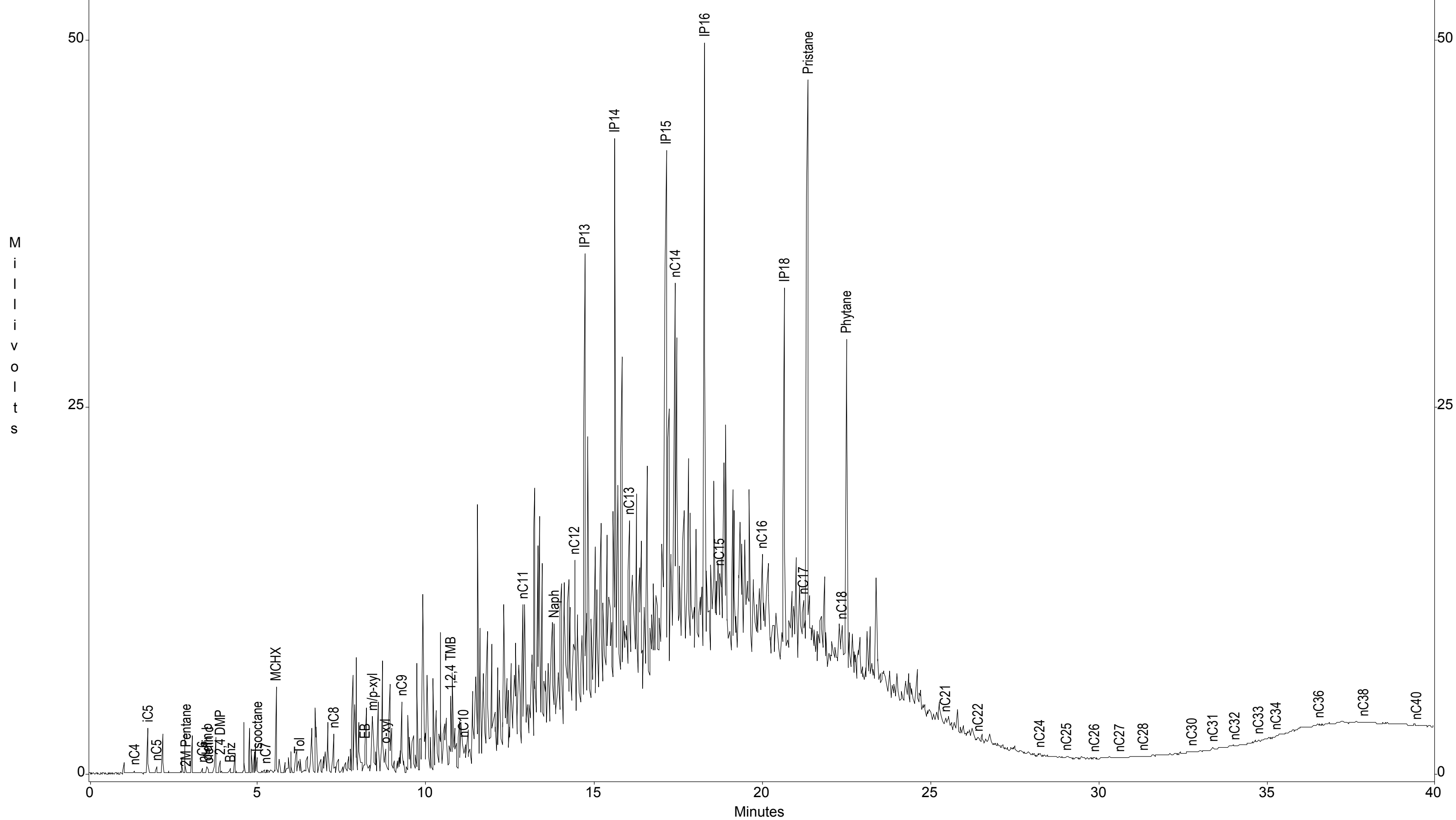
Sun - Philadelphia Refinery COA
Sample ID : S-50
Acquired : Mar 05, 2004 20:09:45

c:\ezchrom\chrom\04046\s-50 -- Channel A



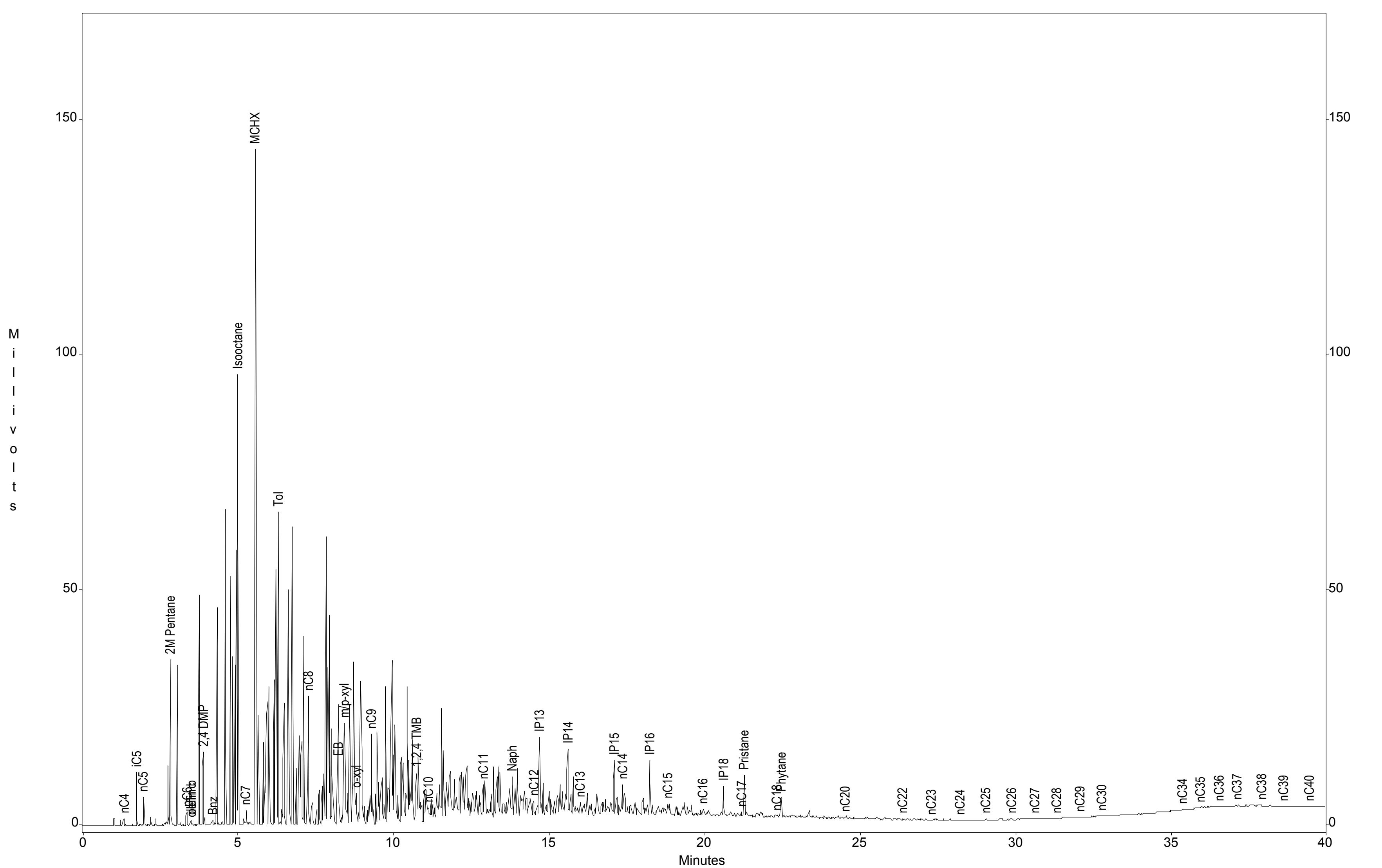
Sun - Philadelphia Refinery COA
Sample ID : S-56
Acquired : Mar 07, 2004 15:39:59

c:\ezchrom\chrom\04046\s-56 -- Channel A



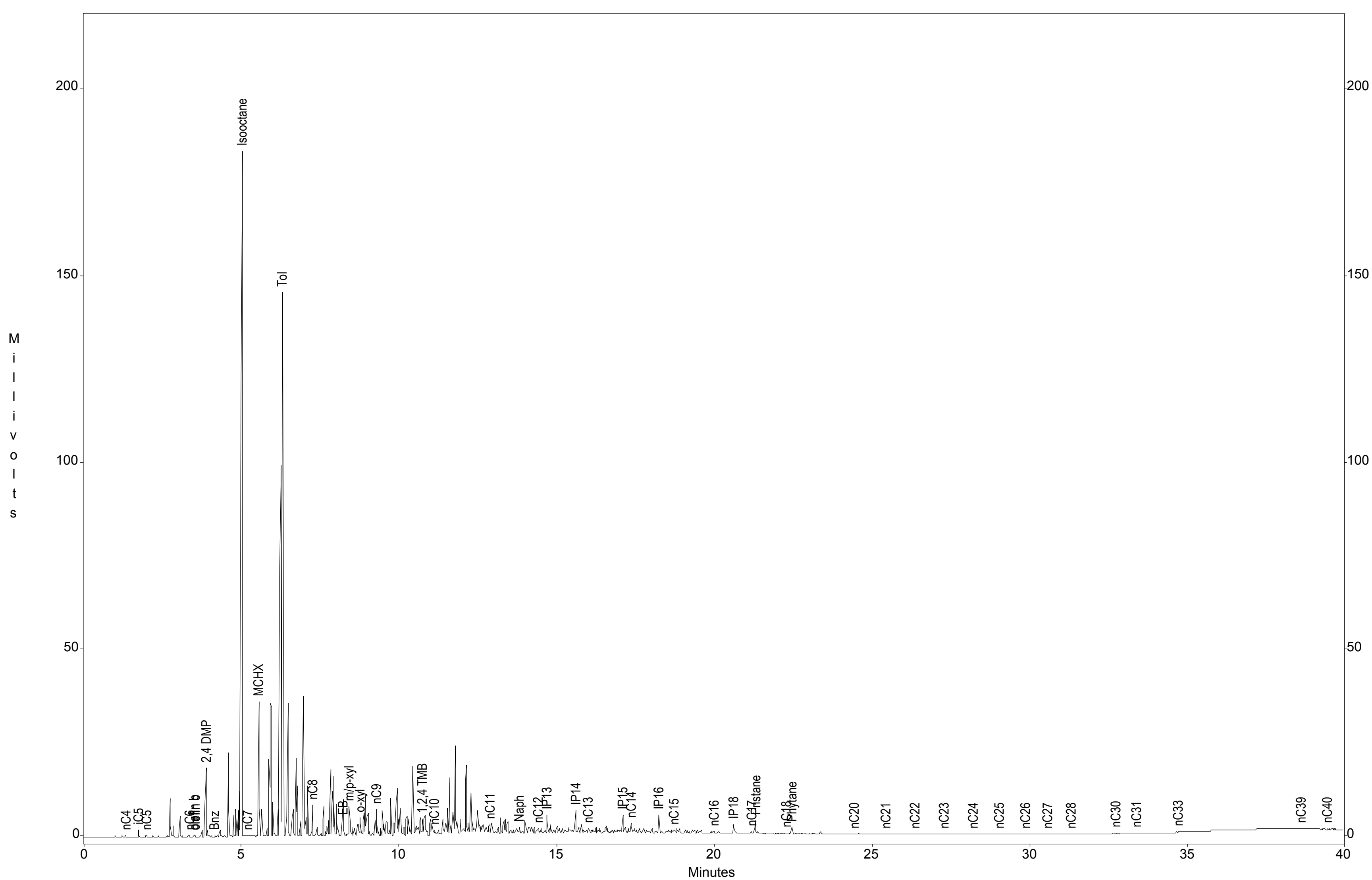
Sun - Philadelphia Refinery COA
Sample ID : S-59
Acquired : Mar 08, 2004 11:53:37

c:\ezchrom\chrom\04046\s-59 -- Channel A



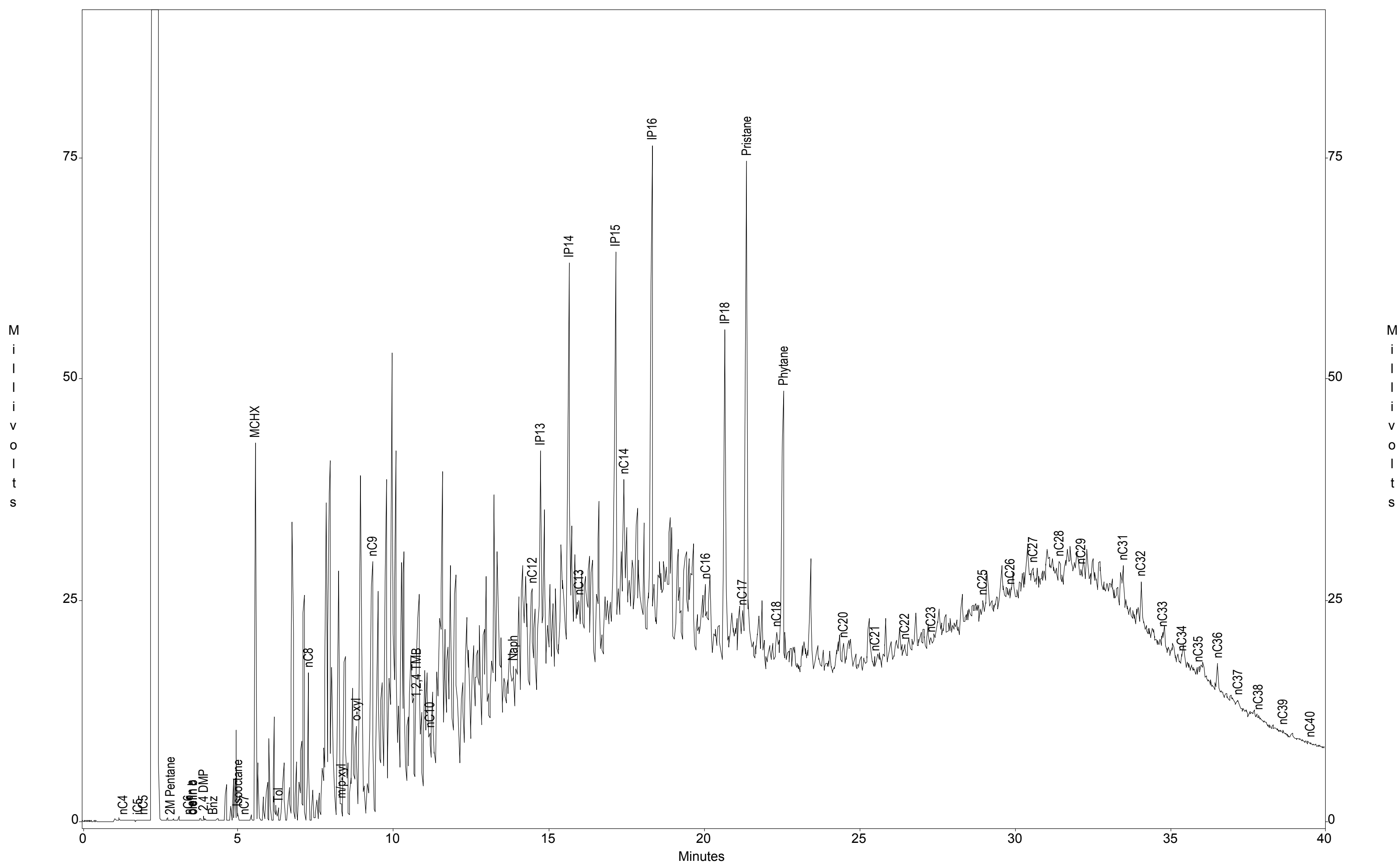
Sun - Philadelphia Refinery COA
Sample ID : S-60
Acquired : Mar 06, 2004 13:54:31

c:\ezchrom\chrom\04046\s-60.2 -- Channel A

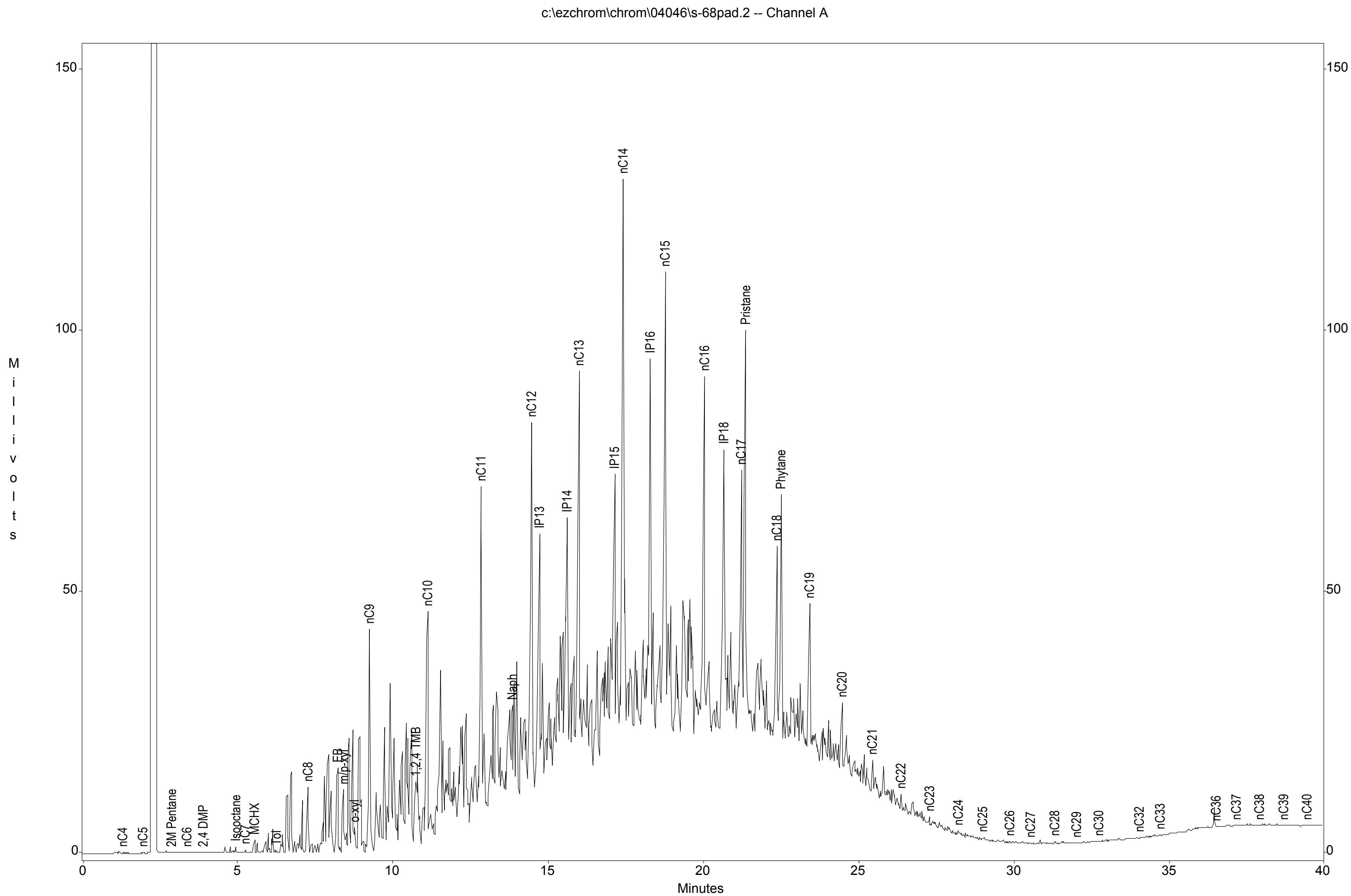


Sun - Philadelphia Refinery COA
Sample ID : S-64 Pad
Acquired : Mar 09, 2004 09:15:53

c:\ezchrom\chrom\04046\s-64pad -- Channel A

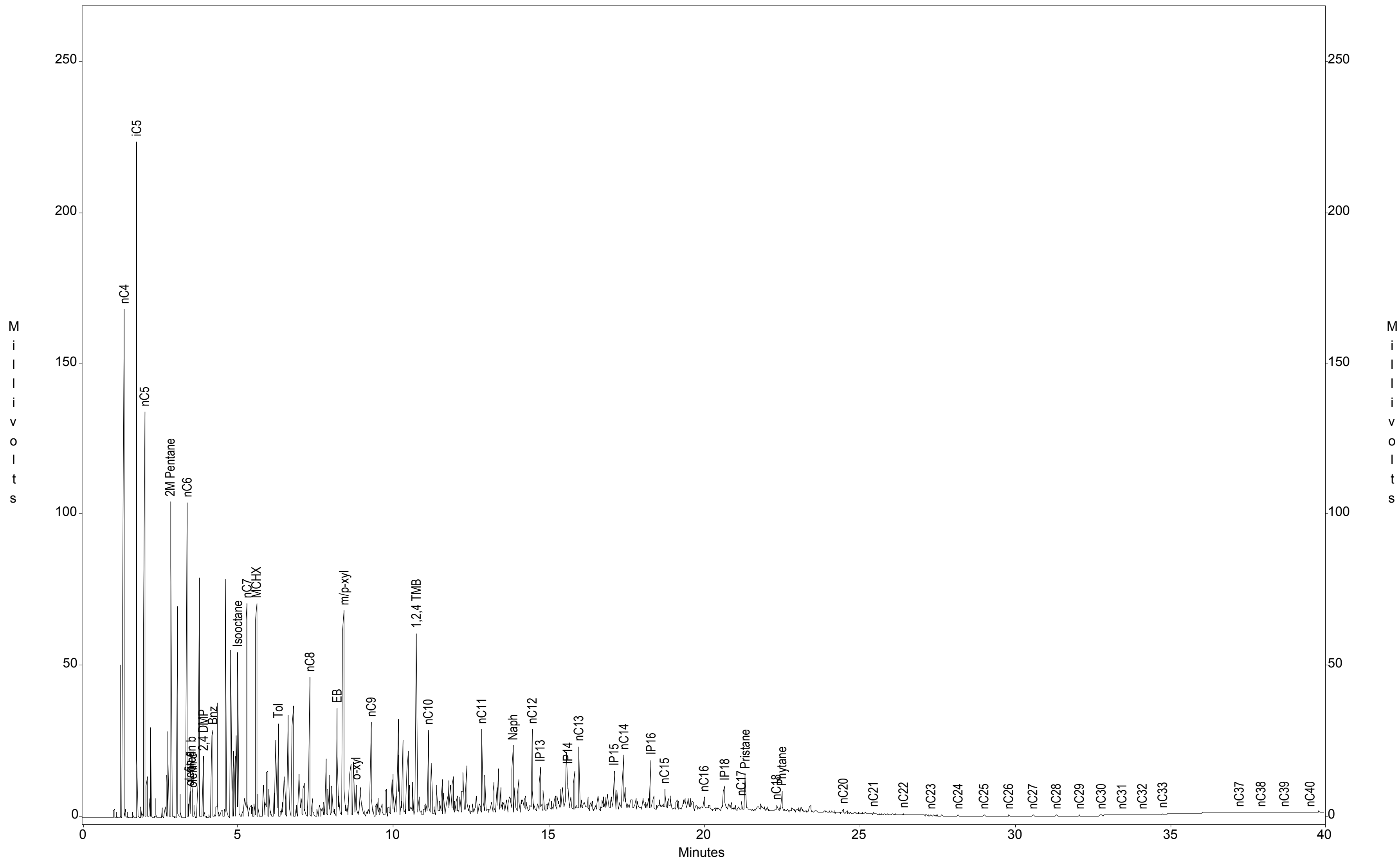


Sun - Philadelphia Refinery COA
Sample ID : S-68 Pad
Acquired : Mar 09, 2004 13:21:33

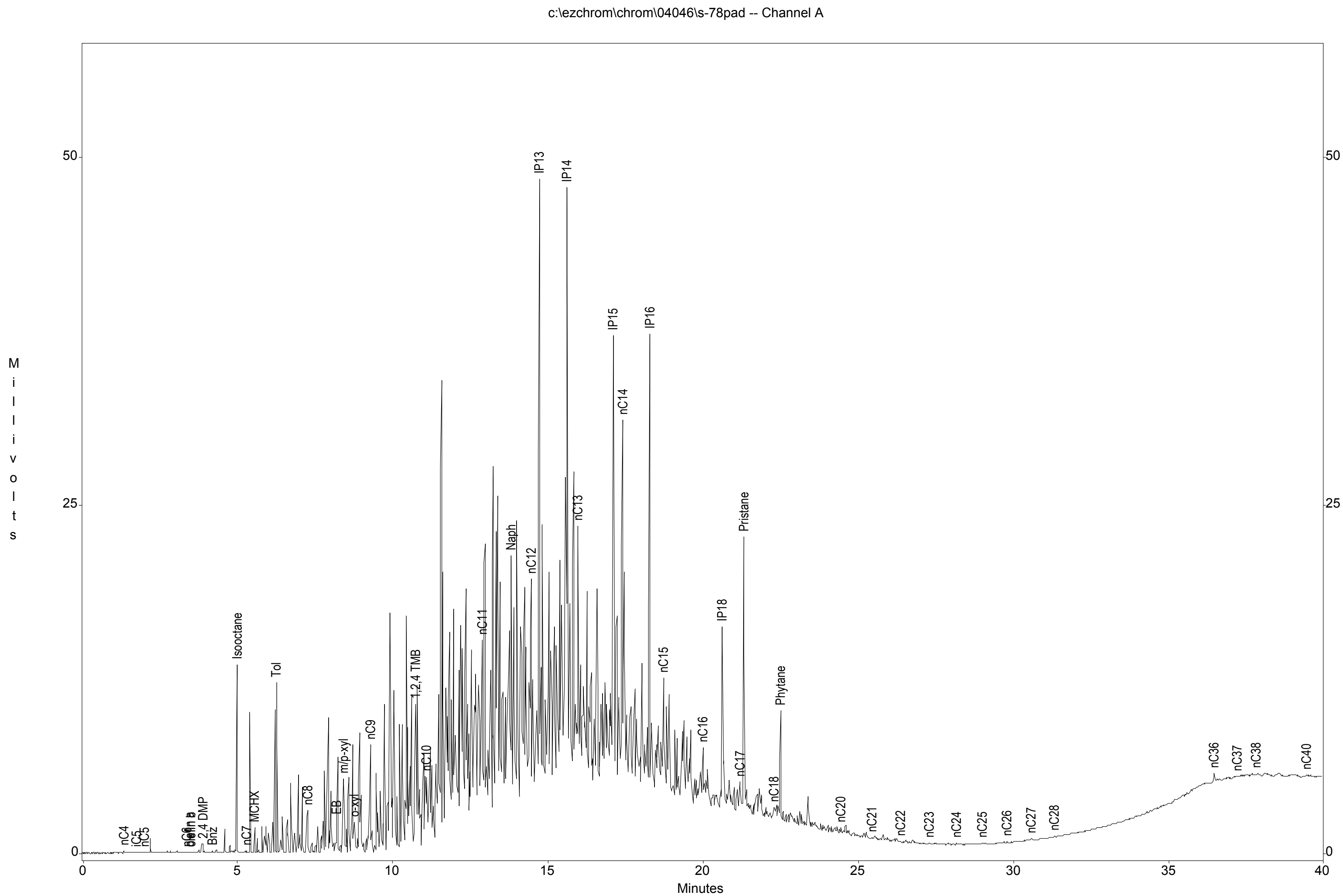


Sun - Philadelphia Refinery COA
Sample ID : S-76
Acquired : Mar 06, 2004 10:39:34

c:\ezchrom\chrom\04046\s-76 -- Channel A

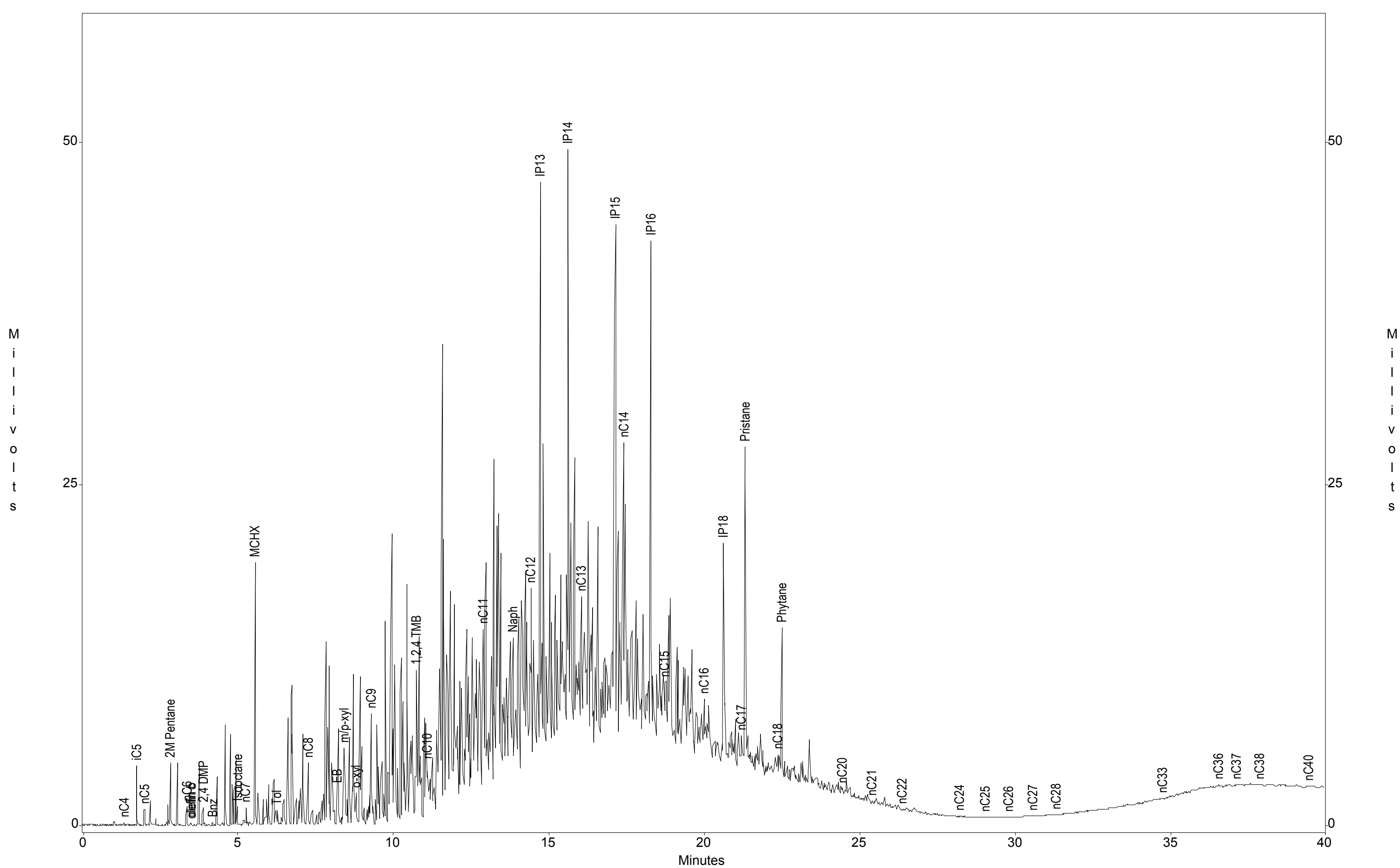


Sun - Philadelphia Refinery COA
Sample ID : S-78 Pad
Acquired : Mar 09, 2004 16:37:51

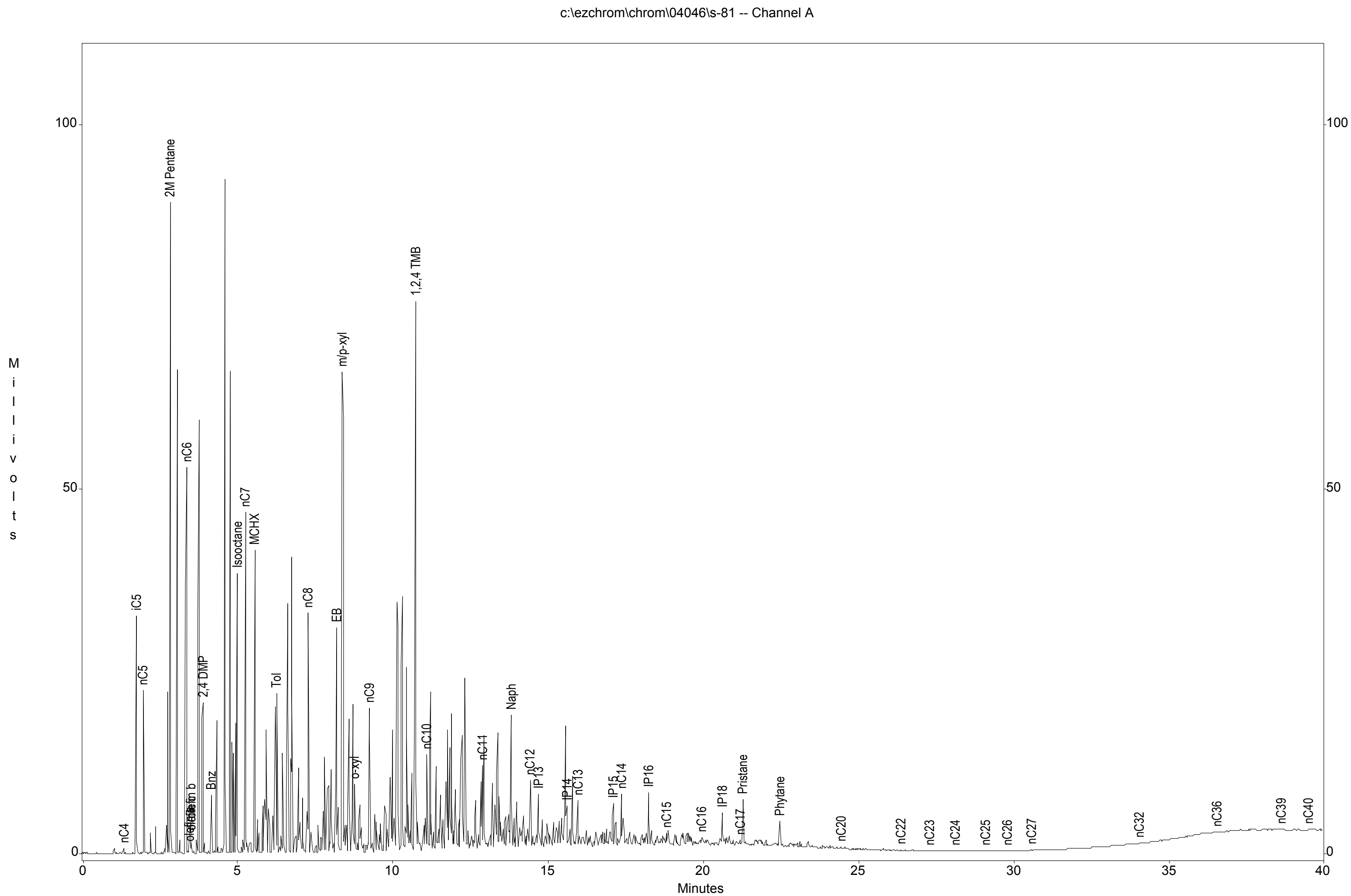


Sun - Philadelphia Refinery COA
Sample ID : S-79
Acquired : Mar 06, 2004 19:45:35

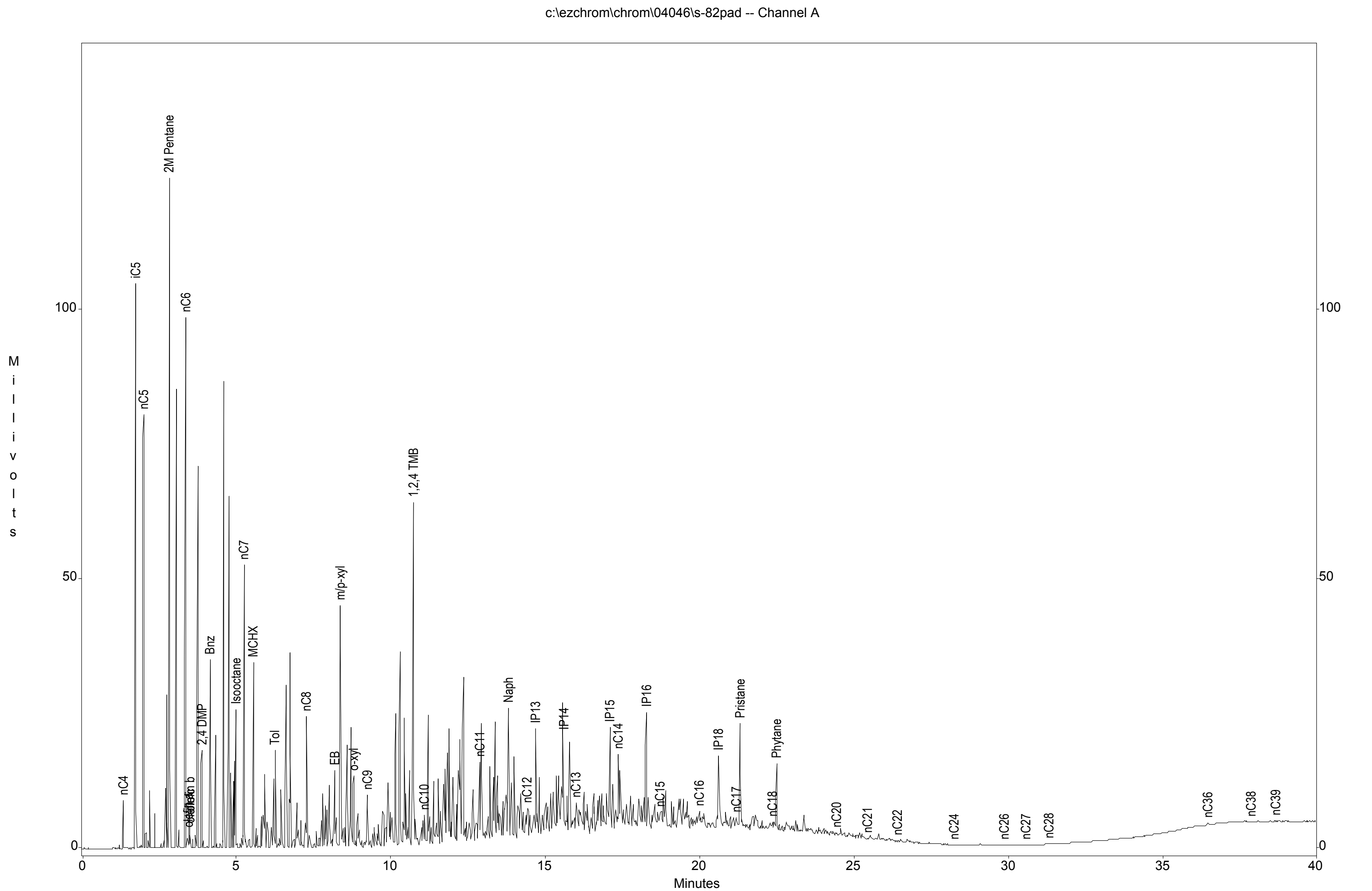
c:\ezchrom\chrom\04046\s-79 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : S-81
Acquired : Mar 07, 2004 20:33:12

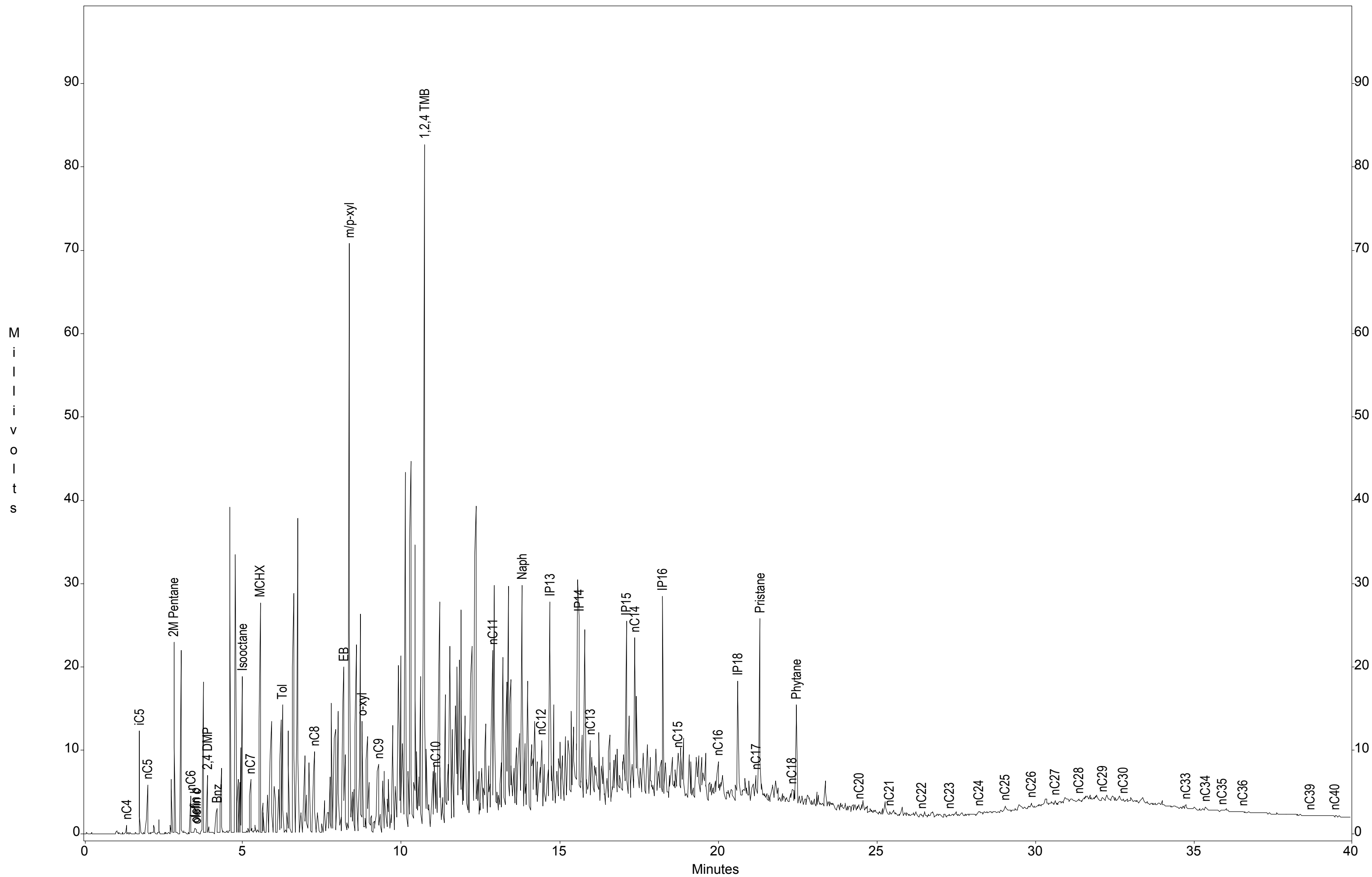


Sun - Philadelphia Refinery COA
Sample ID : S-82 Pad
Acquired : Mar 09, 2004 17:26:13



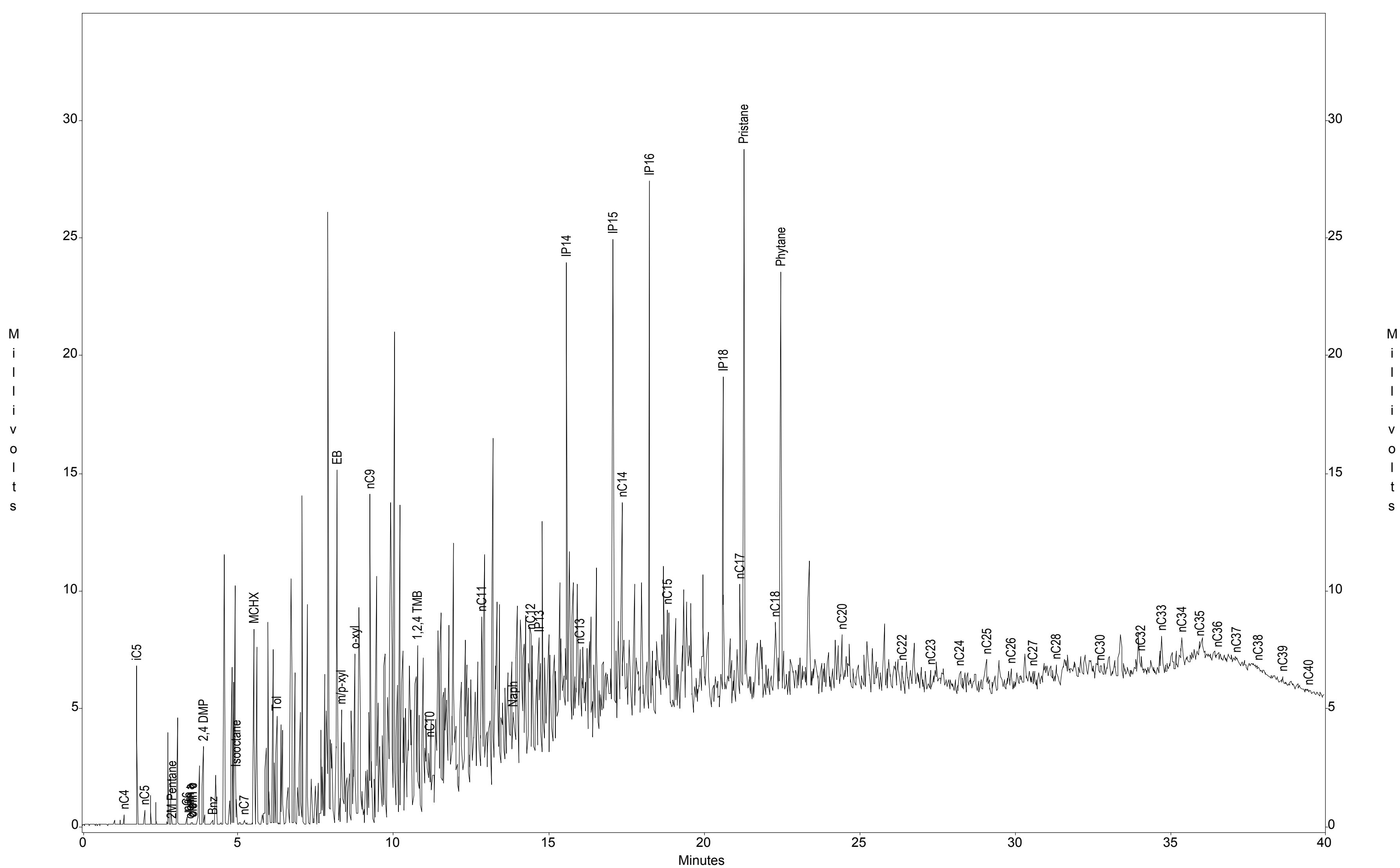
Sun - Philadelphia Refinery COA
Sample ID : S-89
Acquired : Mar 06, 2004 09:49:44

c:\ezchrom\chrom\04046\s-89 -- Channel A

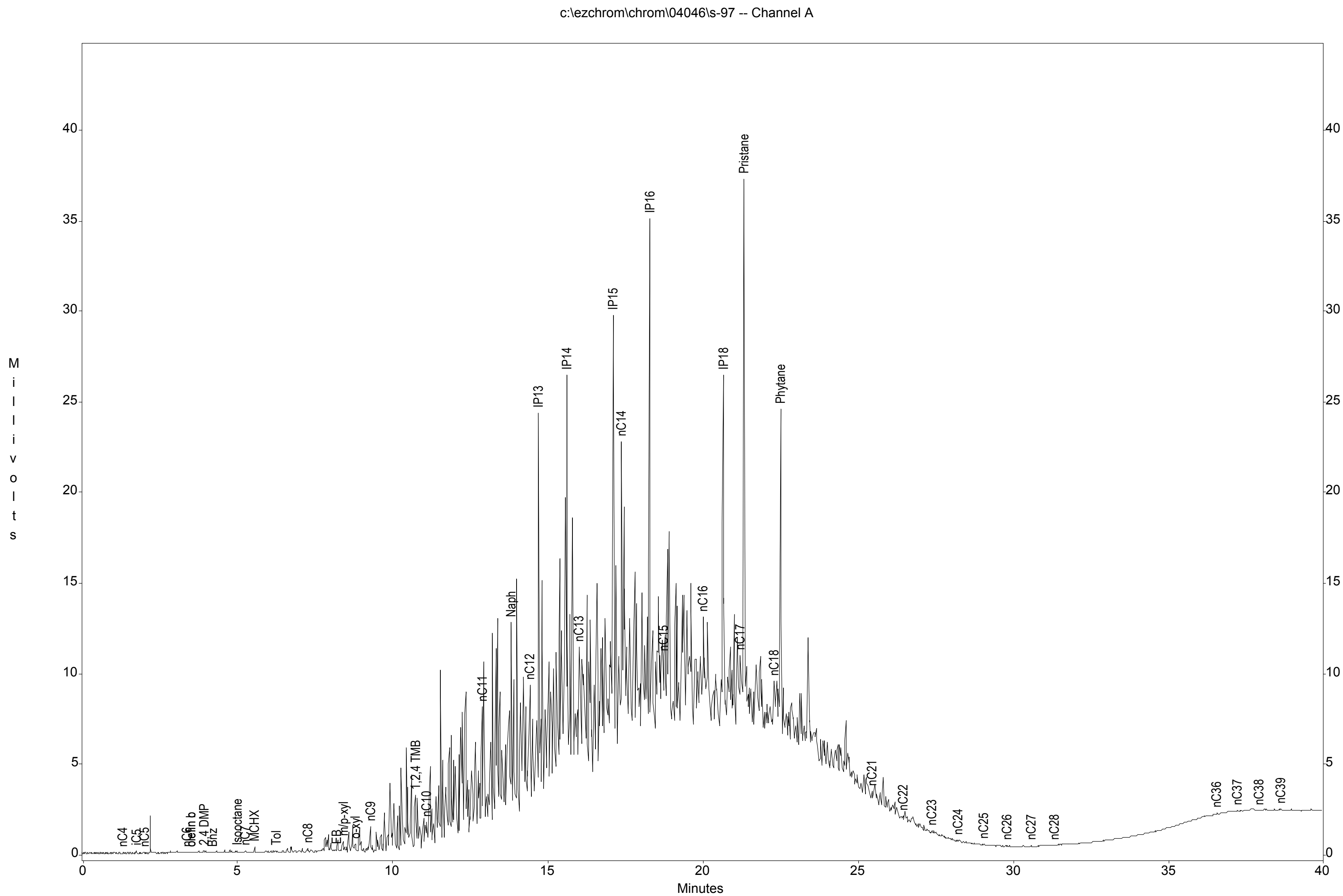


Sun - Philadelphia Refinery COA
Sample ID : S-92
Acquired : Mar 08, 2004 16:45:21

c:\ezchrom\chrom\04046\s-92 -- Channel A

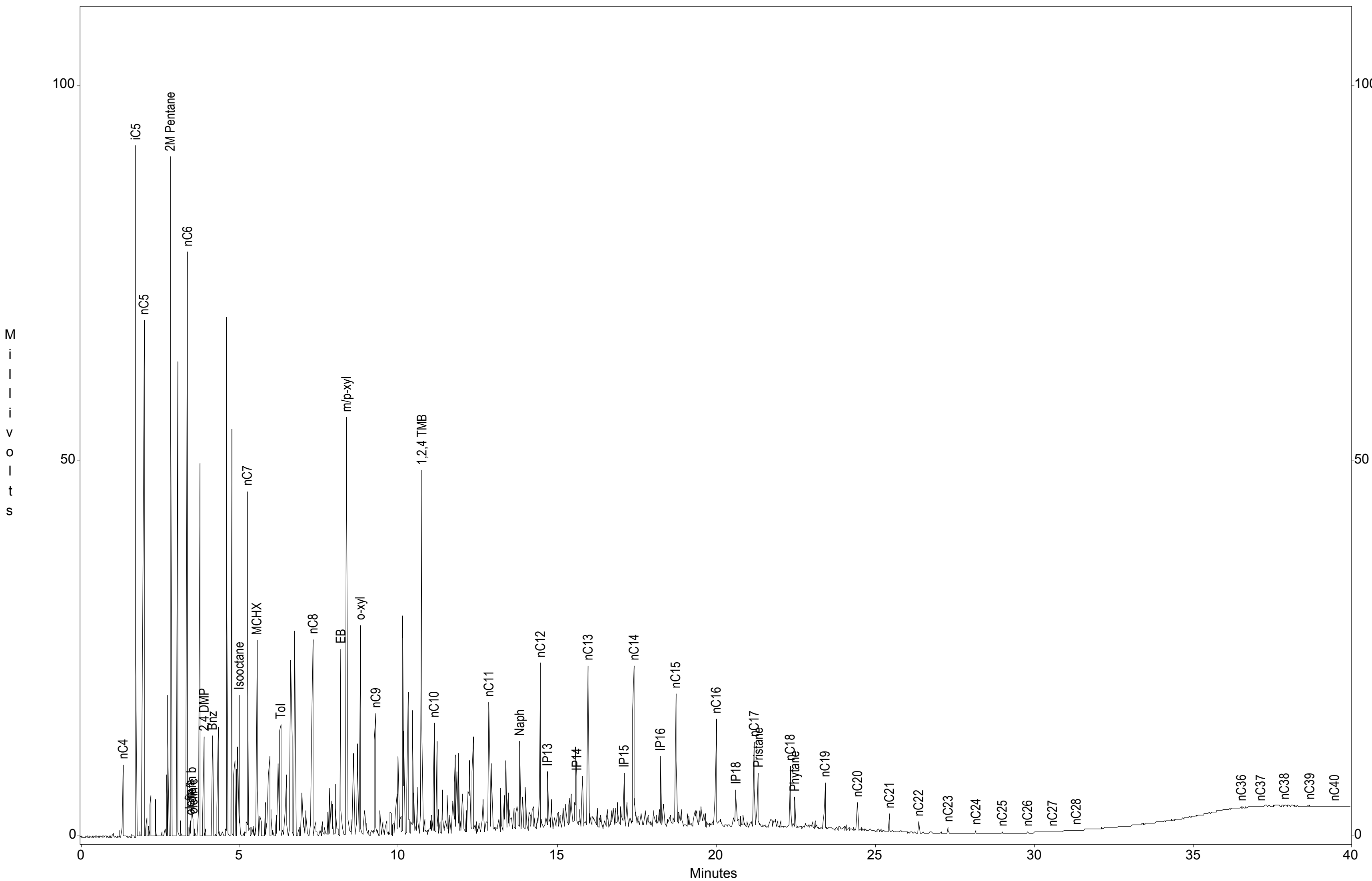


Sun - Philadelphia Refinery COA
Sample ID : S-97
Acquired : Mar 06, 2004 20:35:31



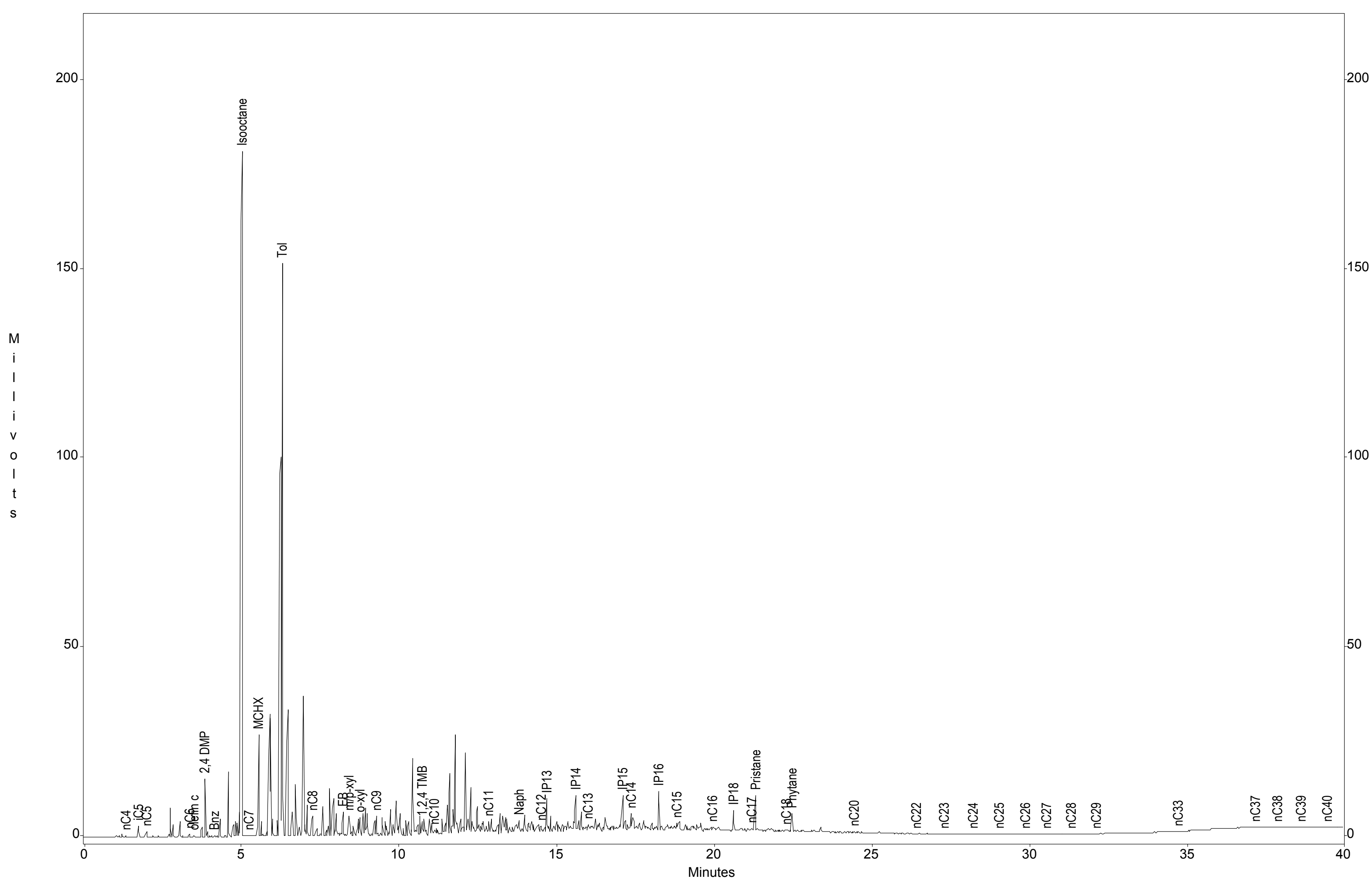
Sun - Philadelphia Refinery COA
Sample ID : S-100
Acquired : Mar 08, 2004 15:07:33

c:\ezchrom\chrom\04046\s-100 -- Channel A



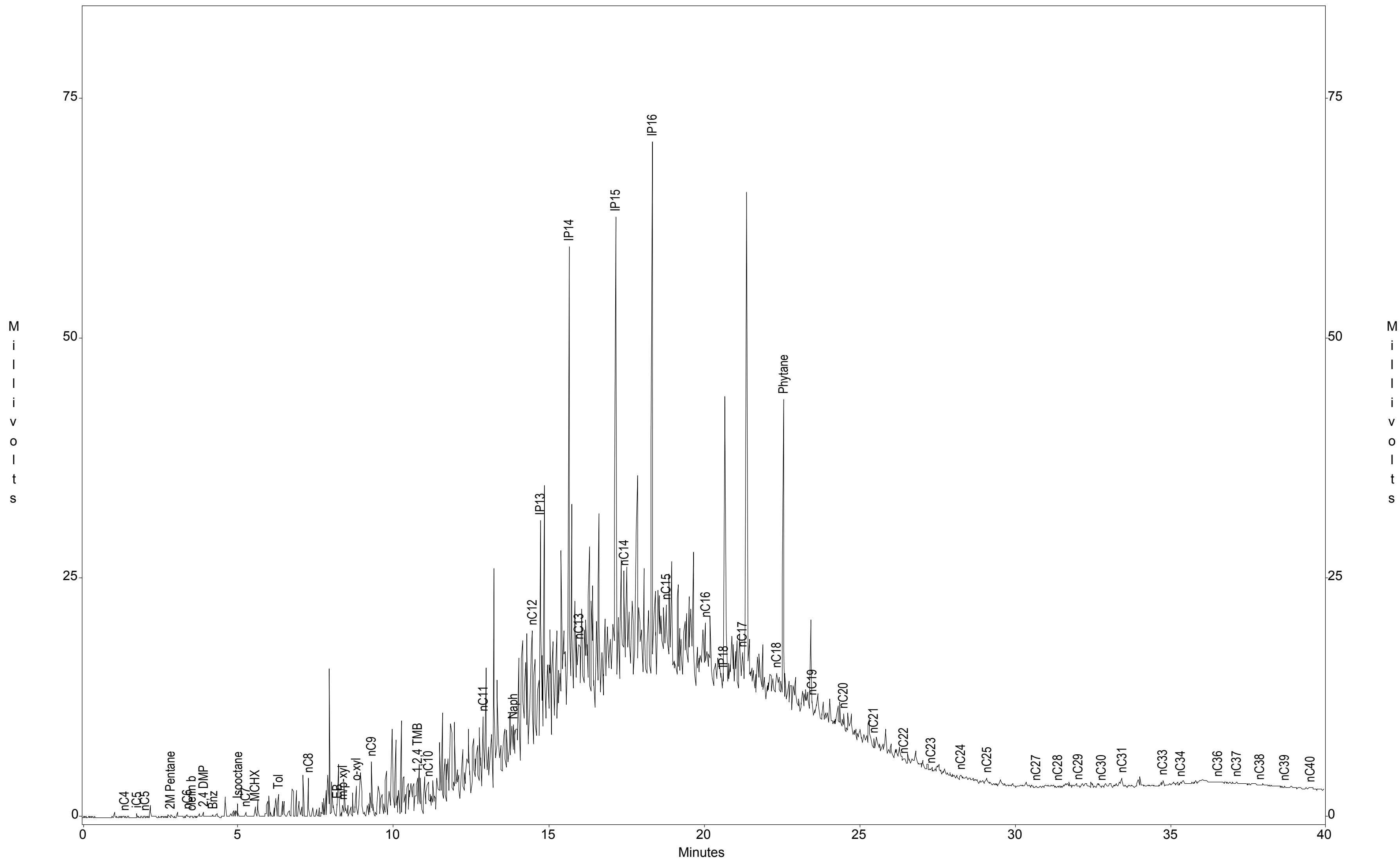
Sun - Philadelphia Refinery COA
Sample ID : S-103
Acquired : Mar 07, 2004 10:31:49

c:\ezchrom\chrom\04046\s-103.2 -- Channel A

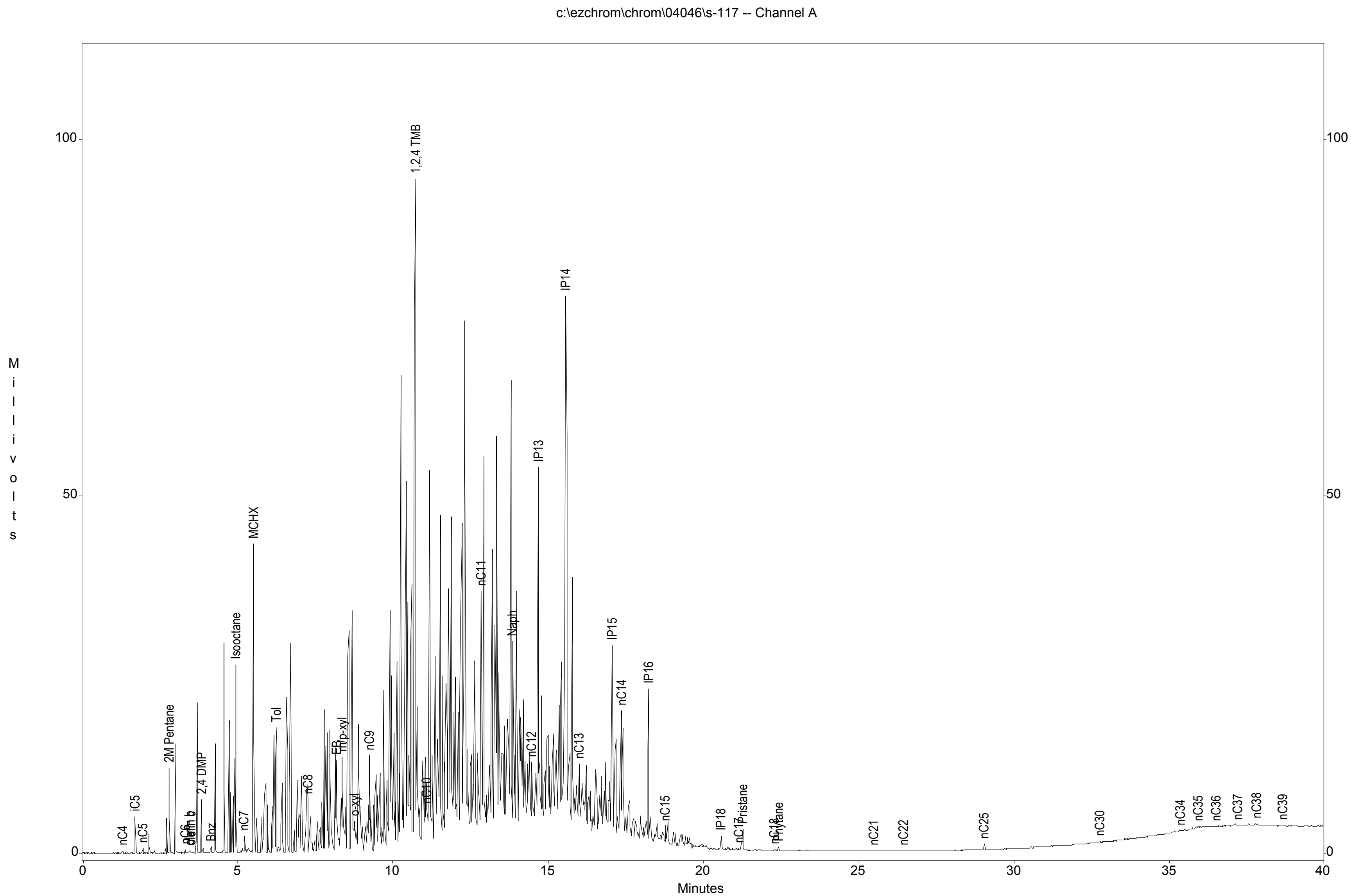


Sun - Philadelphia Refinery COA
Sample ID : S-104
Acquired : Mar 05, 2004 20:59:40

c:\ezchrom\chrom\04046\s-104 -- Channel A

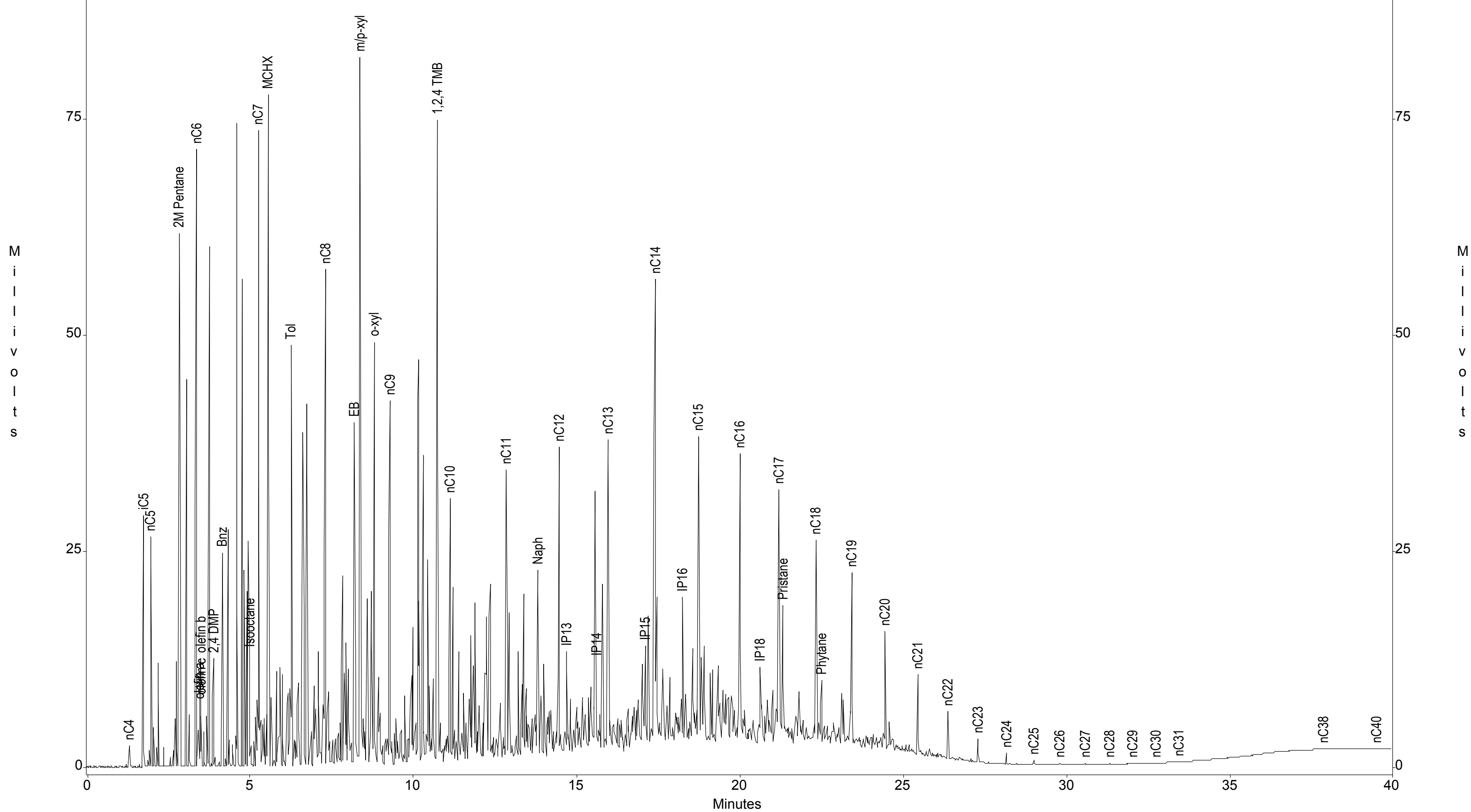


Sun - Philadelphia Refinery COA
Sample ID : S-117
Acquired : Mar 07, 2004 19:44:48

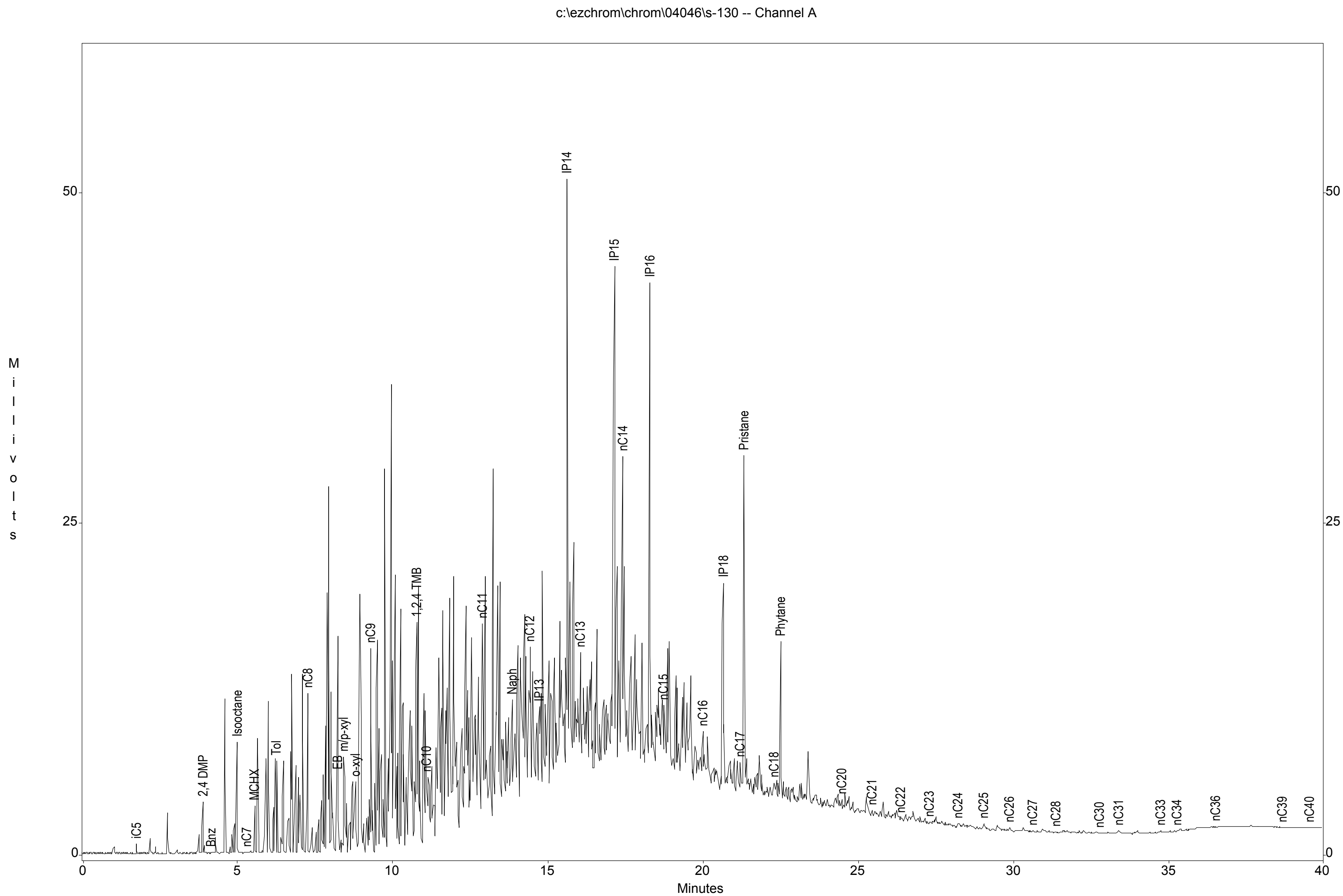


Sun - Philadelphia Refinery COA
Sample ID : S-124
Acquired : Mar 07, 2004 08:06:00

c:\ezchrom\chrom\04046\s-124 -- Channel A

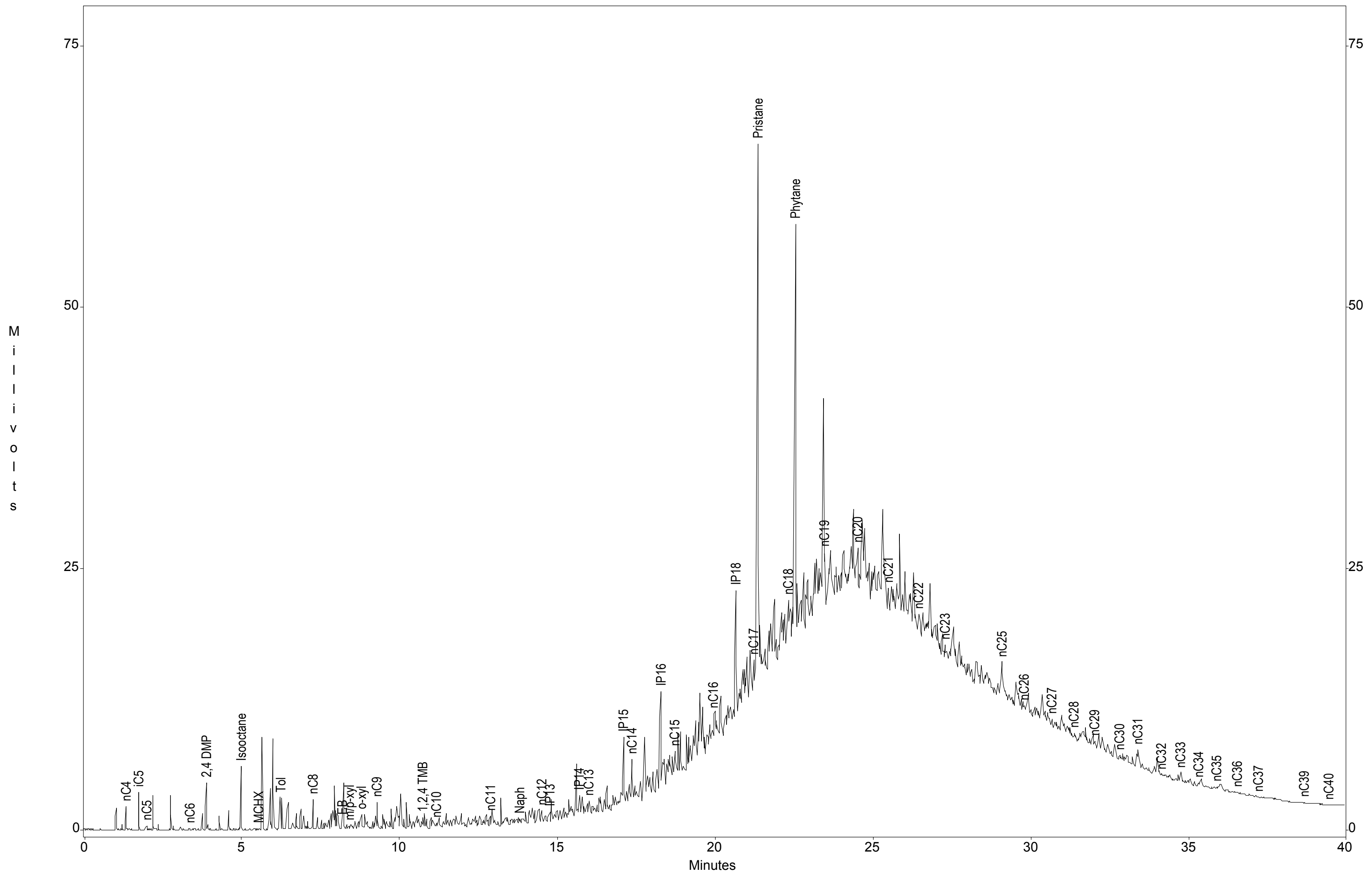


Sun - Philadelphia Refinery COA
Sample ID : S-130
Acquired : Mar 06, 2004 15:34:08



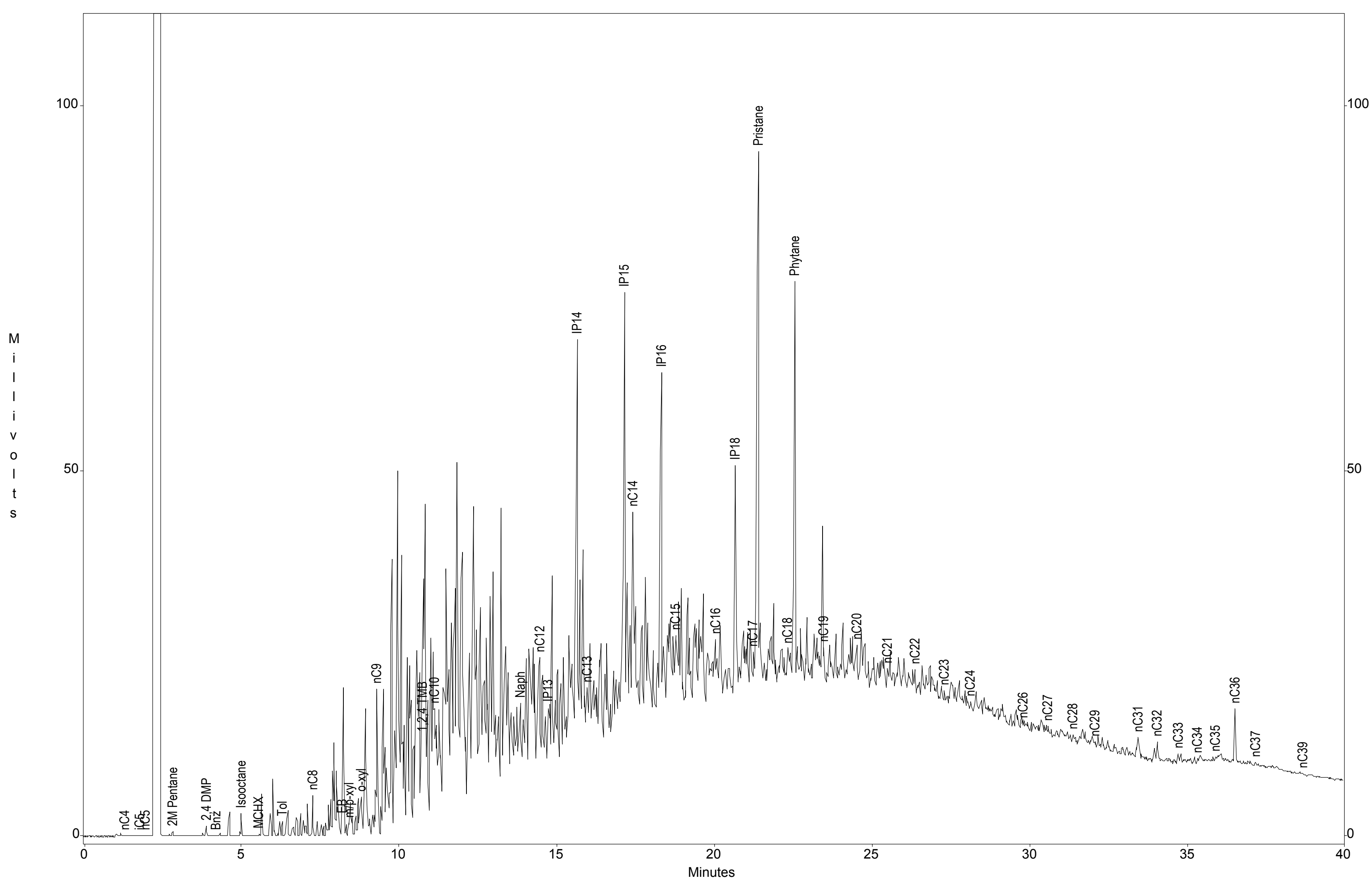
Sun - Philadelphia Refinery COA
Sample ID : S-138
Acquired : Mar 06, 2004 16:23:12

c:\ezchrom\chrom\04046\s-138 -- Channel A



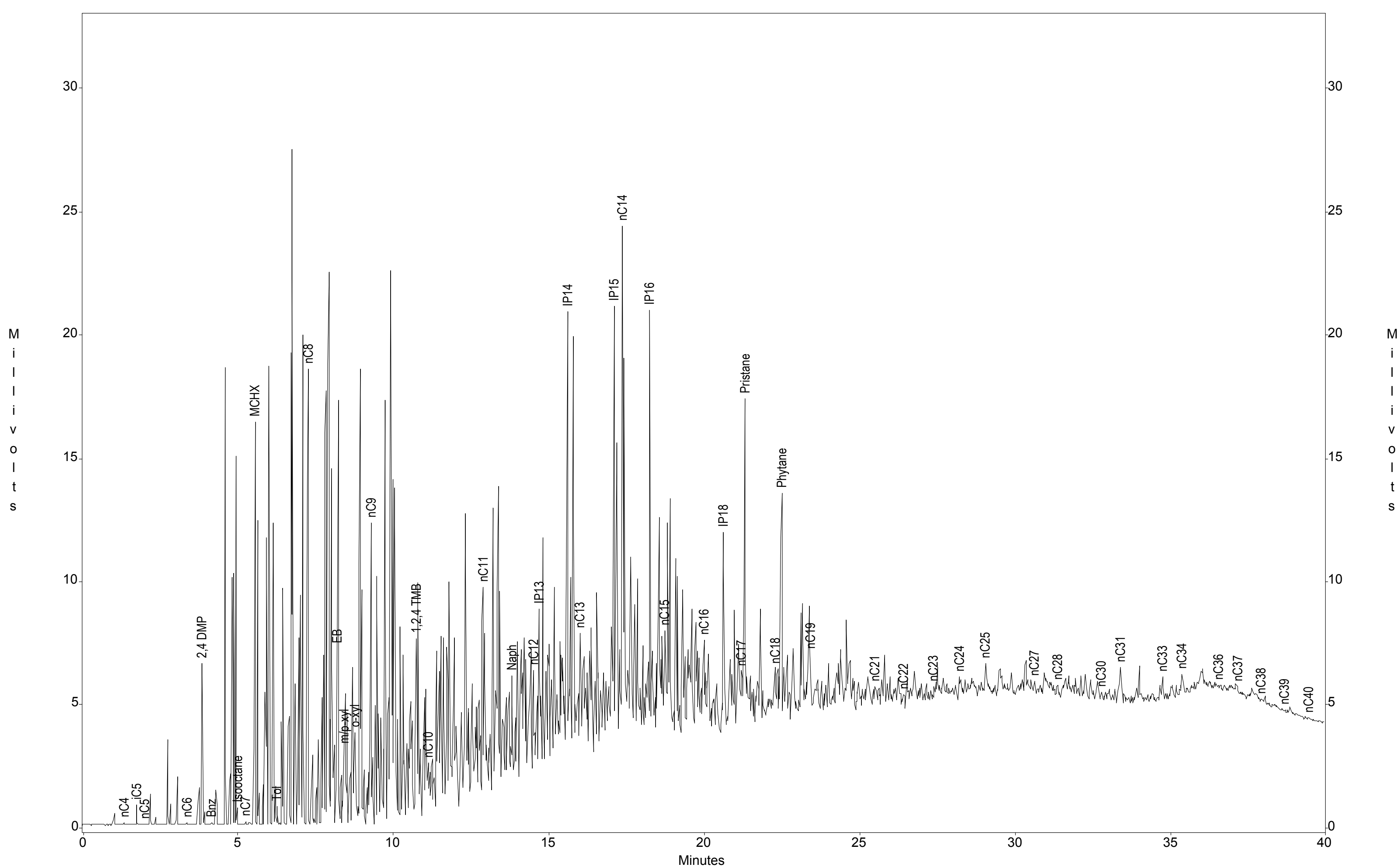
Sun - Philadelphia Refinery COA
Sample ID : S-142 Pad
Acquired : Mar 09, 2004 15:49:23

c:\ezchrom\chrom\04046\s-142pad -- Channel A

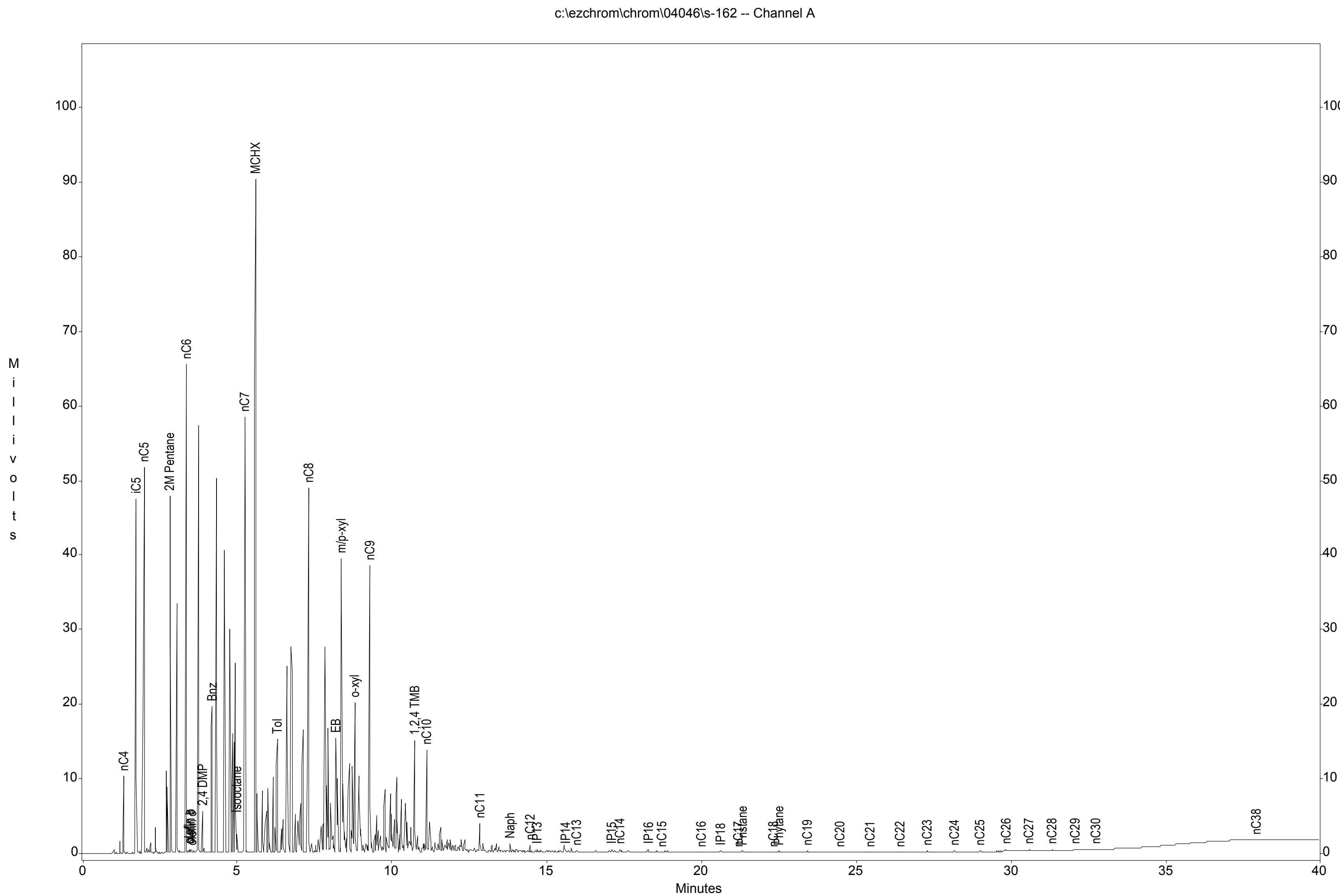


Sun - Philadelphia Refinery COA
Sample ID : S-158
Acquired : Mar 07, 2004 21:21:22

c:\ezchrom\chrom\04046\s-158 -- Channel A

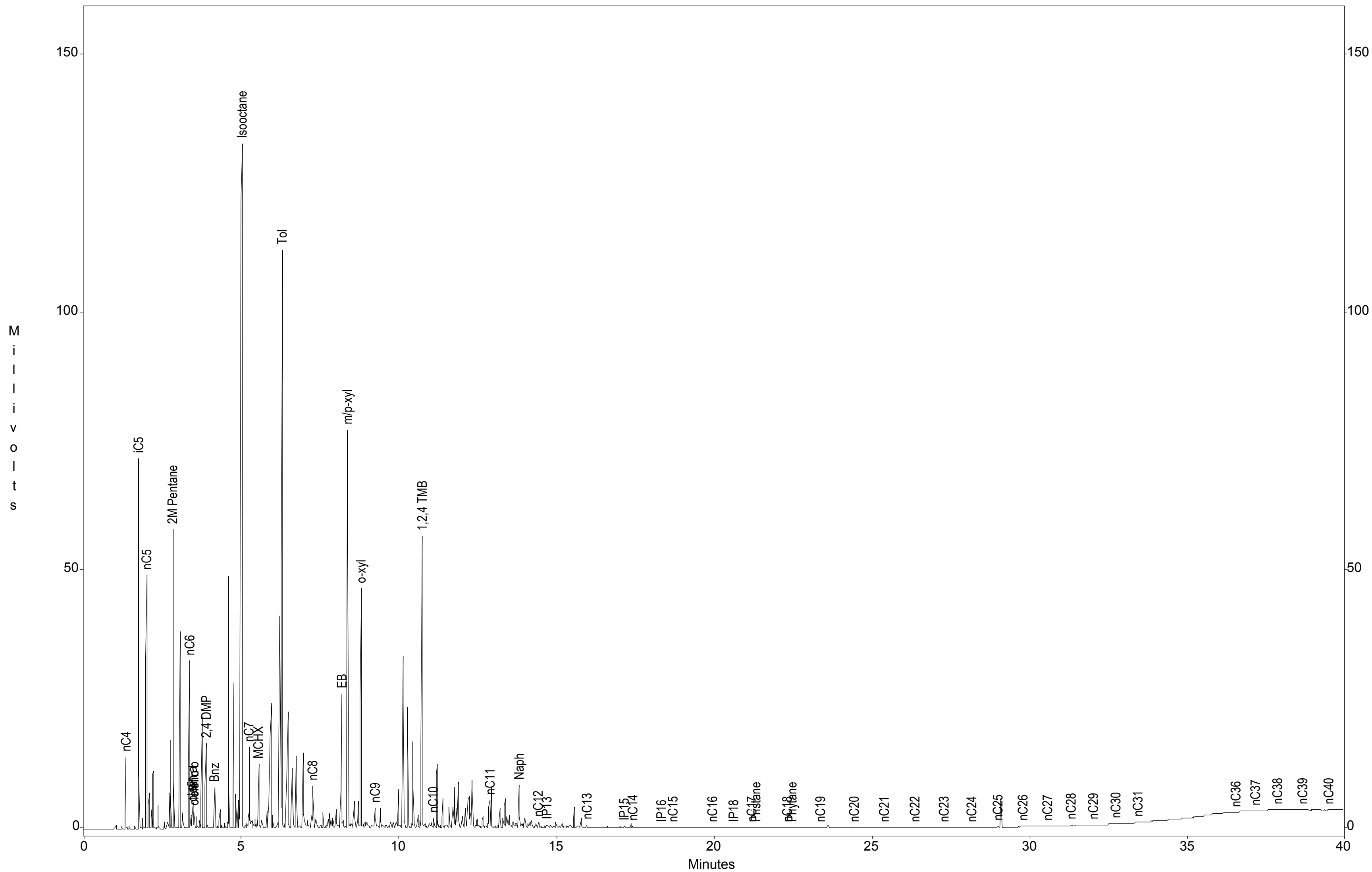


Sun - Philadelphia Refinery COA
Sample ID : S-162
Acquired : Mar 06, 2004 08:11:34



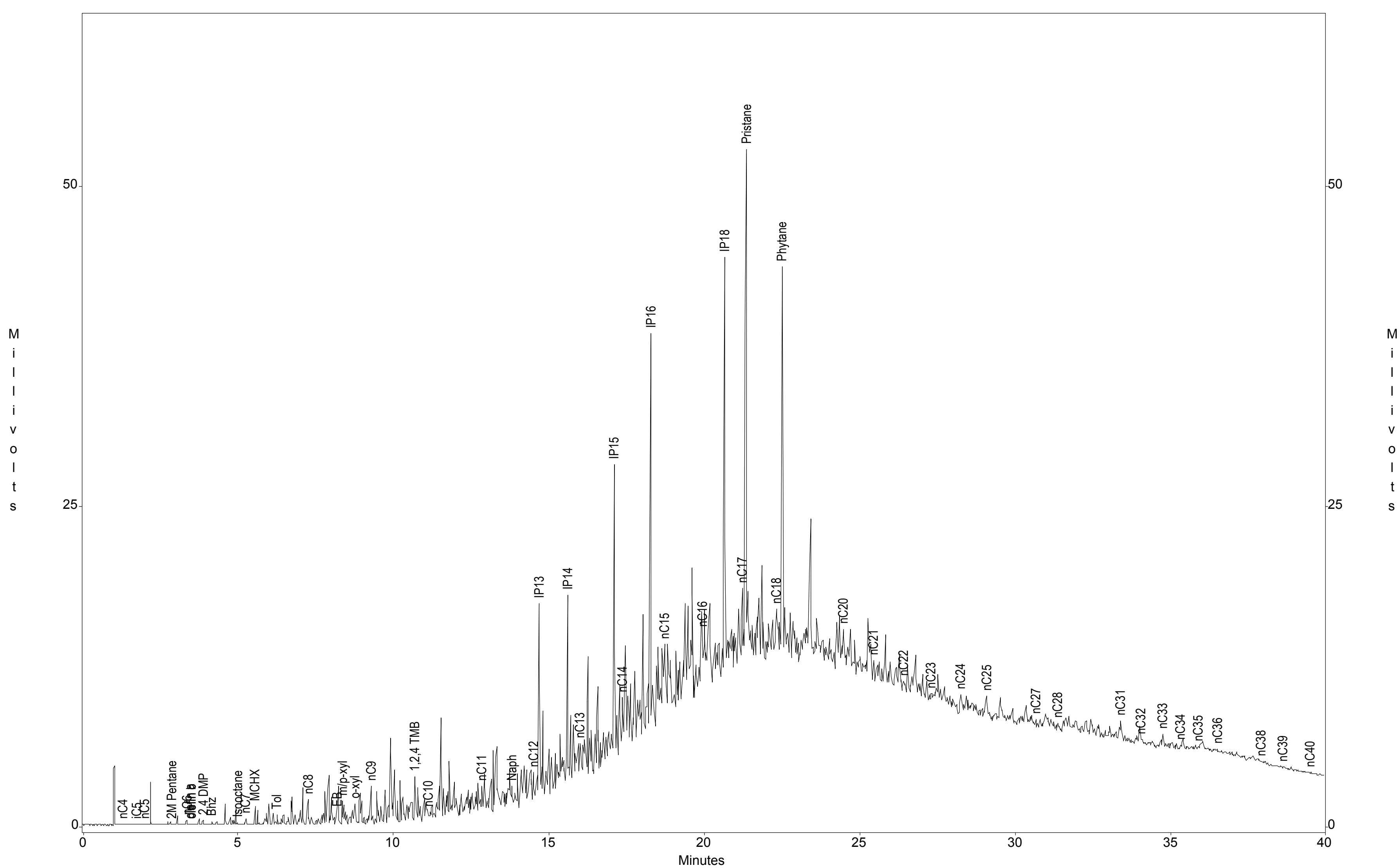
Sun - Philadelphia Refinery COA
Sample ID : SRTF MW-1
Acquired : Mar 08, 2004 15:57:18

c:\ezchrom\chrom\04046\srtfmw1 -- Channel A

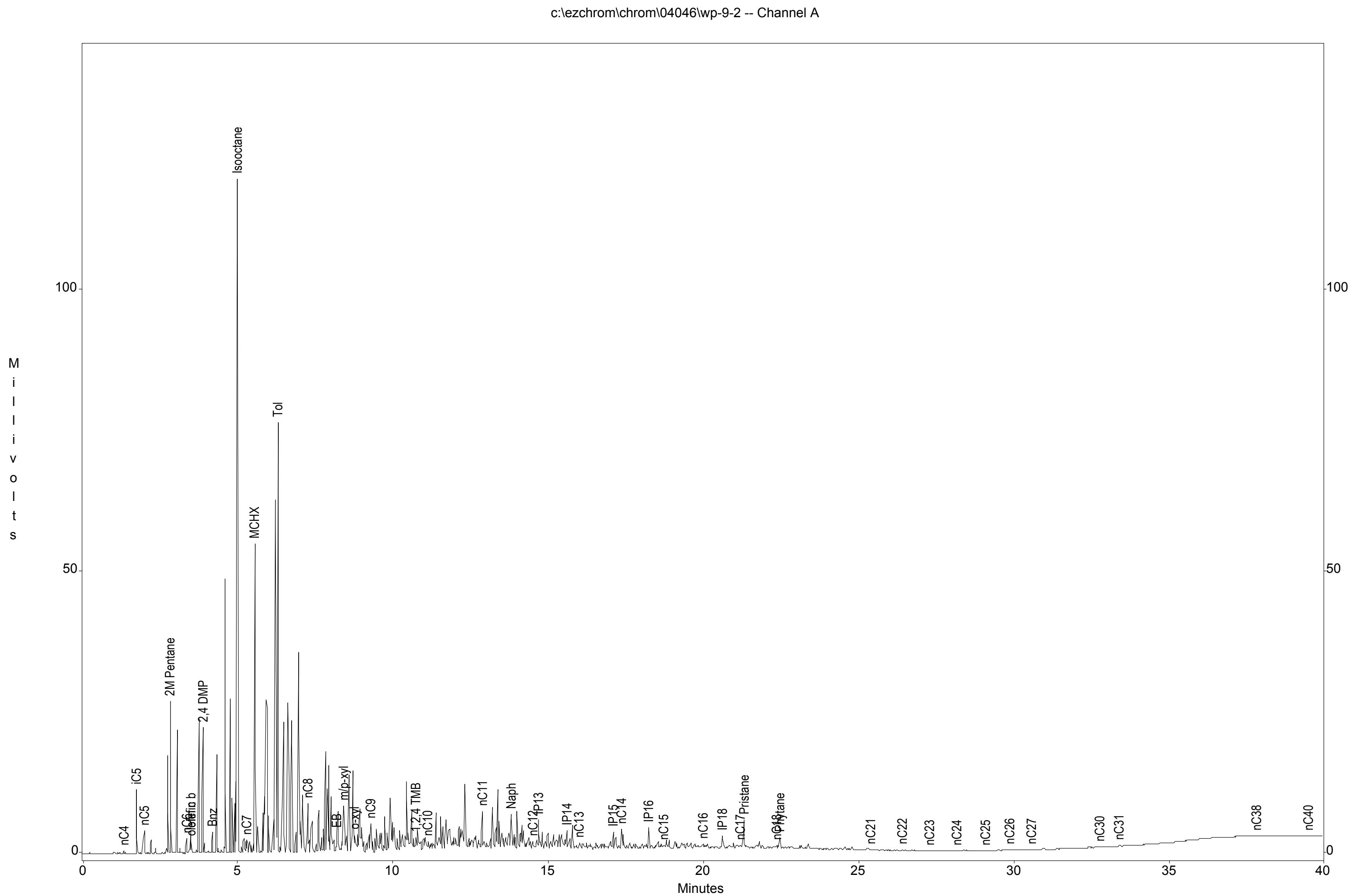


Sun - Philadelphia Refinery COA
Sample ID : West Yard W8
Acquired : Mar 07, 2004 08:54:39

c:\ezchrom\chrom\04046\wyw8 -- Channel A

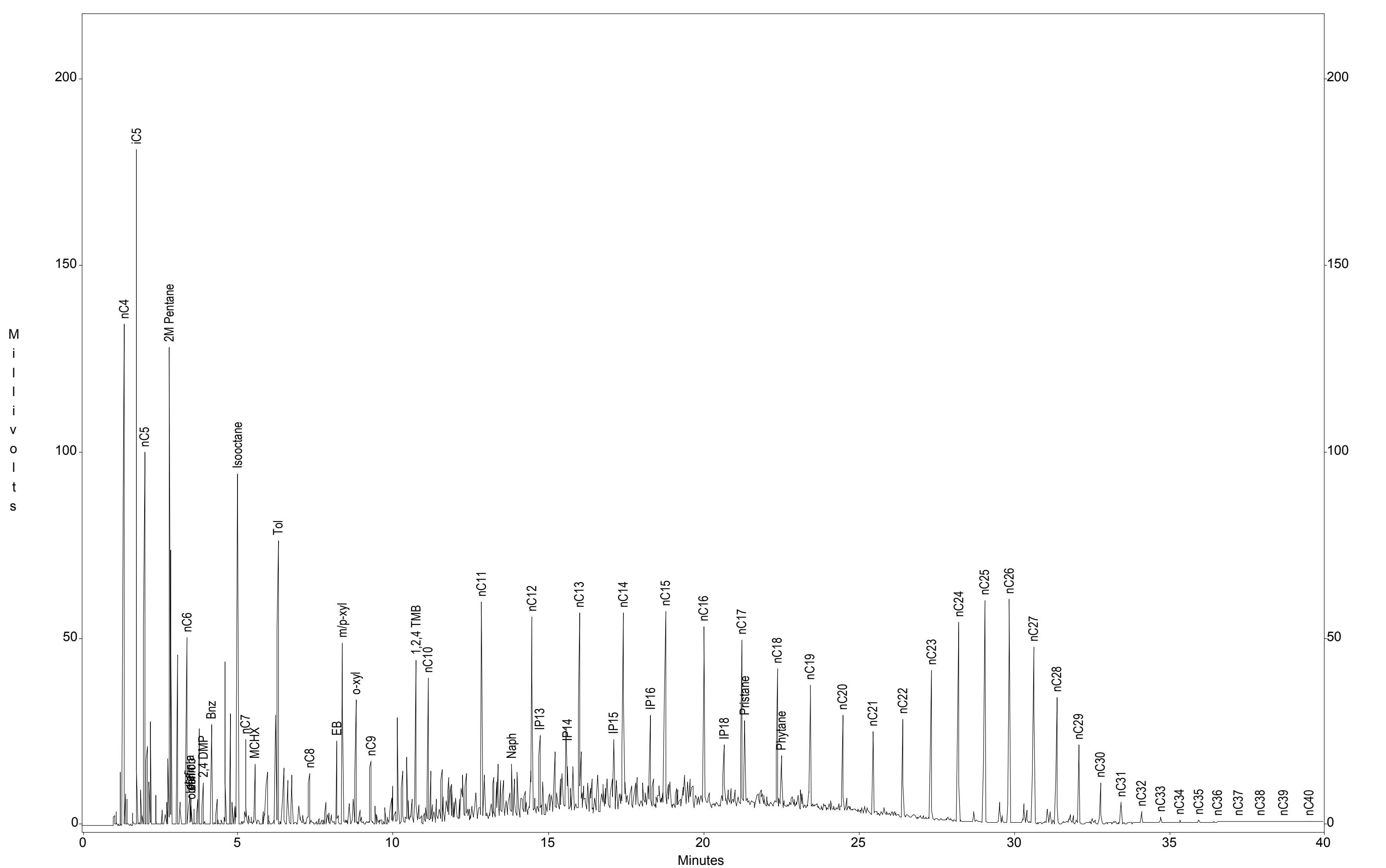


Sun - Philadelphia Refinery COA
Sample ID : WP 9-2
Acquired : Mar 08, 2004 07:50:05



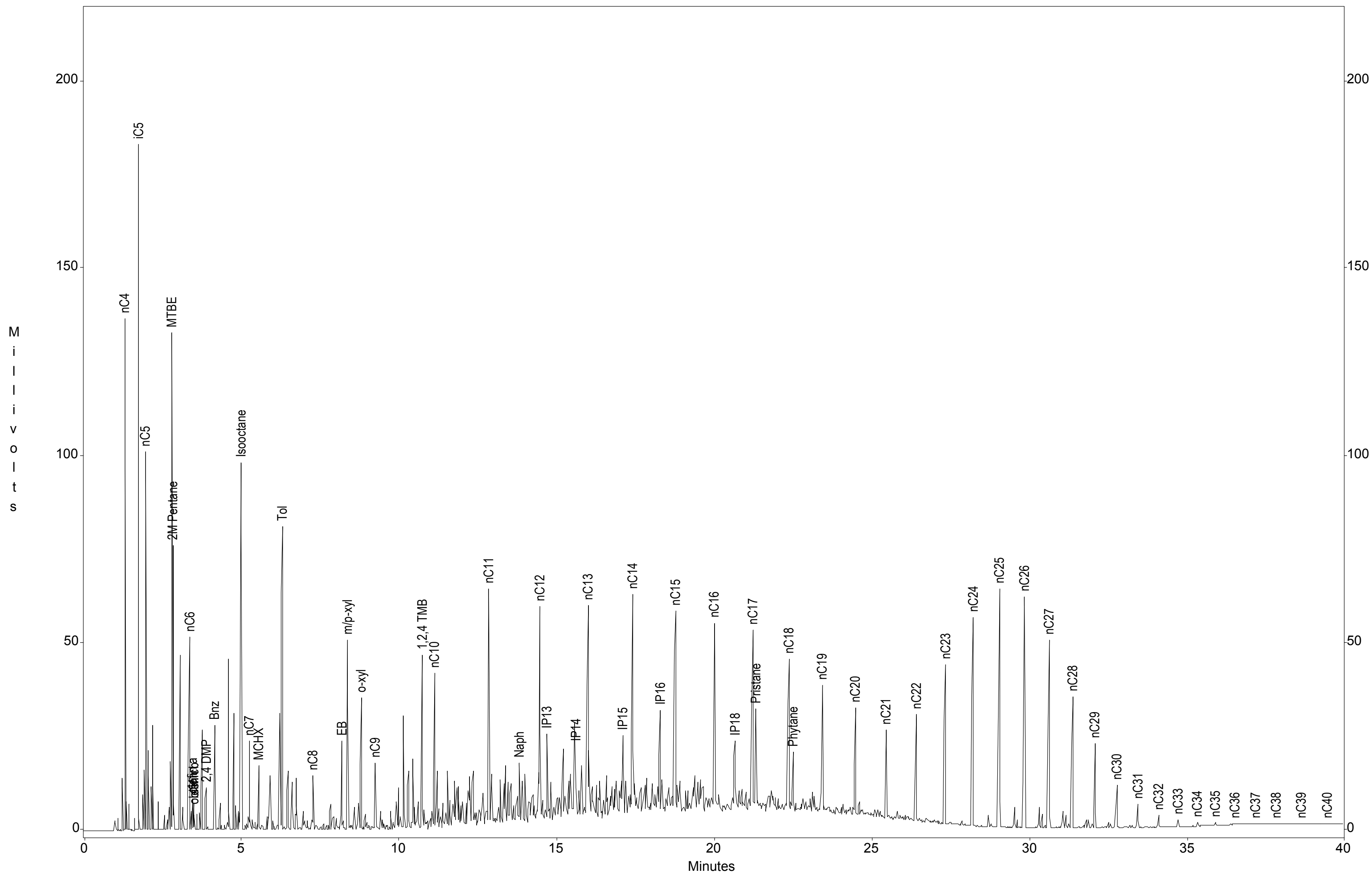
Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 05, 2004 10:14:50

c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



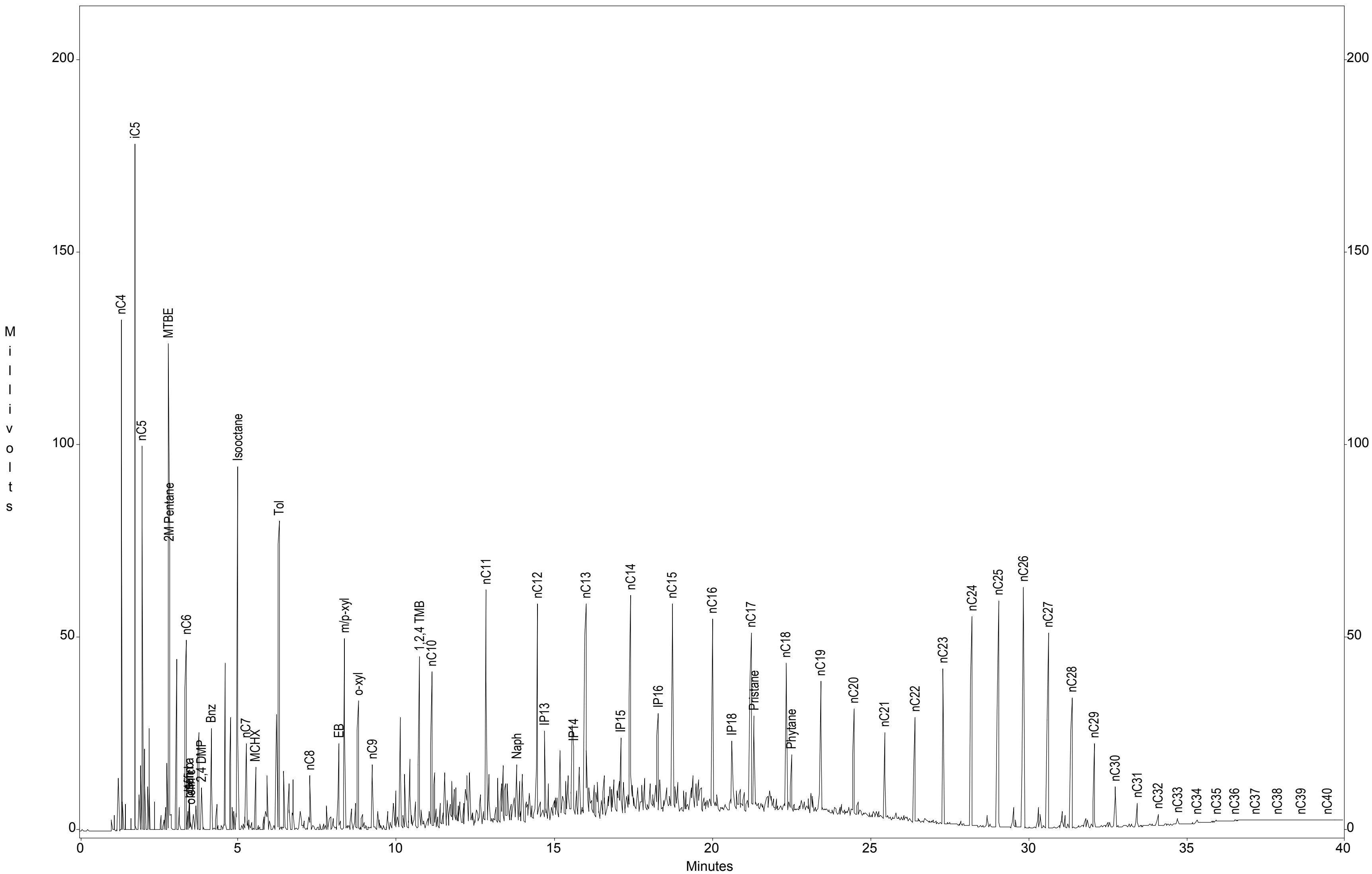
Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 06, 2004 11:29:07

c:\ezchrom\chrom\04046\gadiwax2.2 -- Channel A



Sun - Philadelphia Refinery COA
Sample ID : Gas/Dies/Wax std
Acquired : Mar 07, 2004 16:27:47

c:\ezchrom\chrom\04046\gadiwax2.3 -- Channel A

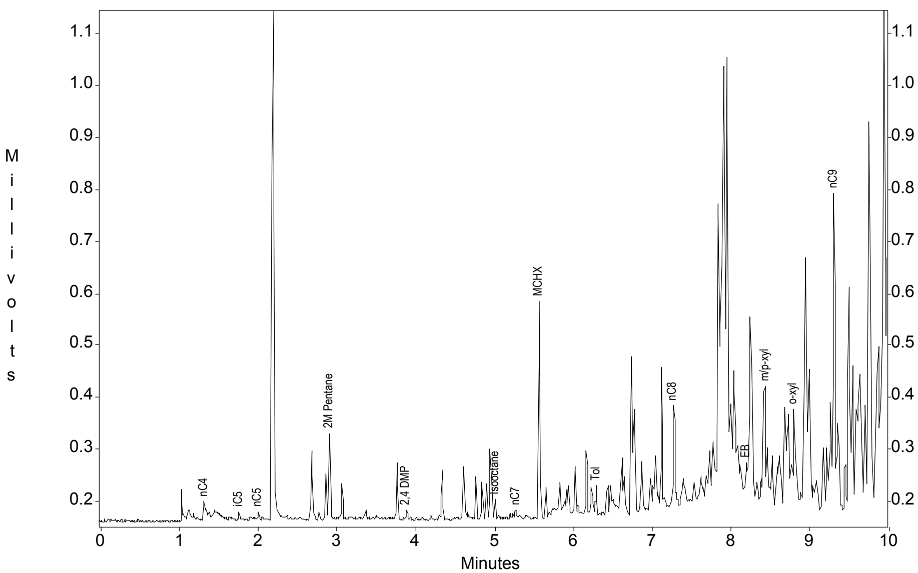


Sun - Philadelphia Refinery COA

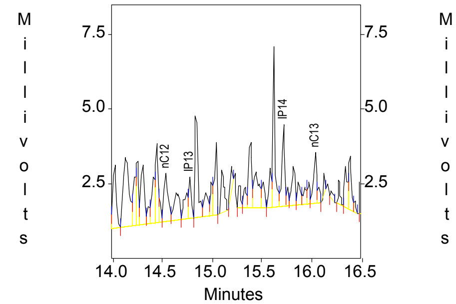
Sample ID : A-13

Acquired : Mar 06, 2004 18:55:23

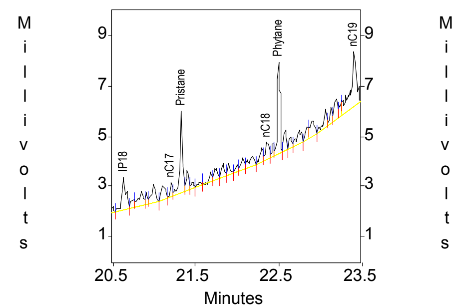
c:\ezchrom\chrom\04046\a-13 -- Channel A



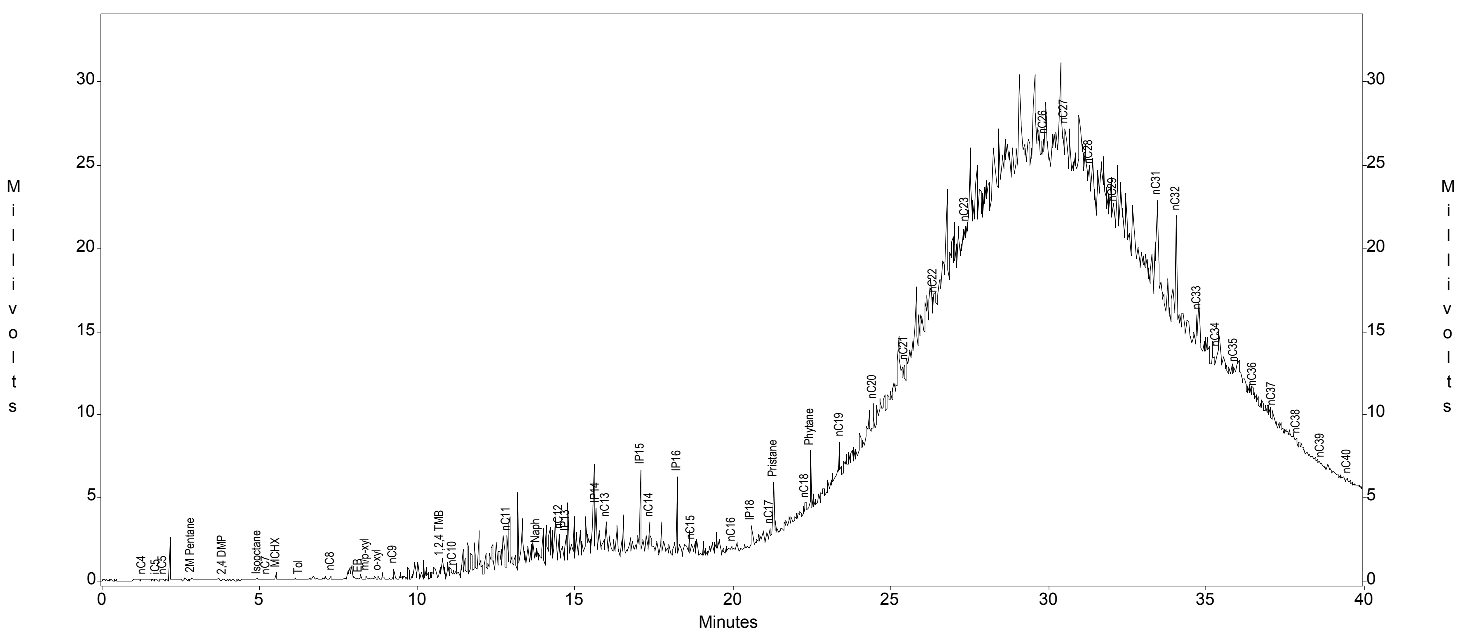
c:\ezchrom\chrom\04046\a-13 -- Channel A



c:\ezchrom\chrom\04046\a-13 -- Channel A



c:\ezchrom\chrom\04046\a-13 -- Channel A

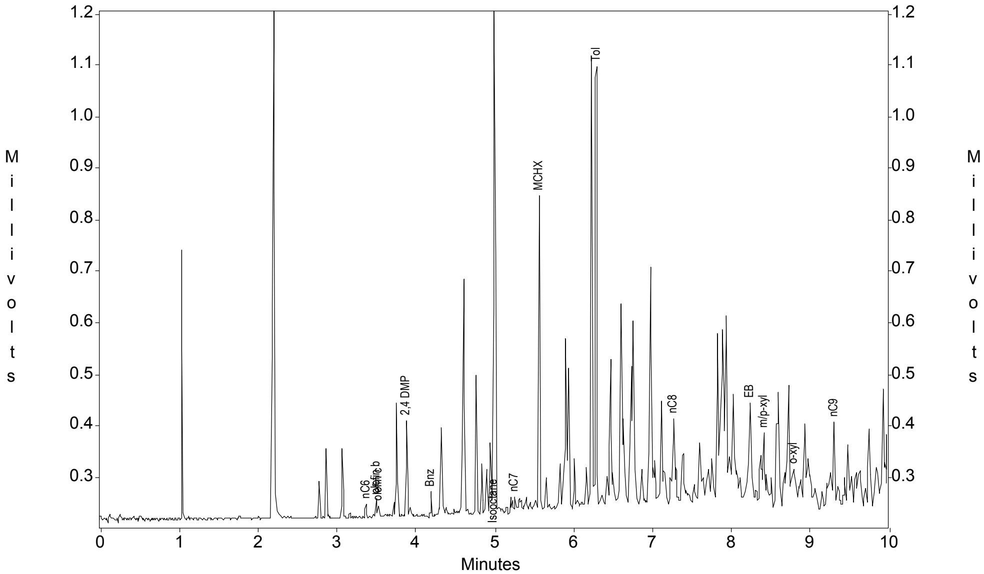


Channel A Results

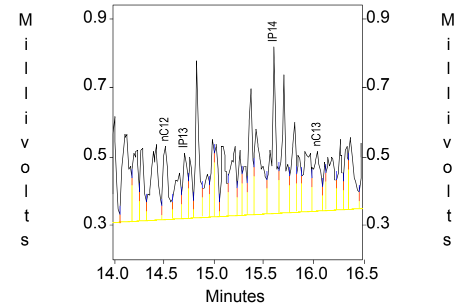
Peak	Area	Height
nC4	67	32
iC5	11	12
nC5	18	14
MTBE	0	0
2M Pentane	216	165
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	21	18
Bnz	0	0
Isooctane	47	38
nC7	21	16
MCHX	512	416
Tol	77	56
nC8	326	193
EB	163	79
m/p-xyl	315	231
o-xyl	405	191
nC9	961	611
1,2,4 TMB	1914	984
nC10	780	442
nC11	4555	2160
Naph	2008	1123
nC12	4979	1652
IP13	2498	1404
IP14	5000	2754
nC13	4125	1738
IP15	8014	4954
nC14	2702	1650
IP16	8164	4713
nC15	1275	627
nC16	1442	485
IP18	4301	1326
nC17	1130	577
Pristane	7882	3308
nC18	2152	691
Phytane	7783	3630
nC19	10580	2200
nC20	3911	1581
nC21	2530	1011
nC22	8215	1256
nC23	3836	1408
nC24	0	0
nC25	0	0
nC26	3075	1696
nC27	5669	2185
nC28	3847	1147
nC29	1652	0
nC30	0	0
nC31	10798	4166
nC32	15949	6067
nC33	2888	1464
nC34	1208	675
nC35	679	358
nC36	560	316
nC37	357	329
nC38	190	180
nC39	479	127
nC40	523	179

Sun - Philadelphia Refinery COA
Sample ID : A-14
Acquired : Mar 08, 2004 08:38:23

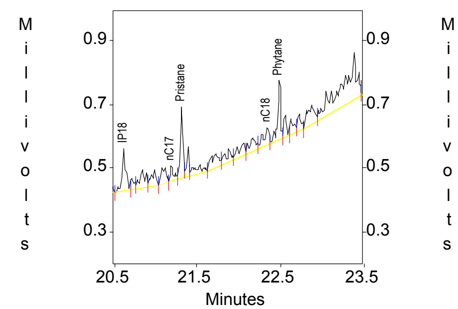
c:\ezchrom\chrom\04046\a-14 -- Channel A



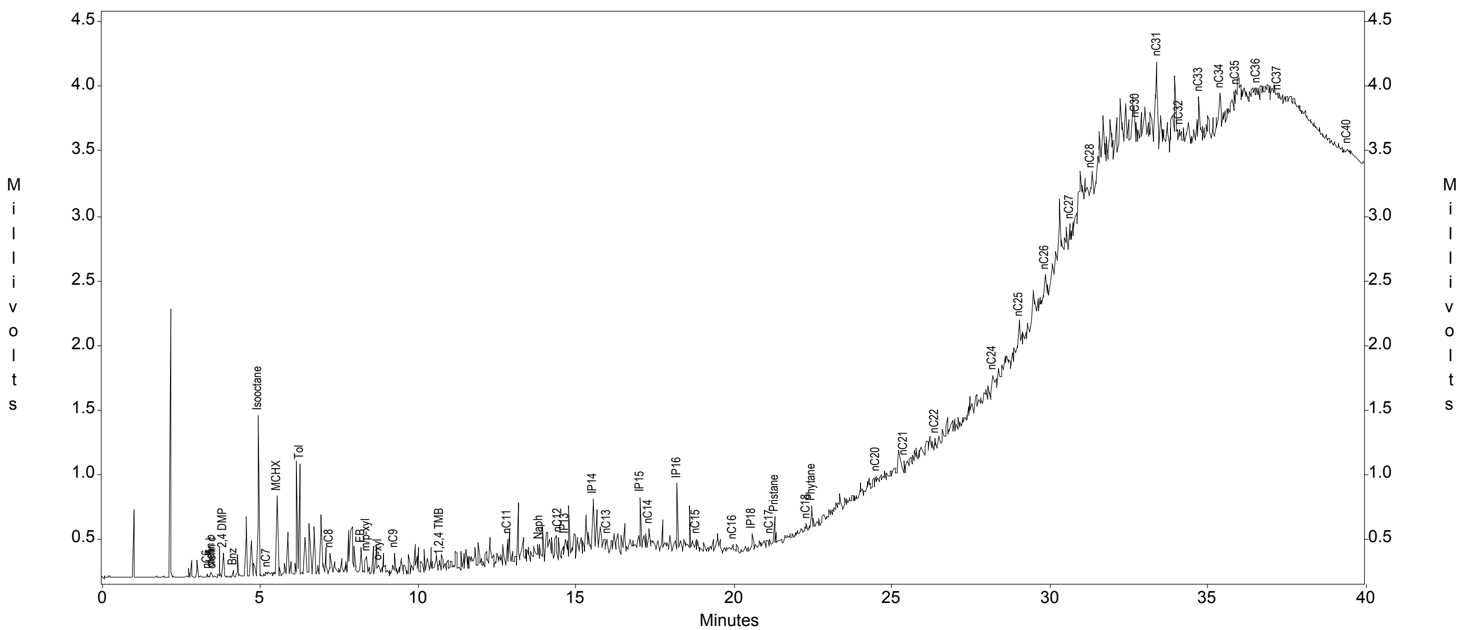
c:\ezchrom\chrom\04046\a-14 -- Channel A



c:\ezchrom\chrom\04046\a-14 -- Channel A



c:\ezchrom\chrom\04046\a-14 -- Channel A

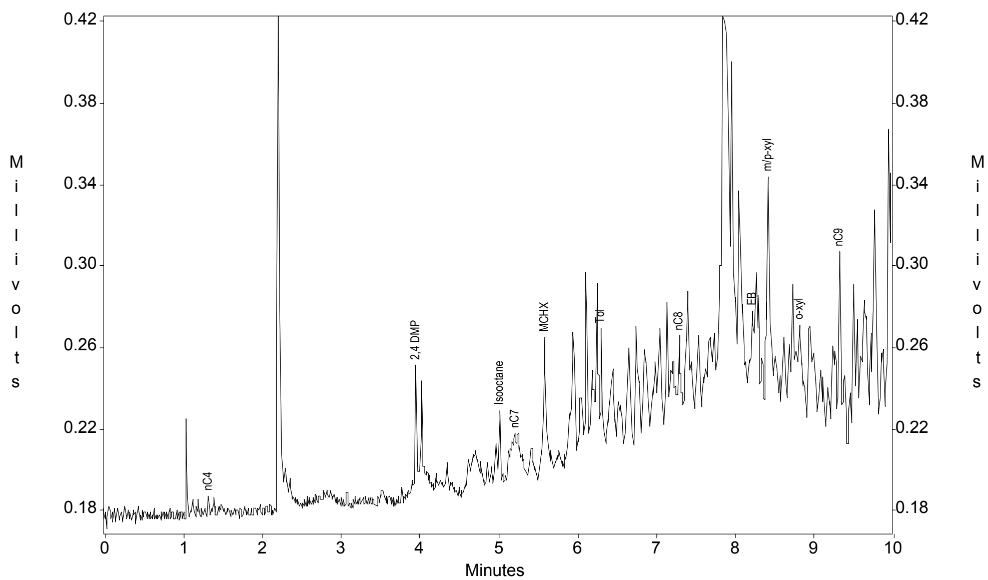


Channel A Results

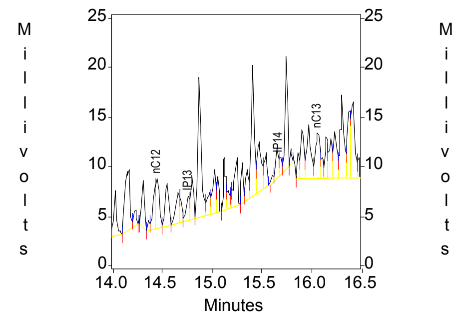
Peak	Area	Height
nC4	0	0
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	32	27
olefin a	0	0
olefin b	40	36
olefin c	24	21
2,4 DMP	221	187
Bnz	63	49
Isooctane	1485	1233
nC7	41	33
MCHX	788	615
Tol	1145	866
nC8	394	179
EB	634	207
m/p-xyl	203	150
o-xyl	307	77
nC9	261	166
1,2,4 TMB	328	95
nC10	0	0
nC11	429	218
Naph	519	161
nC12	741	211
IP13	568	188
IP14	1421	481
nC13	803	171
IP15	969	479
nC14	691	226
IP16	1065	564
nC15	302	122
nC16	315	60
IP18	424	132
nC17	131	51
Pristane	526	225
nC18	277	56
Phytane	490	184
nC19	0	0
nC20	296	111
nC21	180	92
nC22	443	99
nC23	0	0
nC24	1121	162
nC25	1796	233
nC26	1325	209
nC27	723	201
nC28	946	196
nC29	0	0
nC30	234	144
nC31	1103	398
nC32	345	82
nC33	1063	314
nC34	1155	259
nC35	101	80
nC36	141	62
nC37	48	18
nC38	0	0
nC39	0	0
nC40	142	30

Sun - Philadelphia Refinery COA
Sample ID : A-22
Acquired : Mar 07, 2004 14:51:46

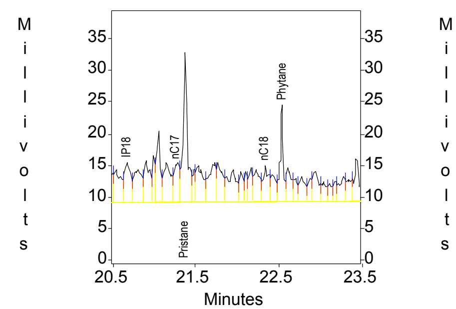
c:\ezchrom\chrom\04046\a-22 -- Channel A



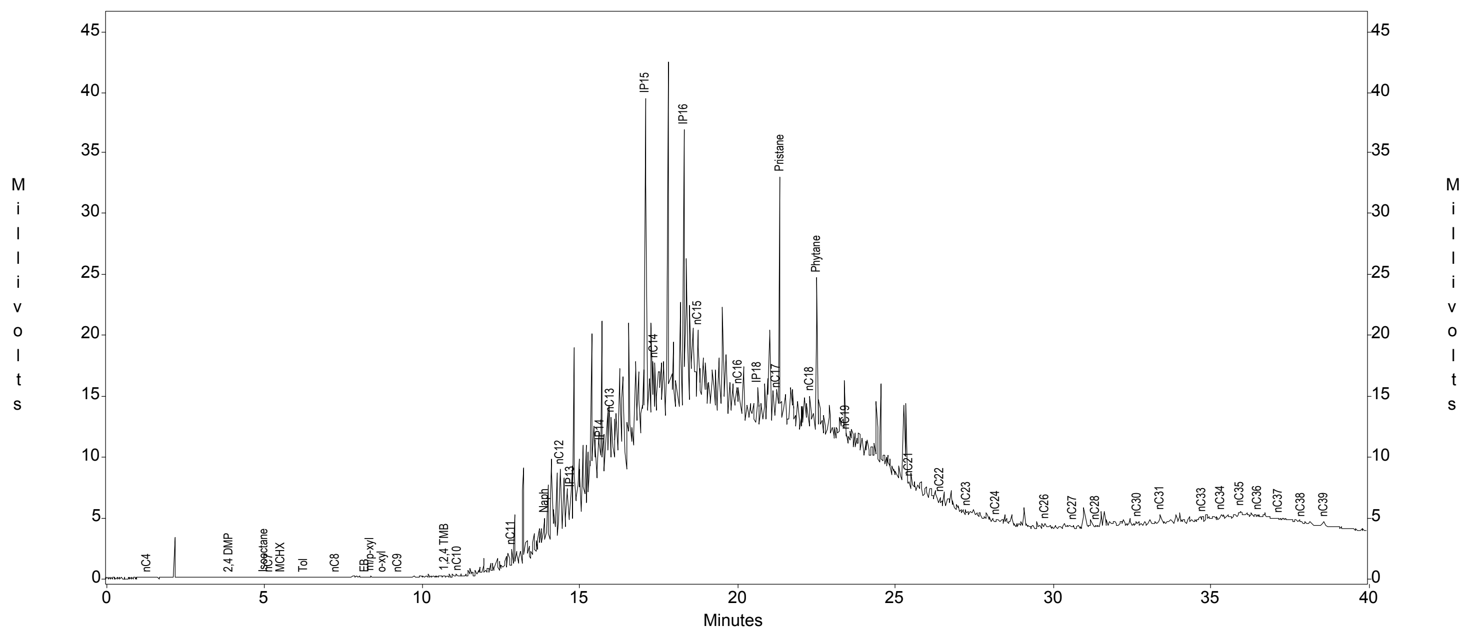
c:\ezchrom\chrom\04046\a-22 -- Channel A



c:\ezchrom\chrom\04046\a-22 -- Channel A



c:\ezchrom\chrom\04046\a-22 -- Channel A

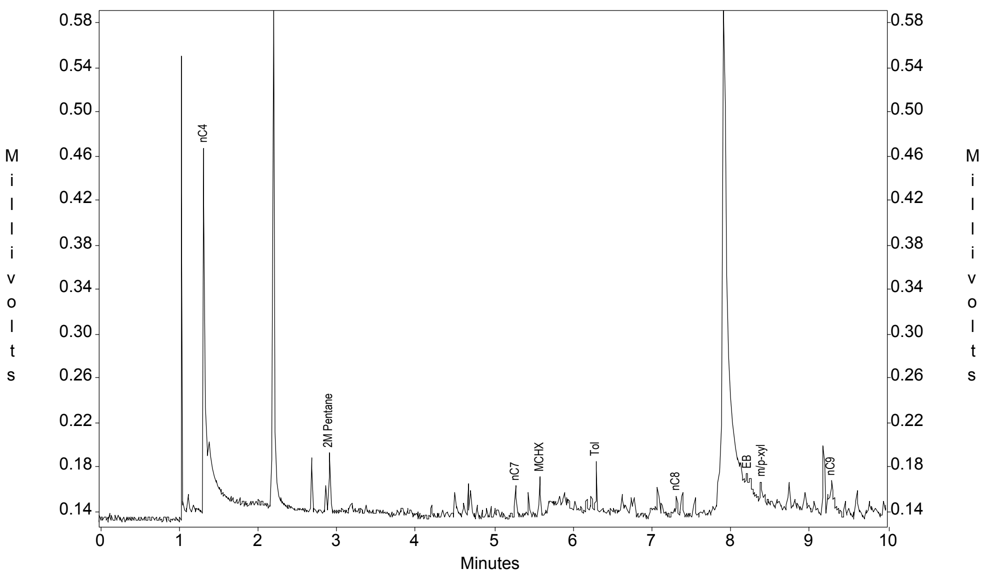


Channel A Results

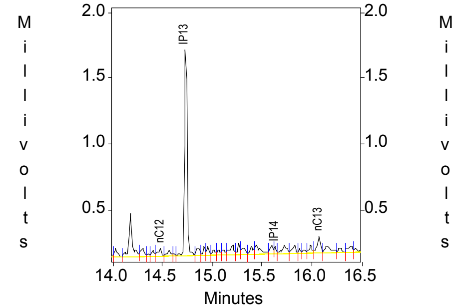
Peak	Area	Height
nC4	10	8
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	92	59
Bnz	0	0
Isooctane	52	36
nC7	141	24
MCHX	198	70
Tol	178	70
nC8	197	63
EB	299	71
m/p-xyl	504	136
o-xyl	189	61
nC9	175	95
1,2,4 TMB	716	156
nC10	400	131
nC11	2754	1406
Naph	6155	2146
nC12	11852	5100
IP13	6283	2488
IP14	4052	1864
nC13	14255	4431
IP15	74971	30494
nC14	24384	8672
IP16	71413	27903
nC15	62383	11372
nC16	35679	6358
IP18	34624	6411
nC17	29364	6015
Pristane	82839	23749
nC18	25243	5529
Phytane	45843	15329
nC19	4952	2402
nC20	0	0
nC21	1461	485
nC22	1987	505
nC23	890	314
nC24	1125	227
nC25	0	0
nC26	1473	490
nC27	502	267
nC28	792	157
nC29	0	0
nC30	701	238
nC31	1403	541
nC32	0	0
nC33	1067	343
nC34	674	296
nC35	1449	271
nC36	501	160
nC37	131	73
nC38	118	80
nC39	2601	382
nC40	0	0

Sun - Philadelphia Refinery COA
Sample ID : A-47
Acquired : Mar 05, 2004 18:23:47

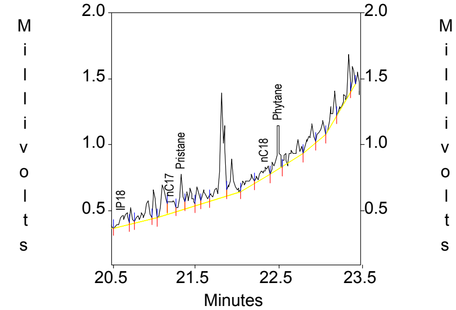
c:\ezchrom\chrom\04046\a47 -- Channel A



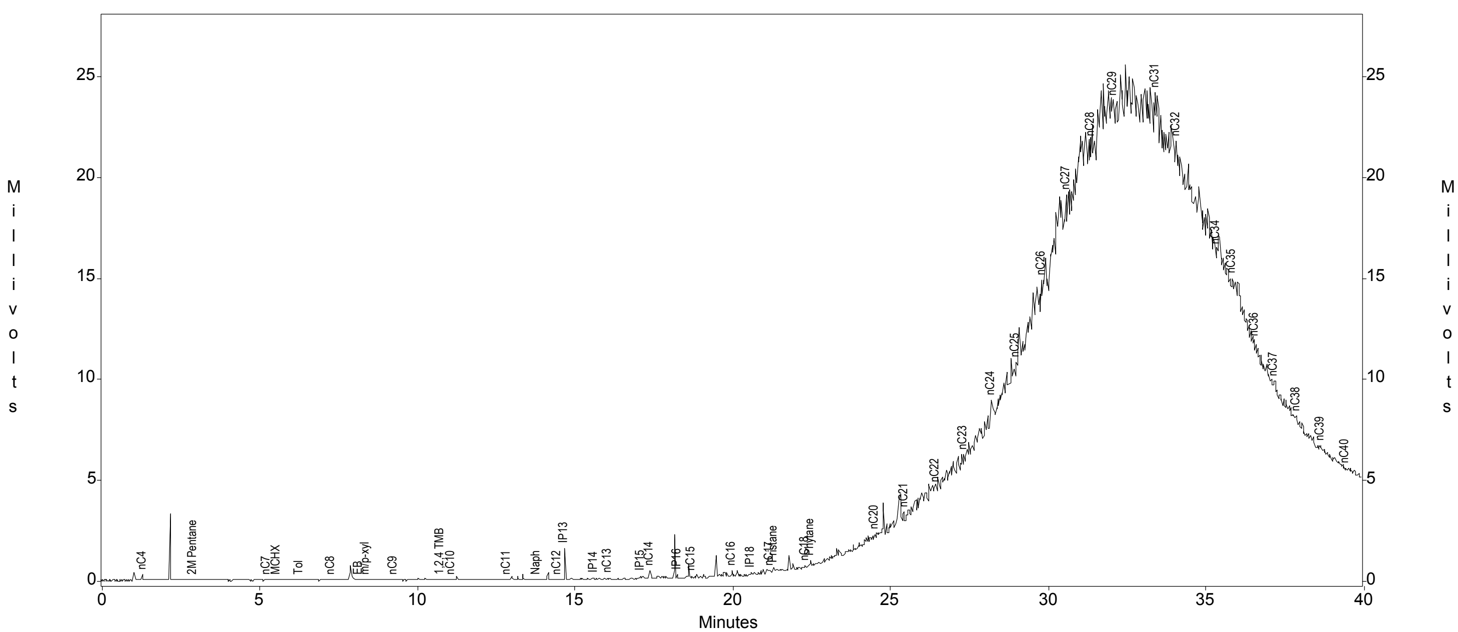
c:\ezchrom\chrom\04046\a47 -- Channel A



c:\ezchrom\chrom\04046\a47 -- Channel A



c:\ezchrom\chrom\04046\a47 -- Channel A



Channel A Results

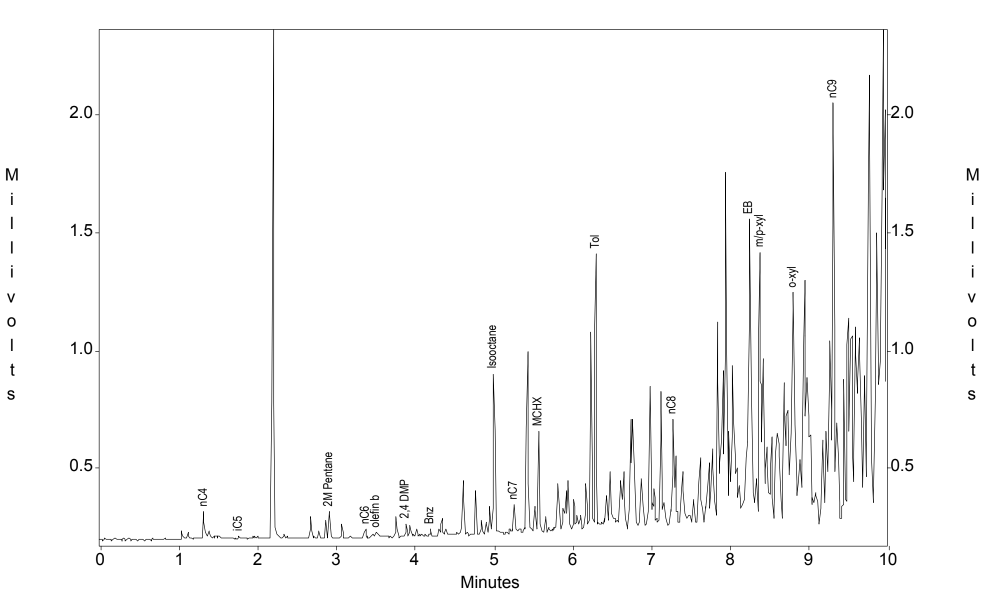
Peak	Area	Height
nC4	531	327
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	63	54
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	0	0
Isooctane	0	0
nC7	39	26
MCHX	40	34
Tol	63	46
nC8	31	17
EB	126	30
m/p-xyl	55	20
o-xyl	0	0
nC9	161	33
1,2,4 TMB	160	58
nC10	38	22
nC11	147	61
Naph	78	26
nC12	142	59
IP13	2609	1570
IP14	89	55
nC13	256	120
IP15	215	101
nC14	772	413
IP16	278	150
nC15	199	70
nC16	696	234
IP18	425	77
nC17	520	87
Pristane	641	269
nC18	469	73
Phytane	885	324
nC19	0	0
nC20	949	317
nC21	757	412
nC22	1476	333
nC23	961	454
nC24	5508	1195
nC25	1689	354
nC26	4919	1383
nC27	5960	1628
nC28	2396	1123
nC29	808	421
nC30	0	0
nC31	1872	1106
nC32	2762	1147
nC33	0	0
nC34	321	285
nC35	692	451
nC36	435	175
nC37	903	255
nC38	716	121
nC39	306	157
nC40	70	88

Sun - Philadelphia Refinery COA

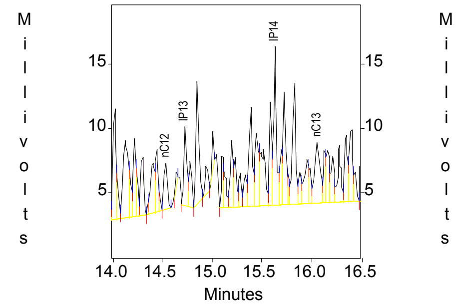
Sample ID : A-133

Acquired : Mar 08, 2004 11:04:46

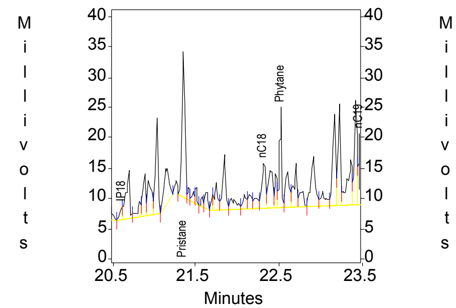
c:\ezchrom\chrom\04046\a-133 -- Channel A



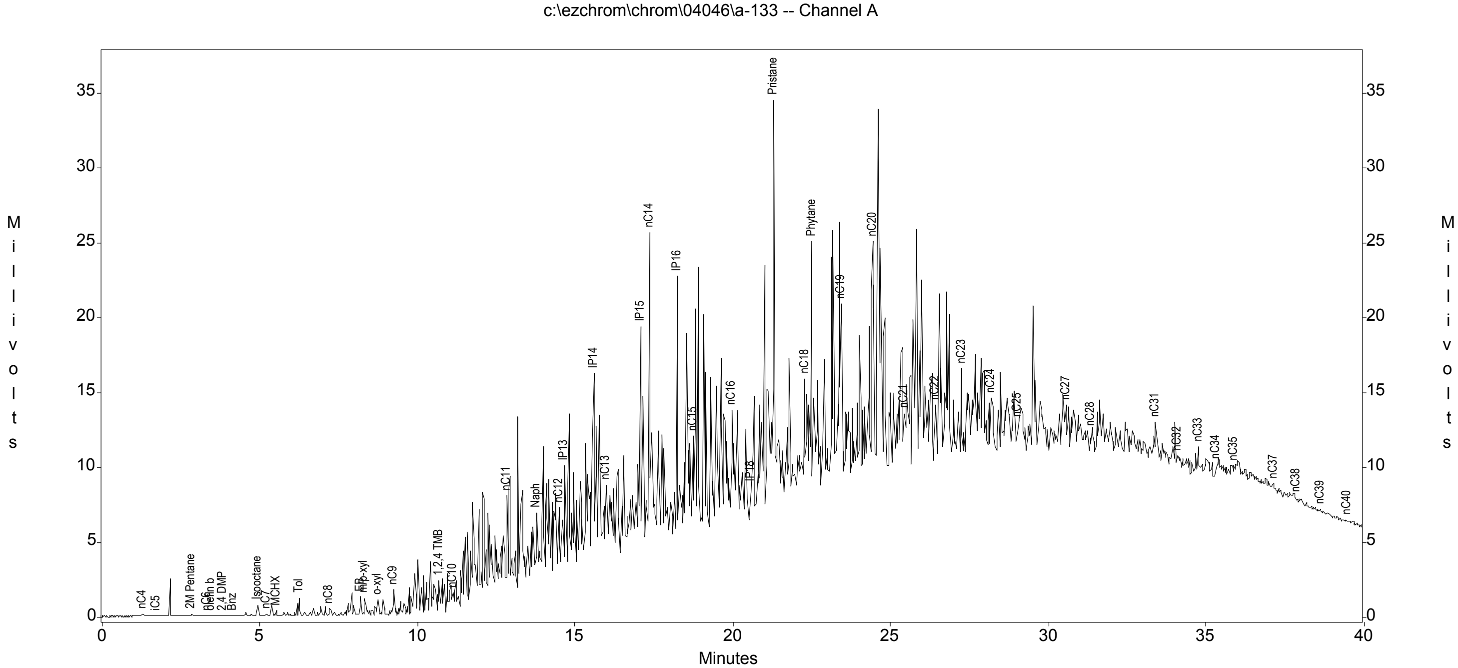
c:\ezchrom\chrom\04046\a-133 -- Channel A



c:\ezchrom\chrom\04046\a-133 -- Channel A



c:\ezchrom\chrom\04046\a-133 -- Channel A

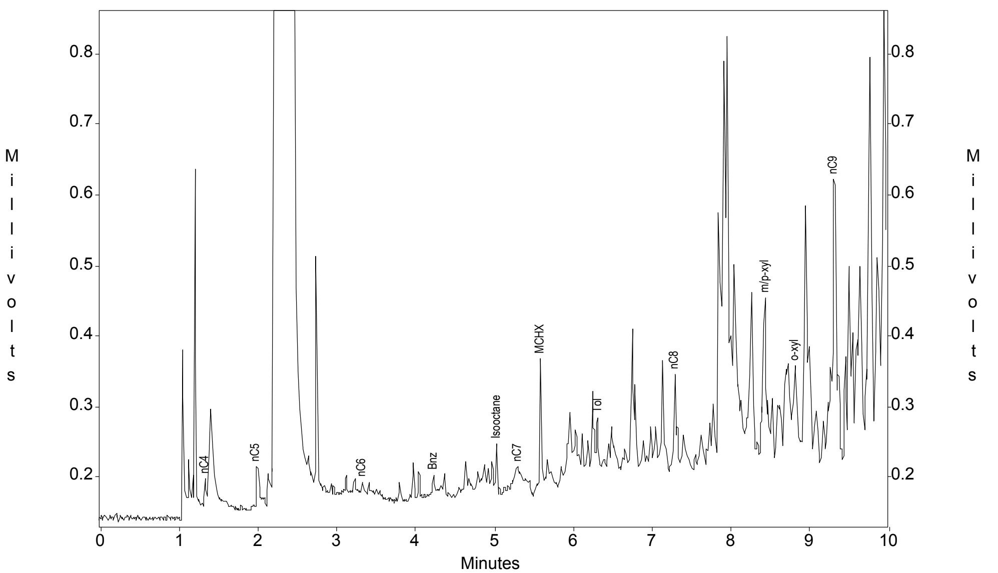


Channel A Results

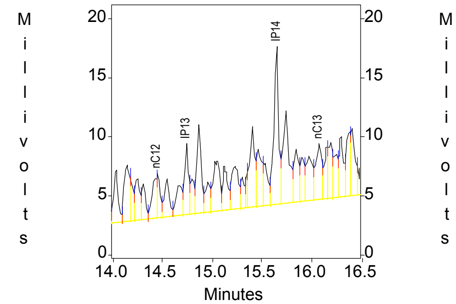
Peak	Area	Height
nC4	158	114
iC5	13	13
nC5	0	0
MTBE	0	0
2M Pentane	139	112
nC6	40	38
olefin a	0	0
olefin b	48	13
olefin c	0	0
2,4 DMP	54	50
Bnz	47	30
Isooctane	844	681
nC7	201	125
MCHX	569	430
Tol	1596	1178
nC8	818	462
EB	3424	1297
m/p-xyl	2126	1155
o-xyl	2572	983
nC9	2824	1777
1,2,4 TMB	1109	778
nC10	1270	820
nC11	13621	6215
Naph	8173	4360
nC12	9473	3663
IP13	12877	6104
IP14	21745	12343
nC13	17819	4733
IP15	30289	14594
nC14	44628	20605
IP16	30410	17025
nC15	13857	5904
nC16	9329	5074
IP18	3986	2066
nC17	0	0
Pristane	52522	24018
nC18	21782	7310
Phytane	36481	16379
nC19	24348	11752
nC20	68080	15450
nC21	9808	3392
nC22	12283	3331
nC23	12972	5575
nC24	4480	2262
nC25	5442	1774
nC26	0	0
nC27	6948	2889
nC28	3967	1300
nC29	0	0
nC30	0	0
nC31	4636	1806
nC32	776	388
nC33	3367	1445
nC34	726	479
nC35	122	90
nC36	0	0
nC37	300	201
nC38	265	119
nC39	115	98
nC40	65	97

Sun - Philadelphia Refinery COA
Sample ID : A-136 Pad
Acquired : Mar 09, 2004 14:59:57

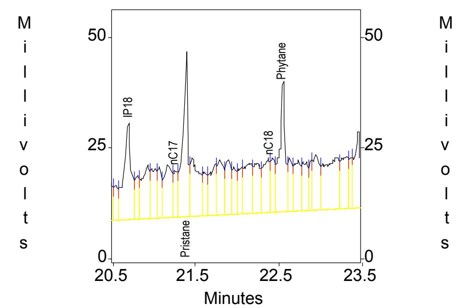
c:\ezchrom\chrom\04046\a-136pad -- Channel A



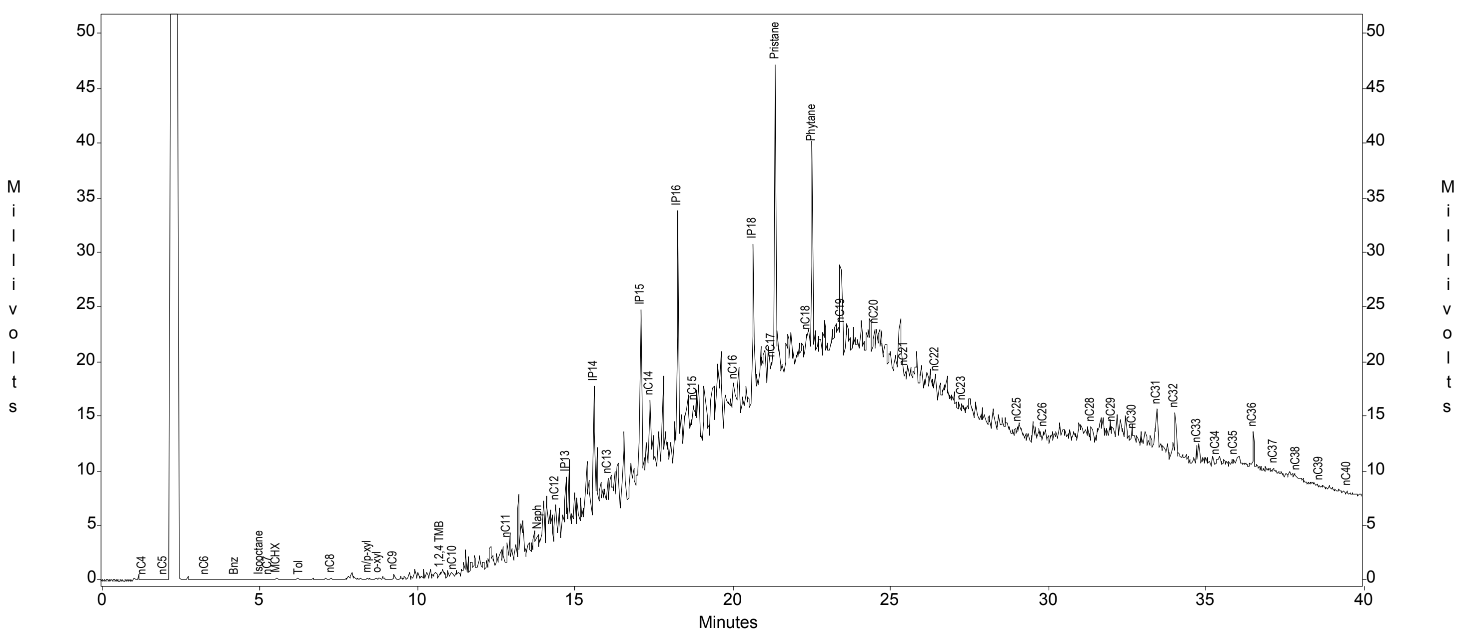
c:\ezchrom\chrom\04046\a-136pad -- Channel A



c:\ezchrom\chrom\04046\a-136pad -- Channel A



c:\ezchrom\chrom\04046\a-136pad -- Channel A

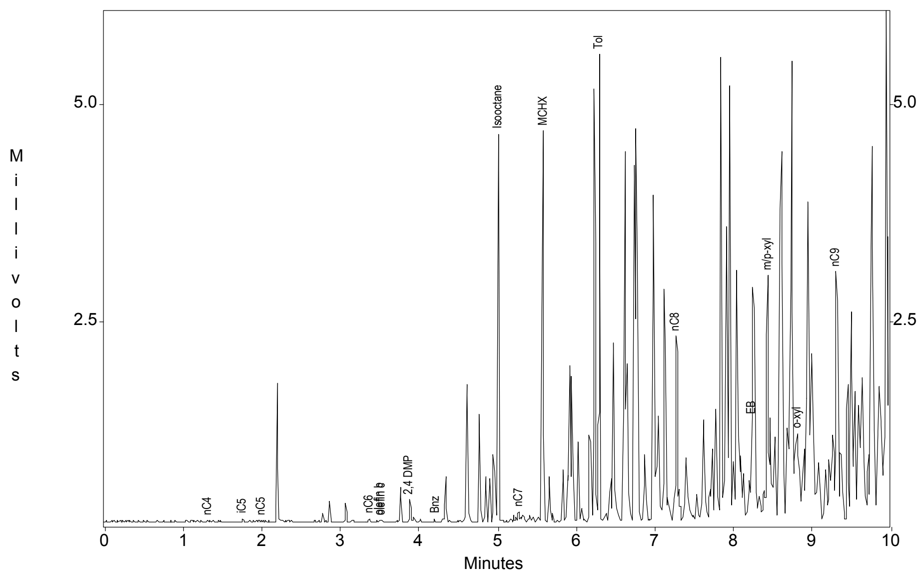


Channel A Results

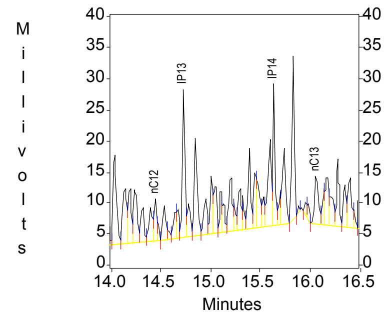
Peak	Area	Height
nC4	55	38
iC5	0	0
nC5	151	60
MTBE	0	0
2M Pentane	0	0
nC6	27	16
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	40	25
Isooctane	105	74
nC7	363	42
MCHX	338	193
Tol	253	96
nC8	300	140
EB	0	0
m/p-xyl	546	228
o-xyl	342	112
nC9	1234	397
1,2,4 TMB	2231	588
nC10	968	301
nC11	4527	1844
Naph	3748	1668
nC12	10332	3836
IP13	17729	6120
IP14	42025	13466
nC13	20986	4725
IP15	73524	19018
nC14	48011	10425
IP16	90963	27000
nC15	29118	8641
nC16	54623	9423
IP18	137009	21675
nC17	33993	10371
Pristane	171689	37333
nC18	52322	11664
Phytane	140483	28734
nC19	26671	11242
nC20	43076	10198
nC21	27221	5337
nC22	26050	3958
nC23	682	316
nC24	0	0
nC25	2182	995
nC26	1902	987
nC27	0	0
nC28	4107	1407
nC29	2227	705
nC30	735	163
nC31	7426	2663
nC32	9161	3657
nC33	3046	1262
nC34	743	388
nC35	649	371
nC36	7860	3215
nC37	1031	333
nC38	429	160
nC39	483	165
nC40	219	155

Sun - Philadelphia Refinery COA
Sample ID : B-39
Acquired : Mar 06, 2004 14:44:39

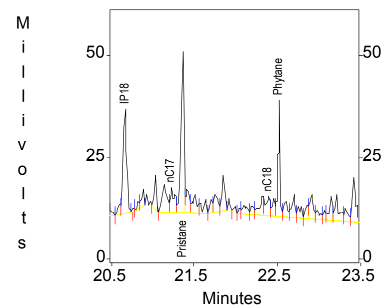
c:\ezchrom\chrom\04046\b-39 -- Channel A



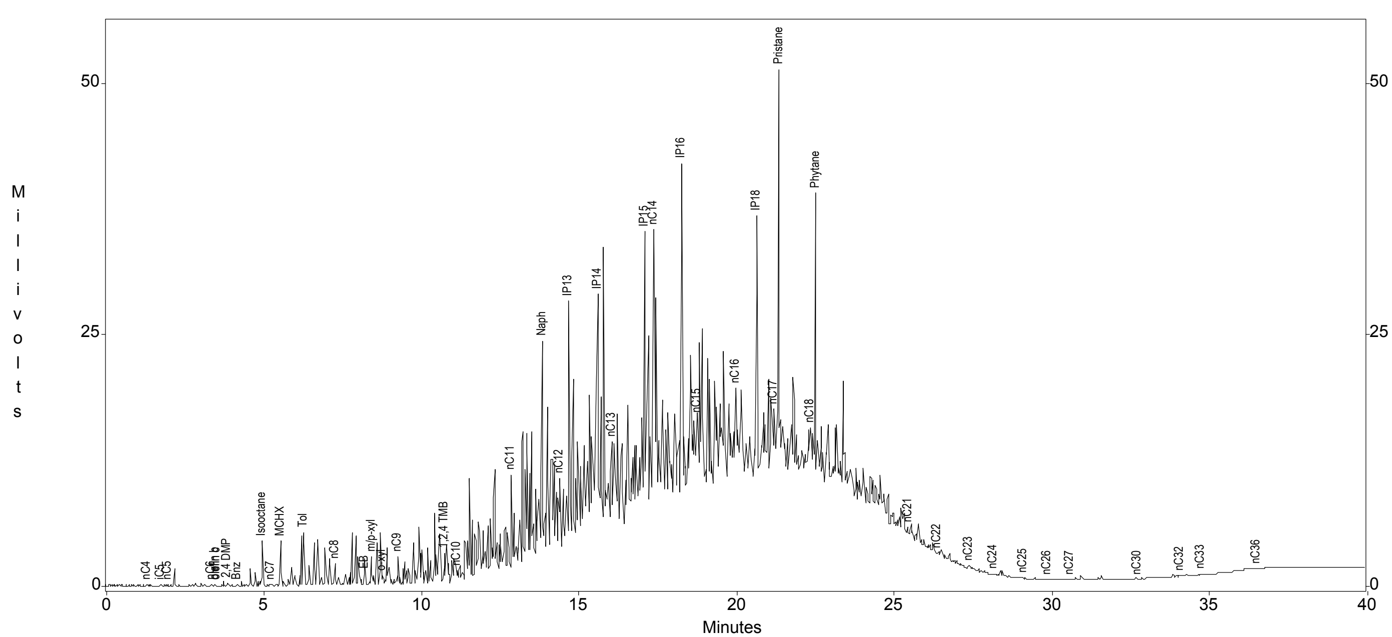
c:\ezchrom\chrom\04046\b-39 -- Channel A



c:\ezchrom\chrom\04046\b-39 -- Channel A



c:\ezchrom\chrom\04046\b-39 -- Channel A



Channel A Results

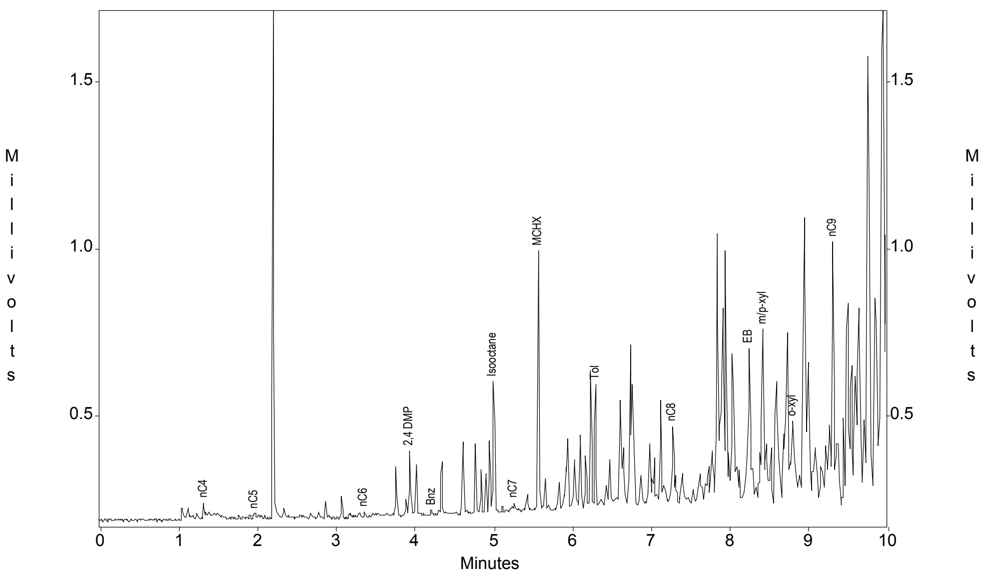
Peak	Area	Height
nC4	11	11
iC5	31	37
nC5	12	13
MTBE	0	0
2M Pentane	0	0
nC6	34	30
olefin a	0	0
olefin b	25	20
olefin c	22	18
2,4 DMP	298	262
Bnz	56	41
Isooctane	5191	4465
nC7	128	109
MCHX	5499	4506
Tol	6702	5366
nC8	3146	2123
EB	904	1156
m/p-xyl	3813	2817
o-xyl	2701	984
nC9	4313	2840
1,2,4 TMB	5582	2857
nC10	1667	1023
nC11	15352	9002
Naph	39682	21148
nC12	13242	6749
IP13	41759	23896
IP14	36238	22543
nC13	19431	7451
IP15	50697	27881
nC14	64857	27660
IP16	59179	32540
nC15	27467	6455
nC16	24934	9192
IP18	67401	25405
nC17	21775	5913
Pristane	101291	39695
nC18	15458	4765
Phytane	62115	28314
nC19	0	0
nC20	0	0
nC21	3593	910
nC22	1133	197
nC23	257	165
nC24	579	57
nC25	895	178
nC26	274	69
nC27	316	74
nC28	0	0
nC29	0	0
nC30	57	20
nC31	0	0
nC32	198	42
nC33	205	48
nC34	0	0
nC35	0	0
nC36	204	24
nC37	0	0
nC38	0	0
nC39	0	0
nC40	0	0

Sun - Philadelphia Refinery COA

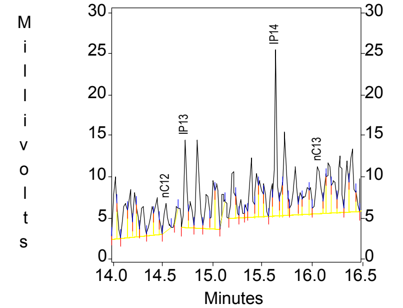
Sample ID : B-43

Acquired : Mar 08, 2004 12:42:07

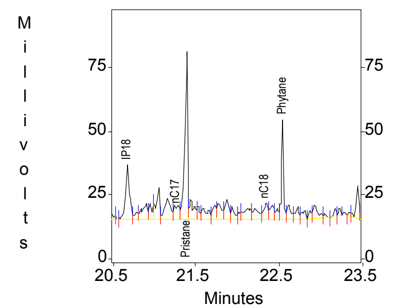
c:\ezchrom\chrom\04046\b-43 -- Channel A



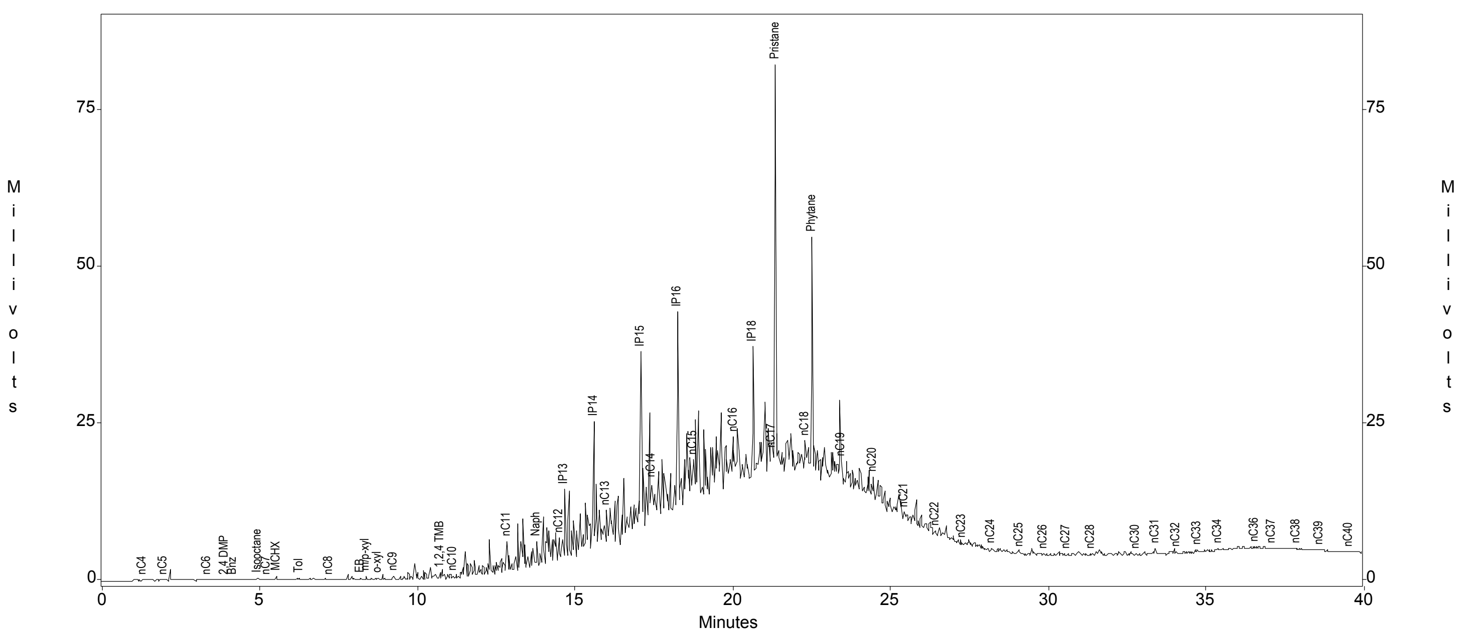
c:\ezchrom\chrom\04046\b-43 -- Channel A



c:\ezchrom\chrom\04046\b-43 -- Channel A



c:\ezchrom\chrom\04046\b-43 -- Channel A

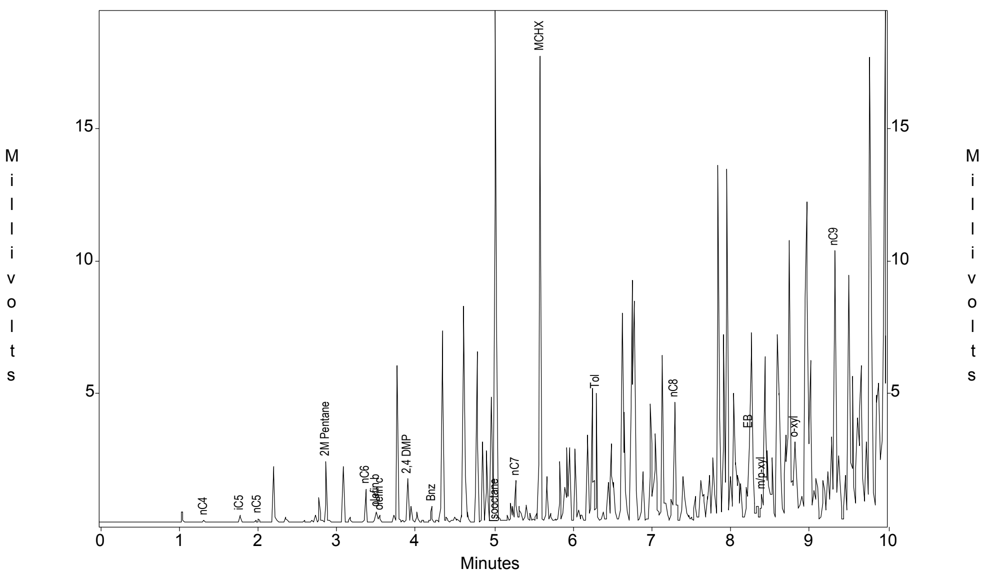


Channel A Results

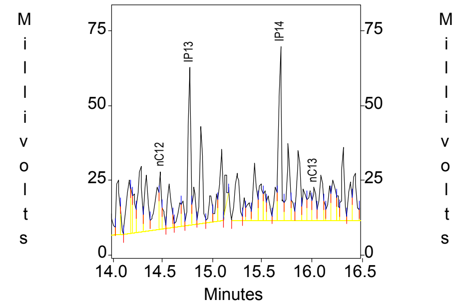
Peak	Area	Height
nC4	64	49
iC5	0	0
nC5	35	16
MTBE	0	0
2M Pentane	0	0
nC6	20	13
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	234	193
Bnz	25	17
Isooctane	492	400
nC7	147	33
MCHX	1033	785
Tol	533	379
nC8	481	248
EB	1397	476
m/p-xyl	958	531
o-xyl	805	256
nC9	1272	787
1,2,4 TMB	3485	1050
nC10	137	136
nC11	8579	5003
Naph	6165	4024
nC12	8304	3532
IP13	19157	10652
IP14	31807	20349
nC13	20063	5767
IP15	51423	28107
nC14	2443	2040
IP16	57678	31189
nC15	27934	6503
nC16	16308	6076
IP18	65148	21207
nC17	23291	4328
Pristane	171538	66055
nC18	21195	6295
Phytane	86796	38868
nC19	5425	3124
nC20	11268	4074
nC21	3844	1245
nC22	3471	834
nC23	875	400
nC24	2117	459
nC25	5446	597
nC26	1346	329
nC27	1606	352
nC28	1005	265
nC29	0	0
nC30	278	136
nC31	3637	1034
nC32	457	142
nC33	1247	449
nC34	934	245
nC35	0	0
nC36	280	96
nC37	475	112
nC38	88	58
nC39	168	22
nC40	208	58

Sun - Philadelphia Refinery COA
Sample ID : B-129
Acquired : Mar 07, 2004 13:12:49

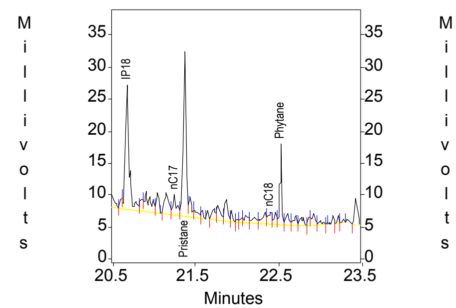
c:\ezchrom\chrom\04046\b-129 -- Channel A



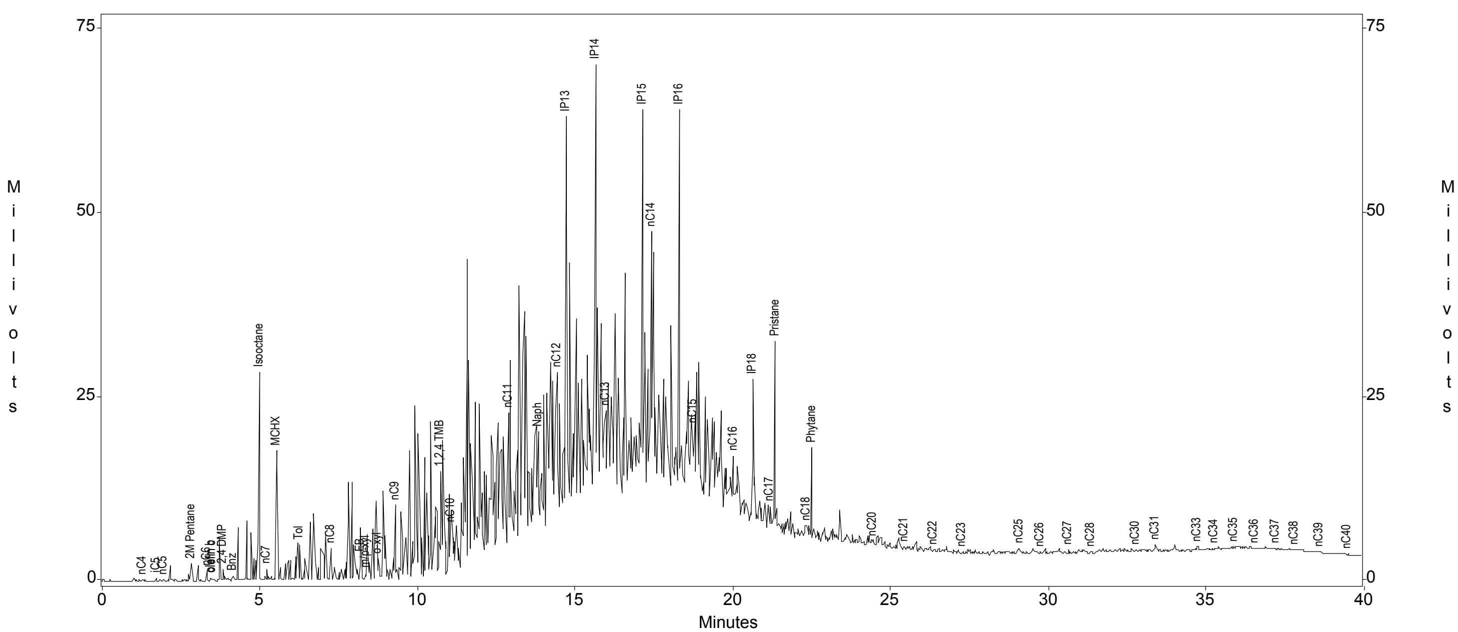
c:\ezchrom\chrom\04046\b-129 -- Channel A



c:\ezchrom\chrom\04046\b-129 -- Channel A



c:\ezchrom\chrom\04046\b-129 -- Channel A



Channel A Results

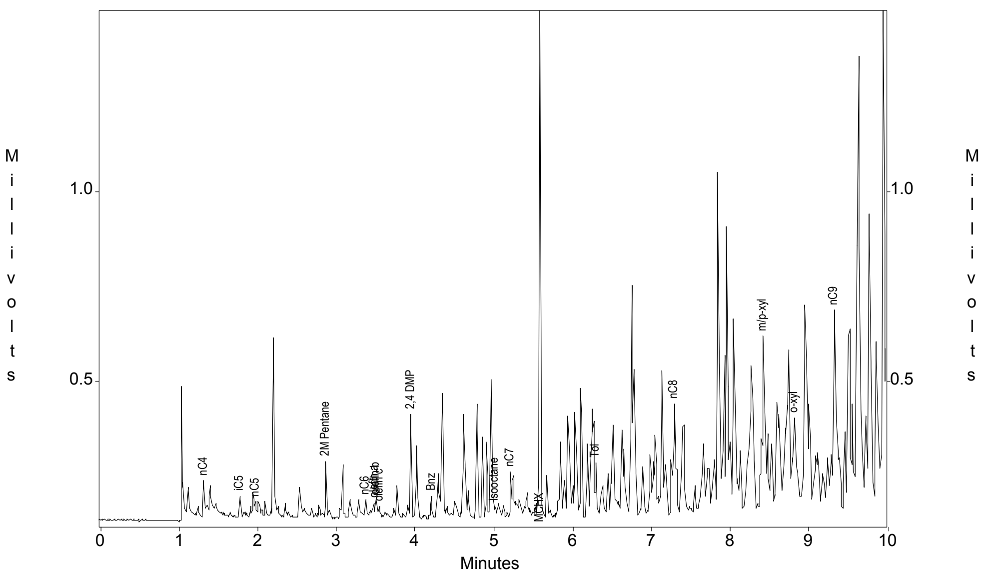
Peak	Area	Height
nC4	71	33
iC5	181	245
nC5	114	141
MTBE	0	0
2M Pentane	2130	2294
nC6	1227	1226
olefin a	0	0
olefin b	420	403
olefin c	345	273
2,4 DMP	1870	1649
Bnz	752	564
Isooctane	33253	28132
nC7	2012	1547
MCHX	21288	17545
Tol	6366	4830
nC8	6692	4445
EB	2718	3239
m/p-xyl	1744	941
o-xyl	4935	2905
nC9	15726	10181
1,2,4 TMB	27880	13963
nC10	7945	5533
nC11	39251	17734
Naph	31207	13373
nC12	33837	19299
IP13	92743	52605
IP14	109997	58069
nC13	20741	11215
IP15	103585	50616
nC14	70945	33415
IP16	104054	51322
nC15	40094	8398
nC16	15053	6365
IP18	54208	19295
nC17	8609	3074
Pristane	57749	25719
nC18	5947	1834
Phytane	25750	12602
nC19	0	0
nC20	3068	726
nC21	1737	588
nC22	1531	286
nC23	933	190
nC24	0	0
nC25	5460	743
nC26	1482	354
nC27	1340	466
nC28	1590	296
nC29	0	0
nC30	734	234
nC31	1992	621
nC32	0	0
nC33	1599	586
nC34	309	190
nC35	183	100
nC36	205	84
nC37	71	48
nC38	127	58
nC39	441	80
nC40	58	38

Sun - Philadelphia Refinery COA

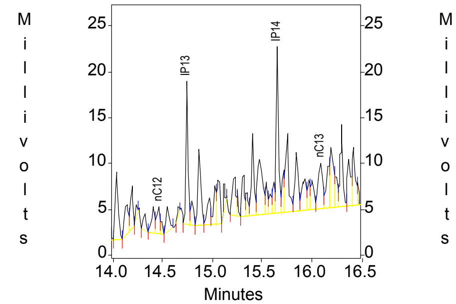
Sample ID : B-130

Acquired : Mar 05, 2004 17:35:01

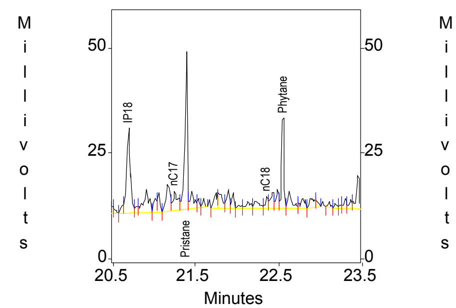
c:\ezchrom\chrom\04046\b-130 -- Channel A



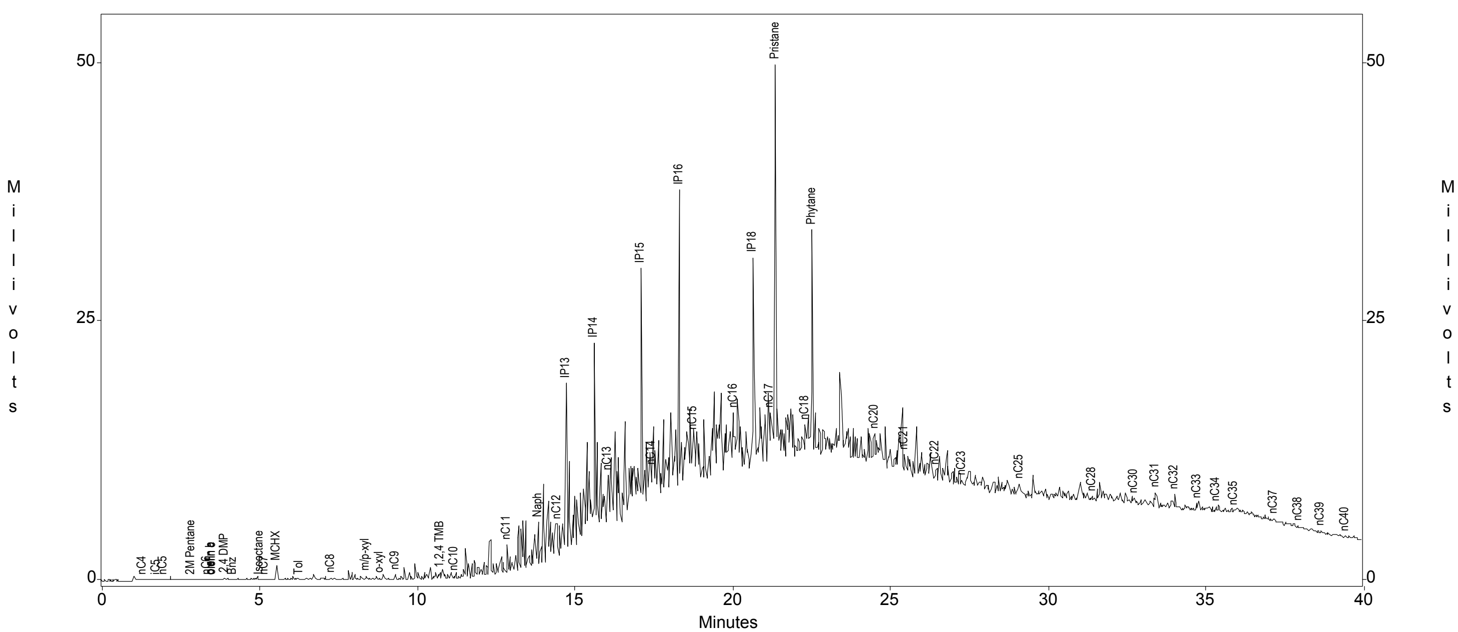
c:\ezchrom\chrom\04046\b-130 -- Channel A



c:\ezchrom\chrom\04046\b-130 -- Channel A



c:\ezchrom\chrom\04046\b-130 -- Channel A



Channel A Results

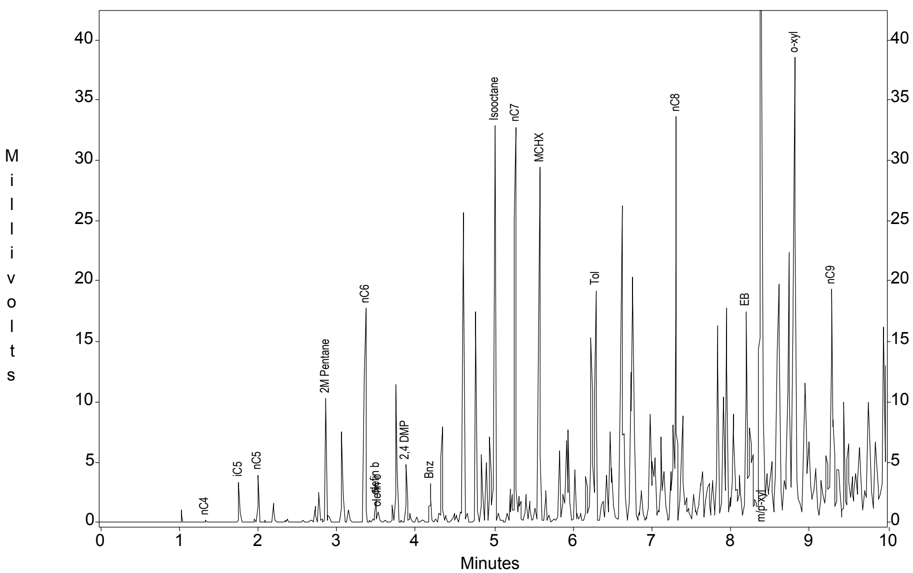
Peak	Area	Height
nC4	119	98
iC5	48	54
nC5	60	42
MTBE	0	0
2M Pentane	152	151
nC6	81	48
olefin a	70	41
olefin b	61	51
olefin c	50	30
2,4 DMP	330	275
Bnz	100	61
Isooctane	47	29
nC7	152	123
MCHX	1786	1444
Tol	243	143
nC8	677	292
EB	0	0
m/p-xyl	1277	460
o-xyl	833	245
nC9	1633	522
1,2,4 TMB	853	472
nC10	638	226
nC11	4516	2613
Naph	6102	4029
nC12	5901	3005
IP13	24166	15684
IP14	28474	18226
nC13	16701	5043
IP15	39145	22295
nC14	3968	2745
IP16	50542	28973
nC15	23605	4669
nC16	12137	4578
IP18	61835	20161
nC17	17786	4505
Pristane	86756	37757
nC18	6868	2883
Phytane	47331	21729
nC19	0	0
nC20	12285	2974
nC21	4884	1712
nC22	5556	983
nC23	1186	507
nC24	0	0
nC25	9629	1308
nC26	0	0
nC27	0	0
nC28	1770	530
nC29	0	0
nC30	588	274
nC31	3112	985
nC32	4878	1310
nC33	1522	618
nC34	771	384
nC35	372	199
nC36	0	0
nC37	160	120
nC38	168	70
nC39	607	156
nC40	226	65

Sun - Philadelphia Refinery COA

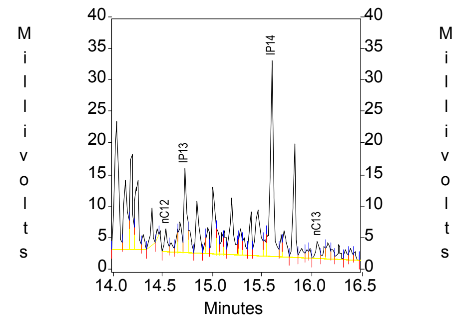
Sample ID : B-144

Acquired : Mar 08, 2004 10:15:49

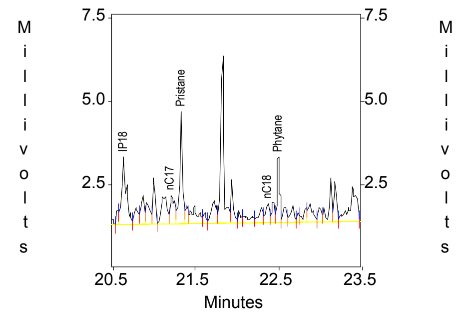
c:\ezchrom\chrom\04046\b-144 -- Channel A



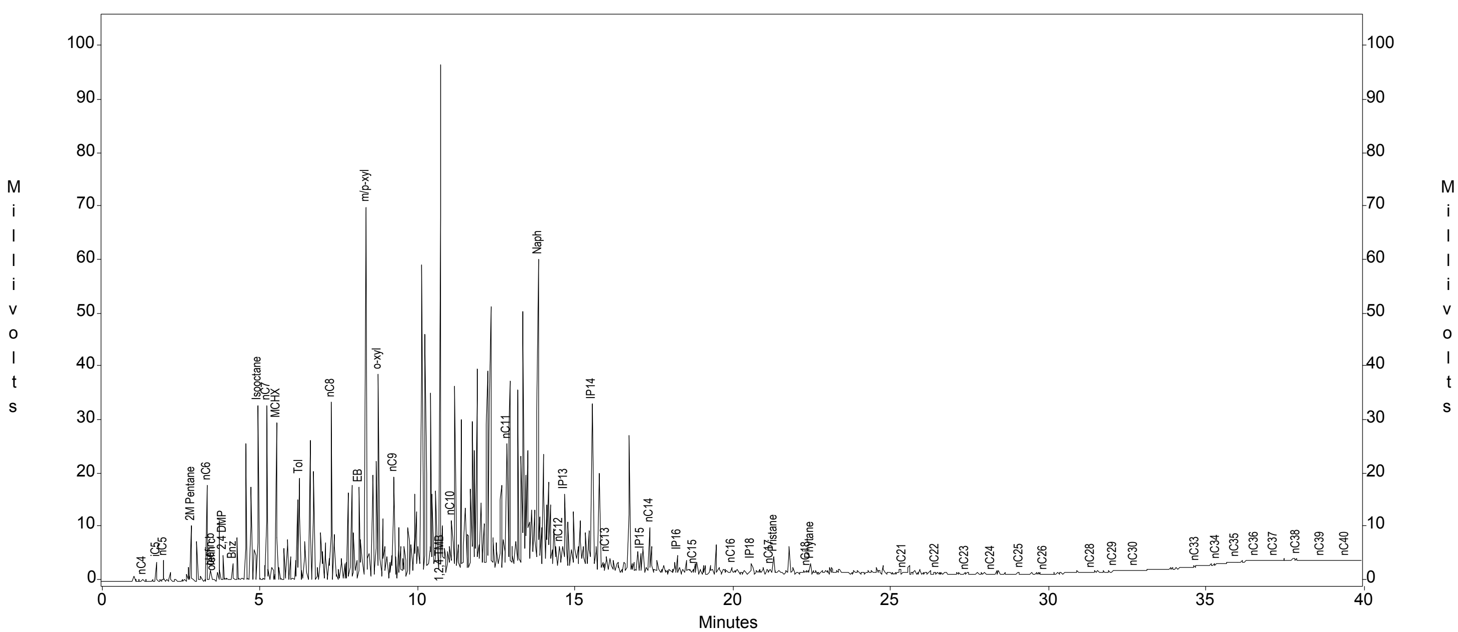
c:\ezchrom\chrom\04046\b-144 -- Channel A



c:\ezchrom\chrom\04046\b-144 -- Channel A



c:\ezchrom\chrom\04046\b-144 -- Channel A

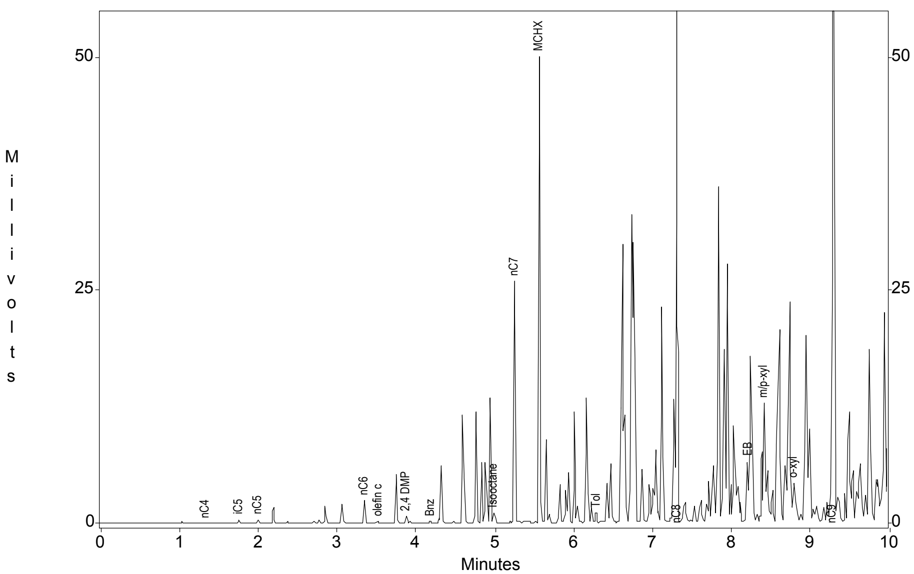


Channel A Results

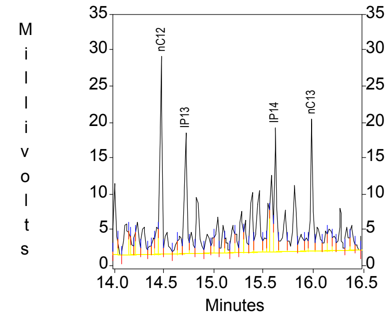
Peak	Area	Height
nC4	75	108
iC5	2543	3277
nC5	3106	3899
MTBE	0	0
2M Pentane	9681	10144
nC6	17286	17638
olefin a	0	0
olefin b	1846	1809
olefin c	1092	893
2,4 DMP	5231	4662
Bnz	4524	3181
Isooctane	40483	32761
nC7	38885	32608
MCHX	36887	29378
Tol	28387	19089
nC8	43804	33397
EB	27580	17108
m/p-xyl	125094	69536
o-xyl	64257	38151
nC9	28499	18782
1,2,4 TMB	195893	94845
nC10	15820	9605
nC11	41196	23086
Naph	105373	57006
nC12	7309	3747
IP13	28236	13553
IP14	64572	31196
nC13	7010	2716
IP15	6591	3784
nC14	16689	8610
IP16	6068	3542
nC15	2906	1027
nC16	2998	1151
IP18	7382	2021
nC17	3108	833
Pristane	7986	3358
nC18	1936	580
Phytane	4216	1985
nC19	0	0
nC20	0	0
nC21	928	324
nC22	1062	275
nC23	1089	165
nC24	508	92
nC25	1827	434
nC26	348	92
nC27	0	0
nC28	383	64
nC29	219	69
nC30	196	60
nC31	0	0
nC32	0	0
nC33	151	75
nC34	466	130
nC35	459	90
nC36	151	70
nC37	134	59
nC38	97	45
nC39	122	36
nC40	163	66

Sun - Philadelphia Refinery COA
Sample ID : BF-106
Acquired : Mar 07, 2004 18:06:23

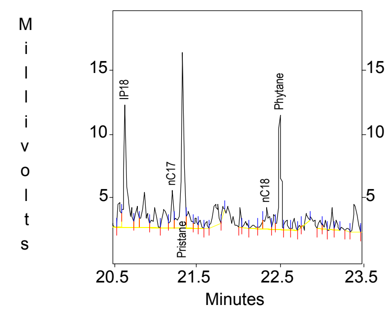
c:\ezchrom\chrom\04046\bf-106 -- Channel A



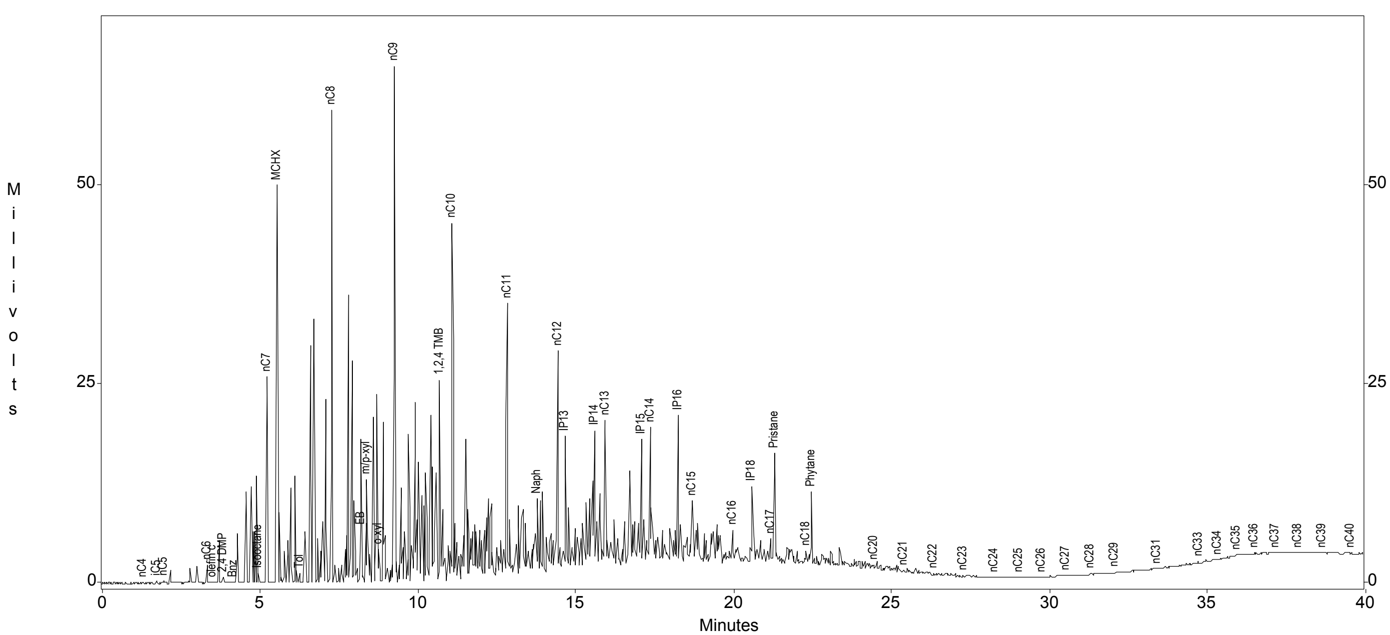
c:\ezchrom\chrom\04046\bf-106 -- Channel A



c:\ezchrom\chrom\04046\bf-106 -- Channel A



c:\ezchrom\chrom\04046\bf-106 -- Channel A



Channel A Results

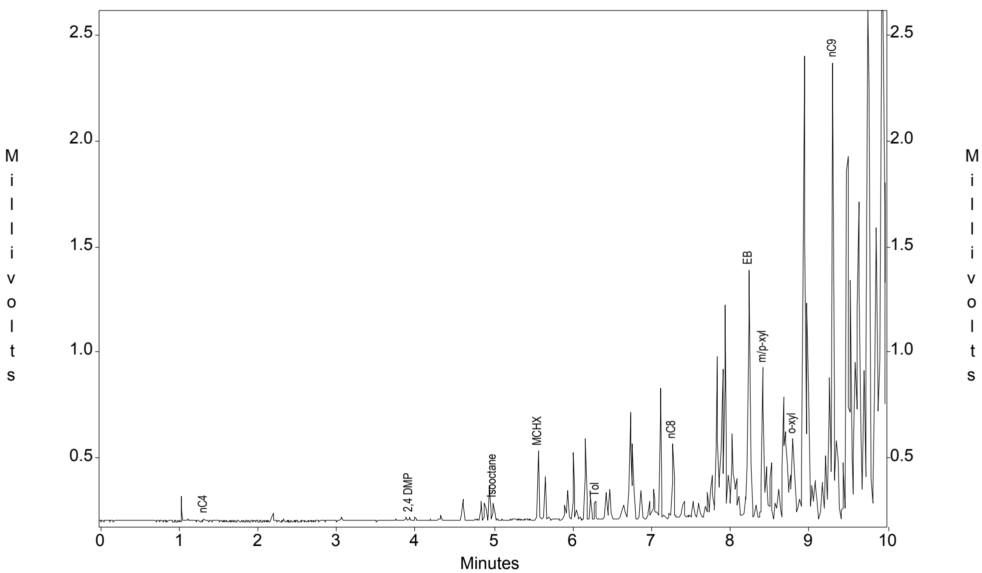
Peak	Area	Height
nC4	21	17
iC5	277	351
nC5	289	343
MTBE	0	0
2M Pentane	0	0
nC6	2408	2350
olefin a	0	0
olefin b	0	0
olefin c	110	55
2,4 DMP	884	795
Bnz	202	142
Isooctane	1398	1130
nC7	29607	25905
MCHX	62945	50041
Tol	1495	1130
nC8	80857	59293
EB	4669	6678
m/p-xyl	17160	12904
o-xyl	6480	4163
nC9	112430	64732
1,2,4 TMB	39702	25157
nC10	68709	44792
nC11	53332	34014
Naph	14731	8961
nC12	41436	27604
IP13	26736	16868
IP14	25303	17284
nC13	30483	18505
IP15	28339	15649
nC14	31300	17130
IP16	31649	18352
nC15	17095	7621
nC16	8846	3652
IP18	27834	9550
nC17	5542	2908
Pristane	31204	13781
nC18	5228	1606
Phytane	17998	8990
nC19	0	0
nC20	1512	571
nC21	425	249
nC22	527	94
nC23	249	113
nC24	507	80
nC25	600	100
nC26	191	64
nC27	455	72
nC28	877	65
nC29	186	44
nC30	0	0
nC31	800	81
nC32	0	0
nC33	542	139
nC34	117	76
nC35	427	163
nC36	369	104
nC37	398	119
nC38	116	50
nC39	141	57
nC40	117	65

Sun - Philadelphia Refinery COA

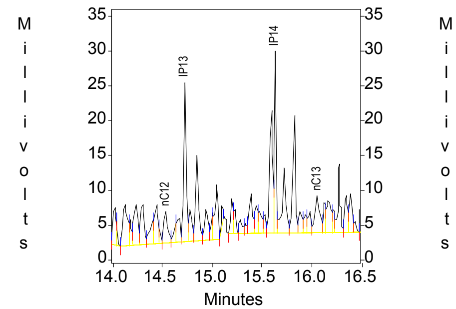
Sample ID : BF-107

Acquired : Mar 06, 2004 07:21:31

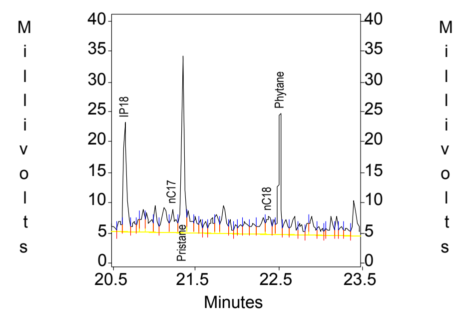
c:\ezchrom\chrom\04046\bf-107 -- Channel A



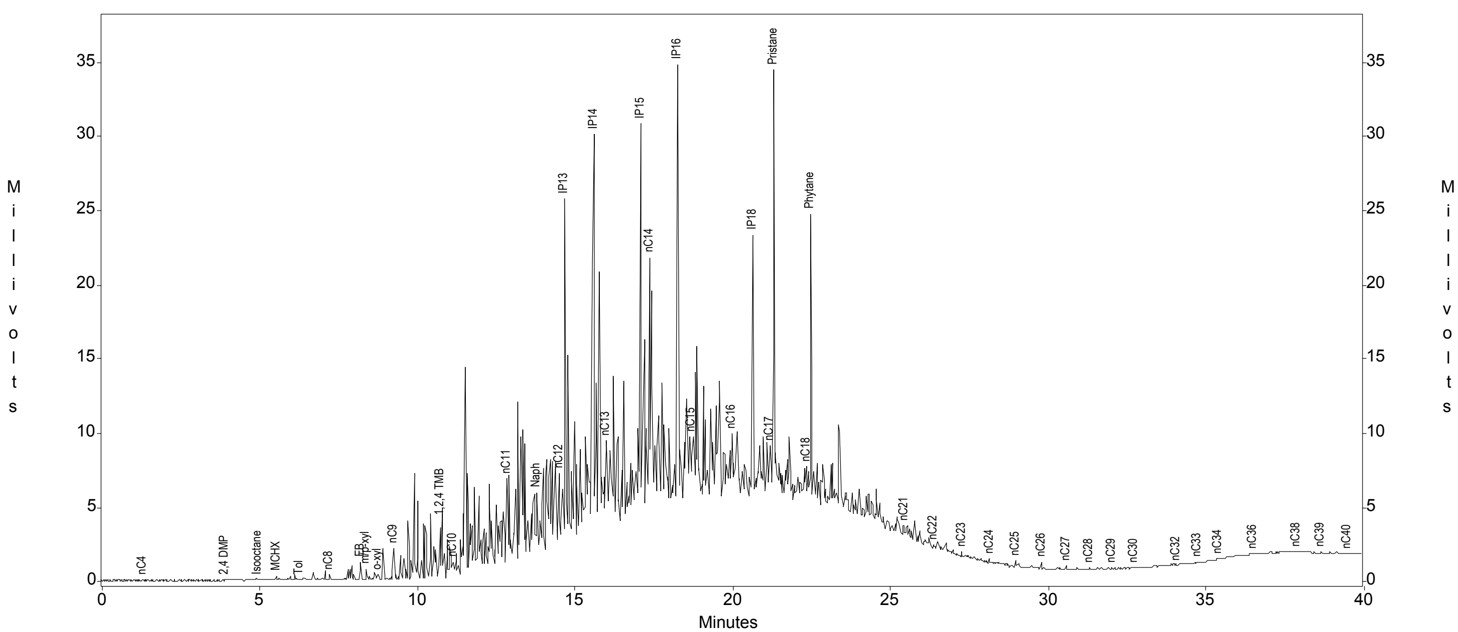
c:\ezchrom\chrom\04046\bf-107 -- Channel A



c:\ezchrom\chrom\04046\bf-107 -- Channel A



c:\ezchrom\chrom\04046\bf-107 -- Channel A



Channel A Results

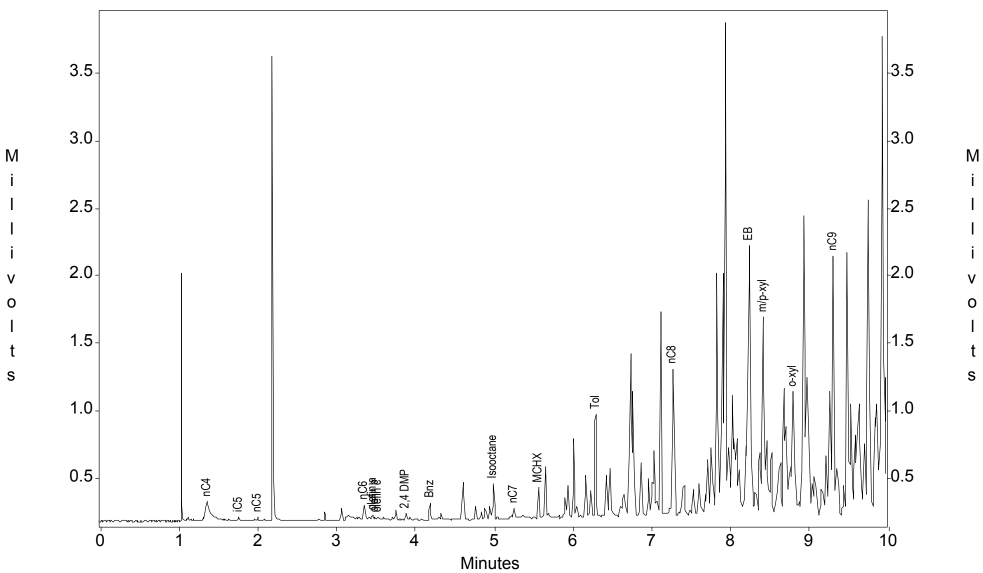
Peak	Area	Height
nC4	13	12
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	24	20
Bnz	0	0
Isooctane	99	83
nC7	0	0
MCHX	401	324
Tol	117	86
nC8	609	359
EB	2028	1178
m/p-xyl	1016	719
o-xyl	866	379
nC9	3349	2159
1,2,4 TMB	7033	3840
nC10	1513	962
nC11	9472	5380
Naph	4093	3199
nC12	12791	4610
IP13	37819	22933
IP14	39386	26307
nC13	18055	5488
IP15	52150	26291
nC14	35532	17059
IP16	52242	29258
nC15	16863	3830
nC16	12798	4315
IP18	46094	17941
nC17	13574	3914
Pristane	66583	29184
nC18	10276	2855
Phytane	43578	19910
nC19	0	0
nC20	0	0
nC21	1262	662
nC22	1020	226
nC23	539	324
nC24	588	330
nC25	812	459
nC26	858	396
nC27	795	268
nC28	383	164
nC29	98	65
nC30	160	48
nC31	0	0
nC32	49	17
nC33	240	70
nC34	238	54
nC35	0	0
nC36	21	15
nC37	0	0
nC38	25	13
nC39	130	21
nC40	30	11

Sun - Philadelphia Refinery COA

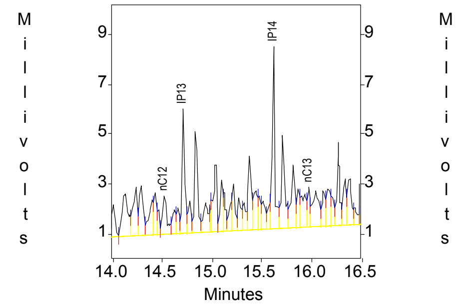
Sample ID : C-65

Acquired : Mar 07, 2004 17:16:51

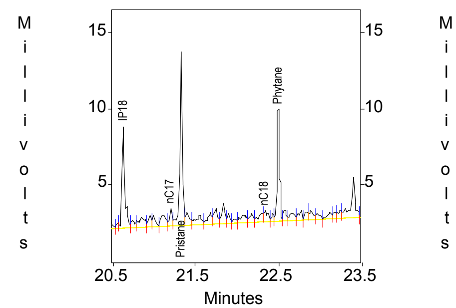
c:\ezchrom\chrom\04046\c-65 -- Channel A



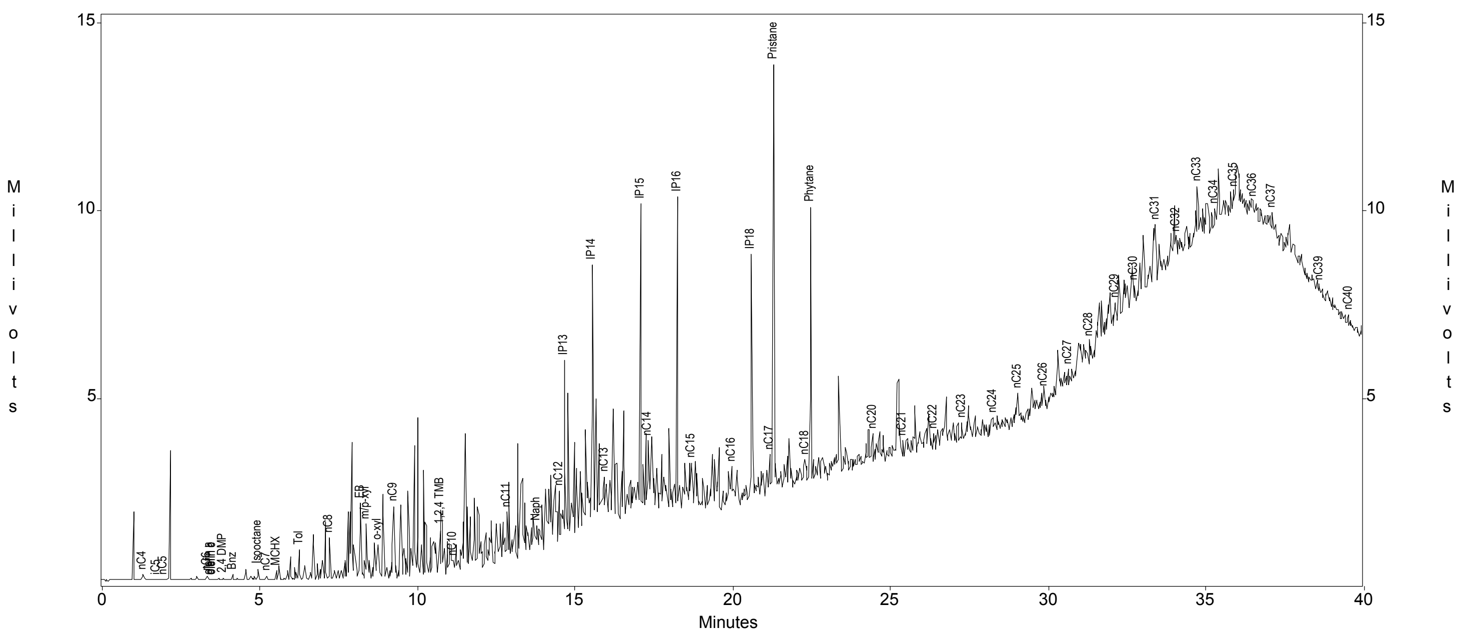
c:\ezchrom\chrom\04046\c-65 -- Channel A



c:\ezchrom\chrom\04046\c-65 -- Channel A



c:\ezchrom\chrom\04046\c-65 -- Channel A



Channel A Results

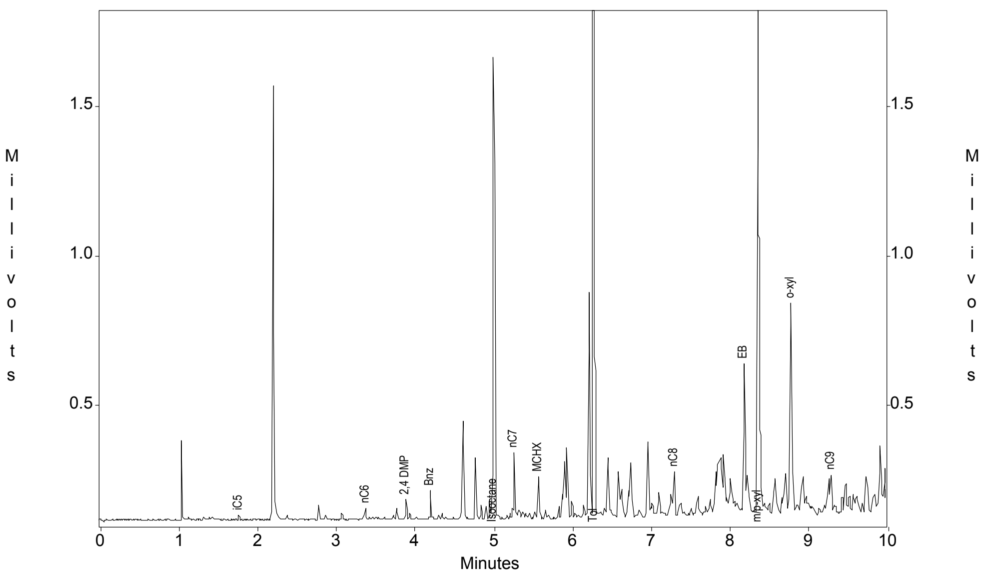
Peak	Area	Height
nC4	567	142
iC5	24	28
nC5	23	20
MTBE	0	0
2M Pentane	0	0
nC6	108	98
olefin a	30	24
olefin b	24	21
olefin c	20	15
2,4 DMP	48	46
Bnz	164	126
Isooctane	320	262
nC7	176	83
MCHX	305	231
Tol	1038	763
nC8	1936	1101
EB	3286	2009
m/p-xyl	2033	1478
o-xyl	1803	913
nC9	2933	1926
1,2,4 TMB	2667	1204
nC10	566	322
nC11	2542	1211
Naph	1390	767
nC12	4665	1542
IP13	8801	4973
IP14	13517	7349
nC13	3565	1621
IP15	13973	8682
nC14	5577	2312
IP16	14719	8603
nC15	6540	1449
nC16	4880	973
IP18	15505	6591
nC17	2145	1096
Pristane	24195	11436
nC18	2451	729
Phytane	15305	7390
nC19	0	0
nC20	4566	882
nC21	1105	497
nC22	352	181
nC23	1962	508
nC24	2731	438
nC25	4415	829
nC26	2430	542
nC27	1494	458
nC28	922	465
nC29	667	386
nC30	702	342
nC31	1968	693
nC32	710	210
nC33	3154	1201
nC34	424	290
nC35	304	222
nC36	202	165
nC37	452	355
nC38	0	0
nC39	402	161
nC40	593	250

Sun - Philadelphia Refinery COA

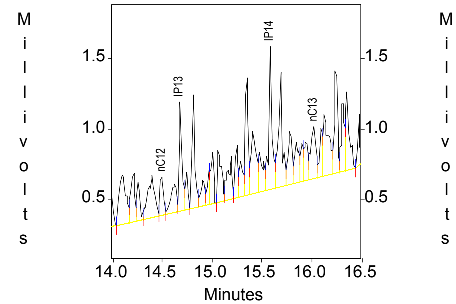
Sample ID : C-106

Acquired : Mar 08, 2004 17:35:42

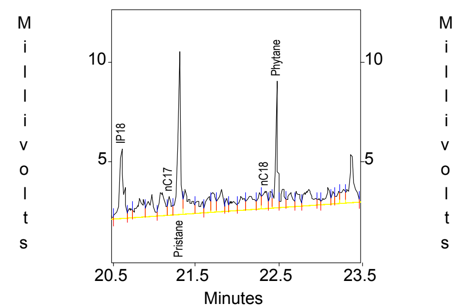
c:\ezchrom\chrom\04046\c-106 -- Channel A



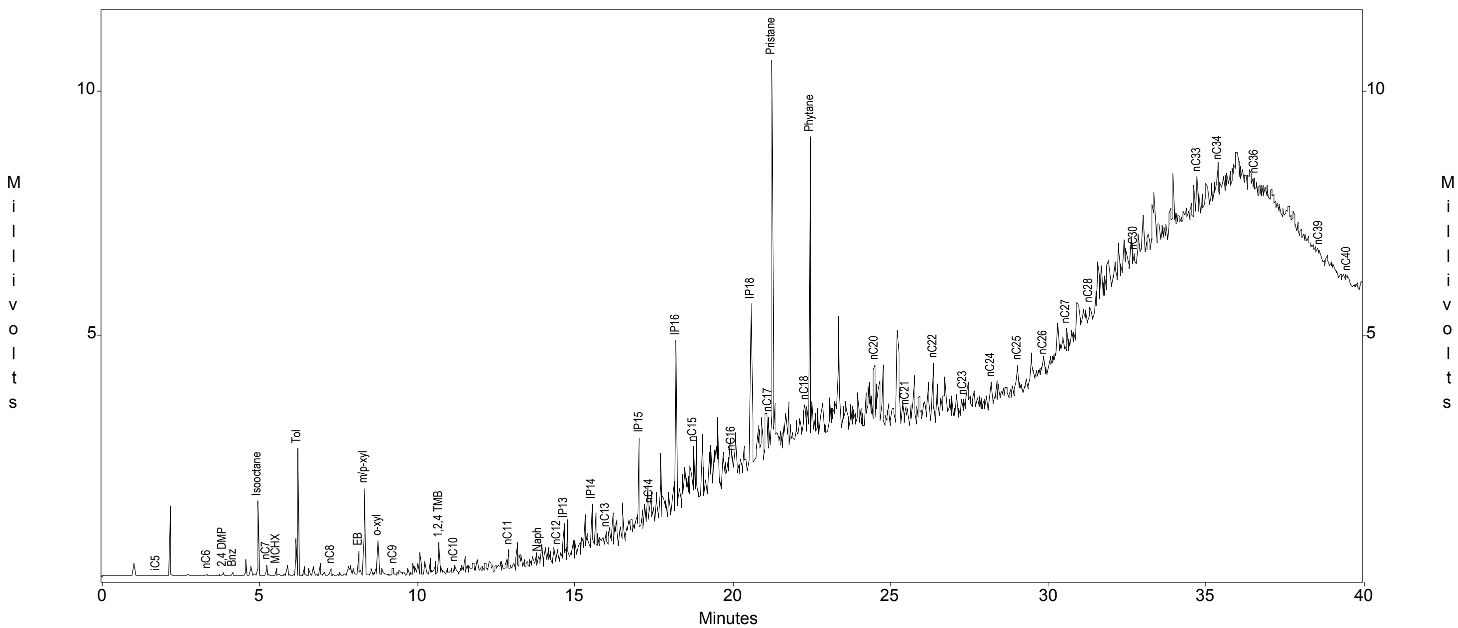
c:\ezchrom\chrom\04046\c-106 -- Channel A



c:\ezchrom\chrom\04046\c-106 -- Channel A



c:\ezchrom\chrom\04046\c-106 -- Channel A

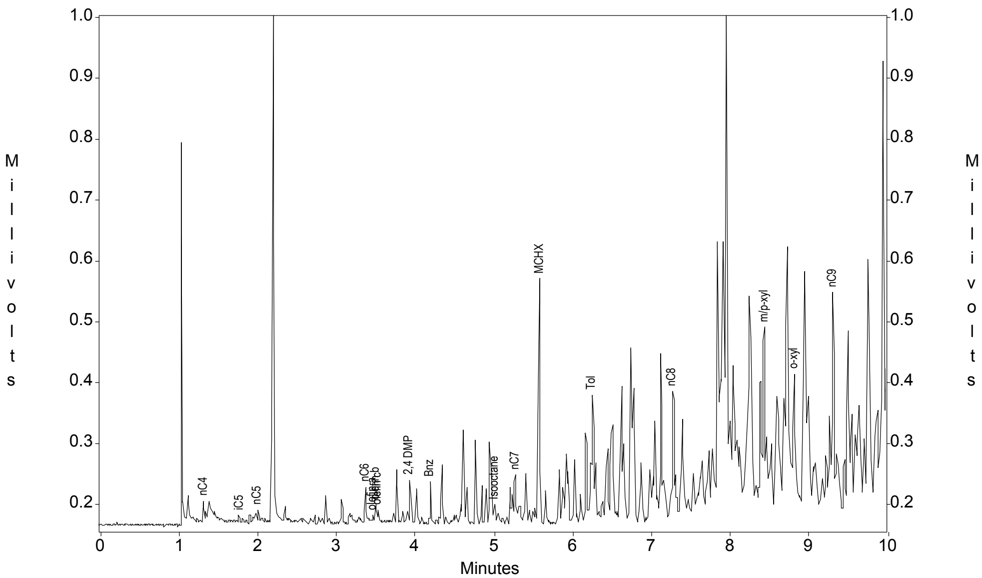


Channel A Results

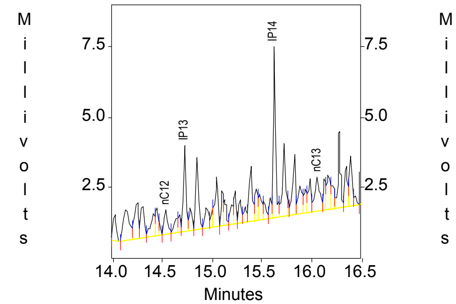
Peak	Area	Height
nC4	0	0
iC5	14	13
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	46	40
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	76	66
Bnz	123	93
Isooctane	1839	1548
nC7	325	221
MCHX	195	141
Tol	3296	2603
nC8	213	152
EB	798	508
m/p-xyl	2466	1761
o-xyl	1075	713
nC9	197	131
1,2,4 TMB	1229	652
nC10	312	150
nC11	847	433
Naph	540	223
nC12	726	270
IP13	1402	776
IP14	2204	1021
nC13	1401	374
IP15	3072	1879
nC14	529	353
IP16	5898	3484
nC15	1964	988
nC16	1888	591
IP18	11158	3494
nC17	2486	1004
Pristane	19095	8270
nC18	3460	917
Phytane	13112	6383
nC19	0	0
nC20	2415	1239
nC21	515	180
nC22	3433	1222
nC23	587	319
nC24	2205	527
nC25	4334	627
nC26	2186	375
nC27	767	468
nC28	653	237
nC29	0	0
nC30	359	140
nC31	0	0
nC32	0	0
nC33	2303	696
nC34	2041	557
nC35	0	0
nC36	414	187
nC37	0	0
nC38	0	0
nC39	447	114
nC40	545	85

Sun - Philadelphia Refinery COA
Sample ID : C-107
Acquired : Mar 06, 2004 18:02:57

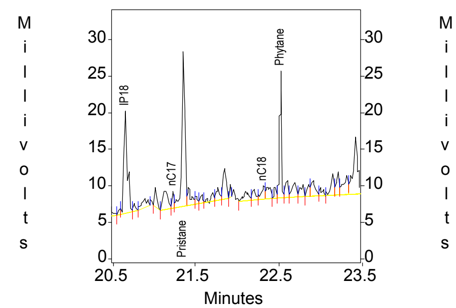
c:\ezchrom\chrom\04046\c-107 -- Channel A



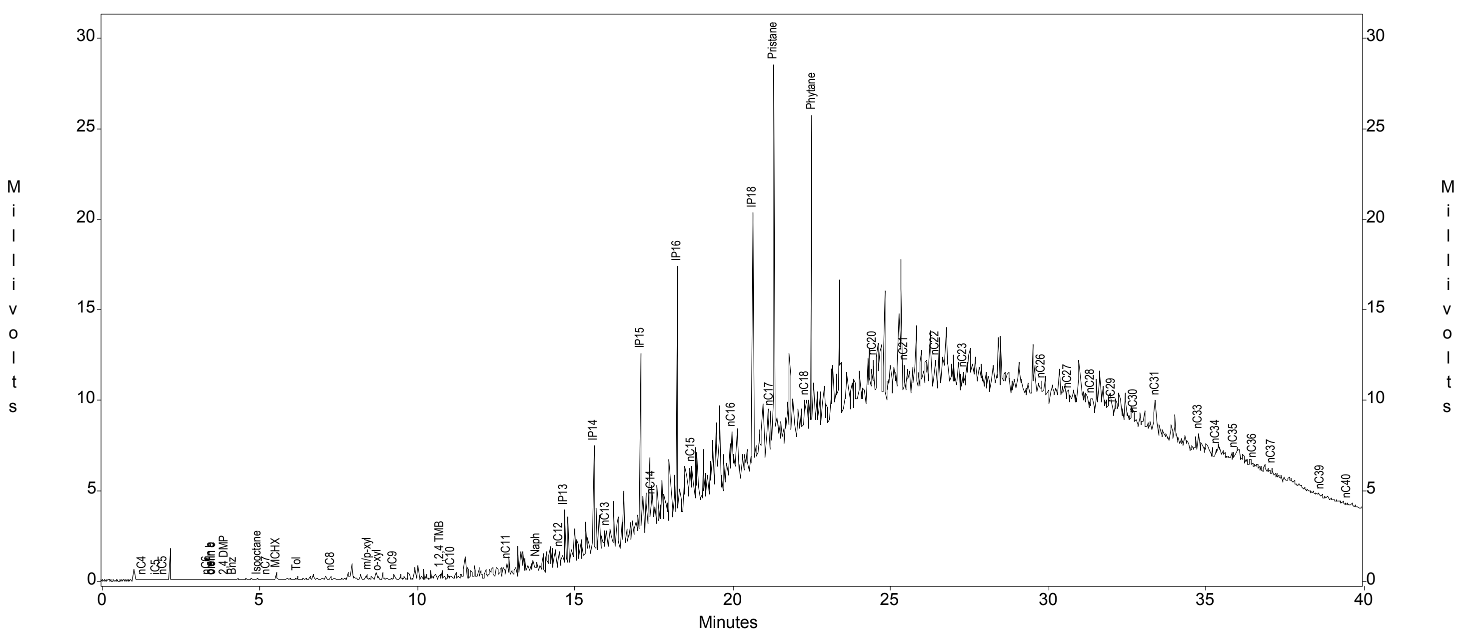
c:\ezchrom\chrom\04046\c-107 -- Channel A



c:\ezchrom\chrom\04046\c-107 -- Channel A



c:\ezchrom\chrom\04046\c-107 -- Channel A



Channel A Results

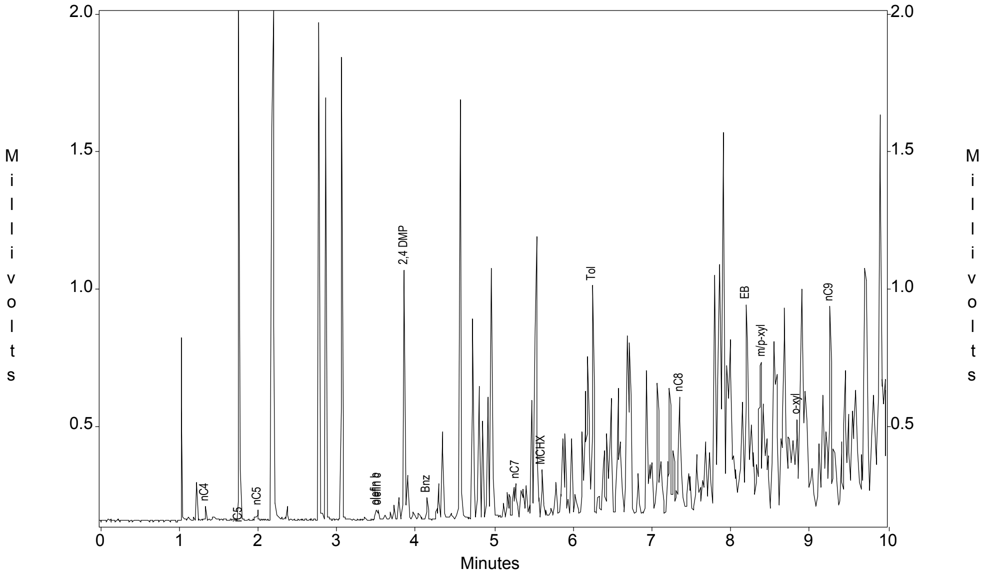
Peak	Area	Height
nC4	36	33
iC5	14	12
nC5	25	19
MTBE	0	0
2M Pentane	0	0
nC6	76	57
olefin a	28	13
olefin b	33	29
olefin c	28	21
2,4 DMP	90	72
Bnz	105	68
Isooctane	62	33
nC7	130	79
MCHX	518	403
Tol	432	211
nC8	420	211
EB	0	0
m/p-xyl	463	307
o-xyl	508	225
nC9	558	357
1,2,4 TMB	1479	378
nC10	552	199
nC11	1266	666
Naph	457	358
nC12	2365	872
IP13	5235	3093
IP14	9672	6104
nC13	4240	1240
IP15	15672	10124
nC14	3188	1653
IP16	22849	13722
nC15	7581	2105
nC16	8835	2846
IP18	38069	13904
nC17	4256	2366
Pristane	47352	21159
nC18	5433	1721
Phytane	35399	17288
nC19	0	0
nC20	6755	2608
nC21	5042	1750
nC22	6309	1547
nC23	2138	987
nC24	0	0
nC25	0	0
nC26	836	321
nC27	2406	521
nC28	1738	419
nC29	455	138
nC30	238	0
nC31	3042	1266
nC32	0	0
nC33	2362	828
nC34	368	262
nC35	636	351
nC36	331	141
nC37	984	300
nC38	0	0
nC39	114	101
nC40	136	66

Sun - Philadelphia Refinery COA

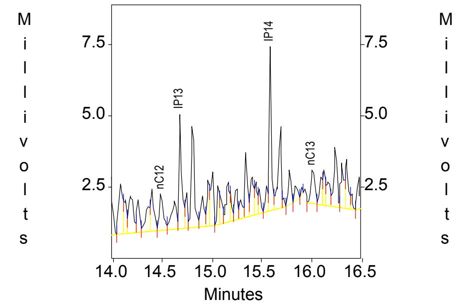
Sample ID : N-14

Acquired : Mar 08, 2004 14:19:28

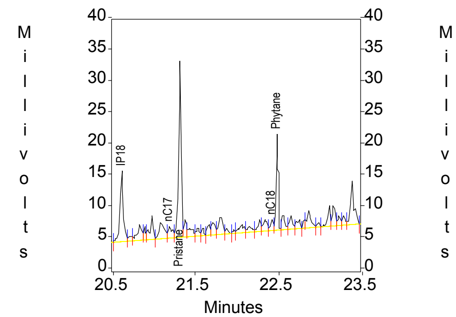
c:\ezchrom\chrom\04046\n-14 -- Channel A



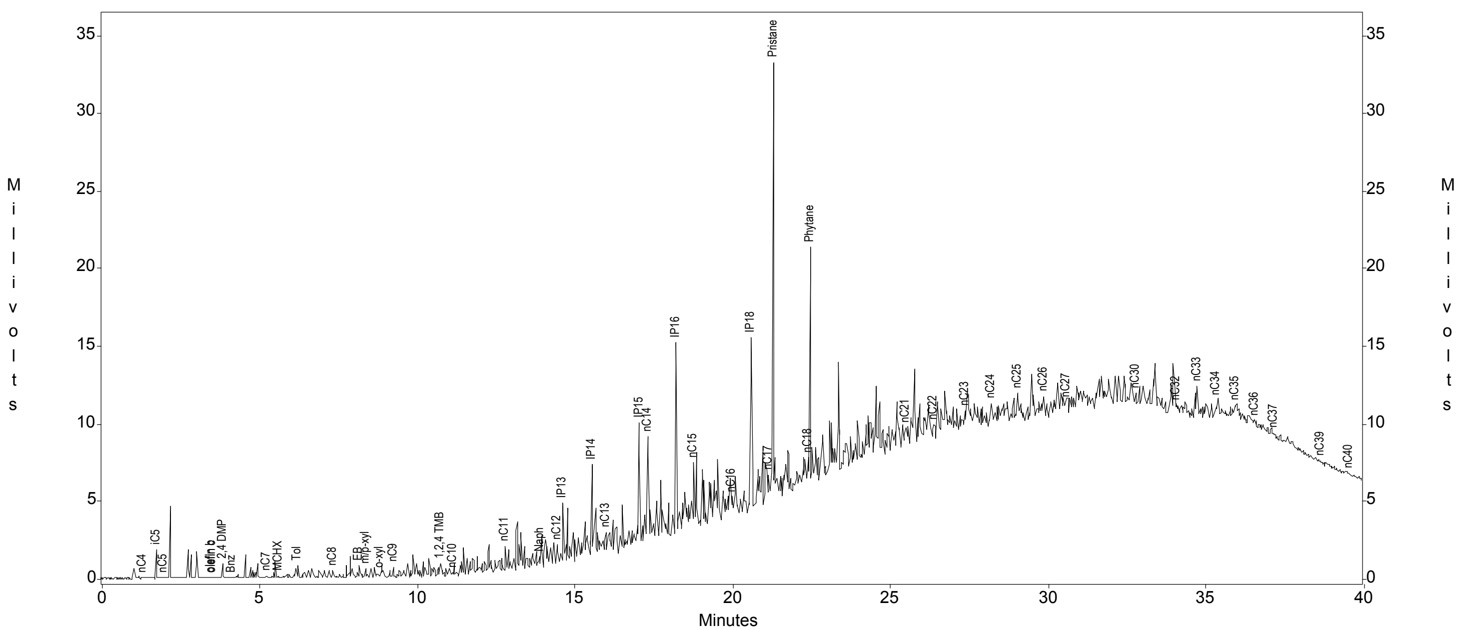
c:\ezchrom\chrom\04046\n-14 -- Channel A



c:\ezchrom\chrom\04046\n-14 -- Channel A



c:\ezchrom\chrom\04046\n-14 -- Channel A

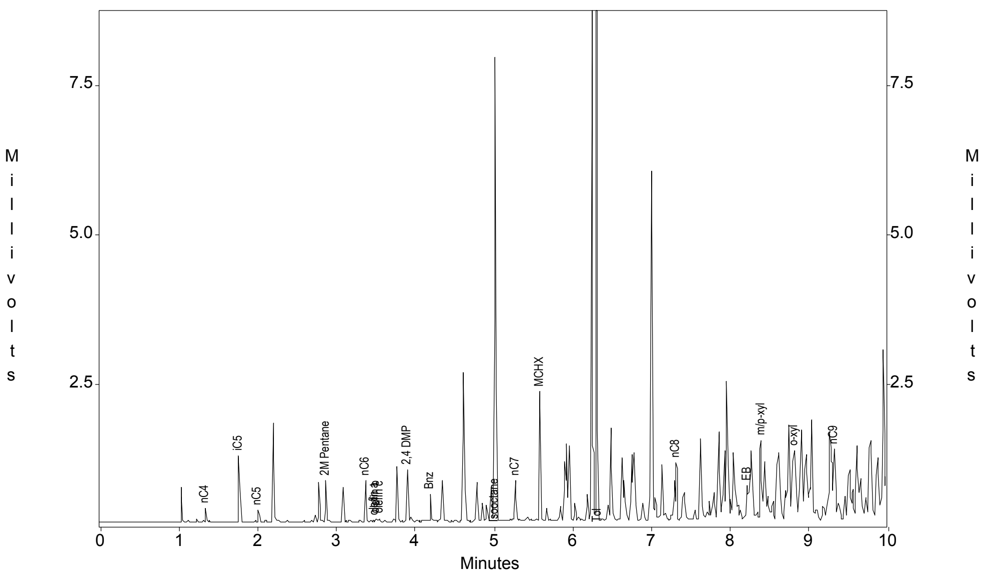


Channel A Results

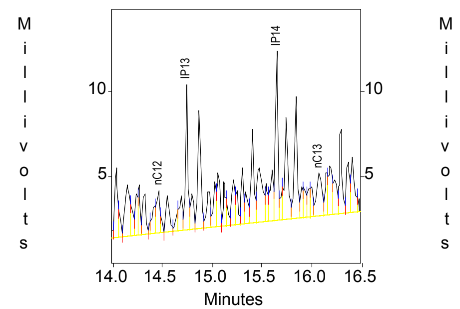
Peak	Area	Height
nC4	53	52
iC5	1327	1853
nC5	56	37
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	53	36
olefin c	38	33
2,4 DMP	1171	906
Bnz	106	78
Isooctane	0	0
nC7	210	116
MCHX	202	167
Tol	1126	830
nC8	984	420
EB	1586	747
m/p-xyl	1223	532
o-xyl	611	320
nC9	1139	723
1,2,4 TMB	1896	816
nC10	873	283
nC11	2648	1581
Naph	1719	733
nC12	3428	1247
IP13	7029	3966
IP14	8428	5742
nC13	3203	1161
IP15	13847	7852
nC14	12813	6709
IP16	20463	12290
nC15	6018	3750
nC16	3609	1255
IP18	29424	11156
nC17	6250	1794
Pristane	59535	28204
nC18	3835	1829
Phytane	31040	15306
nC19	0	0
nC20	0	0
nC21	5530	1277
nC22	4932	913
nC23	3507	1062
nC24	8013	1516
nC25	13192	1942
nC26	4463	1351
nC27	380	158
nC28	0	0
nC29	0	0
nC30	1168	597
nC31	0	0
nC32	692	121
nC33	4523	1600
nC34	1319	469
nC35	338	265
nC36	161	110
nC37	347	165
nC38	0	0
nC39	205	51
nC40	217	87

Sun - Philadelphia Refinery COA
Sample ID : N-25
Acquired : Mar 06, 2004 09:00:33

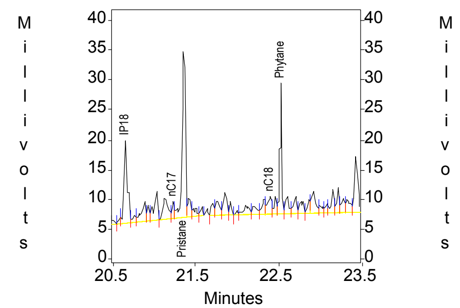
c:\ezchrom\chrom\04046\n-25 -- Channel A



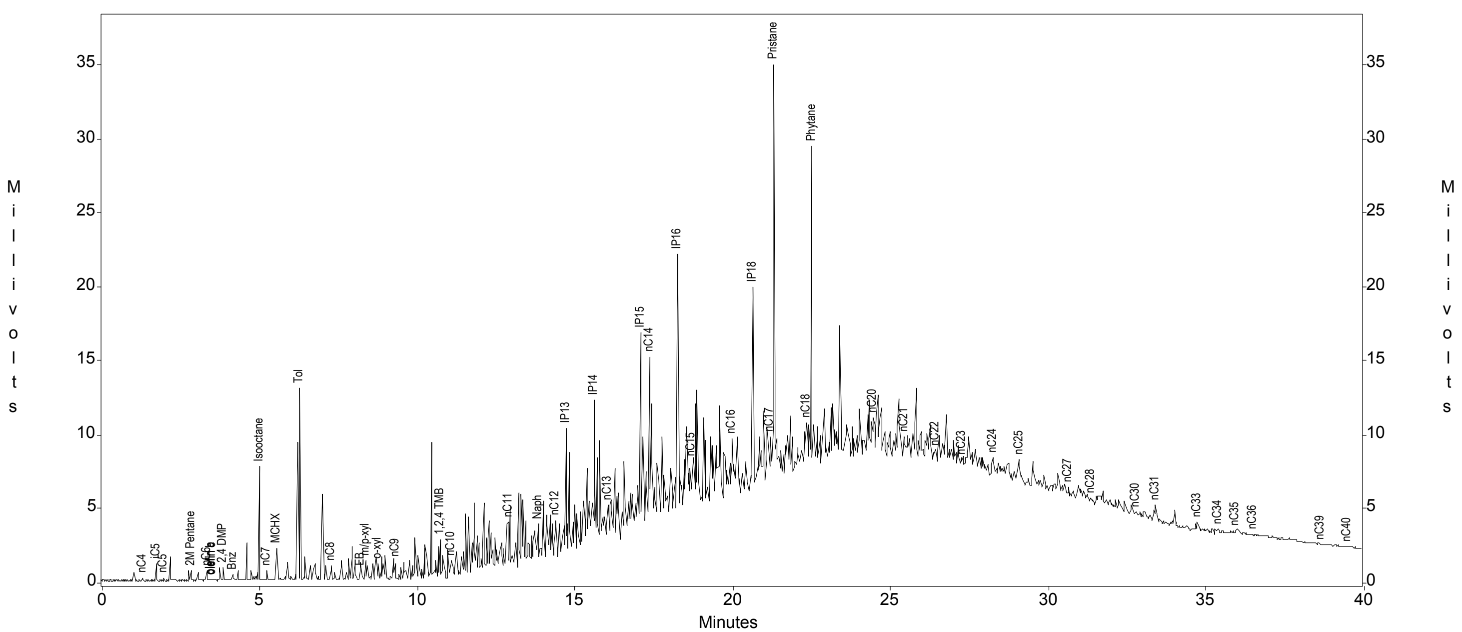
c:\ezchrom\chrom\04046\n-25 -- Channel A



c:\ezchrom\chrom\04046\n-25 -- Channel A



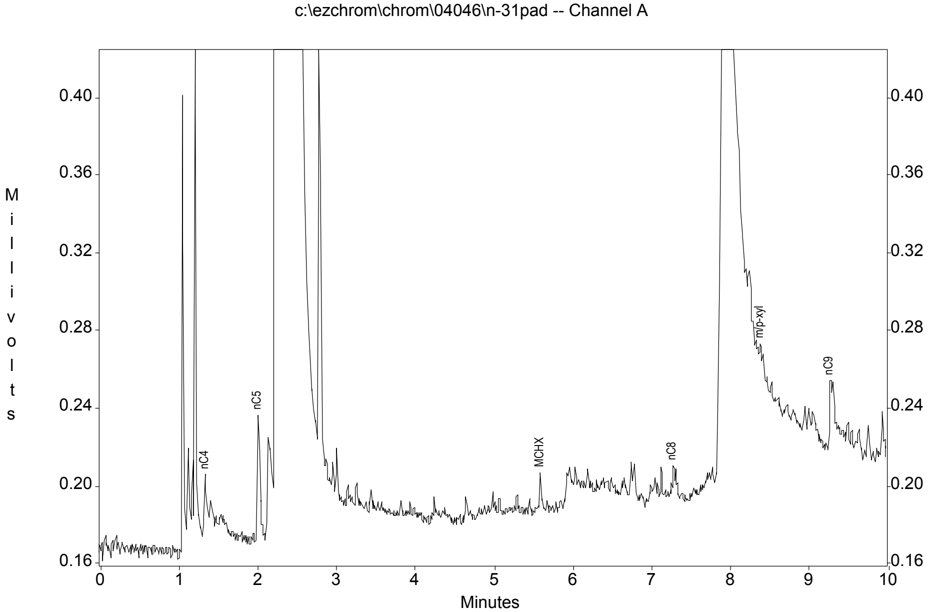
c:\ezchrom\chrom\04046\n-25 -- Channel A

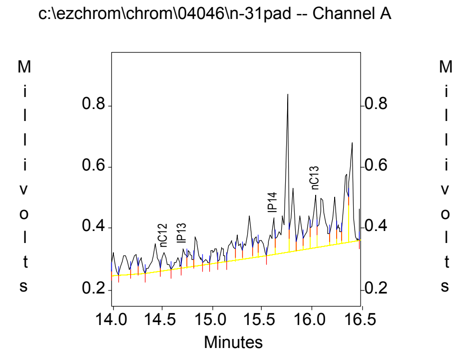


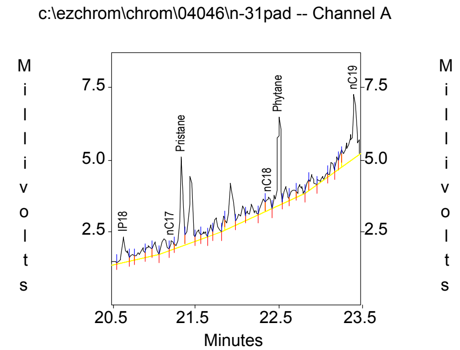
Channel A Results

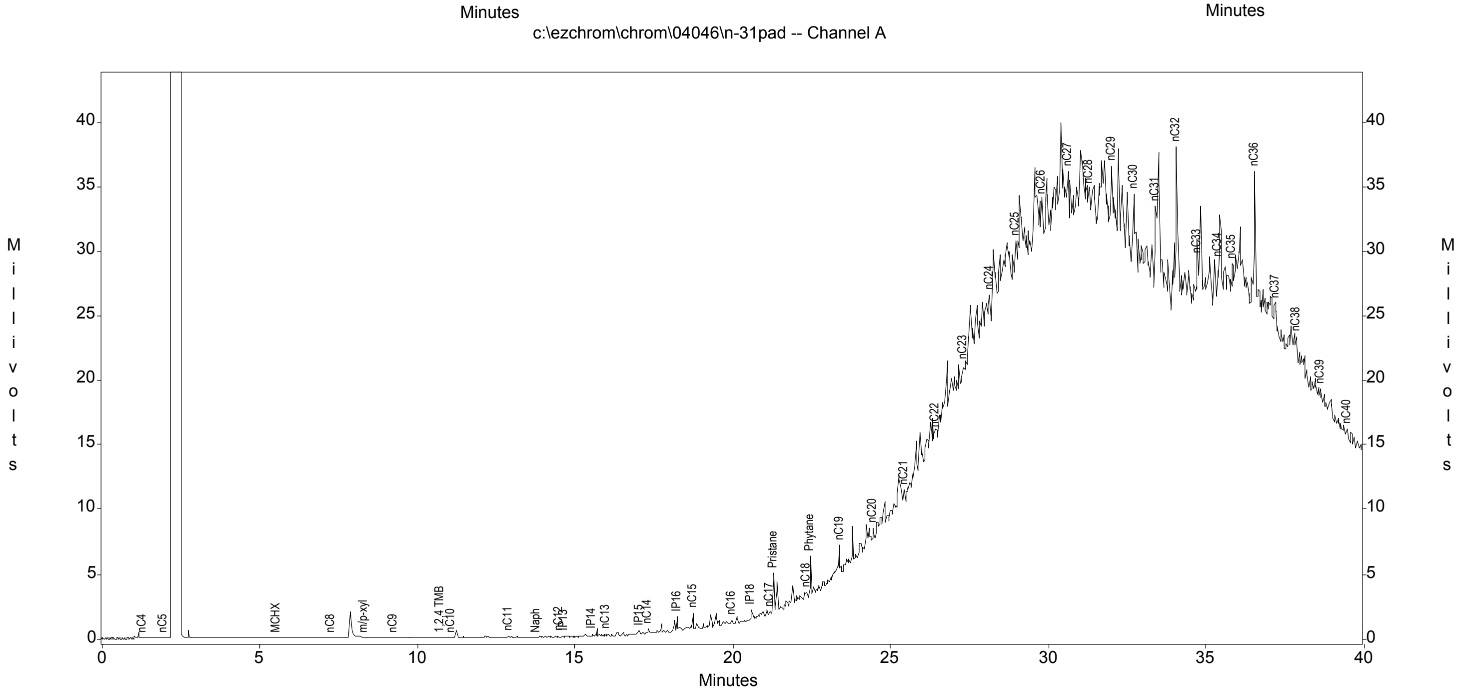
Peak	Area	Height
nC4	190	230
iC5	838	1097
nC5	194	209
MTBE	0	0
2M Pentane	659	688
nC6	676	675
olefin a	24	14
olefin b	66	60
olefin c	76	59
2,4 DMP	958	873
Bnz	558	444
Isooctane	9086	7760
nC7	910	688
MCHX	2670	2163
Tol	15949	13010
nC8	1222	955
EB	1019	576
m/p-xyl	2534	1333
o-xyl	2059	1142
nC9	1026	843
1,2,4 TMB	6519	2670
nC10	2746	1112
nC11	6413	3112
Naph	4691	2639
nC12	6010	2448
IP13	14385	8499
IP14	15651	9873
nC13	9055	2561
IP15	22938	13262
nC14	23574	11214
IP16	27442	16936
nC15	11666	2794
nC16	8816	3224
IP18	37500	13664
nC17	5799	2821
Pristane	66300	27778
nC18	10788	3148
Phytane	46651	21862
nC19	0	0
nC20	9679	2887
nC21	1787	935
nC22	2538	684
nC23	1319	384
nC24	6826	1223
nC25	8879	1637
nC26	0	0
nC27	2016	695
nC28	2183	375
nC29	0	0
nC30	648	172
nC31	2051	809
nC32	0	0
nC33	1447	548
nC34	969	224
nC35	160	111
nC36	36	51
nC37	0	0
nC38	0	0
nC39	116	22
nC40	105	29

Sun - Philadelphia Refinery COA
Sample ID : N-31 Pad
Acquired : Mar 09, 2004 11:40:50









Channel A Results

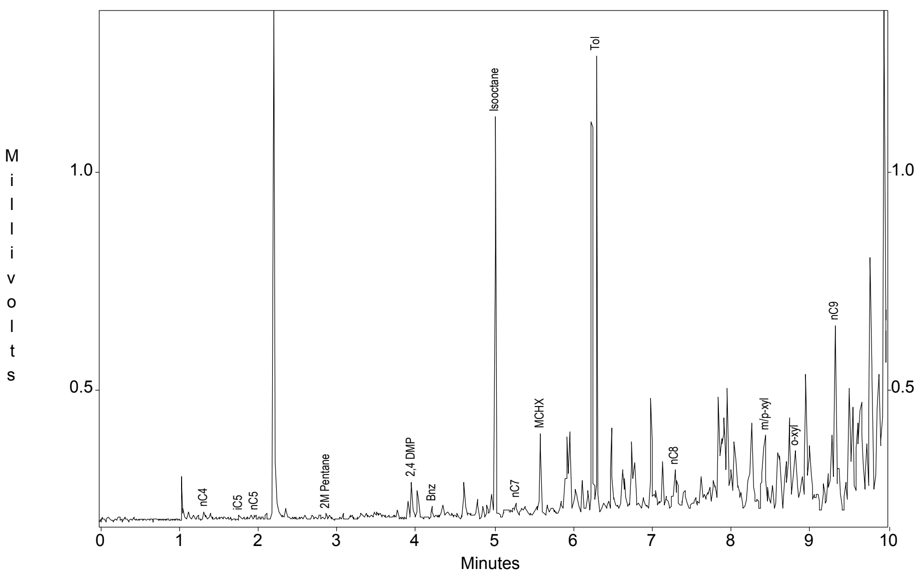
Peak	Area	Height
nC4	67	32
iC5	0	0
nC5	163	64
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	0	0
Isooctane	0	0
nC7	0	0
MCHX	29	19
Tol	0	0
nC8	33	16
EB	0	0
m/p-xyl	139	40
o-xyl	0	0
nC9	220	37
1,2,4 TMB	130	30
nC10	60	20
nC11	510	106
Naph	83	39
nC12	192	62
IP13	144	60
IP14	345	119
nC13	464	171
IP15	865	283
nC14	695	314
IP16	2428	1132
nC15	3731	1302
nC16	2215	405
IP18	2884	870
nC17	650	284
Pristane	7594	3095
nC18	1573	429
Phytane	8339	3035
nC19	11118	2225
nC20	2148	920
nC21	1664	865
nC22	3447	636
nC23	5356	1086
nC24	9440	2379
nC25	5886	2275
nC26	5562	2425
nC27	18426	4426
nC28	15182	2809
nC29	12971	3785
nC30	9752	3225
nC31	5013	1994
nC32	29831	10512
nC33	6258	2051
nC34	1204	1313
nC35	2574	1411
nC36	20919	9217
nC37	1007	679
nC38	786	702
nC39	1050	654
nC40	773	398

Sun - Philadelphia Refinery COA

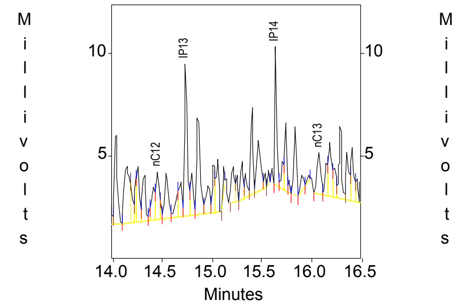
Sample ID : N-35

Acquired : Mar 07, 2004 12:24:39

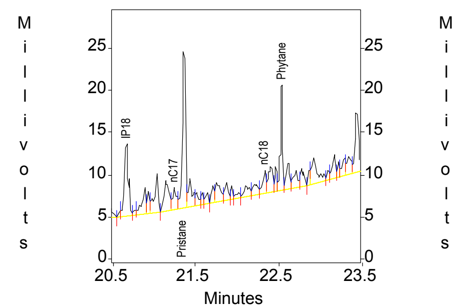
c:\ezchrom\chrom\04046\n-35 -- Channel A



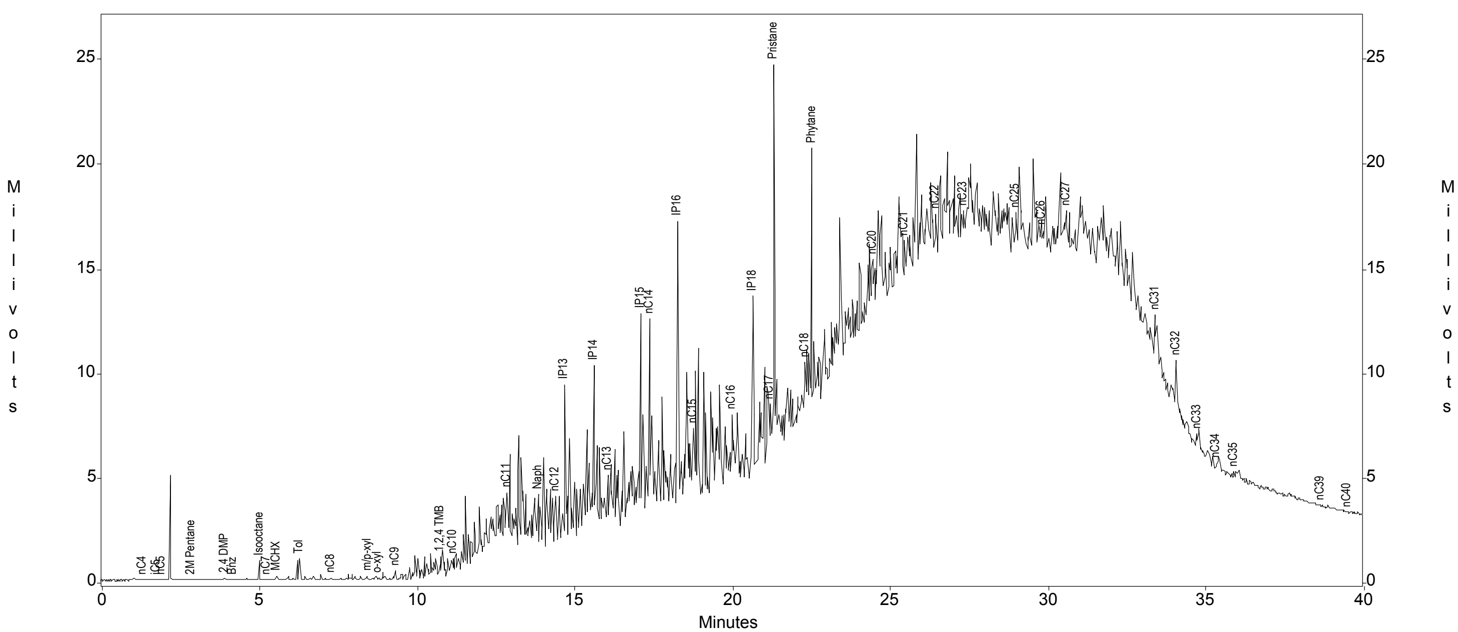
c:\ezchrom\chrom\04046\n-35 -- Channel A



c:\ezchrom\chrom\04046\n-35 -- Channel A



c:\ezchrom\chrom\04046\n-35 -- Channel A



Channel A Results

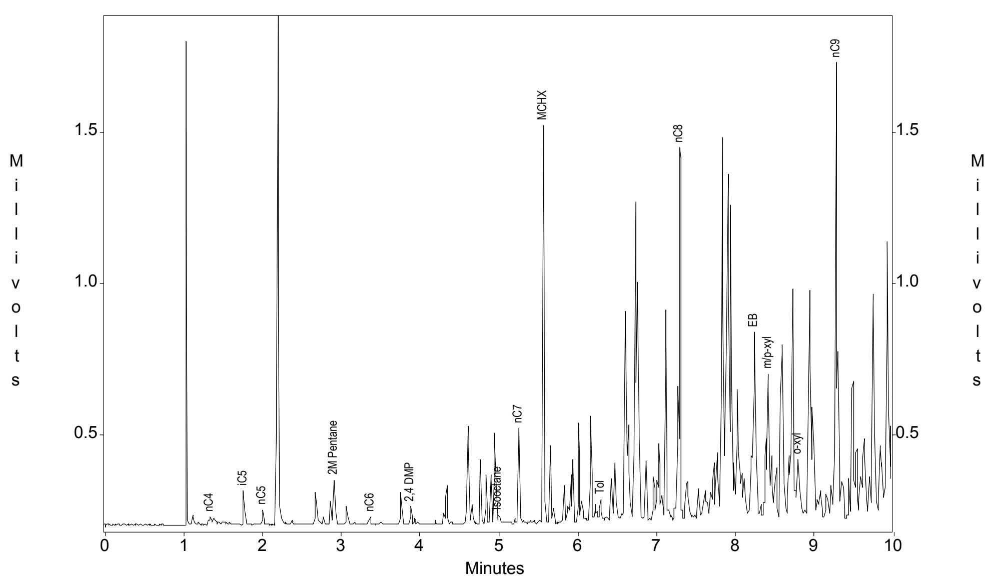
Peak	Area	Height
nC4	28	17
iC5	11	9
nC5	18	8
MTBE	0	0
2M Pentane	21	12
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	111	82
Bnz	36	27
Isooctane	1096	922
nC7	34	26
MCHX	270	191
Tol	1374	1055
nC8	226	100
EB	0	0
m/p-xyl	504	176
o-xyl	439	139
nC9	903	425
1,2,4 TMB	2678	888
nC10	1751	681
nC11	6358	3114
Naph	4288	2581
nC12	4731	2281
IP13	12457	7438
IP14	9033	6796
nC13	5342	2033
IP15	18457	9802
nC14	19182	9402
IP16	22819	13495
nC15	12655	3331
nC16	6520	2805
IP18	26835	8502
nC17	8645	2561
Pristane	42652	18485
nC18	8226	2617
Phytane	27761	12437
nC19	0	0
nC20	2125	1398
nC21	4017	1711
nC22	12917	2401
nC23	5679	2133
nC24	0	0
nC25	8022	1736
nC26	3241	897
nC27	8556	2135
nC28	0	0
nC29	0	0
nC30	0	0
nC31	2477	1161
nC32	5163	2106
nC33	671	417
nC34	288	165
nC35	380	203
nC36	0	0
nC37	0	0
nC38	0	0
nC39	218	79
nC40	199	56

Sun - Philadelphia Refinery COA

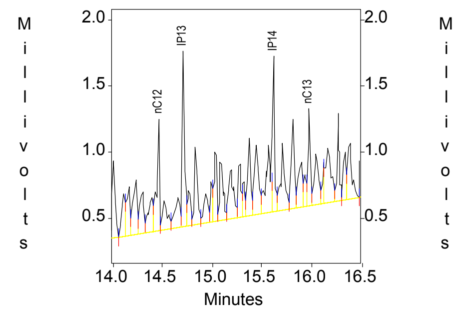
Sample ID : N-48

Acquired : Mar 07, 2004 18:54:39

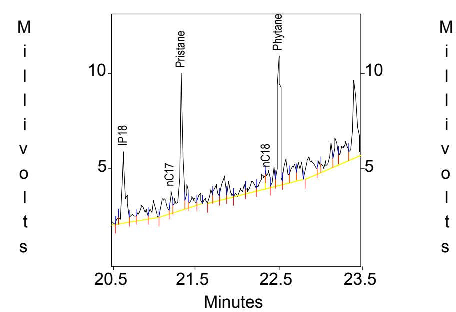
c:\ezchrom\chrom\04046\n-48 -- Channel A



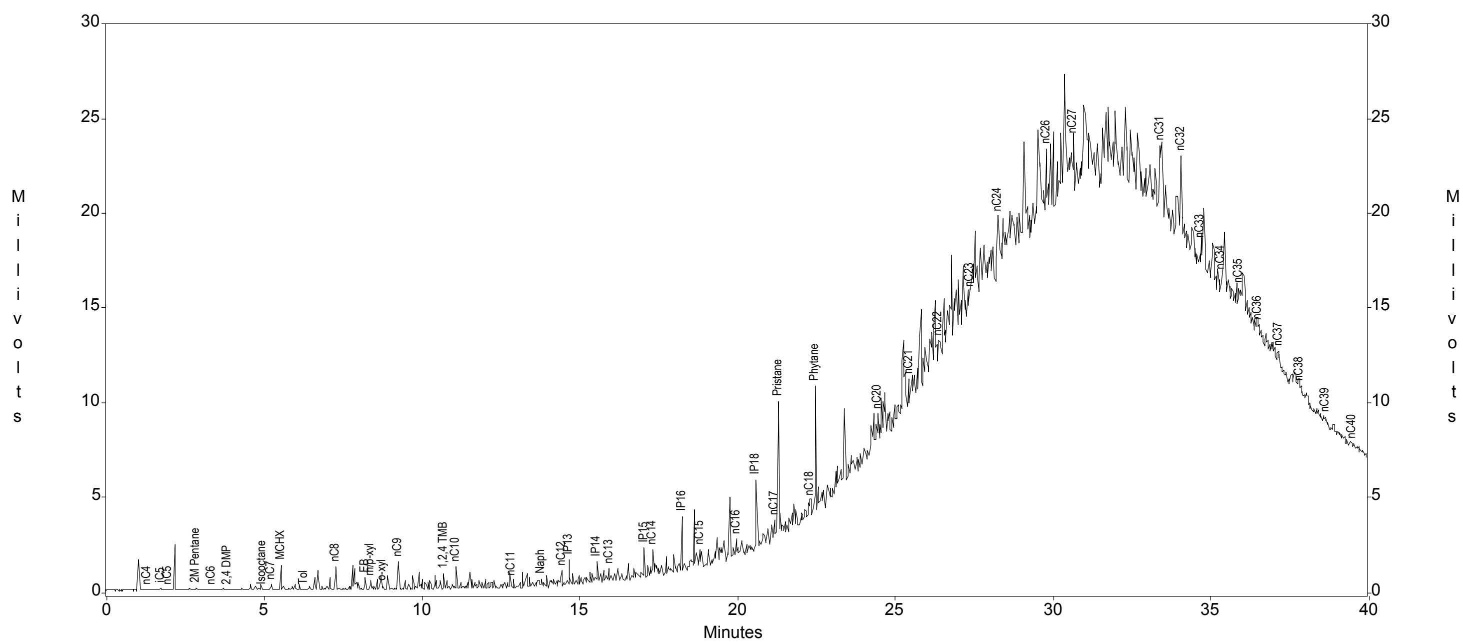
c:\ezchrom\chrom\04046\n-48 -- Channel A



c:\ezchrom\chrom\04046\n-48 -- Channel A



c:\ezchrom\chrom\04046\n-48 -- Channel A



Channel A Results

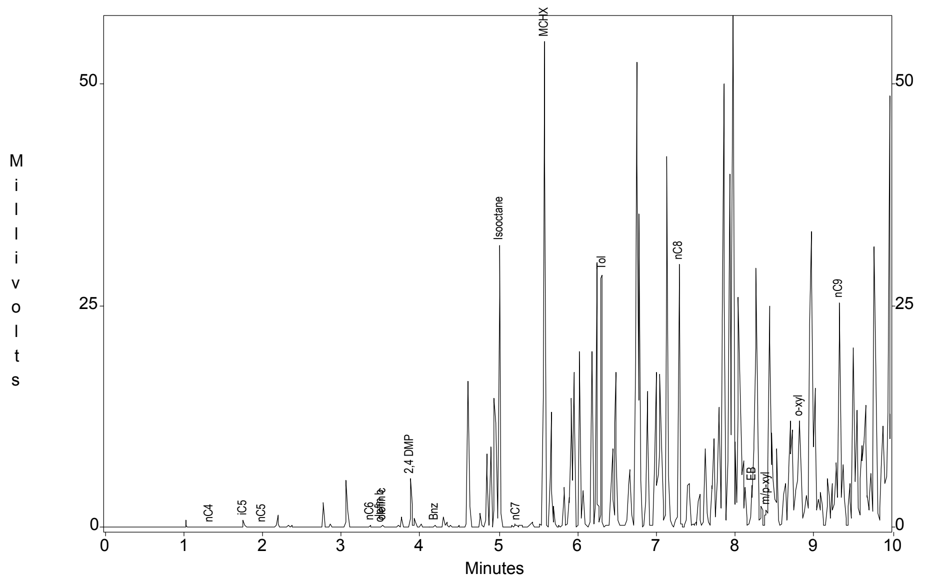
Peak	Area	Height
nC4	63	25
iC5	106	112
nC5	48	49
MTBE	0	0
2M Pentane	220	146
nC6	27	24
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	66	58
Bnz	0	0
Isooctane	49	32
nC7	395	317
MCHX	1591	1320
Tol	103	70
nC8	1558	1236
EB	1182	624
m/p-xyl	658	483
o-xyl	460	201
nC9	2143	1518
1,2,4 TMB	1343	818
nC10	1909	1174
nC11	604	347
Naph	745	433
nC12	1669	836
IP13	2158	1320
IP14	1853	1172
nC13	1177	723
IP15	2914	1643
nC14	3229	1405
IP16	4998	2917
nC15	1561	934
nC16	2829	982
IP18	10212	3687
nC17	2083	1118
Pristane	17006	7170
nC18	3009	914
Phytane	14505	6807
nC19	0	0
nC20	3255	1427
nC21	2443	1429
nC22	1185	536
nC23	2932	1268
nC24	16531	3109
nC25	0	0
nC26	7192	3210
nC27	12415	3193
nC28	0	0
nC29	0	0
nC30	0	0
nC31	2283	1405
nC32	7042	3505
nC33	2539	819
nC34	900	551
nC35	1350	657
nC36	70	0
nC37	402	252
nC38	150	0
nC39	135	183
nC40	161	120

Sun - Philadelphia Refinery COA

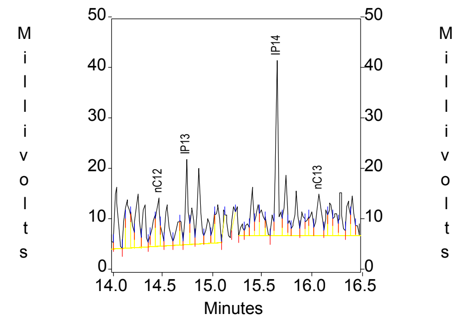
Sample ID : N-52

Acquired : Mar 06, 2004 12:18:31

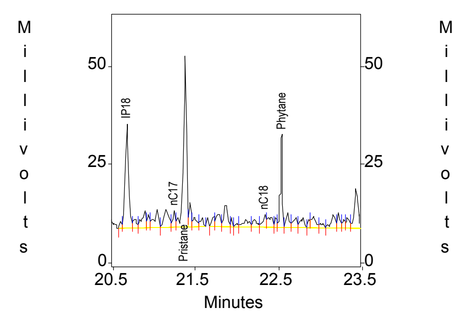
c:\ezchrom\chrom\04046\n-52 -- Channel A



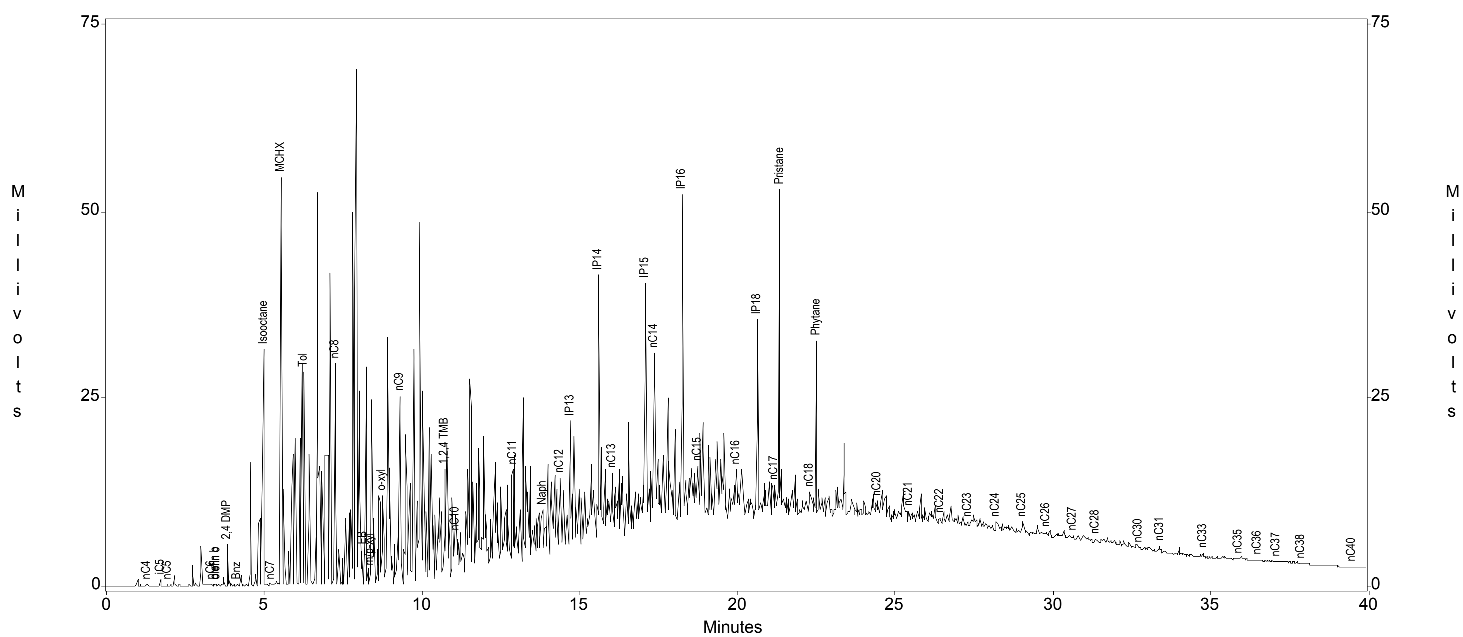
c:\ezchrom\chrom\04046\n-52 -- Channel A



c:\ezchrom\chrom\04046\n-52 -- Channel A



c:\ezchrom\chrom\04046\n-52 -- Channel A

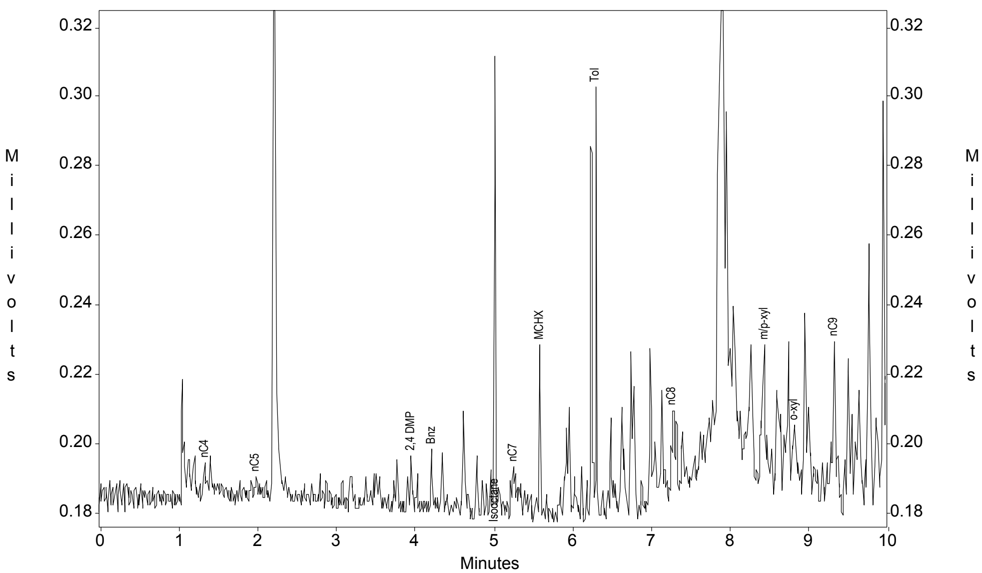


Channel A Results

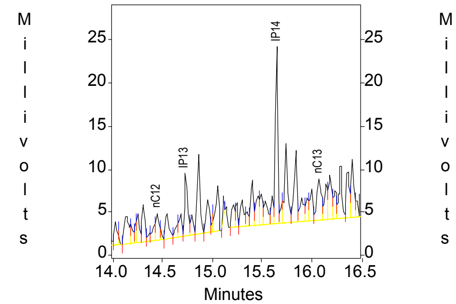
Peak	Area	Height
nC4	19	18
iC5	554	765
nC5	19	17
MTBE	0	0
2M Pentane	0	0
nC6	71	64
olefin a	0	0
olefin b	42	38
olefin c	107	93
2,4 DMP	5910	5485
Bnz	249	175
Isooctane	36775	31645
nC7	291	221
MCHX	70700	54657
Tol	35091	28439
nC8	39707	29531
EB	7079	4605
m/p-xyl	3603	1924
o-xyl	20402	11831
nC9	40910	25123
1,2,4 TMB	30806	14549
nC10	8417	5491
nC11	27412	12762
Naph	10153	6161
nC12	18444	9688
IP13	31769	16957
IP14	61424	34990
nC13	27094	8332
IP15	71687	32871
nC14	52517	23401
IP16	84139	43431
nC15	26712	6508
nC16	17095	6268
IP18	67379	26530
nC17	8182	4017
Pristane	102041	43514
nC18	8630	3157
Phytane	49540	23619
nC19	0	0
nC20	7855	2527
nC21	3384	1394
nC22	4741	935
nC23	3565	886
nC24	8595	1304
nC25	9257	1642
nC26	2375	590
nC27	1691	547
nC28	2040	394
nC29	0	0
nC30	430	97
nC31	1838	597
nC32	0	0
nC33	1425	463
nC34	0	0
nC35	309	99
nC36	70	17
nC37	407	80
nC38	214	73
nC39	0	0
nC40	80	34

Sun - Philadelphia Refinery COA
Sample ID : N-68
Acquired : Mar 07, 2004 14:02:21

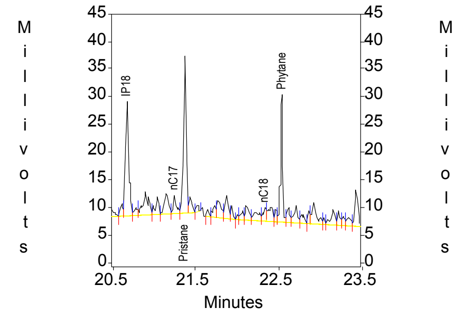
c:\ezchrom\chrom\04046\n-68 -- Channel A



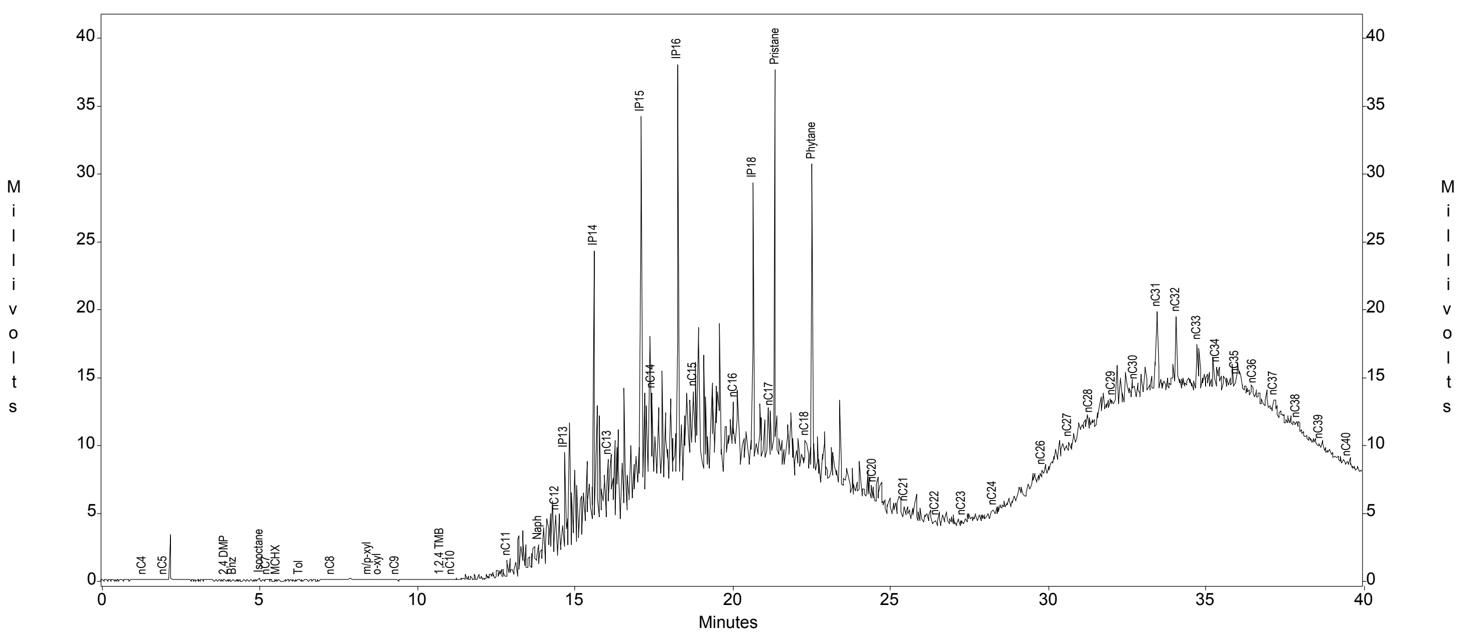
c:\ezchrom\chrom\04046\n-68 -- Channel A



c:\ezchrom\chrom\04046\n-68 -- Channel A



c:\ezchrom\chrom\04046\n-68 -- Channel A



Channel A Results

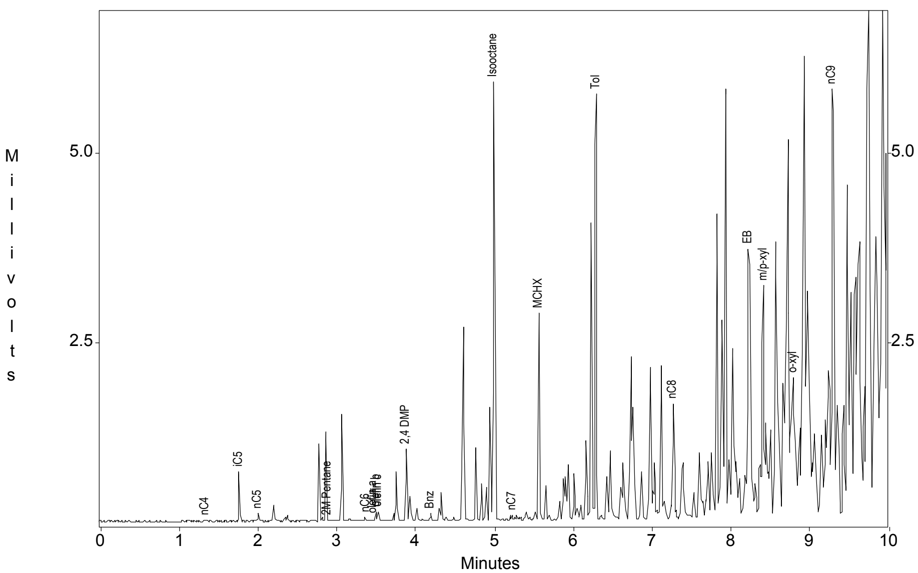
Peak	Area	Height
nC4	14	9
iC5	0	0
nC5	10	5
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	23	16
Bnz	23	16
Isooctane	166	132
nC7	21	14
MCHX	69	51
Tol	172	125
nC8	63	25
EB	0	0
m/p-xyl	135	44
o-xyl	75	23
nC9	201	49
1,2,4 TMB	254	80
nC10	143	51
nC11	1928	1069
Naph	3515	1597
nC12	6082	3070
IP13	13478	7180
IP14	31440	20586
nC13	16001	4831
IP15	51193	27772
nC14	3699	2683
IP16	56443	30507
nC15	27646	6369
nC16	18591	4867
IP18	51338	20557
nC17	7955	3332
Pristane	59147	28361
nC18	8293	2771
Phytane	50575	23323
nC19	0	0
nC20	1648	878
nC21	2341	816
nC22	1673	321
nC23	775	334
nC24	2612	506
nC25	0	0
nC26	1333	586
nC27	2263	722
nC28	1973	962
nC29	368	242
nC30	747	329
nC31	13062	4535
nC32	12087	4721
nC33	5708	2711
nC34	1527	883
nC35	370	158
nC36	238	29
nC37	1912	650
nC38	561	136
nC39	505	194
nC40	627	317

Sun - Philadelphia Refinery COA

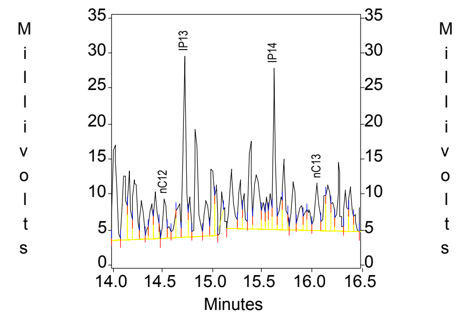
Sample ID : N-78 Pad

Acquired : Mar 09, 2004 10:52:06

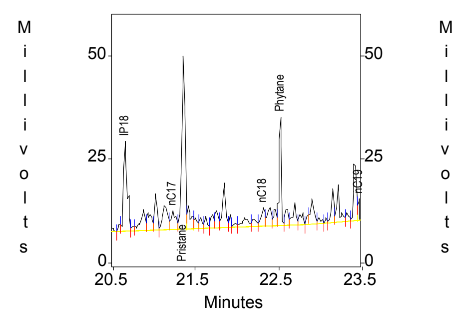
c:\ezchrom\chrom\04046\n-78.2 -- Channel A



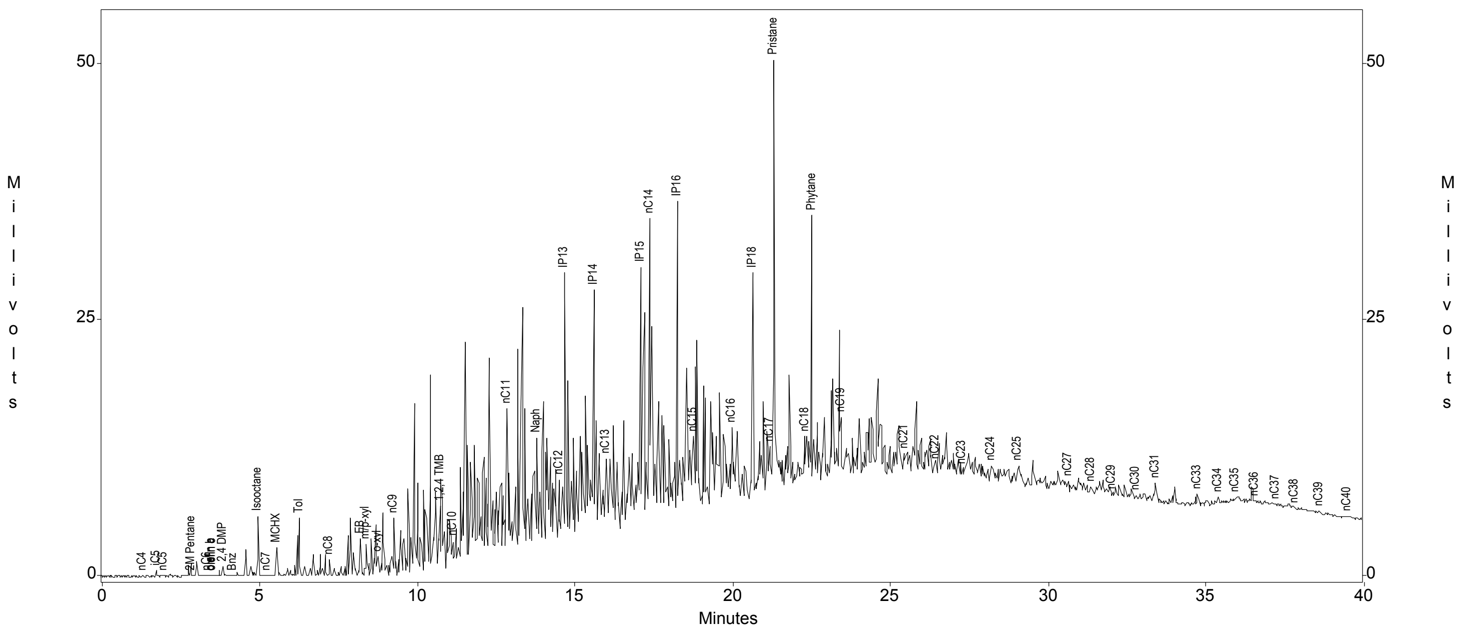
c:\ezchrom\chrom\04046\n-78.2 -- Channel A



c:\ezchrom\chrom\04046\n-78.2 -- Channel A



c:\ezchrom\chrom\04046\n-78.2 -- Channel A



Channel A Results

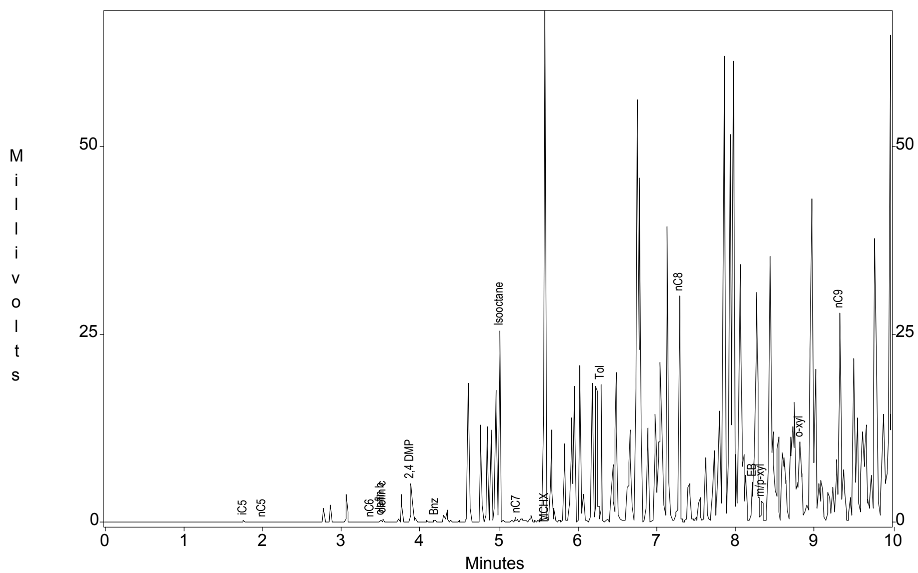
Peak	Area	Height
nC4	27	25
iC5	496	666
nC5	102	112
MTBE	0	0
2M Pentane	23	17
nC6	71	63
olefin a	26	21
olefin b	134	121
olefin c	147	115
2,4 DMP	1111	950
Bnz	148	86
Isooctane	6797	5790
nC7	85	65
MCHX	3415	2733
Tol	7077	5626
nC8	2546	1532
EB	6314	3537
m/p-xyl	4396	3043
o-xyl	3311	1803
nC9	8728	5600
1,2,4 TMB	12791	6121
nC10	984	948
nC11	23831	13370
Naph	16012	9975
nC12	12462	5483
IP13	44423	25573
IP14	34669	22778
nC13	19770	6589
IP15	43995	24195
nC14	65847	28557
IP16	52427	29751
nC15	24788	6454
nC16	17654	6912
IP18	61590	22035
nC17	18221	4565
Pristane	102843	42071
nC18	14730	4587
Phytane	57073	26094
nC19	10718	5194
nC20	0	0
nC21	5366	2043
nC22	4747	861
nC23	1071	406
nC24	8547	1603
nC25	11388	1900
nC26	0	0
nC27	3333	1012
nC28	4144	658
nC29	595	212
nC30	1262	320
nC31	3422	1336
nC32	0	0
nC33	2822	1003
nC34	2008	507
nC35	397	205
nC36	200	92
nC37	172	87
nC38	387	130
nC39	87	76
nC40	128	65

Sun - Philadelphia Refinery COA

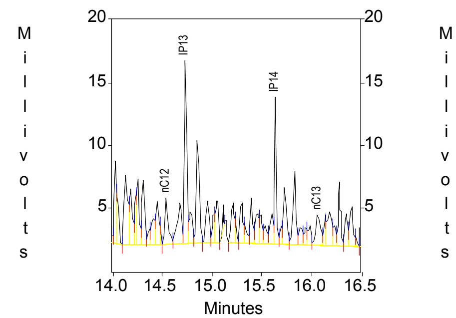
Sample ID : N-79

Acquired : Mar 07, 2004 07:17:27

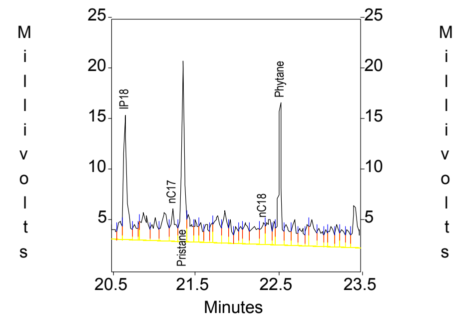
c:\ezchrom\chrom\04046\n-79 -- Channel A



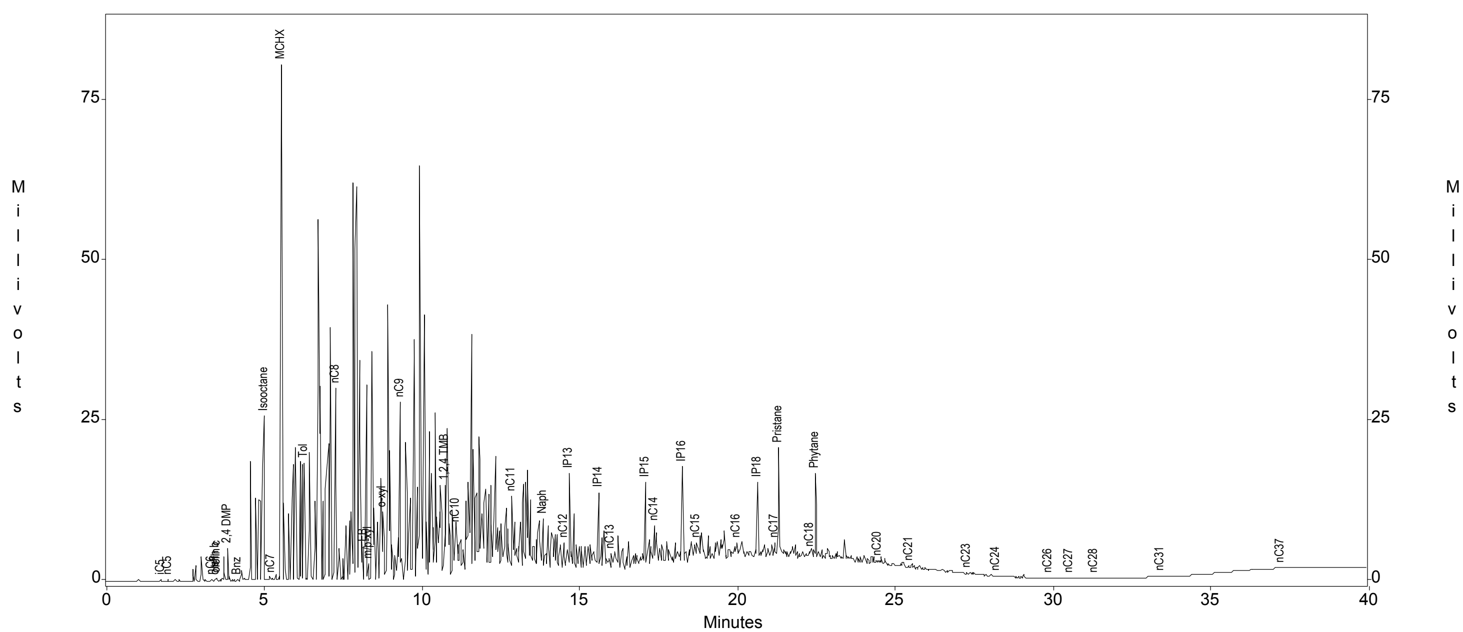
c:\ezchrom\chrom\04046\n-79 -- Channel A



c:\ezchrom\chrom\04046\n-79 -- Channel A



c:\ezchrom\chrom\04046\n-79 -- Channel A

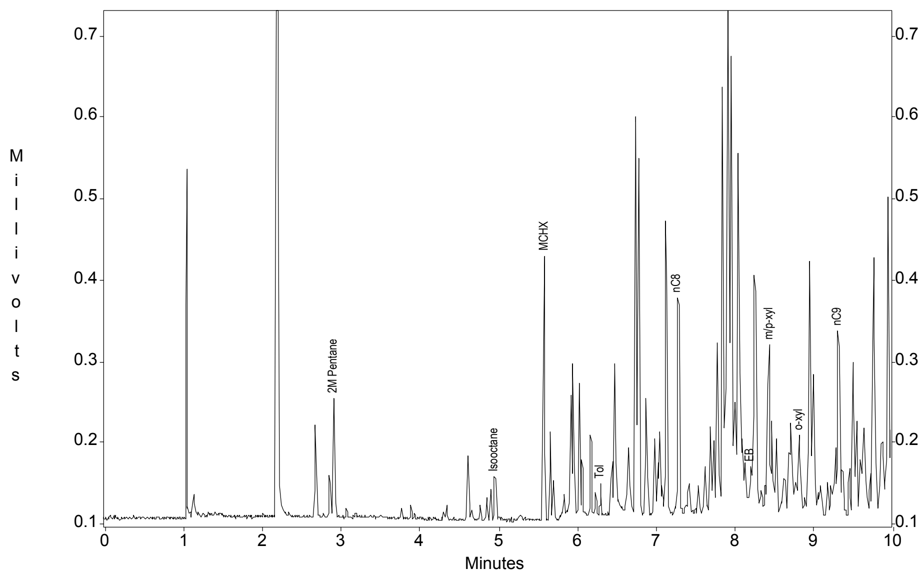


Channel A Results

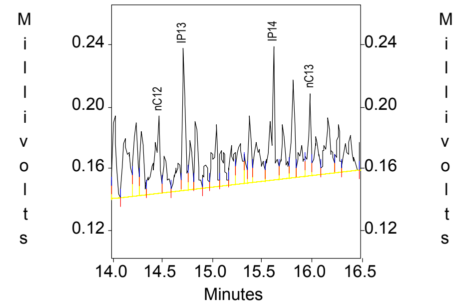
Peak	Area	Height
nC4	0	0
iC5	99	125
nC5	16	18
MTBE	0	0
2M Pentane	0	0
nC6	43	40
olefin a	0	0
olefin b	279	254
olefin c	381	324
2,4 DMP	5631	4980
Bnz	376	199
Isooctane	29968	25554
nC7	588	489
MCHX	109358	80367
Tol	22310	18293
nC8	41075	30050
EB	7485	5125
m/p-xyl	3812	2586
o-xyl	17116	10540
nC9	42849	27723
1,2,4 TMB	34246	14105
nC10	10237	6947
nC11	21367	10896
Naph	9674	6981
nC12	8926	3793
IP13	24264	14647
IP14	16799	11689
nC13	7737	2325
IP15	22697	13158
nC14	13202	6329
IP16	25355	14839
nC15	11171	2623
nC16	14086	2876
IP18	34161	12477
nC17	11833	3176
Pristane	42263	18051
nC18	6838	2172
Phytane	34099	14253
nC19	0	0
nC20	9643	1420
nC21	2644	861
nC22	0	0
nC23	406	171
nC24	750	90
nC25	0	0
nC26	130	52
nC27	101	21
nC28	90	24
nC29	0	0
nC30	0	0
nC31	202	42
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	1420	35
nC38	0	0
nC39	0	0
nC40	0	0

Sun - Philadelphia Refinery COA
Sample ID : PZ-204
Acquired : Mar 05, 2004 19:15:35

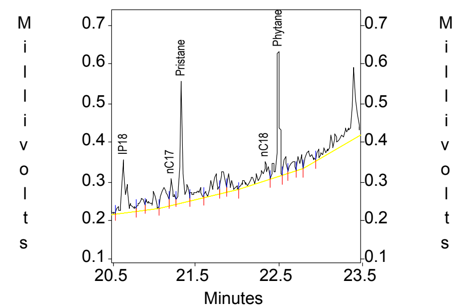
c:\ezchrom\chrom\04046\pz204 -- Channel A



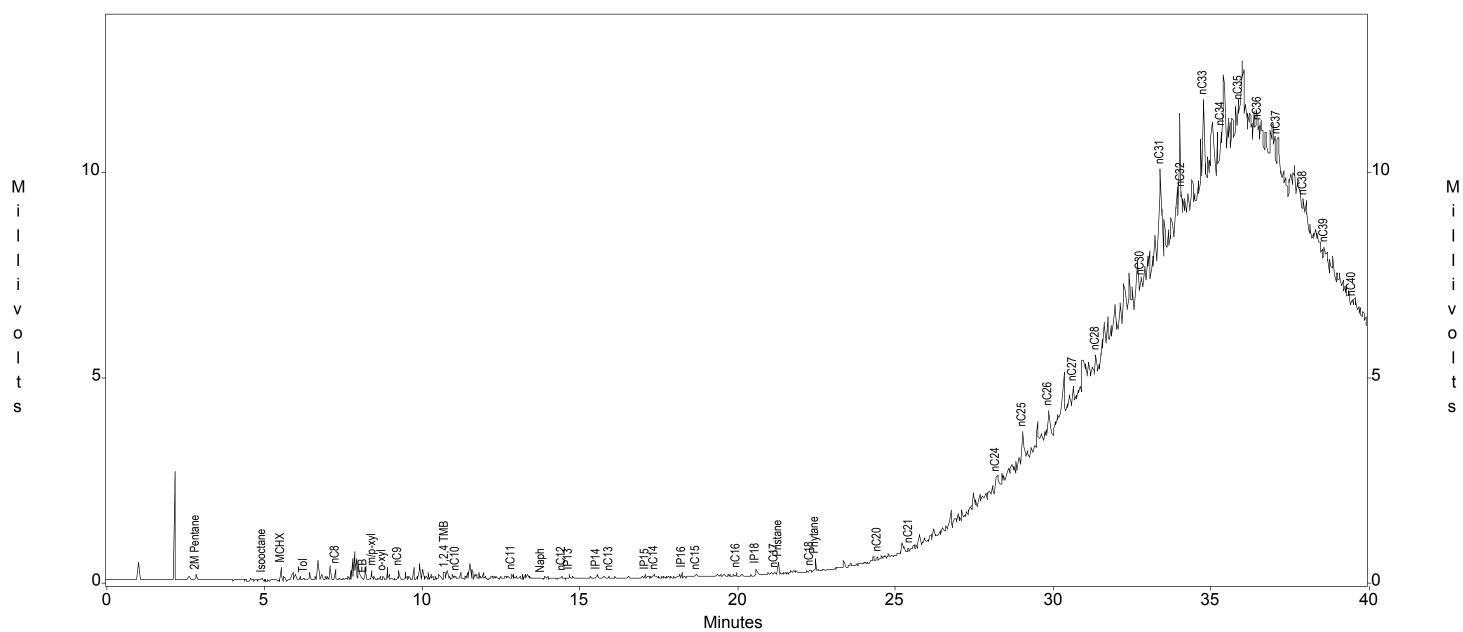
c:\ezchrom\chrom\04046\pz204 -- Channel A



c:\ezchrom\chrom\04046\pz204 -- Channel A



c:\ezchrom\chrom\04046\pz204 -- Channel A



Channel A Results

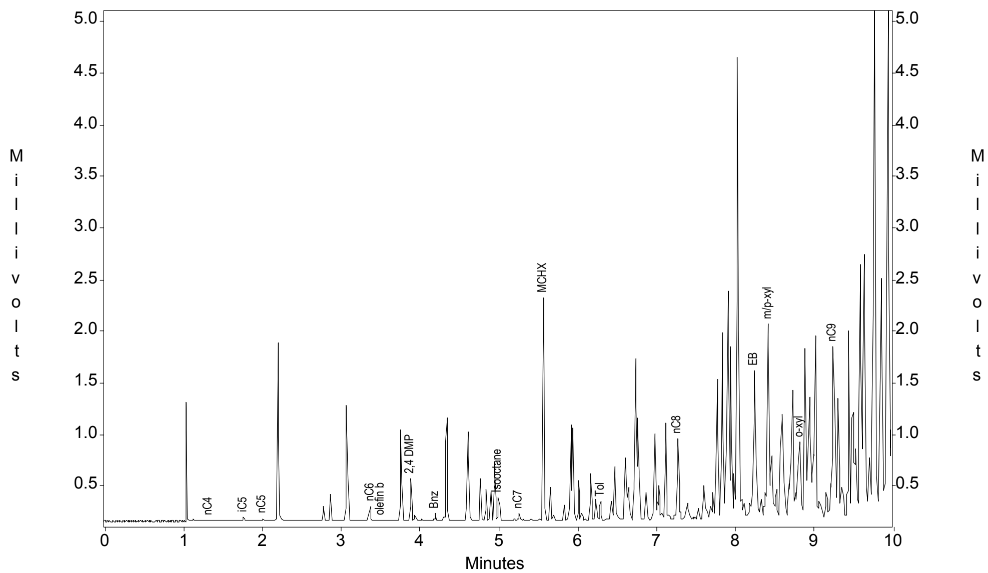
Peak	Area	Height
nC4	0	0
iC5	0	0
nC5	0	0
MTBE	0	0
2M Pentane	196	146
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	0	0
Isooctane	84	54
nC7	0	0
MCHX	401	325
Tol	50	37
nC8	420	268
EB	100	60
m/p-xyl	285	210
o-xyl	209	98
nC9	355	226
1,2,4 TMB	644	191
nC10	208	74
nC11	282	104
Naph	103	36
nC12	193	50
IP13	159	92
IP14	231	86
nC13	112	53
IP15	169	99
nC14	224	97
IP16	227	129
nC15	239	59
nC16	211	68
IP18	513	138
nC17	175	67
Pristane	745	310
nC18	397	51
Phytane	701	322
nC19	0	0
nC20	306	97
nC21	138	75
nC22	0	0
nC23	0	0
nC24	2153	411
nC25	4845	805
nC26	4496	683
nC27	1057	459
nC28	1930	413
nC29	0	0
nC30	621	229
nC31	5291	1504
nC32	444	261
nC33	5084	1833
nC34	777	445
nC35	830	331
nC36	402	170
nC37	1392	448
nC38	98	138
nC39	945	258
nC40	222	81

Sun - Philadelphia Refinery COA

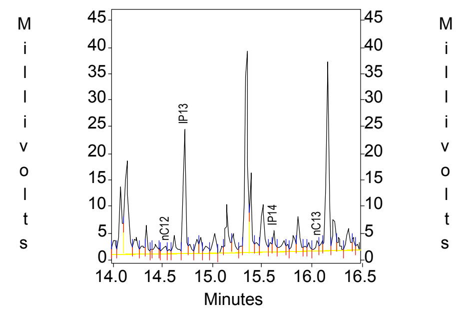
Sample ID : PZ-502

Acquired : Mar 08, 2004 13:31:07

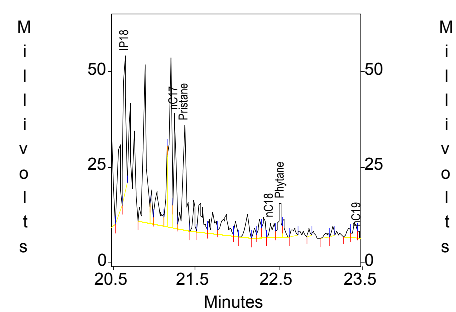
c:\ezchrom\chrom\04046\pz-502 -- Channel A



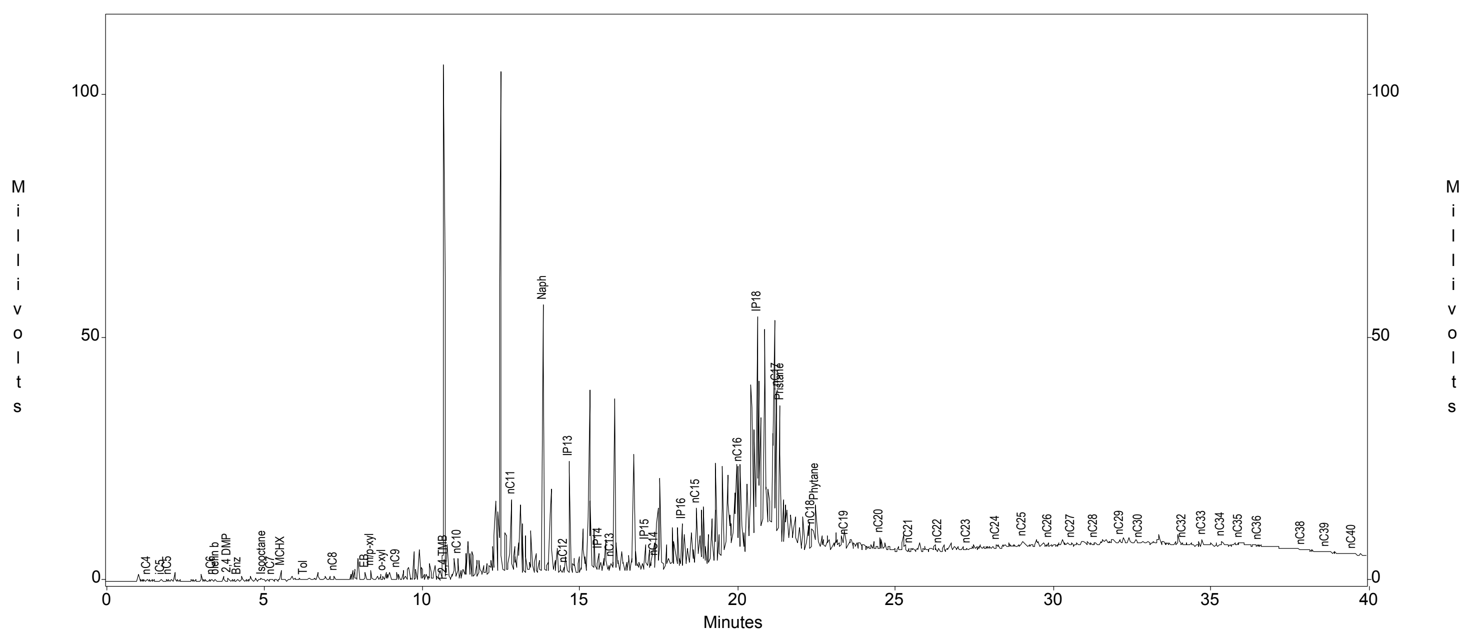
c:\ezchrom\chrom\04046\pz-502 -- Channel A



c:\ezchrom\chrom\04046\pz-502 -- Channel A



c:\ezchrom\chrom\04046\pz-502 -- Channel A

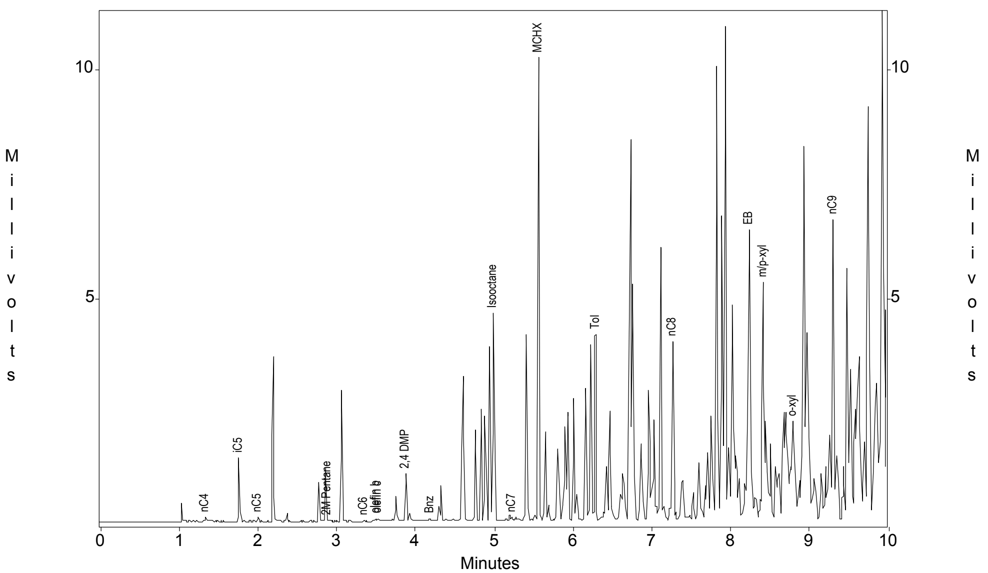


Channel A Results

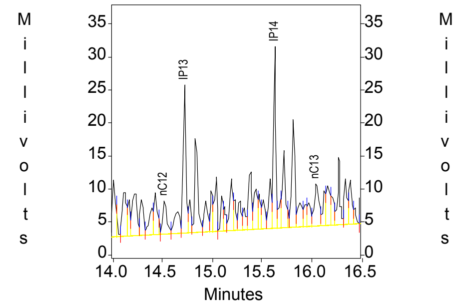
Peak	Area	Height
nC4	20	15
iC5	39	43
nC5	27	15
MTBE	0	0
2M Pentane	0	0
nC6	147	140
olefin a	0	0
olefin b	22	9
olefin c	0	0
2,4 DMP	439	404
Bnz	103	76
Isooctane	271	217
nC7	138	73
MCHX	2636	2153
Tol	248	178
nC8	1249	775
EB	2575	1432
m/p-xyl	2553	1881
o-xyl	1693	734
nC9	2640	1638
1,2,4 TMB	196789	105877
nC10	6495	3788
nC11	33719	15667
Naph	100424	55542
nC12	3728	1339
IP13	37146	23234
IP14	6110	3986
nC13	3878	1843
IP15	8793	5047
nC14	1172	1812
IP16	14650	8886
nC15	21615	10776
nC16	26194	16121
IP18	76700	35795
nC17	48894	29716
Pristane	83646	27446
nC18	16255	3819
Phytane	22062	8828
nC19	3870	1906
nC20	4317	2454
nC21	1035	509
nC22	2921	805
nC23	1079	494
nC24	5611	976
nC25	13384	1528
nC26	5179	849
nC27	1398	663
nC28	3105	559
nC29	2663	924
nC30	1003	187
nC31	0	0
nC32	401	242
nC33	3056	1139
nC34	2257	644
nC35	153	106
nC36	339	167
nC37	0	0
nC38	299	125
nC39	151	63
nC40	74	48

Sun - Philadelphia Refinery COA
Sample ID : S-21
Acquired : Mar 08, 2004 09:27:02

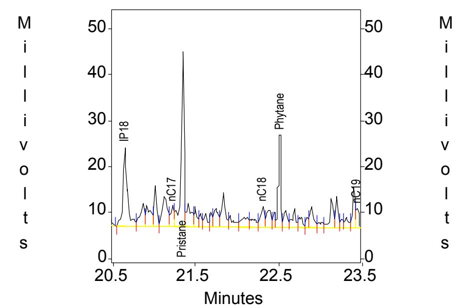
c:\ezchrom\chrom\04046\s-21 -- Channel A



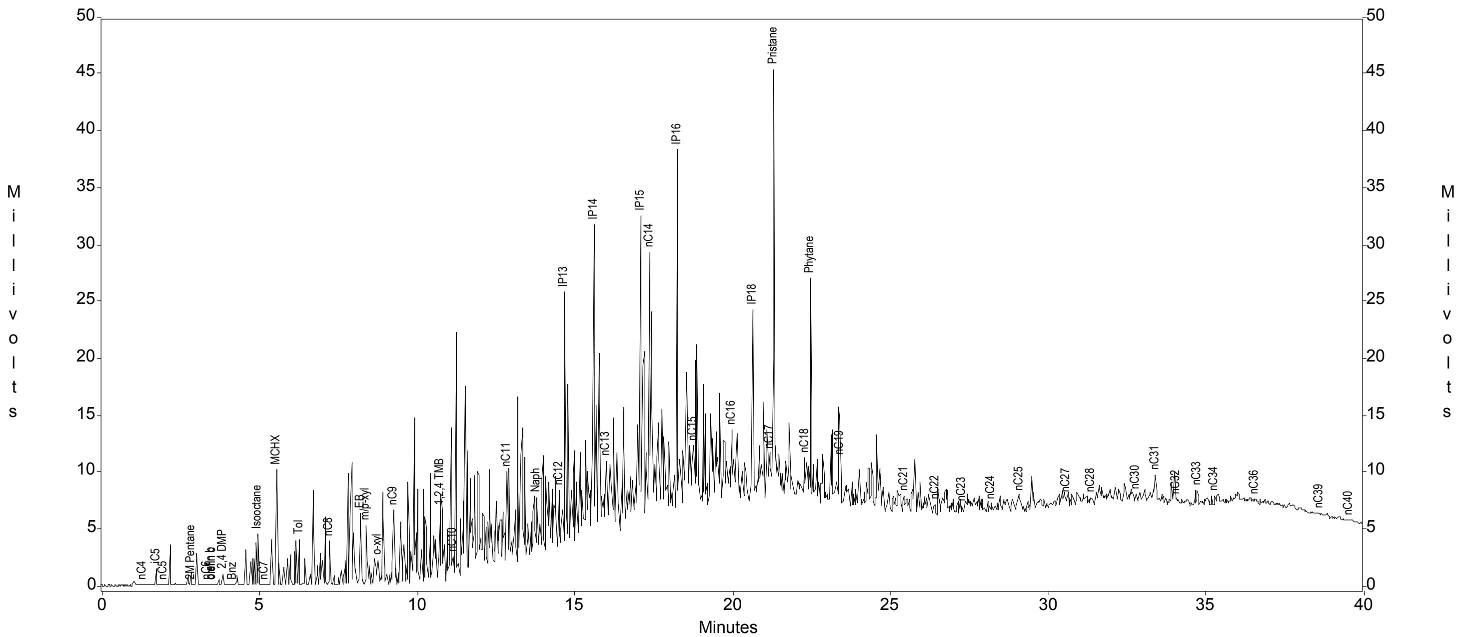
c:\ezchrom\chrom\04046\s-21 -- Channel A



c:\ezchrom\chrom\04046\s-21 -- Channel A



c:\ezchrom\chrom\04046\s-21 -- Channel A

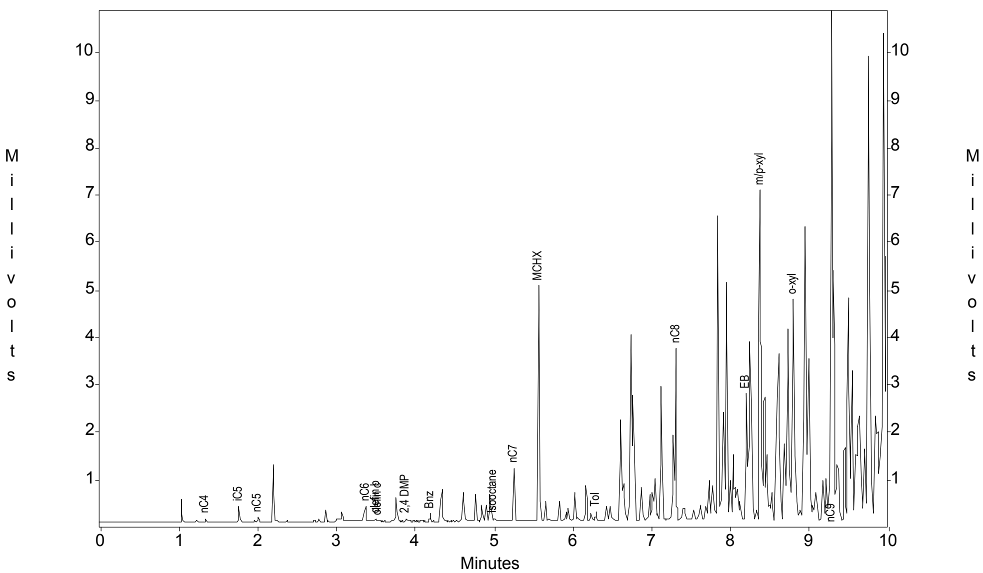


Channel A Results

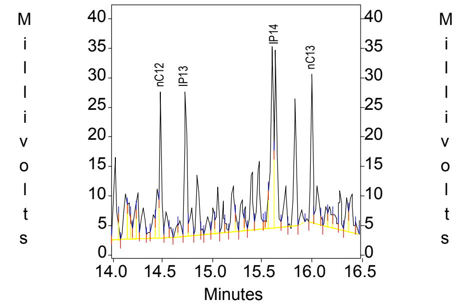
Peak	Area	Height
nC4	68	79
iC5	1109	1379
nC5	97	112
MTBE	0	0
2M Pentane	30	15
nC6	32	28
olefin a	0	0
olefin b	68	55
olefin c	72	60
2,4 DMP	1162	1042
Bnz	95	47
Isooctane	5320	4503
nC7	129	99
MCHX	12322	10100
Tol	5090	4051
nC8	5915	3874
EB	10184	6286
m/p-xyl	7662	5176
o-xyl	3804	2132
nC9	9938	6528
1,2,4 TMB	12471	6271
nC10	3017	1855
nC11	14161	7904
Naph	11853	5132
nC12	13991	5067
IP13	38329	22346
IP14	42474	27537
nC13	22167	6485
IP15	52339	27002
nC14	54414	23440
IP16	57130	31425
nC15	19283	5014
nC16	12229	5222
IP18	56444	16857
nC17	11370	4368
Pristane	98055	38024
nC18	13918	4291
Phytane	43495	20030
nC19	9306	4360
nC20	0	0
nC21	2721	1368
nC22	4460	904
nC23	795	432
nC24	2976	731
nC25	9455	1463
nC26	0	0
nC27	2068	872
nC28	2100	556
nC29	0	0
nC30	1392	562
nC31	5132	1695
nC32	255	0
nC33	3317	1087
nC34	1060	632
nC35	0	0
nC36	318	155
nC37	0	0
nC38	0	0
nC39	498	133
nC40	400	124

Sun - Philadelphia Refinery COA
Sample ID : S-29
Acquired : Mar 06, 2004 21:24:57

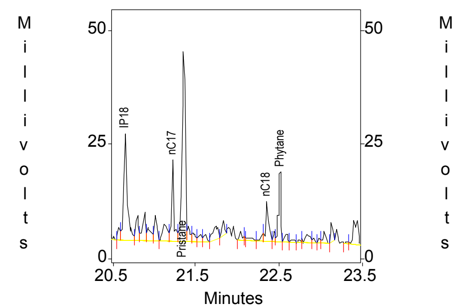
c:\ezchrom\chrom\04046\s-29 -- Channel A



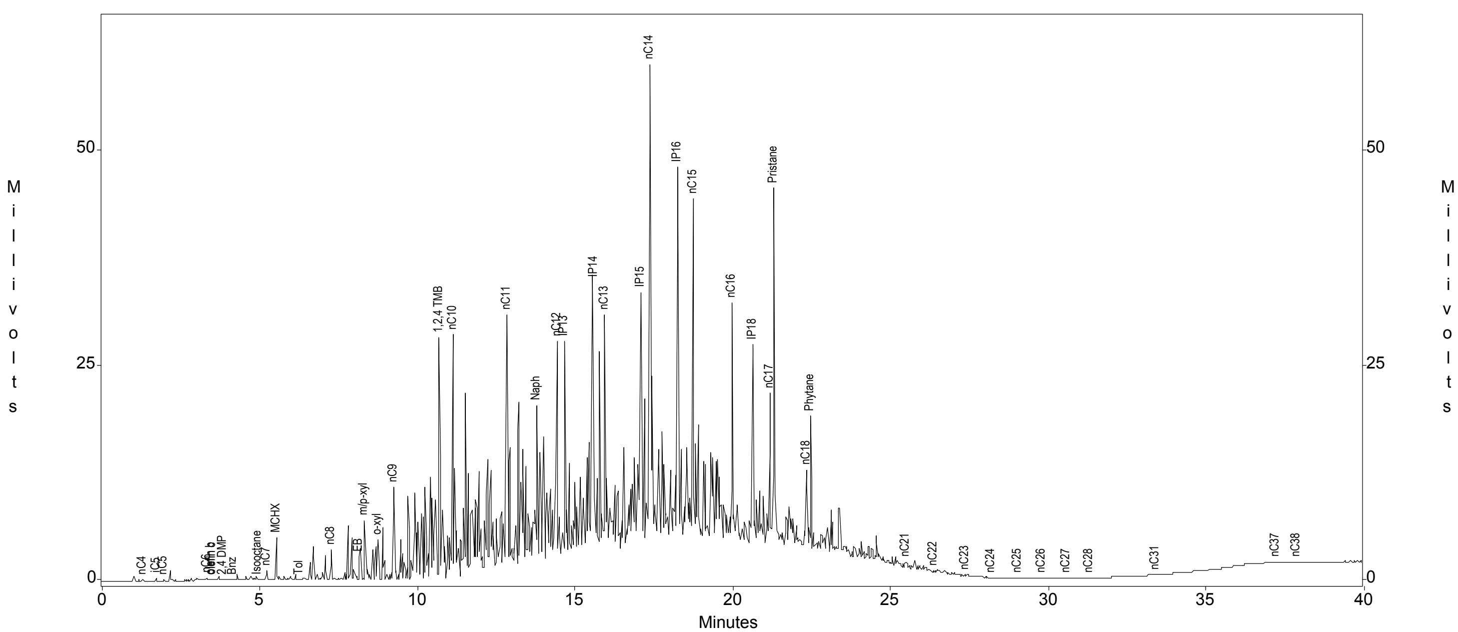
c:\ezchrom\chrom\04046\s-29 -- Channel A



c:\ezchrom\chrom\04046\s-29 -- Channel A



c:\ezchrom\chrom\04046\s-29 -- Channel A

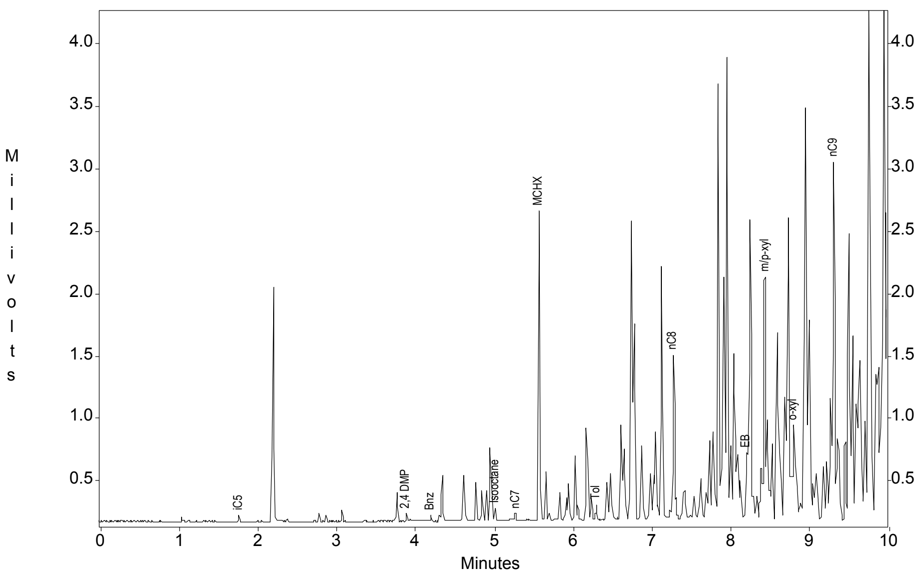


Channel A Results

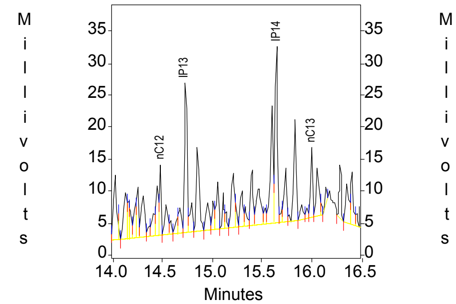
Peak	Area	Height
nC4	51	71
iC5	262	327
nC5	85	97
MTBE	0	0
2M Pentane	0	0
nC6	333	324
olefin a	0	0
olefin b	42	37
olefin c	32	24
2,4 DMP	66	55
Bnz	191	150
Isooctane	105	73
nC7	1288	1117
MCHX	5965	4958
Tol	306	187
nC8	4509	3625
EB	3816	2696
m/p-xyl	9689	6981
o-xyl	7407	4653
nC9	15844	10735
1,2,4 TMB	44639	27982
nC10	43392	28274
nC11	45001	29197
Naph	30031	17905
nC12	37257	24833
IP13	38822	24531
IP14	44656	30086
nC13	38615	25236
IP15	47098	29209
nC14	107065	55460
IP16	80262	42892
nC15	68663	38177
nC16	50647	27023
IP18	65432	23201
nC17	34281	17543
Pristane	95533	41540
nC18	20251	8806
Phytane	31665	15281
nC19	0	0
nC20	0	0
nC21	2489	555
nC22	317	166
nC23	205	86
nC24	246	39
nC25	250	40
nC26	138	50
nC27	128	45
nC28	59	30
nC29	0	0
nC30	0	0
nC31	173	27
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	142	31
nC38	27	15
nC39	0	0
nC40	0	0

Sun - Philadelphia Refinery COA
Sample ID : S-32
Acquired : Mar 06, 2004 17:12:40

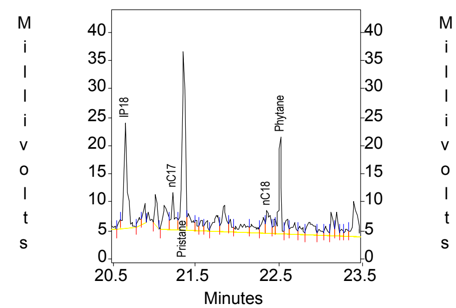
c:\ezchrom\chrom\04046\s-32 -- Channel A



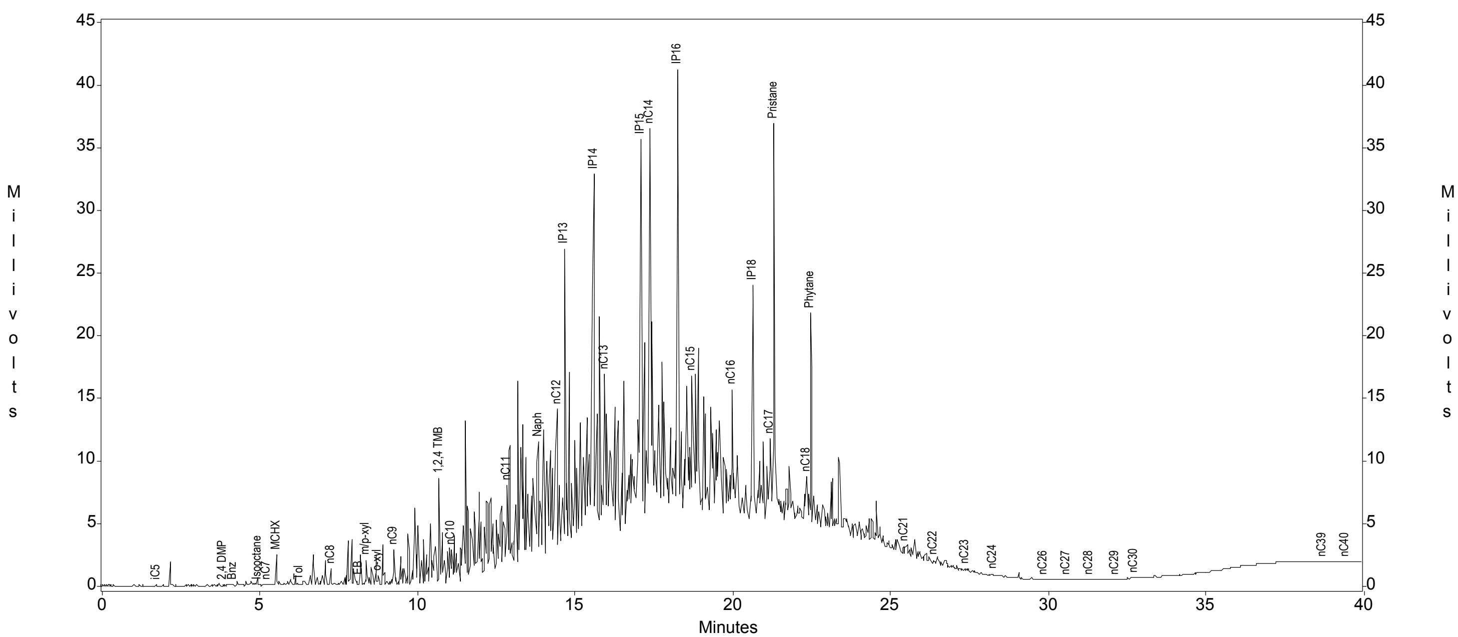
c:\ezchrom\chrom\04046\s-32 -- Channel A



c:\ezchrom\chrom\04046\s-32 -- Channel A



c:\ezchrom\chrom\04046\s-32 -- Channel A



Channel A Results

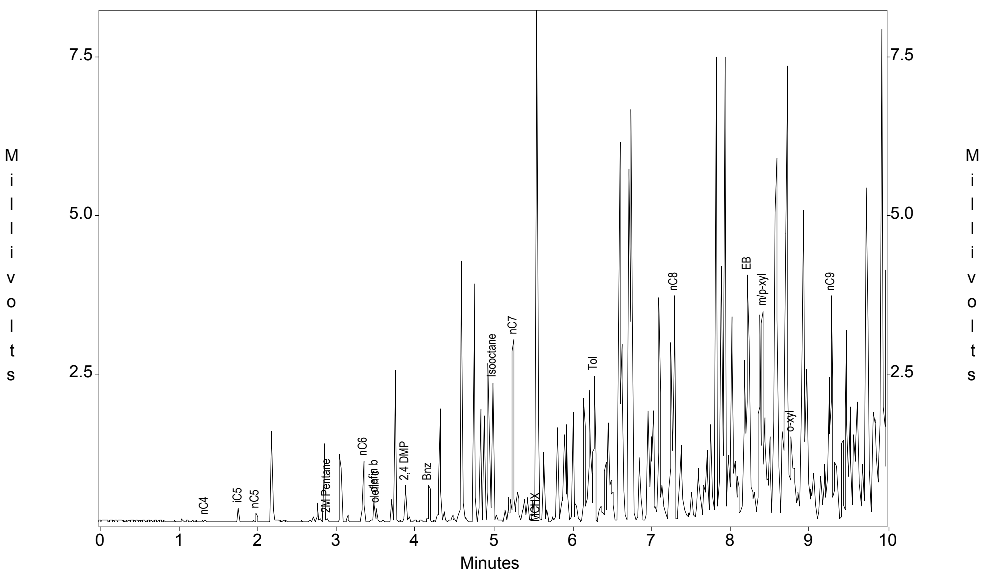
Peak	Area	Height
nC4	0	0
iC5	41	53
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	72	63
Bnz	58	44
Isooctane	122	101
nC7	171	60
MCHX	3034	2482
Tol	209	128
nC8	2327	1316
EB	793	534
m/p-xyl	2599	1953
o-xyl	1772	758
nC9	4359	2865
1,2,4 TMB	13878	8353
nC10	6524	2654
nC11	9488	5762
Naph	17729	9184
nC12	15302	10940
IP13	39440	23323
IP14	40694	27581
nC13	15251	10851
IP15	57636	30801
nC14	60716	31487
IP16	67846	35561
nC15	32132	10902
nC16	22122	9953
IP18	49133	18420
nC17	17635	6469
Pristane	74115	31556
nC18	13673	4015
Phytane	36168	17196
nC19	0	0
nC20	0	0
nC21	987	592
nC22	1040	248
nC23	556	217
nC24	920	119
nC25	0	0
nC26	146	59
nC27	176	50
nC28	143	36
nC29	277	37
nC30	226	17
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	130	17
nC40	184	30

Sun - Philadelphia Refinery COA

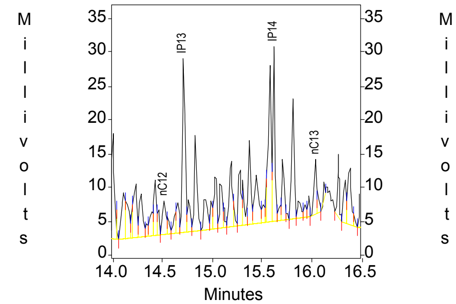
Sample ID : S-33

Acquired : Mar 07, 2004 11:36:22

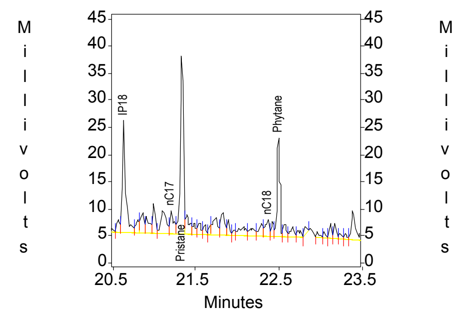
c:\ezchrom\chrom\04046\s-33 -- Channel A



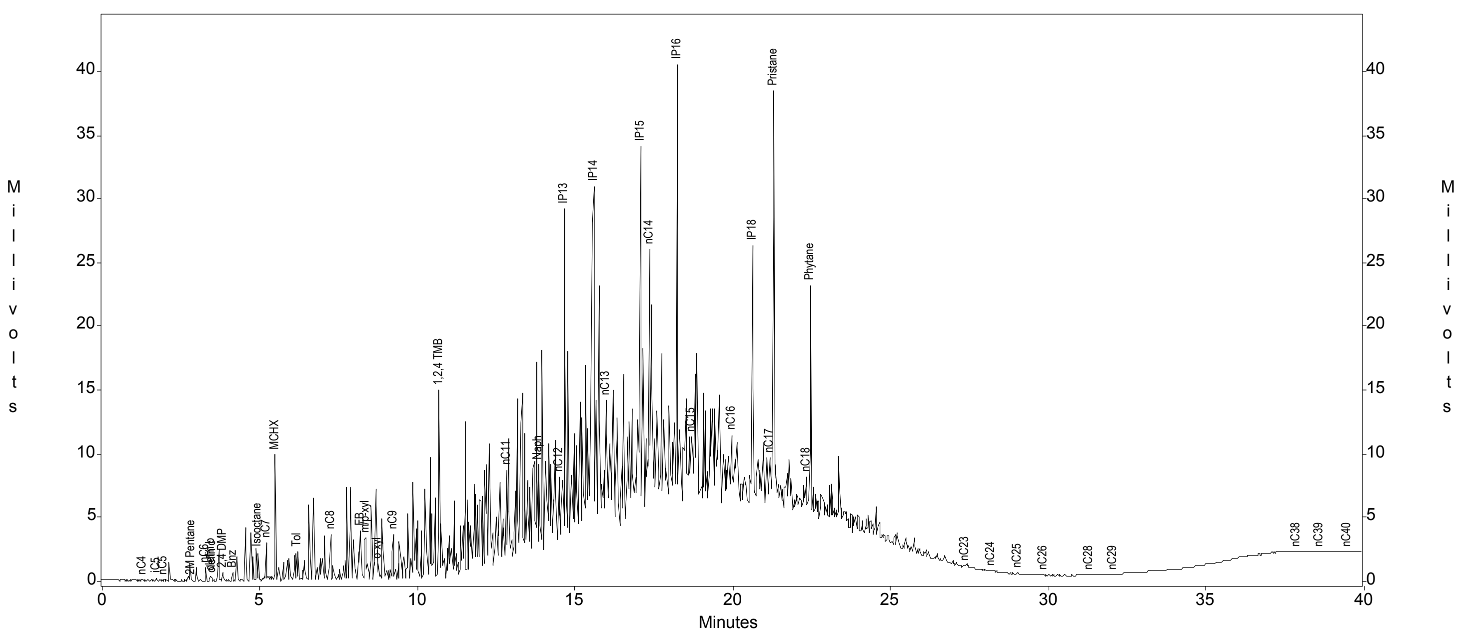
c:\ezchrom\chrom\04046\s-33 -- Channel A



c:\ezchrom\chrom\04046\s-33 -- Channel A



c:\ezchrom\chrom\04046\s-33 -- Channel A

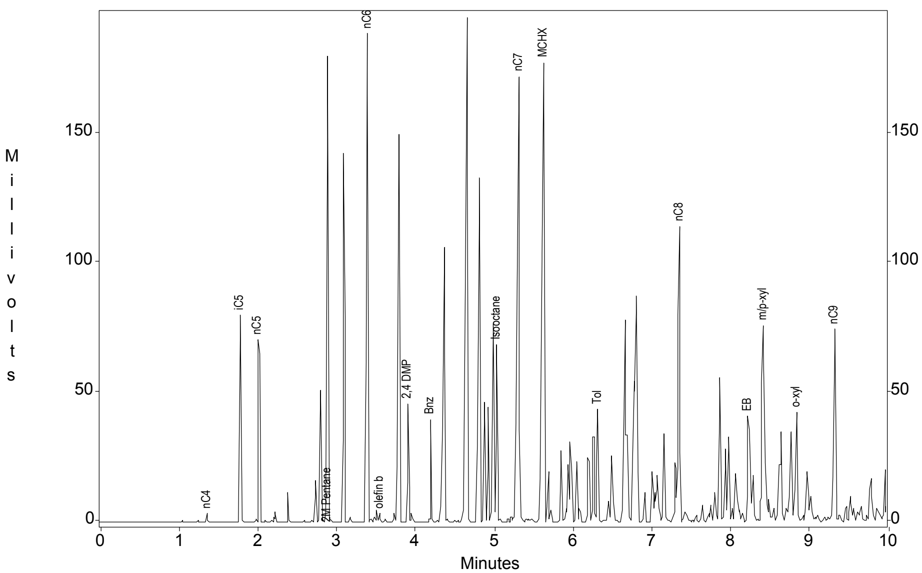


Channel A Results

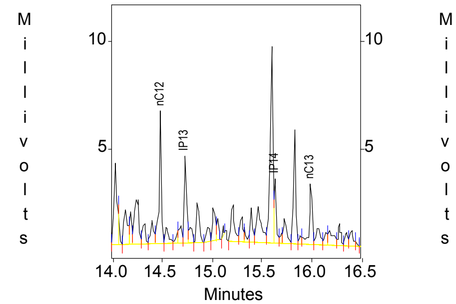
Peak	Area	Height
nC4	11	14
iC5	161	216
nC5	103	129
MTBE	0	0
2M Pentane	56	47
nC6	970	966
olefin a	0	0
olefin b	379	369
olefin c	260	218
2,4 DMP	711	564
Bnz	774	570
Isooctane	2863	2203
nC7	3545	2882
MCHX	12077	9926
Tol	3164	2307
nC8	4609	3537
EB	8318	3874
m/p-xyl	4538	3292
o-xyl	2116	1311
nC9	5252	3519
1,2,4 TMB	24424	14691
nC10	0	0
nC11	14084	6999
Naph	11434	6666
nC12	11074	4935
IP13	42856	25700
IP14	38264	25878
nC13	16743	8160
IP15	70534	29127
nC14	42564	20847
IP16	62626	34374
nC15	20974	4799
nC16	16391	5531
IP18	57949	20636
nC17	13725	4138
Pristane	78747	32942
nC18	9361	3079
Phytane	39731	18085
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	289	145
nC24	867	103
nC25	590	81
nC26	149	43
nC27	0	0
nC28	96	31
nC29	98	15
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	86	20
nC39	27	14
nC40	202	33

Sun - Philadelphia Refinery COA
Sample ID : S-50
Acquired : Mar 05, 2004 20:09:45

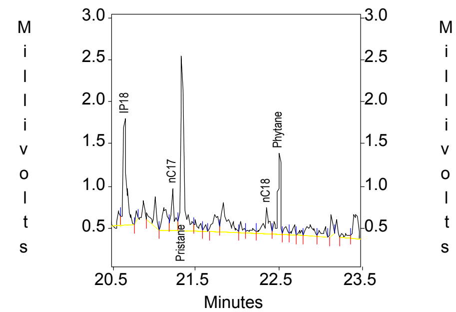
c:\ezchrom\chrom\04046\s-50 -- Channel A



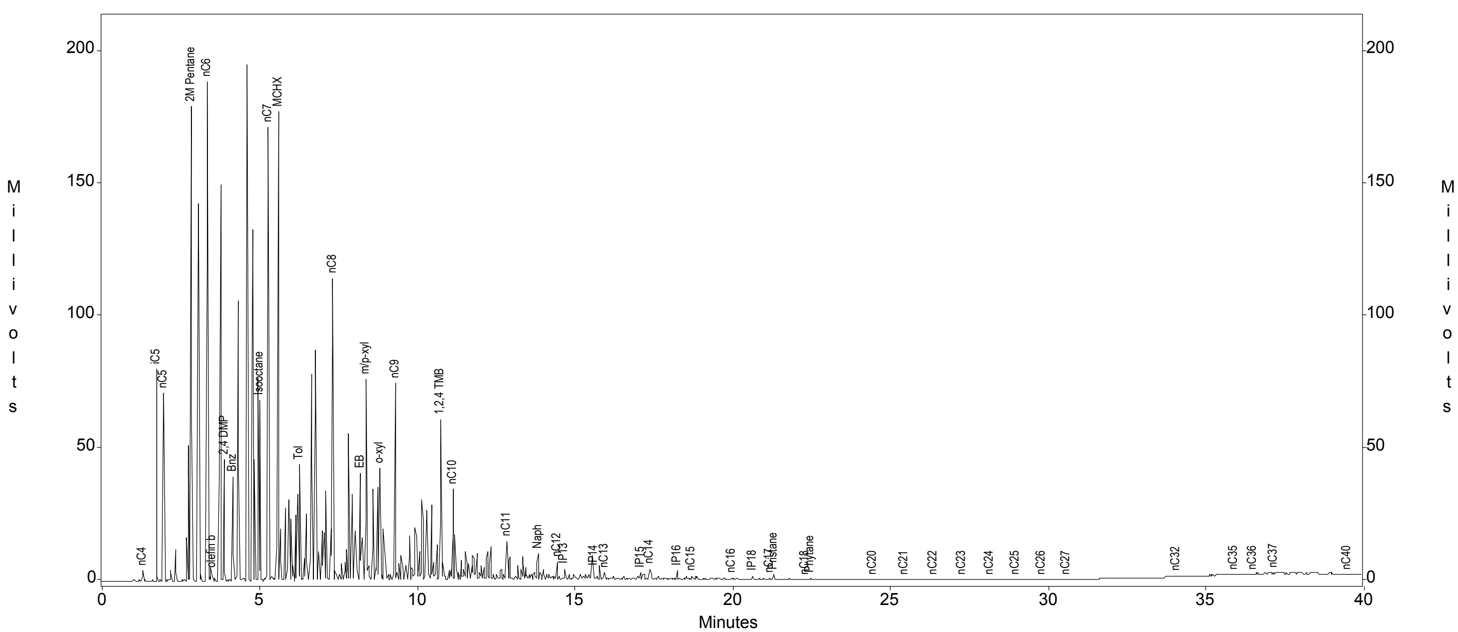
c:\ezchrom\chrom\04046\s-50 -- Channel A



c:\ezchrom\chrom\04046\s-50 -- Channel A



c:\ezchrom\chrom\04046\s-50 -- Channel A



Channel A Results

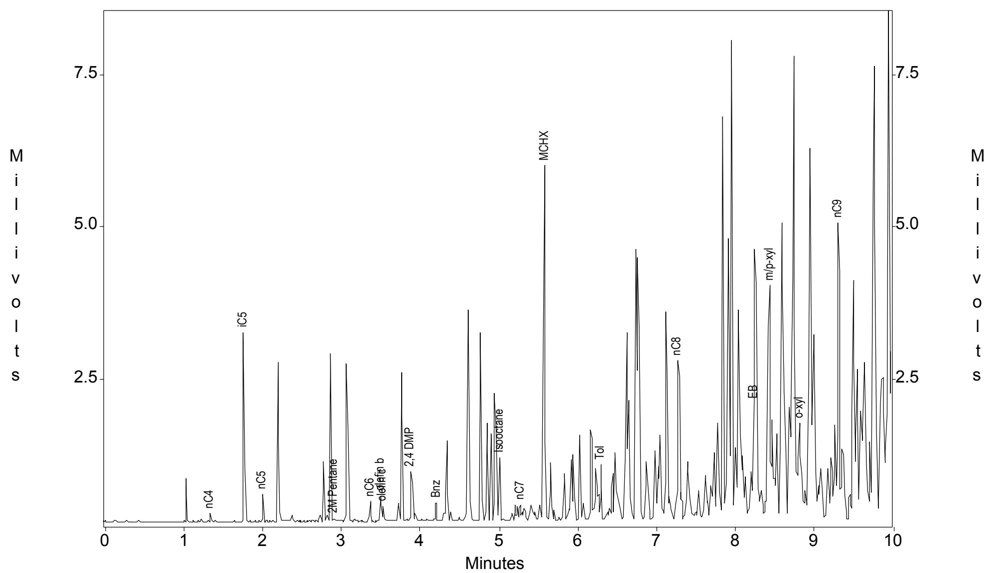
Peak	Area	Height
nC4	2060	3549
iC5	55804	80218
nC5	52203	70682
MTBE	0	0
2M Pentane	193694	179759
nC6	241062	188686
olefin a	0	0
olefin c	0	0
olefin b	3482	3039
2,4 DMP	49027	45591
Bnz	45003	39259
Isooctane	82799	68413
nC7	311233	171731
MCHX	316663	177276
Tol	72971	43892
nC8	195302	114198
EB	65941	40743
m/p-xyl	149049	76035
o-xyl	67028	42497
nC9	127183	74592
1,2,4 TMB	104363	60609
nC10	50676	34158
nC11	20012	14393
Naph	15828	9772
nC12	10483	6224
IP13	6863	4046
IP14	4412	3034
nC13	5088	2778
IP15	4667	2739
nC14	7552	3986
IP16	4842	2902
nC15	1827	909
nC16	2166	781
IP18	3513	1260
nC17	1205	494
Pristane	5167	2078
nC18	1248	323
Phytane	2212	975
nC19	0	0
nC20	509	155
nC21	160	93
nC22	149	57
nC23	80	36
nC24	71	27
nC25	258	33
nC26	82	27
nC27	604	49
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	1857	50
nC33	0	0
nC34	0	0
nC35	92	46
nC36	55	42
nC37	34	19
nC38	0	0
nC39	0	0
nC40	69	43

Sun - Philadelphia Refinery COA

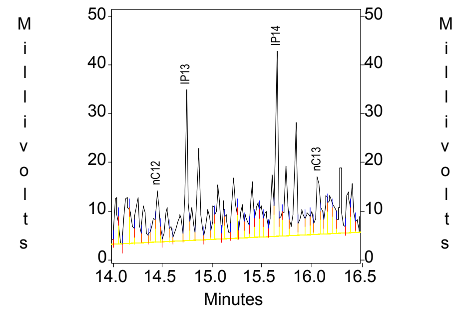
Sample ID : S-56

Acquired : Mar 07, 2004 15:39:59

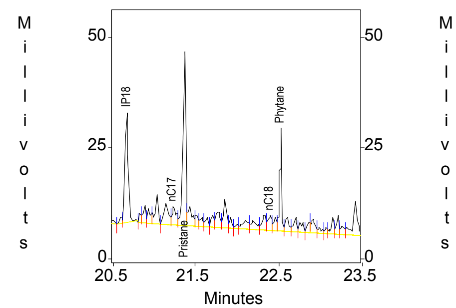
c:\ezchrom\chrom\04046\s-56 -- Channel A



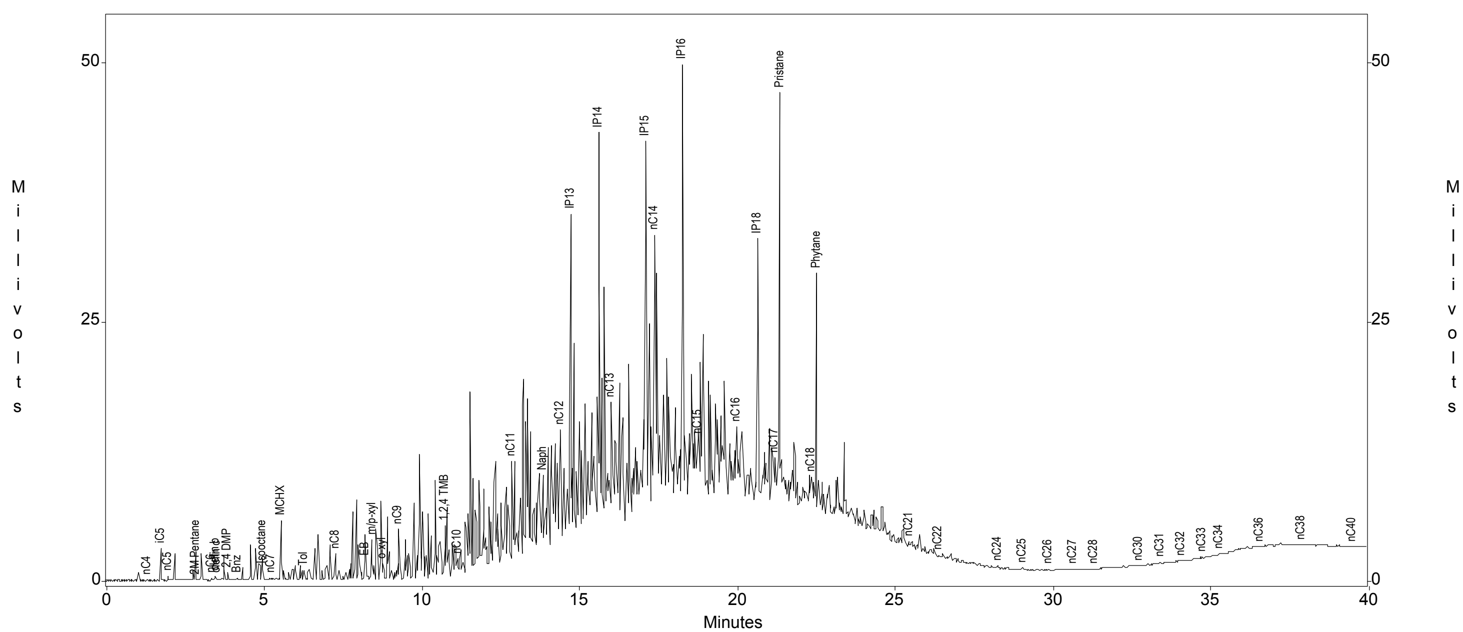
c:\ezchrom\chrom\04046\s-56 -- Channel A



c:\ezchrom\chrom\04046\s-56 -- Channel A



c:\ezchrom\chrom\04046\s-56 -- Channel A



Channel A Results

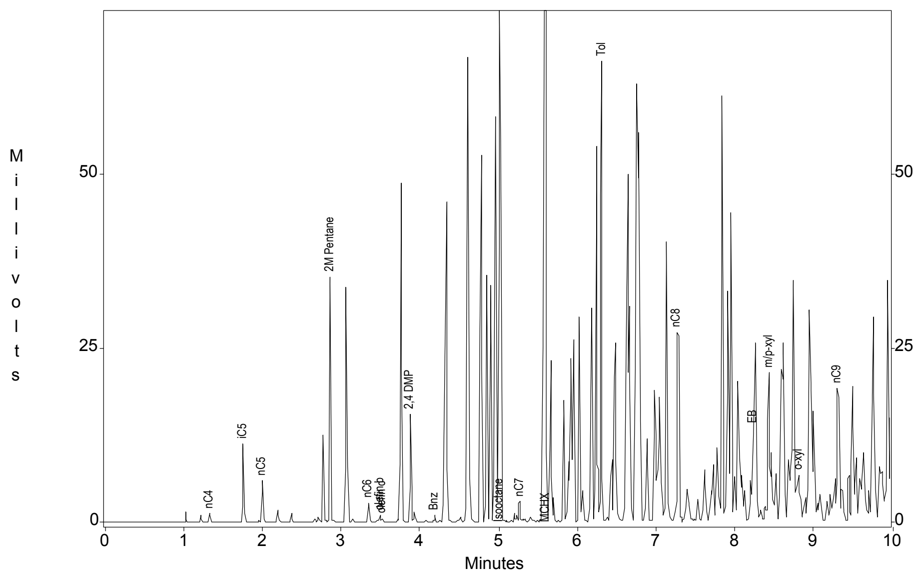
Peak	Area	Height
nC4	104	135
iC5	2374	3106
nC5	364	447
MTBE	0	0
2M Pentane	59	51
nC6	332	328
olefin a	0	0
olefin b	444	416
olefin c	289	252
2,4 DMP	1018	811
Bnz	418	299
Isooctane	1374	1045
nC7	287	250
MCHX	7240	5838
Tol	1288	913
nC8	4341	2606
EB	1503	1883
m/p-xyl	6198	3841
o-xyl	2524	1581
nC9	7365	4840
1,2,4 TMB	9593	4996
nC10	2571	1582
nC11	17291	9365
Naph	11873	7100
nC12	21790	10828
IP13	52831	31317
IP14	58454	38278
nC13	31611	11887
IP15	68488	34450
nC14	54997	25611
IP16	77913	41486
nC15	23512	4912
nC16	13765	5766
IP18	61592	24871
nC17	15432	4076
Pristane	95249	39591
nC18	11717	3489
Phytane	49685	23130
nC19	0	0
nC20	0	0
nC21	910	459
nC22	884	181
nC23	0	0
nC24	1015	194
nC25	1340	172
nC26	676	106
nC27	101	60
nC28	163	42
nC29	0	0
nC30	103	36
nC31	758	165
nC32	128	38
nC33	729	137
nC34	214	62
nC35	0	0
nC36	67	41
nC37	0	0
nC38	24	19
nC39	0	0
nC40	24	19

Sun - Philadelphia Refinery COA

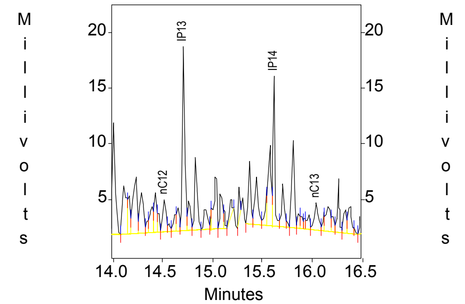
Sample ID : S-59

Acquired : Mar 08, 2004 11:53:37

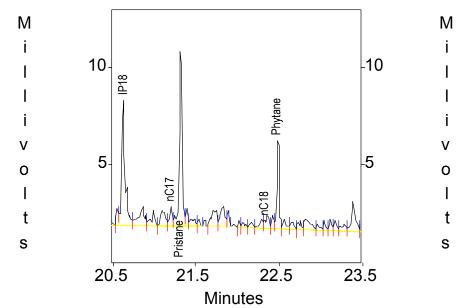
c:\ezchrom\chrom\04046\s-59 -- Channel A



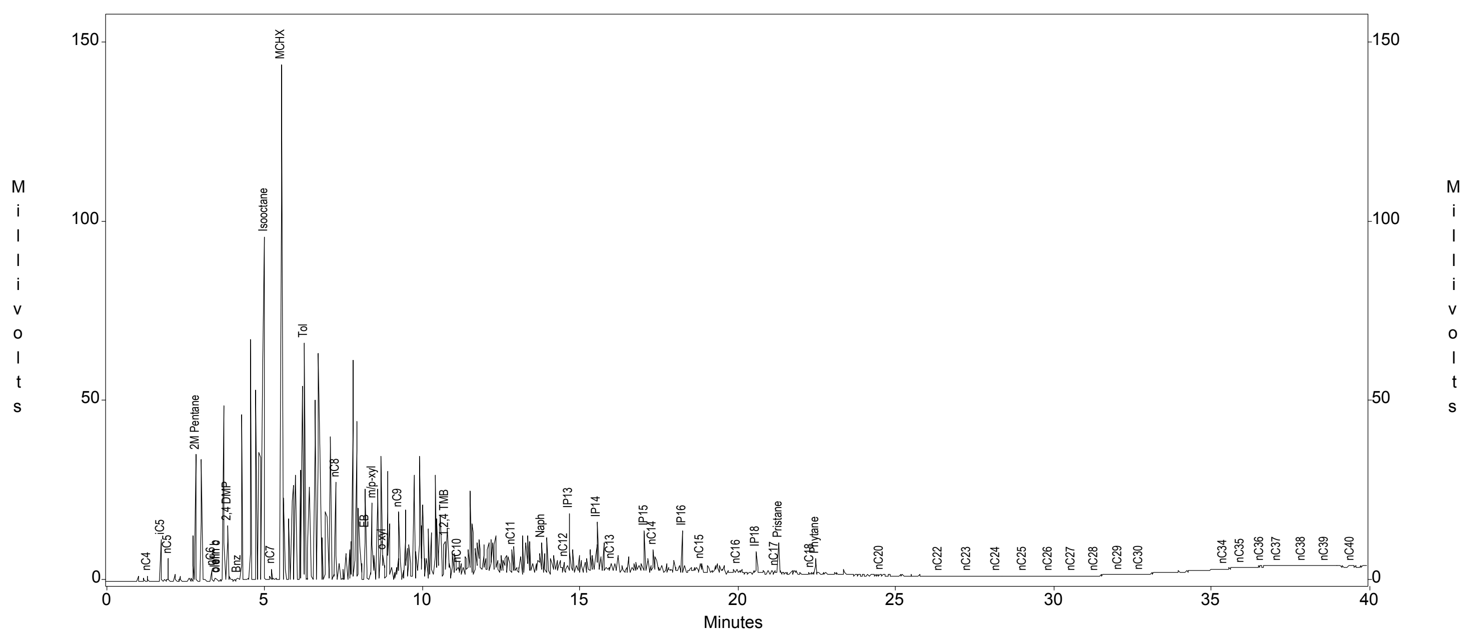
c:\ezchrom\chrom\04046\s-59 -- Channel A



c:\ezchrom\chrom\04046\s-59 -- Channel A



c:\ezchrom\chrom\04046\s-59 -- Channel A

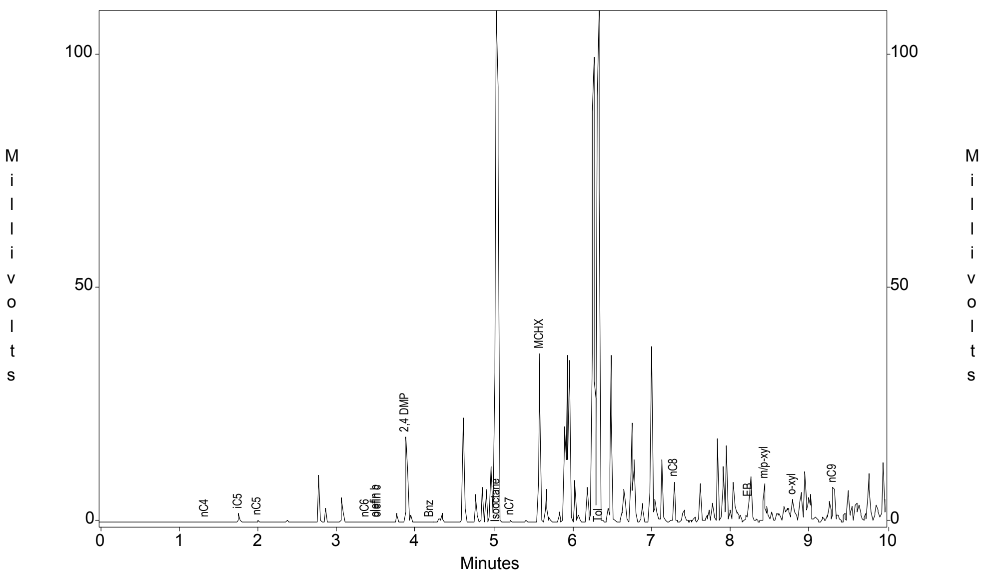


Channel A Results

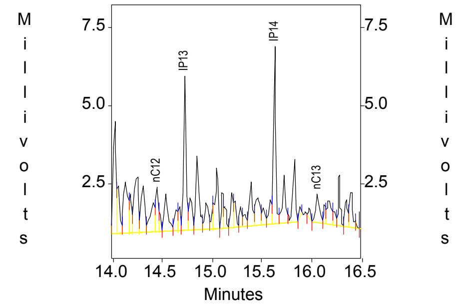
Peak	Area	Height
nC4	796	1253
iC5	8790	11308
nC5	5003	6081
MTBE	0	0
2M Pentane	33578	35340
nC6	2779	2698
olefin a	0	0
olefin b	1010	961
olefin c	718	564
2,4 DMP	16845	15499
Bnz	1277	960
Isooctane	127550	95750
nC7	3902	2951
MCHX	235014	143729
Tol	88911	66356
nC8	38664	27230
EB	11901	13321
m/p-xyl	30634	21454
o-xyl	14906	6722
nC9	29253	19131
1,2,4 TMB	16425	10313
nC10	7657	2660
nC11	12486	6585
Naph	13669	8513
nC12	6475	2890
IP13	25912	16556
IP14	19794	13545
nC13	6951	2380
IP15	15913	10976
nC14	11395	6328
IP16	19616	11680
nC15	4060	2371
nC16	6206	1428
IP18	17152	6413
nC17	1893	956
Pristane	19794	8959
nC18	1829	422
Phytane	9314	4519
nC19	0	0
nC20	846	342
nC21	0	0
nC22	551	102
nC23	159	88
nC24	999	140
nC25	1169	175
nC26	418	120
nC27	637	72
nC28	243	55
nC29	406	80
nC30	266	81
nC31	0	0
nC32	0	0
nC33	0	0
nC34	515	129
nC35	170	73
nC36	309	68
nC37	237	58
nC38	48	16
nC39	443	80
nC40	860	115

Sun - Philadelphia Refinery COA
Sample ID : S-60
Acquired : Mar 06, 2004 13:54:31

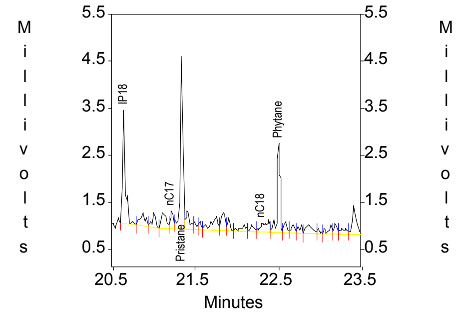
c:\ezchrom\chrom\04046\s-60.2 -- Channel A



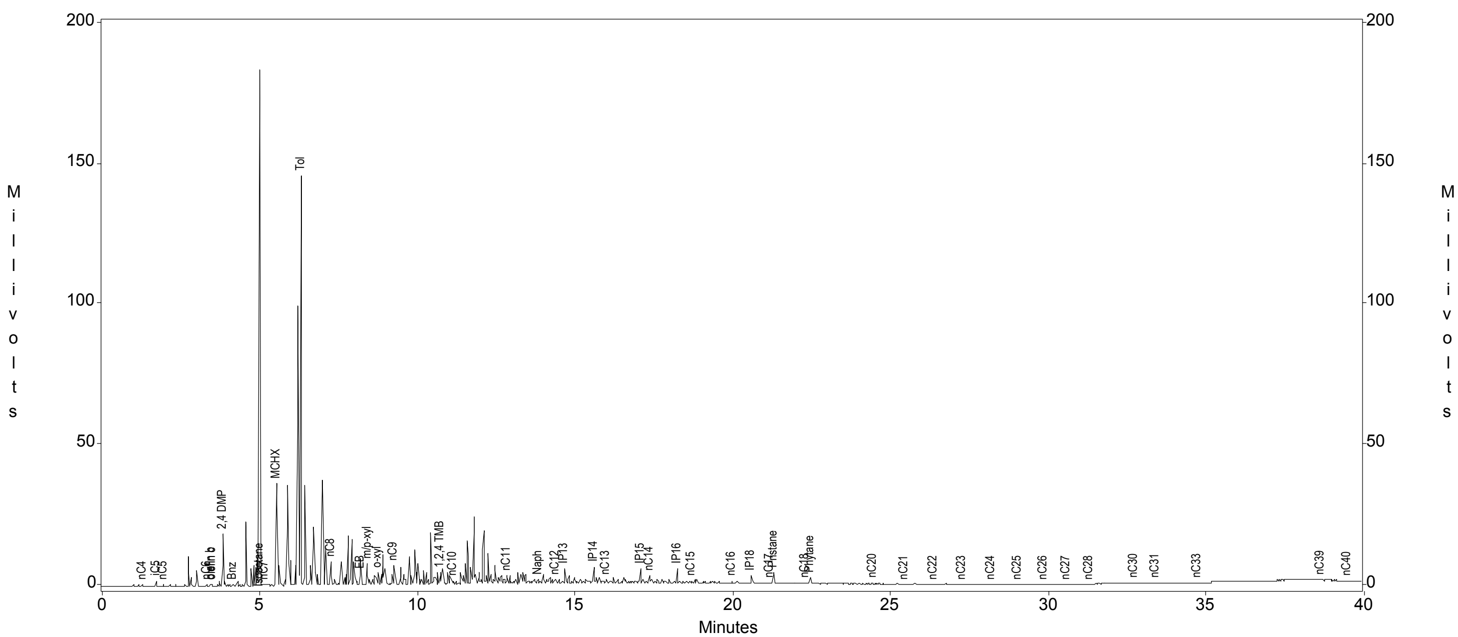
c:\ezchrom\chrom\04046\s-60.2 -- Channel A



c:\ezchrom\chrom\04046\s-60.2 -- Channel A



c:\ezchrom\chrom\04046\s-60.2 -- Channel A

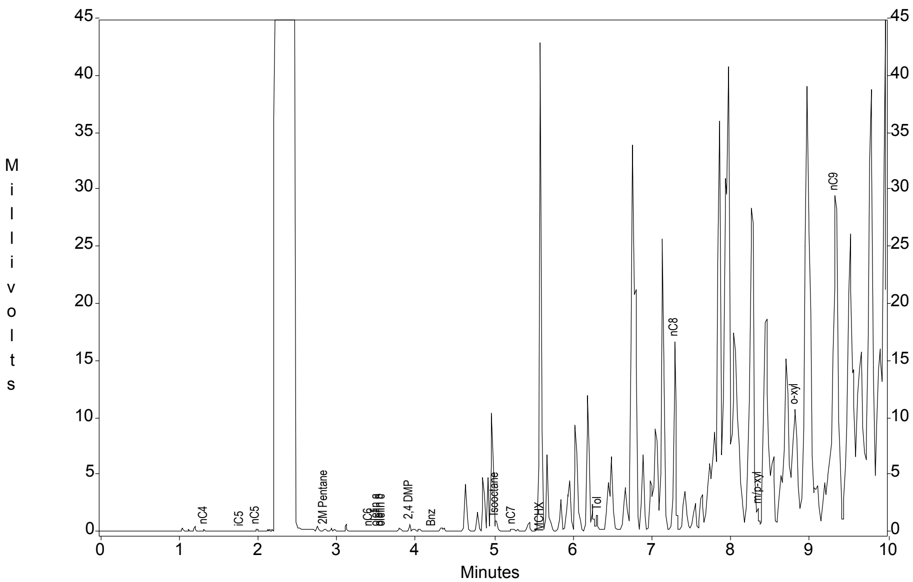


Channel A Results

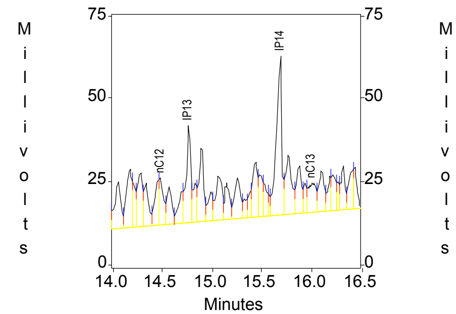
Peak	Area	Height
nC4	27	37
iC5	1378	1717
nC5	114	136
MTBE	0	0
2M Pentane	0	0
nC6	42	36
olefin a	0	0
olefin b	41	35
olefin c	63	47
2,4 DMP	19732	18177
Bnz	67	38
Isooctane	325902	183410
nC7	168	129
MCHX	44484	36100
Tol	245108	145617
nC8	11974	8493
EB	3374	4310
m/p-xyl	10585	7988
o-xyl	10585	4817
nC9	11030	7330
1,2,4 TMB	11539	4506
nC10	2528	1452
nC11	6735	2801
Naph	2984	1732
nC12	2958	1475
IP13	8106	4977
IP14	8643	5681
nC13	2478	910
IP15	8270	4897
nC14	5922	2742
IP16	8047	4941
nC15	2429	590
nC16	2420	556
IP18	5471	2389
nC17	753	383
Pristane	7916	3669
nC18	1366	189
Phytane	4264	1880
nC19	0	0
nC20	681	148
nC21	265	98
nC22	258	46
nC23	99	55
nC24	457	64
nC25	803	108
nC26	315	77
nC27	257	47
nC28	194	49
nC29	0	0
nC30	75	21
nC31	446	92
nC32	0	0
nC33	410	48
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	41	15
nC40	69	22

Sun - Philadelphia Refinery COA
Sample ID : S-64 Pad
Acquired : Mar 09, 2004 09:15:53

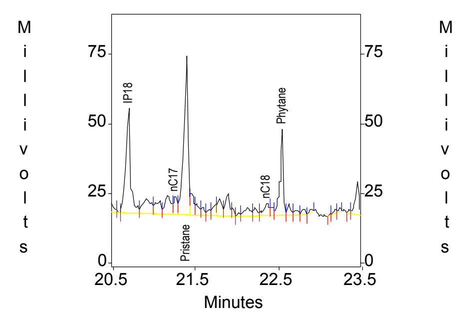
c:\ezchrom\chrom\04046\s-64pad -- Channel A



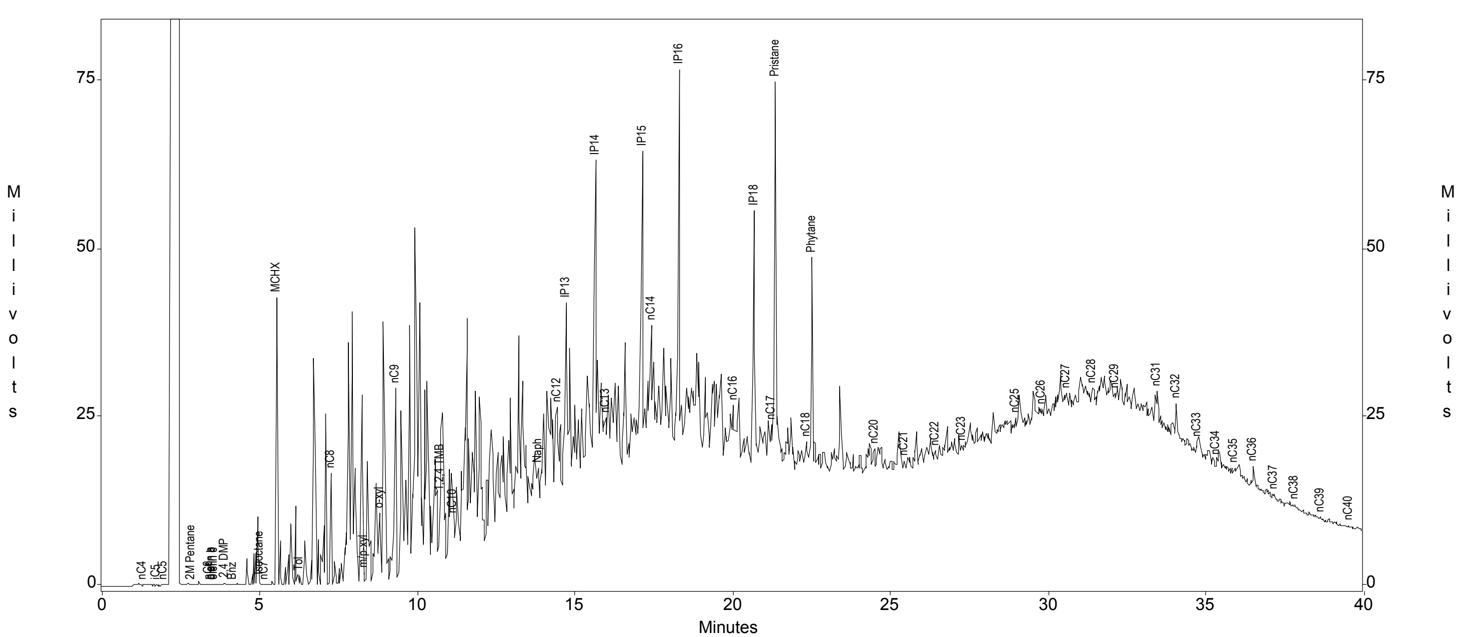
c:\ezchrom\chrom\04046\s-64pad -- Channel A



c:\ezchrom\chrom\04046\s-64pad -- Channel A



c:\ezchrom\chrom\04046\s-64pad -- Channel A



Channel A Results

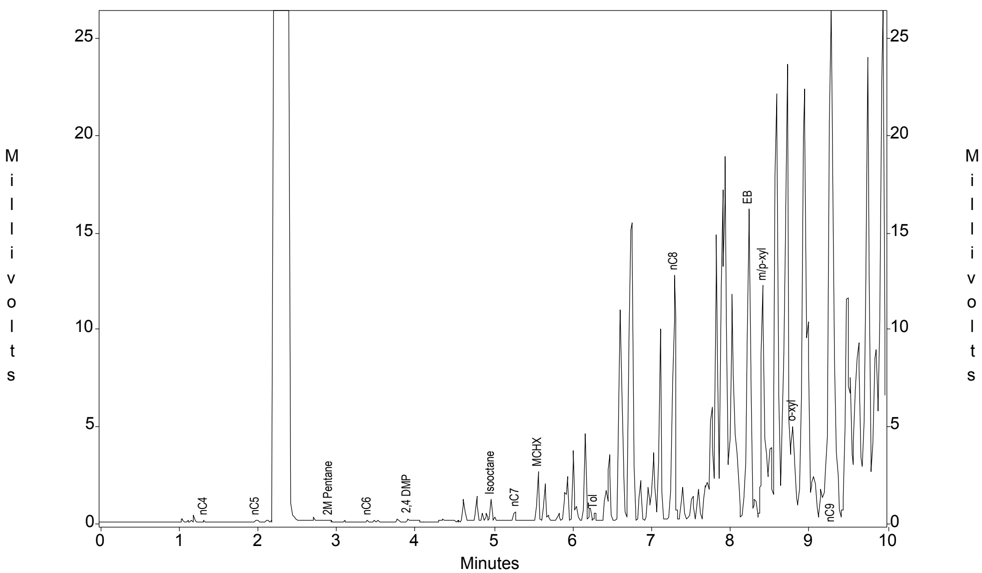
Peak	Area	Height
nC4	66	49
iC5	29	17
nC5	153	47
MTBE	0	0
2M Pentane	158	124
nC6	31	24
olefin a	26	18
olefin b	20	16
olefin c	24	18
2,4 DMP	671	505
Bnz	56	23
Isooctane	1519	934
nC7	116	77
MCHX	74341	42818
Tol	2667	1370
nC8	38102	16575
EB	0	0
m/p-xyl	2911	1459
o-xyl	28747	10005
nC9	74926	28402
1,2,4 TMB	17158	9694
nC10	10211	5503
nC11	0	0
Naph	15401	6744
nC12	37450	14092
IP13	96527	28957
IP14	169233	47882
nC13	48828	8780
IP15	171297	45419
nC14	61624	19005
IP16	165266	54539
nC15	0	0
nC16	47441	7885
IP18	140837	37390
nC17	16681	5983
Pristane	201460	57035
nC18	20389	4008
Phytane	101623	31219
nC19	0	0
nC20	14227	3287
nC21	3066	1244
nC22	6638	1454
nC23	2408	836
nC24	0	0
nC25	6881	1943
nC26	1589	696
nC27	13573	2069
nC28	3920	2219
nC29	1300	601
nC30	0	0
nC31	6830	2692
nC32	11517	4516
nC33	1681	848
nC34	1004	510
nC35	394	505
nC36	5847	2706
nC37	894	353
nC38	947	393
nC39	797	336
nC40	571	182

Sun - Philadelphia Refinery COA

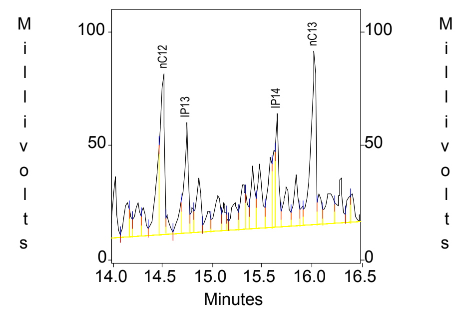
Sample ID : S-68 Pad

Acquired : Mar 09, 2004 13:21:33

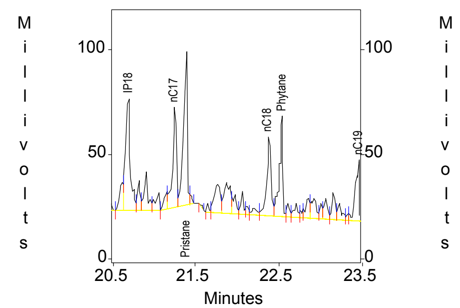
c:\ezchrom\chrom\04046\s-68pad.2 -- Channel A



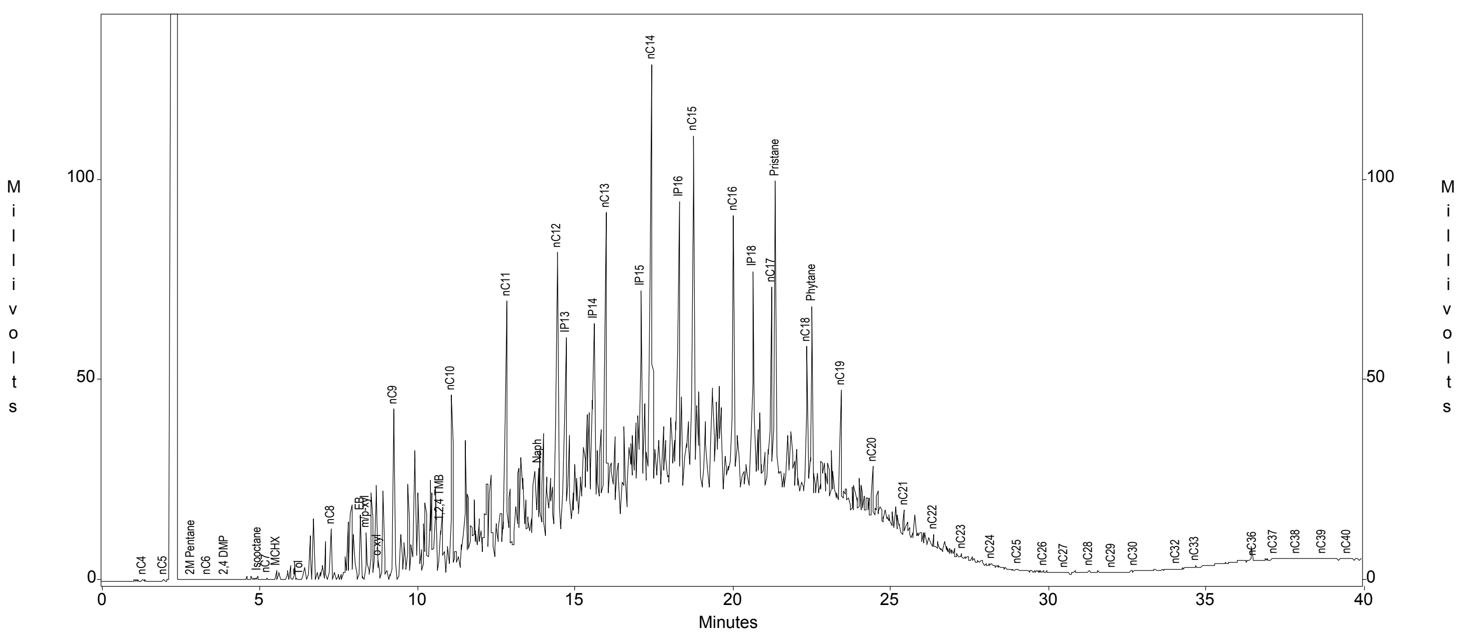
c:\ezchrom\chrom\04046\s-68pad.2 -- Channel A



c:\ezchrom\chrom\04046\s-68pad.2 -- Channel A



c:\ezchrom\chrom\04046\s-68pad.2 -- Channel A

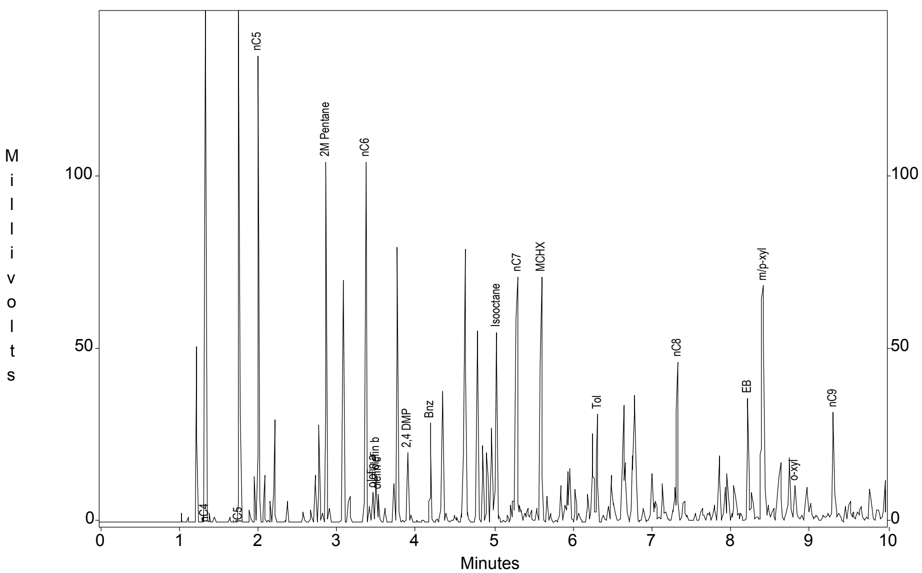


Channel A Results

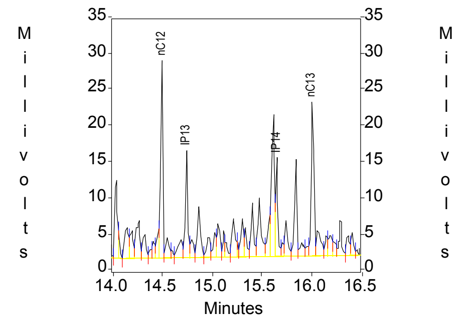
Peak	Area	Height
nC4	41	23
iC5	0	0
nC5	97	39
MTBE	0	0
2M Pentane	50	44
nC6	27	25
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	148	117
Bnz	0	0
Isooctane	1802	1110
nC7	723	498
MCHX	4121	2543
Tol	663	357
nC8	23710	12610
EB	48420	15964
m/p-xyl	30284	11996
o-xyl	16235	4665
nC9	125600	42495
1,2,4 TMB	49594	12099
nC10	134641	43947
nC11	195930	63121
Naph	49959	18694
nC12	177272	70866
IP13	138784	48932
IP14	104878	49727
nC13	252811	76722
IP15	168029	49973
nC14	345005	104221
IP16	186438	67623
nC15	309322	87692
nC16	206115	65138
IP18	201010	53708
nC17	141902	48292
Pristane	235075	74130
nC18	117898	37367
Phytane	154983	47849
nC19	115791	29314
nC20	33859	12849
nC21	11676	6143
nC22	6997	3064
nC23	3512	1498
nC24	3229	785
nC25	3163	427
nC26	532	220
nC27	1150	265
nC28	1546	525
nC29	210	57
nC30	273	93
nC31	0	0
nC32	139	83
nC33	729	191
nC34	0	0
nC35	0	0
nC36	124	45
nC37	314	138
nC38	268	79
nC39	88	47
nC40	1044	109

Sun - Philadelphia Refinery COA
Sample ID : S-76
Acquired : Mar 06, 2004 10:39:34

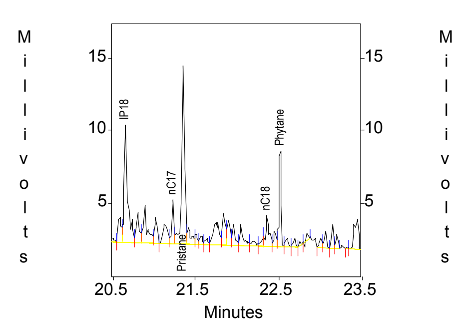
c:\ezchrom\chrom\04046\s-76 -- Channel A



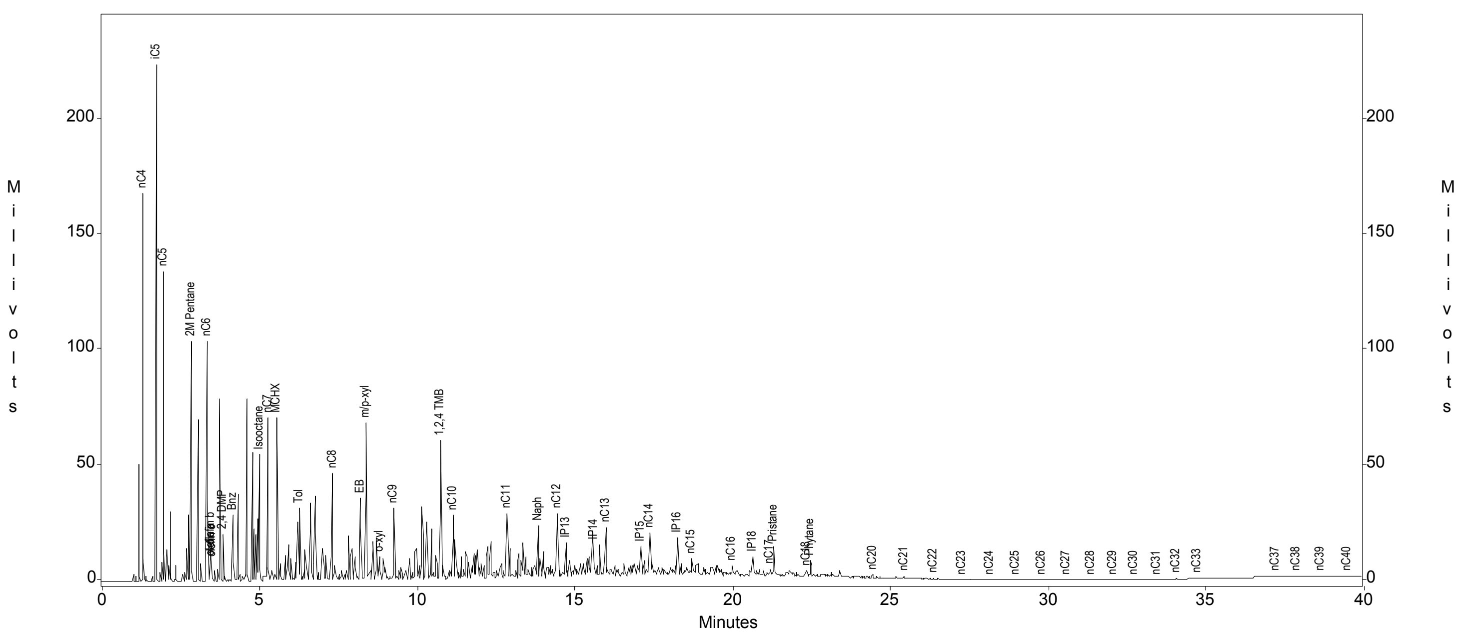
c:\ezchrom\chrom\04046\s-76 -- Channel A



c:\ezchrom\chrom\04046\s-76 -- Channel A



c:\ezchrom\chrom\04046\s-76 -- Channel A

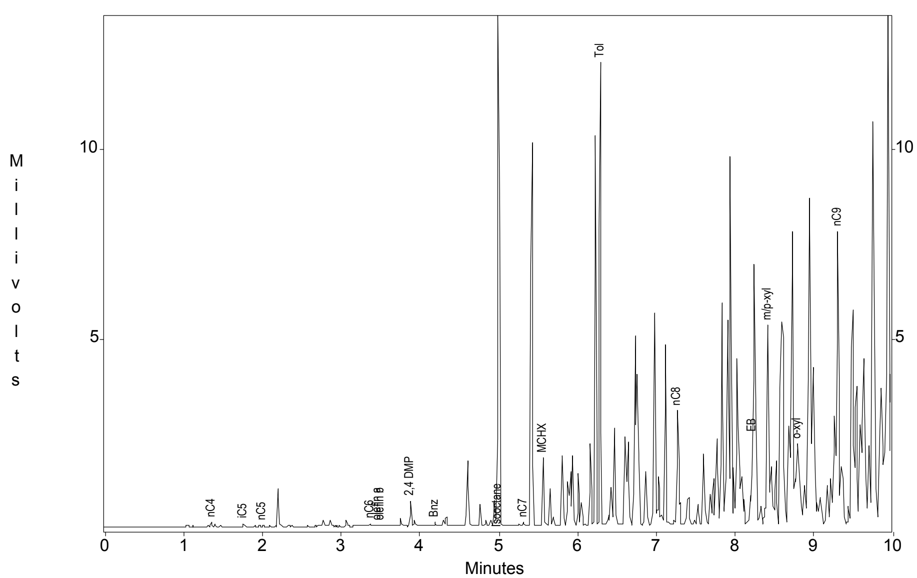


Channel A Results

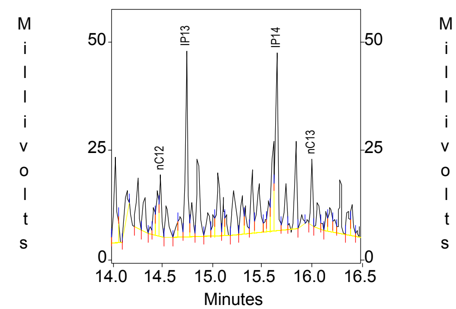
Peak	Area	Height
nC4	96738	168016
iC5	158567	223696
nC5	99106	134444
MTBE	0	0
2M Pentane	101248	104242
nC6	112398	104151
olefin a	10519	8469
olefin b	13268	13503
olefin c	8885	7975
2,4 DMP	21714	19892
Bnz	41295	28665
Isooctane	68076	54489
nC7	94689	70592
MCHX	95810	70599
Tol	44480	30983
nC8	61078	46070
EB	53076	35690
m/p-xyl	123713	68192
o-xyl	17806	10323
nC9	53460	31332
1,2,4 TMB	103082	60172
nC10	42462	27825
nC11	40407	27840
Naph	34559	22103
nC12	43936	27411
IP13	24742	14908
IP14	20250	13725
nC13	33594	21387
IP15	18857	12039
nC14	31804	18232
IP16	26022	15910
nC15	14656	6618
nC16	8025	4069
IP18	25124	8087
nC17	5461	2989
Pristane	28000	12374
nC18	5843	2092
Phytane	13314	6676
nC19	0	0
nC20	3427	1363
nC21	1388	842
nC22	1085	501
nC23	585	333
nC24	455	297
nC25	628	342
nC26	796	434
nC27	802	475
nC28	664	403
nC29	576	328
nC30	610	241
nC31	446	179
nC32	365	116
nC33	250	76
nC34	0	0
nC35	0	0
nC36	0	0
nC37	50	17
nC38	28	9
nC39	23	13
nC40	99	12

Sun - Philadelphia Refinery COA
Sample ID : S-78 Pad
Acquired : Mar 09, 2004 16:37:51

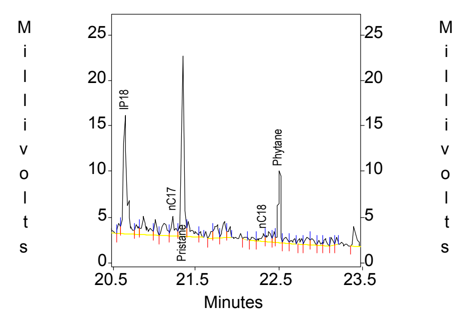
c:\ezchrom\chrom\04046\s-78pad -- Channel A



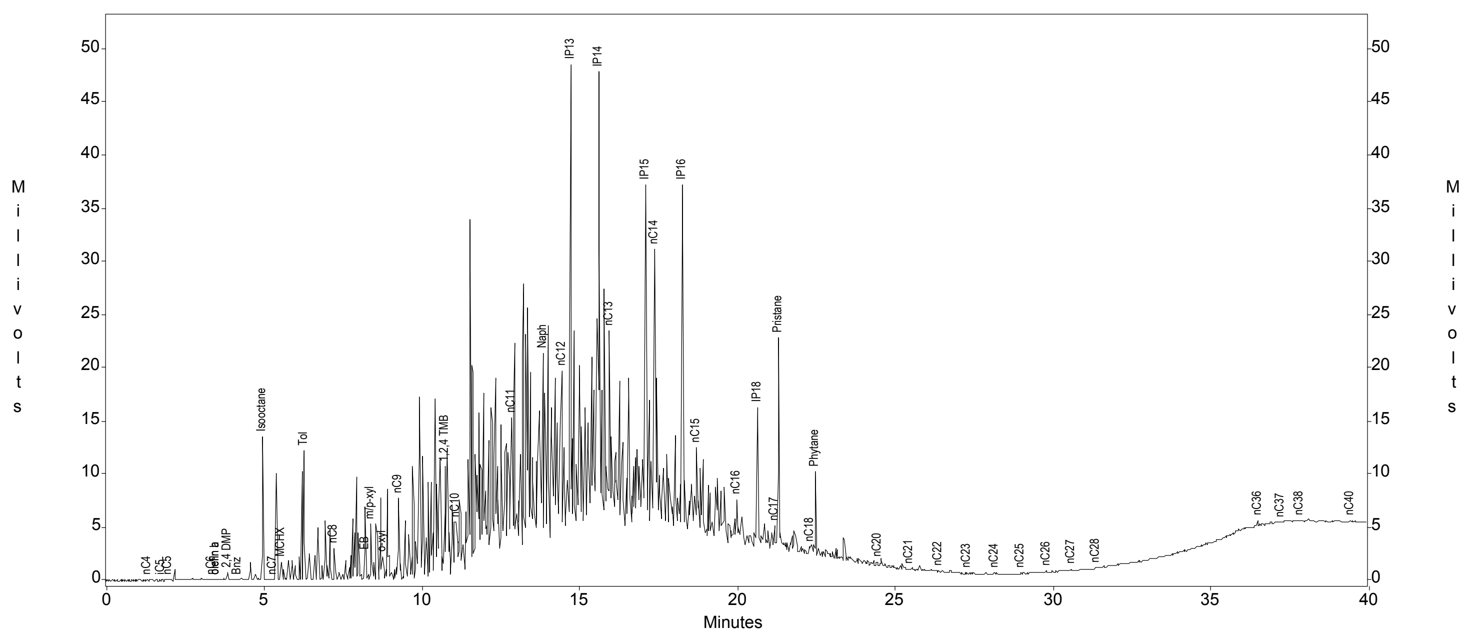
c:\ezchrom\chrom\04046\s-78pad -- Channel A



c:\ezchrom\chrom\04046\s-78pad -- Channel A



c:\ezchrom\chrom\04046\s-78pad -- Channel A



Channel A Results

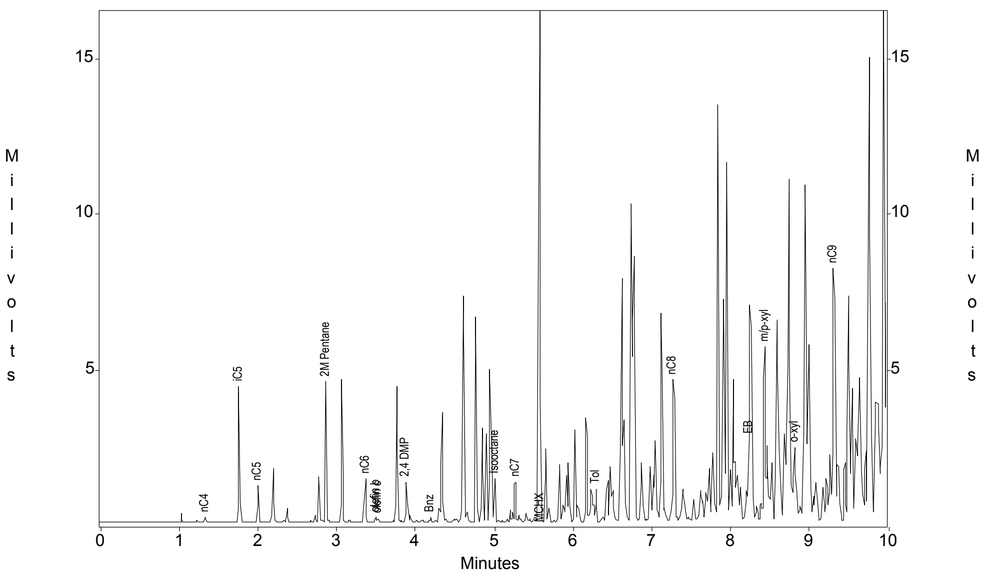
Peak	Area	Height
nC4	138	145
iC5	79	79
nC5	52	52
MTBE	0	0
2M Pentane	0	0
nC6	44	40
olefin a	20	15
olefin b	22	15
olefin c	0	0
2,4 DMP	715	650
Bnz	124	94
Isooctane	16069	13509
nC7	131	86
MCHX	2291	1777
Tol	15099	12212
nC8	4605	3000
EB	1731	2303
m/p-xyl	8143	5255
o-xyl	3729	2151
nC9	11877	7709
1,2,4 TMB	20041	10159
nC10	9715	4747
nC11	26509	12576
Naph	28663	17574
nC12	19190	14068
IP13	70188	43173
IP14	65216	40979
nC13	20570	15416
IP15	58313	32194
nC14	47635	26203
IP16	56734	32654
nC15	24076	8014
nC16	9208	3855
IP18	34861	13060
nC17	6086	2186
Pristane	41585	19831
nC18	2022	772
Phytane	15608	7892
nC19	0	0
nC20	993	408
nC21	268	161
nC22	325	83
nC23	192	103
nC24	195	111
nC25	277	119
nC26	261	111
nC27	821	94
nC28	315	102
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	1527	569
nC37	293	71
nC38	432	111
nC39	0	0
nC40	284	40

Sun - Philadelphia Refinery COA

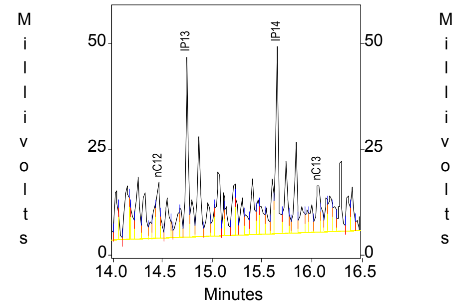
Sample ID : S-79

Acquired : Mar 06, 2004 19:45:35

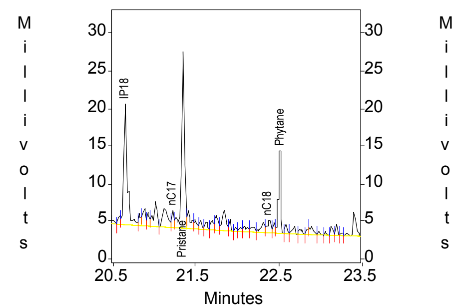
c:\ezchrom\chrom\04046\s-79 -- Channel A



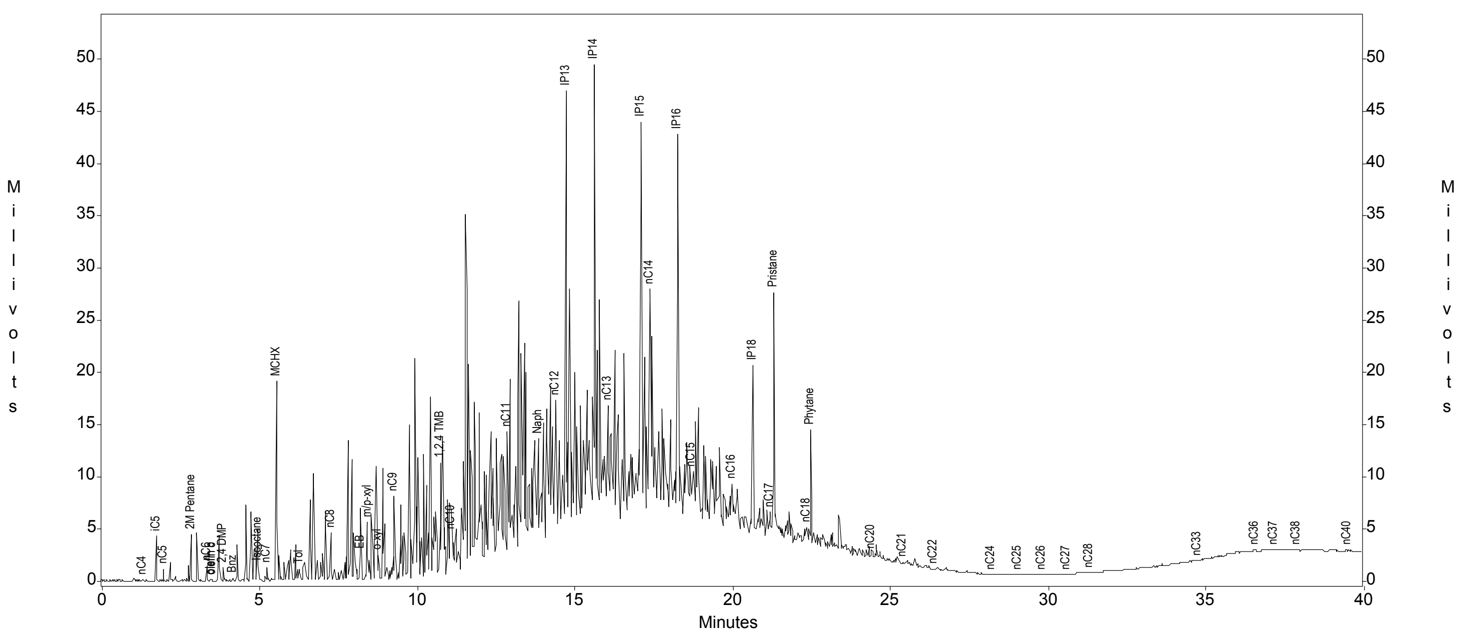
c:\ezchrom\chrom\04046\s-79 -- Channel A



c:\ezchrom\chrom\04046\s-79 -- Channel A



c:\ezchrom\chrom\04046\s-79 -- Channel A

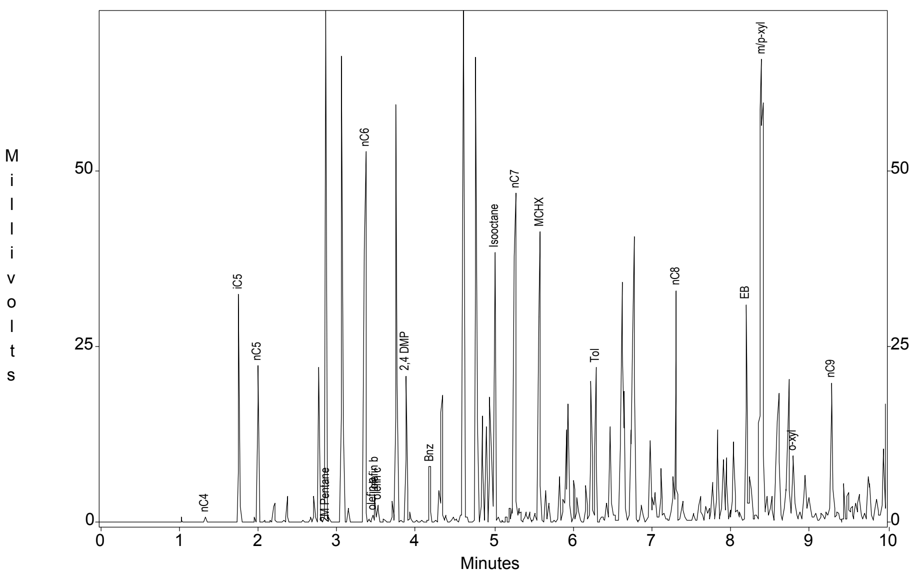


Channel A Results

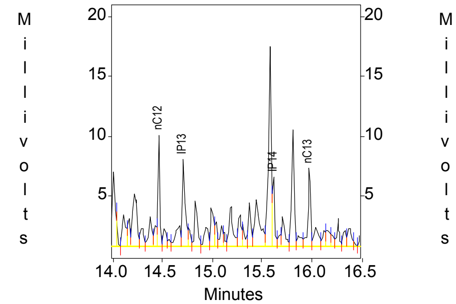
Peak	Area	Height
nC4	90	131
iC5	3326	4330
nC5	933	1146
MTBE	0	0
2M Pentane	4257	4510
nC6	1352	1363
olefin a	0	0
olefin b	159	148
olefin c	109	79
2,4 DMP	1403	1269
Bnz	282	177
Isooctane	1734	1396
nC7	1526	1258
MCHX	23169	19197
Tol	1522	1068
nC8	7074	4543
EB	2110	2638
m/p-xyl	7446	5616
o-xyl	3808	2345
nC9	12579	8108
1,2,4 TMB	22386	10871
nC10	4617	3316
nC11	23594	11673
Naph	22539	10180
nC12	25240	13182
IP13	72950	42667
IP14	78802	44241
nC13	31774	11132
IP15	64844	36535
nC14	45364	21126
IP16	65656	36230
nC15	16573	3882
nC16	9815	3718
IP18	42913	16052
nC17	5271	2372
Pristane	54066	23603
nC18	4867	1667
Phytane	23186	11053
nC19	0	0
nC20	2092	466
nC21	593	233
nC22	504	52
nC23	0	0
nC24	269	43
nC25	407	51
nC26	145	37
nC27	273	41
nC28	893	48
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	2822	87
nC34	0	0
nC35	0	0
nC36	418	77
nC37	96	53
nC38	116	41
nC39	0	0
nC40	301	45

Sun - Philadelphia Refinery COA
Sample ID : S-81
Acquired : Mar 07, 2004 20:33:12

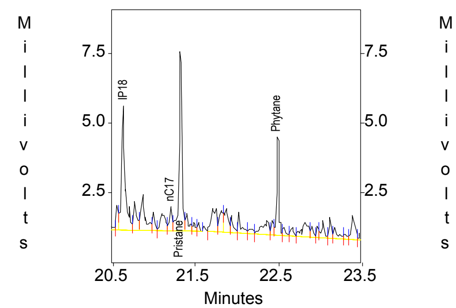
c:\ezchrom\chrom\04046\s-81 -- Channel A



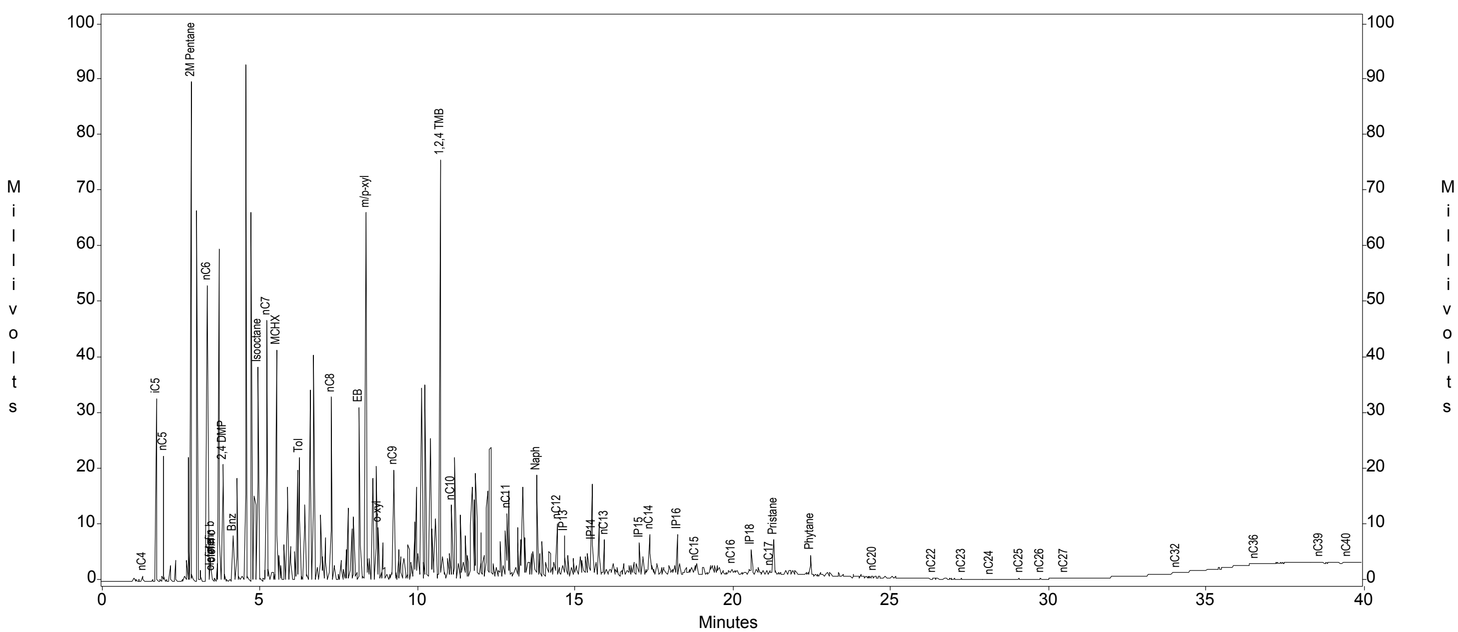
c:\ezchrom\chrom\04046\s-81 -- Channel A



c:\ezchrom\chrom\04046\s-81 -- Channel A



c:\ezchrom\chrom\04046\s-81 -- Channel A



Channel A Results

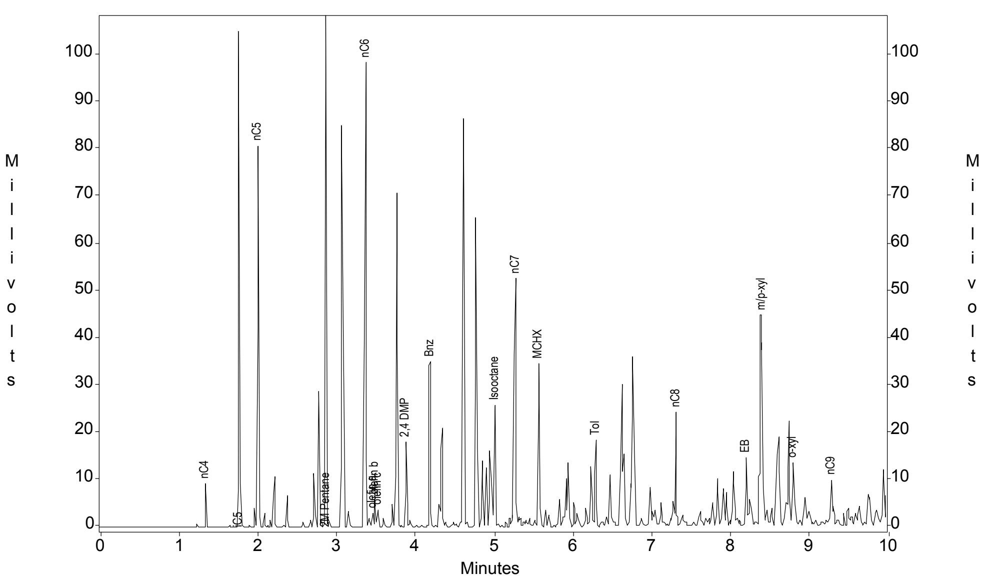
Peak	Area	Height
nC4	464	706
iC5	24533	32623
nC5	17642	22393
MTBE	0	0
2M Pentane	85524	89489
nC6	52326	52929
olefin a	1069	892
olefin b	3935	3969
olefin c	2931	2432
2,4 DMP	22219	20707
Bnz	11030	7976
Isooctane	45838	38407
nC7	57011	46832
MCHX	52455	41534
Tol	27937	21944
nC8	41882	32994
EB	43523	30956
m/p-xyl	122510	66020
o-xyl	16546	9407
nC9	31360	19841
1,2,4 TMB	136927	75389
nC10	20014	13096
nC11	18039	11304
Naph	29277	18151
nC12	13420	9268
IP13	12662	7282
IP14	8297	5729
nC13	11421	6448
IP15	9762	5747
nC14	13262	7101
IP16	11180	7007
nC15	2829	1680
nC16	3387	899
IP18	13155	4430
nC17	1580	812
Pristane	14030	6428
nC18	0	0
Phytane	7040	3520
nC19	0	0
nC20	805	226
nC21	0	0
nC22	299	112
nC23	143	81
nC24	69	45
nC25	363	94
nC26	87	35
nC27	168	26
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	581	37
nC33	0	0
nC34	0	0
nC35	0	0
nC36	1161	125
nC37	0	0
nC38	0	0
nC39	109	39
nC40	78	31

Sun - Philadelphia Refinery COA

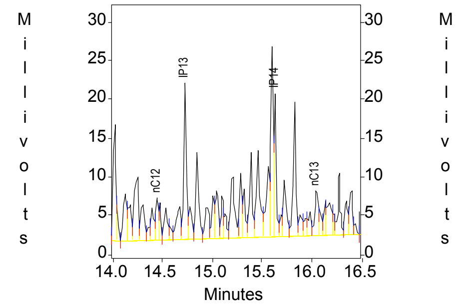
Sample ID : S-82 Pad

Acquired : Mar 09, 2004 17:26:13

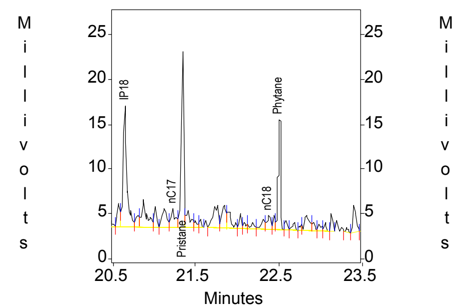
c:\ezchrom\chrom\04046\s-82pad -- Channel A



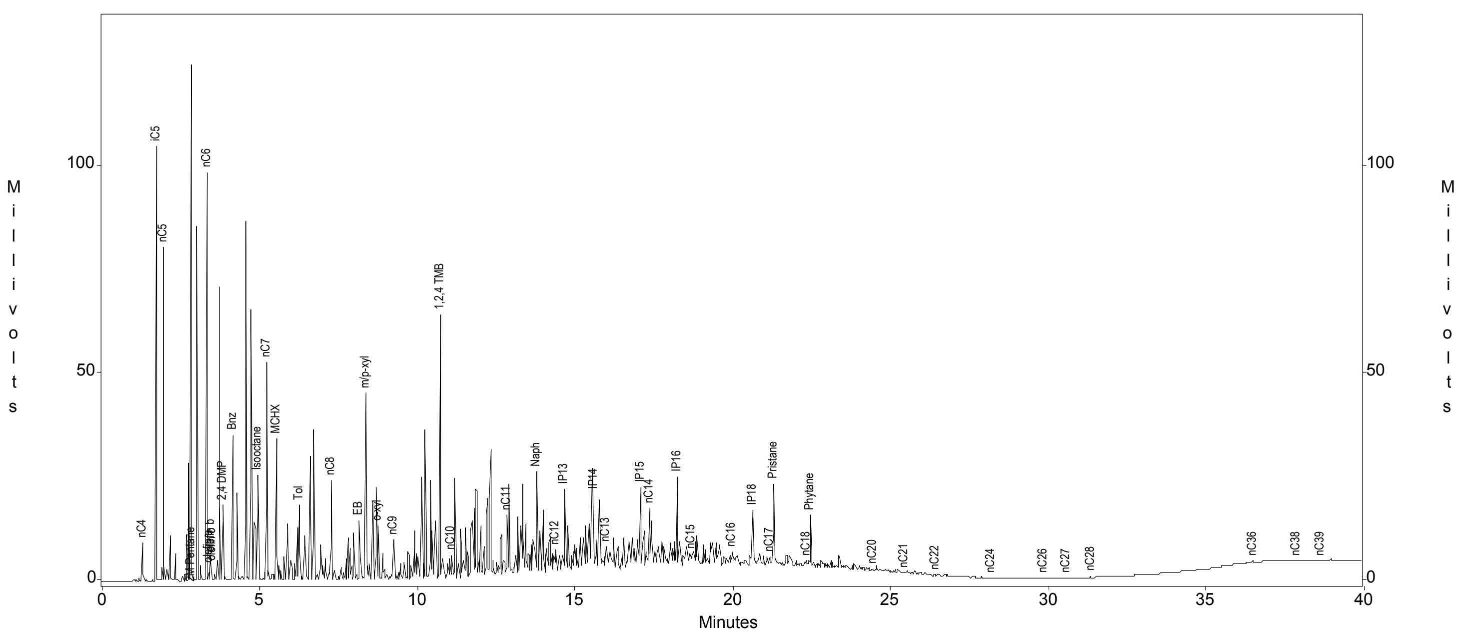
c:\ezchrom\chrom\04046\s-82pad -- Channel A



c:\ezchrom\chrom\04046\s-82pad -- Channel A



c:\ezchrom\chrom\04046\s-82pad -- Channel A



Channel A Results

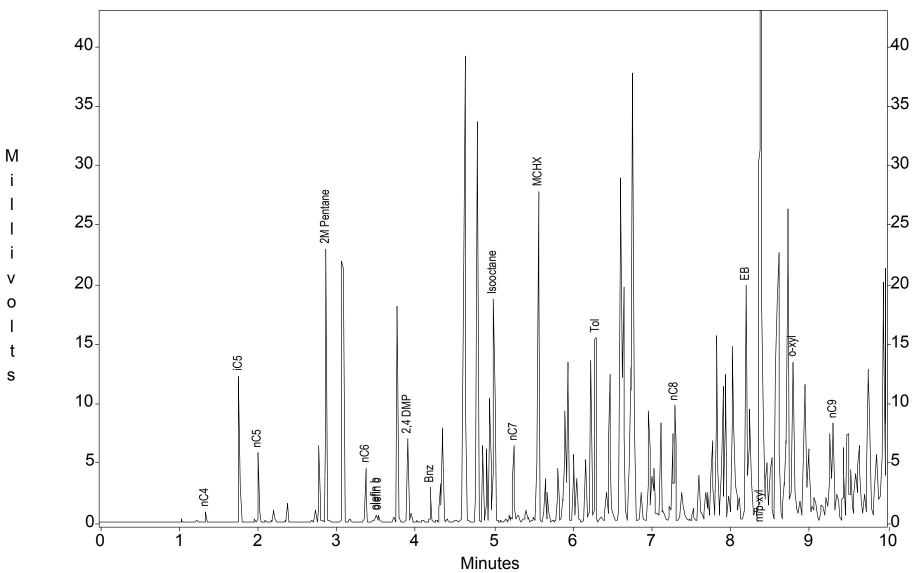
Peak	Area	Height
nC4	5458	8990
iC5	75686	104888
nC5	61386	80532
MTBE	0	0
2M Pentane	122006	124425
nC6	103461	98602
olefin a	3915	2984
olefin b	5841	5764
olefin c	4160	3516
2,4 DMP	19763	18092
Bnz	40859	34923
Isooctane	30898	25554
nC7	65291	52588
MCHX	43569	34369
Tol	24302	18242
nC8	30638	24267
EB	21610	14416
m/p-xyl	73466	44897
o-xyl	21845	13293
nC9	15552	9875
1,2,4 TMB	108704	63016
nC10	10684	5444
nC11	25198	14230
Naph	37159	23904
nC12	9399	5294
IP13	34366	19947
IP14	27533	18395
nC13	15312	5794
IP15	28447	17849
nC14	25869	13728
IP16	34248	20729
nC15	12723	2738
nC16	6903	2591
IP18	38652	13472
nC17	7079	2107
Pristane	42586	19597
nC18	4413	1567
Phytane	25438	12329
nC19	0	0
nC20	1703	593
nC21	457	272
nC22	317	105
nC23	0	0
nC24	704	107
nC25	0	0
nC26	113	33
nC27	181	47
nC28	222	102
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	761	343
nC37	0	0
nC38	83	26
nC39	128	44
nC40	0	0

Sun - Philadelphia Refinery COA

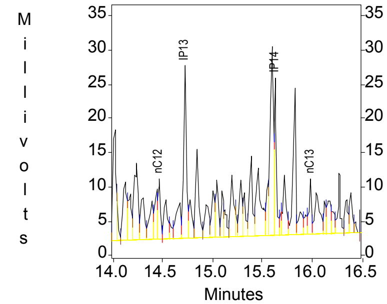
Sample ID : S-89

Acquired : Mar 06, 2004 09:49:44

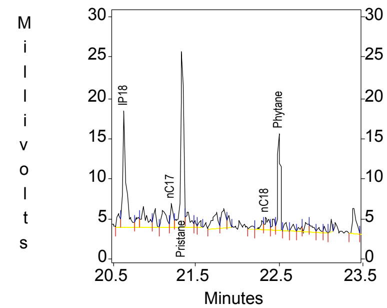
c:\ezchrom\chrom\04046\s-89 -- Channel A



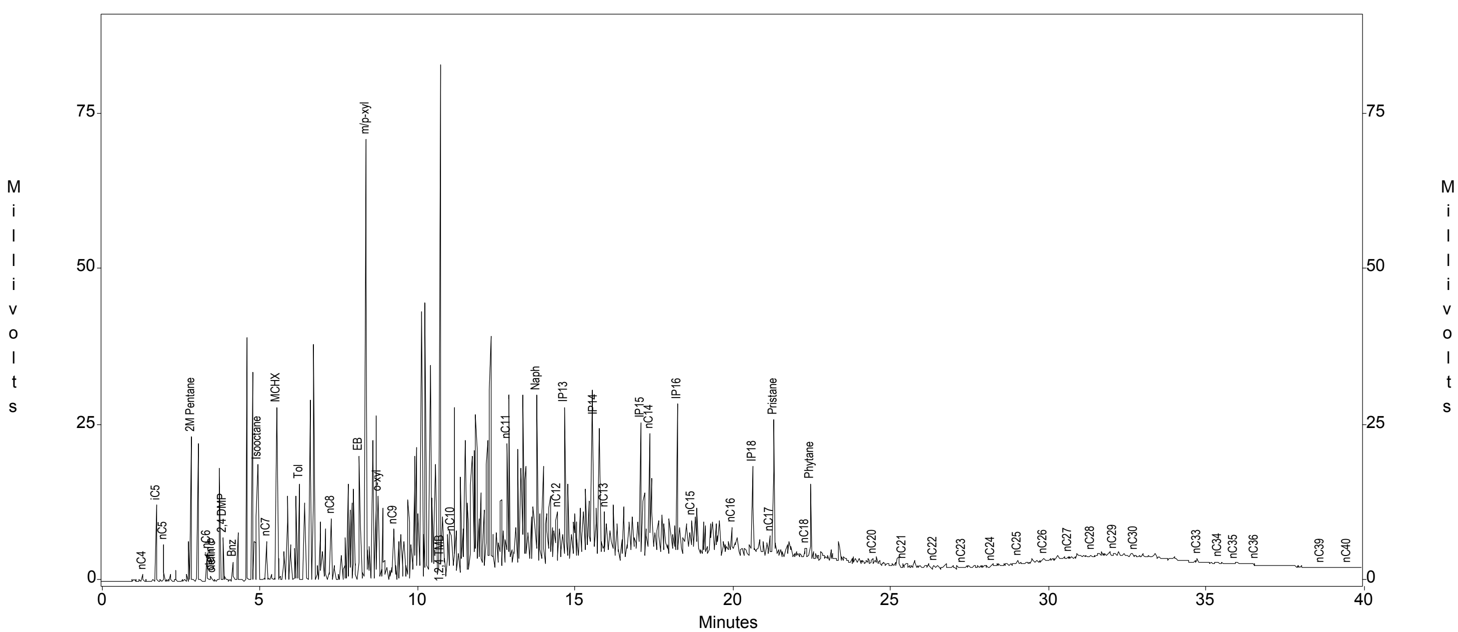
c:\ezchrom\chrom\04046\s-89 -- Channel A



c:\ezchrom\chrom\04046\s-89 -- Channel A



c:\ezchrom\chrom\04046\s-89 -- Channel A

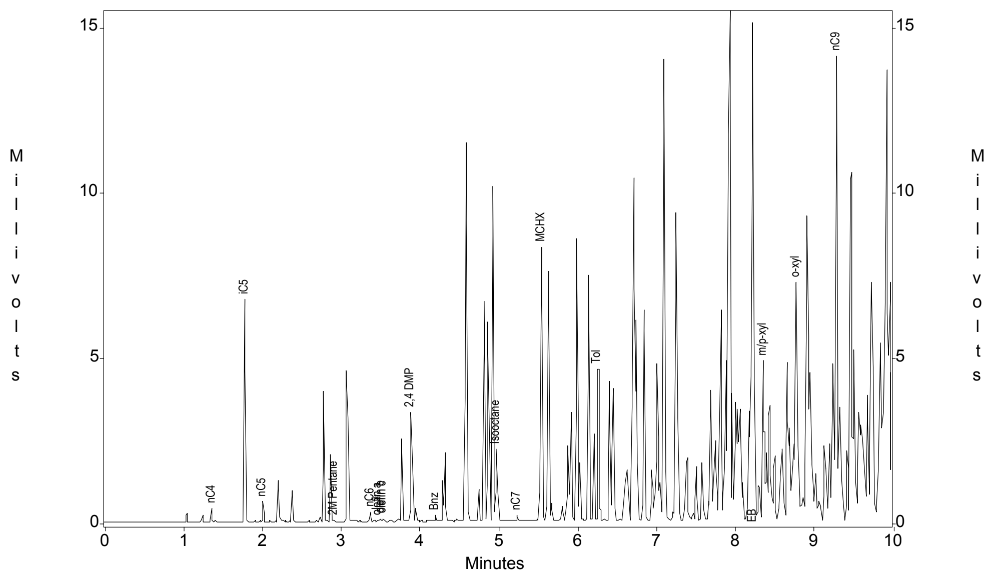


Channel A Results

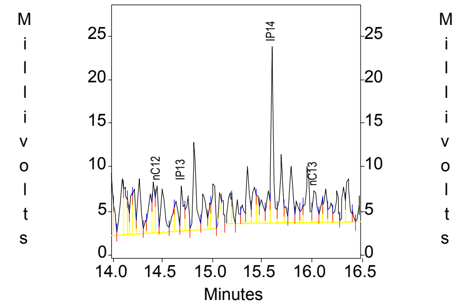
Peak	Area	Height
nC4	509	885
iC5	8572	12258
nC5	4371	5813
MTBE	0	0
2M Pentane	20857	22969
nC6	4392	4439
olefin a	0	0
olefin b	594	591
olefin c	625	490
2,4 DMP	7395	6923
Bnz	3601	2952
Isooctane	21603	18686
nC7	7622	6388
MCHX	34221	27659
Tol	19411	15394
nC8	12195	9767
EB	30116	19826
m/p-xyl	128276	70691
o-xyl	21968	13365
nC9	12316	8146
1,2,4 TMB	160737	82043
nC10	14270	6412
nC11	37292	20361
Naph	47696	27747
nC12	13657	8772
IP13	43903	25242
IP14	35782	22900
nC13	14025	7990
IP15	40251	21544
nC14	37730	19473
IP16	39392	23646
nC15	16505	5175
nC16	9142	4054
IP18	39330	14344
nC17	6076	3076
Pristane	49120	21849
nC18	5086	1564
Phytane	24122	11923
nC19	0	0
nC20	2115	873
nC21	798	456
nC22	1453	360
nC23	709	192
nC24	2081	334
nC25	4274	659
nC26	2474	561
nC27	1891	534
nC28	1777	350
nC29	1198	259
nC30	469	187
nC31	0	0
nC32	0	0
nC33	1287	391
nC34	1668	333
nC35	280	63
nC36	93	28
nC37	0	0
nC38	0	0
nC39	60	24
nC40	59	18

Sun - Philadelphia Refinery COA
Sample ID : S-92
Acquired : Mar 08, 2004 16:45:21

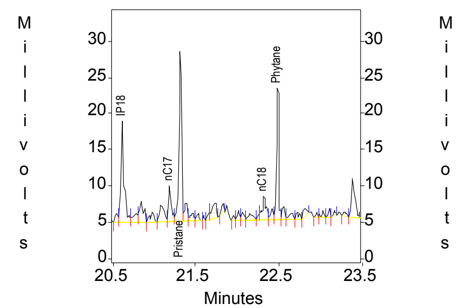
c:\ezchrom\chrom\04046\s-92 -- Channel A



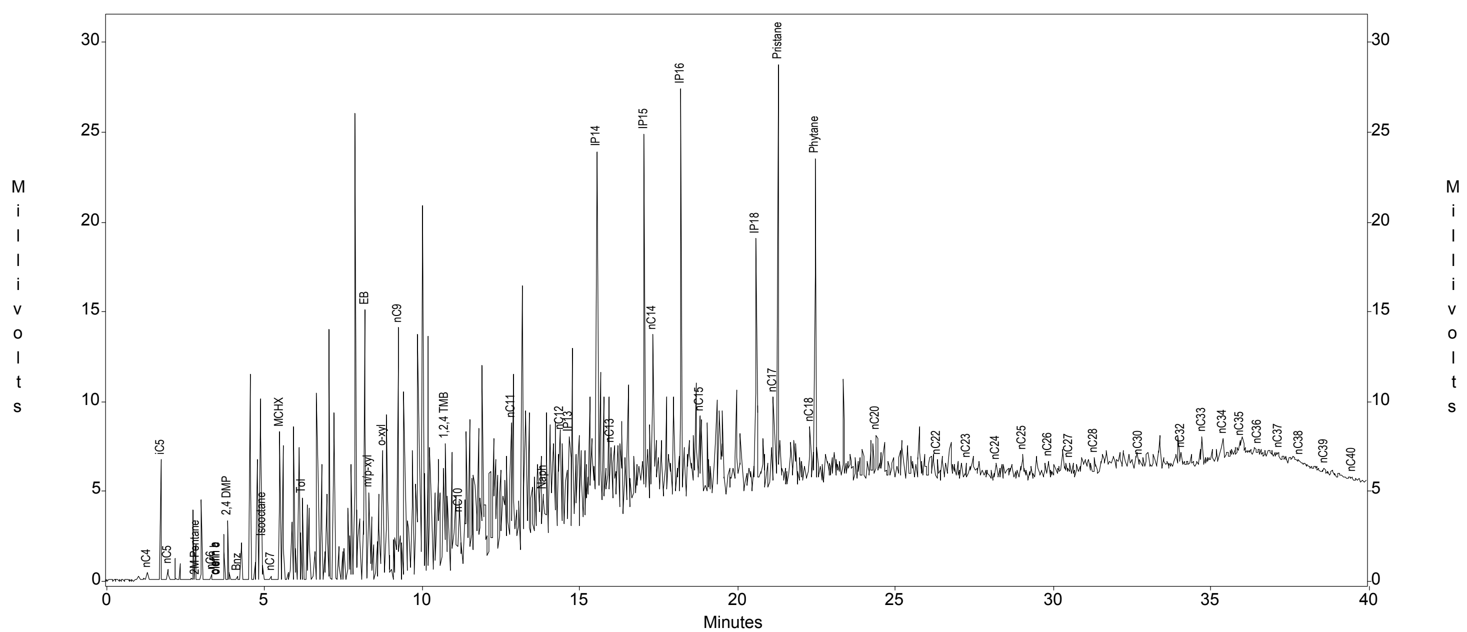
c:\ezchrom\chrom\04046\s-92 -- Channel A



c:\ezchrom\chrom\04046\s-92 -- Channel A



c:\ezchrom\chrom\04046\s-92 -- Channel A

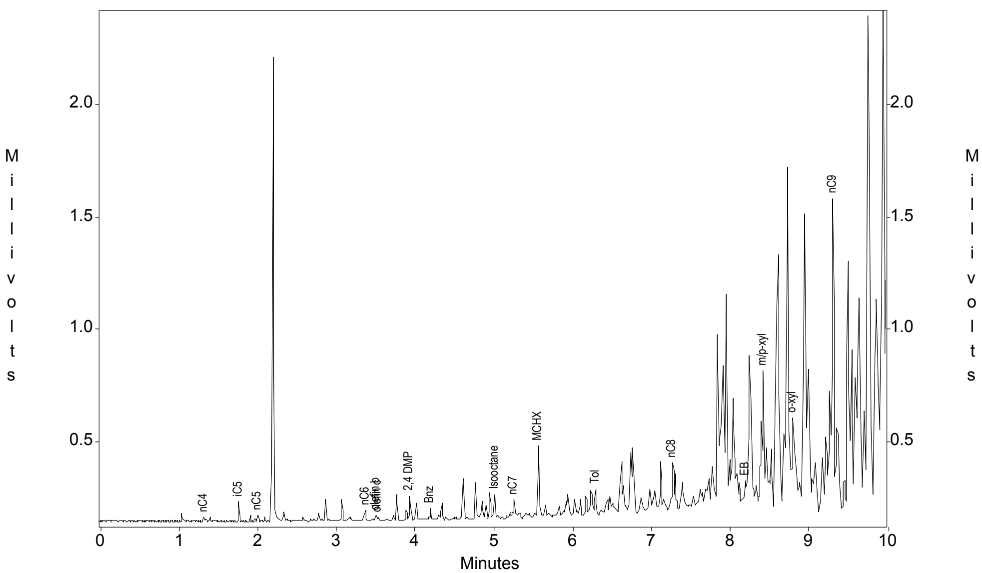


Channel A Results

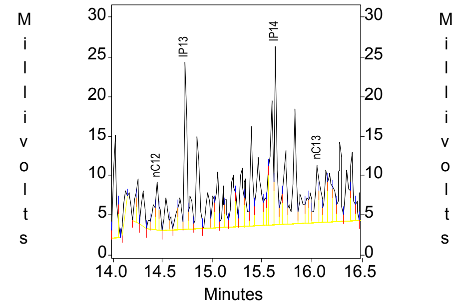
Peak	Area	Height
nC4	312	414
iC5	5246	6713
nC5	509	596
MTBE	0	0
2M Pentane	22	17
nC6	318	310
olefin a	53	41
olefin b	66	58
olefin c	82	61
2,4 DMP	3593	3315
Bnz	339	183
Isooctane	2617	2205
nC7	312	187
MCHX	10483	8267
Tol	5831	4585
nC8	0	0
EB	22654	15047
m/p-xyl	6613	4830
o-xyl	11443	7195
nC9	21682	14010
1,2,4 TMB	14838	7150
nC10	3463	2224
nC11	15395	7195
Naph	8411	2575
nC12	8192	5438
IP13	11739	5163
IP14	31800	20263
nC13	11000	3765
IP15	35181	20796
nC14	18653	9485
IP16	38916	22720
nC15	8981	4176
nC16	0	0
IP18	37540	13987
nC17	10690	4952
Pristane	49915	23427
nC18	10287	3154
Phytane	37982	18002
nC19	0	0
nC20	7523	2433
nC21	0	0
nC22	1691	871
nC23	1536	828
nC24	4263	906
nC25	7152	1431
nC26	2531	928
nC27	1299	622
nC28	1392	651
nC29	0	0
nC30	903	287
nC31	0	0
nC32	818	566
nC33	4083	1380
nC34	2217	774
nC35	743	408
nC36	985	215
nC37	427	129
nC38	293	132
nC39	635	218
nC40	327	77

Sun - Philadelphia Refinery COA
Sample ID : S-97
Acquired : Mar 06, 2004 20:35:31

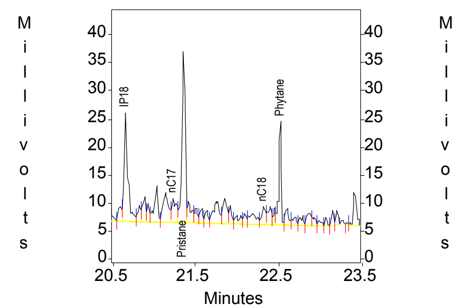
c:\ezchrom\chrom\04046\s-97 -- Channel A



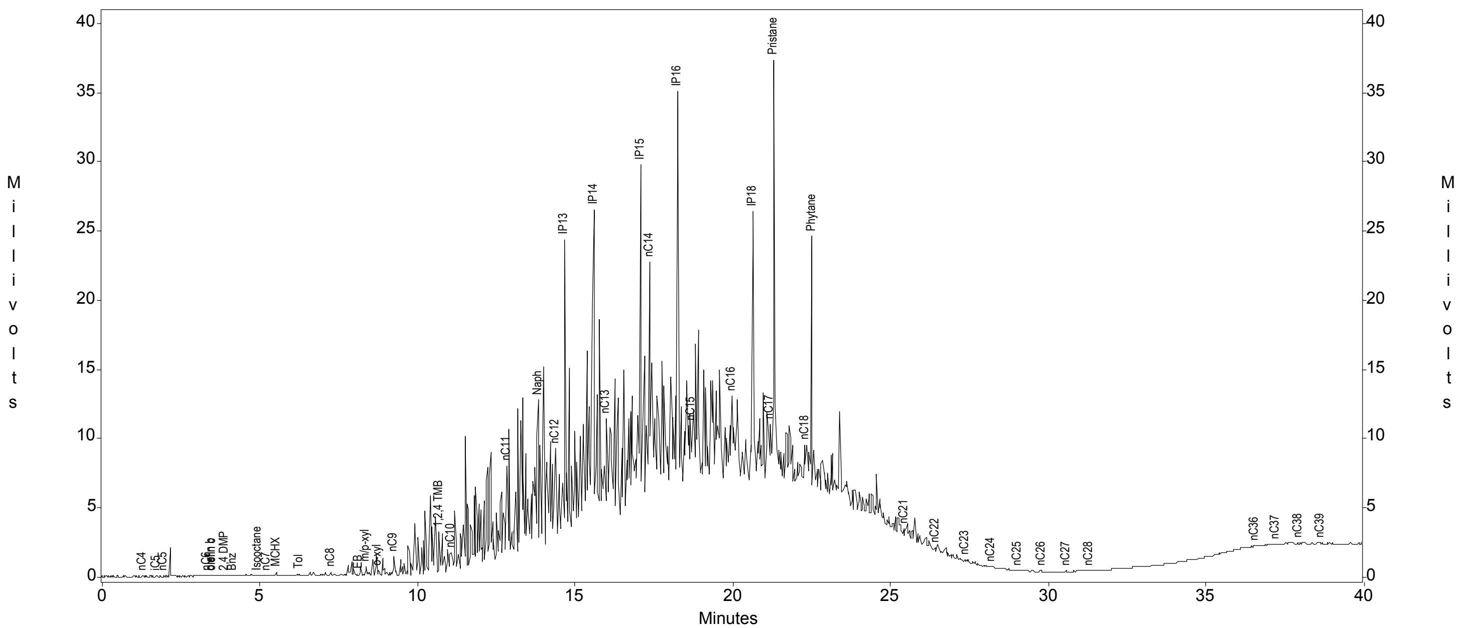
c:\ezchrom\chrom\04046\s-97 -- Channel A



c:\ezchrom\chrom\04046\s-97 -- Channel A



c:\ezchrom\chrom\04046\s-97 -- Channel A

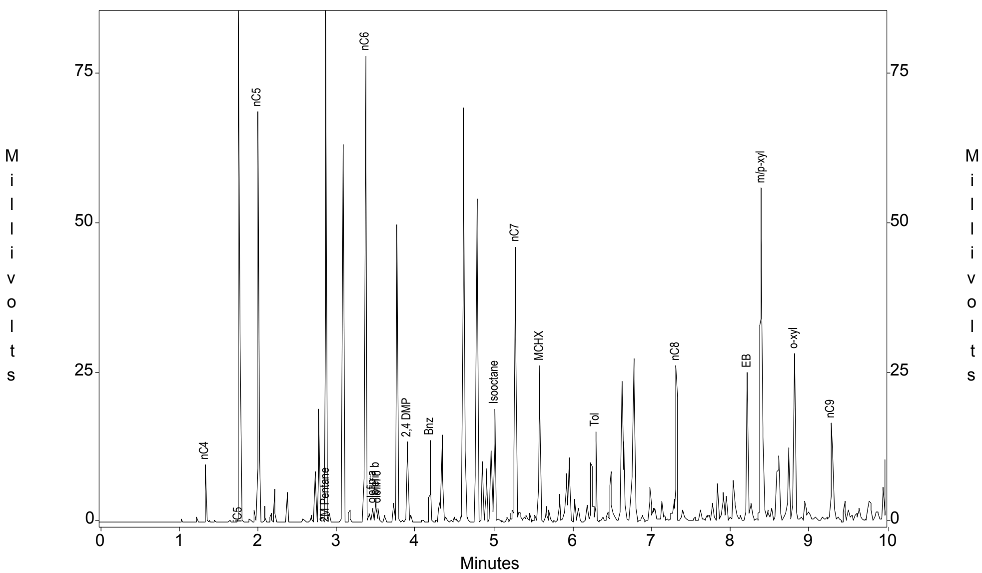


Channel A Results

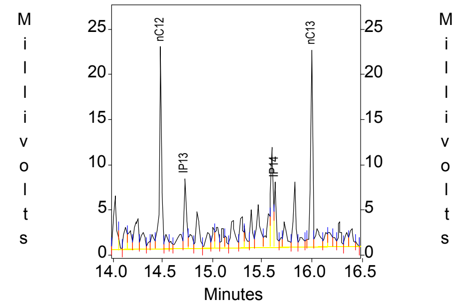
Peak	Area	Height
nC4	23	20
iC5	72	90
nC5	30	29
MTBE	0	0
2M Pentane	0	0
nC6	49	47
olefin a	0	0
olefin b	28	24
olefin c	23	18
2,4 DMP	125	104
Bnz	58	44
Isooctane	145	105
nC7	121	81
MCHX	412	315
Tol	177	112
nC8	477	222
EB	361	147
m/p-xyl	884	629
o-xyl	1099	419
nC9	2138	1380
1,2,4 TMB	5496	2980
nC10	2573	1308
nC11	12413	6595
Naph	18167	10622
nC12	11402	6063
IP13	34497	21075
IP14	33424	22548
nC13	19826	7219
IP15	47282	24192
nC14	33025	16689
IP16	49314	27554
nC15	18226	3680
nC16	17748	6029
IP18	58859	19578
nC17	17289	4350
Pristane	73390	30691
nC18	9378	3287
Phytane	39454	18387
nC19	0	0
nC20	0	0
nC21	742	478
nC22	510	223
nC23	1044	151
nC24	577	68
nC25	397	54
nC26	121	38
nC27	67	25
nC28	127	21
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	90	35
nC37	154	31
nC38	53	24
nC39	41	17
nC40	0	0

Sun - Philadelphia Refinery COA
Sample ID : S-100
Acquired : Mar 08, 2004 15:07:33

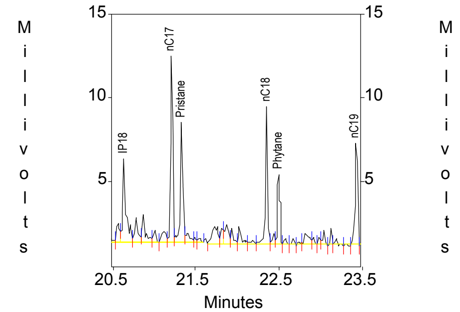
c:\ezchrom\chrom\04046\s-100 -- Channel A



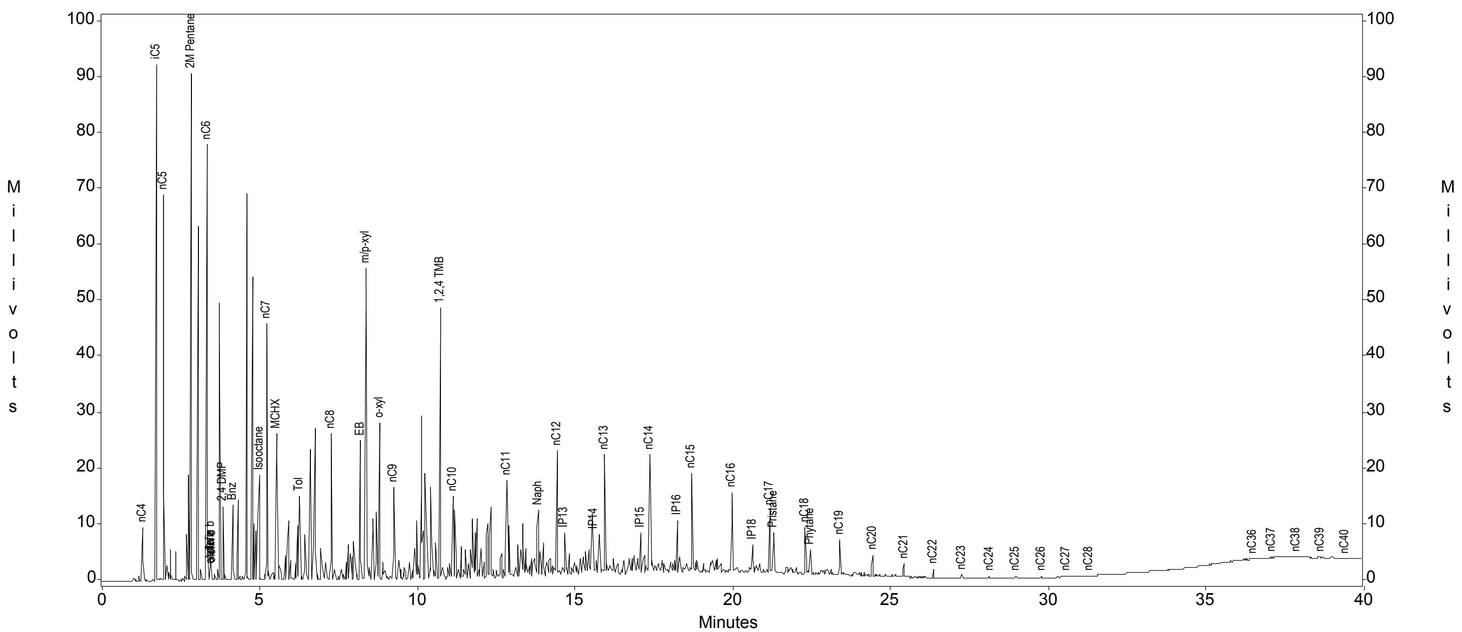
c:\ezchrom\chrom\04046\s-100 -- Channel A



c:\ezchrom\chrom\04046\s-100 -- Channel A



c:\ezchrom\chrom\04046\s-100 -- Channel A



Channel A Results

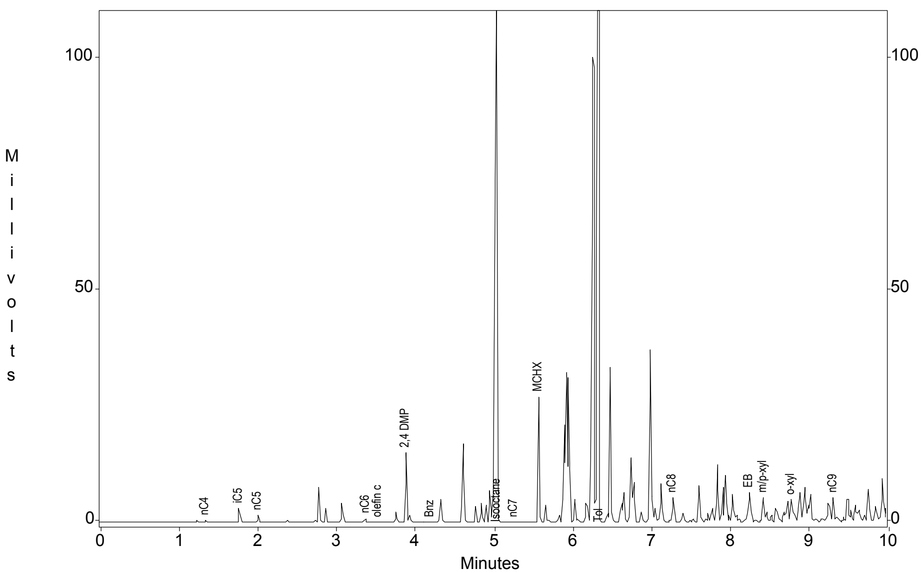
Peak	Area	Height
nC4	6776	9650
iC5	70938	92133
nC5	57240	68806
MTBE	0	0
2M Pentane	87303	90637
nC6	79654	77886
olefin a	2822	2169
olefin b	3890	3840
olefin c	2725	2256
2,4 DMP	14467	13236
Bnz	17085	13500
Isooctane	22651	18853
nC7	56030	46007
MCHX	32405	26119
Tol	20203	14982
nC8	33173	26209
EB	34416	24838
m/p-xyl	98556	55748
o-xyl	39984	28130
nC9	25574	16449
1,2,4 TMB	77711	48457
nC10	21327	14854
nC11	24794	17457
Naph	19540	11984
nC12	35311	22438
IP13	13133	7773
IP14	10551	7158
nC13	33561	21712
IP15	13142	7285
nC14	38498	21477
IP16	15942	9281
nC15	30743	17627
nC16	23661	14225
IP18	15126	4987
nC17	17655	11228
Pristane	15055	7193
nC18	14162	8243
Phytane	8162	4177
nC19	10746	6086
nC20	6571	3774
nC21	3794	2442
nC22	2422	1501
nC23	1293	743
nC24	612	382
nC25	370	186
nC26	220	109
nC27	107	62
nC28	507	45
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	196	82
nC37	23	15
nC38	124	40
nC39	52	43
nC40	120	31

Sun - Philadelphia Refinery COA

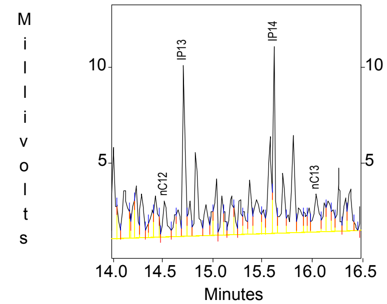
Sample ID : S-103

Acquired : Mar 07, 2004 10:31:49

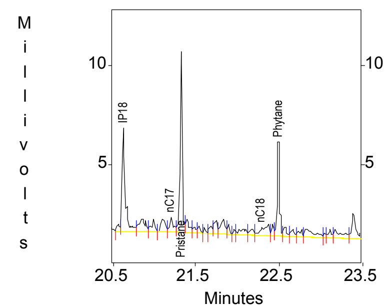
c:\ezchrom\chrom\04046\s-103.2 -- Channel A



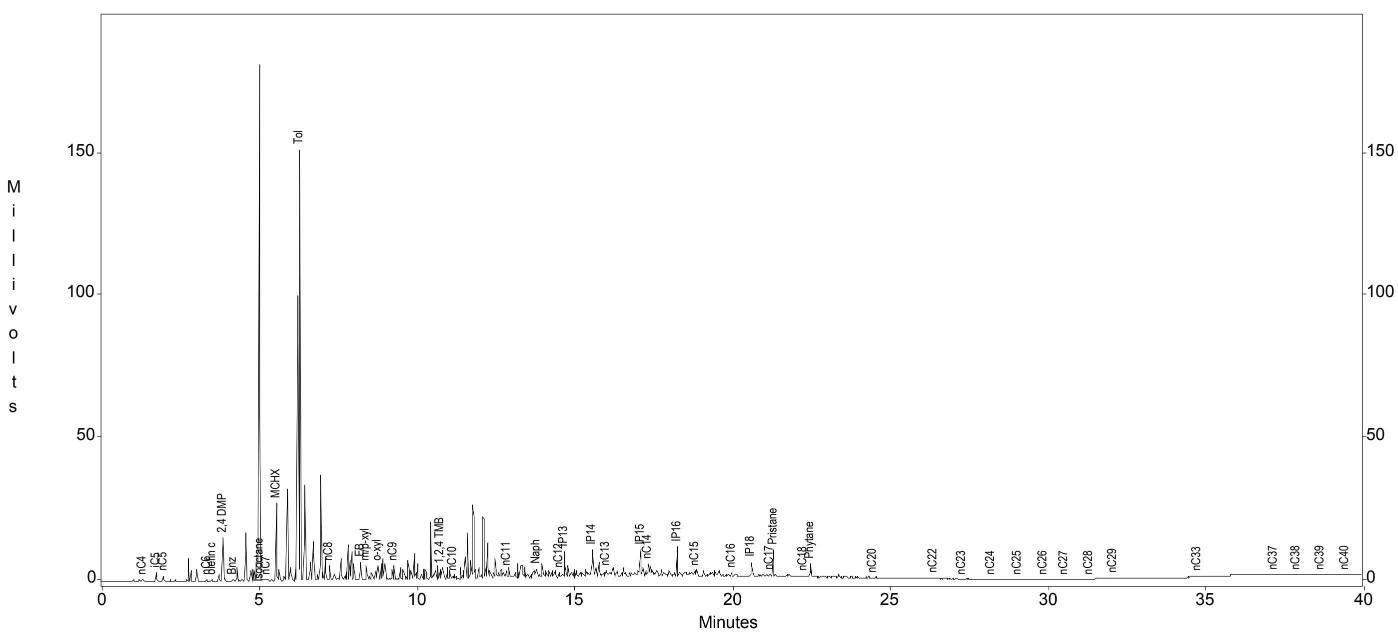
c:\ezchrom\chrom\04046\s-103.2 -- Channel A



c:\ezchrom\chrom\04046\s-103.2 -- Channel A



c:\ezchrom\chrom\04046\s-103.2 -- Channel A



Channel A Results

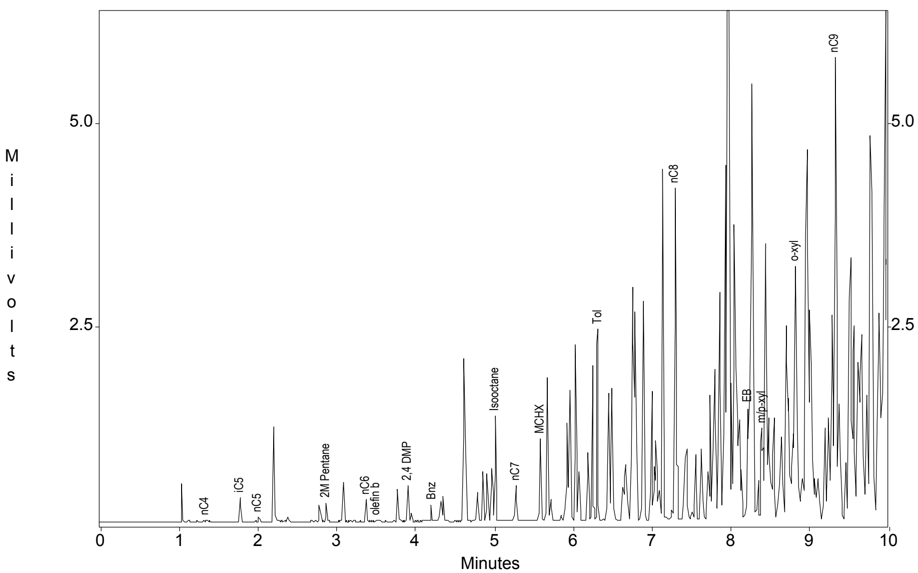
Peak	Area	Height
nC4	203	263
iC5	2588	2794
nC5	1301	1365
MTBE	0	0
2M Pentane	0	0
nC6	533	497
olefin a	0	0
olefin b	0	0
olefin c	49	22
2,4 DMP	16422	15047
Bnz	150	108
Isooctane	318942	181189
nC7	99	45
MCHX	32892	27003
Tol	257684	151454
nC8	7490	5131
EB	10050	6402
m/p-xyl	7488	5344
o-xyl	9173	4971
nC9	8050	5308
1,2,4 TMB	11300	3827
nC10	2711	1161
nC11	7048	3007
Naph	7821	3451
nC12	5357	1839
IP13	14474	8956
IP14	14863	9766
nC13	6913	1917
IP15	15190	8859
nC14	8783	4341
IP16	16328	10100
nC15	3205	1896
nC16	4400	1038
IP18	13242	5272
nC17	2081	784
Pristane	18002	9256
nC18	3014	386
Phytane	9690	4746
nC19	0	0
nC20	1160	251
nC21	0	0
nC22	225	62
nC23	76	30
nC24	490	69
nC25	640	91
nC26	252	59
nC27	123	32
nC28	142	30
nC29	102	33
nC30	0	0
nC31	0	0
nC32	0	0
nC33	212	47
nC34	0	0
nC35	0	0
nC36	0	0
nC37	306	33
nC38	32	19
nC39	108	16
nC40	40	16

Sun - Philadelphia Refinery COA

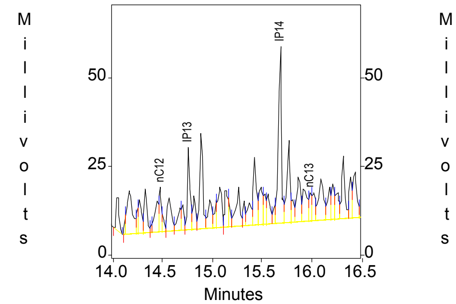
Sample ID : S-104

Acquired : Mar 05, 2004 20:59:40

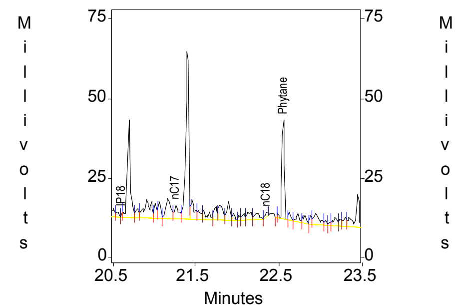
c:\ezchrom\chrom\04046\s-104 -- Channel A



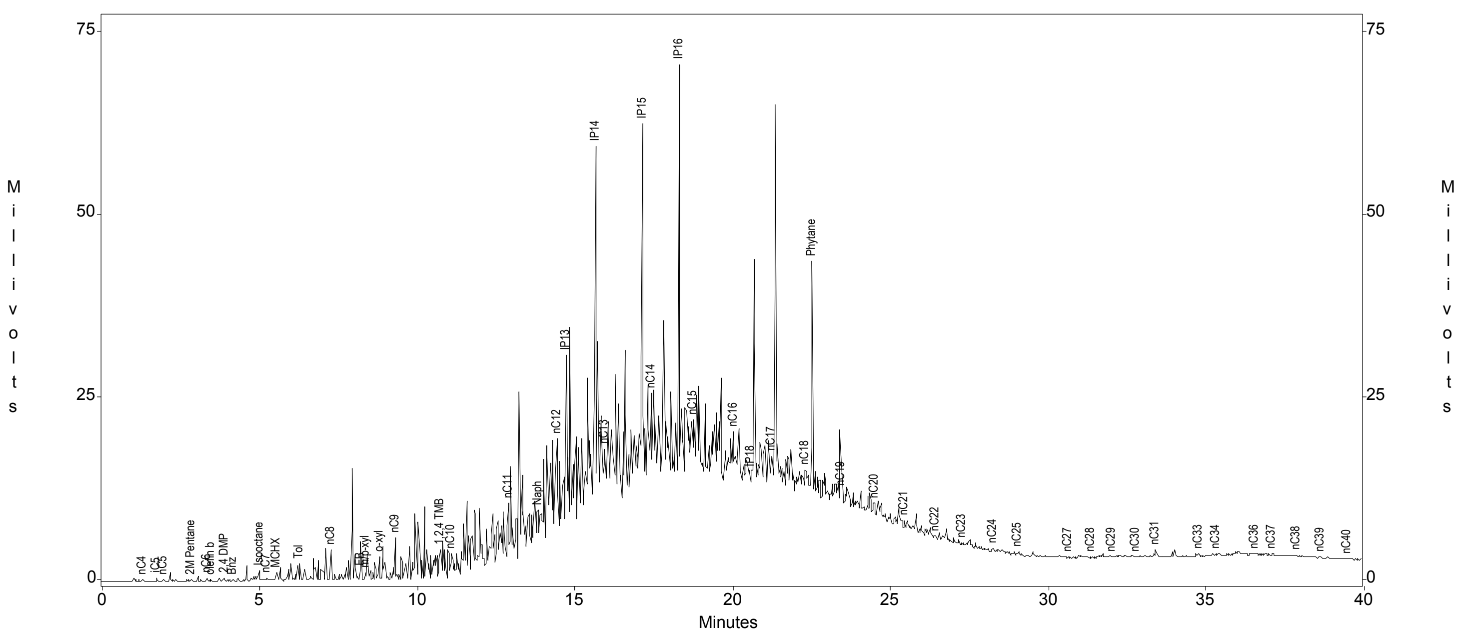
c:\ezchrom\chrom\04046\s-104 -- Channel A



c:\ezchrom\chrom\04046\s-104 -- Channel A



c:\ezchrom\chrom\04046\s-104 -- Channel A

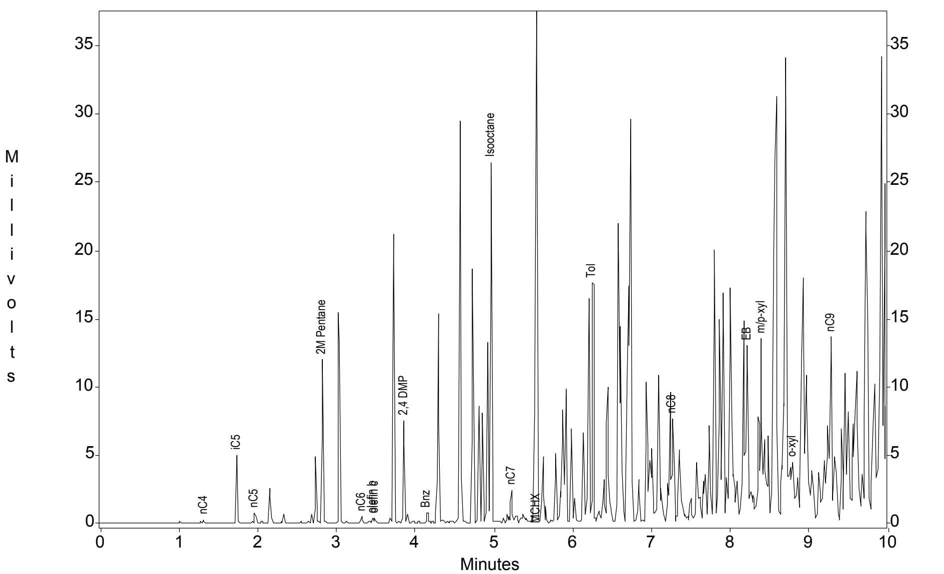


Channel A Results

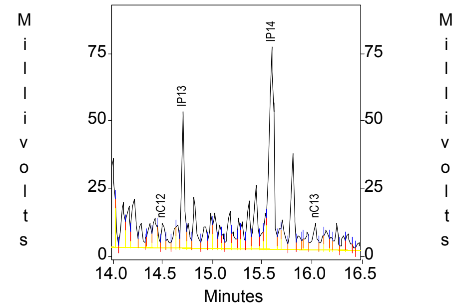
Peak	Area	Height
nC4	13	17
iC5	220	296
nC5	61	57
MTBE	0	0
2M Pentane	229	230
nC6	294	278
olefin a	0	0
olefin b	26	10
olefin c	0	0
2,4 DMP	471	439
Bnz	237	195
Isooctane	1528	1295
nC7	527	427
MCHX	1325	1023
Tol	2951	2362
nC8	6174	4105
EB	2036	1384
m/p-xyl	1511	1123
o-xyl	5978	3127
nC9	8780	5711
1,2,4 TMB	7829	3759
nC10	5368	3137
nC11	15205	7803
Naph	4334	3105
nC12	24966	12772
IP13	45824	23715
IP14	98127	50511
nC13	19421	8281
IP15	103879	50568
nC14	30309	13082
IP16	106856	56096
nC15	13511	4656
nC16	22457	6306
IP18	943	1568
nC17	14022	4174
Pristane	0	0
nC18	3004	1404
Phytane	68967	31157
nC19	4091	2017
nC20	6018	2090
nC21	2453	977
nC22	1740	334
nC23	1429	251
nC24	2404	432
nC25	3403	599
nC26	0	0
nC27	796	218
nC28	873	180
nC29	391	117
nC30	283	118
nC31	2057	660
nC32	0	0
nC33	1102	448
nC34	121	103
nC35	0	0
nC36	74	44
nC37	269	134
nC38	119	38
nC39	237	80
nC40	60	27

Sun - Philadelphia Refinery COA
Sample ID : S-117
Acquired : Mar 07, 2004 19:44:48

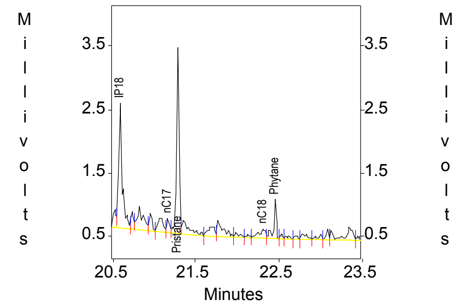
c:\ezchrom\chrom\04046\s-117 -- Channel A



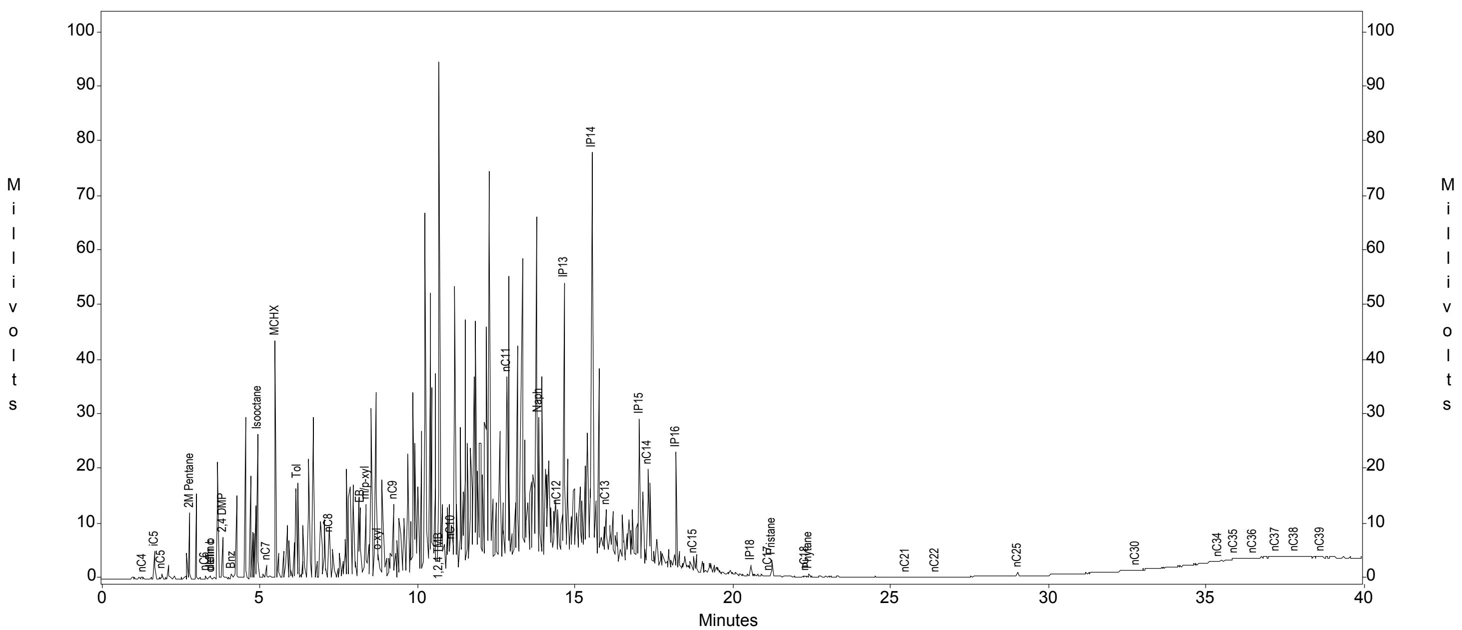
c:\ezchrom\chrom\04046\s-117 -- Channel A



c:\ezchrom\chrom\04046\s-117 -- Channel A



c:\ezchrom\chrom\04046\s-117 -- Channel A



Channel A Results

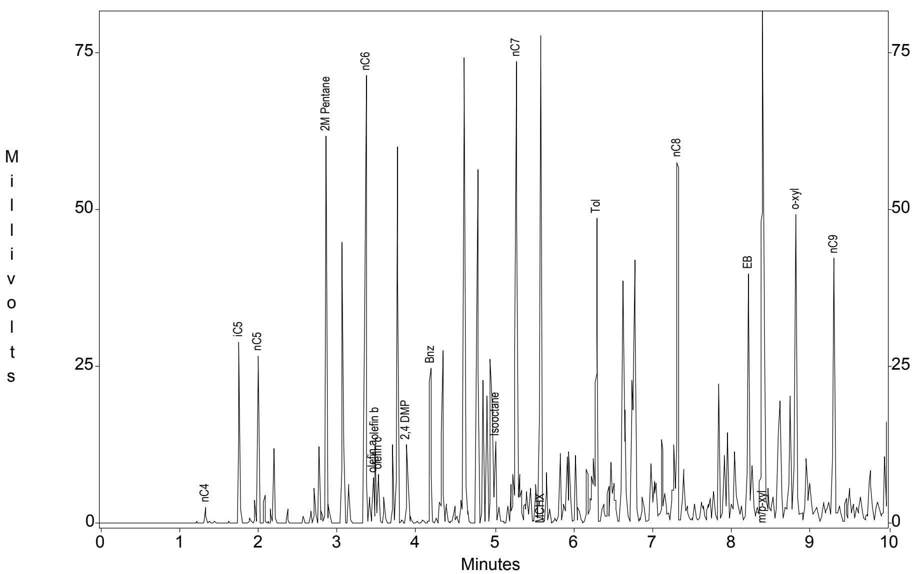
Peak	Area	Height
nC4	157	255
iC5	3649	4977
nC5	578	732
MTBE	0	0
2M Pentane	11007	11960
nC6	524	509
olefin a	0	0
olefin b	345	333
olefin c	357	292
2,4 DMP	8058	7511
Bnz	1108	762
Isooctane	31002	26334
nC7	3178	2360
MCHX	54988	43378
Tol	21987	17499
nC8	9620	7481
EB	22901	12812
m/p-xyl	18798	13227
o-xyl	7637	4163
nC9	20612	13387
1,2,4 TMB	210900	92993
nC10	8013	4380
nC11	64161	32875
Naph	41877	26211
nC12	23933	9636
IP13	92144	50902
IP14	228533	75358
nC13	31882	10043
IP15	50133	27067
nC14	35067	17997
IP16	39671	21509
nC15	5192	2488
nC16	0	0
IP18	5546	1975
nC17	415	211
Pristane	5954	2956
nC18	744	127
Phytane	1429	610
nC19	0	0
nC20	0	0
nC21	164	35
nC22	163	49
nC23	0	0
nC24	0	0
nC25	1560	817
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	302	59
nC31	0	0
nC32	0	0
nC33	0	0
nC34	487	112
nC35	559	106
nC36	191	71
nC37	174	54
nC38	98	59
nC39	170	73
nC40	0	0

Sun - Philadelphia Refinery COA

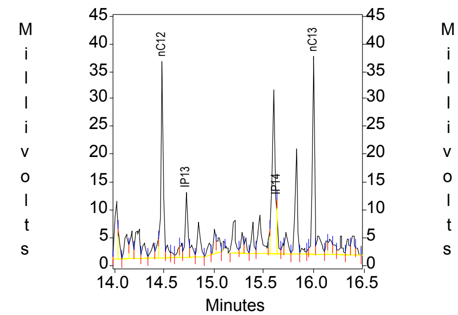
Sample ID : S-124

Acquired : Mar 07, 2004 08:06:00

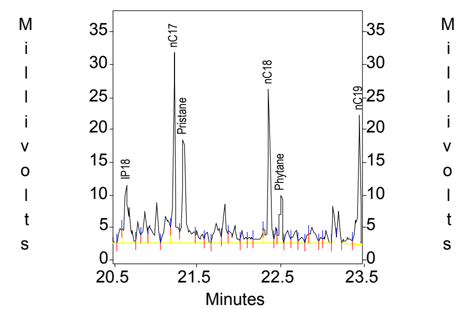
c:\ezchrom\chrom\04046\s-124 -- Channel A



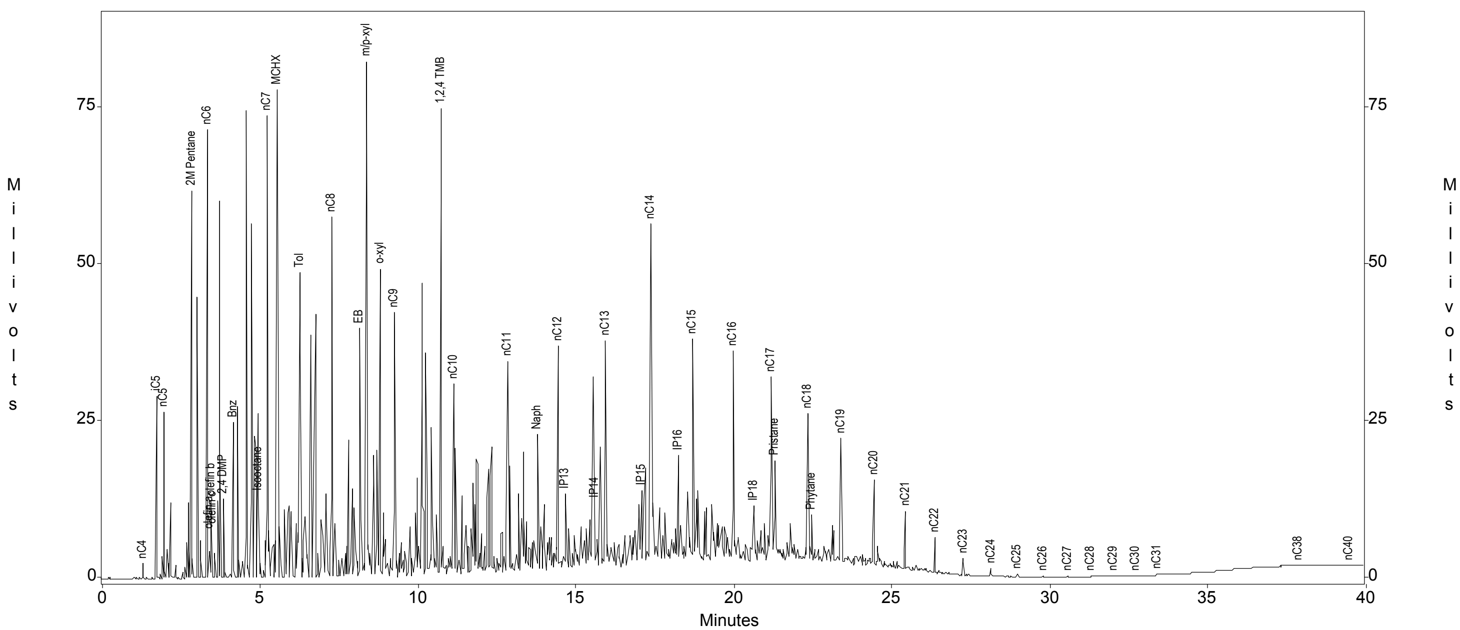
c:\ezchrom\chrom\04046\s-124 -- Channel A



c:\ezchrom\chrom\04046\s-124 -- Channel A



c:\ezchrom\chrom\04046\s-124 -- Channel A



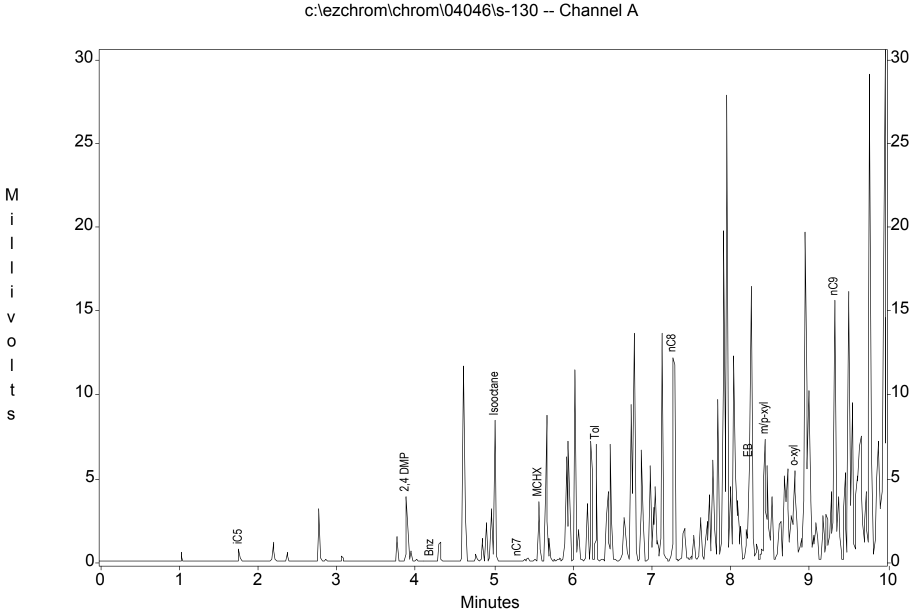
Channel A Results

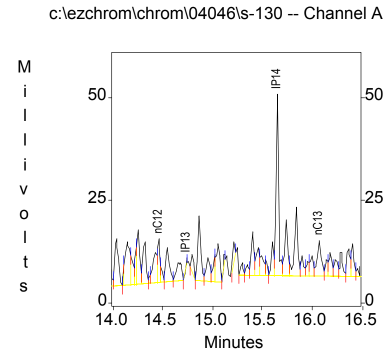
Peak	Area	Height
nC4	1481	2363
iC5	22116	28988
nC5	21684	26523
MTBE	0	0
2M Pentane	59269	61660
nC6	73300	71320
olefin a	8853	7174
olefin b	12672	12453
olefin c	8717	7766
2,4 DMP	14306	12545
Bnz	36651	24657
Isooctane	17208	13080
nC7	102092	73558
MCHX	106362	77654
Tol	70325	48613
nC8	78483	57308
EB	59856	39629
m/p-xyl	156078	81869
o-xyl	78009	48948
nC9	66931	42099
1,2,4 TMB	135615	74163
nC10	45361	30339
nC11	49003	33375
Naph	34181	21560
nC12	57113	35482
IP13	20129	11719
IP14	8237	10037
nC13	57251	35861
IP15	24156	11484
nC14	104221	53660
IP16	26967	16035
nC15	60990	34554
nC16	67176	33276
IP18	32726	8783
nC17	54728	29335
Pristane	47405	15899
nC18	44168	23525
Phytane	15393	7388
nC19	41994	19812
nC20	24360	13421
nC21	15385	9333
nC22	9234	5620
nC23	4268	2747
nC24	1914	1201
nC25	923	541
nC26	481	278
nC27	329	145
nC28	150	82
nC29	85	46
nC30	92	30
nC31	106	29
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	82	16
nC39	0	0
nC40	127	14

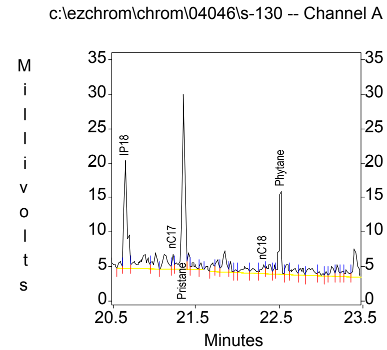
Sun - Philadelphia Refinery COA

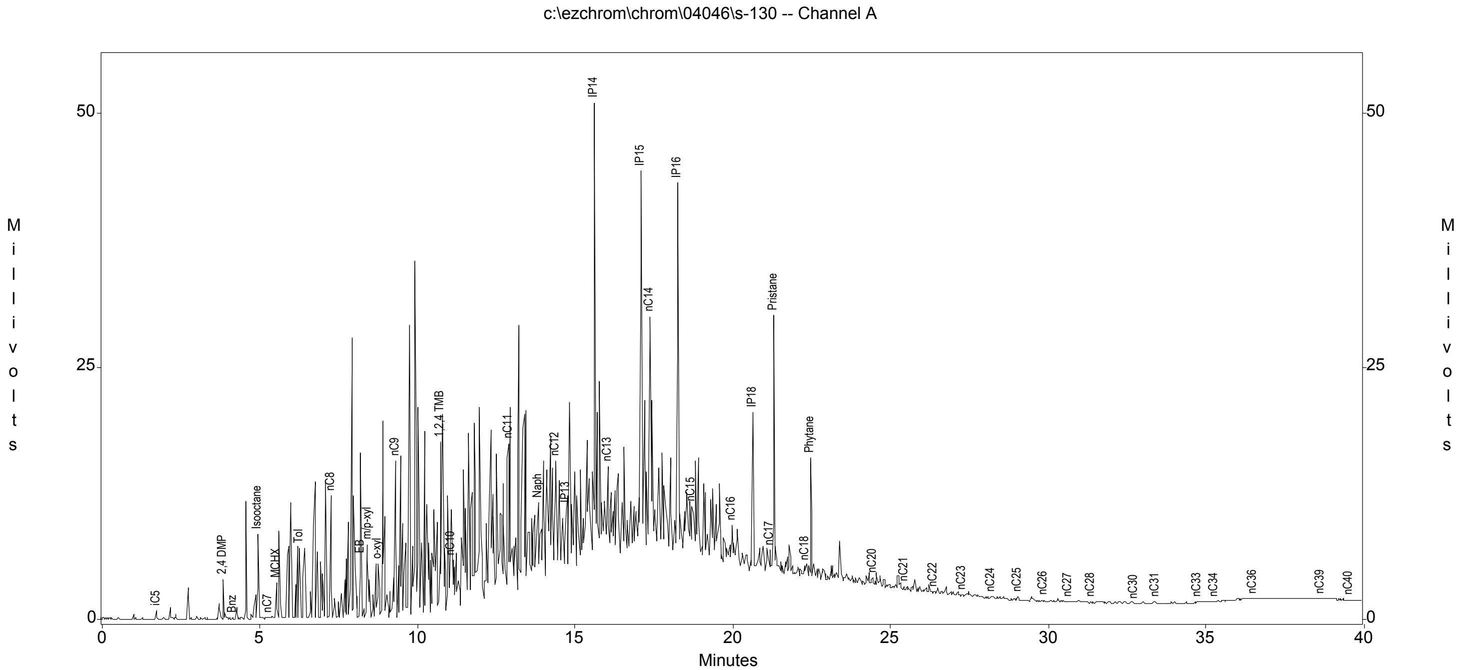
Sample ID : S-130

Acquired : Mar 06, 2004 15:34:08







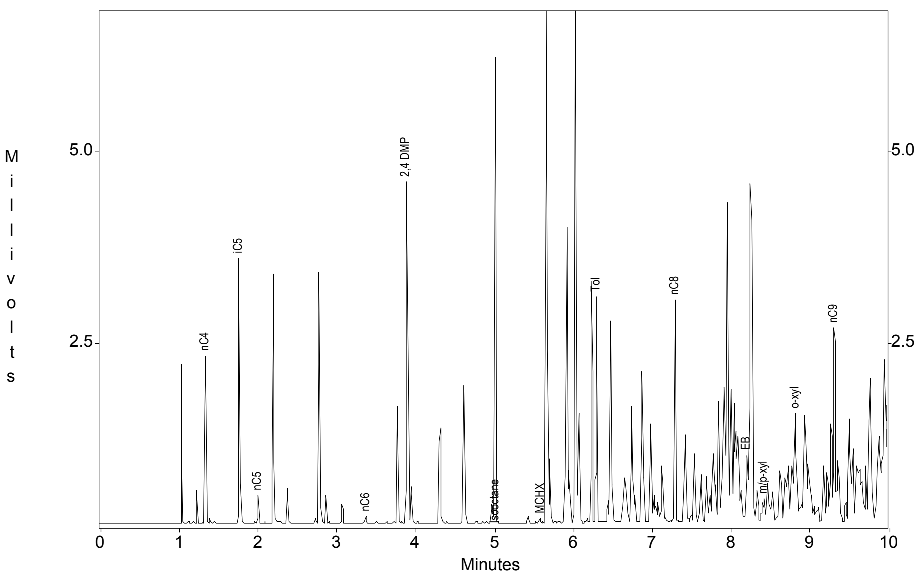


Channel A Results

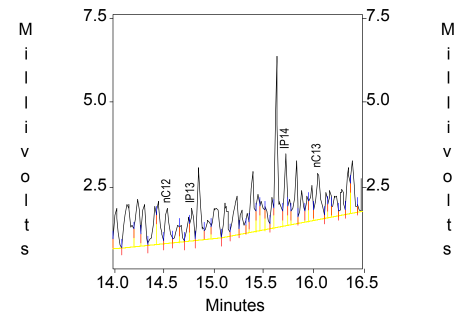
Peak	Area	Height
nC4	0	0
iC5	574	718
nC5	0	0
MTBE	0	0
2M Pentane	0	0
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	4089	3864
Bnz	20	13
Isooctane	9803	8339
nC7	42	15
MCHX	4471	3495
Tol	8541	6966
nC8	16962	12072
EB	4258	5831
m/p-xyl	9800	7241
o-xyl	8447	5334
nC9	23933	15468
1,2,4 TMB	33041	16711
nC10	5686	4045
nC11	32386	14801
Naph	13172	7628
nC12	19757	10652
IP13	3071	2880
IP14	77861	44312
nC13	24780	8625
IP15	71379	37965
nC14	47895	23489
IP16	66194	36600
nC15	16928	4550
nC16	7663	3198
IP18	39506	15586
nC17	4185	2233
Pristane	55441	25462
nC18	3697	1207
Phytane	24156	11966
nC19	0	0
nC20	2745	902
nC21	892	380
nC22	1141	190
nC23	736	189
nC24	2042	319
nC25	2650	396
nC26	1309	240
nC27	355	138
nC28	551	101
nC29	0	0
nC30	153	67
nC31	1378	256
nC32	0	0
nC33	761	161
nC34	54	35
nC35	0	0
nC36	23	16
nC37	0	0
nC38	0	0
nC39	26	11
nC40	43	13

Sun - Philadelphia Refinery COA
Sample ID : S-138
Acquired : Mar 06, 2004 16:23:12

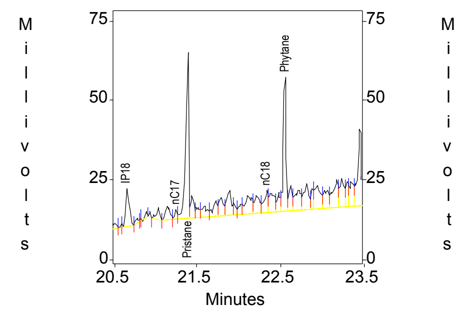
c:\ezchrom\chrom\04046\s-138 -- Channel A



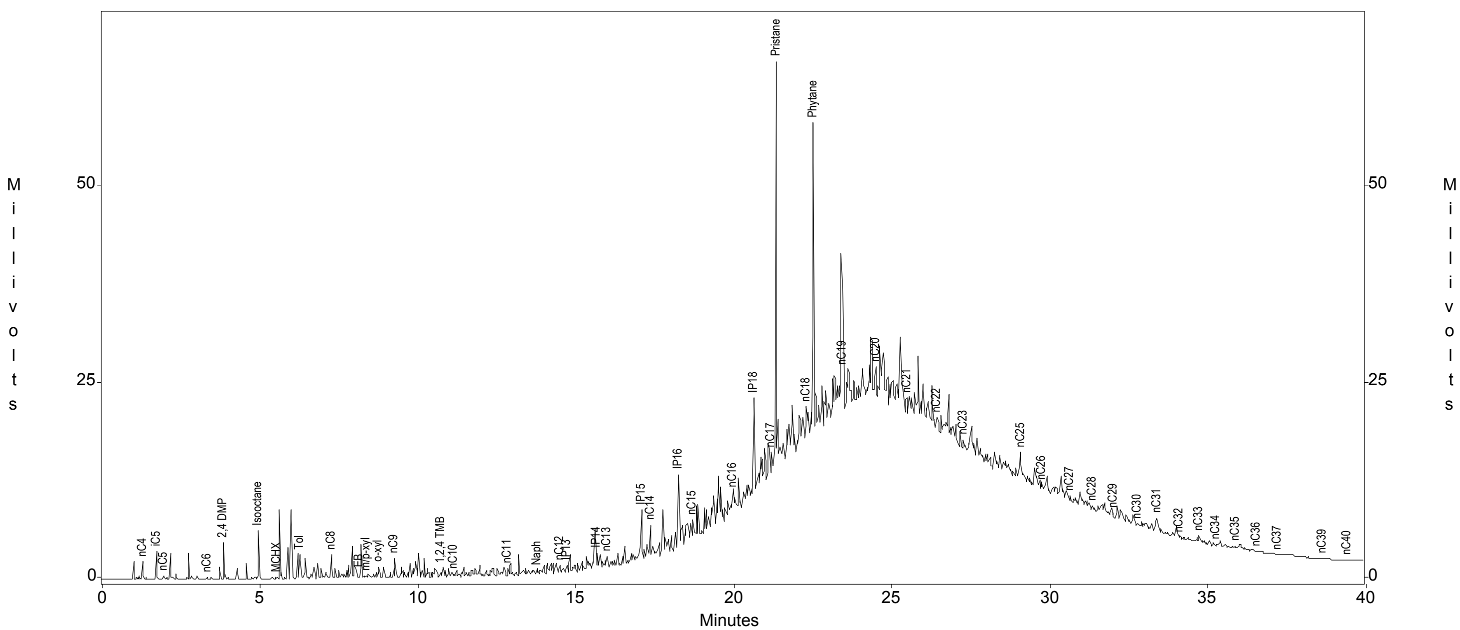
c:\ezchrom\chrom\04046\s-138 -- Channel A



c:\ezchrom\chrom\04046\s-138 -- Channel A



c:\ezchrom\chrom\04046\s-138 -- Channel A



Channel A Results

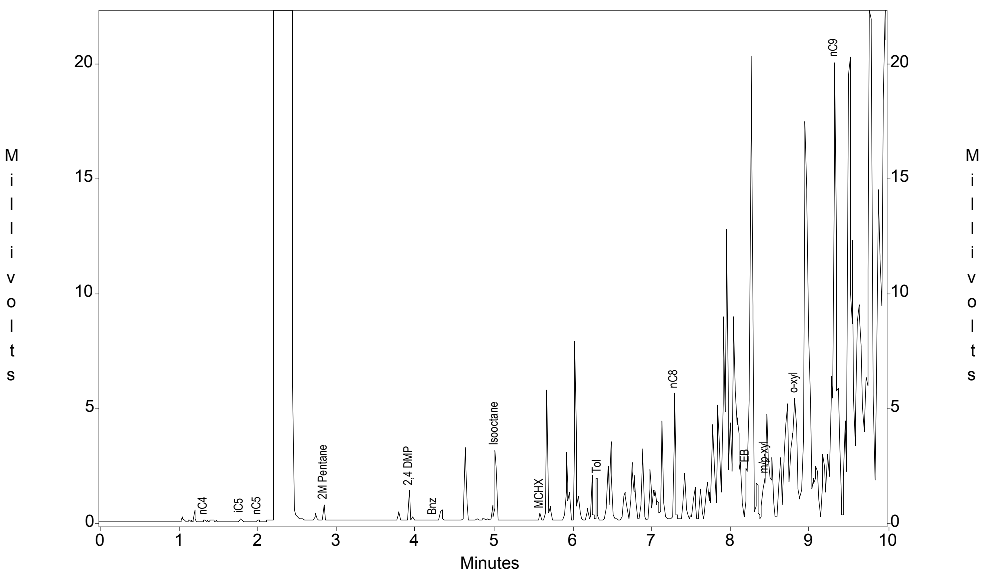
Peak	Area	Height
nC4	1359	2166
iC5	2556	3446
nC5	277	346
MTBE	0	0
2M Pentane	0	0
nC6	79	77
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	4666	4445
Bnz	0	0
Isooctane	7057	6067
nC7	0	0
MCHX	90	70
Tol	3656	2940
nC8	3837	2902
EB	1331	861
m/p-xyl	434	292
o-xyl	2892	1404
nC9	3920	2517
1,2,4 TMB	2078	1080
nC10	746	429
nC11	1894	953
Naph	917	532
nC12	3161	1048
IP13	1625	952
IP14	4226	2114
nC13	4426	1389
IP15	13022	6375
nC14	5862	3698
IP16	18093	9301
nC15	6872	2570
nC16	13571	2938
IP18	31891	11836
nC17	6803	3259
Pristane	132168	52449
nC18	25091	6969
Phytane	108595	42478
nC19	16819	9378
nC20	44531	7840
nC21	6123	2112
nC22	1510	1246
nC23	3357	1344
nC24	0	0
nC25	18504	3499
nC26	1835	645
nC27	1874	674
nC28	2350	458
nC29	632	273
nC30	1328	377
nC31	2705	1016
nC32	597	104
nC33	2169	749
nC34	287	140
nC35	422	156
nC36	90	59
nC37	91	36
nC38	0	0
nC39	92	24
nC40	57	28

Sun - Philadelphia Refinery COA

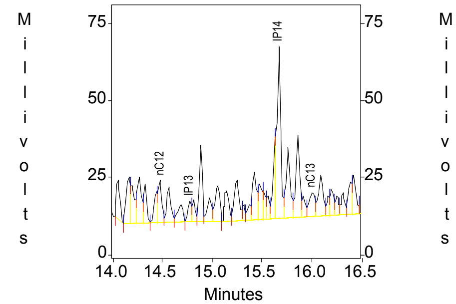
Sample ID : S-142 Pad

Acquired : Mar 09, 2004 15:49:23

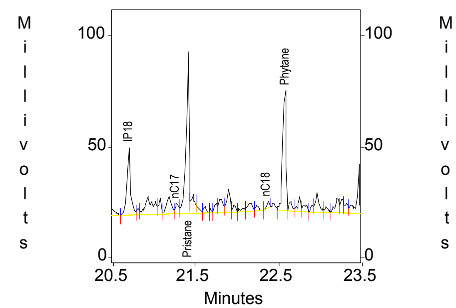
c:\ezchrom\chrom\04046\s-142pad -- Channel A



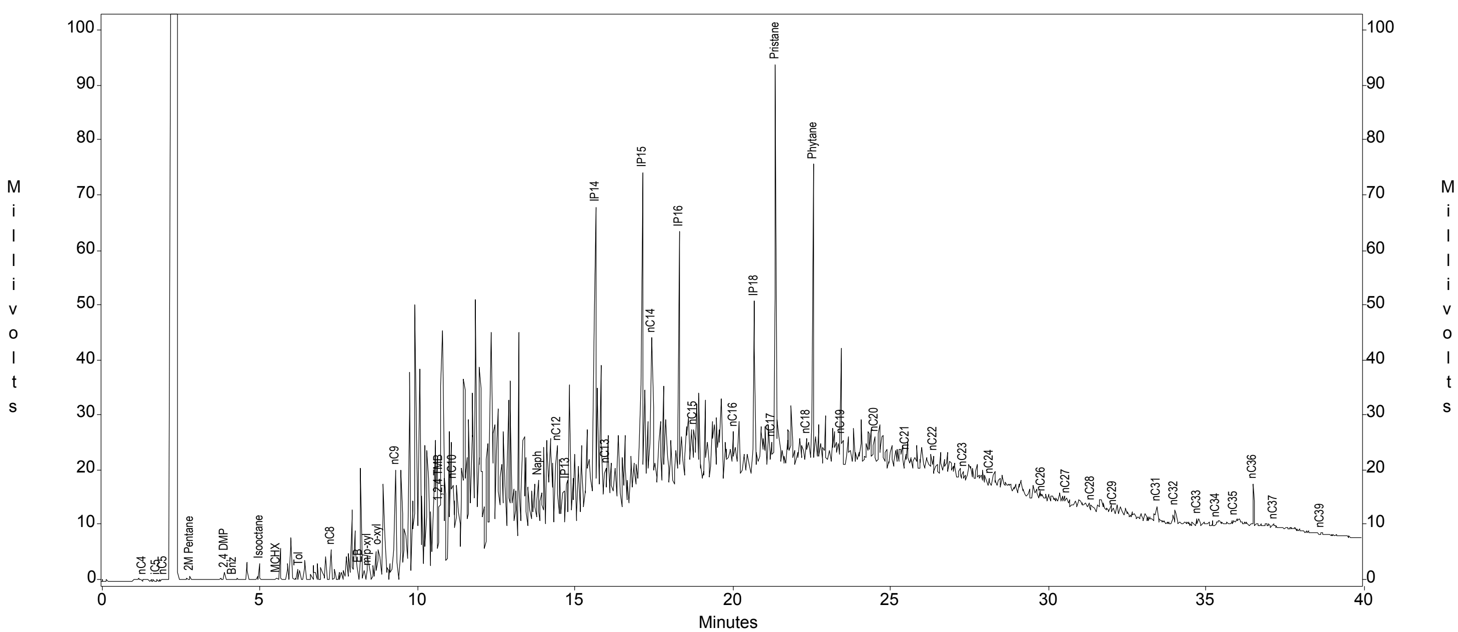
c:\ezchrom\chrom\04046\s-142pad -- Channel A



c:\ezchrom\chrom\04046\s-142pad -- Channel A



c:\ezchrom\chrom\04046\s-142pad -- Channel A

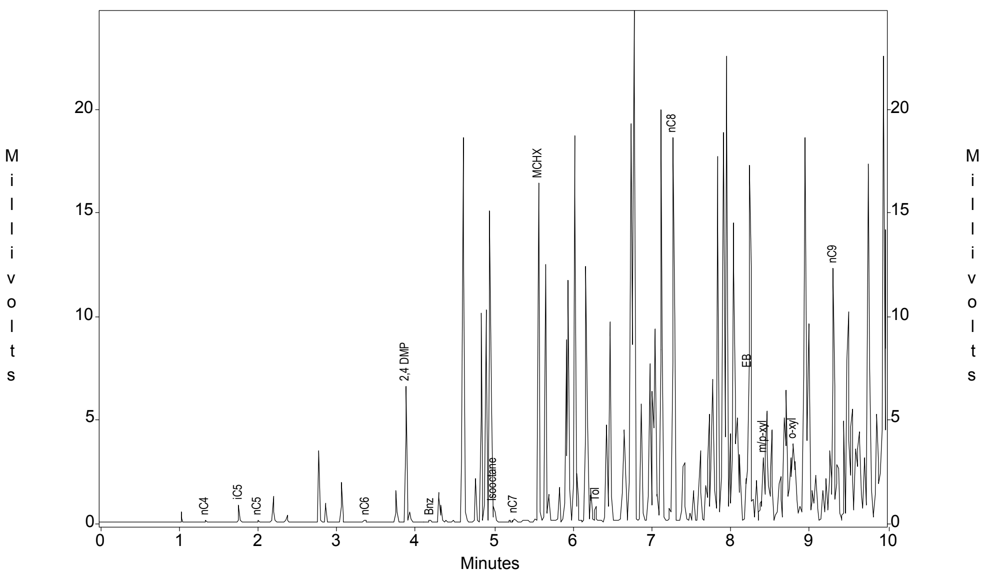


Channel A Results

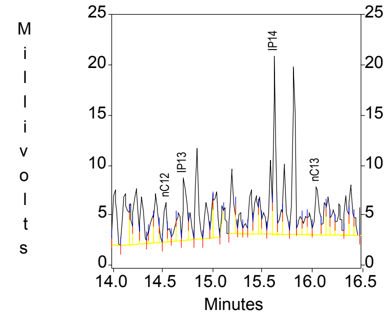
Peak	Area	Height
nC4	51	29
iC5	119	126
nC5	117	52
MTBE	0	0
2M Pentane	799	714
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	1528	1348
Bnz	35	16
Isooctane	3965	3090
nC7	0	0
MCHX	518	334
Tol	2630	1833
nC8	9291	5494
EB	2919	2147
m/p-xyl	3322	1701
o-xyl	10133	5193
nC9	41973	19815
1,2,4 TMB	24771	10691
nC10	22404	13900
nC11	0	0
Naph	14322	7497
nC12	36282	13953
IP13	17741	6885
IP14	126781	56096
nC13	33727	7761
IP15	169061	59634
nC14	93984	28942
IP16	108921	46497
nC15	46271	9494
nC16	17341	5928
IP18	94854	31111
nC17	13334	5006
Pristane	209322	73362
nC18	5853	2568
Phytane	141884	53794
nC19	12073	5067
nC20	22836	6508
nC21	9442	4248
nC22	15036	4795
nC23	10744	2853
nC24	11316	2149
nC25	0	0
nC26	2403	502
nC27	3863	1335
nC28	3603	1250
nC29	681	231
nC30	0	0
nC31	6325	2048
nC32	5910	2340
nC33	2177	1078
nC34	917	459
nC35	774	426
nC36	15357	7296
nC37	1632	444
nC38	0	0
nC39	692	130
nC40	0	0

Sun - Philadelphia Refinery COA
Sample ID : S-158
Acquired : Mar 07, 2004 21:21:22

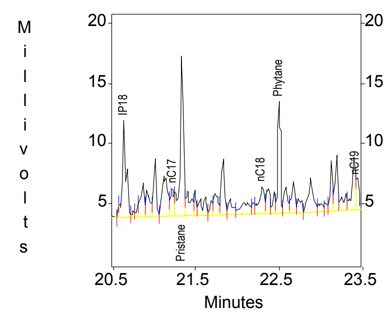
c:\ezchrom\chrom\04046\s-158 -- Channel A



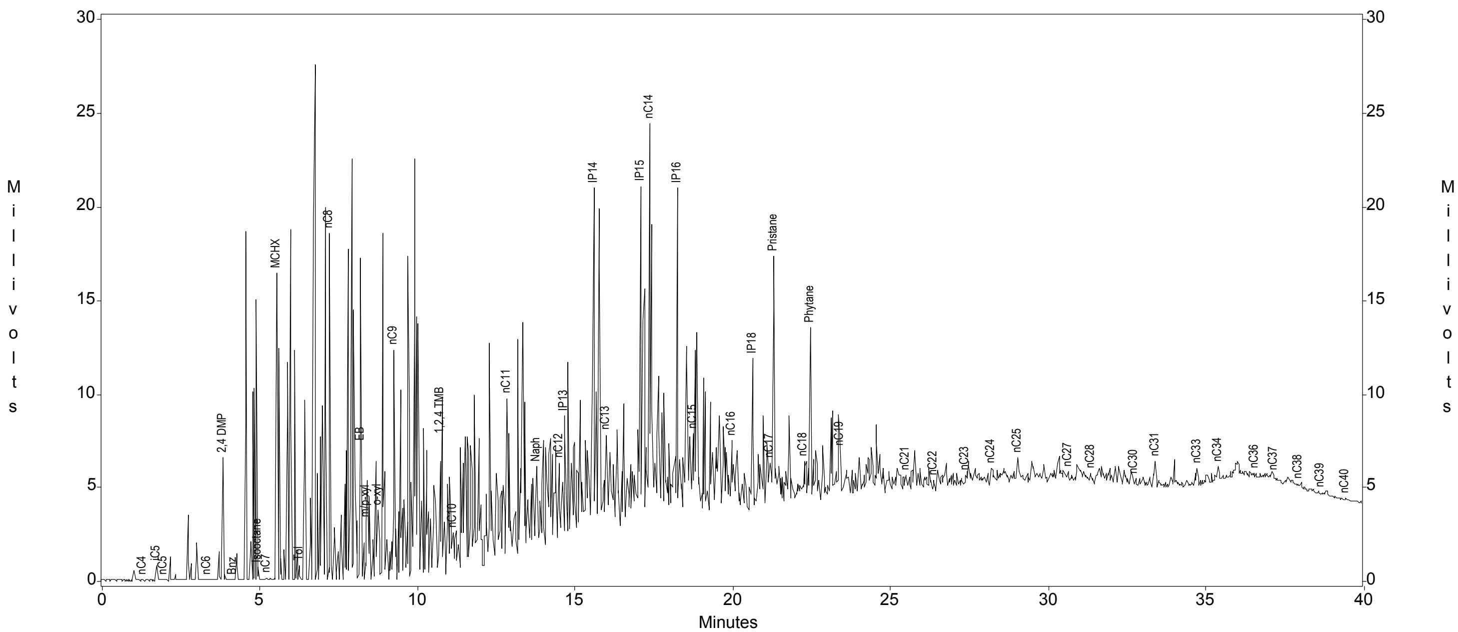
c:\ezchrom\chrom\04046\s-158 -- Channel A



c:\ezchrom\chrom\04046\s-158 -- Channel A



c:\ezchrom\chrom\04046\s-158 -- Channel A

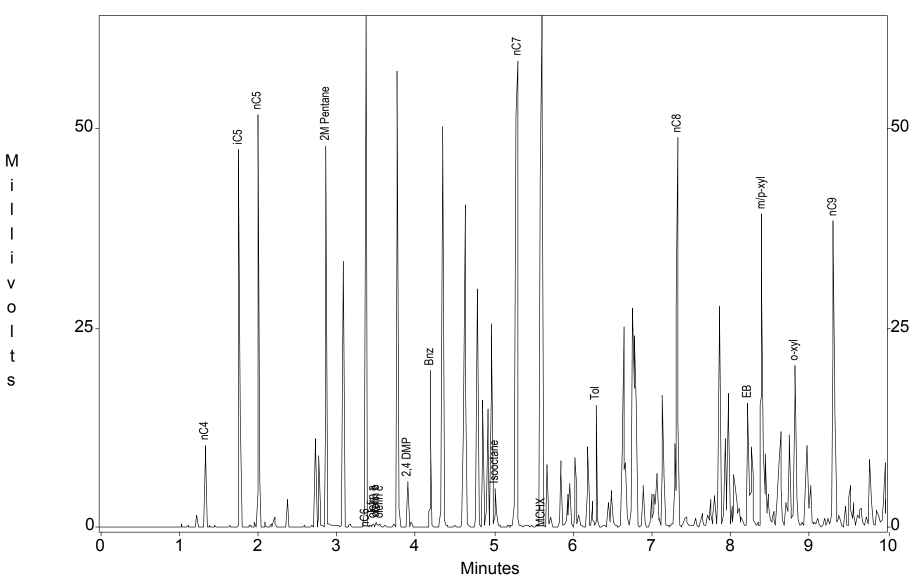


Channel A Results

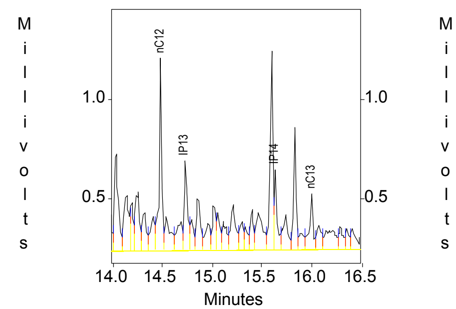
Peak	Area	Height
nC4	52	59
iC5	600	815
nC5	34	38
MTBE	0	0
2M Pentane	0	0
nC6	68	62
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	6984	6522
Bnz	101	60
Isooctane	927	711
nC7	218	109
MCHX	20666	16311
Tol	958	728
nC8	25535	18476
EB	6026	7128
m/p-xyl	4168	3031
o-xyl	5474	3696
nC9	18361	12184
1,2,4 TMB	14010	6586
nC10	3217	1997
nC11	13546	7943
Naph	6455	3987
nC12	8848	3955
IP13	13508	6289
IP14	27015	17790
nC13	15328	4752
IP15	34466	17620
nC14	44518	20726
IP16	26763	16410
nC15	12509	3758
nC16	9035	3485
IP18	24849	8069
nC17	5987	2326
Pristane	36889	13360
nC18	8389	2175
Phytane	19784	9230
nC19	5130	2418
nC20	0	0
nC21	2963	707
nC22	2686	535
nC23	1819	535
nC24	4740	880
nC25	9260	1321
nC26	0	0
nC27	2192	630
nC28	2893	498
nC29	0	0
nC30	902	275
nC31	3552	1041
nC32	0	0
nC33	2181	780
nC34	3029	687
nC35	0	0
nC36	135	114
nC37	128	142
nC38	108	70
nC39	135	58
nC40	211	69

Sun - Philadelphia Refinery COA
Sample ID : S-162
Acquired : Mar 06, 2004 08:11:34

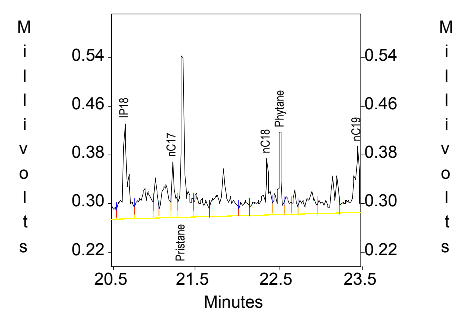
c:\ezchrom\chrom\04046\s-162 -- Channel A



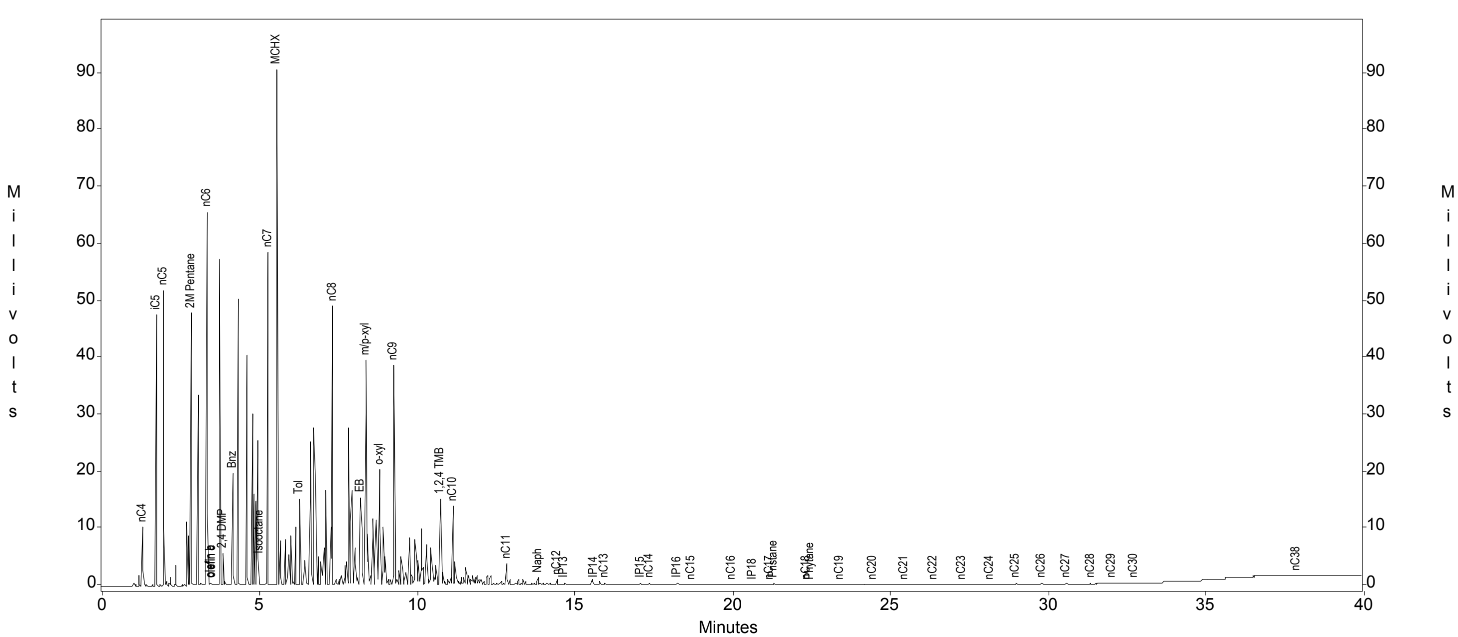
c:\ezchrom\chrom\04046\s-162 -- Channel A



c:\ezchrom\chrom\04046\s-162 -- Channel A



c:\ezchrom\chrom\04046\s-162 -- Channel A



Channel A Results

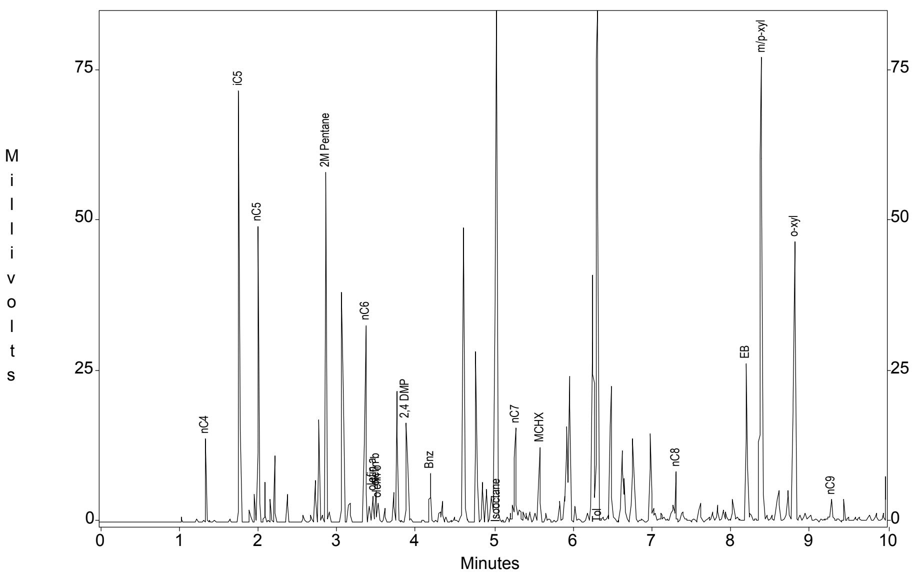
Peak	Area	Height
nC4	6689	10250
iC5	35189	47437
nC5	40255	51781
MTBE	0	0
2M Pentane	44611	47892
nC6	65068	65519
olefin a	481	376
olefin b	525	512
olefin c	414	355
2,4 DMP	5980	5568
Bnz	21292	19558
Isooctane	5487	4701
nC7	72745	58495
MCHX	126835	90442
Tol	19460	15165
nC8	65673	48903
EB	21225	15453
m/p-xyl	60293	39434
o-xyl	30497	20210
nC9	61627	38546
1,2,4 TMB	24836	15001
nC10	19333	13734
nC11	5475	3893
Naph	2267	1221
nC12	1759	959
IP13	910	450
IP14	705	402
nC13	661	279
IP15	690	345
nC14	888	431
IP16	1055	334
nC15	645	108
nC16	411	105
IP18	632	157
nC17	264	91
Pristane	800	266
nC18	467	92
Phytane	398	136
nC19	562	107
nC20	270	84
nC21	164	78
nC22	171	84
nC23	211	115
nC24	341	175
nC25	399	219
nC26	393	218
nC27	353	148
nC28	199	98
nC29	113	41
nC30	125	24
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	66	10
nC39	0	0
nC40	0	0

Sun - Philadelphia Refinery COA

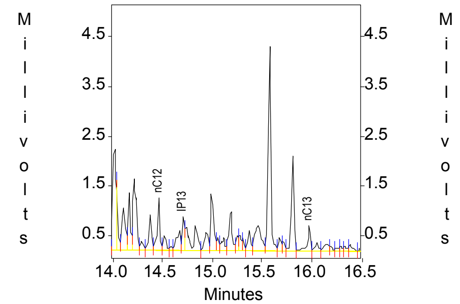
Sample ID : SRTF MW-1

Acquired : Mar 08, 2004 15:57:18

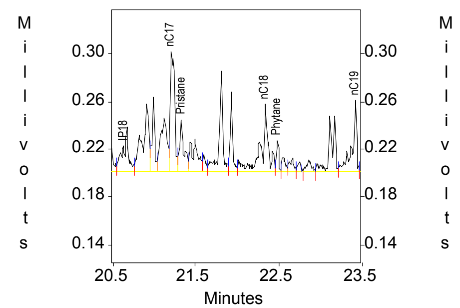
c:\ezchrom\chrom\04046\srtfmw1 -- Channel A



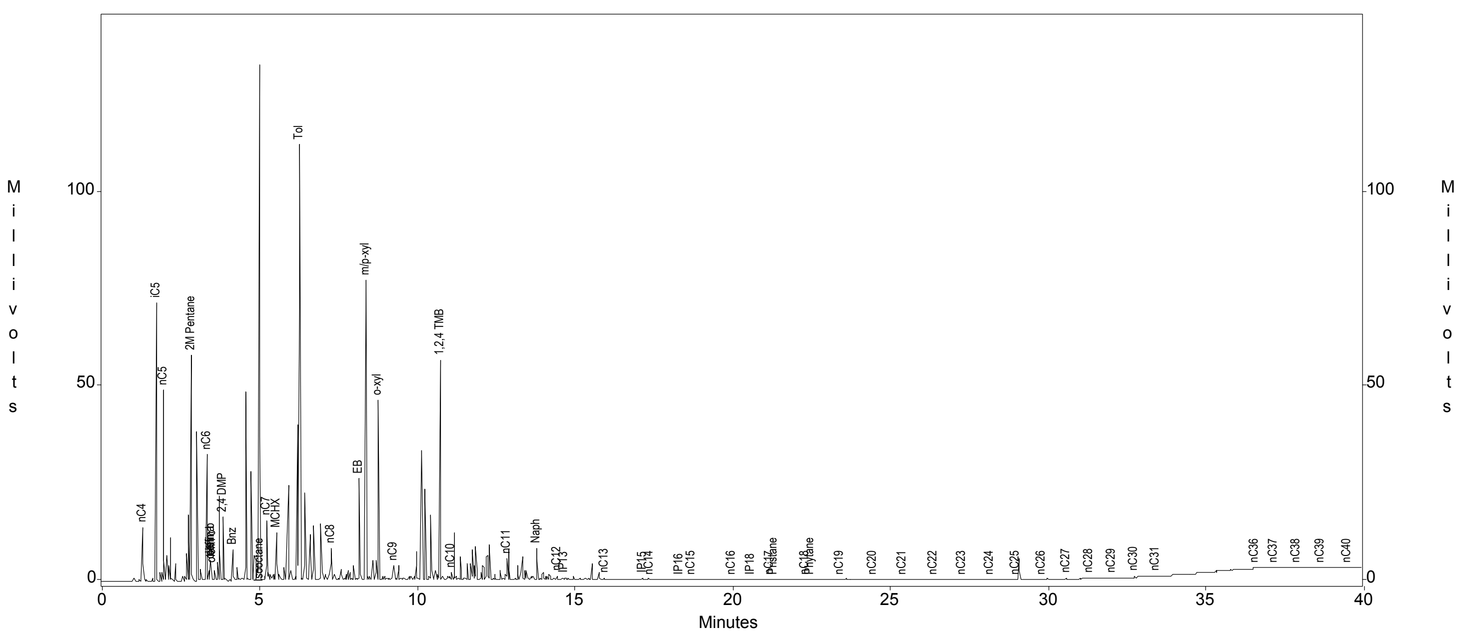
c:\ezchrom\chrom\04046\srtfmw1 -- Channel A



c:\ezchrom\chrom\04046\srtfmw1 -- Channel A



c:\ezchrom\chrom\04046\srtfmw1 -- Channel A

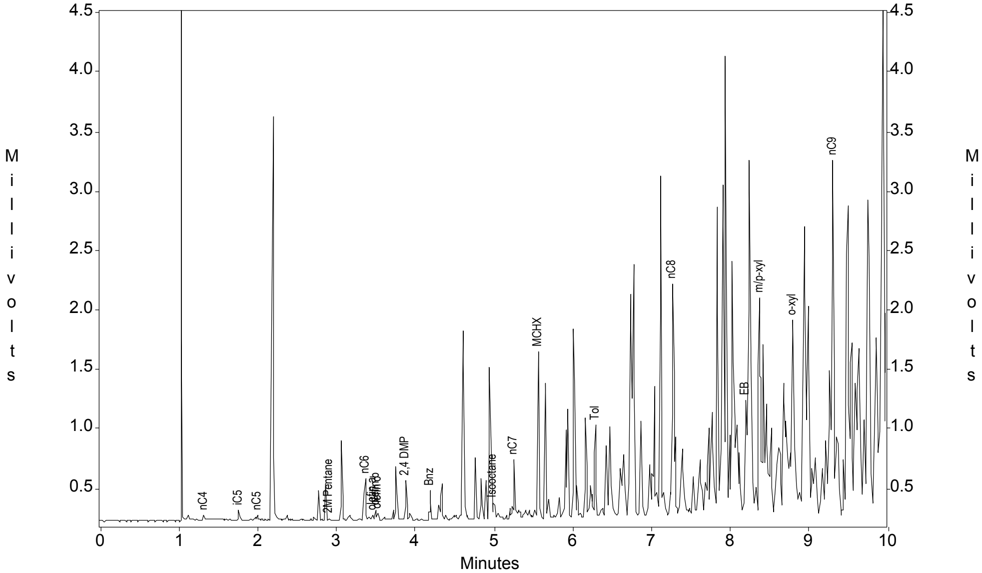


Channel A Results

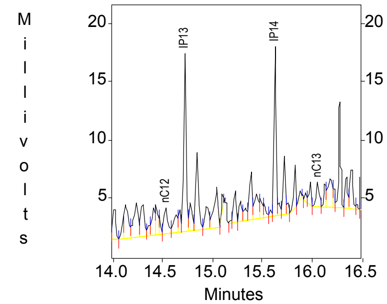
Peak	Area	Height
nC4	9564	13860
iC5	55333	71539
nC5	38959	49065
MTBE	0	0
2M Pentane	53997	58104
nC6	32840	32656
olefin a	5049	4269
olefin b	4975	4988
olefin c	3739	3243
2,4 DMP	18144	16541
Bnz	11446	7933
Isooctane	205290	132762
nC7	19572	15656
MCHX	16022	12475
Tol	193036	112111
nC8	10330	8259
EB	35403	26164
m/p-xyl	143263	77188
o-xyl	69450	46423
nC9	5305	3600
1,2,4 TMB	89849	56478
nC10	2487	1940
nC11	8515	5480
Naph	14461	8355
nC12	1867	1056
IP13	1026	659
IP14	0	0
nC13	1045	494
IP15	193	157
nC14	595	311
IP16	160	64
nC15	288	110
nC16	371	86
IP18	165	22
nC17	385	101
Pristane	151	43
nC18	342	57
Phytane	58	27
nC19	215	59
nC20	225	40
nC21	89	44
nC22	109	51
nC23	136	61
nC24	192	73
nC25	256	133
nC26	240	90
nC27	311	97
nC28	150	69
nC29	203	76
nC30	89	38
nC31	209	53
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	1404	43
nC37	532	44
nC38	50	19
nC39	284	46
nC40	47	24

Sun - Philadelphia Refinery COA
Sample ID : West Yard W8
Acquired : Mar 07, 2004 08:54:39

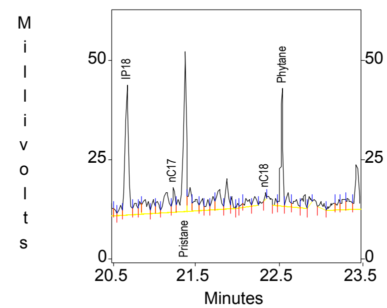
c:\ezchrom\chrom\04046\wyw8 -- Channel A



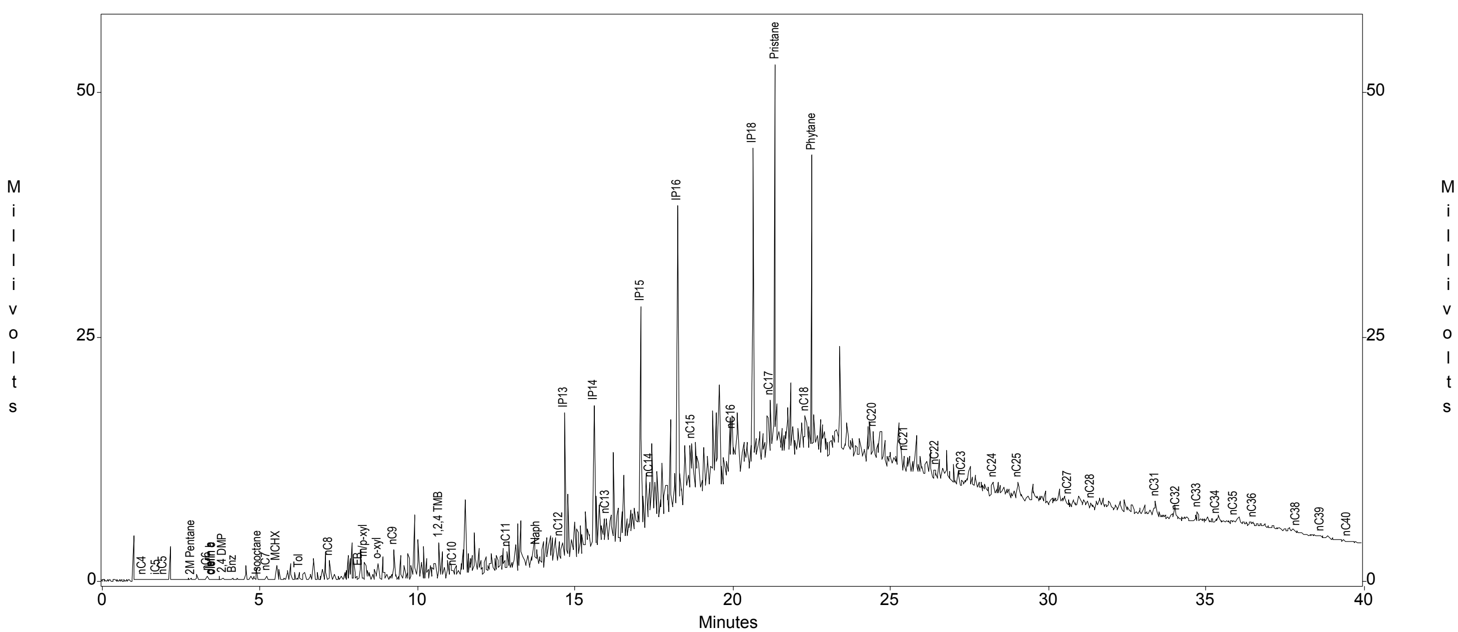
c:\ezchrom\chrom\04046\wyw8 -- Channel A



c:\ezchrom\chrom\04046\wyw8 -- Channel A



c:\ezchrom\chrom\04046\wyw8 -- Channel A

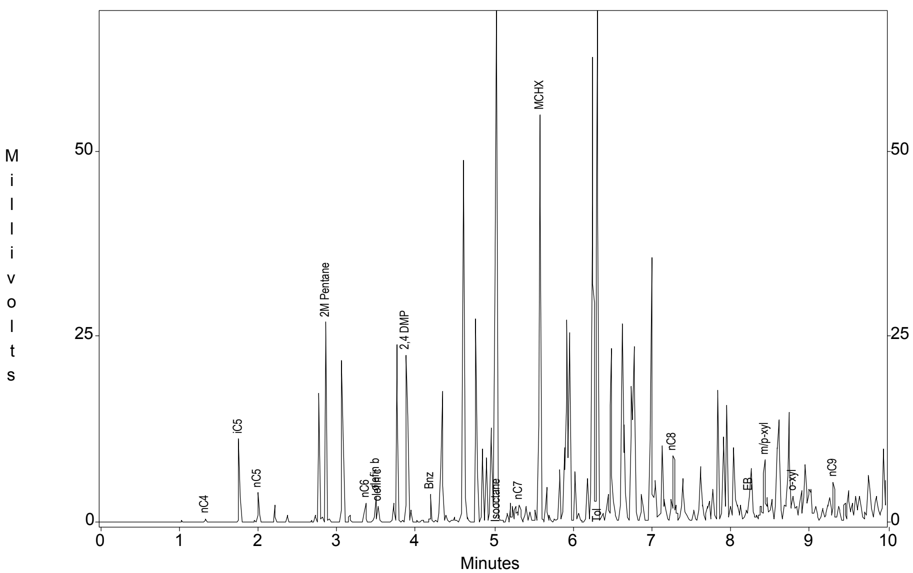


Channel A Results

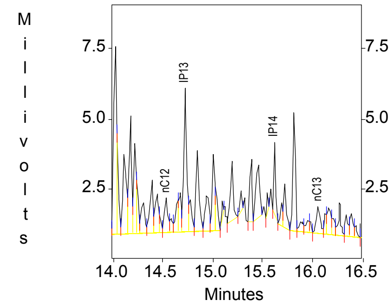
Peak	Area	Height
nC4	85	38
iC5	85	87
nC5	48	34
MTBE	0	0
2M Pentane	20	17
nC6	372	351
olefin a	61	46
olefin b	89	79
olefin c	69	52
2,4 DMP	416	333
Bnz	347	242
Isooctane	215	139
nC7	665	497
MCHX	1808	1410
Tol	1069	791
nC8	3217	1967
EB	1578	975
m/p-xyl	2602	1833
o-xyl	3282	1641
nC9	4621	2989
1,2,4 TMB	6250	3329
nC10	1082	708
nC11	4258	2161
Naph	4325	1661
nC12	6509	2239
IP13	23661	15231
IP14	21139	14532
nC13	4862	2151
IP15	37066	22909
nC14	10084	4287
IP16	57078	30928
nC15	17857	5345
nC16	29379	4704
IP18	82764	33089
nC17	12805	6468
Pristane	104693	40629
nC18	2009	1689
Phytane	66616	30095
nC19	0	0
nC20	13675	3235
nC21	3774	1540
nC22	513	0
nC23	2965	632
nC24	7841	1449
nC25	13049	1846
nC26	0	0
nC27	1177	660
nC28	875	469
nC29	0	0
nC30	0	0
nC31	2456	1062
nC32	200	50
nC33	2256	908
nC34	506	264
nC35	652	189
nC36	173	118
nC37	0	0
nC38	65	58
nC39	198	82
nC40	118	43

Sun - Philadelphia Refinery COA
Sample ID : WP 9-2
Acquired : Mar 08, 2004 07:50:05

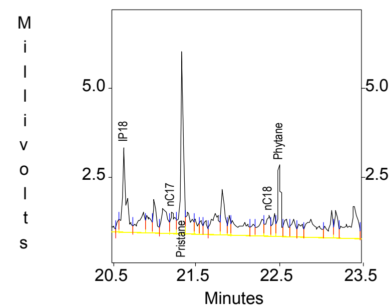
c:\ezchrom\chrom\04046\wp-9-2 -- Channel A



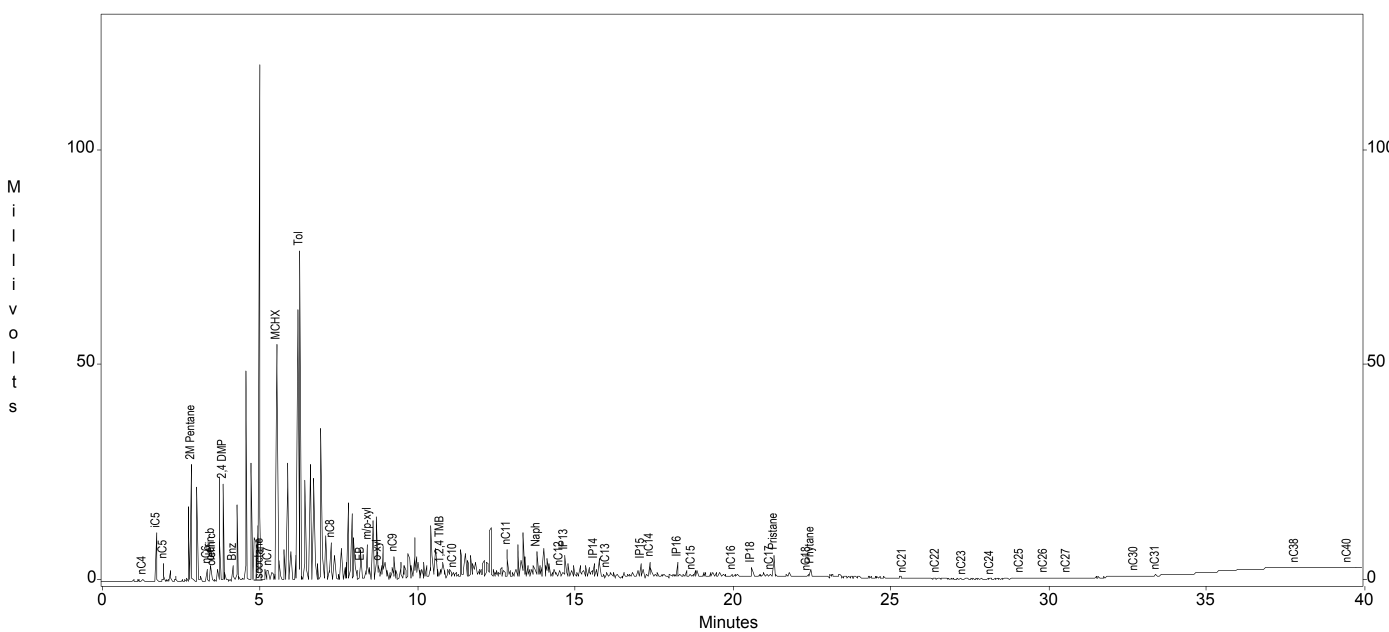
c:\ezchrom\chrom\04046\wp-9-2 -- Channel A



c:\ezchrom\chrom\04046\wp-9-2 -- Channel A



c:\ezchrom\chrom\04046\wp-9-2 -- Channel A



Channel A Results

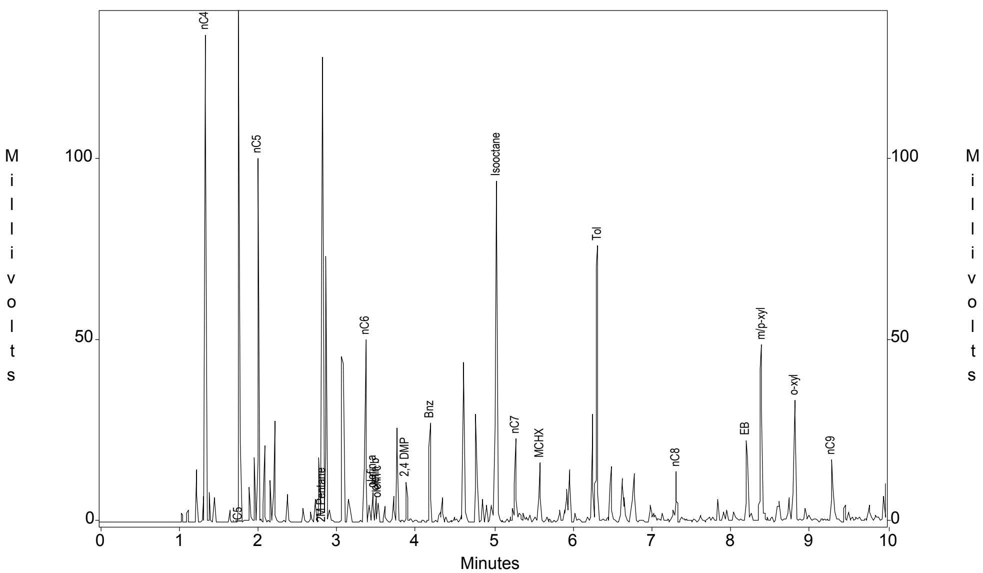
Peak	Area	Height
nC4	246	313
iC5	9460	11309
nC5	3546	3923
MTBE	0	0
2M Pentane	26392	27034
nC6	2843	2590
olefin a	0	0
olefin b	3614	3505
olefin c	2434	2029
2,4 DMP	24525	22423
Bnz	4570	3631
Isooctane	175569	119655
nC7	2700	2312
MCHX	70616	54792
Tol	107068	76371
nC8	12550	8771
EB	3188	3296
m/p-xyl	11455	8206
o-xyl	7717	3242
nC9	8201	5135
1,2,4 TMB	6104	2544
nC10	4706	1606
nC11	11357	6650
Naph	12152	6077
nC12	2777	1227
IP13	9374	5043
IP14	3268	2598
nC13	2665	963
IP15	5202	2982
nC14	6984	3632
IP16	5921	3592
nC15	2381	538
nC16	3582	798
IP18	7706	2392
nC17	2580	645
Pristane	11209	5172
nC18	2179	572
Phytane	4932	2050
nC19	0	0
nC20	0	0
nC21	864	159
nC22	445	124
nC23	64	34
nC24	215	29
nC25	411	61
nC26	102	38
nC27	437	43
nC28	0	0
nC29	0	0
nC30	70	29
nC31	933	75
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	25	6
nC39	0	0
nC40	132	16

Sun - Philadelphia Refinery COA

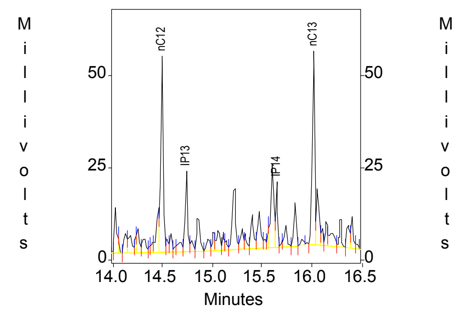
Sample ID : Gas/Dies/Wax std

Acquired : Mar 05, 2004 10:14:50

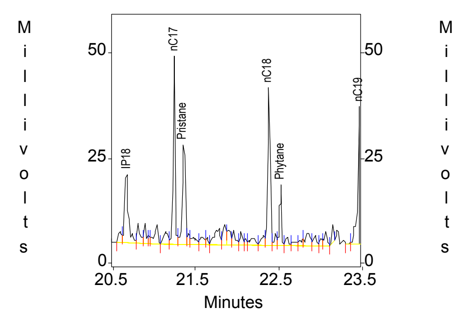
c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



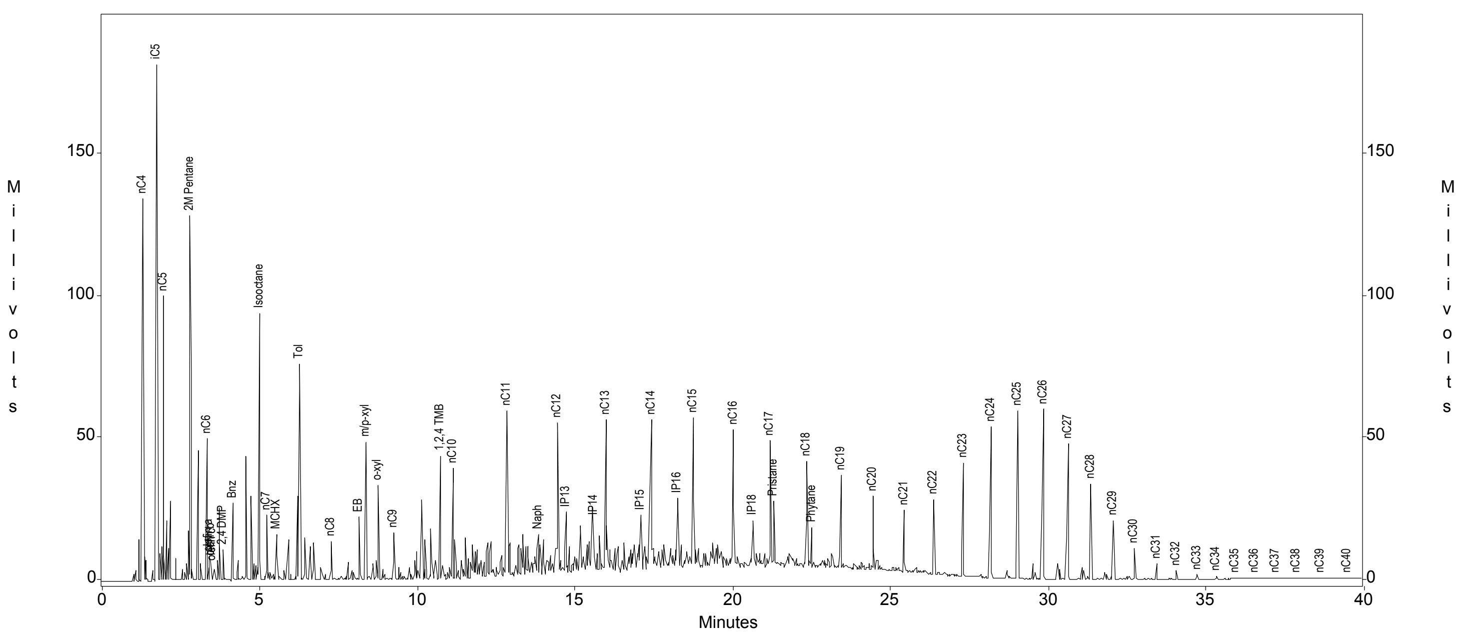
c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



c:\ezchrom\chrom\04046\gadiwax2 -- Channel A



Channel A Results

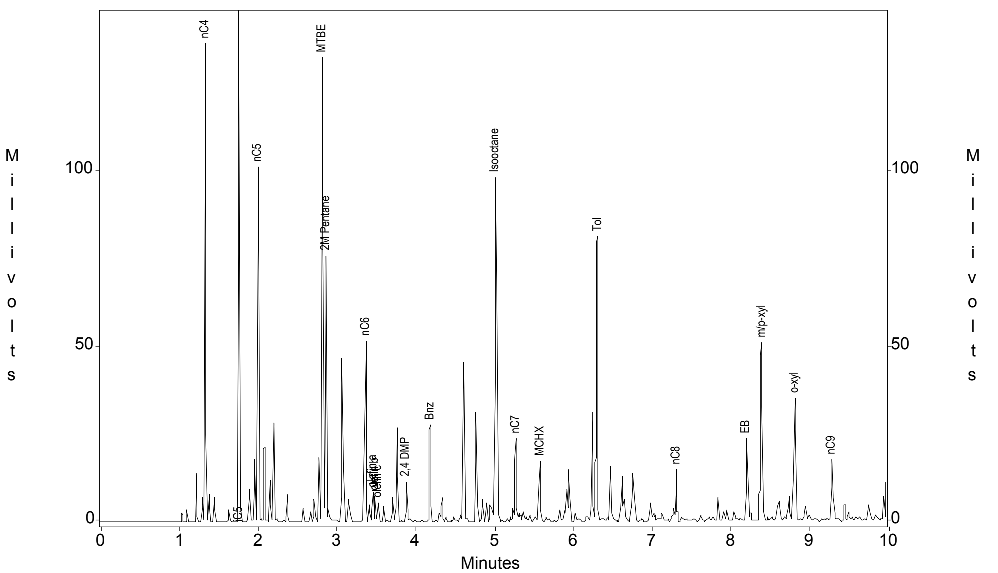
Peak	Area	Height
nC4	76324	134418
iC5	125697	181328
nC5	73607	100180
MTBE	0	0
2M Pentane	125882	128303
nC6	50848	50159
olefin a	9257	8012
olefin b	7096	7246
olefin c	5741	5209
2,4 DMP	11717	11007
Bnz	34021	27022
Isooctane	131604	94025
nC7	28641	22911
MCHX	20811	16248
Tol	125348	76234
nC8	17073	13806
EB	30382	22407
m/p-xyl	79762	48711
o-xyl	47102	33207
nC9	24070	16777
1,2,4 TMB	72129	43739
nC10	57840	39063
nC11	103371	58108
Naph	25460	14283
nC12	89711	53298
IP13	35566	21510
IP14	24622	17633
nC13	89976	52606
IP15	36521	19016
nC14	125559	52513
IP16	45684	24554
nC15	100204	52753
nC16	106353	48603
IP18	48327	16426
nC17	84413	44714
Pristane	51017	23376
nC18	67604	37326
Phytane	29173	14070
nC19	63991	32590
nC20	46362	25707
nC21	38755	22106
nC22	48811	26567
nC23	76713	39972
nC24	117301	53494
nC25	138486	59360
nC26	142113	60095
nC27	109196	47455
nC28	69480	33913
nC29	38149	20797
nC30	20512	10921
nC31	10070	5608
nC32	5237	2932
nC33	2822	1643
nC34	1556	907
nC35	803	499
nC36	479	261
nC37	285	129
nC38	200	75
nC39	115	45
nC40	84	27

Sun - Philadelphia Refinery COA

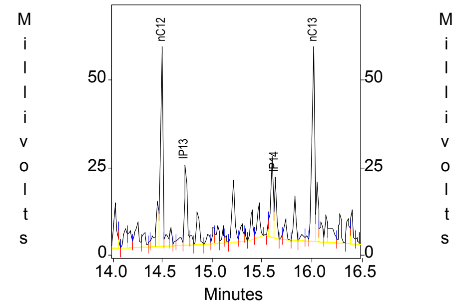
Sample ID : Gas/Dies/Wax std

Acquired : Mar 06, 2004 11:29:07

c:\ezchrom\chrom\04046\gadiwax2.2 -- Channel A



c:\ezchrom\chrom\04046\gadiwax2.2 -- Channel A



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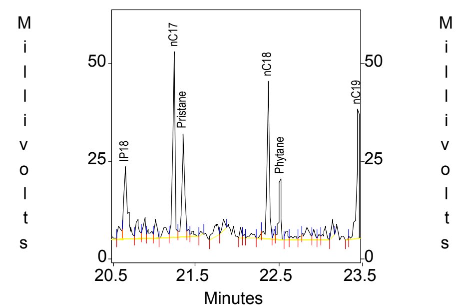
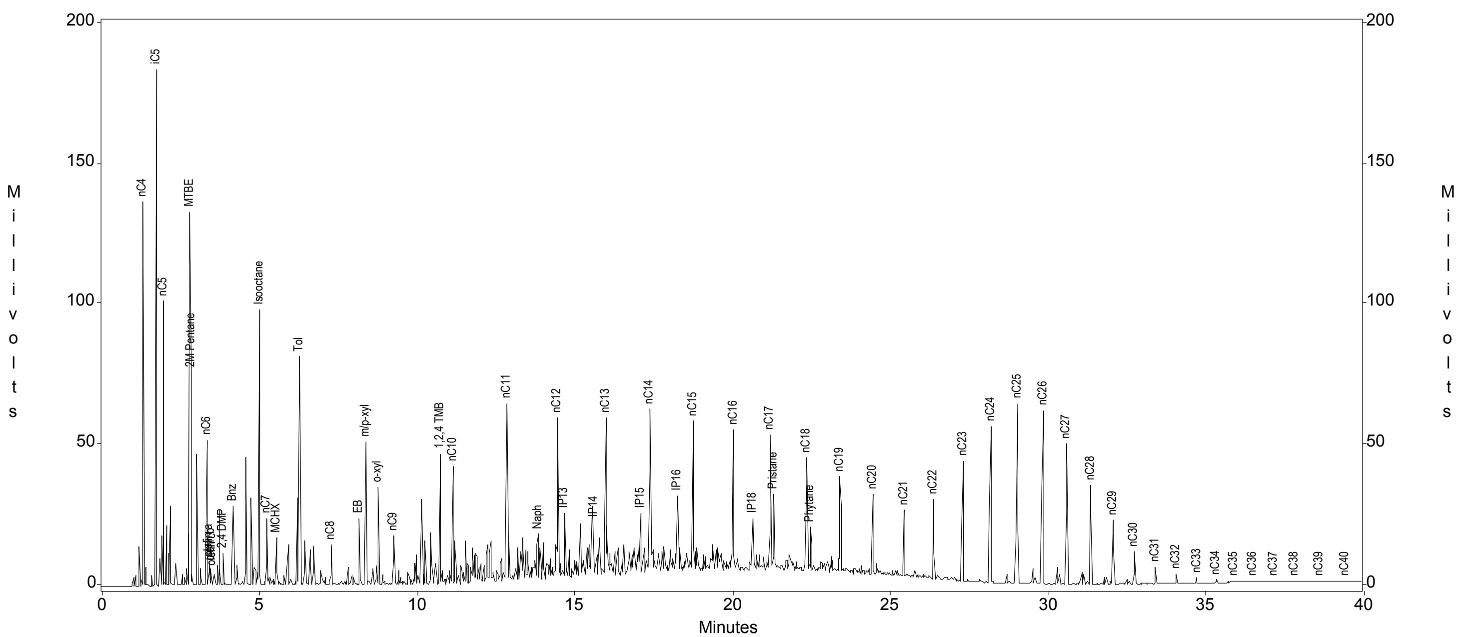


c:\ezchrom\chrom\04046\gadiwax2.2 -- Channel A



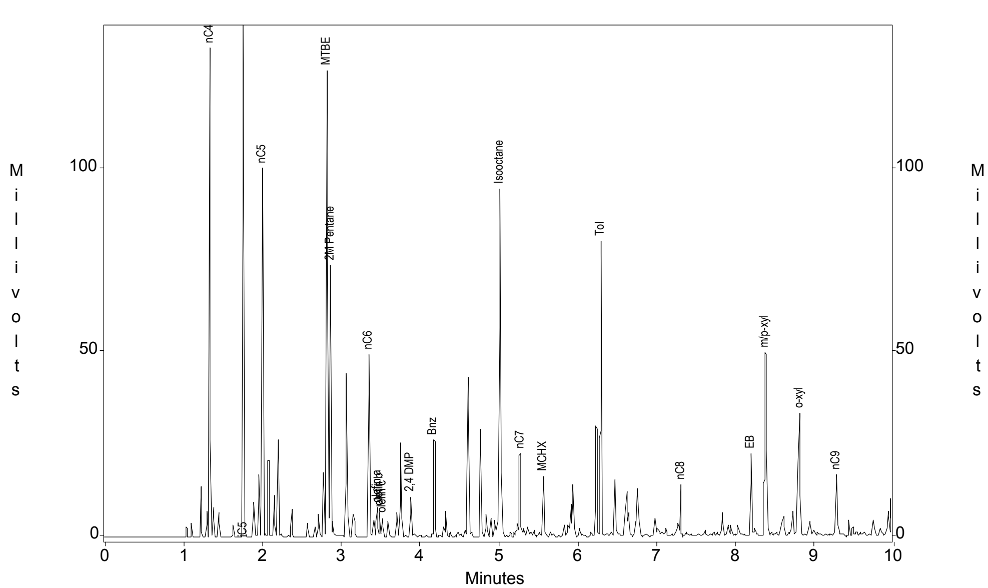
Channel A Results

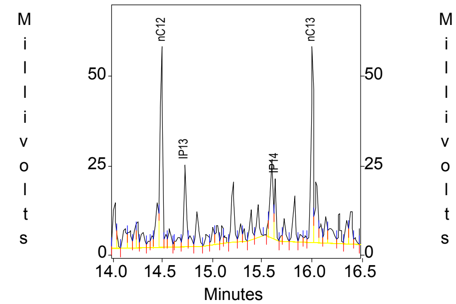
Peak	Area	Height
nC4	77458	136558
iC5	128744	183286
nC5	75526	101085
MTBE	128144	132765
2M Pentane	69925	75907
nC6	52780	51587
olefin a	9581	8348
olefin b	7328	7361
olefin c	5995	5340
2,4 DMP	12106	11305
Bnz	35354	27900
Isooctane	137200	98040
nC7	30024	23818
MCHX	21837	17163
Tol	130835	81258
nC8	18106	14621
EB	32373	23606
m/p-xyl	84188	50805
o-xyl	49868	34944
nC9	28694	17851
1,2,4 TMB	73652	45692
nC10	61839	41682
nC11	111185	62682
Naph	27486	15961
nC12	96922	57306
IP13	38469	23100
IP14	24187	17833
nC13	101176	56029
IP15	42255	21856
nC14	142941	59197
IP16	54663	27834
nC15	114595	54351
nC16	114660	50580
IP18	56358	18729
nC17	92736	47895
Pristane	54986	26608
nC18	75561	40240
Phytane	31599	15655
nC19	70996	33254
nC20	52053	28326
nC21	40971	23744
nC22	52801	28682
nC23	83935	42583
nC24	128314	55675
nC25	150243	63886
nC26	153225	61778
nC27	117341	50227
nC28	74472	35384
nC29	40653	22326
nC30	20232	11478
nC31	10756	6096
nC32	5612	3324
nC33	3034	1777
nC34	1676	946
nC35	900	547
nC36	560	286
nC37	374	159
nC38	201	82
nC39	149	57
nC40	114	35

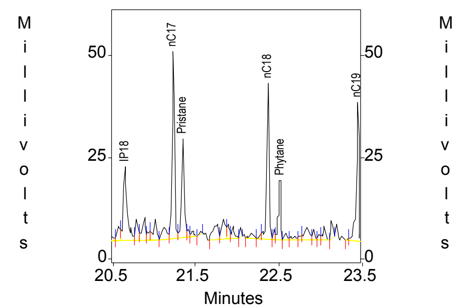
Sun - Philadelphia Refinery COA

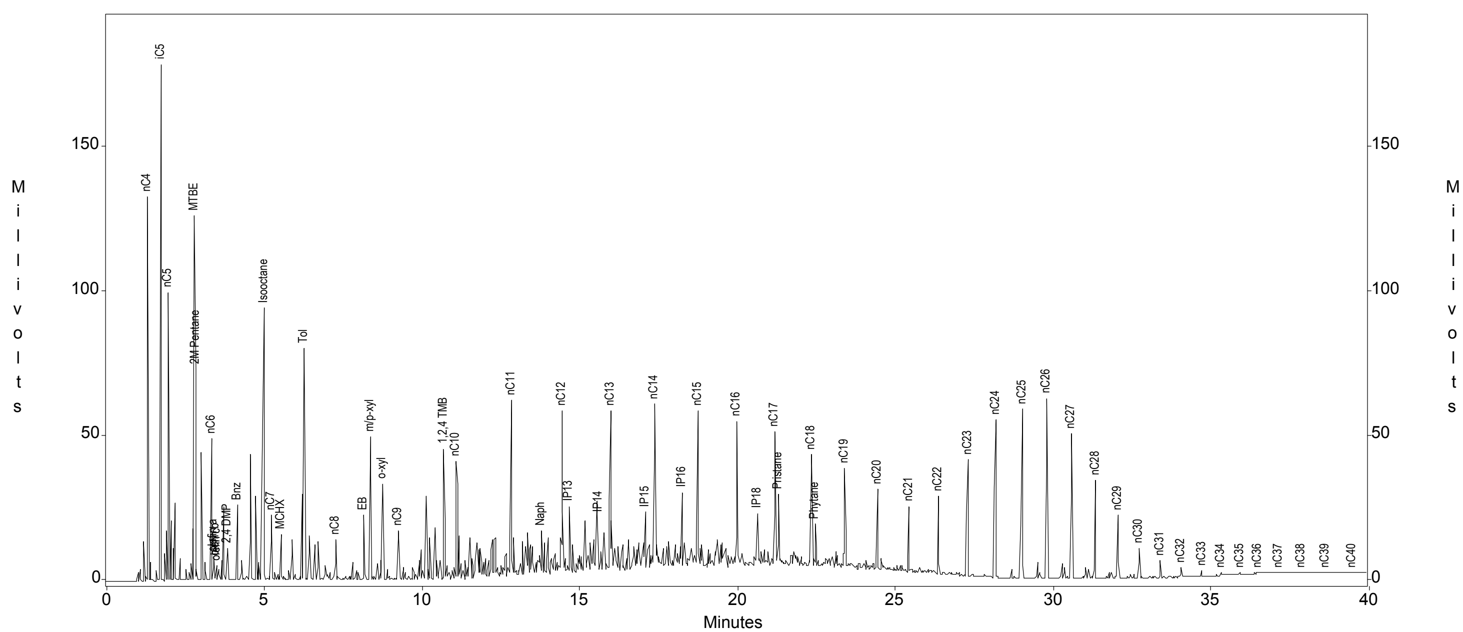
Sample ID : Gas/Dies/Wax std

Acquired : Mar 07, 2004 16:27:47









Channel A Results

Peak	Area	Height
nC4	73277	132589
iC5	122397	178292
nC5	72111	99927
MTBE	120053	126296
2M Pentane	67309	73384
nC6	50110	49331
olefin a	9060	8035
olefin b	6897	6990
olefin c	5633	5009
2,4 DMP	11448	10863
Bnz	33610	26331
Isooctane	131090	94376
nC7	28645	22570
MCHX	20551	16158
Tol	124718	80339
nC8	17171	14000
EB	30742	22465
m/p-xyl	81647	49629
o-xyl	47338	33265
nC9	27340	17017
1,2,4 TMB	70044	44193
nC10	59484	40762
nC11	107019	60555
Naph	26087	15252
nC12	93349	56487
IP13	37261	22961
IP14	23534	17207
nC13	97647	55033
IP15	40713	20552
nC14	137643	57277
IP16	52746	26623
nC15	110085	54657
nC16	115273	50330
IP18	54821	18200
nC17	88744	46155
Pristane	52604	24413
nC18	72412	38407
Phytane	30125	14657
nC19	71773	34120
nC20	49409	27517
nC21	39259	22392
nC22	50700	27374
nC23	79711	40253
nC24	121096	54615
nC25	142086	58736
nC26	145134	62459
nC27	111056	50452
nC28	70506	33745
nC29	38493	21488
nC30	19227	10452
nC31	10144	5823
nC32	5288	3046
nC33	2883	1634
nC34	1617	885
nC35	828	504
nC36	575	264
nC37	300	148
nC38	265	108
nC39	113	48
nC40	70	26

Sample Date	25-JUL-13
Sample ID	204020378
Batch Number	
User SampleID	20130725-378
Sample Type	PBPSSO POLLOCK STREET SEWER OUTFALL
Tag	07/25/13 1351
Material Name	MISC. UNDEFINED PRODUCT
Condition	APPROVED
EPA Batch #	
Comments	S29/ST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Material Type PLANT SAMPLE

Component	Result	Units	Inspec	Low	High
API GRAVITY	32.1	deg API	N/A		
SULFUR	0.0743	wt.%	N/A		
SULFUR FOR COA	743	ppm	N/A		
INITIAL BOILING POINT (GC)	260.4	deg F	N/A		
01 % (GC)	276.4	deg F	N/A		
02 % (GC)	305.2	deg F	N/A		
03 % (GC)	315.4	deg F	N/A		
04 % (GC)	322.6	deg F	N/A		
05 % (GC)	329.8	deg F	N/A		
10 % (GC)	357.6	deg F	N/A		
20 % (GC)	399.2	deg F	N/A		
30 % (GC)	433.6	deg F	N/A		
40 % (GC)	462	deg F	N/A		
50 % (GC)	486.8	deg F	N/A		
60 % (GC)	511.8	deg F	N/A		
70 % (GC)	539.2	deg F	N/A		
80 % (GC)	575	deg F	N/A		
90 % (GC)	612.8	deg F	N/A		
95 % (GC)	647	deg F	N/A		
END POINT (GC)	737.6	deg F	N/A		
BROMINE NUMBER	0.86	NONE	N/A		

Printed: 13:57:12 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020378
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-378
*** RETAIN ***
Sample timestamp: 07/25/13 13:51
S29/ST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:07 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020379
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-379
*** RETAIN ***
Sample timestamp: 07/25/13 13:52
S32/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 14:01:36 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020380
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-380
*** RETAIN ***
Sample timestamp: 07/25/13 13:53
S31/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:03 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020381
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-381
*** RETAIN ***
Sample timestamp: 07/25/13 13:55
S30/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Sample Date	25-JUL-13
Sample ID	204020381
Batch Number	
User SampleID	20130725-381
Sample Type	PBPSSO POLLOCK STREET SEWER OUTFALL
Tag	07/25/13 1354
Material Name	MISC. UNDEFINED PRODUCT
Material Type	PLANT SAMPLE
Condition	APPROVED
EPA Batch #	
Comments	S30/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Component	Result	Units	Inspec	Low	High
API GRAVITY	31.5	deg API	N/A		
SULFUR	0.1216	wt.%	N/A		
SULFUR FOR COA	1216	ppm	N/A		
INITIAL BOILING POINT (GC)	247.4	deg F	N/A		
01 % (GC)	270.4	deg F	N/A		
02 % (GC)	302	deg F	N/A		
03 % (GC)	313.8	deg F	N/A		
04 % (GC)	322.6	deg F	N/A		
05 % (GC)	331.2	deg F	N/A		
10 % (GC)	362.8	deg F	N/A		
20 % (GC)	407.8	deg F	N/A		
30 % (GC)	441.8	deg F	N/A		
40 % (GC)	471.4	deg F	N/A		
50 % (GC)	492.8	deg F	N/A		
60 % (GC)	518.8	deg F	N/A		
70 % (GC)	546.6	deg F	N/A		
80 % (GC)	577.2	deg F	N/A		
90 % (GC)	618.6	deg F	N/A		
95 % (GC)	651.6	deg F	N/A		
END POINT (GC)	742	deg F	N/A		
BROMINE NUMBER	0	NONE	N/A		

Printed: 13:57:12 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020378
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-378
*** RETAIN ***
Sample timestamp: 07/25/13 13:51
S29/ST TO DETERMINE SIM DIS METHOD
AND MUST REVIEW RESULTS

Printed: 13:57:07 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020379
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-379
*** RETAIN ***
Sample timestamp: 07/25/13 13:52
S32/ CHEMIST TO DETERMINE SIM DIS
METHOD AND MUST REVIEW RESULTS

Printed: 14:01:36 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020380
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-380
*** RETAIN ***
Sample timestamp: 07/25/13 13:53
S31/ CHEMIST TO DETERMINE SIM DIS
METHOD AND MUST REVIEW RESULTS

Printed: 13:57:03 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020381
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-381
*** RETAIN ***
Sample timestamp: 07/25/13 13:55
S30/ CHEMIST TO DETERMINE SIM DIS
METHOD AND MUST REVIEW RESULTS

Sample Date	25-JUL-13
Sample ID	204020380
Batch Number	
User SampleID	20130725-380
Sample Type	PBPSSO POLLOCK STREET SEWER OUTFALL
Tag	07/25/13 1353
Material Name	MISC. UNDEFINED PRODUCT
Material Type	PLANT SAMPLE
Condition	APPROVED
EPA Batch #	
Comments	S31/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Component	Result	Units	Inspec	Low	High
API GRAVITY	34.5	deg API	N/A		
SULFUR	0.1198	wt.%	N/A		
SULFUR FOR COA	1198	ppm	N/A		
INITIAL BOILING POINT (GC)	240.2	deg F	N/A		
01 % (GC)	268.4	deg F	N/A		
02 % (GC)	286.2	deg F	N/A		
03 % (GC)	300	deg F	N/A		
04 % (GC)	309.6	deg F	N/A		
05 % (GC)	316.8	deg F	N/A		
10 % (GC)	342.8	deg F	N/A		
20 % (GC)	394.8	deg F	N/A		
30 % (GC)	434.8	deg F	N/A		
40 % (GC)	468	deg F	N/A		
50 % (GC)	492.8	deg F	N/A		
60 % (GC)	524.2	deg F	N/A		
70 % (GC)	560.2	deg F	N/A		
80 % (GC)	596	deg F	N/A		
90 % (GC)	643.6	deg F	N/A		
95 % (GC)	678.8	deg F	N/A		
END POINT (GC)	800.6	deg F	N/A		
BROMINE NUMBER	0.67	NONE	N/A		

Printed: 13:57:12 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020378
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-378
*** RETAIN ***
Sample timestamp: 07/25/13 13:51
S29/ST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:07 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020379
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-379
*** RETAIN ***
Sample timestamp: 07/25/13 13:52
S32/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 14:01:36 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020380
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-380
*** RETAIN ***
Sample timestamp: 07/25/13 13:53
S31/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:03 07/25/2013
MISC. UNDEFINED PRODUCT
H=XX F=XX R=XX PE=X MSDS XXXX
204020381
PBPSSO POLLOCK STREET SEWER OUTFALL
20130725-381
*** RETAIN ***
Sample timestamp: 07/25/13 13:55
S30/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Sample Date	25-JUL-13
Sample ID	204020379
Batch Number	
User SampleID	20130725-379
Sample Type	PBPSSO POLLOCK STREET SEWER OUTFALL
Tag	07/25/13 1352
Material Name	MISC. UNDEFINED PRODUCT
Material Type	PLANT SAMPLE
Condition	APPROVED
EPA Batch #	
Comments	S32/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Component	Result	Units	Inspec	Low	High
API GRAVITY	29.2	deg API	N/A		
SULFUR	0.2396	wt.%	N/A		
SULFUR FOR COA	2396	ppm	N/A		
INITIAL BOILING POINT (GC)	262.4	deg F	N/A		
01 % (GC)	282.2	deg F	N/A		
02 % (GC)	311	deg F	N/A		
03 % (GC)	321.2	deg F	N/A		
04 % (GC)	332.6	deg F	N/A		
05 % (GC)	342.8	deg F	N/A		
10 % (GC)	377.4	deg F	N/A		
20 % (GC)	420.6	deg F	N/A		
30 % (GC)	451.4	deg F	N/A		
40 % (GC)	481	deg F	N/A		
50 % (GC)	505.8	deg F	N/A		
60 % (GC)	531.8	deg F	N/A		
70 % (GC)	564.8	deg F	N/A		
80 % (GC)	600.4	deg F	N/A		
90 % (GC)	648.2	deg F	N/A		
95 % (GC)	690.8	deg F	N/A		
END POINT (GC)	876.8	deg F	N/A		
BROMINE NUMBER	1.42	NONE	N/A		

Printed: 13:57:12 07/25/2013

MISC. UNDEFINED PRODUCT

H=XX F=XX R=XX PE=X MSDS XXXX

204020378

PBPSSO POLLOCK STREET SEWER OUTFALL

20130725-378

*** RETAIN ***

Sample timestamp: 07/25/13 13:51

S29/ST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:07 07/25/2013

MISC. UNDEFINED PRODUCT

H=XX F=XX R=XX PE=X MSDS XXXX

204020379

PBPSSO POLLOCK STREET SEWER OUTFALL

20130725-379

*** RETAIN ***

Sample timestamp: 07/25/13 13:52

S32/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 14:01:36 07/25/2013

MISC. UNDEFINED PRODUCT

H=XX F=XX R=XX PE=X MSDS XXXX

204020380

PBPSSO POLLOCK STREET SEWER OUTFALL

20130725-380

*** RETAIN ***

Sample timestamp: 07/25/13 13:53

S31/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Printed: 13:57:03 07/25/2013

MISC. UNDEFINED PRODUCT

H=XX F=XX R=XX PE=X MSDS XXXX

204020381

PBPSSO POLLOCK STREET SEWER OUTFALL

20130725-381

*** RETAIN ***

Sample timestamp: 07/25/13 13:55

S30/ CHEMIST TO DETERMINE SIM DIS METHOD AND MUST REVIEW RESULTS

Sunoco Refinery - Philadelphia						
TGI Job 13094						
Interpretation of Product Type(s), Proportions and Weathering				**Similarities to Other Samples in this Study**		
Sample	**Product Type(s)**	**Proportions**	**Weathering**	**Quite Similar to**	**Fairly Similar to**	**Somewhat Similar to**
S-360	Alkylate	99	?	S-363		S-369
	Middle Distillate	1	Extreme			
S-363	Alkylate	99	?	S-360		S-369
	Middle Distillae	1	Extreme			
S-365	Unknown Light Material	48	?			
	Middle Distillate	52	Extreme		S-369	S-382
S-369	Middle Distillate	80	Extreme		S-365	S-382
	Alkylate	20	?			S-360 and S-363
S-382	Middle Distillate	71	Extreme			S-365 and S-369
	Unknown Light Material	16	?			
	Heavier Material	13	?			
	Note: Heavier material could be either crude oil or residual oil					

Torkelson Geochemistry, Inc.
2528 S. Columbia Place
Tulsa, OK 74114-3233
Phone: 918-749-8441
Fax: 918-749-6005
e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Project: S. Philly Refinery
Location: AOI 2 and AOI 4
Proj. No.:
P.O.:
Sampled By: Andrew Ebert

Report/Bill To: Aquaterra Technologies
Address: 122 S. Church St
West Chester, PA
Phone: 484-887-7347
Fax:
e-mail: Tiffany Doerr
td@aquaterra-tech.com

Additional Instructions: CC: Pat Troy of Langan Engineering
ptroy@langan.com

Requested Turn-Around Time: 2 weeks

ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # Of Vials	Preservatives: None					Analyses Requested: GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur					REMARKS
1	S-360	6/18/13			1						X	X											
2	S-363	6/18/13			1						X	X											
3	S-365	6/18/13			1						X	X											
4	S-369	6/18/13			1						X	X											
5	Warehouse mw-2	6/18/13			1						X	X											
6																							
7	renamed S-382 per																						
8	email from Tiffany Doerr																						
9	BET																						
10																							

RELINQUISHED BY	DATE	TIME	ACCEPTED BY	DATE	TIME
[signature] / Aquaterra	6/21/13	1336	FED-EX Cooler	6/21/13	1330
			[signature] Bruce Torkelson	6-27-13	1200

Torkelson Geochemistry, Inc.							
Physical Properties Measurements							
Sample	TGI Job Number	Density of NAPL (gm/ml)	Viscosity of NAPL (centipoise)	Surface Tension Air/Water (dynes/cm)	Interfacial Tension NAPL/Water (dynes/cm)	Surface Tension Air/NAPL (dynes/cm)	Temperature of Measurements
S-360	13094	0.7667	NA	NA	NA	NA	60F
S-363	13094	0.7298	NA	NA	NA	NA	60F
S-365	13094	0.8158	NA	NA	NA	NA	60F
S-369	13094	QNS	NA	NA	NA	NA	60F
S-382	13094	QNS	NA	NA	NA	NA	60F

NA = Not Analyzed

QNS = Quantity Not Sufficientensi

Torkelson Geochemistry, Inc.
2528 S. Columbia Place
Tulsa, OK 74114-3233
Phone: 918-749-8441
Fax: 918-749-6005
e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Project: S. Philly Refinery
Location: AOI 2 and AOI 4
Proj. No.:
P.O.:
Sampled By: Andrew Ebrts

Report/Bill To: Aquaterra Technologies
Address: 122 S Church St
West Chester, PA
Phone: 484-887-7347
Fax:
e-mail: Tiffani Doerr
tdo@aquaterra-tech.com

Additional Instructions: CC: Pat Troy of Langan Engineering
ptroy@langan.com

Requested Turn-Around Time: 2 weeks

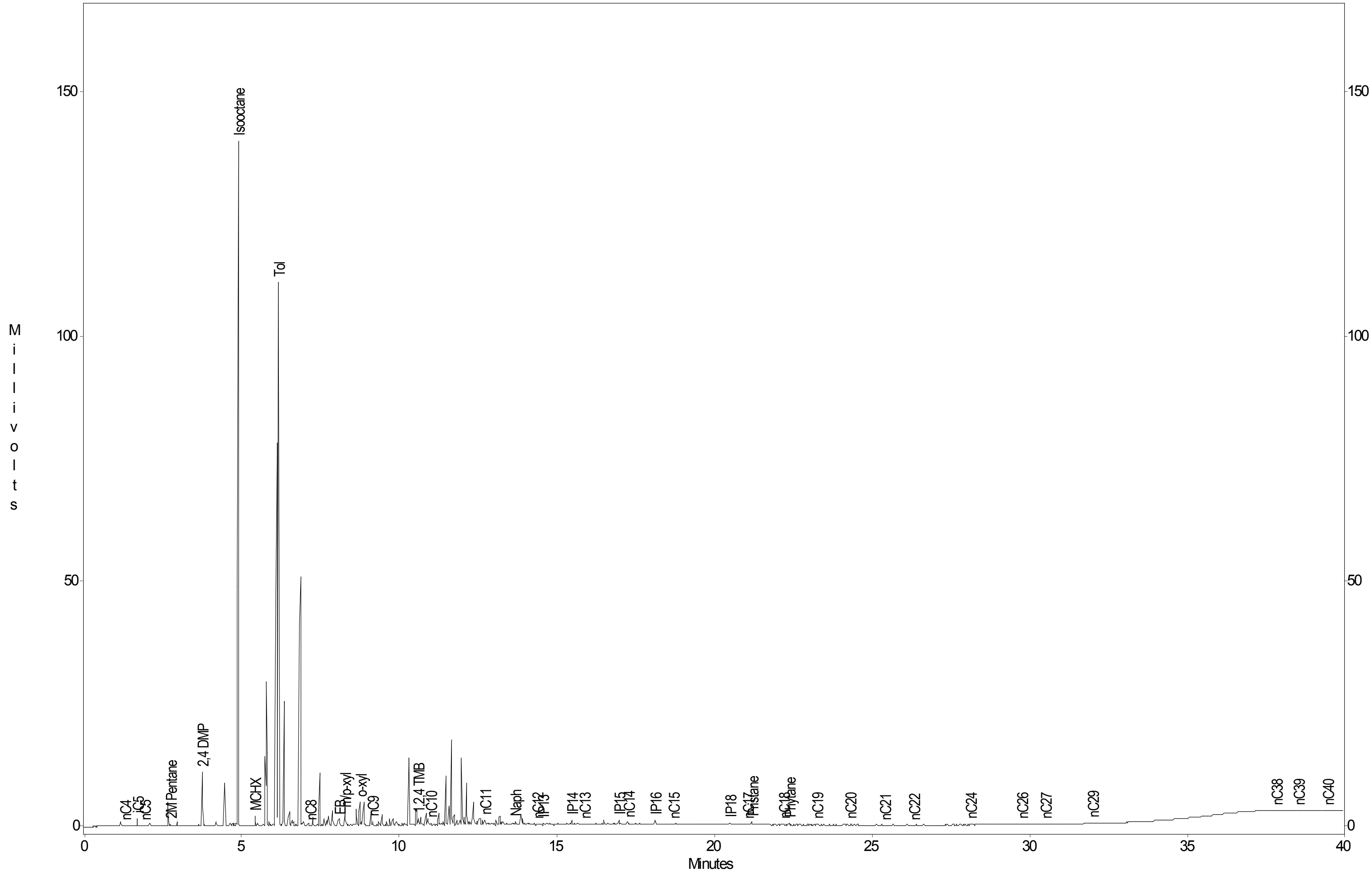
ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # Of Vials	PRESERVATIVES: None	ANALYSES REQUESTED: GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur	REMARKS
1	S-360	6/18/13			1		X	X							
2	S-363	6/18/13			1		X	X							
3	S-365	6/18/13			1		X	X							
4	S-369	6/18/13			1		X	X							
5	Warehouse MW-2	6/18/13			1		X	X							
6															
7	renamed S-382 per														
8	email from Tiffany Doerr														
9	BET														
10															

RELINQUISHED BY	DATE	TIME	ACCEPTED BY	DATE	TIME
[illegible signature] /AQUATERRA	6/21/13	1330	FED-EX Cooler	6/21/13	1330
			Bruce Torkelson	6-27-13	1200

Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-360
Acquired : Jul 03, 2013 15:57:14

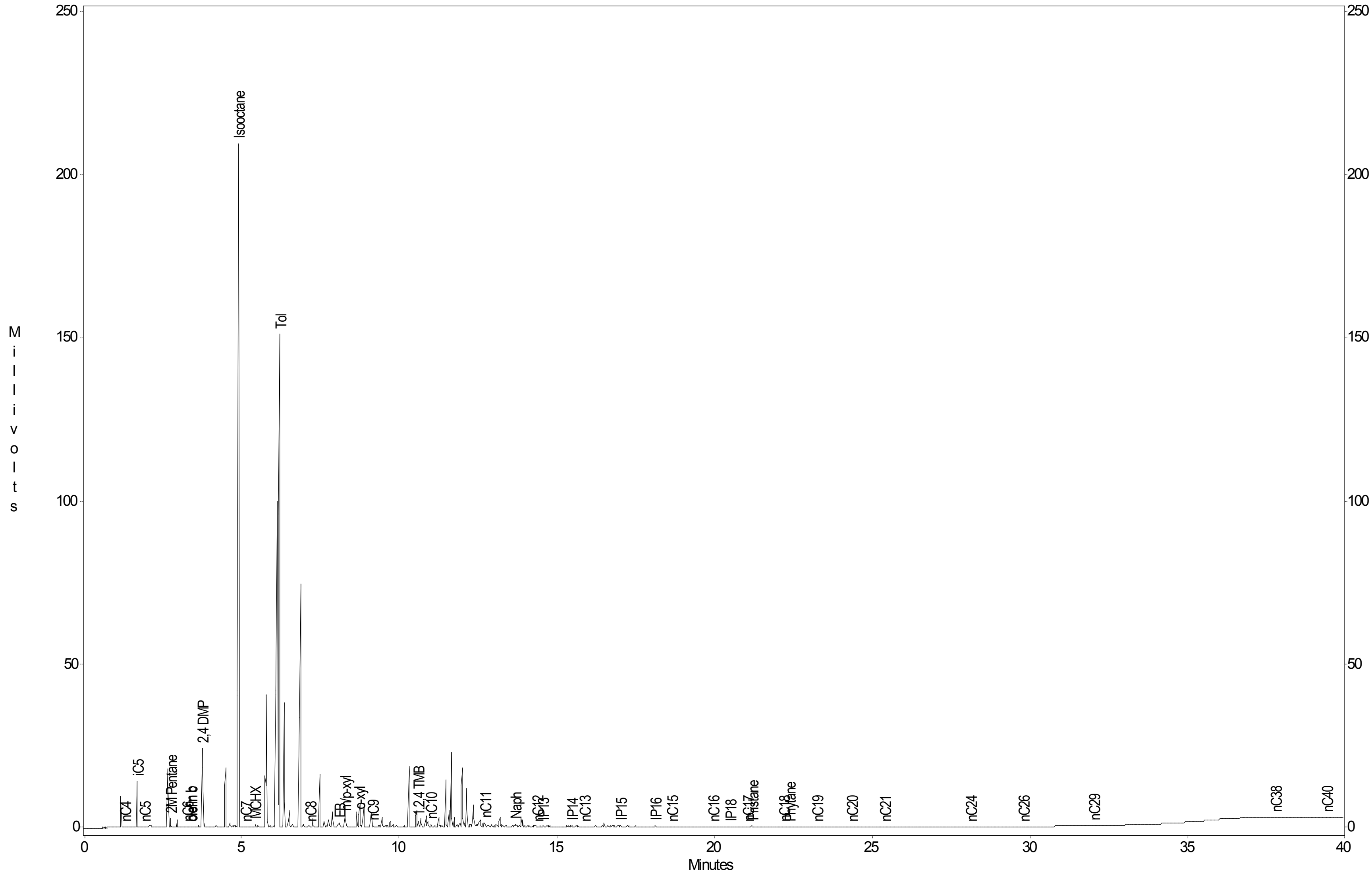
c:\ezchrom\chrom\13094\s-360.2 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-363
Acquired : Jul 03, 2013 15:06:17

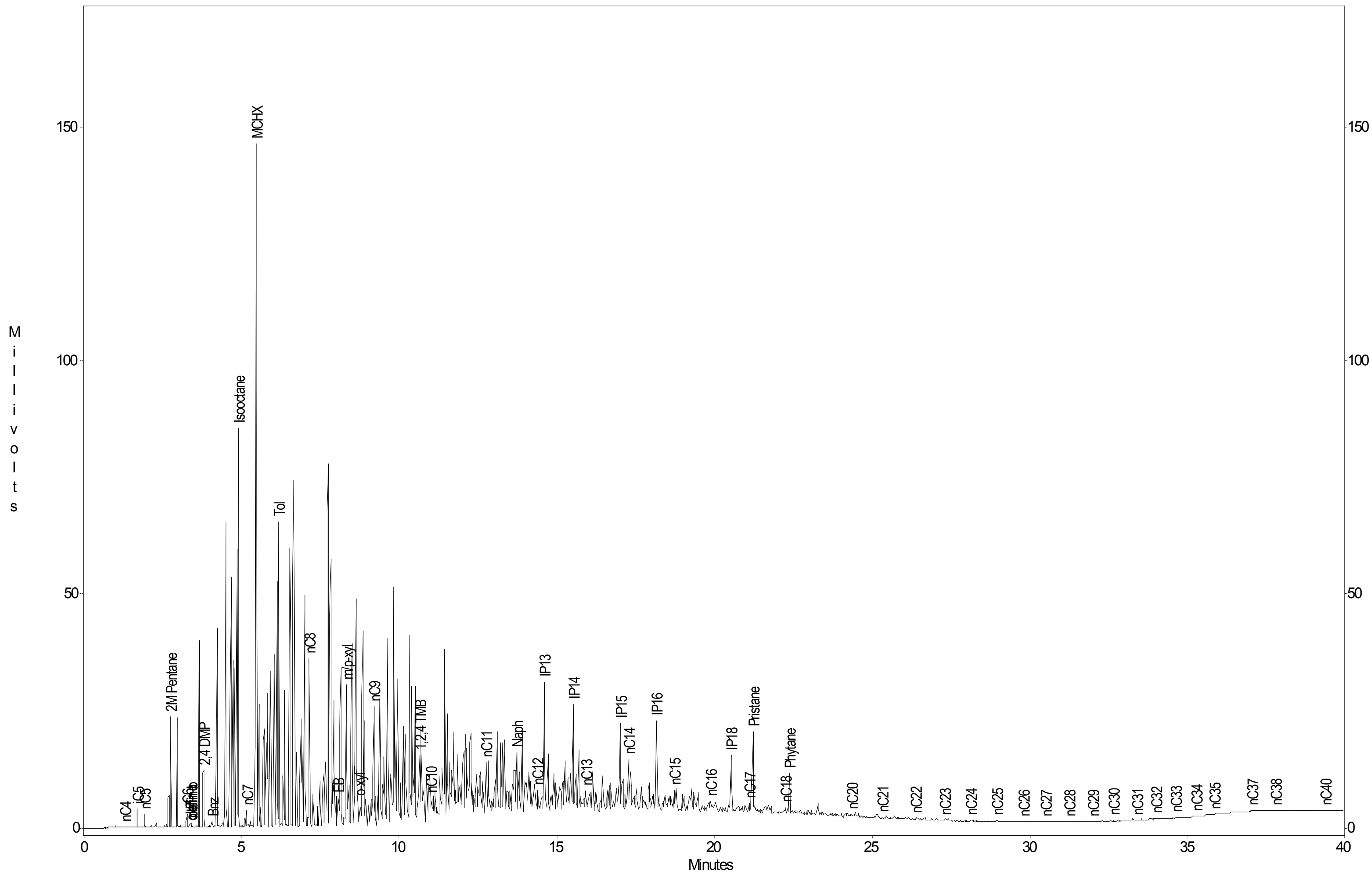
c:\ezchrom\chrom\13094\s-363.2 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-365
Acquired : Jul 03, 2013 11:44:42

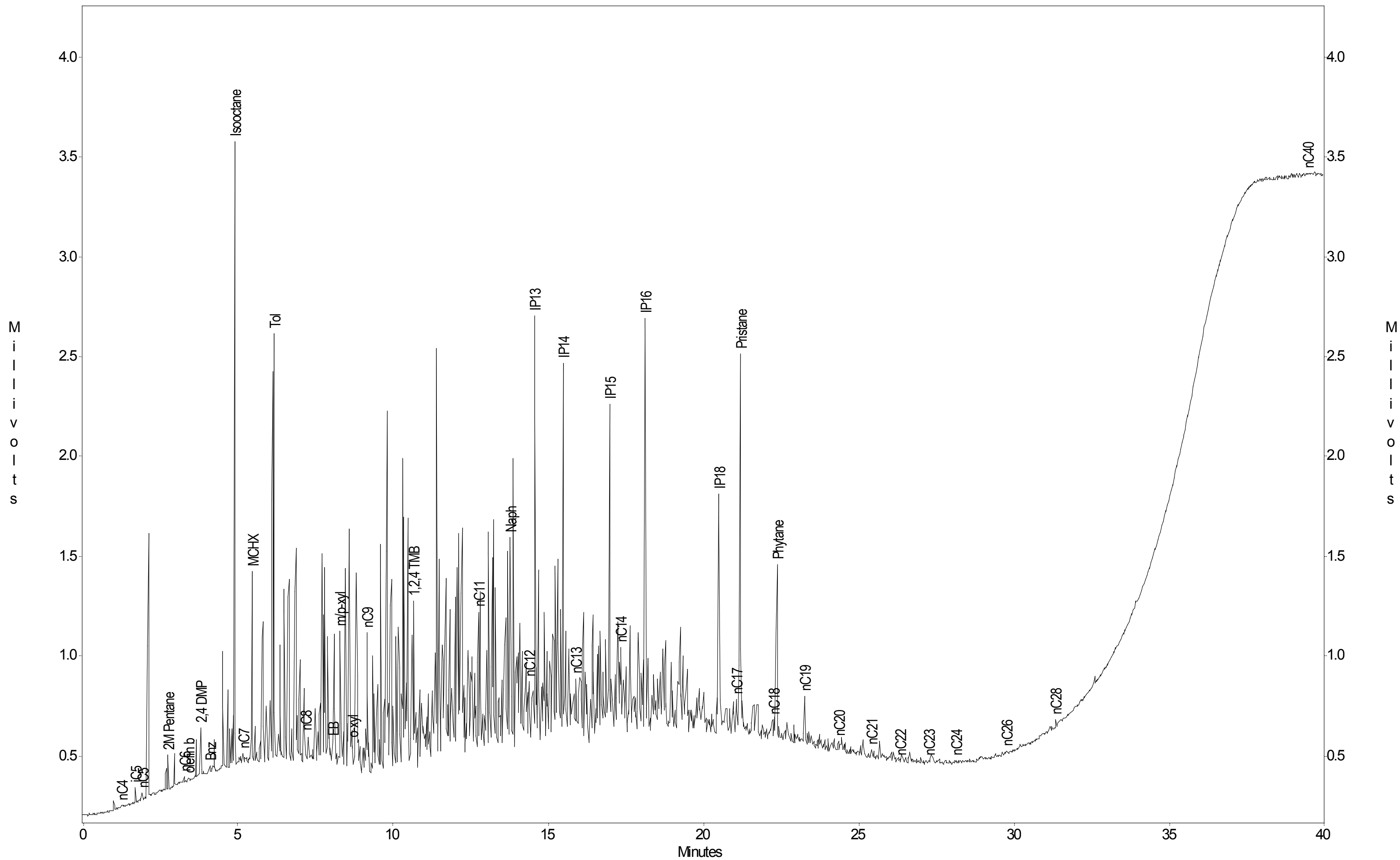
c:\ezchrom\chrom\13094\s-365 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-369
Acquired : Jul 03, 2013 17:37:14

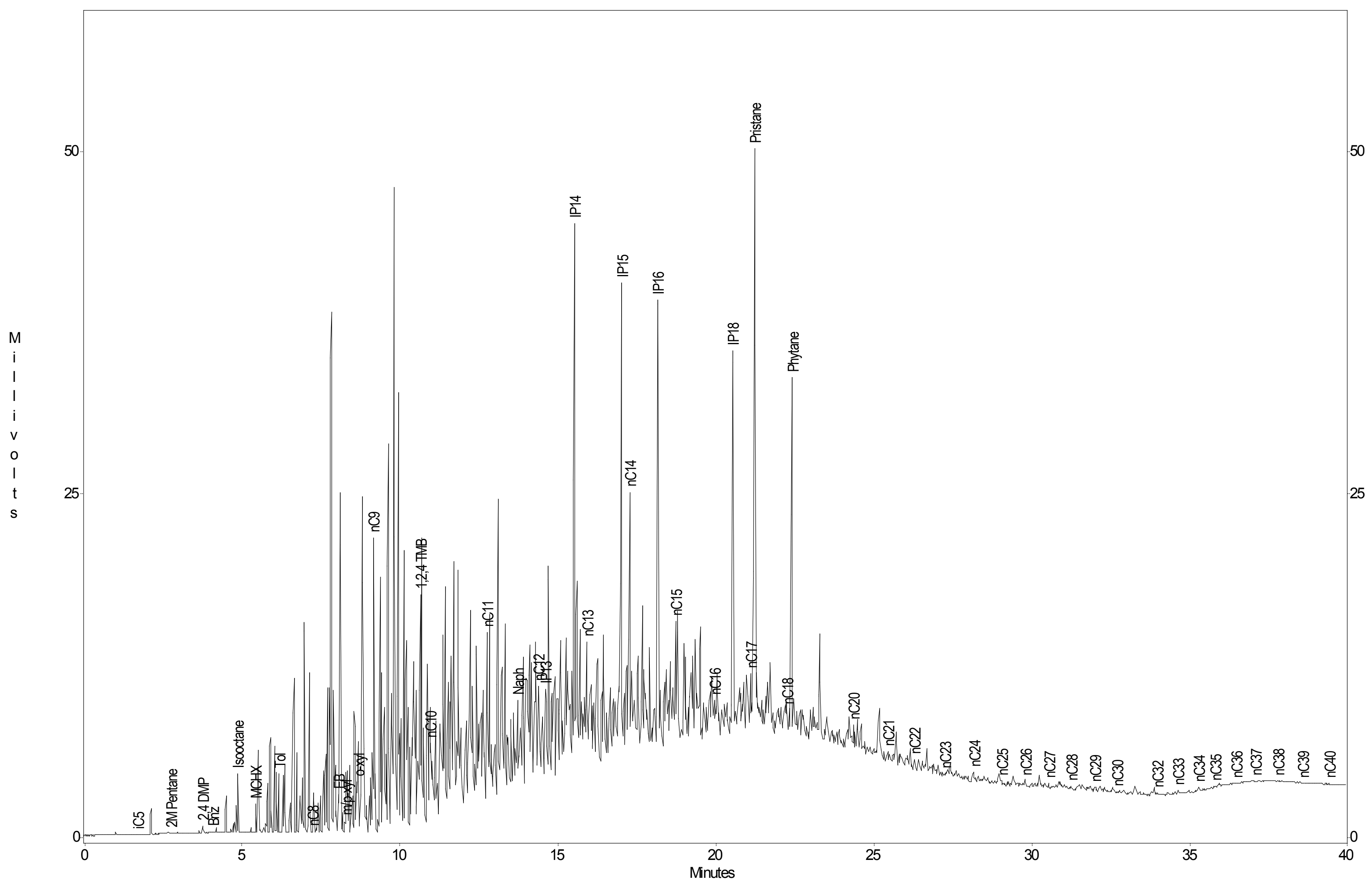
c:\ezchrom\chrom\13094\s-369.2 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-382
Acquired : Jul 03, 2013 14:15:09

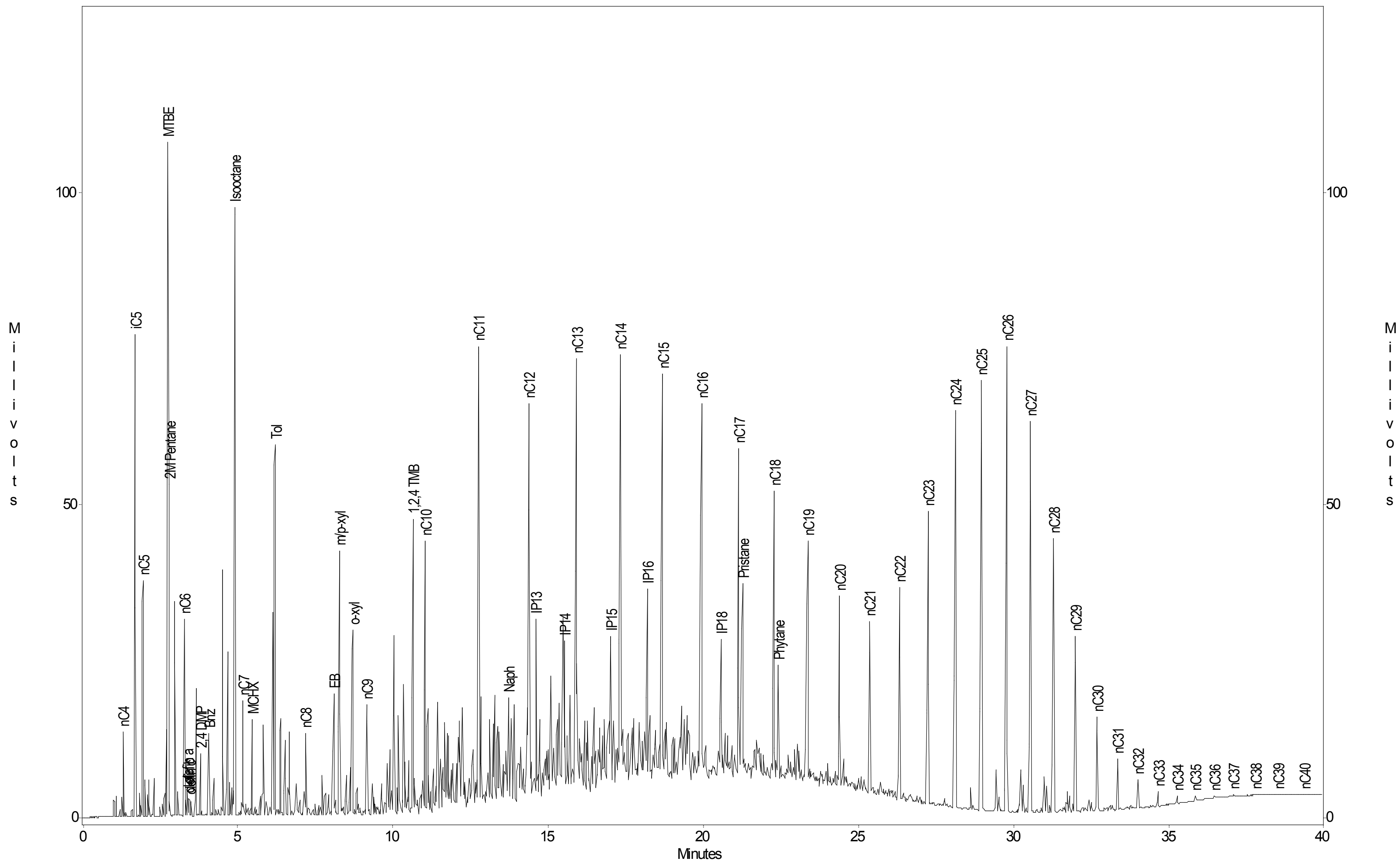
c:\ezchrom\chrom\13094\s-382 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : Gas/Dies/Wax std
Acquired : Jul 03, 2013 10:25:49

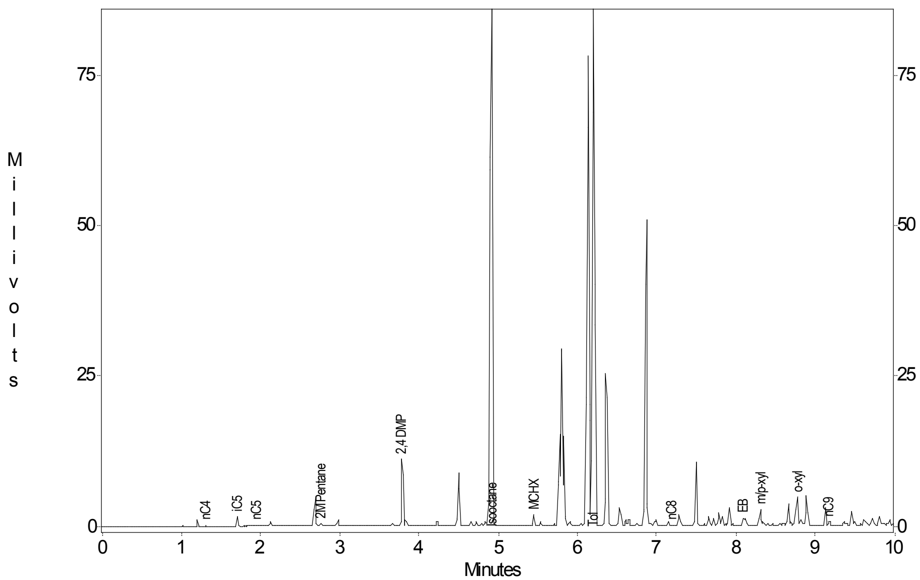
c:\ezchrom\chrom\13094\gadiwax2 – Channel A



Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-360
Acquired : Jul 03, 2013 15:57:14

c:\ezchrom\chrom\13094\s-360.2 – Channel A



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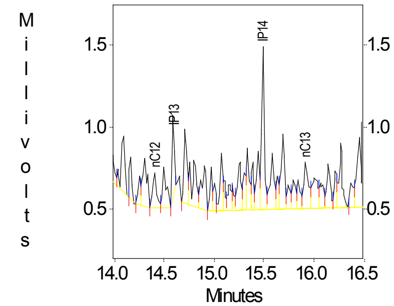
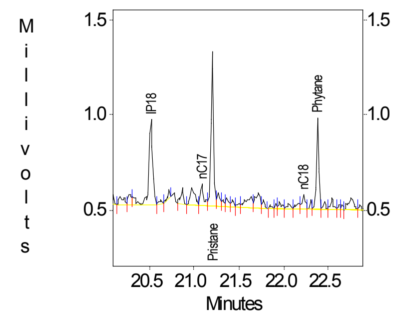
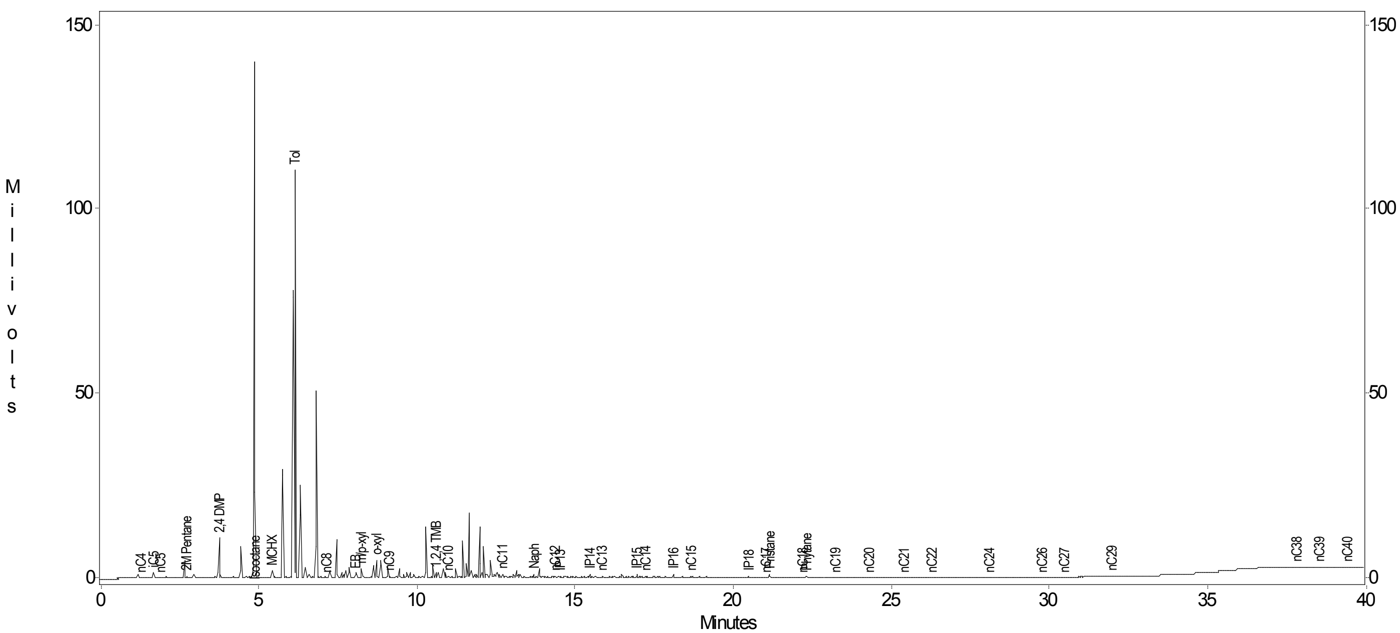


c:\ezchrom\chrom\13094\s-360.2 – Channel A



c:\ezchrom\chrom\13094\s-360.2 – Channel A



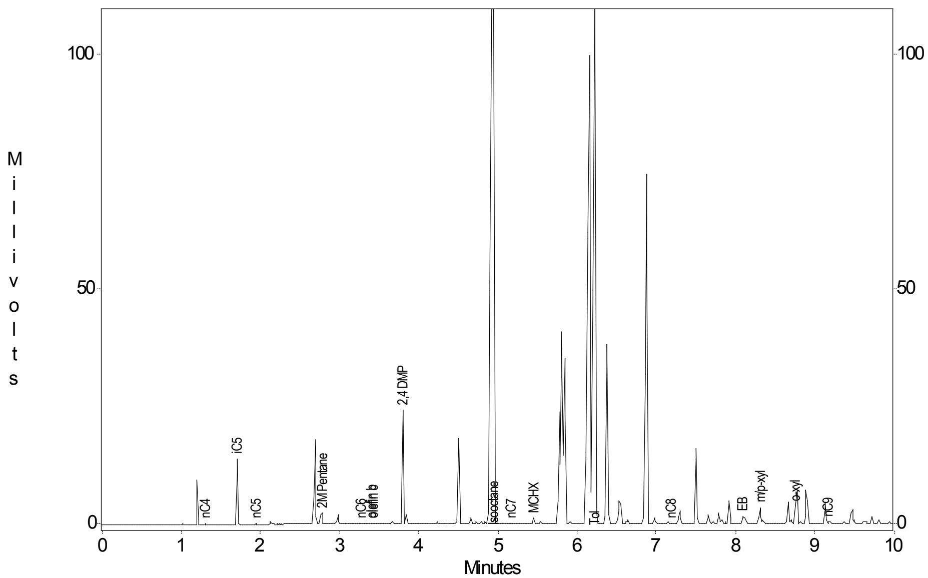
Channel A Results

Peak	Area	Height
nC4	41	54
iC5	1209	1581
nC5	10	13
MTBE	0	0
2M Pentane	350	378
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2,4 DMP	11346	10993
Bnz	0	0
Isooctane	230113	139645
nC7	0	0
MCHX	2129	1774
Tol	171879	110736
nC8	16	17
EB	3299	1115
m/p-xyl	3204	2491
o-xyl	9172	4784
nC9	1031	687
1,2,4 TMB	2577	1358
nC10	999	554
nC11	2200	1110
Naph	1395	641
nC12	566	208
IP13	755	399
IP14	1731	992
nC13	844	278
IP15	2463	871
nC14	1154	346
IP16	1429	820
nC15	320	189
nC16	0	0
IP18	1252	447
nC17	255	110
Pristane	1612	810
nC18	230	81
Phytane	968	486
nC19	610	143
nC20	103	48
nC21	74	28
nC22	10	6
nC23	0	0
nC24	122	24
nC25	0	0
nC26	75	25
nC27	25	15
nC28	0	0
nC29	112	19
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	12	15
nC39	20	11
nC40	53	12

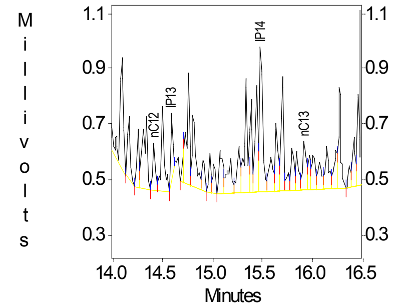
Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-363
Acquired : Jul 03, 2013 15:06:17

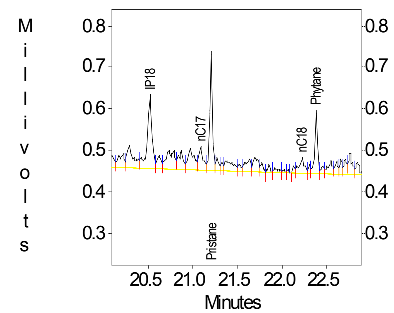
c:\ezchrom\chrom\13094\s-363.2 – Channel A



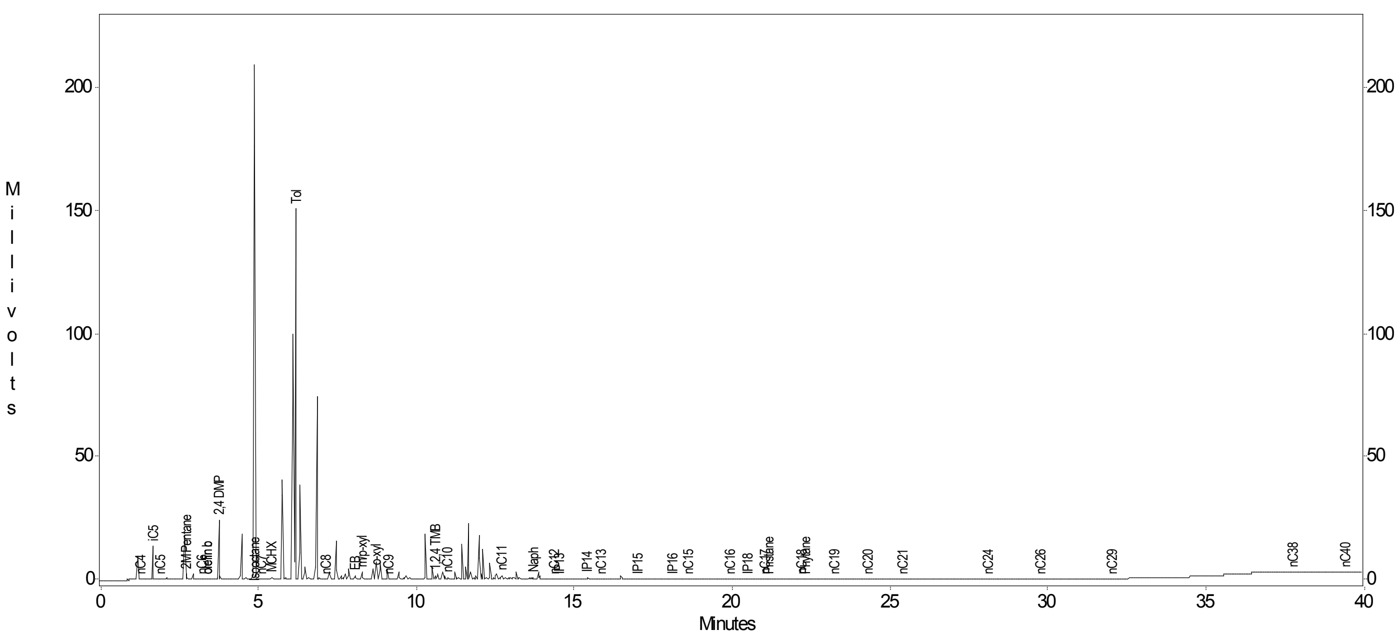
c:\ezchrom\chrom\13094\s-363.2 – Channel A



c:\ezchrom\chrom\13094\s-363.2 – Channel A



c:\ezchrom\chrom\13094\s-363.2 – Channel A

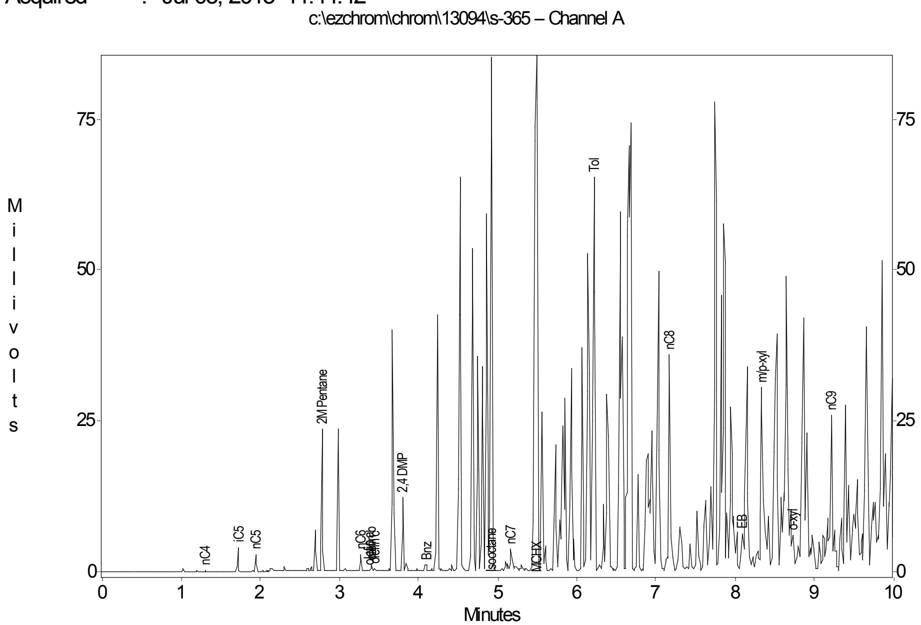


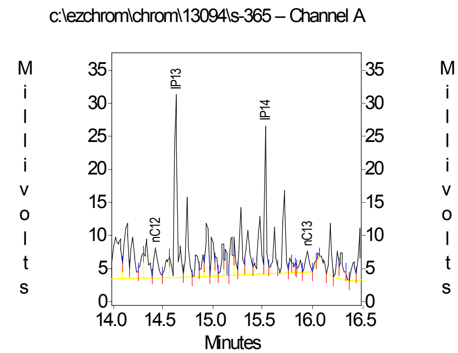
Channel A Results

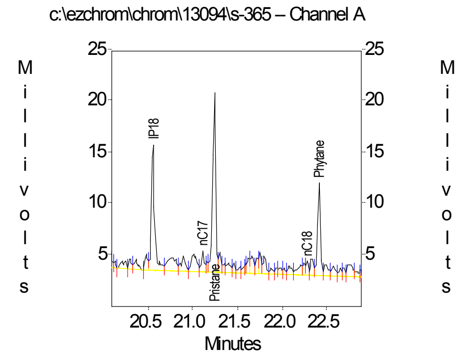
Peak	Area	Height
nC4	49	72
iC5	9160	13964
nC5	135	190
MTBE	0	0
2M Pentane	2177	2452
nC6	79	85
olefin a	0	0
olefin b	21	21
olefin c	17	17
2,4 DMP	25189	24186
Bnz	0	0
Isooctane	425349	209438
nC7	163	121
MCHX	1224	1026
Tol	268176	150900
nC8	182	142
EB	3748	1390
m/p-xyl	4369	3310
o-xyl	2569	3816
nC9	827	480
1,2,4 TMB	2994	1763
nC10	1137	759
nC11	2349	1370
Naph	1636	805
nC12	325	173
IP13	289	233
IP14	1151	524
nC13	429	177
IP15	943	369
nC14	0	0
IP16	809	313
nC15	297	107
nC16	317	40
IP18	623	177
nC17	176	58
Pristane	627	289
nC18	169	40
Phytane	343	155
nC19	282	67
nC20	45	22
nC21	38	11
nC22	0	0
nC23	0	0
nC24	35	9
nC25	0	0
nC26	70	11
nC27	0	0
nC28	0	0
nC29	119	13
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	21	11
nC39	0	0
nC40	32	13

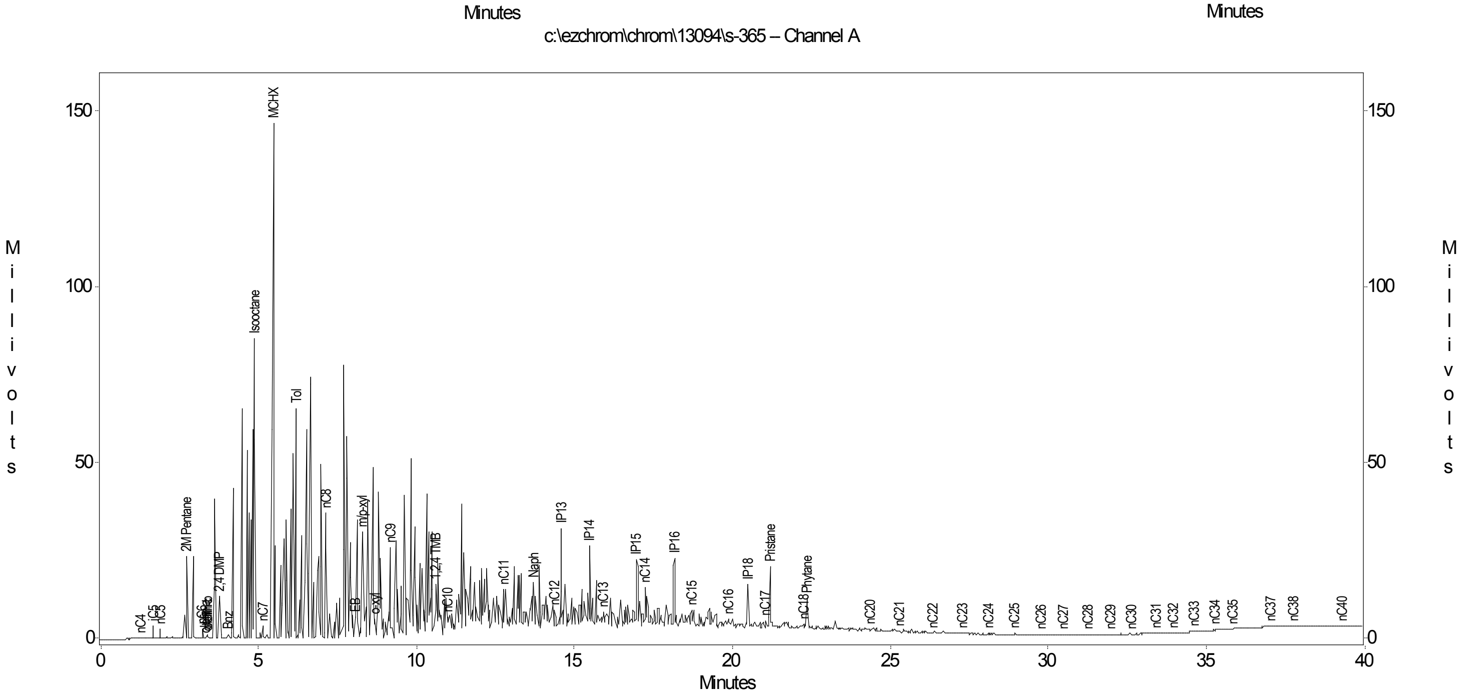
Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-365
Acquired : Jul 03, 2013 11:44:42









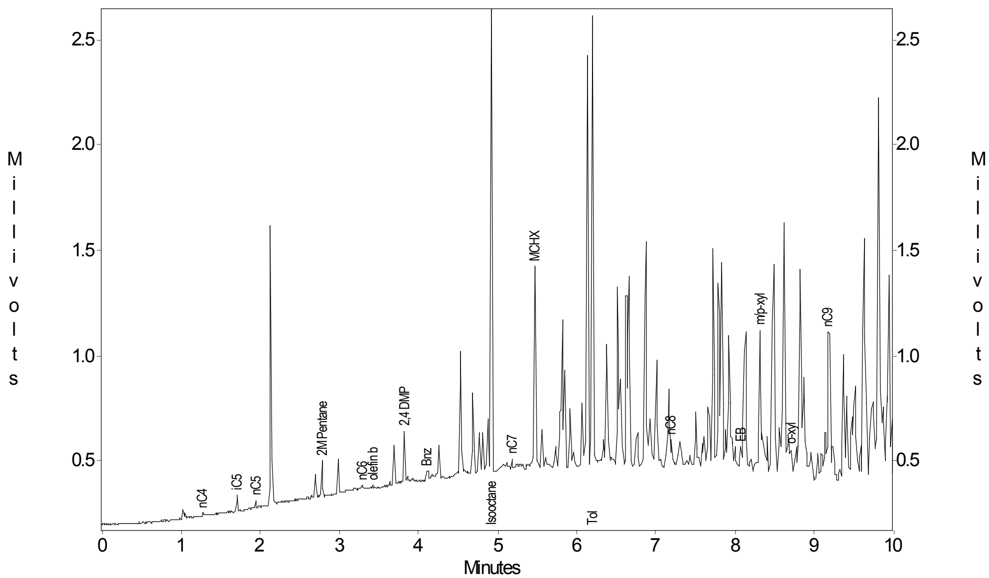
Channel A Results

Peak	Area	Height
nC4	105	179
iC5	2600	3883
nC5	2042	2857
MTBE	0	0
2M Pentane	20874	23601
nC6	2531	2610
olefin a	162	167
olefin b	843	850
olefin c	498	438
2,4 DMP	12548	12079
Bnz	1279	1038
Isooctane	109726	85200
nC7	4722	3550
MCHX	258006	146289
Tol	88993	65238
nC8	49606	35858
EB	9330	6049
m/p-xyl	62115	30313
o-xyl	8009	5581
nC9	41432	25492
1,2,4 TMB	33983	14419
nC10	7407	4668
nC11	20077	10687
Naph	21941	12705
nC12	13179	4625
IP13	56295	27709
IP14	32127	22332
nC13	8020	3293
IP15	33216	18651
nC14	22840	10803
IP16	33568	19030
nC15	7256	4485
nC16	7242	2111
IP18	31884	12140
nC17	4050	1980
Pristane	37109	17482
nC18	2224	1363
Phytane	19308	9035
nC19	0	0
nC20	1829	666
nC21	618	274
nC22	298	175
nC23	573	178
nC24	1118	214
nC25	1753	283
nC26	557	187
nC27	246	101
nC28	500	131
nC29	429	108
nC30	176	57
nC31	138	65
nC32	71	45
nC33	320	111
nC34	389	89
nC35	77	39
nC36	0	0
nC37	82	37
nC38	30	4
nC39	0	0
nC40	31	21

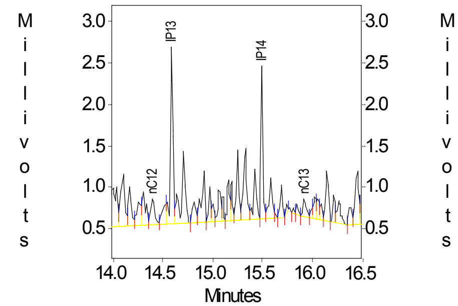
Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-369
Acquired : Jul 03, 2013 17:37:14

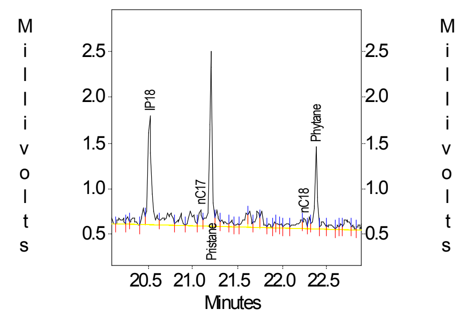
c:\ezchrom\chrom\13094\s-369.2 – Channel A



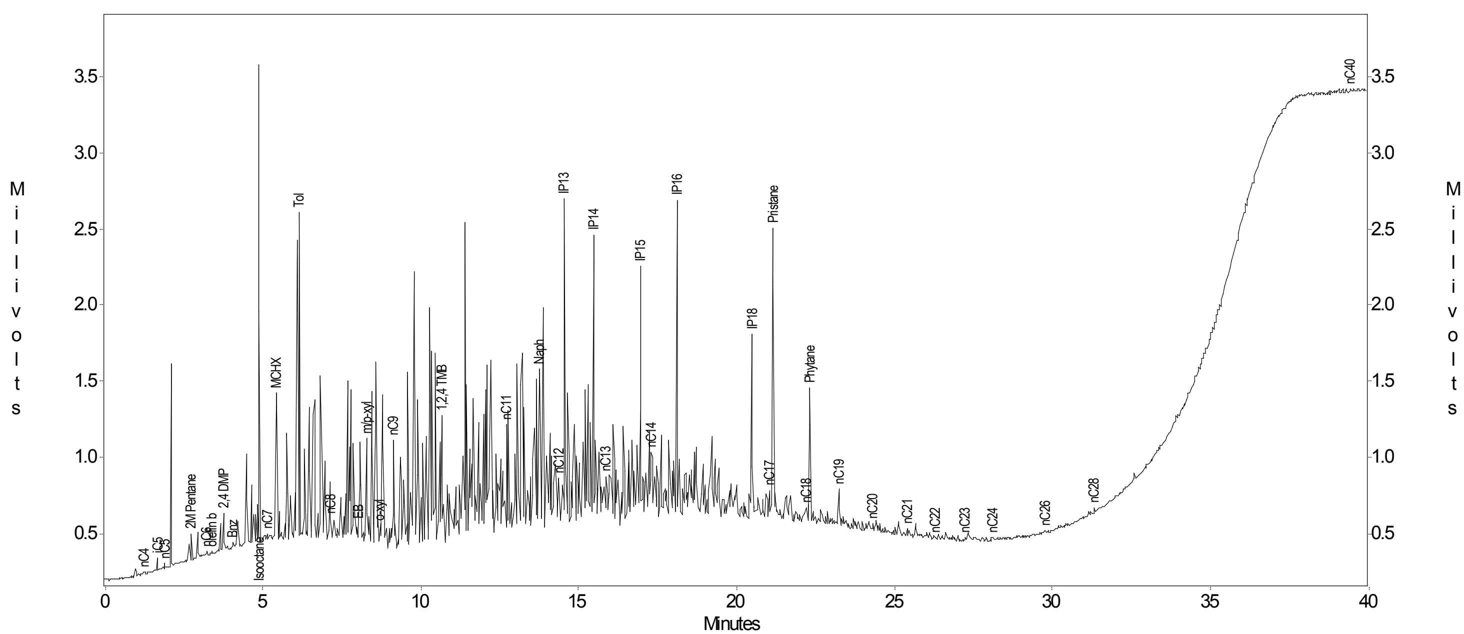
c:\ezchrom\chrom\13094\s-369.2 – Channel A



c:\ezchrom\chrom\13094\s-369.2 – Channel A



c:\ezchrom\chrom\13094\s-369.2 – Channel A



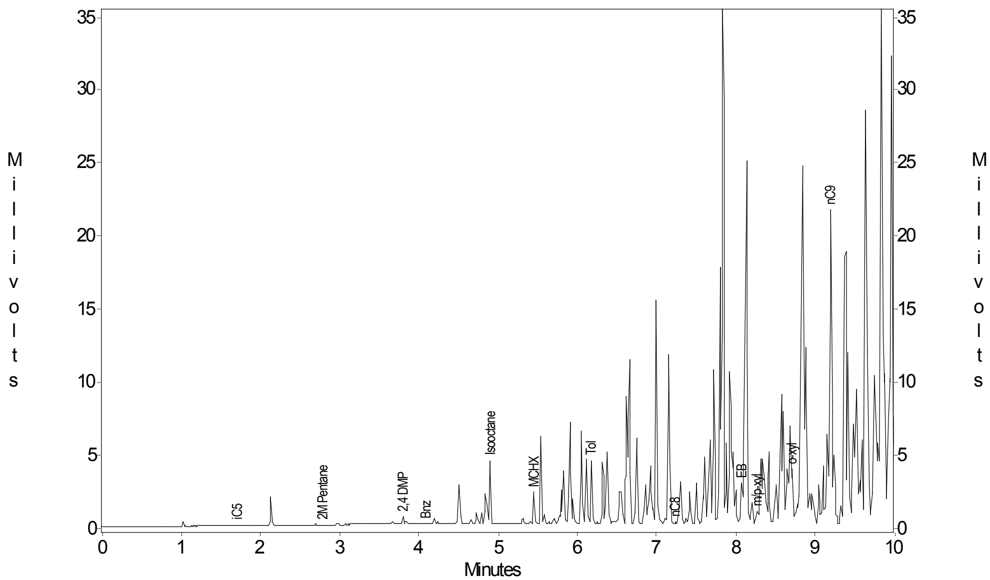
Channel A Results

Peak	Area	Height
nC4	15	12
iC5	51	77
nC5	22	31
MTBE	0	0
2M Pentane	147	170
nC6	20	22
olefin a	0	0
olefin b	12	14
olefin c	0	0
2,4 DMP	246	236
Bnz	46	33
Isooctane	3530	3129
nC7	55	47
MCHX	1320	960
Tol	2574	2126
nC8	241	135
EB	233	132
m/p-xyl	1117	691
o-xyl	215	142
nC9	1109	704
1,2,4 TMB	1709	833
nC10	0	0
nC11	1135	676
Naph	2065	1042
nC12	902	305
IP13	3561	2133
IP14	2484	1836
nC13	465	220
IP15	2904	1670
nC14	1082	430
IP16	3279	2045
nC15	0	0
nC16	0	0
IP18	3186	1208
nC17	383	192
Pristane	4105	1926
nC18	220	114
Phytane	1848	899
nC19	811	257
nC20	134	61
nC21	128	46
nC22	17	9
nC23	54	16
nC24	100	18
nC25	0	0
nC26	49	15
nC27	0	0
nC28	72	34
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	34	12

Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : S-382
Acquired : Jul 03, 2013 14:15:09

c:\ezchrom\chrom\13094\s-382 – Channel A



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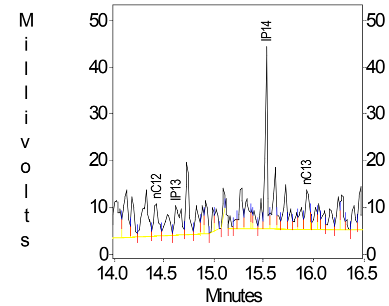

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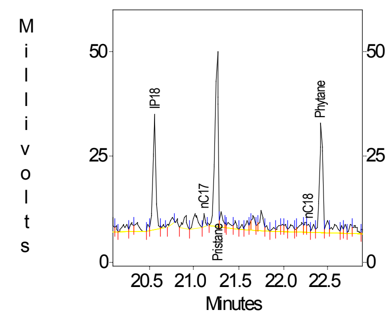
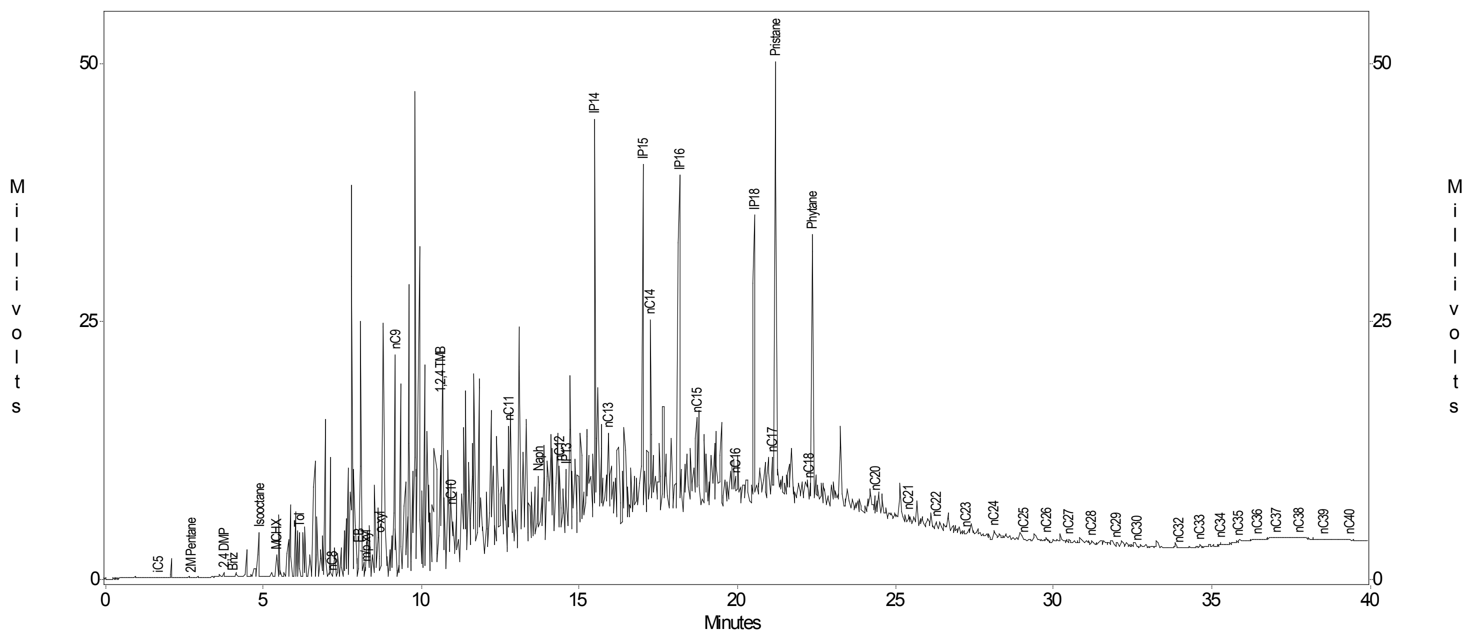


c:\ezchrom\chrom\13094\s-382 – Channel A



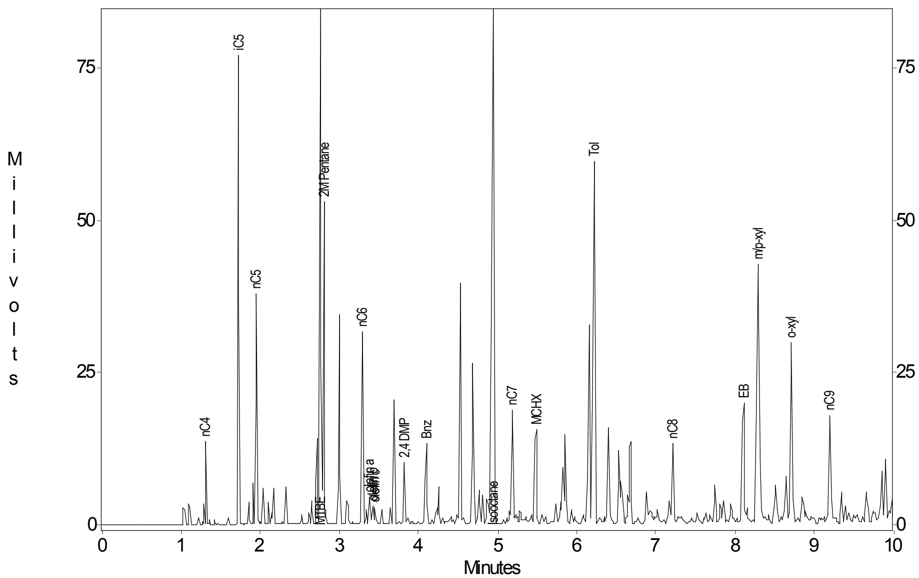
Channel A Results

Peak	Area	Height
nC4	0	0
i C5	21	25
nC5	0	0
MTBE	0	0
2M Pentane	11	14
nC6	0	0
olefin a	0	0
olefin b	0	0
olefin c	0	0
2, 4 DMP	473	451
Bnz	18	17
Isooctane	4815	4256
nC7	0	0
MCHX	2552	2058
Tol	5151	4286
nC8	49	30
EB	4020	2738
m/p-xyl	1217	811
o-xyl	4922	3662
nC9	33925	21428
1, 2, 4 TMB	34480	16629
nC10	9217	5620
nC11	22784	12146
Naph	14184	6424
nC12	22068	6901
IP13	26344	6459
IP14	62373	38825
nC13	21133	8514
IP15	70174	34421
nC14	41987	19107
IP16	69059	32603
nC15	15319	8627
nC16	6334	2595
IP18	61684	27490
nC17	5079	3203
Pristane	92603	41296
nC18	3312	1974
Phytane	57515	26258
nC19	0	0
nC20	4901	2122
nC21	2500	811
nC22	2263	704
nC23	241	197
nC24	2268	718
nC25	726	349
nC26	1365	397
nC27	656	333
nC28	123	112
nC29	596	264
nC30	238	117
nC31	0	0
nC32	126	72
nC33	853	257
nC34	1182	266
nC35	97	43
nC36	69	32
nC37	55	32
nC38	81	40
nC39	28	26
nC40	74	23

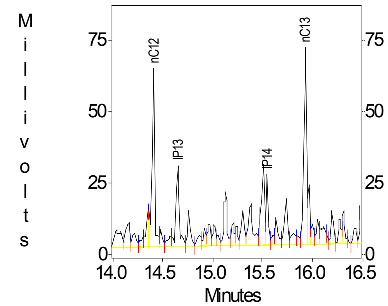
Torkelson Geochemistry, Inc.

Sun Philly Refinery, AOI-2 and AOI-4
Sample ID : Gas/Dies/Wax std
Acquired : Jul 03, 2013 10:25:49

c:\ezchrom\chrom\13094\gadiwax2 – Channel A



c:\ezchrom\chrom\13094\gadiwax2 – Channel A



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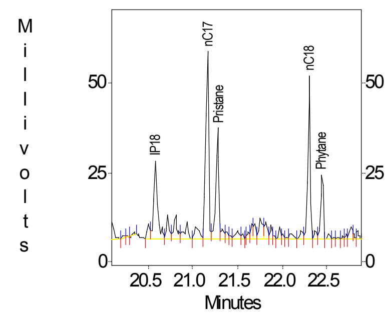
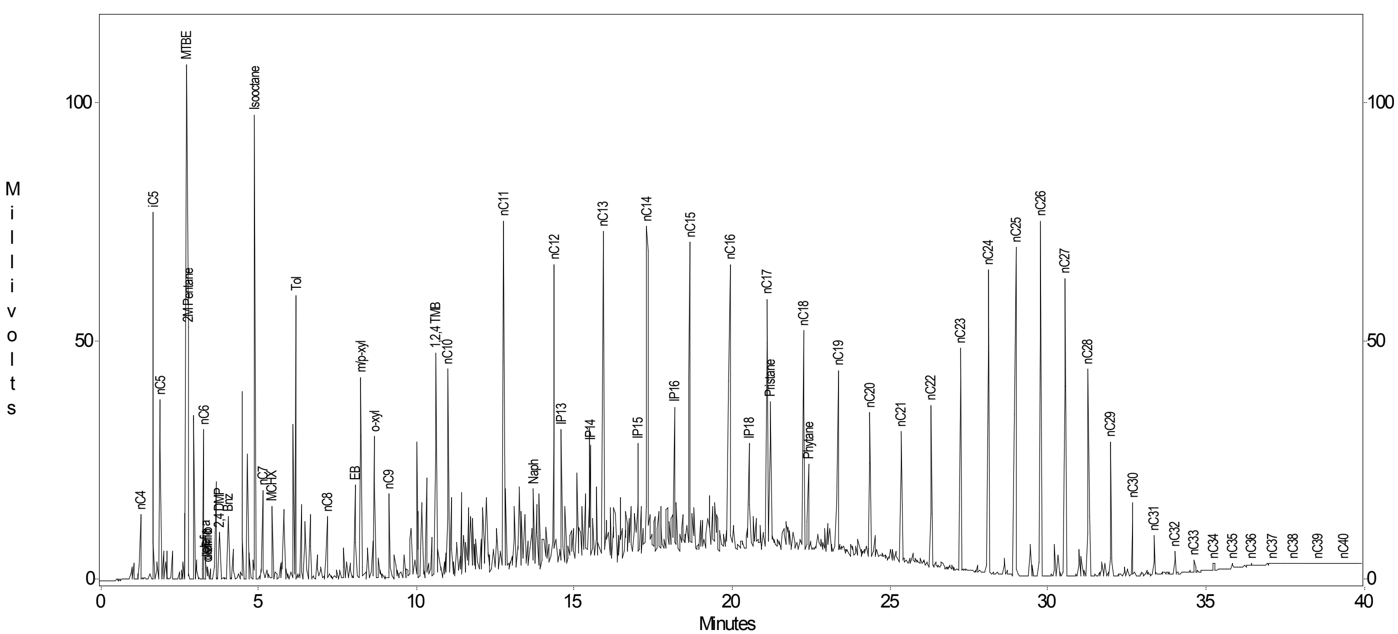


c:\ezchrom\chrom\13094\gadiwax2 – Channel A



Channel A Results

Peak	Area	Height
nC4	7777	13634
iC5	52343	77135
nC5	27378	37765
MTBE	101096	107921
2M Pentane	46598	53077
nC6	30945	31475
olefin a	5079	4316
olefin b	2850	2754
olefin c	2958	2498
2,4 DMP	10350	9884
Bnz	15708	13254
Isooctane	138338	97241
nC7	22456	18474
MCHX	19409	15383
Tol	91676	59363
nC8	15936	13025
EB	26533	19547
m/p-xyl	92392	42412
o-xyl	43740	29657
nC9	28786	17581
1,2,4 TMB	79162	47077
nC10	67341	43464
nC11	127792	72961
Naph	31661	16715
nC12	140912	63288
IP13	59187	28695
IP14	36134	24710
nC13	134735	69622
IP15	46985	23693
nC14	178610	68492
IP16	68239	30076
nC15	125498	63511
nC16	134528	59971
IP18	64055	21927
nC17	110602	52649
Pristane	69230	31110
nC18	87188	46023
Phytane	36703	18009
nC19	88952	38617
nC20	61018	30991
nC21	49144	27787
nC22	62132	34078
nC23	100661	46831
nC24	99631	63666
nC25	192730	68818
nC26	201525	74328
nC27	108247	62660
nC28	101027	43779
nC29	55876	27990
nC30	25729	14712
nC31	14775	8076
nC32	7804	4647
nC33	4228	2417
nC34	2349	1310
nC35	1264	746
nC36	775	410
nC37	490	221
nC38	320	124
nC39	206	78
nC40	210	56

Appendix H
Table 1
AOI 3 LNAPL Characterization Summary Table
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Interpretation of Product Types, Proportions, and Weathering						Similarities to Other Samples in Study		
Characterization Results Compiled for CCR (TGI Job No. 04046 - Analyzed in March 2004)								
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**
S-21	0.9281	Residual Oil	Residual Oil	100	Extreme	S-92 & S-158	N-78 & S-142	All other residual oils in the study except A-133
S-59	0.8039	Gasoline	?Gasoline	60	Severe		B-39, B-129, S-78, S-117, & S-138	All other gasolines in study
			Middle Distillate	40	Extreme			All other middle distillates in the study
S-60	0.7898	Aviation Gasoline	Aviation Gasoline	80	Extreme	S-103	WP-9-2	All other aviation gasolines in study
			Middle Distillate	20				All other middle distillates in the study
S-68/S-29	0.855	Middle Distillate	Middle Distillate	100	Highly		S-29	All other middle distillates in the study
BF-106	0.8199	Condensate	Condensate	100	Highly			S-130
BF-107	0.8671	Middle Distillate	Middle Distillate	100	Severe	S-32, S-53, S-56, & S-97		All other middle distillates in the study
Characterization Results Compiled for AOI 3 Site Characterization Activities (TGI Job No. 10099 - Analyzed in July 2010)								
S-282	0.8104	Middle Distillate	Middle Distillate	70	Extreme			S-315
			Aviation Gasoline	20	Severe		S-297	
			Heavier Material	10	Extreme			All other heavier materials in the study
S-285	0.8921	Middle Distillate	Middle Distillate	80	Extreme	Unique		
			Heavier Material	20				All other heavier materials in the study
			Unknown Lt. Material	<1		Unique		

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 reported were analyzed by TGI.
Product interpretations were provided by TGI.

Torkelson Geochemistry, Inc.				
Density Measurements				
Paar DMA 512 / DMA 60		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	10099	7/20/10
S-285	0.8921	60F	10099	7/20/10
S-297	0.8229	60F	10099	7/20/10
S-313	0.8694	60F	10099	7/20/10
S-315	0.8552	60F	10099	7/20/10

Torkelson Geochemistry, Inc.

2528 S. Columbia Place
Tulsa, OK 74114-3233

Phone: 918-749-8441
Fax: 918-749-6005
e-mail: BTorkelson@torkelsongeochemistry.com

CHAIN-OF-CUSTODY RECORD

Project: Sunoco, Inc. Philadelphia Refinery
Location: 3144 Passyunk Avenue, Philadelphia, PA 19145

Proj. No.: AOIs 2, 3, & 7 SCRs/RIRs
P.O.:
Sampled By: Tim Delk

Report/Bill To: Langan Engineering & Env'l Services
Address: P.O. Box 1569
Doylestown, PA 18901-0219
Phone: 215.491.6500
Fax: 215.491.6501
e-mail: dwebster@langan.com

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. Must have data results no later than July 30, 2010.

Requested Turn-Around Time: Data needed by July 30th

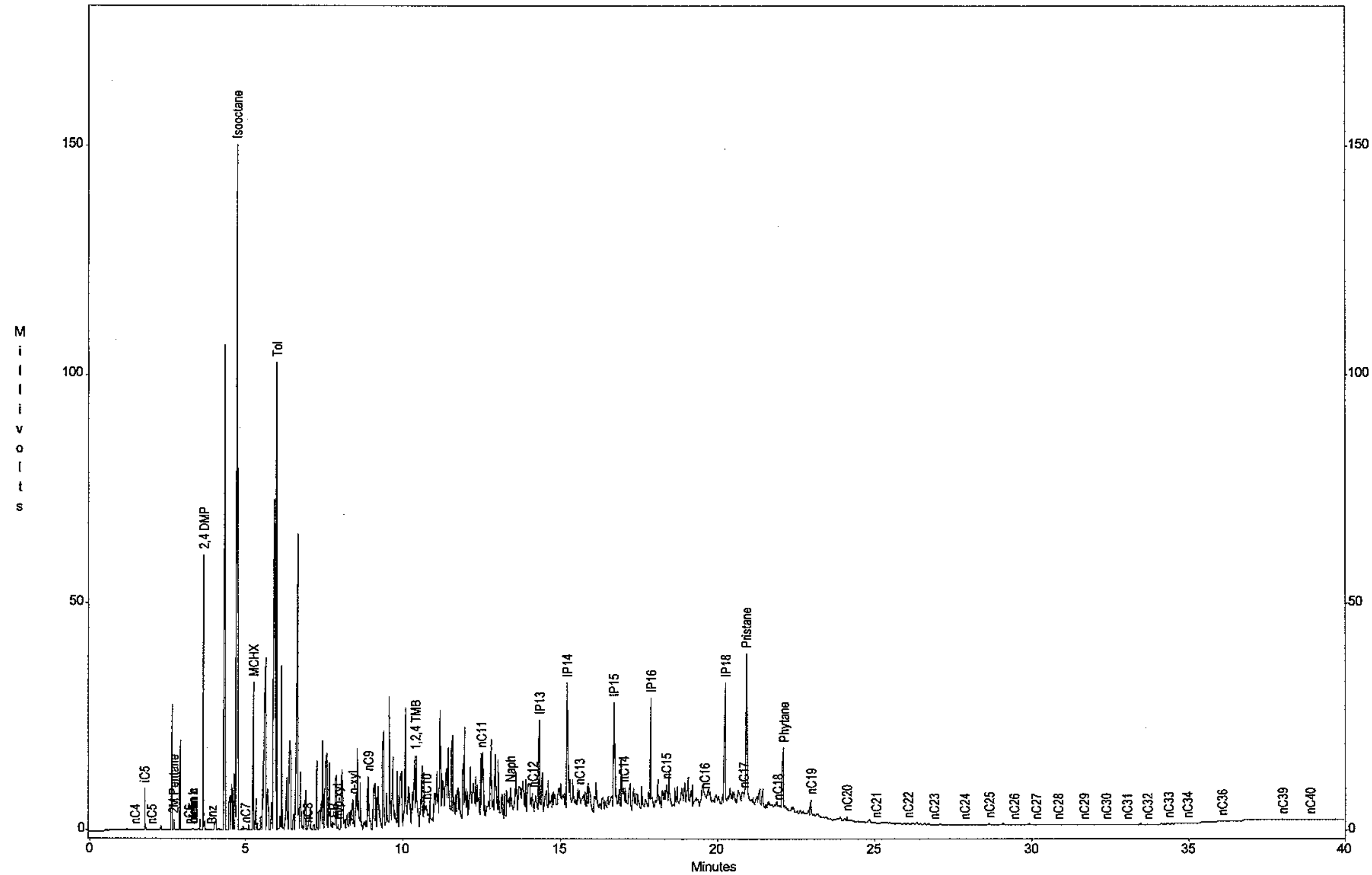
	ITEM NO.	SAMPLE DESCRIPTION	DATE	MATRIX	LAB NO.	Total # OF Vials	PRESERVATIVES: None	Fingerprint-GC Characterization	Density	Viscosity	Water Surface Tension	NAPL Surface Tension	NAPL/Water Interfac. Tens.	Lead	Sulfur	REMARKS
AOI-3	1	S-282	7/15/10	Prod		1	X	X	X							Include a "Brief Description/Interpretation" of LNAPL, to be
AOI-3	2	S-285	↓	↓		1	↓	↓	↓							consistent with existing LNAPL types for Sunoco Philadelphia.
AOI 2	3	S-297				1										
AOI 2	4	S-313				1										Times S-282 - 0950
AOI 2	5	S-315	↓			1										S-285 - 1115
AOI-7	6	C-143	7/15/10	Prod		1	X	X	X							S-297 - 1100
	7															S-313 - 1035
	8															S-315 - 1020
	9															C-143 - 1130
	10															

RELINQUISHED BY	ACCEPTED BY	DATE	TIME
[signature]	T S DRAKE WAREHOUSE	07-16	
RELEASED TO FED EX EXP.	SAME DATE		
	[signature]	7-19-10	0845

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-297
Acquired : Jul 20, 2010 10:38:19

c:\ezchrom\chrom\10099\s-297 – Channel A



Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-313
Acquired : Jul 20, 2010 14:02:27

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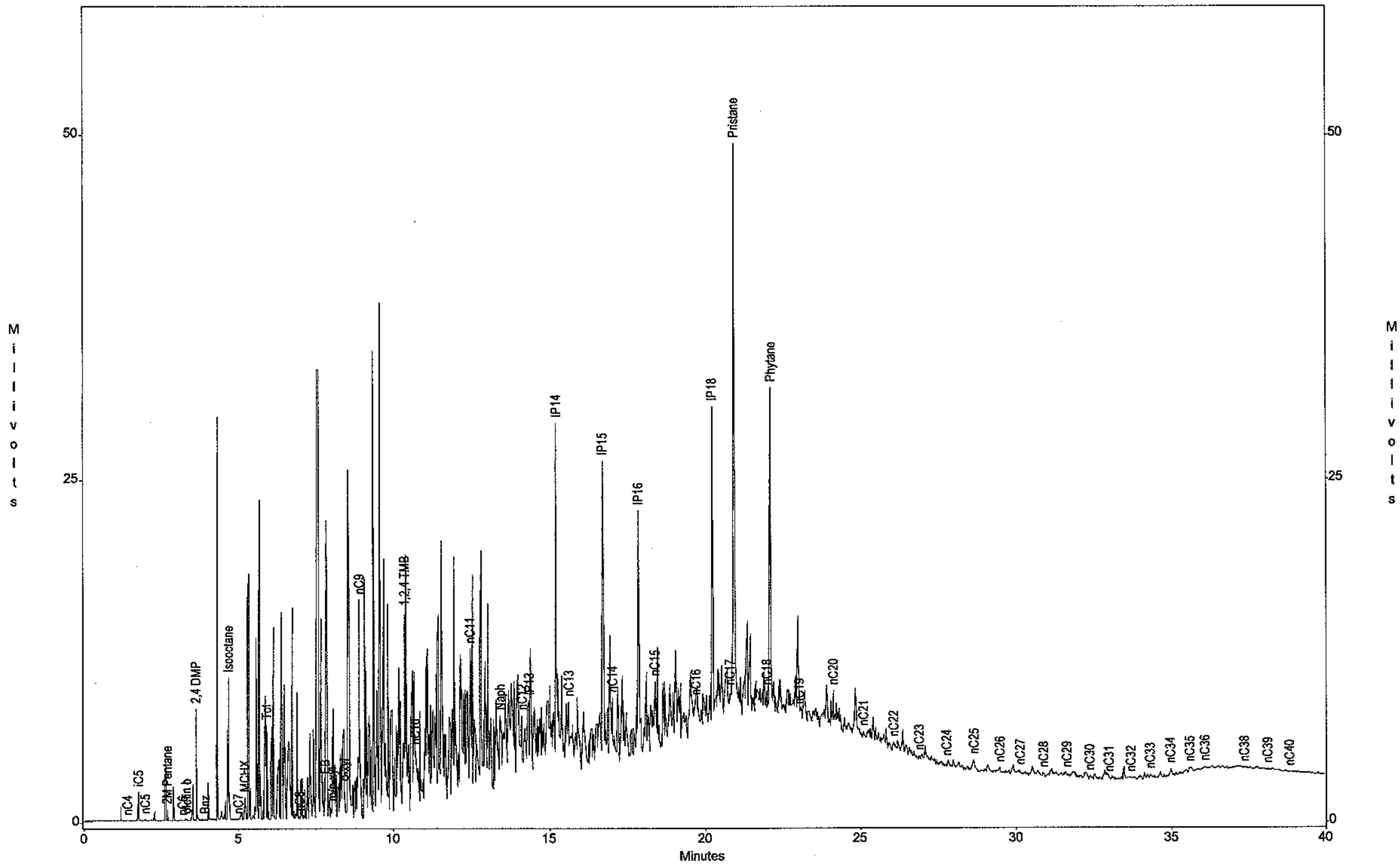

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-315
Acquired : Jul 20, 2010 13:11:48

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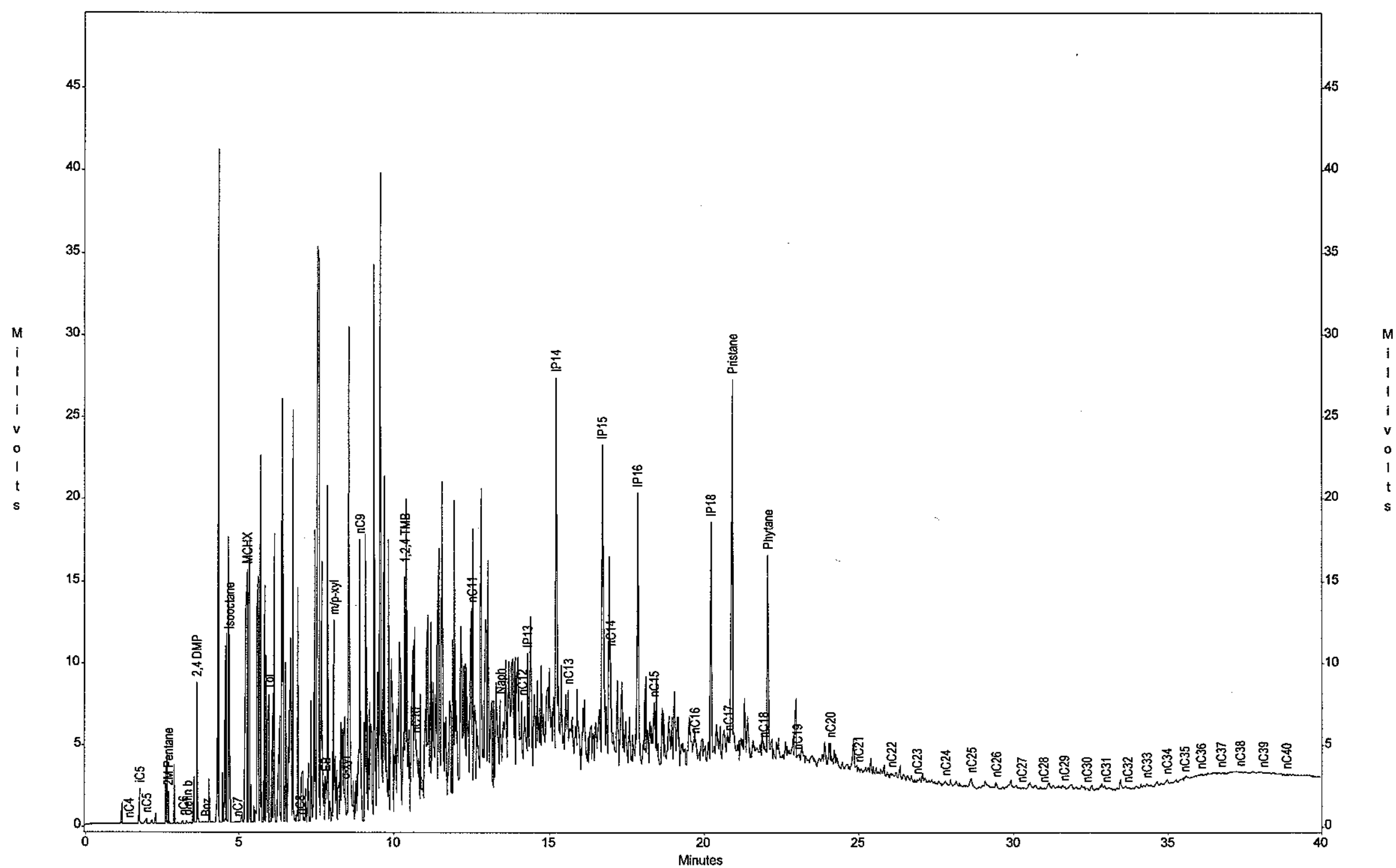

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : C-143
Acquired : Jul 20, 2010 11:28:51

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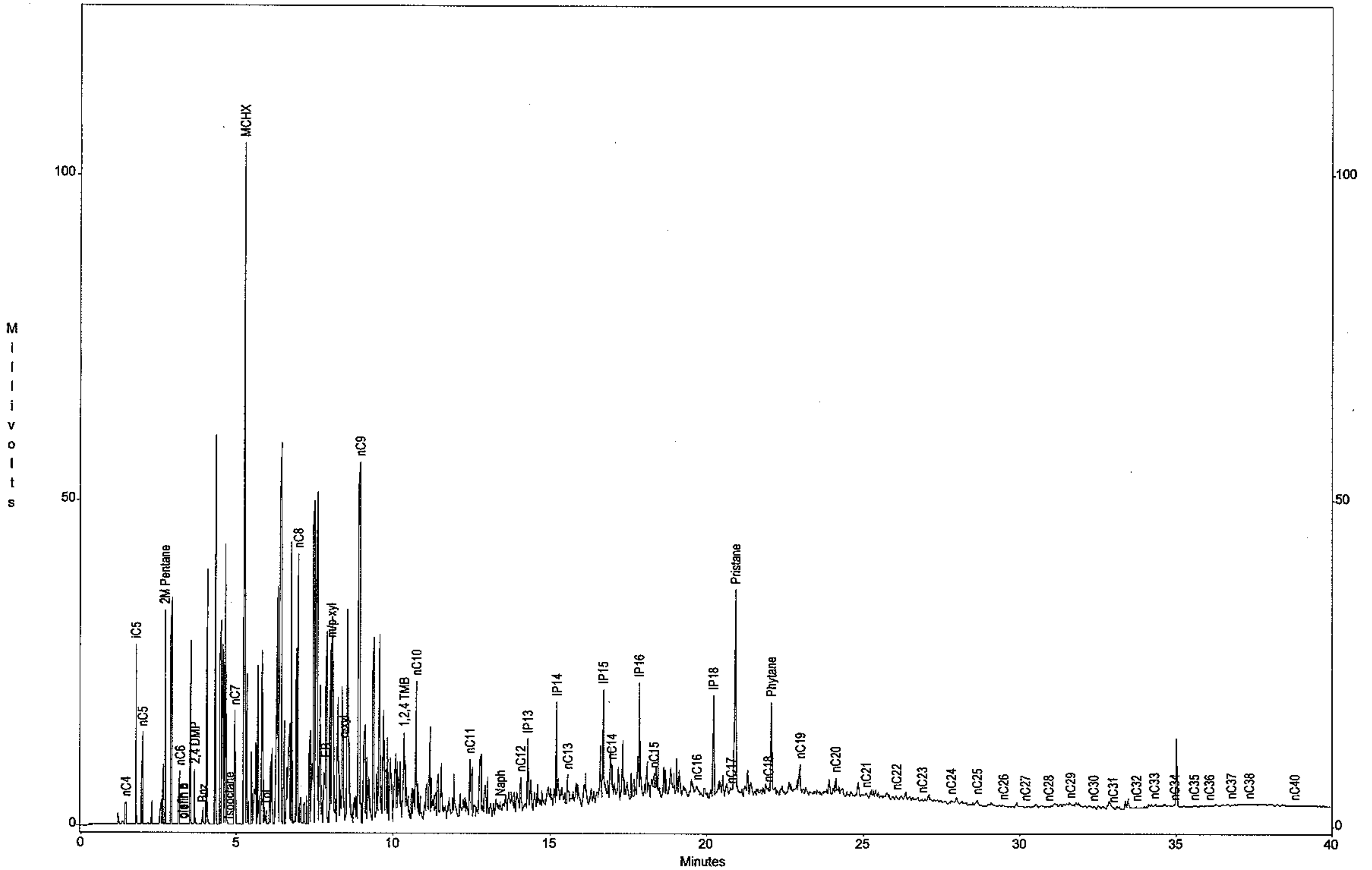

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-282
Acquired : Jul 20, 2010 12:19:51

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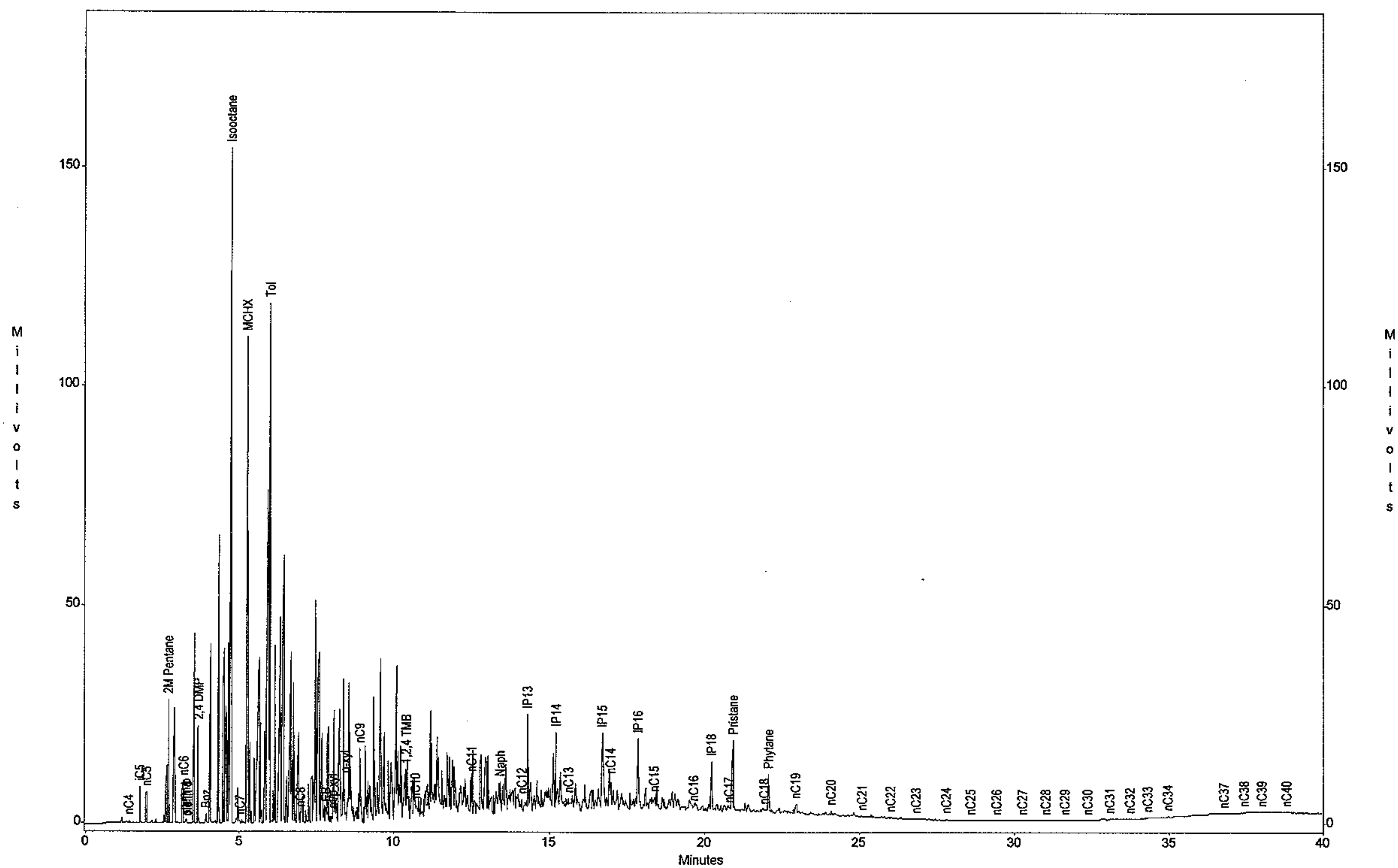

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-285
Acquired : Jul 20, 2010 15:01:23

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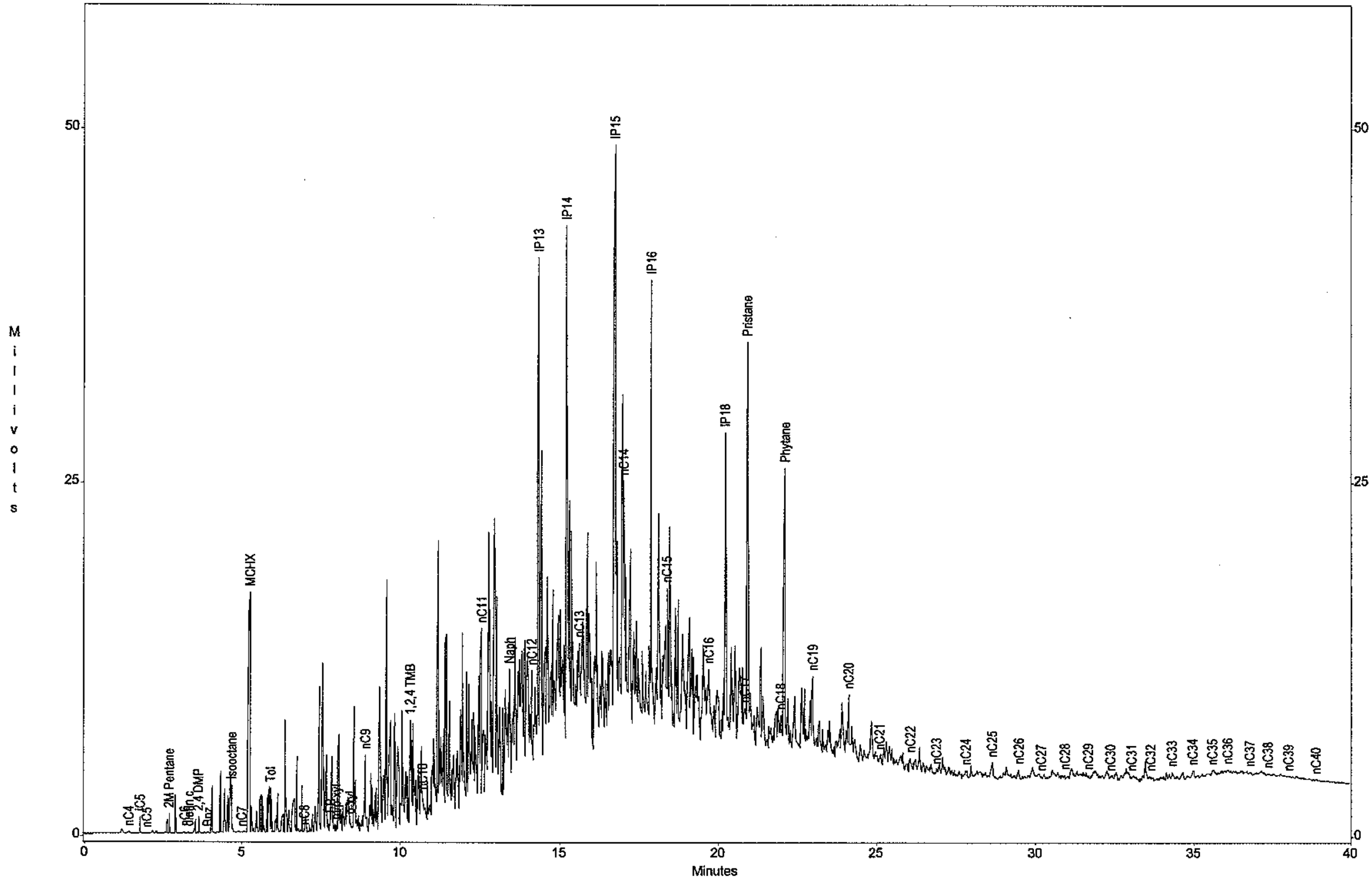
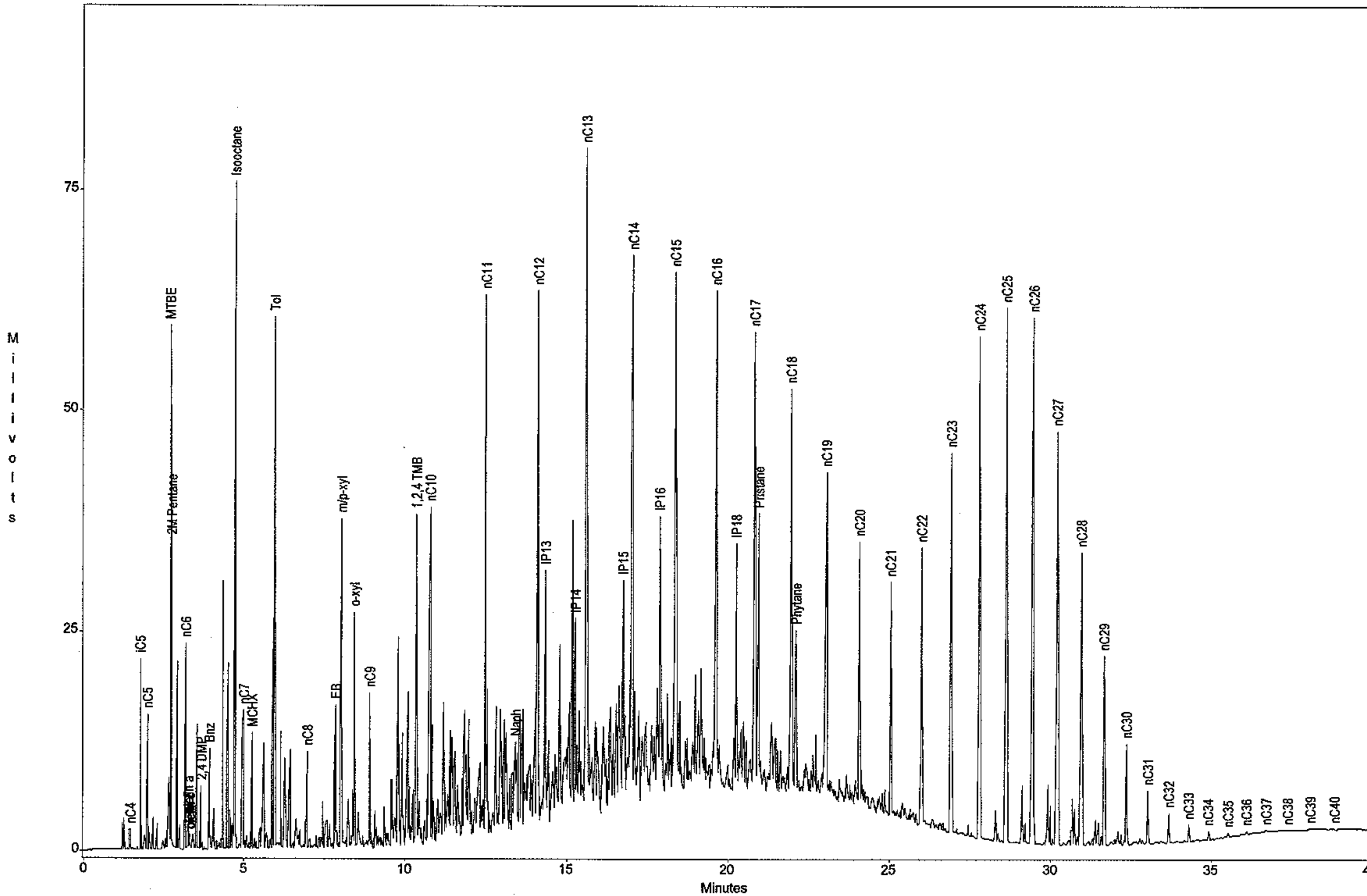


Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
Acquired : Jul 20, 2010 09:47:53

c:\ezchrom\chrom\10099\gadiwax2 – Channel A



Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : C-143
Acquired : Jul 20, 2010 11:28:51

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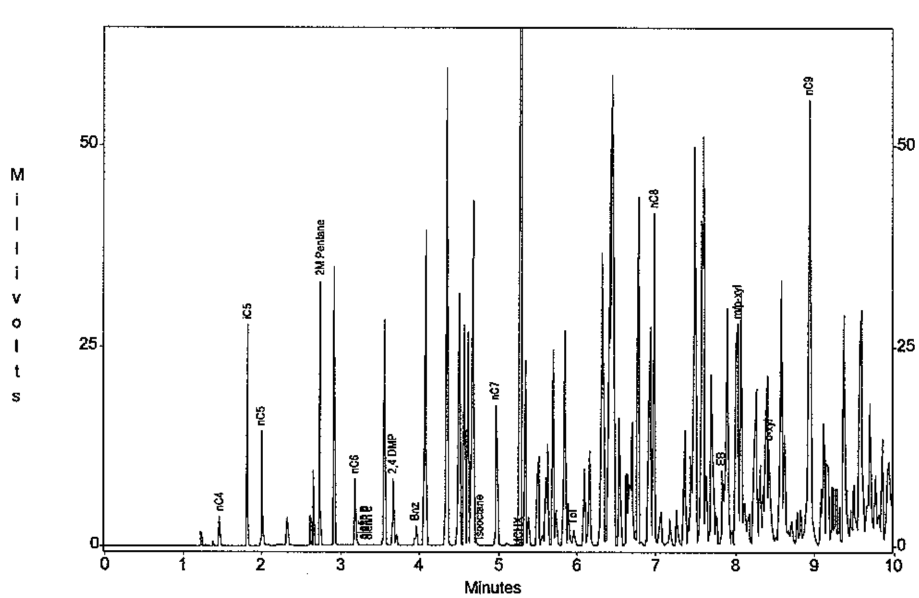

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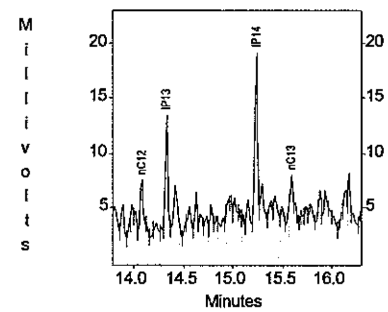

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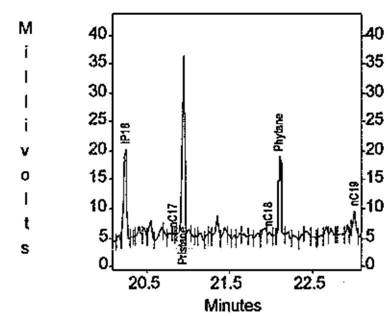

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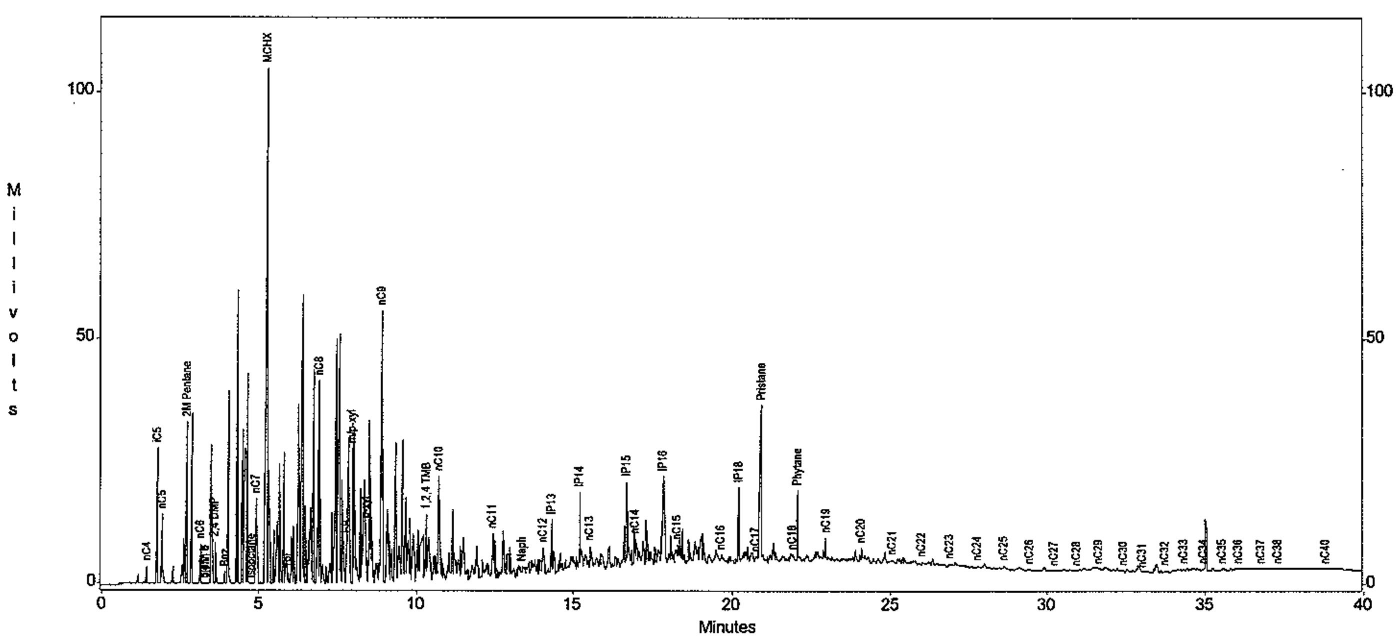


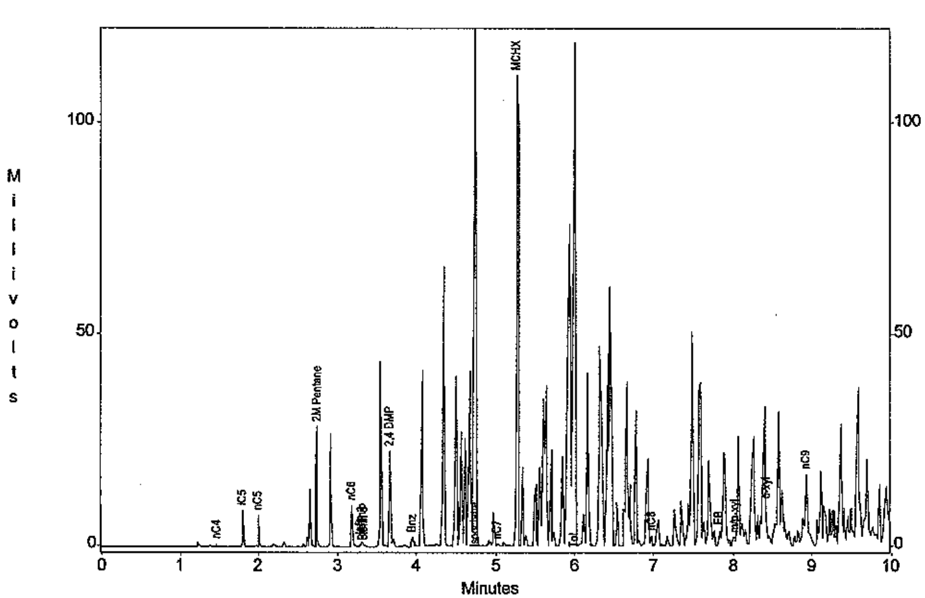
Channel A Results

Peak	Area	Height
nC4	2466	3538
iC5	20859	27746
nC5	11629	14336
MTBE	0	0
2M Pentane	30030	33150
nC6	8194	8347
olefin a	31	22
olefin b	87	79
olefin c	170	131
2.4 DMP	8824	8480
Bnz	3262	2470
Isooctane	66	28
nC7	20862	17512
MCHX	175772	104822
Tol	3534	2045
nC8	56205	41636
EB	13984	9360
m/p-xyl	48704	27779
o-xyl	27084	12423
nC9	103249	55760
1.2.4 TMB	21432	13604
nC10	35696	21414
nC11	18458	9121
Naph	5146	2309
nC12	13846	5931
IP13	23181	11735
IP14	30530	17192
nC13	12747	6018
IP15	37102	18746
nC14	22855	7069
IP16	37790	19641
nC15	19382	5566
nC16	7722	3124
IP18	42487	17021
nC17	5390	2594
Pristane	81585	33254
nC18	6651	2466
Phytane	41071	15565
nC19	18528	5838
nC20	8963	3423
nC21	2753	766
nC22	2350	782
nC23	1492	493
nC24	1618	483
nC25	2799	700
nC26	1023	328
nC27	200	104
nC28	304	155
nC29	741	432
nC30	386	214
nC31	93	36
nC32	333	172
nC33	1103	305
nC34	46	61
nC35	190	102
nC36	147	91
nC37	30	46
nC38	39	44
nC39	0	0
nC40	108	28

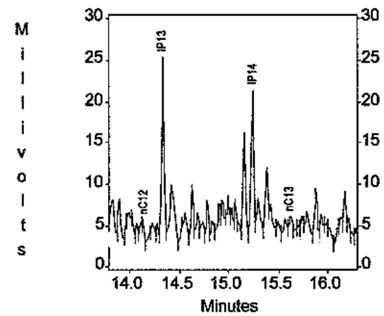
Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-282
Acquired : Jul 20, 2010 12:19:51

c:\ezchrom\chrom\10099\s-282 – Channel A



c:\ezchrom\chrom\10099\s-282 – Channel A



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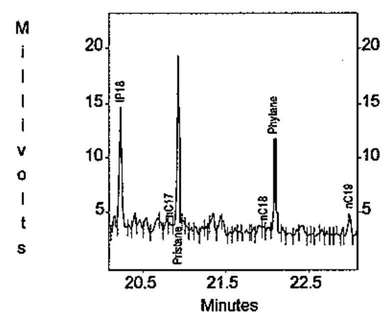
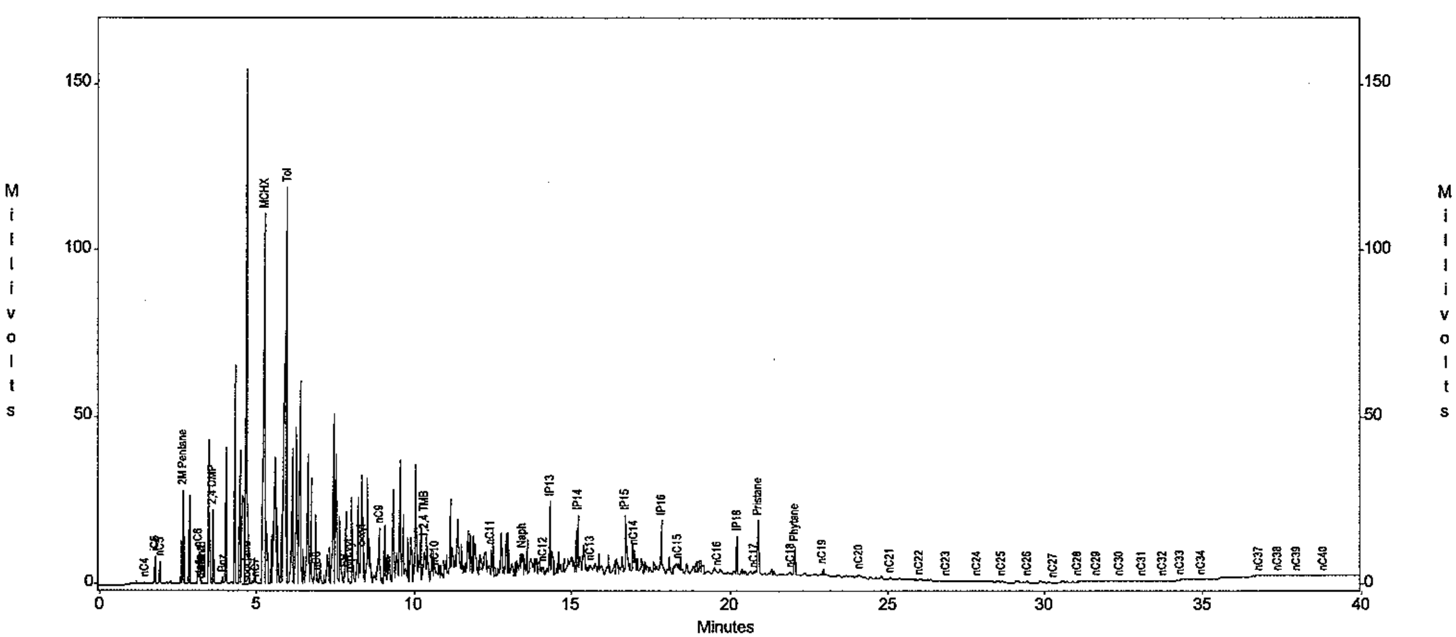


c:\ezchrom\chrom\10099\s-282 – Channel A



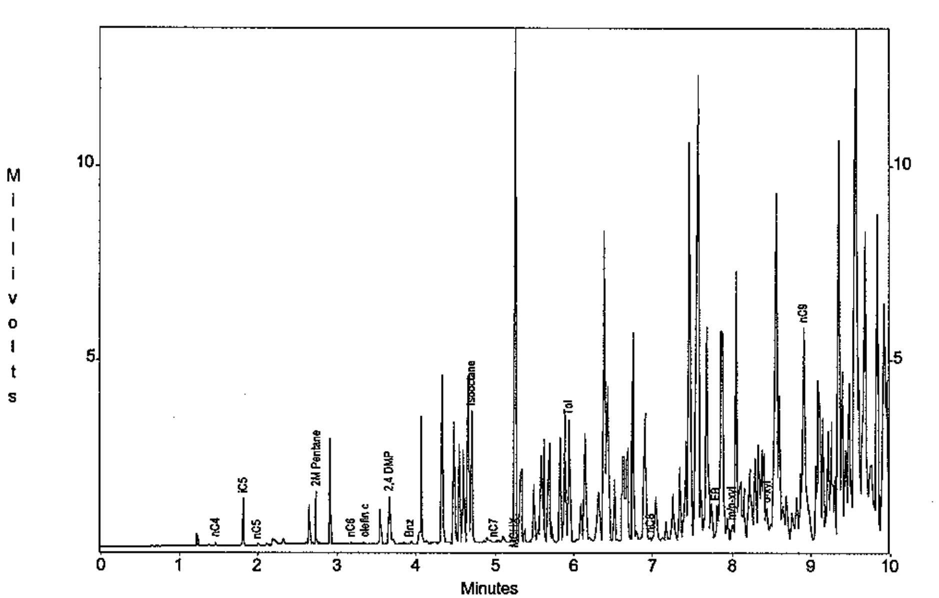
Channel A Results

Peak	Area	Height
nC4	413	613
iC5	6385	8603
nC5	5842	7271
MTBE	0	0
2M Pentane	25979	28465
nC6	9651	9598
olefin a	267	250
olefin b	1116	1001
olefin c	589	445
2,4 DMP	23606	22556
Bnz	3163	2349
Isooctane	299102	154391
nC7	888	627
MCHX	192023	111391
Tol	214424	118961
nC8	3212	2532
EB	5400	3705
m/p-xyl	3713	2192
o-xyl	11140	10112
nC9	31252	16912
1,2,4 TMB	16970	11670
nC10	7402	3235
nC11	16239	8213
Naph	17069	7443
nC12	5874	3289
IP13	40678	22930
IP14	31468	18695
nC13	9703	3413
IP15	34942	18125
nC14	19906	7423
IP16	32439	16402
nC15	4793	2130
nC16	1643	1046
IP18	27814	11563
nC17	3811	1060
Pristane	35702	16445
nC18	1769	888
Phytane	19965	8901
nC19	5124	2134
nC20	2822	1087
nC21	1171	384
nC22	295	180
nC23	76	43
nC24	487	191
nC25	1267	251
nC26	563	163
nC27	247	58
nC28	72	37
nC29	194	59
nC30	198	50
nC31	83	34
nC32	67	37
nC33	53	34
nC34	90	43
nC35	0	0
nC36	0	0
nC37	78	40
nC38	58	27
nC39	128	26
nC40	45	17

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-285
Acquired : Jul 20, 2010 15:01:23

c:\ezchrom\chrom\10099\s-285 – Channel A



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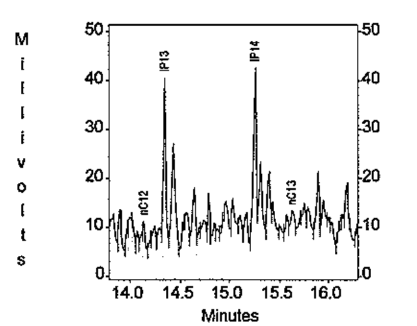

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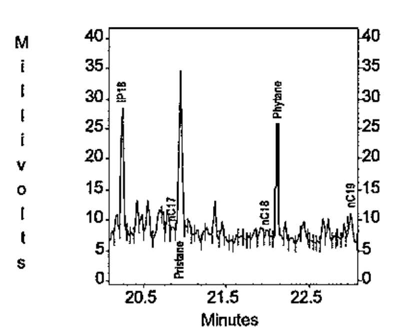

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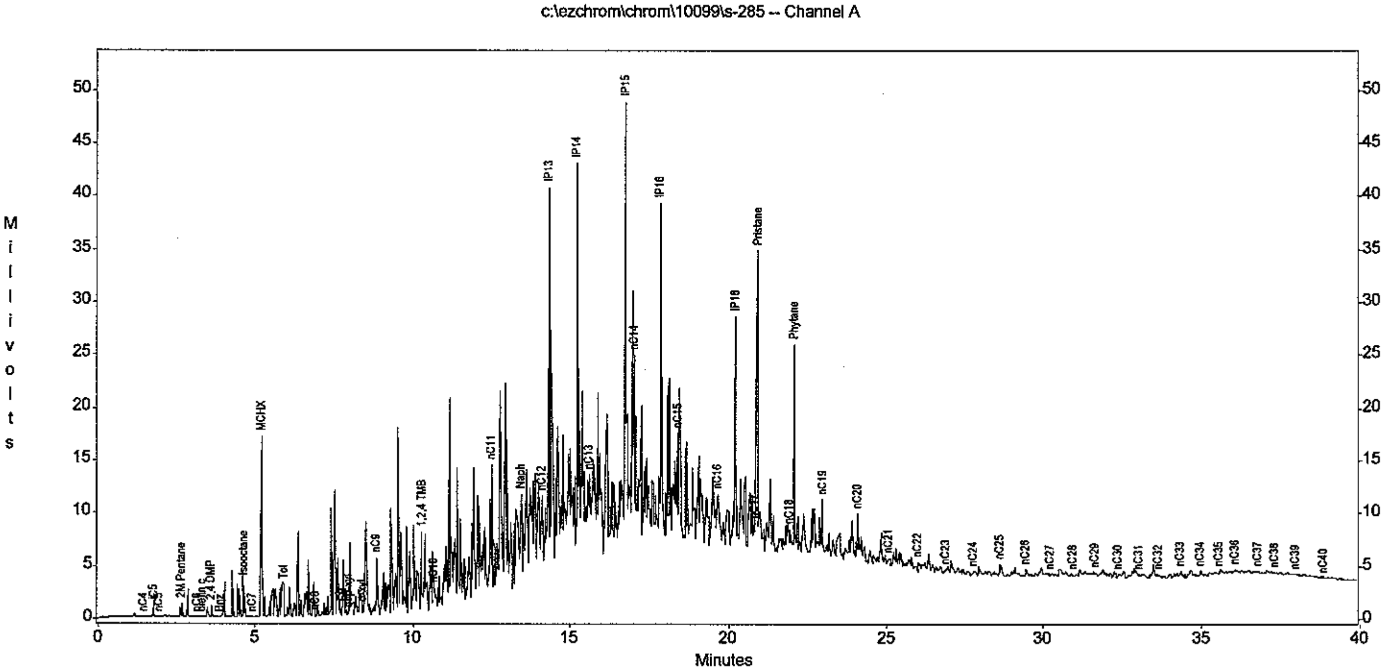


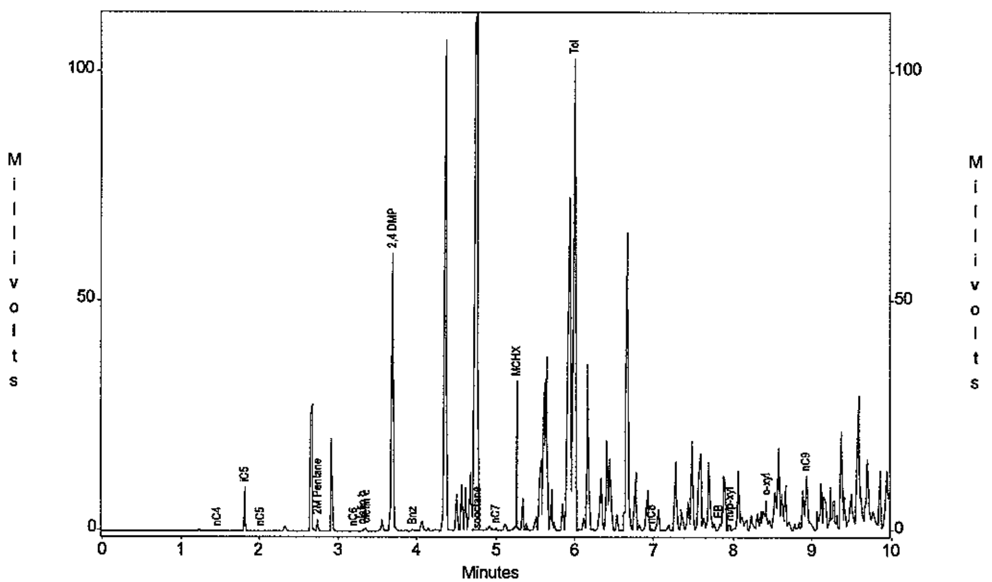
Channel A Results

Peak	Area	Height
nC4	74	75
iC5	935	1227
nC5	49	49
MTBE	0	0
2M Pentane	1281	1375
nC6	31	25
olefin a	0	0
olefin b	0	0
olefin c	38	21
2.4 DMP	1378	1191
Bnz	60	34
Isooctane	3866	3421
nC7	52	32
MCHX	19867	17102
Tol	3987	3133
nC8	115	101
EB	1313	890
m/p-xyl	560	381
o-xyl	974	607
nC9	9894	5486
1.2.4 TMB	13195	7526
nC10	3833	1930
nC11	18896	11773
Naph	29599	8698
nC12	16460	7837
IP13	70772	36698
IP14	73665	37957
nC13	26993	8099
IP15	87311	41720
nC14	43137	17507
IP16	63159	31225
nC15	26231	9973
nC16	15970	5080
IP18	51741	22060
nC17	9435	2736
Pristane	74194	28622
nC18	6456	2642
Phytane	47968	20155
nC19	16910	5754
nC20	12299	4931
nC21	1813	915
nC22	3026	976
nC23	986	421
nC24	1418	548
nC25	5649	1122
nC26	2012	674
nC27	646	257
nC28	559	289
nC29	346	224
nC30	414	137
nC31	221	166
nC32	210	201
nC33	679	318
nC34	277	189
nC35	315	128
nC36	147	91
nC37	221	147
nC38	83	50
nC39	39	46
nC40	265	85

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-297
Acquired : Jul 20, 2010 10:38:19

c:\ezchrom\chrom\10099\s-297 – Channel A



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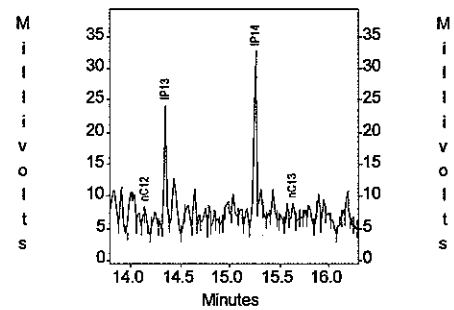

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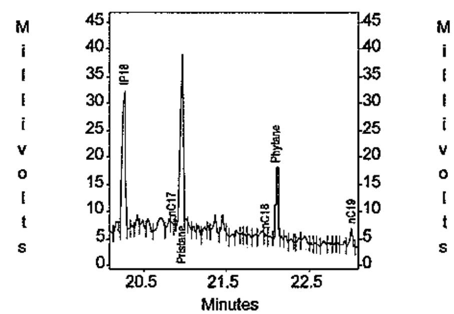
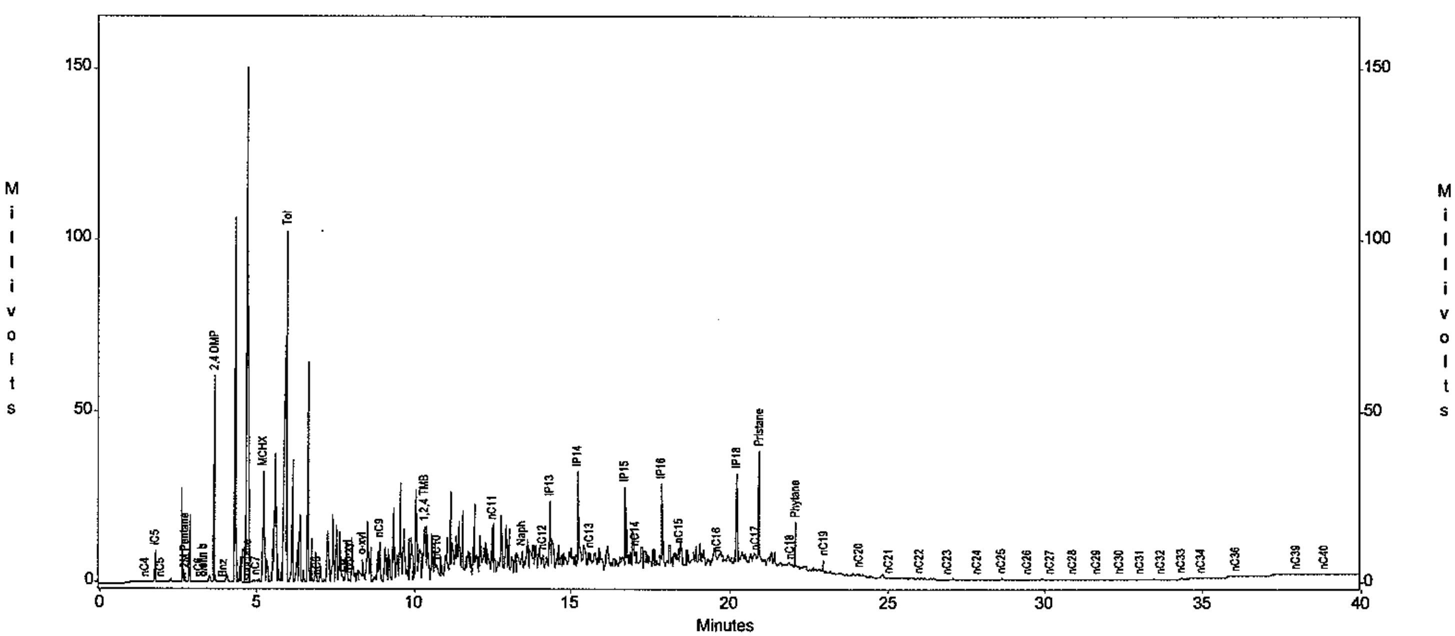


c:\ezchrom\chrom\10099\s-297 – Channel A



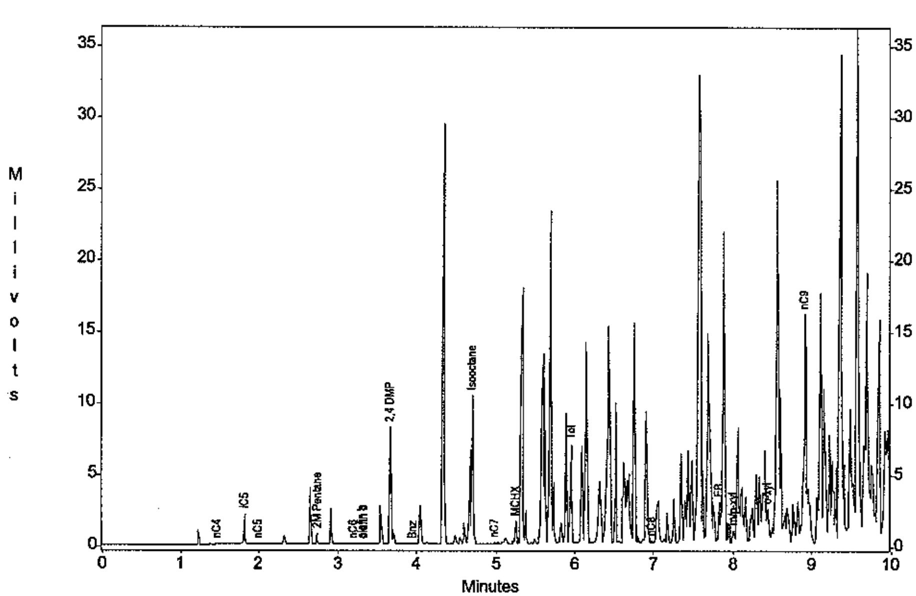
Channel A Results

Peak	Area	Height
nC4	63	70
iC5	6808	9247
nC5	38	29
MTBE	0	0
2M Pentane	2502	2620
nC6	33	27
olefin a	0	0
olefin b	204	205
olefin c	519	439
2.4 DMP	66668	60475
Bnz	255	199
Isooctane	289515	150440
nC7	564	490
MCHX	39219	32508
Tol	175037	102734
nC8	494	408
EB	2428	1514
m/p-xyl	2065	1194
o-xyl	9020	6516
nC9	21246	11819
1.2.4 TMB	24547	15782
nC10	7811	4107
nC11	28557	14648
Naph	11705	6052
nC12	5991	3837
IP13	37220	20236
IP14	51503	28733
nC13	14185	4971
IP15	43217	24055
nC14	9199	5114
IP16	46807	24547
nC15	9104	3937
nC16	6142	3334
IP18	70459	28211
nC17	9949	4347
Pristane	97158	35244
nC18	5392	2411
Phytane	36753	15011
nC19	12604	4082
nC20	2542	998
nC21	134	132
nC22	650	210
nC23	166	124
nC24	671	199
nC25	1842	348
nC26	626	208
nC27	305	113
nC28	282	79
nC29	212	80
nC30	159	42
nC31	46	25
nC32	92	38
nC33	40	25
nC34	393	78
nC35	0	0
nC36	706	50
nC37	0	0
nC38	0	0
nC39	184	31
nC40	72	26

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-313
Acquired : Jul 20, 2010 14:02:27

c:\ezchrom\chrom\10099\s-313 -- Channel A



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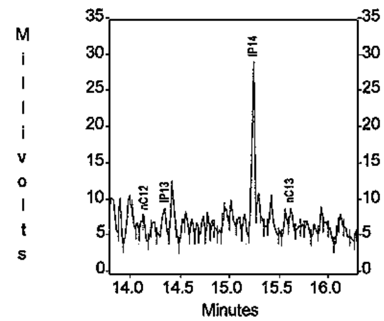
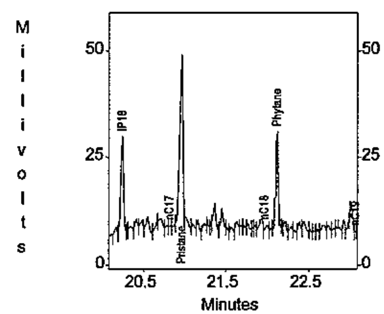
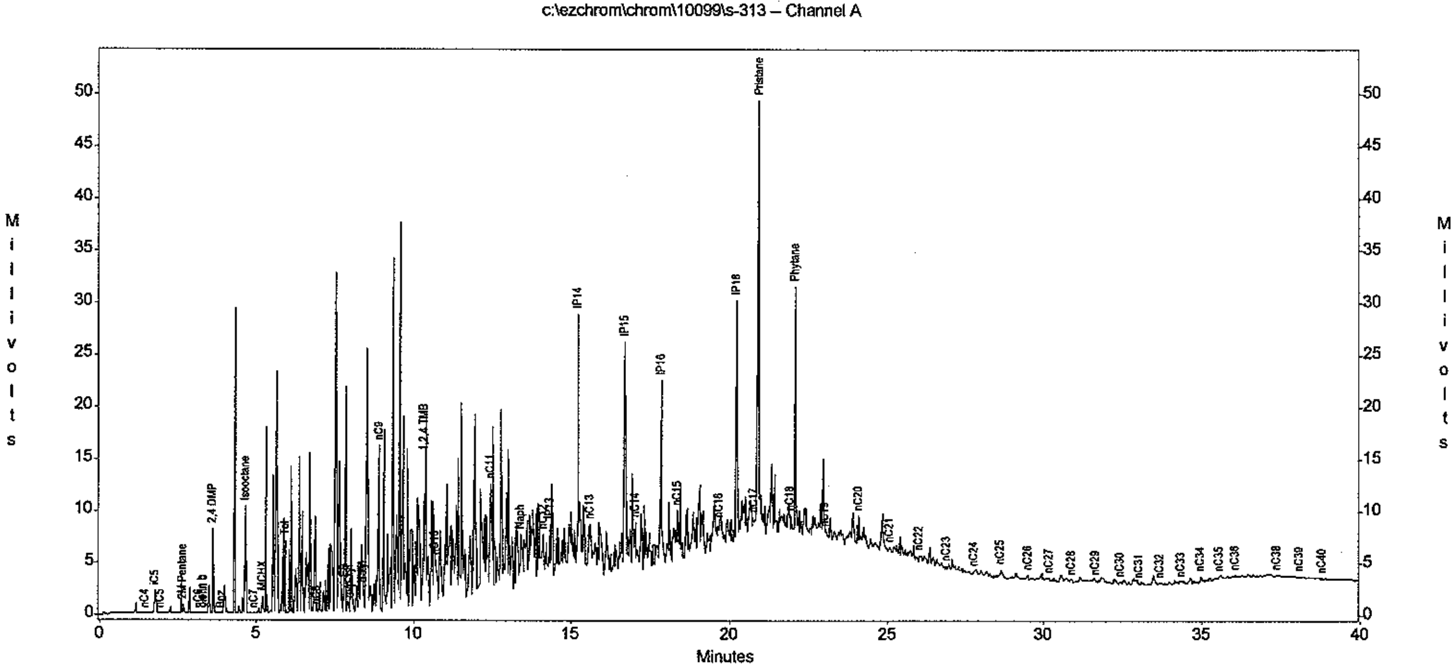


c:\ezchrom\chrom\10099\s-313 -- Channel A



c:\ezchrom\chrom\10099\s-313 -- Channel A



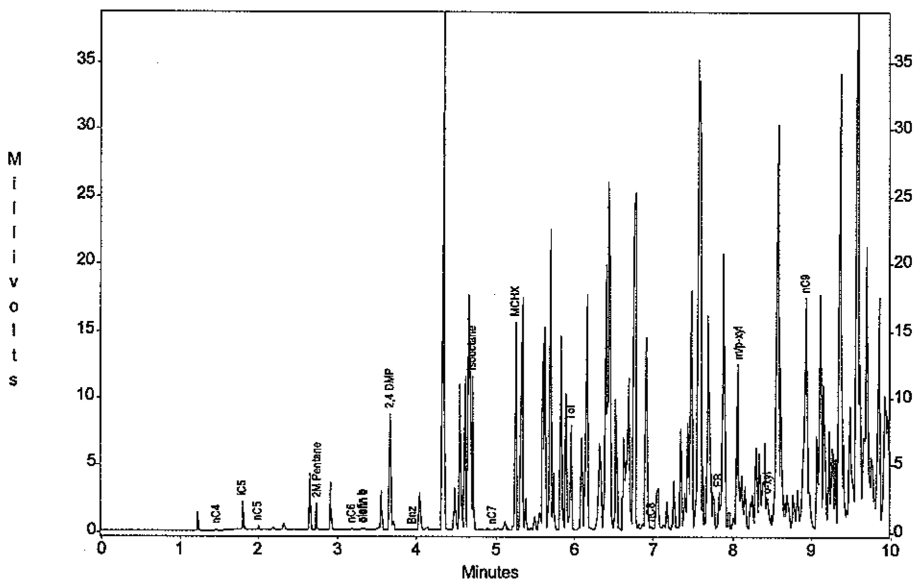
Channel A Results

Peak	Area	Height
nC4	16	22
iC5	1590	2144
nC5	95	103
MTBE	0	0
2M Pentane	760	789
nC6	16	13
olefin a	0	0
olefin b	61	61
olefin c	78	58
2.4 DMP	8270	8163
Bnz	37	30
Isooctane	11514	10348
nC7	100	42
MCHX	1989	1596
Tol	8229	6883
nC8	257	195
EB	4111	2895
m/p-xyl	1267	849
o-xyl	4538	2332
nC9	29478	15964
1.2.4 TMB	23119	14585
nC10	9201	4073
nC11	19588	9934
Naph	8387	4416
nC12	7127	4106
IP13	19074	5165
IP14	45567	25286
nC13	14478	5003
IP15	31594	20987
nC14	11210	4286
IP16	34225	17843
nC15	8342	3862
nC16	3575	2279
IP18	55874	23036
nC17	4206	2132
Pristane	112261	41951
nC18	4111	1874
Phytane	58620	23953
nC19	292	373
nC20	7346	3081
nC21	2093	802
nC22	1841	688
nC23	751	290
nC24	685	361
nC25	4194	898
nC26	1443	448
nC27	774	282
nC28	74	107
nC29	664	278
nC30	483	201
nC31	209	141
nC32	249	151
nC33	875	233
nC34	2082	486
nC35	302	139
nC36	159	136
nC37	0	0
nC38	77	69
nC39	65	46
nC40	45	48

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : S-315
Acquired : Jul 20, 2010 13:11:48

c:\ezchrom\chrom\10099\s-315 – Channel A



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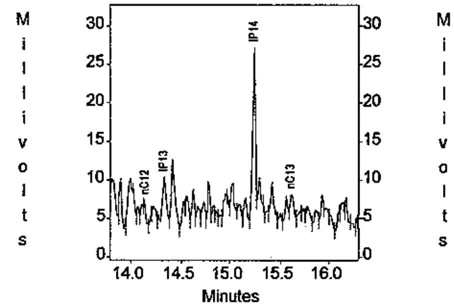

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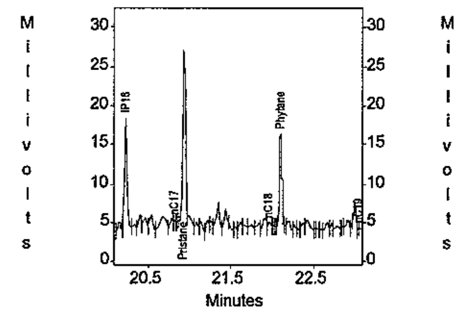

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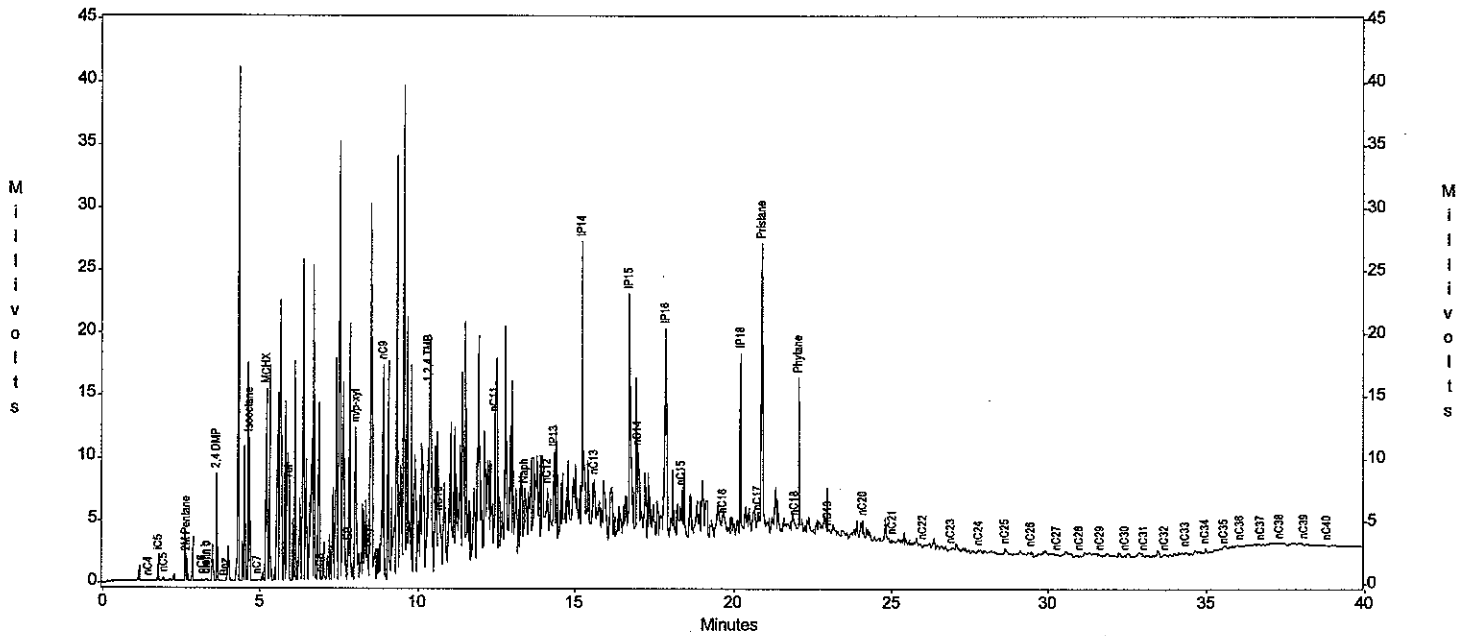


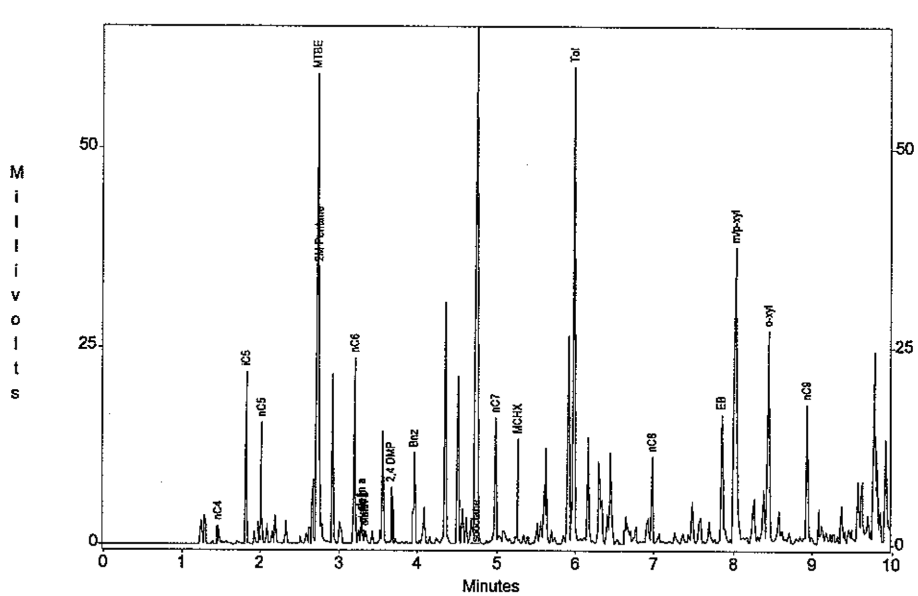
Channel A Results

Peak	Area	Height
nC4	30	35
iC5	1591	2136
nC5	274	308
MTBE	0	0
2M Pentane	1840	1931
nC6	151	137
olefin a	0	0
olefin b	155	146
olefin c	161	128
2,4 DMP	8780	8580
Bnz	62	36
Isooctane	12393	11504
nC7	62	58
MCHX	18767	15448
Tol	9212	7764
nC8	223	165
EB	3937	2792
m/p-xyl	18376	12334
o-xyl	4392	2242
nC9	31438	17237
1,2,4 TMB	22878	14899
nC10	9224	4129
nC11	21185	10648
Naph	10213	4860
nC12	5306	3225
IP13	20513	6660
IP14	42857	23771
nC13	13743	4809
IP15	37552	19705
nC14	19613	7049
IP16	29613	16621
nC15	6110	3008
nC16	2286	1629
IP18	34525	14832
nC17	3622	1831
Pristane	54083	23565
nC18	3688	1441
Phytane	30393	12911
nC19	1055	712
nC20	3019	1436
nC21	563	302
nC22	835	349
nC23	396	209
nC24	1606	305
nC25	3112	629
nC26	1065	359
nC27	70	63
nC28	225	81
nC29	263	180
nC30	387	134
nC31	176	103
nC32	179	79
nC33	224	100
nC34	1290	295
nC35	50	34
nC36	402	100
nC37	76	40
nC38	110	54
nC39	42	22
nC40	97	50

Torkelson Geochemistry, Inc.

Sunoco, Inc., Philadelphia Refinery
Sample ID : Gas/Dies/Wax std
Acquired : Jul 20, 2010 09:47:53

c:\ezchrom\chrom\10099\gadiwax2 – Channel A



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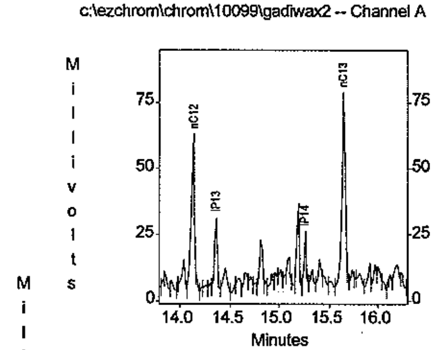

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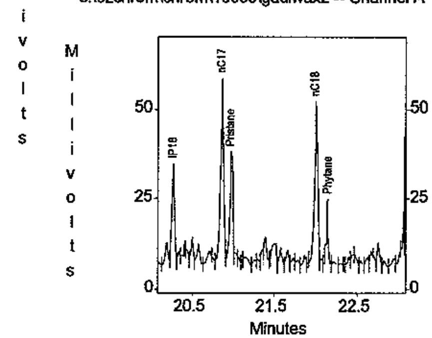

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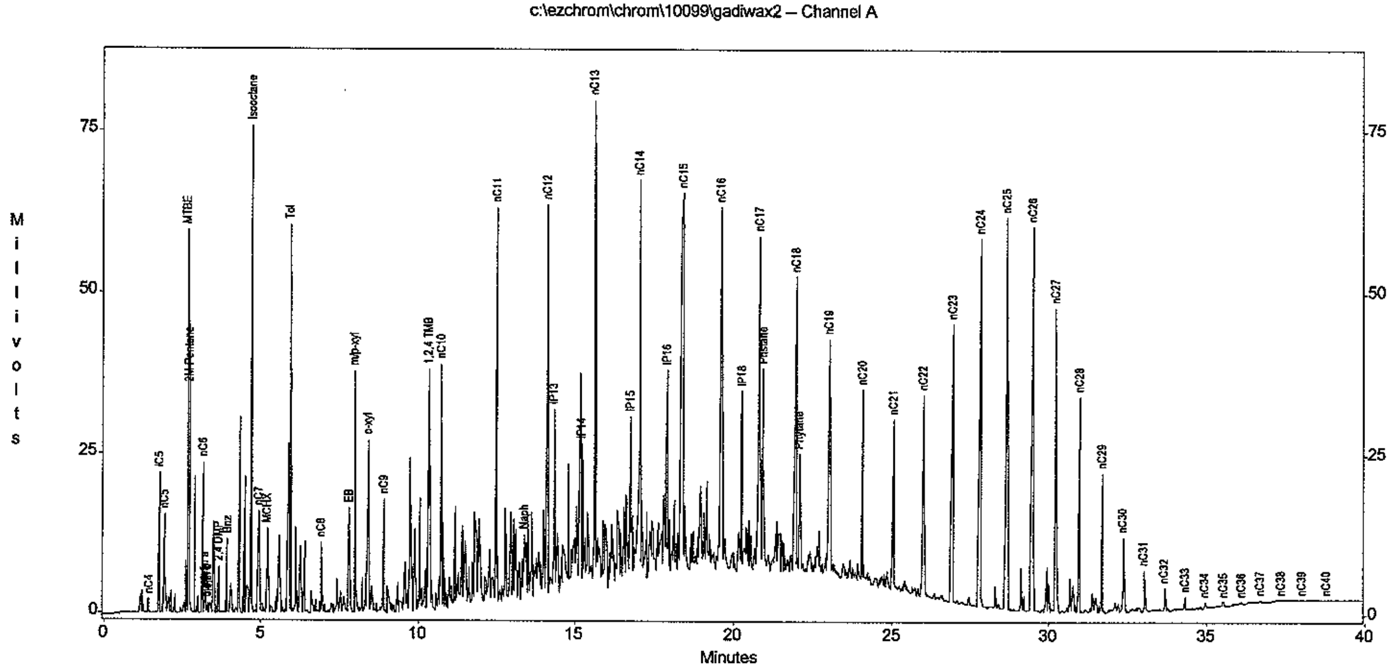


Channel A Results

Peak	Area	Height
nC4	1984	2368
iC5	15414	21815
nC5	11667	15453
MTBE	49307	59479
2M Pentane	33096	34918
nC6	22200	23338
olefin a	3612	3418
olefin b	1724	1722
olefin c	1971	1548
2.4 DMP	7274	7143
Bnz	14167	11489
Isooctane	105230	75635
nC7	19179	15820
MCHX	15682	13181
Tol	85518	60313
nC8	13430	11072
EB	23107	16349
m/p-xyl	81108	37519
o-xyl	39737	26870
nC9	24717	17590
1.2.4 TMB	68131	37505
nC10	61257	38172
nC11	124394	61224
Naph	19825	9956
nC12	128262	60646
IP13	52562	28790
IP14	40766	22703
nC13	176610	75744
IP15	39477	24563
nC14	151755	60419
IP16	75003	32151
nC15	156310	59696
nC16	142887	57295
IP18	65882	28620
nC17	129725	52397
Pristane	74492	31831
nC18	97720	45871
Phytane	40775	18464
nC19	83344	36711
nC20	61701	30048
nC21	54890	26638
nC22	68336	31525
nC23	106107	43174
nC24	160461	57025
nC25	186168	60645
nC26	183641	59685
nC27	134561	46943
nC28	82385	33357
nC29	45276	21535
nC30	21360	11336
nC31	11214	6091
nC32	6031	3388
nC33	3267	1886
nC34	1852	992
nC35	1084	567
nC36	546	285
nC37	326	167
nC38	241	92
nC39	236	68
nC40	153	45

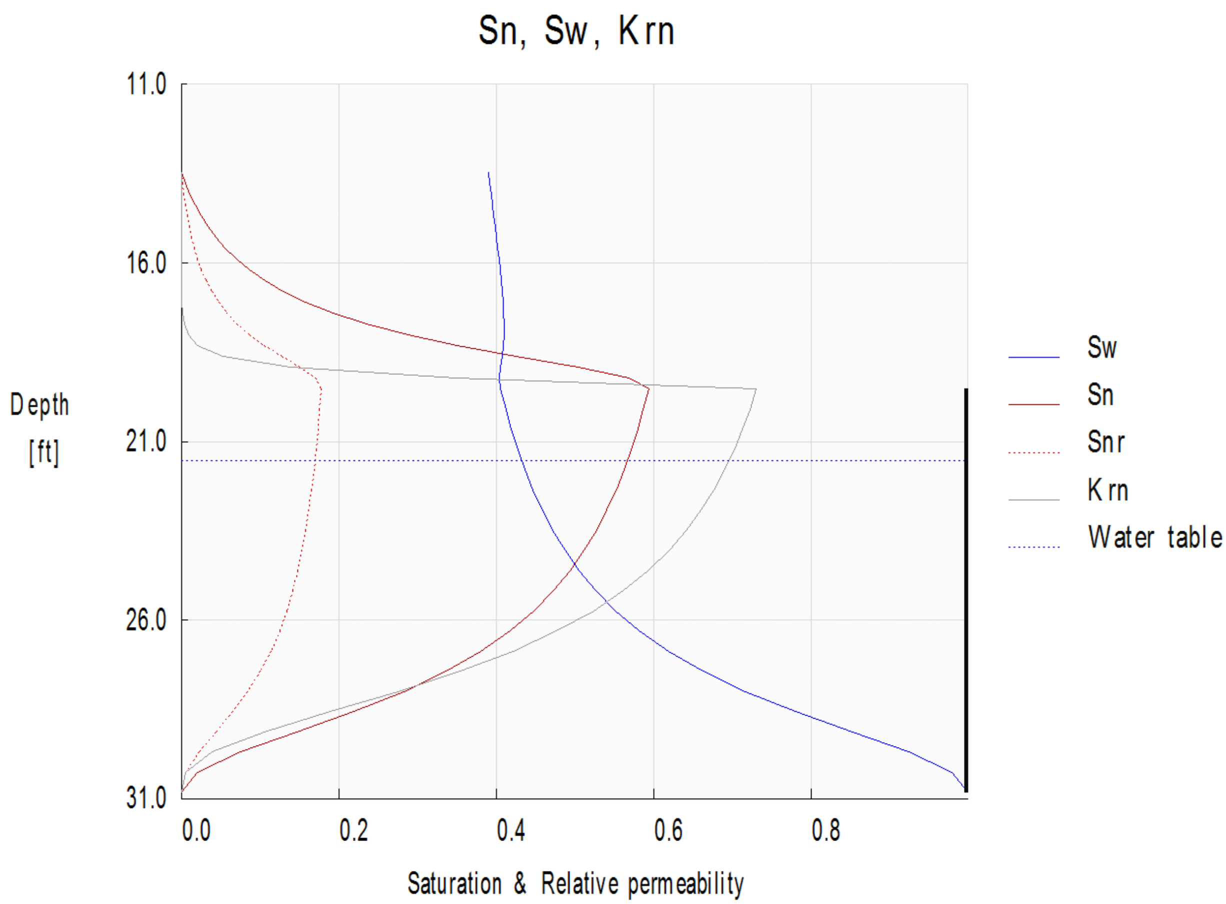
APPENDIX III

API LDRM: SATURATION PROFILE GRAPHS

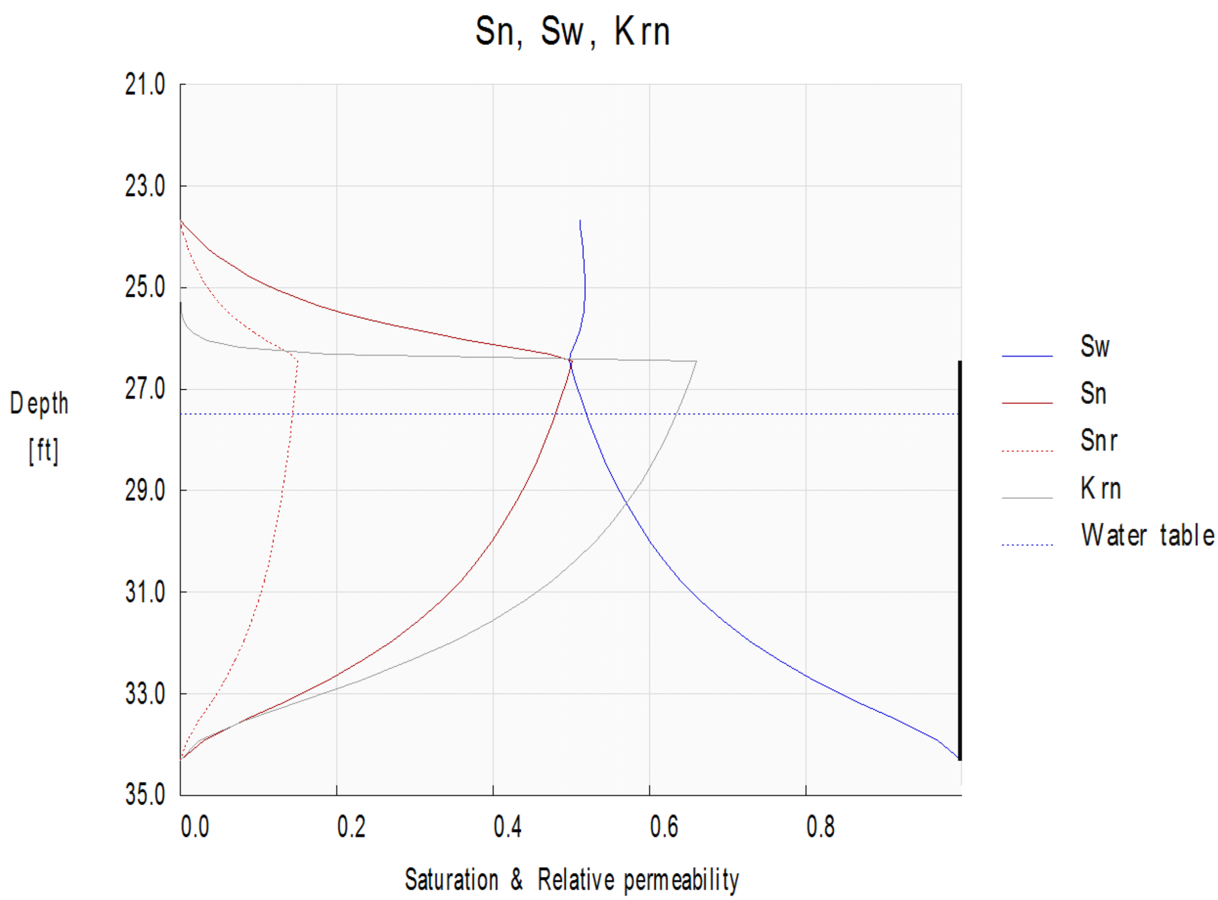
PHILADELPHIA REFINING COMPLEX
3144 WEST PASSYUNK AVENUE
PHILADELPHIA, PENNSYLVANIA
SITEWIDE PADEP FACILITY ID NO. 780190
AREA OF INTEREST 4 PADEP FACILITY NO. 770318

Light Non-Aqueous Phase Liquid
Conceptual Site Model, AOI 4
Appendix III
API LDRM: Saturation Profile Graphs

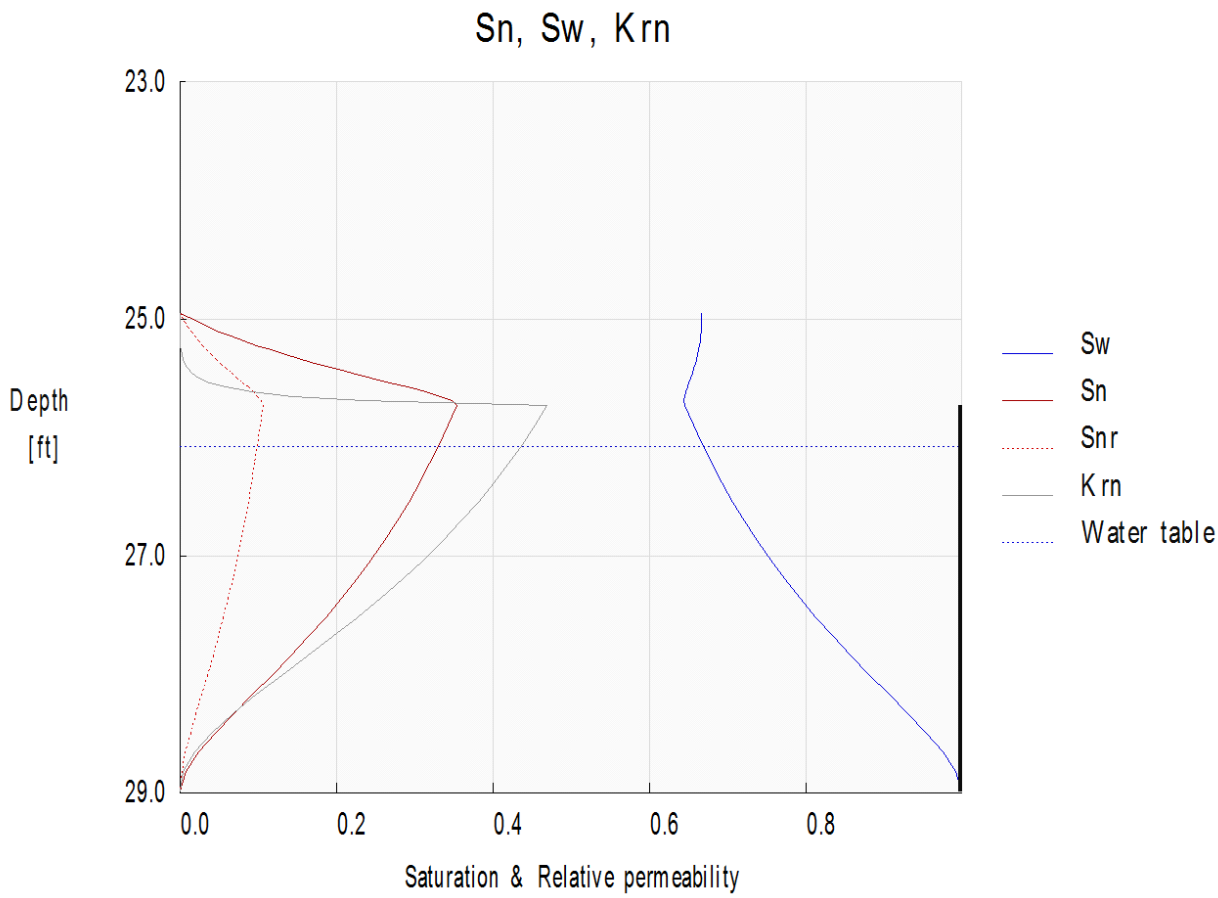
RW-700



S-30


Sn, Sw, Krn
Depth [ft]
21.0
23.0
25.0
27.0
29.0
31.0
33.0
35.0
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-241


Sn, Sw, Krn
23.0
25.0
27.0
29.0
Depth
[ft]
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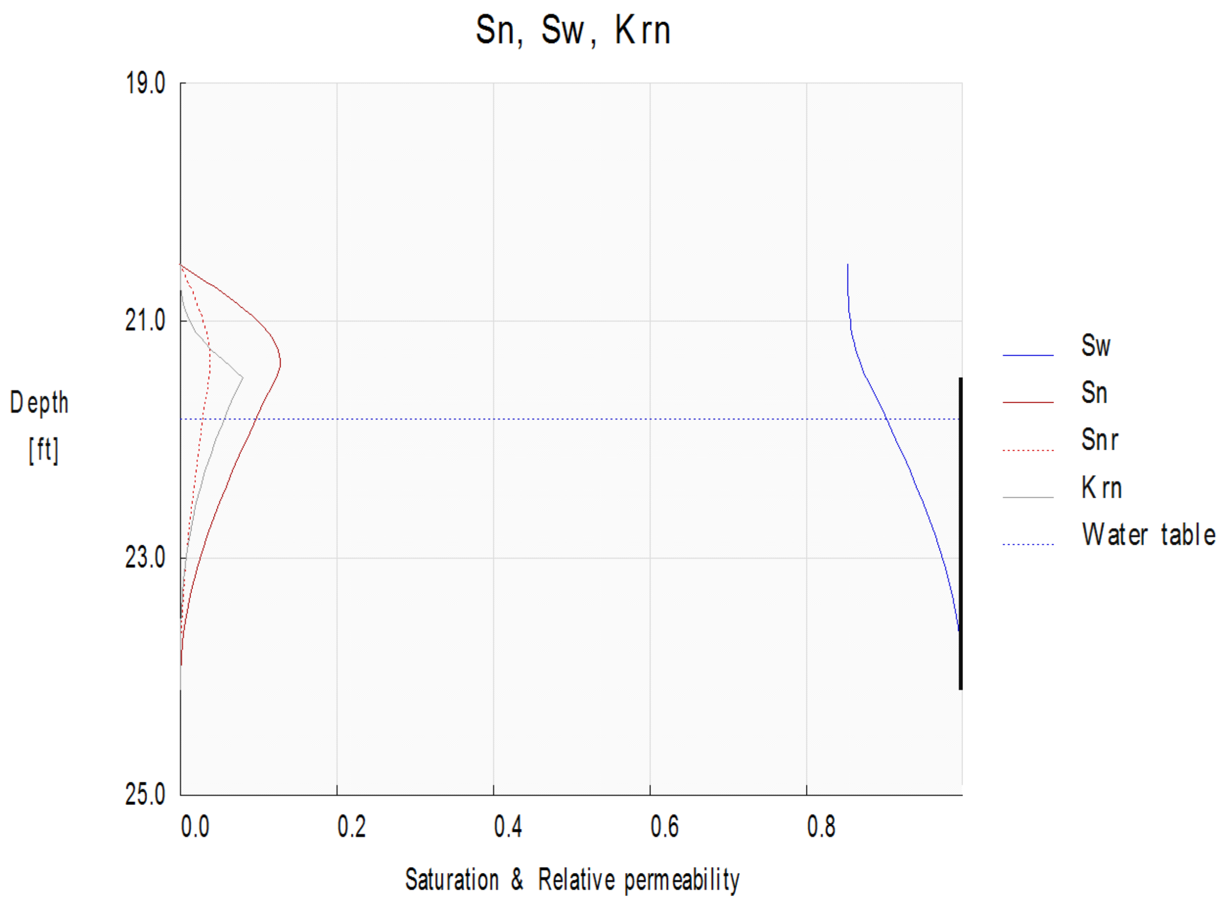
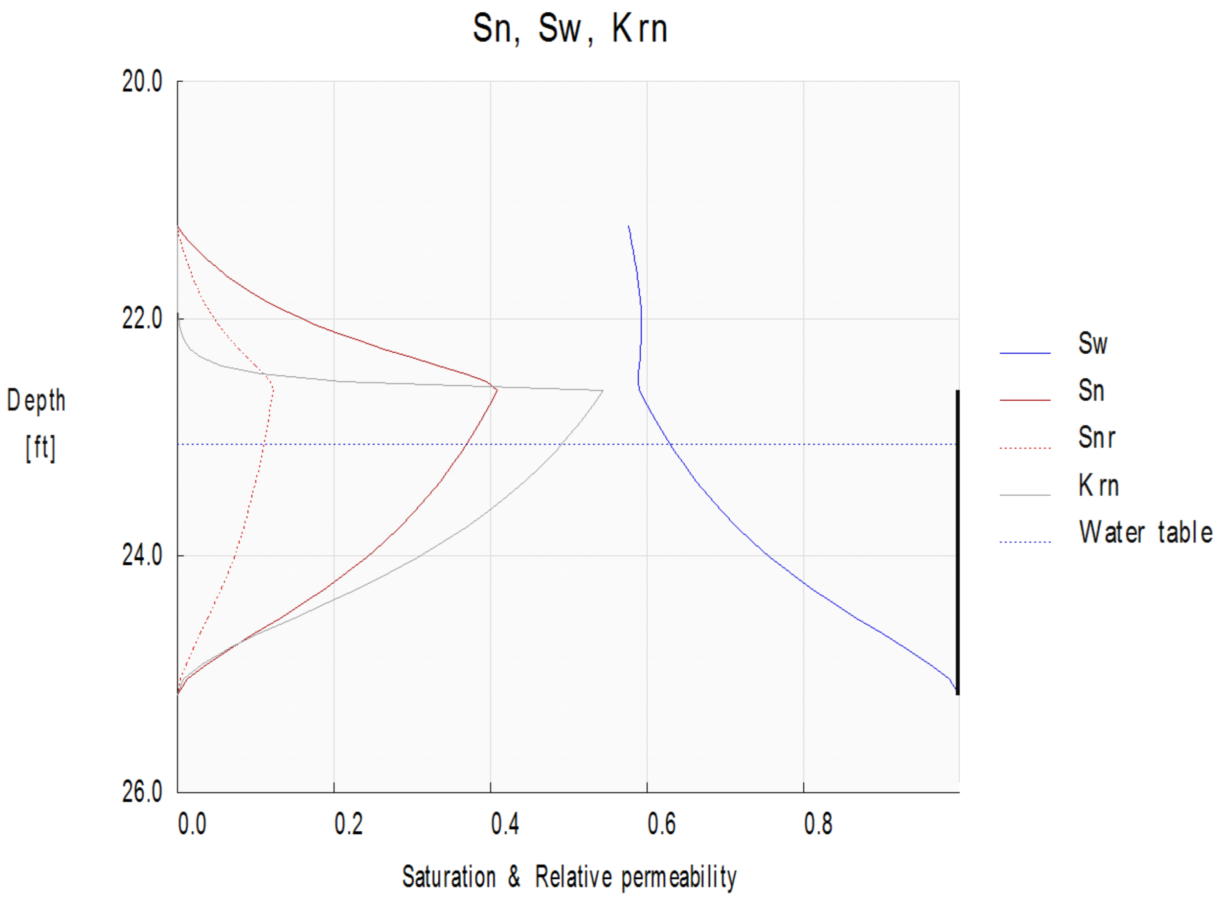
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-29


Sn, Sw, Krn
19.0
21.0
23.0
25.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-240


Sn, Sw, Krn
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22.0
24.0
26.0
Depth [ft]
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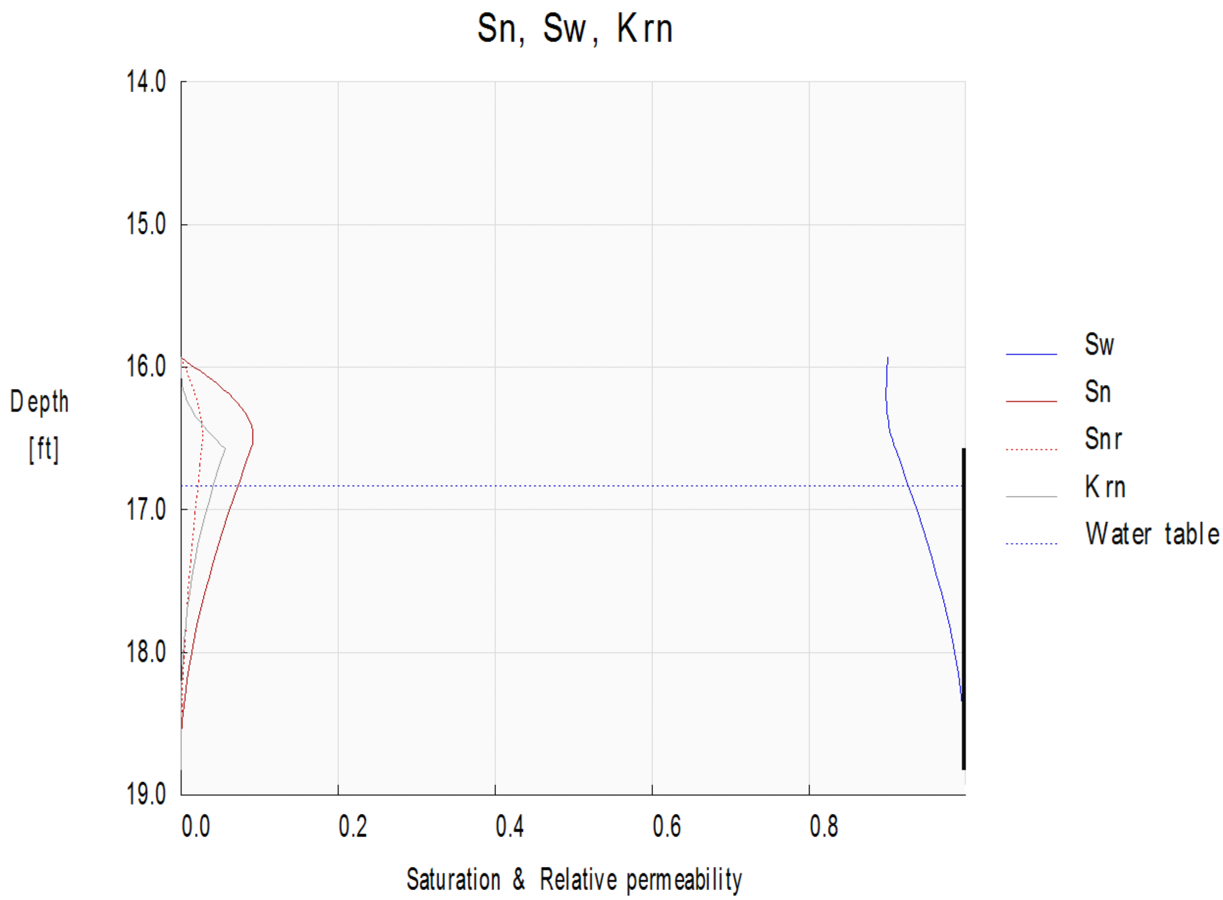
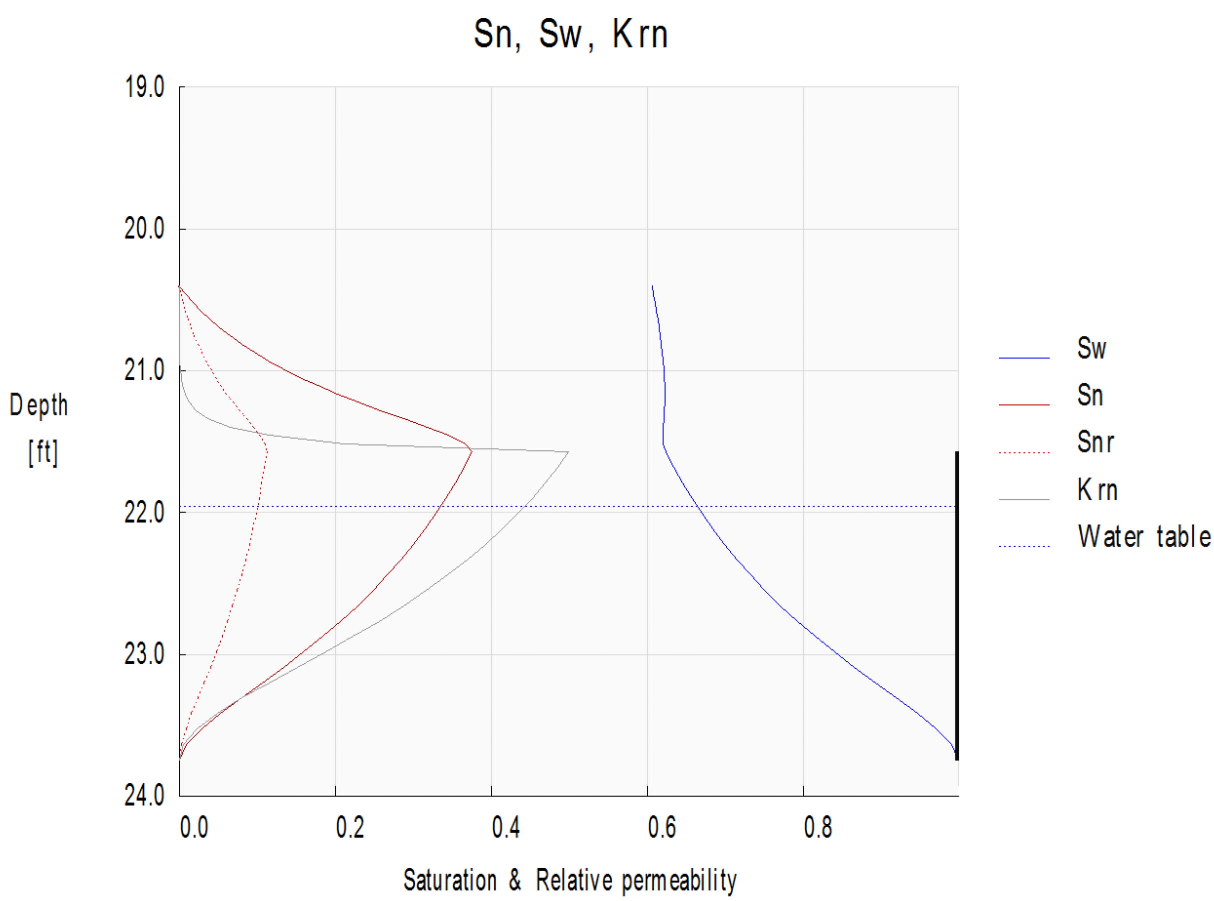
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

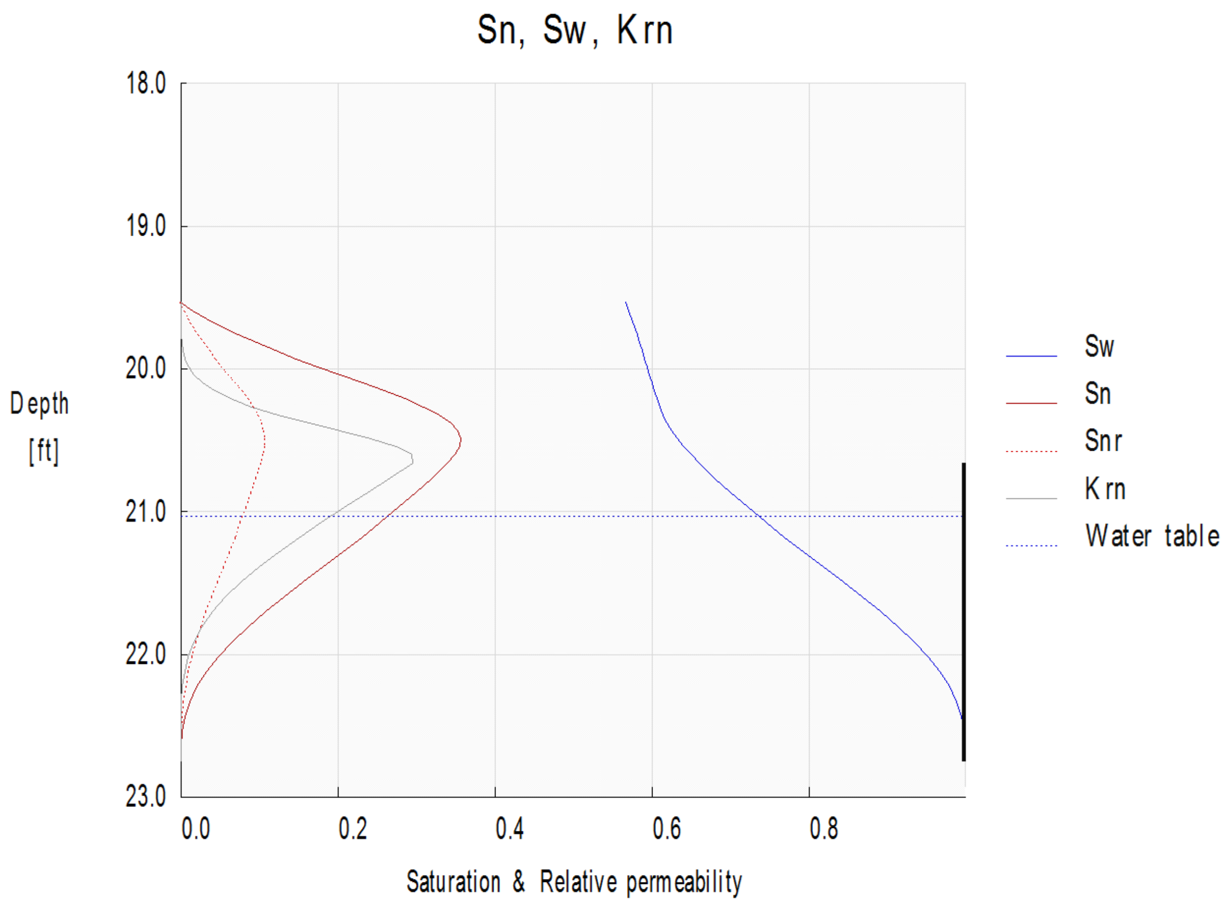
S-368


Sn, Sw, Krn
14.0
15.0
16.0
17.0
18.0
19.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-221


Sn, Sw, Krn
19.0
20.0
21.0
22.0
23.0
24.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-237


Sn, Sw, Krn
18.0
19.0
20.0
21.0
22.0
23.0
Depth
[ft]
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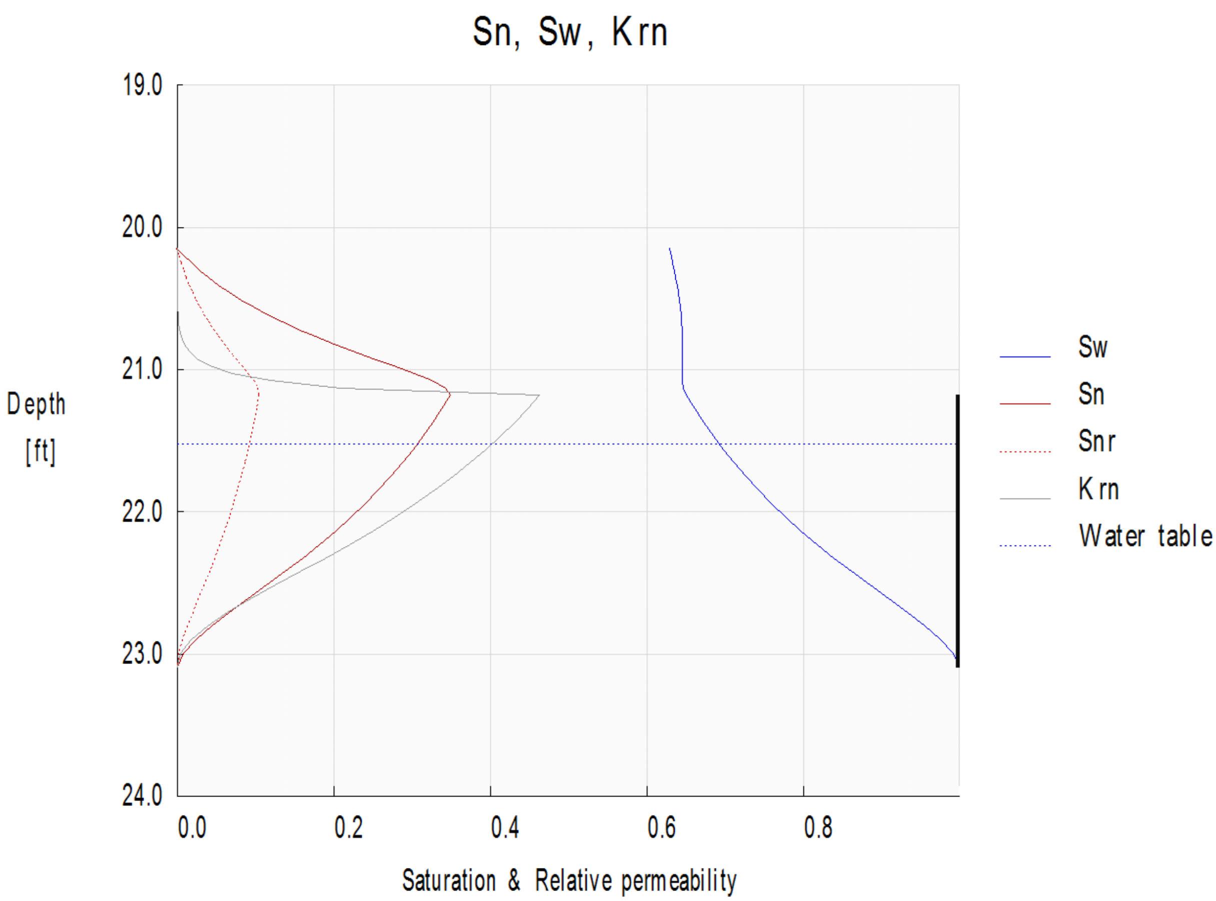
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-236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19.0
20.0
21.0
22.0
23.0
24.0
Depth
[ft]
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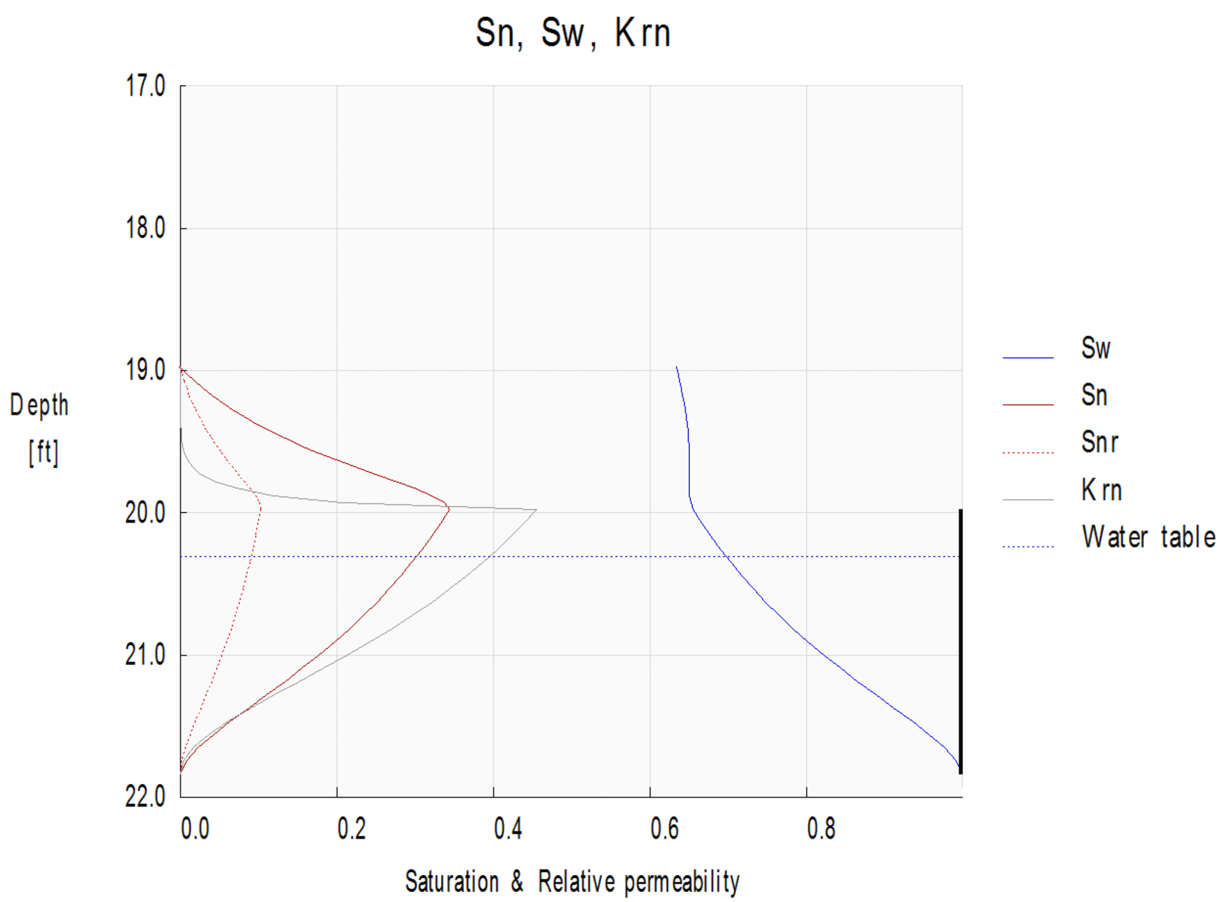
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

<u>S-233</u>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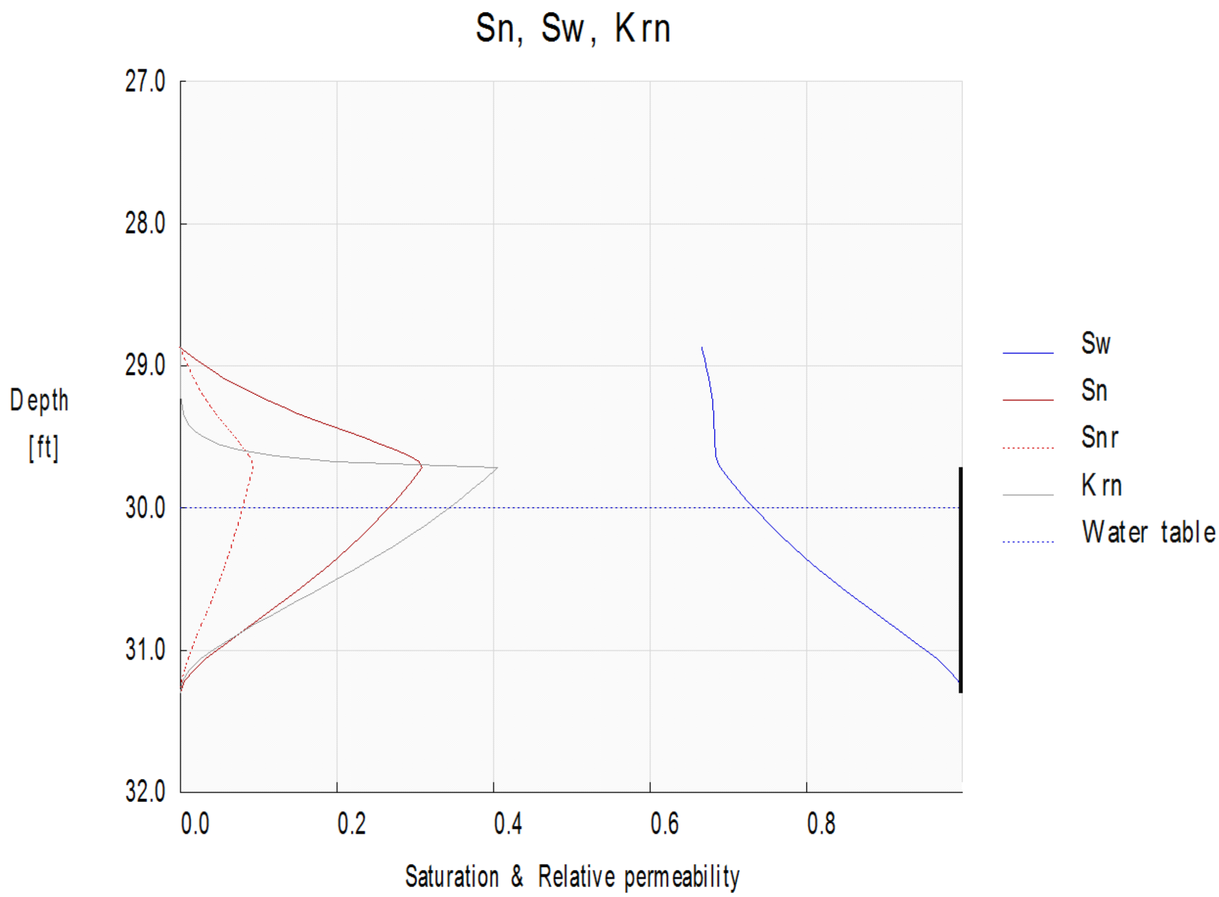
17.0
18.0
19.0
20.0
21.0
22.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

RW-703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28.0
29.0
30.0
31.0
32.0
Depth
[ft]
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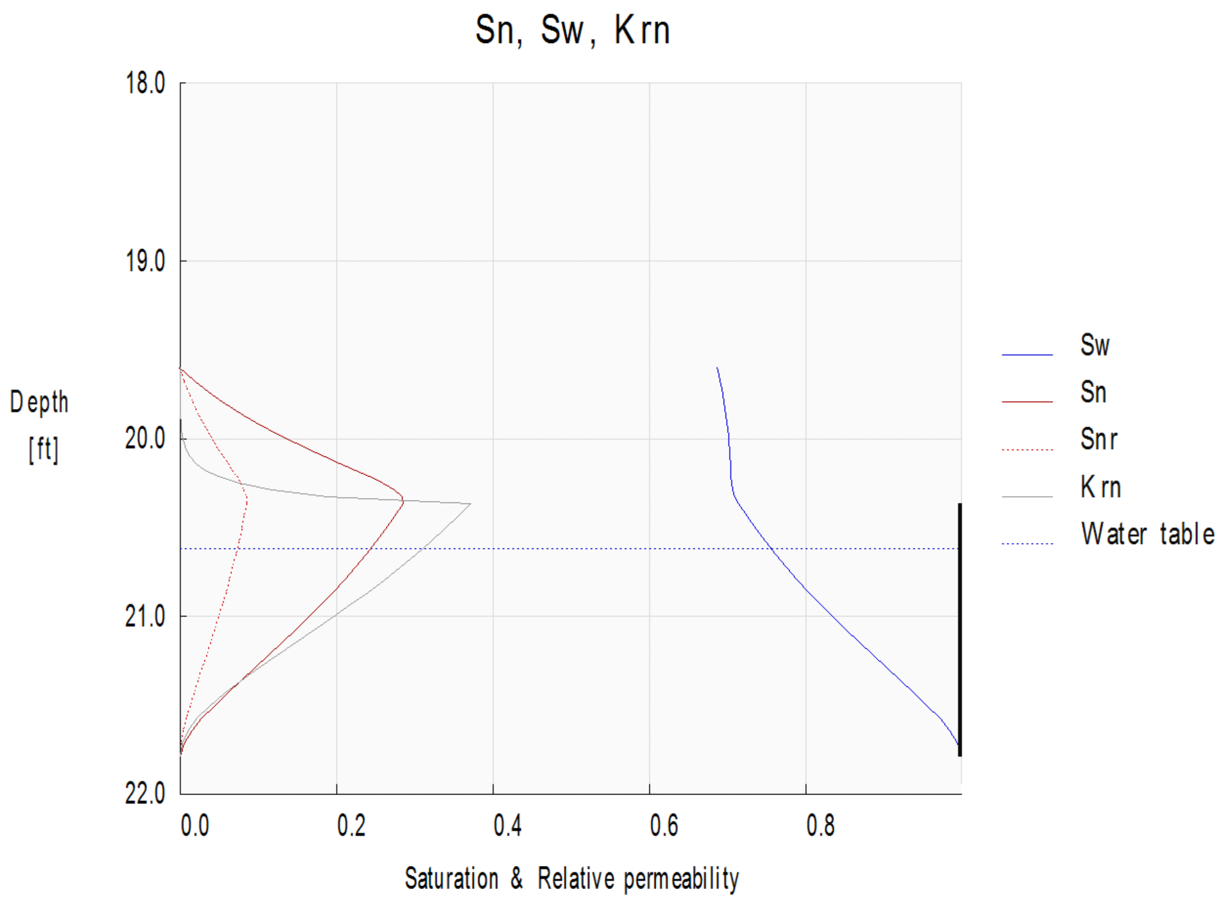
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

<u>RW-701</u>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19.0
20.0
21.0
22.0
Depth
[ft]
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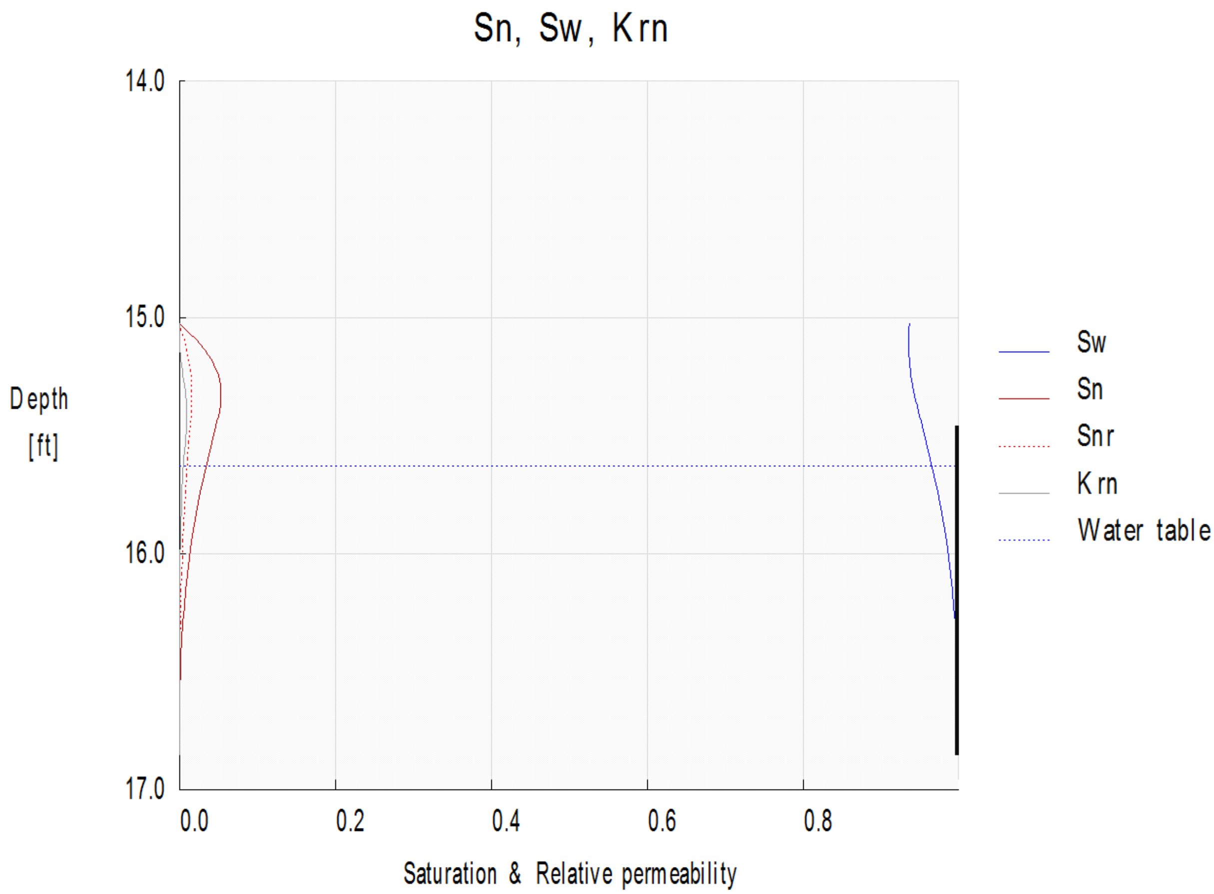
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-104


Sn, Sw, Krn
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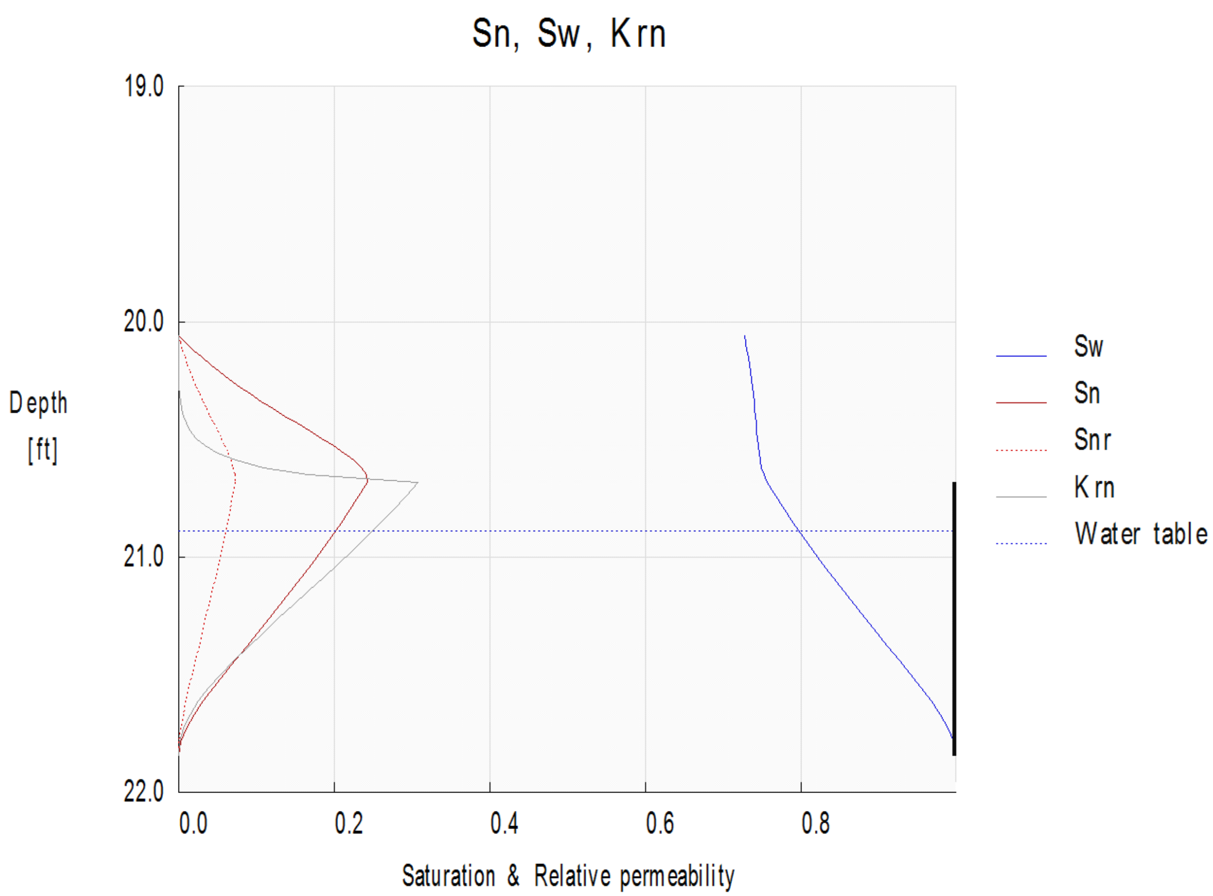
15.0
16.0
17.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-235


Sn, Sw, Krn
19.0
20.0
21.0
22.0
Depth
[ft]
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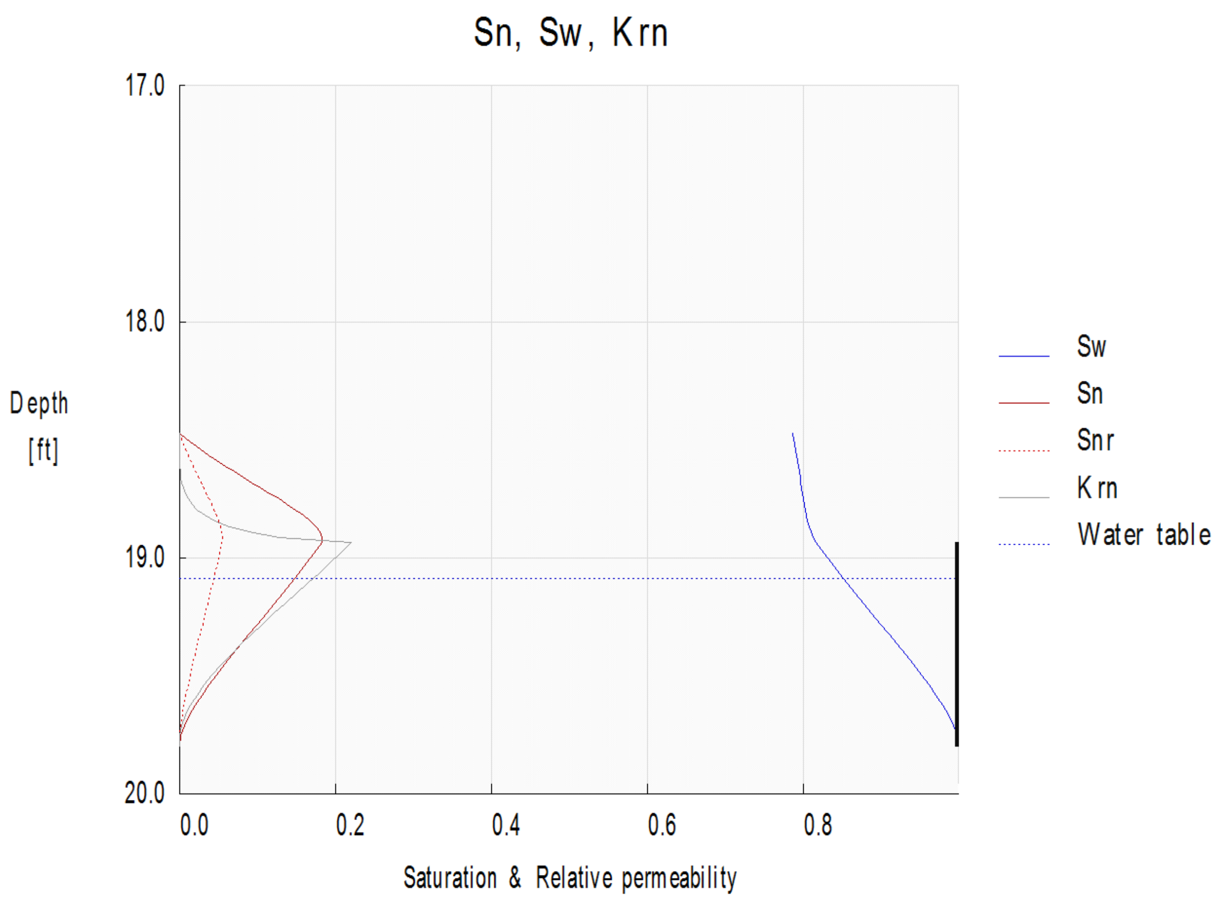
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-220


Sn, Sw, Krn
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18.0
19.0
20.0
Depth
[ft]
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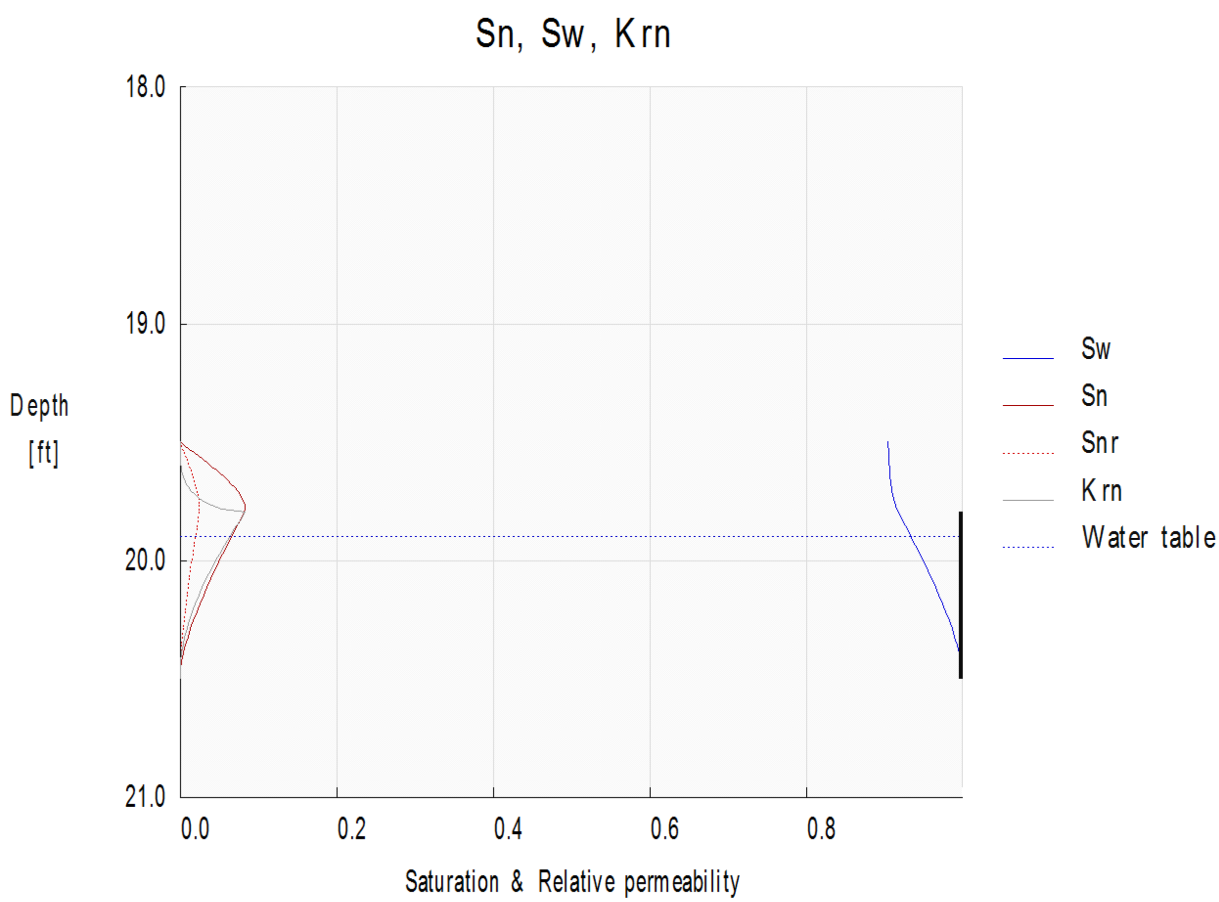
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

<u>S-31</u>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20.0
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[ft]
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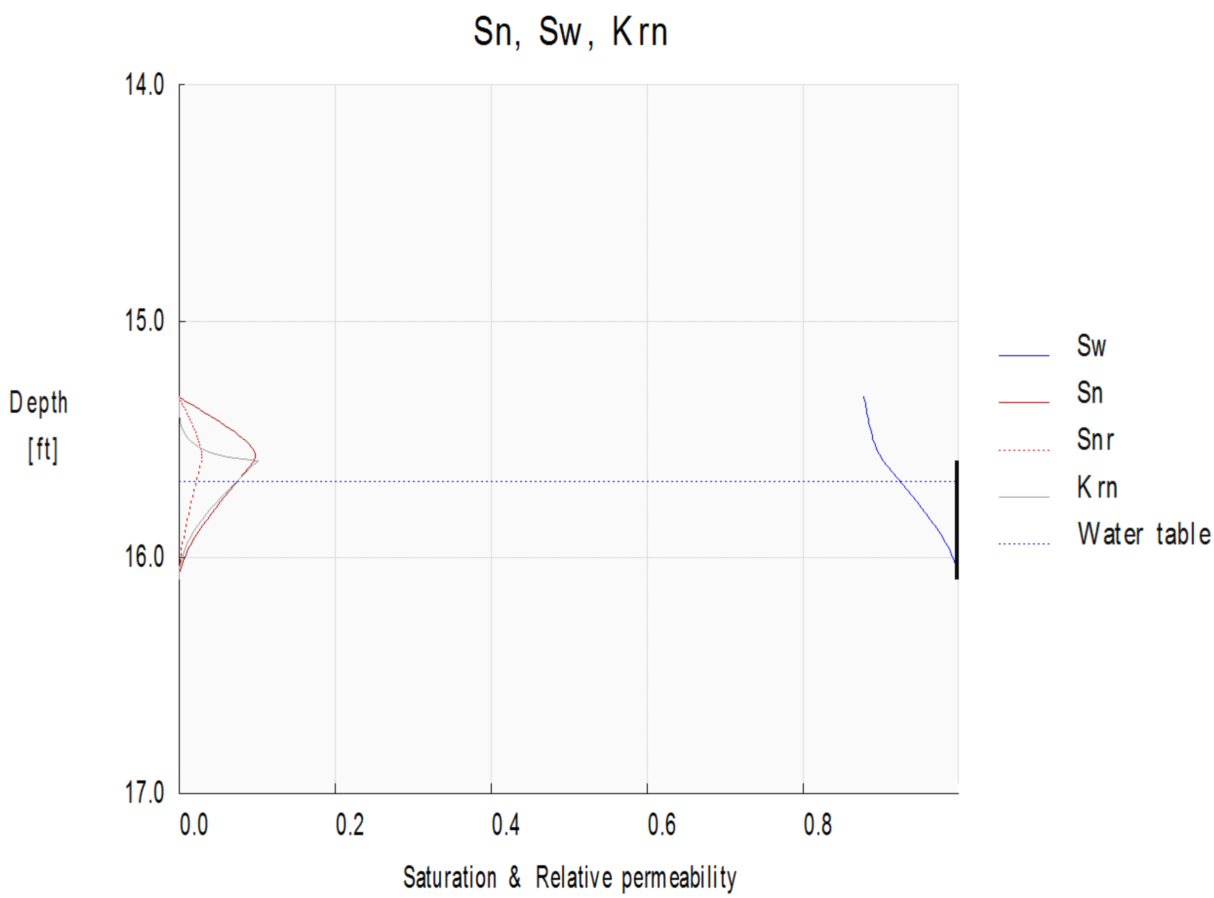
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

RW-714


Sn, Sw, Krn
14.0
15.0
16.0
17.0
Depth
[ft]
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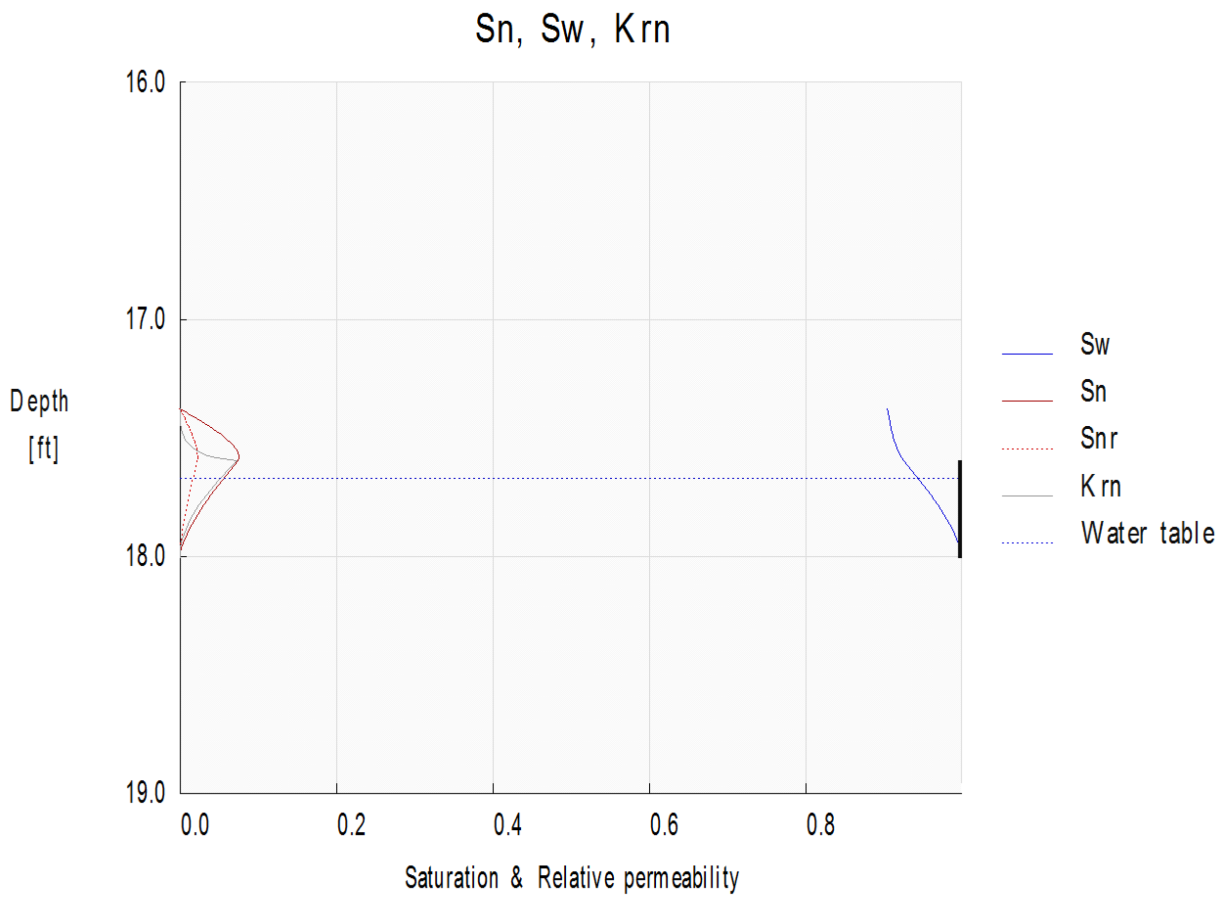
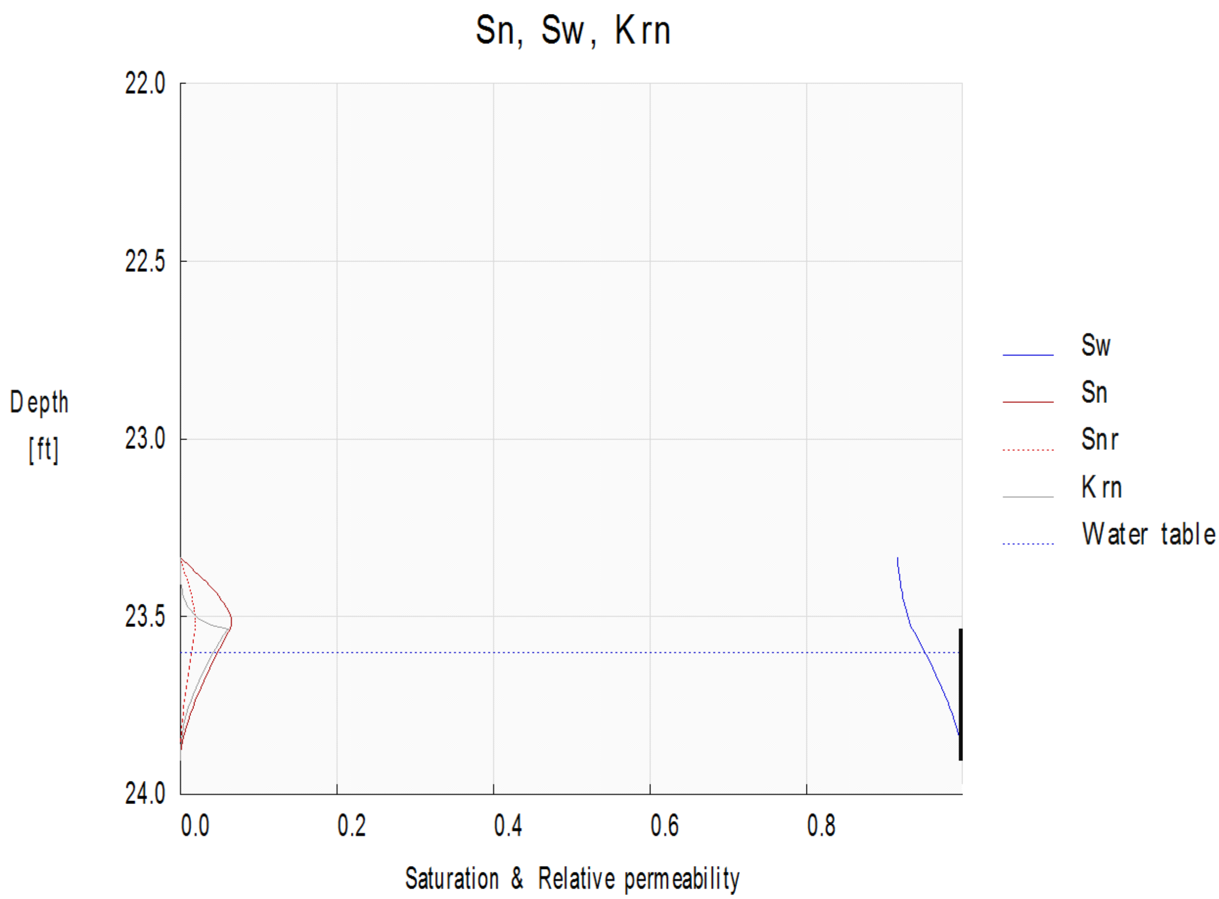
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-278


Sn, Sw, Krn
16.0
17.0
18.0
19.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

RW-704


Sn, Sw, Krn
Depth [ft]
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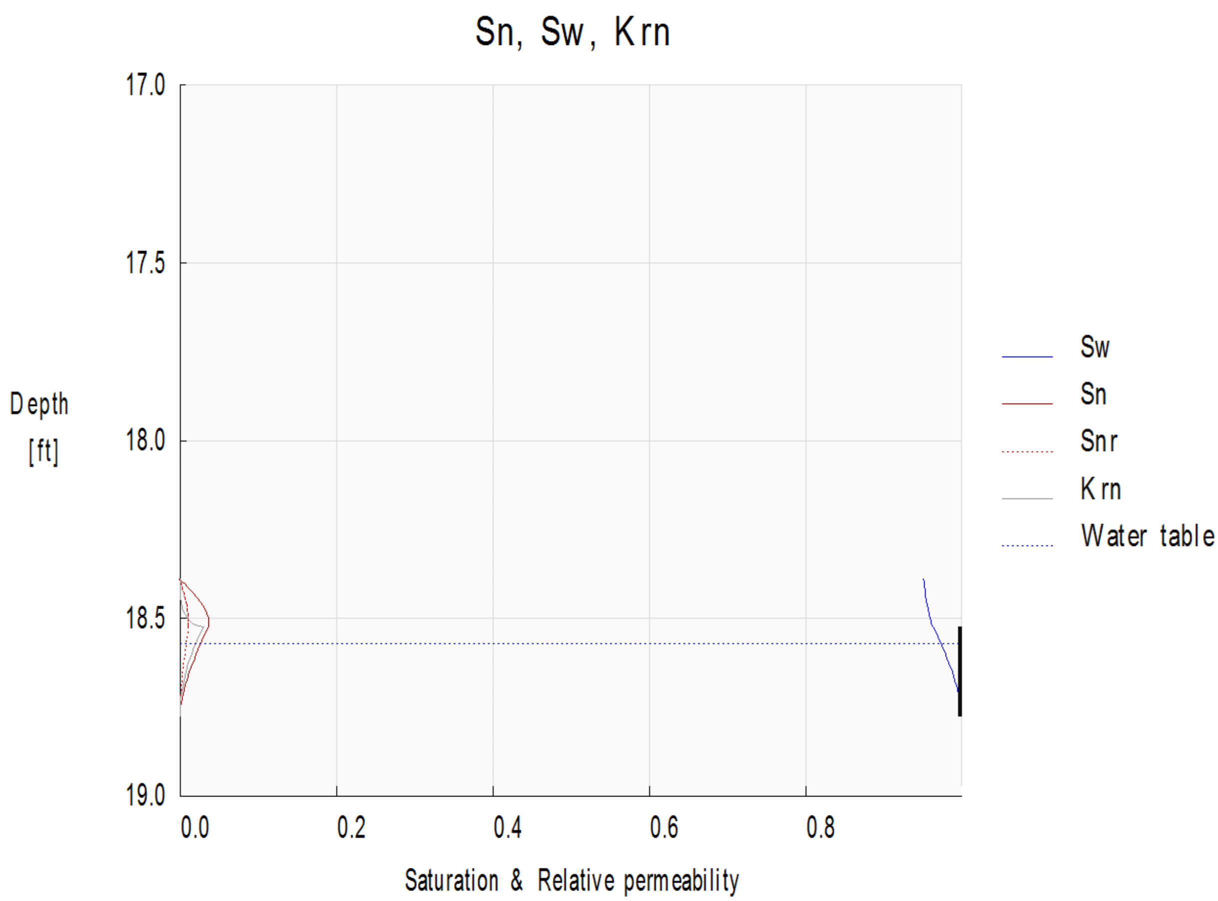
22.5
23.0
23.5
24.0
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

S-373


Sn, Sw, Krn
17.0
17.5
18.0
18.5
19.0
Depth
[ft]
0.0
0.2
0.4
0.6
0.8
Saturation & Relative permeability
Sw
Sn
Snr
Krn
Water table

Appendix F
Remediation System Summary
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

1.0 Penrose Avenue Remediation System

1.1 SYSTEM DESCRIPTION

The Penrose Avenue Remediation System is a total fluids remediation system that was originally designed to provide hydraulic control of hydrocarbon impact resulting from historic petroleum refining operations. The system is operated and maintained by Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) on property presently under the ownership of Philadelphia Energy Solutions Refining and Marketing LLC (PES). Construction of the Penrose Avenue Remediation System began in December 2011 with the installation of 18 recovery wells (RW-700 through RW-717). The operation of the system started on March 20, 2013.

The recovery well locations are installed with a two-foot by two-foot vault around each well. Recovery wells RW-700, RW-701, RW-702, RW-703, RW-704, RW-705, RW-706, RW-708, RW-709, RW-711, RW-712, RW-713, RW-714, RW-715, RW-716, and RW-717 were piped to the remediation system and are referenced as active system recovery wells on **Figure 1**. Recovery wells RW-707 and RW-110 were not connected to the remediation due to their proximity to adjacent wells and are referenced as inactive system recovery wells on **Figure 1**. Total fluids (groundwater and LNAPL) are extracted from the active system recovery wells by pneumatic submersible QED Environmental Systems AP-4 pumps utilizing plant-supplied compressed air. RW-700, RW-701, RW-2, RW-703, RW-704, RW-708, and RW-714 contain top loading pumps. Currently, the remaining recovery wells have been disabled due to a lack of recoverable LNAPL at those locations.

A common air line passes from the plant-supplied air through an isolation valve, a moisture separator, and a pressure-regulating valve prior to supplying compressed air to the recovery wells. The recovery wells are in two rows running parallel to Penrose Avenue. The common airline then separates to power each system well. There are isolation valves installed on the air lines running from the common line to the individual well pumps. The total fluids discharge line from the pumps passes through a check valve and isolation valve before entering a common line that conveys the liquids to the treatment system. Conveyance of total fluids is accomplished with underground piping to avoid seasonal temperature issues.

Total fluids are processed through an enclosed 50-gallon per minute (gpm) oil/water separator and a 225-gallon secondary settling tank within the treatment trailer. The recovered groundwater is discharged by a transfer pump to a 4-inch discharge line. The discharge pipe is connected to the Philadelphia Water Department (PWD) sanitary sewer, parallel to Penrose Avenue, approximately 530 feet southwest of the intersection with 26th Street. The recovered LNAPL is stored in a 550-gallon horizontal holding tank that is periodically pumped out and recycled by the facility. The oil/water separator, the LNAPL holding tank and settling tank are equipped with high level alarms to shut off the system in the event of a high level fault condition.

The remediation system has been designed to be a closed vent system. A blower is connected to the system components (LNAPL holding tank, oil/water separator and settling tank) to control odors and vapor emissions. The blower discharge is processed by a biofilter which is designed for 200 standard cubic feet per minute (scfm) flow through a 100 cubic foot (ft3) filtration bed. From the biofilter, the air stream enters two vapor-phase granular activated carbon vessels (drums) in series. Each drum, containing 180 pounds of activated carbon, is designed to treat VOC vapors at a maximum of 100 scfm. After passing through the carbon vessels, the treated air stream is vented to the atmosphere.

1.2 OPERATIONAL HISTORY

The Penrose Avenue Remediation System operation began on March 20, 2013 and has operated since with the exception of periodic maintenance and repairs. Maintenance and repairs have included the removal and cleaning and/or replacement of components including down-well total fluids pumps, the flow meter, and the transfer pump. Additionally, the system is turned off as needed to clean the oil/water separator, settling tank, and discharge lines. The recovery wells are gauged on a monthly basis and the pneumatic pumps are turned on or off based upon the presence of LNAPL.

On April 9, 2015, the system was turned off due to an elevated lower explosive limit (LEL) reading of the treated groundwater in the settling tank. The system remained off until May 19, 2015, when the system was restarted. The closed vent system was adjusted to reduce the buildup of vapor phase volatile organic compounds in the settling tank.

Since its inception, the Penrose Avenue Remediation System has recovered approximately 16 million gallons of groundwater and approximately 2,900 gallons of LNAPL (through March 2017).

1.3 O&M ACTIVITIES

Each week, readings are collected from the system totalizer and the holding tank. The oil/water separator is cleaned on a monthly basis. The biofilter system is evaluated to ensure proper operating parameters. Water is added as needed in order to control the temperature and humidity of the biofilter bed. PID readings are collected at the biofilter and closed vent system effluent. The Penrose Remediation System recovery wells are gauged on a monthly basis, and the pumps are removed semi-annually for maintenance.

2.0 S-30 Remediation System

2.1 SYSTEM DESCRIPTION

The S-30 Remediation System, which was designed to recover LNAPL, was started on January 15, 1996. The system consisted of a LNAPL recovery pump installed in monitoring well S-30. Recovered LNAPL was stored in a 2,500-gallon holding tank that was periodically pumped out and the contents were recycled by the facility. The holding tank was equipped with high level alarms to shut off the system in the event of a high level fault condition.

2.2 OPERATIONAL HISTORY

The S-30 Remediation System operation began on January 15, 1996 and operated with the exception of periodic weather related issues, maintenance and repairs. The system was susceptible to weather conditions and was off-line during freezing weather conditions. Maintenance and repairs have included the replacement of components including down-well pump and float sensors.

The system was taken off line on December 30, 2010, after no significant product accumulation was observed in monitoring well S-30. The system remains off-line to date. Approximately 39,650 gallons of LNAPL were recovered by the S-30 Remediation System during the system lifetime (1996 through 2010).

Liquid level gauging is completed quarterly on monitoring well S-30, and the results are reported in the semiannual Status Reports. Due to accumulation of LNAPL in the well, a new pump, probe and control panel are planned for installation in 2017.

3.0 S-36 Remediation System

3.1 SYSTEM DESCRIPTION

The S-36 Remediation System was designed to recover LNAPL and a Xitech skimmer was installed in monitoring well S-36 on September 15, 2004 to determine if sustainable LNAPL recovery from S-36 was possible. Recovered LNAPL from monitoring well S-36 was stored in a 1,100-gallon holding tank. The holding tank was periodically pumped out and the contents recycled by the facility. As detailed in the following section, additional system modifications were made, which include changing out the Xitech skimmer in S-36 for an electric pump, at which time pumps were also added to additional wells. Final modifications included addition of pneumatic pumps.

3.2 OPERATIONAL HISTORY

After demonstrating consistent LNAPL recovery, the Xitech skimmer was taken off-line in October 2005 to complete upgrades for an electric system. Electric LNAPL skimming pumps were installed in monitoring wells S-34, and S-35, and S-36 during the second quarter of 2007 and the system was restarted on October 26, 2007.

The system was taken off-line from December 11, 2008 to March 17, 2009 due to winter weather conditions. The system was upgraded during this time to include QED AP-4 pneumatic pumps at monitoring wells S-34, S-35, and S-36. The pumps were powered by a two horsepower (hp) Quincy air compressor.

Due to the absence of recoverable LNAPL, the S-36 Remediation System was taken off-line on July 28, 2010. The system remains off-line to date. Approximately 1,025 gallons of LNAPL were recovered by the S-36 Remediation System during the system's lifetime (2004 through 2010).

Liquid level gauging is completed quarterly on monitoring well S-36, and the results are reported in the semiannual Status Reports.

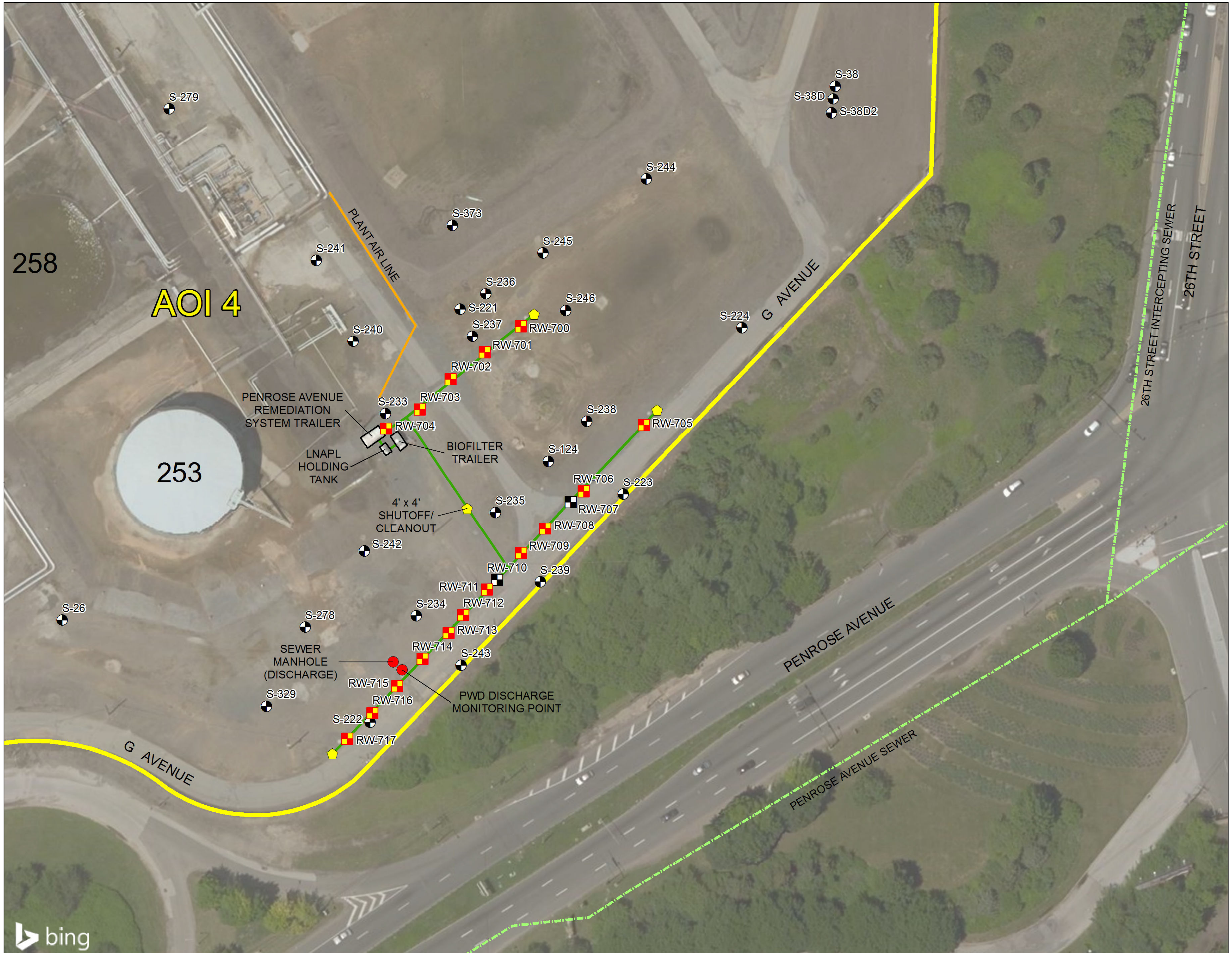


Figure No.

1

Title

PENROSE AVENUE REMEDIATION SYSTEM SITE PLAN

Client/Project

PHILADELPHIA REFINERY OPERATIONS, A SERIES OF EVERGREEN RESOURCES GROUP, LLC
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 213402429

City of Philadelphia, Pennsylvania

Prepared by GWC on 3/8/2017
Technical Review by AJB on 3/8/2017
Independent Review by JLM on 3/8/2017

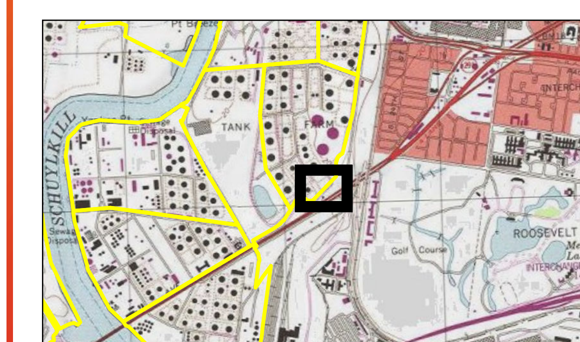
0 80 160 Feet

1:960 (At original document size of 11x17)

N

LEGEND

ACTIVE SYSTEM RECOVERY WELL
INACTIVE SYSTEM RECOVERY WELL
MONITORING WELL
CLEAN OUT
DISCHARGE POINT
PLANT AIR LINE
REMEDIATION SYSTEM PIPING
SEWER LINE
AREA OF INTEREST (AOI) BOUNDARY
253 TANK IDENTIFICATION NUMBER



Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Source: Camp Dresser & McKee and Stantec
   Service Layer Credits: © 2017 Microsoft Corporation
3. Copyright:© 2013 National Geographic Society, i-cubed
   Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

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ALPHA GEOSCIENCE
Geology
Hydrology
Remediation
Water Supply

March 8, 2017

Mr. Andrew Bradley, PMP, MS IS
Senior Associate/Environmental Scientist
Stantec
1060 Andrew Drive, Suite 140
West Chester, PA 19380-5602

Re: Data Usability Assessment
Philadelphia Refinery Operations,
a series of Evergreen Resources Group, LLC
June and October 2016 Sampling Events

Dear Mr. Bradley:

The data usability assessments have been sent via e-mail for the Philadelphia Refining Complex, June and October 2016 soil and ground water sampling events. The data for ESC Lab Sciences, sample delivery group (SDG) numbers L841529 and L865801 are mostly acceptable. There were metals data in SDG L865801 that contain data that were unusable (R). The data usability assessment outlines the reason for qualifying the data rejected, unusable (R).

If you have any questions concerning the work performed, please contact me at (518) 348-6995. Thank you for providing us an opportunity with Stantec.

Sincerely,
Alpha Geoscience

Donald Anné
Senior Chemist

DCA/bms
Via email

N:\projects\2015\15600-15620\15611-Evergreen\2017\Evergreen-171.ltr.doc

Technical Memorandum

To:	Jennifer Menges, Stantec	From:	Donald C. Anné, Senior Chemist
File:	Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC	Date:	March 7, 2017

Reference: Data Usability Assessment – ESC Lab Sciences Sample Data Group L841529

This memorandum presents the findings of analytical data validation and usability assessment of the data generated from the analysis of 5 soil samples collected on June 13 and 14, 2016 by Stantec Consulting Services Inc. (Stantec) at the Philadelphia Refining Complex site. The data review was performed according to the quality assurance and quality control parameters set by the project laboratory and the following guidance documents.

- USEPA, 2014, National Functional Guidelines for Inorganic Superfund Data Review, EPA-540-R-013-001, August 2014.
- Stantec, 2015, Evergreen Data Usability – Data Updates, Standard Operating Procedures, Draft, May 31, 2015.

The samples were analyzed at the ESC Lab Sciences facility in Mt. Juliet, Tennessee for total solids and trace metals using the analytical methods listed below.

- Trace Metals (Lead) by SW-846 Method 6010B

1. Validation Overview

The following table summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameters
L841529	L841529-01	6/14/2016	AOI4-BH-16-008-0-2-20160614	Lead
L841529	L841529-02	6/14/2016	AOI4-BH-16-009-0-2-20160614	Lead
L841529	L841529-03	6/14/2016	AOI4-BH-16-010-0-2-20160614	Lead
L841529	L841529-04	6/13/2016	AOI4-BH-16-011-0-2-20160613	Lead
L841529	L841529-05	6/13/2016	AOI4-BH-16-012-0-2-20160613	Lead

The sample results were subject to a data review that includes, but is not limited to, an evaluation of the following parameters: laboratory raw data and finished data packages; chain-of-custody records; sample holding time, temperature, and sample preservation; blank data; calibration data; laboratory control sample/laboratory control sample duplicate recovery; matrix spike/matrix spike duplicate recovery; and overall data assessment.

Reference: Data Usability Assessment

The data qualifiers applied to the data are defined below.

J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

2. Major Exceptions to Data Acceptance Criteria

Major exceptions include those that significantly impact data quality and require the rejection of results. Major exceptions were not identified.

3. Minor Exceptions to Data Acceptance Criteria

Minor exceptions effect data quality but do not result in unusable data. The section below describes the minor exceptions that were identified.

a. ***General Comment***

Sample results reported below the laboratory reporting limit are flagged "J" to indicate that the results are estimated.

b. ***Lead by SW-846 Method 6010B***

i. ***Spike Sample Recovery***

The percent recoveries for lead were below the control limits (75-125%) but not below 30% for MS/MSD sample A014-BH-010-0-2-20160614. The associated positive sample results for lead were flagged "J". There were no "non-detect" results for lead in the associated samples.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameters
L841529	L841529-01	6/14/2016	AOI4-BH-16-008-0-2-20160614	Lead
L841529	L841529-02	6/14/2016	AOI4-BH-16-009-0-2-20160614	Lead
L841529	L841529-03	6/14/2016	AOI4-BH-16-010-0-2-20160614	Lead
L841529	L841529-04	6/13/2016	AOI4-BH-16-011-0-2-20160613	Lead
L841529	L841529-05	6/13/2016	AOI4-BH-16-012-0-2-20160613	Lead

4. Comments

All data are considered usable with the specific exceptions and qualifications noted above.

Completeness of the data set is 100% (defined as the percentage of analytical results that are considered to be valid).

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ALPHA GEOSCIENCE

Technical Memorandum

To:	Jennifer Menges, Stantec	From:	Donald C. Anné, Senior Chemist
File:	Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC	Date:	March 8, 2017

Reference: Data Usability Assessment – ESC Lab Sciences Sample Data Group L865801

This memorandum presents the findings of analytical data validation and usability assessment of the data generated from the analysis of 27 samples including 24 groundwater samples , one duplicate sample, one field blank sample and one equipment blank sample. The samples were collected on October 11 and 12, 2016 by Stantec Consulting Services Inc. (Stantec) at the Philadelphia Refining Complex site. The data review was performed according to the quality assurance and quality control parameters set by the project laboratory and the following guidance documents.

- USEPA, 2014, National Functional Guidelines for Inorganic Superfund Data Review, EPA-540-R-013-001, August 2014.
- USEPA, 2014, National Functional Guidelines for Organic Superfund Data Review, EPA-540-R-014-002, August 2014.
- Stantec, 2015, Evergreen Data Usability – Data Updates, Standard Operating Procedures, Draft, May 31, 2015.

The samples were analyzed at the ESC Lab Sciences facility in Mt. Juliet, Tennessee for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and metals using the analytical methods listed below.

- VOCs by SW-846 Methods 8260B and 8011
- SVOCs by SW-846 Method 8270C and SIM 8270C
- Metals by SW-846 Method 6020

1. Validation Overview

The following table summarizes the laboratory and client sample identification numbers, sample collection dates, and analytical parameters subject to review.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameters
L865801	L865801-01	10/12/2016	S-103-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-02	10/12/2016	S-124-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-03	10/12/2016	S-235-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-04	10/12/2016	S-220-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-05	10/12/2016	S-365-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-06	10/11/2016	S-39D-HS-20161011-WG	VOCs, SVOCs, Metals
L865801	L865801-07	10/11/2016	S-218D-HS-20161011-WG	VOCs, SVOCs, Metals
L865801	L865801-08	10/11/2016	S-39D -20161011-WG	VOCs, SVOCs, Metals
L865801	L865801-09	10/11/2016	S-218D -20161011-WG	VOCs, SVOCs, Metals

Reference: Data Usability Assessment

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameters
L865801	L865801-10	10/12/2016	AOI-4-EQUIPMENTBLANK-20161012	VOCs, SVOCs, Metals
L865801	L865801-11	10/12/2016	AOI-4-FIELDBLANK-20161012	VOCs, SVOCs, Metals
L865801	L865801-12	10/12/2016	S-102-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-13	10/12/2016	S-35-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-14	10/12/2016	S-35-20161012-WG-DUP	VOCs, SVOCs, Metals
L865801	L865801-15	10/12/2016	S-370-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-16	10/12/2016	S-218-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-17	10/12/2016	S-371-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-18	10/12/2016	S-216-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-19	10/12/2016	S-416-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-20	10/12/2016	RW-717-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-21	10/12/2016	RW-715-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-22	10/12/2016	RW-711-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-23	10/12/2016	RW-705-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-24	10/12/2016	RW-700-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-25	10/12/2016	RW-701-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-26	10/12/2016	RW-702-20161012-WG	VOCs, SVOCs, Metals
L865801	L865801-27	10/12/2016	RW-703-20161012-WG	VOCs, SVOCs, Metals

The sample results were subject to a data review that includes, but is not limited to, an evaluation of the following parameters: laboratory raw data and finished data packages; chain-of-custody records; sample holding time, temperature, and sample preservation; blank data (method, trip, and equipment); calibration data; chromatograms; laboratory control sample/laboratory control sample duplicate recovery; matrix spike/matrix spike duplicate recovery; surrogate recovery; and overall data assessment.

The data qualifiers applied to the data are defined below.

J The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ The result is an estimated quantity, but the result may be biased high.

J- The result is an estimated quantity, but the result may be biased low.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The result is unusable. The sample result is rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

2. Major Exceptions to Data Acceptance Criteria

Major exceptions include those that significantly impact data quality and require the rejection of results. Major exceptions were identified. The section below describes the major exceptions that were identified.

a. Metals Analysis by SW-846 Method 6020

i. *Laboratory Control Sample/Laboratory Control Sample Duplicate*

Method 6020 Batch WG918507 – %R was above the 80 - 120% limit for zinc (530%) and greater than 150%. The associated sample results are flagged "R" and should be considered rejected, unusable. The rejected results are summarized in the following table.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameter	Flags
L865801	L865801-21	10/12/2016	RW-715-20161012-WG	Zinc	R
L865801	L865801-22	10/12/2016	RW-711-20161012-WG	Zinc	R
L865801	L865801-23	10/12/2016	RW-705-20161012-WG	Zinc	R
L865801	L865801-24	10/12/2016	RW-700-20161012-WG	Zinc	R
L865801	L865801-25	10/12/2016	RW-701-20161012-WG	Zinc	R
L865801	L865801-26	10/12/2016	RW-702-20161012-WG	Zinc	R
L865801	L865801-27	10/12/2016	RW-703-20161012-WG	Zinc	R

3. Minor Exceptions to Data Acceptance Criteria

Minor exceptions effect data quality but do not result in unusable data. The section below describes the minor exceptions that were identified.

a. General Comment

Sample results reported below the laboratory reporting limit are flagged "J" to indicate that the results are estimated.

b. VOCs by SW-846 Methods 8260B

i. *Surrogate Recovery*

One of four surrogate %R was below the control limit but not below 10% for sample S-371-20161012-WG. Positive and non-detect VOC results (Method 8260B) for the sample are estimated, were flagged "J-" and "UJ," respectively, and are biased low.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameters
L865801	L865801-17	10/12/2016	S-371-20161012-WG	VOCs by Method 8260

c. ***SVOCs by SW-846 Method 8270C and SIM 8270C***

i. ***Surrogate Recovery***

Method 8270C:

The positive 8270C semi-volatile result for biphenyl was qualified as estimated, biased high (J+) in sample S-371-20161012-WG, because one of three base/neutral surrogate recoveries was above control limits. The non-detect 8270C semi-volatile results for phenol, 2-methylphenol, and 3&4-methylphenol were qualified as estimated (UJ) in sample RW-700-20161212-WG, because one of three base/neutral surrogate recoveries was above control limits.

Method SIM 8270C:

The positive SIM 8270C semi-volatile results for 11 compounds were qualified as estimated, biased high (J+) in sample S-220-20161012-WG (1.25 dilution results), because one of three base/neutral surrogate recoveries was above the control limits.

The positive SIM 8270C semi-volatile results for target compounds were qualified as estimated, biased low (J-) and not detected results for target compounds qualified "estimated" (UJ) in sample S-216-20161012-WG because one of three surrogate recoveries was below control limits, but not below 10% in the sample.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameter	Flags
L865801	L865801-17	10/12/2016	S-371-20161012-WG	8270C, biphenyl, +	J+
L865801	L865801-24	10/12/2016	RW-700-20161012-WG	8270C, phenol, 2-methylphenol, and 3&4-methylphenol , ND	UJ
L865801	L865801-04	10/12/2016	S-220-20161012-WG (1.25 dilution results)	SIM 8270C; anthracene, acenaphthene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, chrysene, fluoranthene, fluorine,phenanthrene, pyrene; +	J+
L865801	L865801-18	10/12/2016	S-216-20161012-WG	SIM 8270C, all analytes, + / ND	J- / UJ

d. ***Field Duplicates***

Method SIM 8270C:

The positive SIM 8270C semi-volatile results for pyrene were qualified as estimated (J) in samples S-35-20161012-WG and S-35-20161012-WG-DUP, because the relative percent difference for pyrene was above the allowable maximum in aqueous field duplicate pair S-35-20161012-WG/S-35-20161012-WG-DUP.

SDG	Lab ID	Sample Date	Client Sample ID	Analytical Parameter	Flags
L865801	L865801-13	10/12/2016	S-35-20161012-WG	SIM 8270C, pyrene, +	J
L865801	L865801-14	10/12/2016	S-35-20161012-WG-DUP	SIM 8270C, pyrene, +	J

4. **Comments**

All data are considered usable with the specific exceptions and qualifications noted above.

Completeness of the data set is 100% (defined as the percentage of analytical results that are considered to be valid).

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1. PROJECT INFORMATION

Project Name: **PHRO-AOI 4**
Date of Review: **10/31/2016 11:25:48 AM**
Project Category: **Hazardous Waste Clean-up, Site Remediation, and Reclamation, Spill (e.g., oil, chemical)**
Project Area: **105.80 acres**
County(s): **Philadelphia**
Township/Municipality(s): **PHILADELPHIA**
ZIP Code: **19145**
Quadrangle Name(s): **PHILADELPHIA**
Watersheds HUC 8: **Schuylkill**
Watersheds HUC 12: **City of Philadelphia-Schuylkill River**
Decimal Degrees: **39.909328, -75.196805**
Degrees Minutes Seconds: **39° 54' 33.5821" N, 75° 11' 48.4972" W**

2. SEARCH RESULTS

Agency	Results	Response
PA Game Commission	No Known Impact	No Further Review Required
PA Department of Conservation and Natural Resources	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
PA Fish and Boat Commission	**Potential Impact**	**FURTHER REVIEW IS REQUIRED, See Agency Response**
U.S. Fish and Wildlife Service	No Known Impact	No Further Review Required

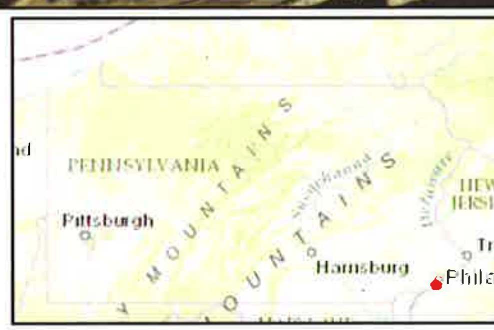
As summarized above, Pennsylvania Natural Diversity Inventory (PNDI) records indicate there may be potential impacts to threatened and endangered and/or special concern species and resources within the project area. If the response above indicates "No Further Review Required" no additional communication with the respective agency is required. If the response is "Further Review Required" or "See Agency Response," refer to the appropriate agency comments below. Please see the DEP Information Section of this receipt if a PA Department of Environmental Protection Permit is required.

Note that regardless of PNDI search results, projects requiring a Chapter 105 DEP individual permit or GP 5, 6, 7, 8, 9 or 11 in certain counties (Adams, Berks, Bucks, Carbon, Chester, Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill and York) must comply with the bog turtle habitat screening requirements of the PASPGP.

PHRO-AOI 4

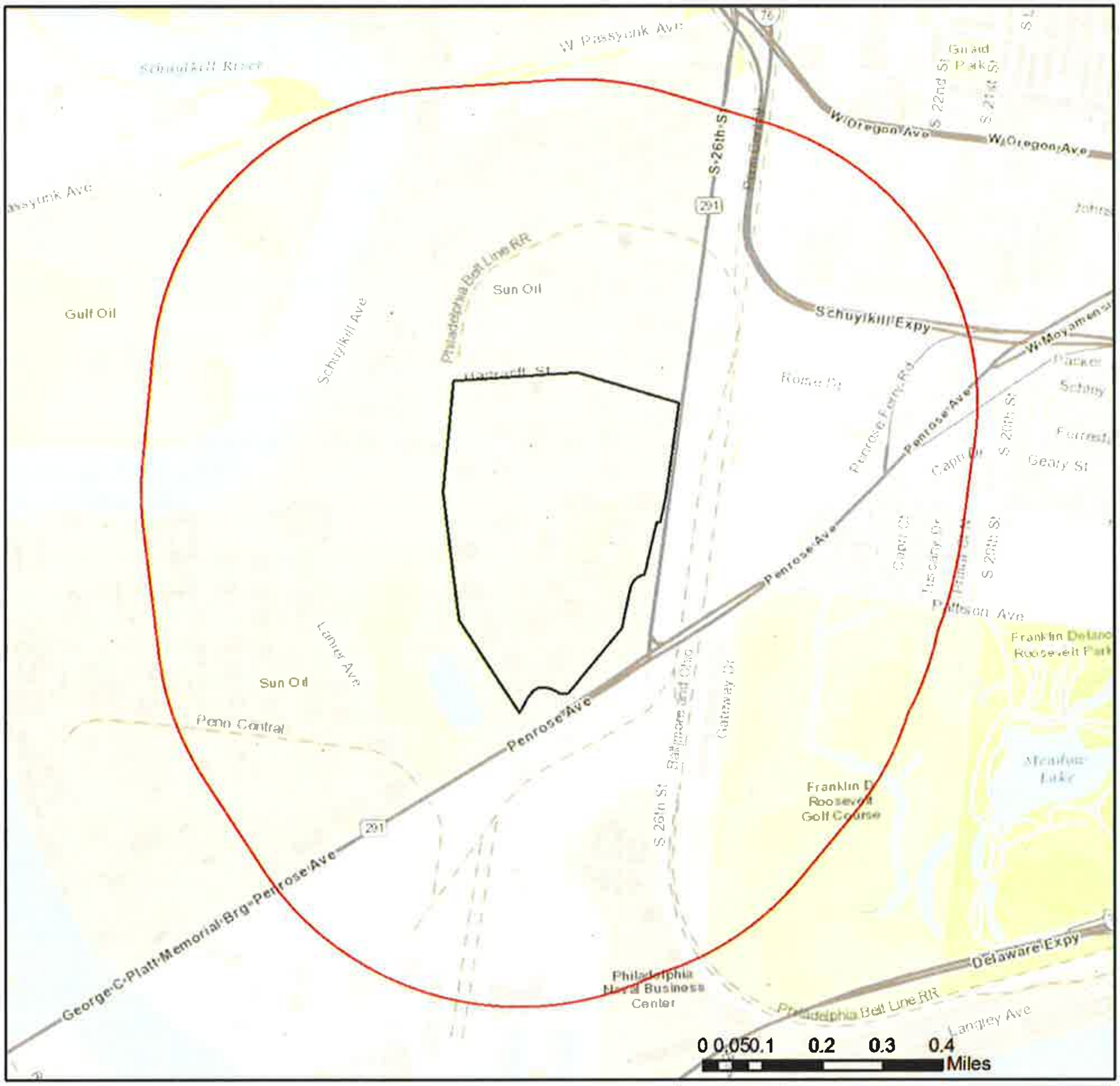
Project Boundary

Buffered Project Boundary



Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user

PHRO-AOI 4



Project Boundary

Buffered Project Boundary

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

RESPONSE TO QUESTION(S) ASKED

Q1: Accurately describe what is known about wetland presence in the project area or on the land parcel by selecting ONE of the following. "Project" includes all features of the project (including buildings, roads, utility lines, outfall and intake structures, wells, stormwater retention/detention basins, parking lots, driveways, lawns, etc.), as well as all associated impacts (e.g., temporary staging areas, work areas, temporary road crossings, areas subject to grading or clearing, etc.). Include all areas that will be permanently or temporarily affected -- either directly or indirectly -- by any type of disturbance (e.g., land clearing, grading, tree removal, flooding, etc.). Land parcel = the lot(s) on which some type of project(s) or activity(s) are proposed to occur.
Your answer is: The project area (or land parcel) has not been investigated by someone qualified to identify and delineate wetlands, or it is currently unknown if the project or project activities will affect wetlands.

Q2: Aquatic habitat (stream, river, lake, pond, etc.) is located on or adjacent to the subject property and project activities (including discharge) may occur within 300 feet of these habitats?
Your answer is: Unknown

3. AGENCY COMMENTS

Regardless of whether a DEP permit is necessary for this proposed project, any potential impacts to threatened and endangered species and/or special concern species and resources must be resolved with the appropriate jurisdictional agency. In some cases, a permit or authorization from the jurisdictional agency may be needed if adverse impacts to these species and habitats cannot be avoided.

These agency determinations and responses are **valid for two years** (from the date of the review), and are based on the project information that was provided, including the exact project location; the project type, description, and features; and any responses to questions that were generated during this search. If any of the following change: 1) project location, 2) project size or configuration, 3) project type, or 4) responses to the questions that were asked during the online review, the results of this review are not valid, and the review must be searched again via the PNDI Environmental Review Tool and resubmitted to the jurisdictional agencies. The PNDI tool is a primary screening tool, and a desktop review may reveal more or fewer impacts than what is listed on this PNDI receipt. The jursidictional agencies **strongly advise against** conducting surveys for the species listed on the receipt prior to consultation with the agencies.

PA Game Commission
RESPONSE:
No Impact is anticipated to threatened and endangered species and/or special concern species and resources.

PA Department of Conservation and Natural Resources
RESPONSE:
Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

DCNR Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below. After desktop review, if a botanical survey is required by DCNR, we recommend the DCNR Botanical Survey Protocols, available here: http://www.gis.dcnr.state.pa.us/hgis-er/PNDI_DCNR.aspx.)

Scientific Name	Common Name	Current Status	Proposed Status	Survey Window
Echinochloa walteri	Walter's Barnyard-grass	Endangered	Endangered	Aug-Sept
Heteranthera multiflora	Multiflowered Mud-plantain	Endangered	Endangered	Flowers july-early oct.

PA Fish and Boat Commission
RESPONSE:

Further review of this project is necessary to resolve the potential impact(s). Please send project information to this agency for review (see WHAT TO SEND).

PFBC Species: (Note: The Pennsylvania Conservation Explorer tool is a primary screening tool, and a desktop review may reveal more or fewer species than what is listed below.)

Scientific Name	Common Name	Current Status
Sensitive Species**		Endangered
Sensitive Species**		Threatened

U.S. Fish and Wildlife Service

RESPONSE:

No impacts to **federally** listed or proposed species are anticipated. Therefore, no further consultation/coordination under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq. is required. Because no take of federally listed species is anticipated, none is authorized. This response does not reflect potential Fish and Wildlife Service concerns under the Fish and Wildlife Coordination Act or other authorities.

* Special Concern Species or Resource - Plant or animal species classified as rare, tentatively undetermined or candidate as well as other taxa of conservation concern, significant natural communities, special concern populations (plants or animals) and unique geologic features.
** Sensitive Species - Species identified by the jurisdictional agency as collectible, having economic value, or being susceptible to decline as a result of visitation.

WHAT TO SEND TO JURISDICTIONAL AGENCIES

If project information was requested by one or more of the agencies above, upload* or email* the following information to the agency(s). Instructions for uploading project materials can be found here. This option provides the applicant with the convenience of sending project materials to a single location accessible to all three state agencies. Alternatively, applicants may email or mail their project materials (see AGENCY CONTACT INFORMATION).
***Note:** U.S.Fish and Wildlife Service requires applicants to mail project materials to the USFWS PA field office (see AGENCY CONTACT INFORMATION). USFWS will not accept project materials submitted electronically (by upload or email).

Check-list of Minimum Materials to be submitted:
____Project narrative with a description of the overall project, the work to be performed, current physical characteristics of the site and acreage to be impacted.
____A map with the project boundary and/or a basic site plan(particularly showing the relationship of the project to the physical features such as wetlands, streams, ponds, rock outcrops, etc.)
In addition to the materials listed above, USFWS REQUIRES the following
____**SIGNED** copy of a Final Project Environmental Review Receipt

The inclusion of the following information may expedite the review process.
____Color photos keyed to the basic site plan (i.e. showing on the site plan where and in what direction each photo was taken and the date of the photos)
____Information about the presence and location of wetlands in the project area, and how this was determined (e.g., by a qualified wetlands biologist), if wetlands are present in the project area, provide project plans showing the location of all project features, as well as wetlands and streams.

4. DEP INFORMATION

The Pa Department of Environmental Protection (DEP) requires that a signed copy of this receipt, along with any required documentation from jurisdictional agencies concerning resolution of potential impacts, be submitted with applications for permits requiring PNDI review. Two review options are available to permit applicants for handling PNDI coordination in conjunction with DEP's permit review process involving either T&E Species or species of special concern. Under sequential review, the permit applicant performs a PNDI screening and completes all coordination with the appropriate jurisdictional agencies prior to submitting the permit application. The applicant will include with its application, both a PNDI receipt and/or a clearance letter from the jurisdictional agency if the PNDI Receipt shows a Potential Impact to a species or the applicant chooses to obtain letters directly from the jurisdictional agencies. Under concurrent review, DEP, where feasible, will allow technical review of the permit to occur concurrently with the T&E species consultation with the jurisdictional agency. The applicant must still supply a copy of the PNDI Receipt with its permit application. The PNDI Receipt should also be submitted to the appropriate agency according to directions on the PNDI Receipt. The applicant and the jurisdictional agency will work together to resolve the potential impact(s). See the DEP PNDI policy at https://conservationexplorer.dcnr.pa.gov/content/resources.

5. ADDITIONAL INFORMATION

The PNDI environmental review website is a preliminary screening tool. There are often delays in updating species status classifications. Because the proposed status represents the best available information regarding the conservation status of the species, state jurisdictional agency staff give the proposed statuses at least the same consideration as the current legal status. If surveys or further information reveal that a threatened and endangered and/or special concern species and resources exist in your project area, contact the appropriate jurisdictional agency/agencies immediately to identify and resolve any impacts.

For a list of species known to occur in the county where your project is located, please see the species lists by county found on the PA Natural Heritage Program (PNHP) home page (www.naturalheritage.state.pa.us). Also note that the PNDI Environmental Review Tool only contains information about species occurrences that have actually been reported to the PNHP.

6. AGENCY CONTACT INFORMATION

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street, PO Box 8552
Harrisburg, PA 17105-8552
Email: RA-HeritageReview@pa.gov
Fax:(717) 772-0271

U.S. Fish and Wildlife Service
Pennsylvania Field Office
Endangered Species Section
110 Radnor Rd; Suite 101
State College, PA 16801
NO Faxes Please

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA 16823
Email: RA-FBPACENOTIFY@pa.gov

PA Game Commission
Bureau of Wildlife Habitat Management
Division of Environmental Planning and Habitat Protection
2001 Elmerton Avenue, Harrisburg, PA 17110-9797
Email: RA-PGC_PNDI@pa.gov
NO Faxes Please

7. PROJECT CONTACT INFORMATION

Name: Andrew Klingbeil
Company/Business Name: Stantec Consulting Services
Address: 1060 Andrew drive Suite 140
City, State, Zip: West Chester, PA 19380
Phone:(610) 840-2525 Fax:( )
Email: andrew.klingbeil@stantec.com

8. CERTIFICATION

I certify that ALL of the project information contained in this receipt (including project location, project size/configuration, project type, answers to questions) is true, accurate and complete. In addition, if the project type, location, size or configuration changes, or if the answers to any questions that were asked during this online review change, I agree to re-do the online environmental review.

[signature] 10-31-16

applicant/project proponent signature date

Stantec

October 31, 2016

PA Department of Conservation and Natural Resources
Bureau of Forestry, Ecological Services Section
400 Market Street
P.O. Box 8552
Harrisburg, PA, 17105-8552

Reference: Potential PNDI Conflict
Philadelphia Refinery Complex – AOI 4
PNDI Search ID: PNDI 612642
City of Philadelphia, Philadelphia County, Pennsylvania

Dear Sir/Madam,

Stantec Consulting Services, Inc. (Stantec) is currently preparing Site Characterization Reports (SCRs) on behalf of Philadelphia Energy Solutions Refining and Marketing LLC (PES) and Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) for select aboveground storage tanks located in the PES Philadelphia Refinery Complex (facility), located at 3144 Passyunk Avenue in the City of Philadelphia, Philadelphia County, Pennsylvania (**Figure 1**) in response to tank-related incidents. Additionally, the facility is part of the One Cleanup Program which provides a mechanism for properties participating in the Pennsylvania Land Recycling Program to also satisfy the requirements of the Environmental Protection Agency (EPA) Corrective Measures program. As a part of this program, Stantec is currently preparing combined Site Characterization Reports/Remedial Investigation Reports (SCR/RIRs) to establish the current conditions of the site and investigate environmental impacts resulting from historical refining operations.

The storage tank Corrective Action Process (CAP) regulations in 25 PA Code Chapter 245, Subchapter D, specifically §245.310(a) (28) and §245.310(b) (4), and the Land Recycling Program regulations in 25 PA Code Chapter 250, specifically §250.311 and §250.402, require an evaluation of ecological receptors at the facility. According to the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Tool search (PNDI Search ID: 612642), potential impacts may exist within the facility under the jurisdiction of the State of Pennsylvania Department of Conservation and Natural Resources (PADCNR). The search identified Walter's Barnyard-grass (Echinochloa walteri) and Multiflowered Mud-plantain (Heteranthera multiflora) as endangered species of concern within the general project area. A copy of the PNDI Project Environmental Review Receipt is attached.

The facility is located on industrial property with access restricted by fencing and security measures. AOI 4 is bordered by Hartranft Avenue to the north, 26th Street to the east, Penrose Avenue to the south, and by industrial properties of AOI 3 to the west. AOI 4 encompasses

Reference: Potential PNDI Conflict
Philadelphia Refinery Complex – AOI 4
PNDI Search ID: PNDI 612642
City of Philadelphia, Philadelphia County, Pennsylvania

approximately 106 acres and is located approximately 1,200 feet to the east of the Schuylkill River. AOI 4 consists of an aboveground storage tank (AST) farm (No. 4 Tank Farm). An aerial photograph depicting site features is included as **Figure 2**. The current and intended future uses of AOI 4 are non-residential.

We request a determination from the PADCNR as to whether or not projects at this facility could affect Walter's Barnyard-grass and Multiflowered Mud-plantain, identified by the PNDI Environmental Project Review to be endangered species and/or species of concern in the area under PADCNR jurisdiction. If you have questions on the enclosed material or require any additional information to make your determination, please feel free to contact me at (610) 840-2525.

Regards,

Stantec Consulting Services, Inc.

Andrew D. Klingbeil, P.G.
Geologic Project Specialist
Phone: 610-840-2525
Fax: 610-840-2501
andrew.klingbeil@stantec.com

Attachment: PNDI Project Environmental Review Receipt
Figure 1 – Site Location Map
Figure 2 – Site Plan

c. Stantec Project File
Evergreen Project File

October 31, 2016

PA Fish and Boat Commission
Division of Environmental Services
450 Robinson Lane, Bellefonte, PA 16823

Reference: Potential PNDI Conflict
Philadelphia Refinery Complex – AOI 4
PNDI Search ID: PNDI 612642
City of Philadelphia, Philadelphia County, Pennsylvania

Dear Sir/Madam,

Stantec Consulting Services, Inc. (Stantec) is currently preparing Site Characterization Reports (SCRs) on behalf of Philadelphia Energy Solutions Refining and Marketing LLC (PES) and Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen) for select aboveground storage tanks located in the PES Philadelphia Refinery Complex (facility), located at 3144 Passyunk Avenue in the City of Philadelphia, Philadelphia County, Pennsylvania (**Figure 1**) in response to tank-related incidents. Additionally, the facility is part of the One Cleanup Program which provides a mechanism for properties participating in the Pennsylvania Land Recycling Program to also satisfy the requirements of the Environmental Protection Agency (EPA) Corrective Measures program. As a part of this program, Stantec is currently preparing combined Site Characterization Reports/Remedial Investigation Reports (SCR/RIRs) to establish the current conditions of the site and investigate environmental impacts resulting from historical refining operations.

The storage tank Corrective Action Process (CAP) regulations in 25 PA Code Chapter 245, Subchapter D, specifically §245.310(a)(28) and §245.310(b)(4), and the Land Recycling Program regulations in 25 PA Code Chapter 250, specifically §250.311 and §250.402, require an evaluation of ecological receptors at the facility. According to the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Tool search (PNDI Search ID: 612642), potential impacts may exist within the facility under the jurisdiction of the State of Pennsylvania Fish and Boat Commission (PA FBC). The search identified two un-named species (sensitive species) as endangered and threatened species within the general project area. A copy of the PNDI Project Environmental Review Receipt is attached.

The facility is located on industrial property with access restricted by fencing and security measures. AOI 4 is bordered by Hartranft Avenue to the north, 26th Street to the east, Penrose Avenue to the south, and by industrial properties of AOI 3 to the west. AOI 4 encompasses approximately 106 acres and is located approximately 1,200 feet to the east of the Schuylkill River. AOI 4 consists of an aboveground storage tank (AST) farm (No. 4 Tank Farm). An aerial

Reference: Potential PNDI Conflict
Philadelphia Refinery Complex – AOI 4
PNDI Search ID: PNDI 612642
City of Philadelphia, Philadelphia County, Pennsylvania

photograph depicting site features is included as **Figure 2**. The current and intended future uses of AOI 4 are non-residential.

We request a determination from the PA FBC as to whether or not projects at this facility could affect the sensitive species identified by the PNDI Environmental Project Review to be endangered and/or threatened in the area under PA FBC jurisdiction. If you have questions on the enclosed material or require any additional information to make your determination, please feel free to contact me at (610) 840-2525.

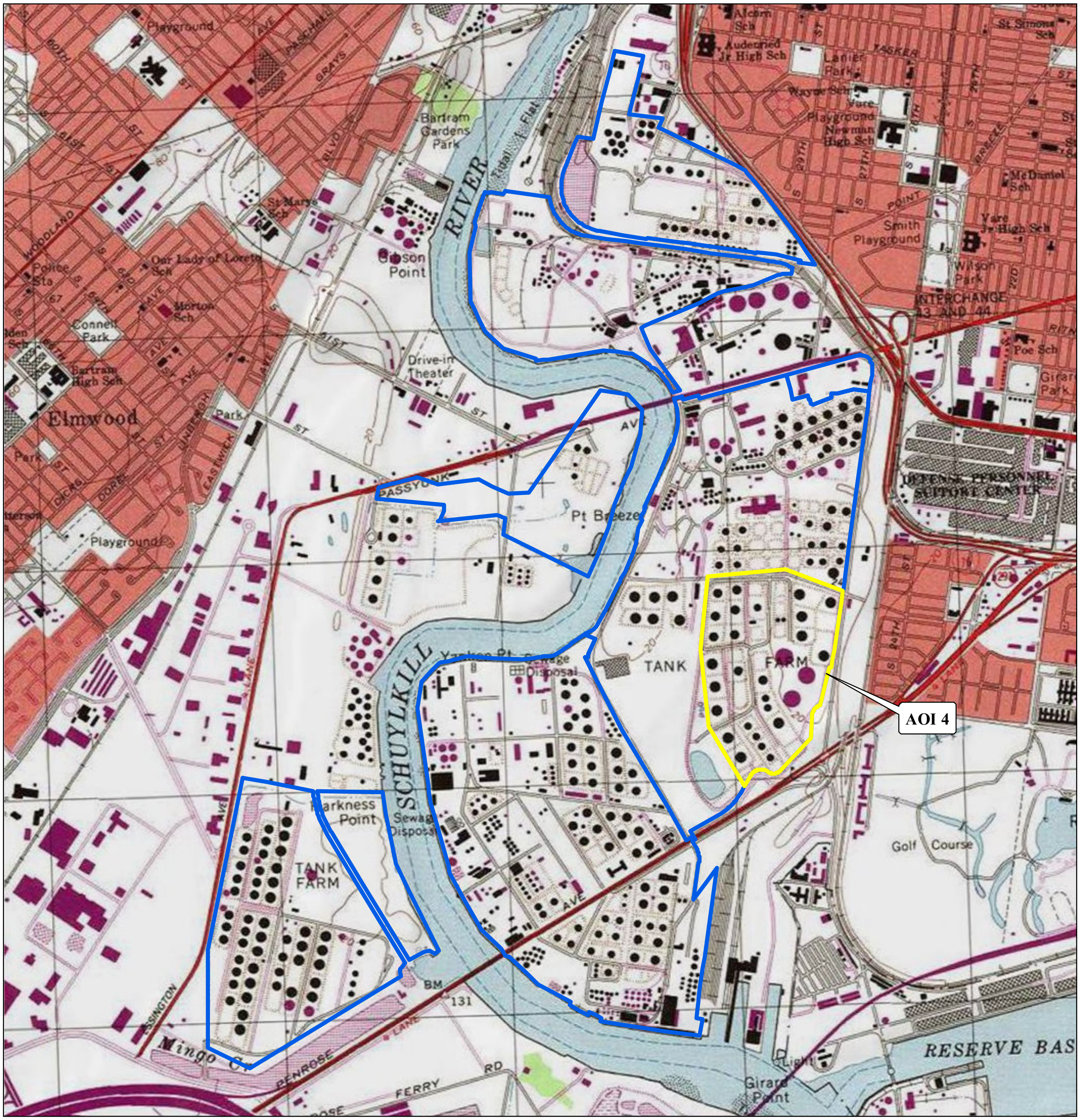
Regards,

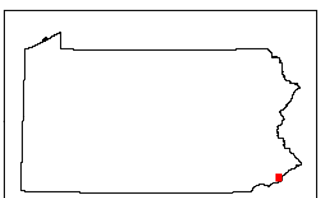
Stantec Consulting Services, Inc.

Andrew D. Klingbeil, P.G.
Geologic Project Specialist
Phone: 610-840-2525
Fax: 610-840-2501
andrew.klingbeil@stantec.com

Attachment: PNDI Project Environmental Review Receipt
Figure 1 – Site Location Map
Figure 2 – Site Plan

c. Stantec Project File
Evergreen Project File





PHILADELPHIA, PA-NJ
USGS 7.5' TOPOGRAPHIC QUADRANGLE

Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Source: Stantec, Evergreen Resources Management
3. Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

LEGEND

- AOI 4
- PHILADELPHIA REFINERY COMPLEX

0 550 1,100 2,200 Feet

1:26,400 (at original document size of 8.5x11)

N

Stantec

EVERGREEN

Project Location
City of Philadelphia, Pennsylvania

213402602
Prepared by GWC on 9/12/2016
Technical Review by ADK on 10/24/2016
Independent Review by MN on10/24/2016

Client/Project
EVERGREEN RESOURCES MANAGEMENT OPERATIONS LLC
PHILADELPHIA REFINERY
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
1

Title
AOI 4 - SITE LOCATION MAP

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

LEGEND

AOI 4

PHILADELPHIA REFINERY COMPLEX

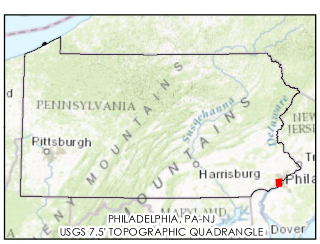
0 100 200 300 400 500 Feet

1:6,000 (at original document size of 8.5x11)

N

Stantec

EVERGREEN



Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Source: Stantec, Evergreen Resources Management
3. Service Layer Credits: Image courtesy of USGS Earthstar Geographics SIO © 2016 Microsoft Corporation Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors

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Project Location 213402602
City of Philadelphia, Pennsylvania
Prepared by GWC on 9/12/2016
Technical Review by ADK on 10/24/2016
Independent Review by MN on10/24/2016

Client/Project
EVERGREEN RESOURCES MANAGEMENT OPERATIONS LLC
PHILADELPHIA REFINERY
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Figure No.
2

Title
AOI 4 - SITE PLAN

pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

BUREAU OF FORESTRY

November 8, 2016 **PNDI Number: PNDI-612642**

Avani Patel
Stantec Consulting, Inc.
1060 Andrew Drive, Suite 140
West Chester, PA 19380
Email: avani.patel@stantec.com (hard copy not to follow)

Re: PHRO-AOI 4
City of Philadelphia, Philadelphia County, PA

Dear Avani,

Thank you for the submission of the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Environmental Review Receipt Number **PNDI-612642** for review. PA Department of Conservation and Natural Resources screened this project for potential impacts to species and resources of concern under DCNR's responsibility, which includes plants, terrestrial invertebrates, natural communities, and geologic features only.

No Impact Anticipated

PNDI records indicate species or resources under DCNR's jurisdiction located in the vicinity of the project. However, based on the information you submitted concerning the nature of the project, the immediate location, and our detailed resource information, DCNR has determined that no impact is likely. No further coordination with our agency is needed for this project.

DCNR recommends the following to help prevent the spread of invasive plant species and to encourage the use of native plants:

- Avoid using seed mixes that include invasive plant species if the project requires re-vegetating the area (http://www.ernstseed.com/seed-mixes/). Please also attempt to use weed-free straw or hay mixes when possible. A complete list of all Pennsylvania invasive plant species can be found here: http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20026634.pdf.
- The area of disturbance should be minimized to the fullest extent that would allow for this project; this will help to lessen the area of indirect disturbance to adjacent riparian/wetland areas.

This response represents the most up-to-date review of the PNDI data files and is valid for two (2) years only. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. Should the proposed work continue beyond the period covered by this letter, please resubmit the project to this agency as an "Update" (including an updated PNDI receipt, project narrative and accurate map). As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review.

Should you have any questions or concerns, please contact Frederick Sechler, Jr., Ecological Information Specialist, by phone (717-705-2819) or via email (c-frsechle@pa.gov).

Sincerely,

Greg Podniesinski

Greg Podniesinski, Section Chief
Natural Heritage Section, DCNR Bureau of Forestry

Pennsylvania Fish & Boat Commission

established 1866

Division of Environmental Services
Natural Diversity Section
450 Robinson Lane
Bellefonte, PA 16823
814-359-5237

November 28, 2016

IN REPLY REFER TO
SIR# 46875

Stantec Consulting
Avani Patel
1060 Andrew Drive
West Chester, Pennsylvania 19380

RE: Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species
PNDI Search No. 612642_1
PHRO - AOI 4
PHILADELPHIA County: Philadelphia City

Dear Avani Patel:

This responds to your inquiry about a Pennsylvania Natural Diversity Inventory (PNDI) Internet Database search "potential conflict" or a threatened and endangered species impact review. These projects are screened for potential conflicts with rare, candidate, threatened or endangered species under Pennsylvania Fish & Boat Commission jurisdiction (fish, reptiles, amphibians, aquatic invertebrates only) using the Pennsylvania Natural Diversity Inventory (PNDI) database and our own files. These species of special concern are listed under the Endangered Species Act of 1973, the Wild Resource Conservation Act, and the Pennsylvania Fish & Boat Code (Chapter 75), or the Wildlife Code.

An element occurrence of a rare, candidate, threatened, or endangered species under our jurisdiction is known from the vicinity of the proposed project. However, given the nature of the proposed project, the immediate location, or the current status of the nearby element occurrence(s), no adverse impacts are expected to the species of special concern.

This response represents the most up-to-date summary of the PNDI data and our files and is valid for two (2) years from the date of this letter. An absence of recorded species information does not necessarily imply species absence. Our data files and the PNDI system are continuously being updated with species occurrence information. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered, and consultation shall be re-initiated.

If you have any questions regarding this review, please contact Kathy Gipe at 814-359-5186 and refer to the SIR # 46875. Thank you for your cooperation and attention to this important matter of species conservation and habitat protection.

Sincerely,

Christopher A. Urban

Christopher A. Urban, Chief
Natural Diversity Section

CAU/KDG/dn

Project No. G15-104
August 28, 2015

Ms. Tiffani Doerr, PG
Aquaterra Technologies, Inc.
122 S. Church St.
West Chester, PA 19381

Re: Geotechnical Laboratory Testing Results
Philadelphia Refinery AOI-9

GeoStructures received two (2) *Shelby tube* samples from Aquaterra (see attached chain of custody form). The soil parameters determined are as follows: visual classification; moist bulk density and dry density; total and effective porosity, and fraction organic carbon. Refer to the testing summary below for sample descriptions and test results.

Laboratory Testing Summary

Sample	Visual Description & Remarks	Moist Bulk Density (pcf)[1]	Dry Density (pcf)[1]	Total Porosity[2] (%)	Effective Porosity[2] (%)	Water Content (%)	Fraction Organic Carbon[3] (%)
AOI9-S-118DSRTF, 42'-44'	Sand and gravel	120.9	101.1	35.5	28.2	19.6	1.0
AOI9-S-110DSRTF, 10'-12'	Sand and gravel	121.0	109.8	28.1	22.5	10.2	3.0

[1] ASTM D7263
[2] ASTM D425M.
[3] ASTM D2974, Method D.

We appreciate your request for services. Please call if you have any questions.

Sincerely,

Eric J. Seksinsky, P.G., P.E.
Associate

Analysis Request/ Environmental Services Chain of Custody

Client: Aquaterra
Project Name/#: Philly Refinery AOI-9
Project Manager: T. Doerr
Sampler: N. Stroik
Name of State where samples were collected: PA

Matrix: Soil / Water (Potable ___ NPDES ___) / Other

Analyses Requested: Bulk Density (D7263); Effective Porosity ASTM D425; FOC (2974)

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water	Other	Total # of Containers	Bulk Density (D7263)	Effective Porosity ASTM D425	FOC (2974)							Remarks	Temperature of samples upon receipt (if applicable)
AOI9_S-118DSRTF_42-44_061615	6/16/15	1500	X		X			1	X	X	X								
AOI9_S-110 DSRTF_10-12_062215	6/22/15	0900	X		X			1	X	X	X								

For Lab Use Only
FSC:
SCR:

Turnaround Time Requested (TAT) (please Ccircle): Normal / Rush

Date results are needed: ______

Rush results requested by (please circle): Phone Fax

Phone #: ______ Fax #: ______

Relinquished by:	Date	Time	Received by:	Date	Time
Noelle Stroik	6/23/15	1600	Aquaterra Office	6/23/15	1600
[signature] / Aquaterra	7/1/15	1545			

Environmental Engineers and Consultants
Copies: Original should accompany samples to laboratory. A photocopy should be retained by the client.

Bashar S. Qubain, Ph.D., P.E.
Eric J. Seksinsky, P.G., P.E.
Jianchao Li, P.E.

GeoStructures

GEOTECHNICAL ENGINEERING CONSULTANTS

Project No. G16-109
May 6, 2016

Mr. Andrew Klingbeil, P.G.
Stantec
1060 Andrew Drive,
Suite 140
West Chester, PA 19380-5602

Re: Laboratory Testing
Philadelphia Refinery Operations
Area of Interest 4 Remedial Investigation

Dear Mr. Klingbeil:

GeoStructures, Inc. has completed the following laboratory testing on jar and Shelby tube samples from the referenced location:

- 2 Sieve analysis tests (ASTM D422)
- 6 Organic content tests (ASTM D2974)
- 3 Hydraulic conductivity tests (ASTM D5084)

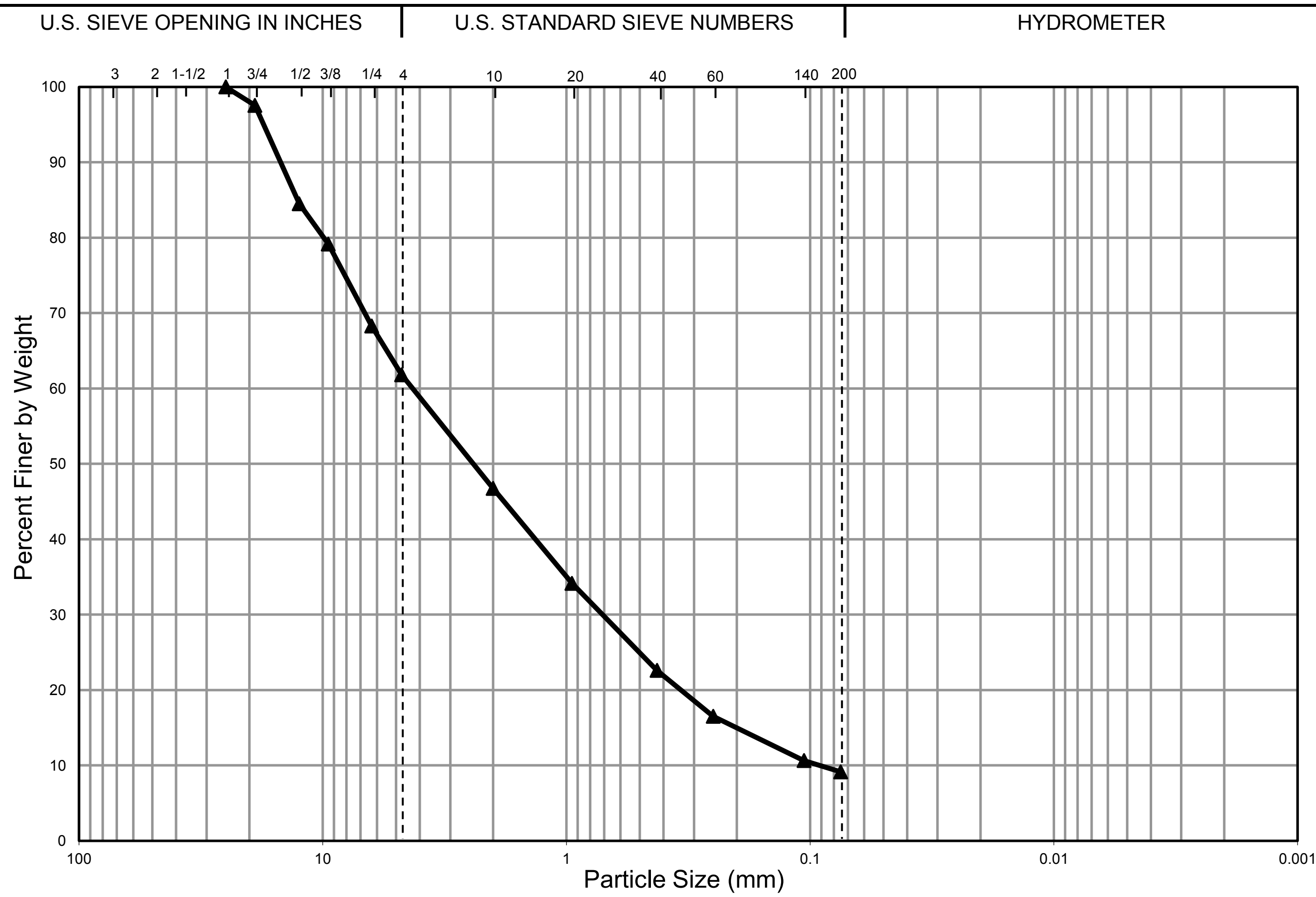
The results are presented in the attached reports. We appreciate your request for services and look forward to assisting you in the future. Please feel free to call me if you have any questions.

Sincerely,

Vasili Martysiuk, M.S.
Laboratory Manager

Attachments

PARTICLE SIZE ANALYSIS OF SOILS



%	Cobbles	Gravel		Sand			Fines (Silt, Clay)
		Coarse	Fine	Coarse	Medium	Fine	
▲	0.0	38.2		52.7			9.1

Sieve	Percent Finer ▲
3"	
2"	
1-1/2"	
1"	100.0
3/4"	97.5
1/2"	84.5
3/8"	79.2
1/4"	68.3
No. 4	61.8
No. 10	46.7
No. 20	34.1
No. 40	22.6
No. 60	16.5
No. 140	10.6
No. 200	9.1

	▲
Stratum	
Boring	S-39D
Sample	S-57
Depth (ft)	124.0 - 126.0
C_u	43.0
C_c	1.1
w (%)	10.7
LL	N.P.
PL	N.P.
PI	N.P.
USCS	SW-SM

	Color	USCS Group Name
▲	Light brown	Well-graded sand with silt and gravel

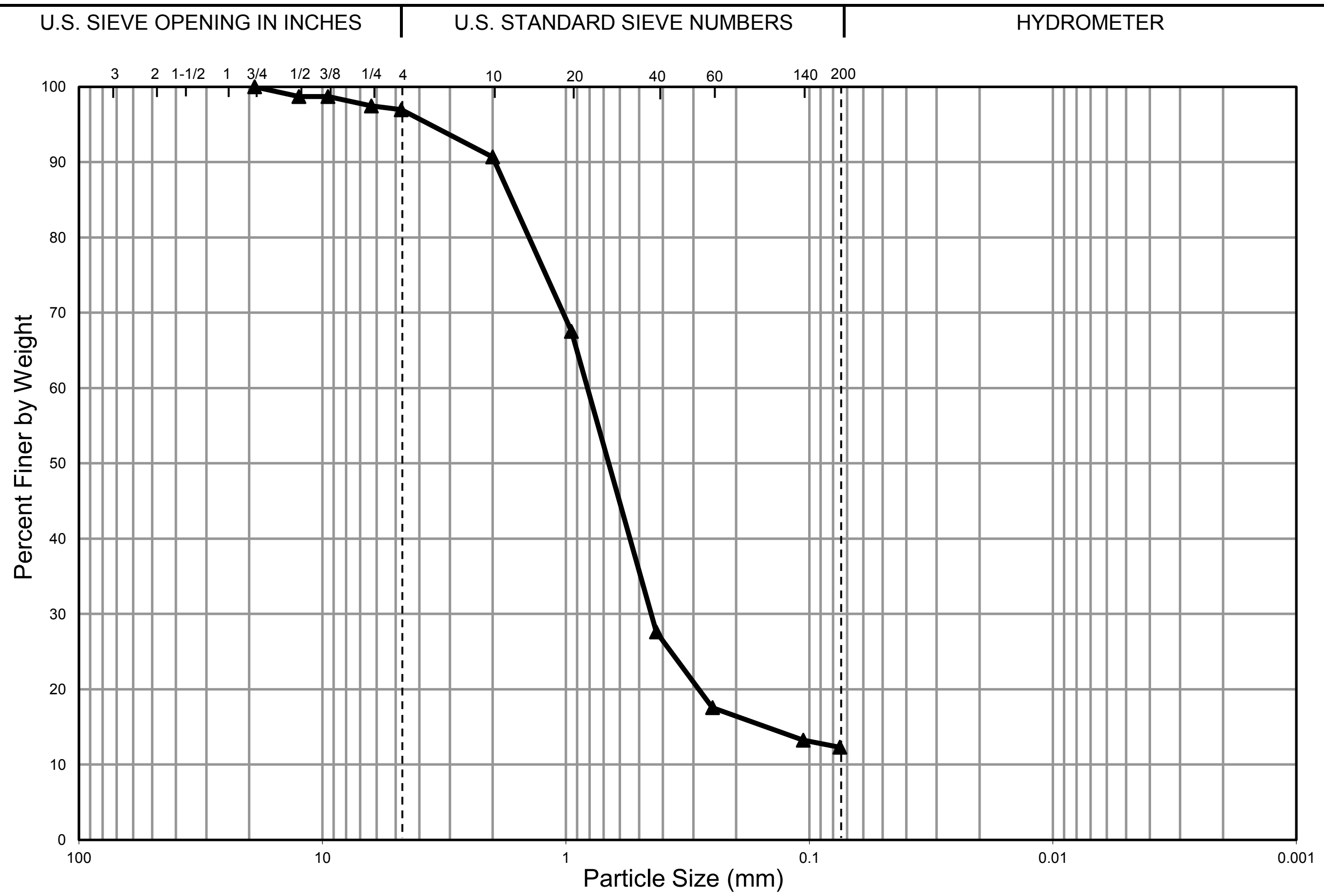
GeoStructures

Philadelphia Refinery Complex (Area 4 Remedial Investigation)

GeoStructures Project No.: G16-109 | 4/29/2016

Ph. 610.265.1818 1000 W. 9th Avenue, King of Prussia, PA 19406 www.geostructures.net Fax 610.265.1833

PARTICLE SIZE ANALYSIS OF SOILS



%	Cobbles	Gravel		Sand			Fines (Silt, Clay)
		Coarse	Fine	Coarse	Medium	Fine	
▲	0.0	3.1		84.6			12.3

Sieve	Percent Finer ▲
3"	
2"	
1-1/2"	
1"	
3/4"	100.0
1/2"	98.7
3/8"	98.7
1/4"	97.5
No. 4	96.9
No. 10	90.7
No. 20	67.5
No. 40	27.6
No. 60	17.6
No. 140	13.2
No. 200	12.3

	▲
Stratum	
Boring	S-218D
Sample	S-42
Depth (ft)	90.0 - 92.0
C_u	
C_c	
w (%)	17.8
LL	N.P.
PL	N.P.
PI	N.P.
USCS	SM

	Color	USCS Group Name
▲	Yellowish brown	Silty sand

GeoStructures

Philadelphia Refinery Complex (Area 4 Remedial Investigation)

GeoStructures Project No.: G16-109 | 4/29/2016

Ph. 610.265.1818 1000 W. 9th Avenue, King of Prussia, PA 19406 www.geostructures.net Fax 610.265.1833

Summary of Moisture and Organic Content Testing
(ASTM D2216-10 and ASTM D2974-13)

Boring	Sample	Depth (ft)	Water Content	Organic Content[1]
S-39D	S-59	128.0 - 130.0	8.7%	0.9%
S-39D	S-64	138.0 - 140.0	8.5%	1.0%
S-39D	S-10	26.0 - 28.0	18.4%	0.4%
S-218D	S-43	92.0 - 94.0	10.4%	1.0%
S-218D	S-47	100.0 - 102.0	7.7%	1.0%
S-218D	S-16	38.0 - 40.0	23.0%	1.9%

[1] Test Method D.

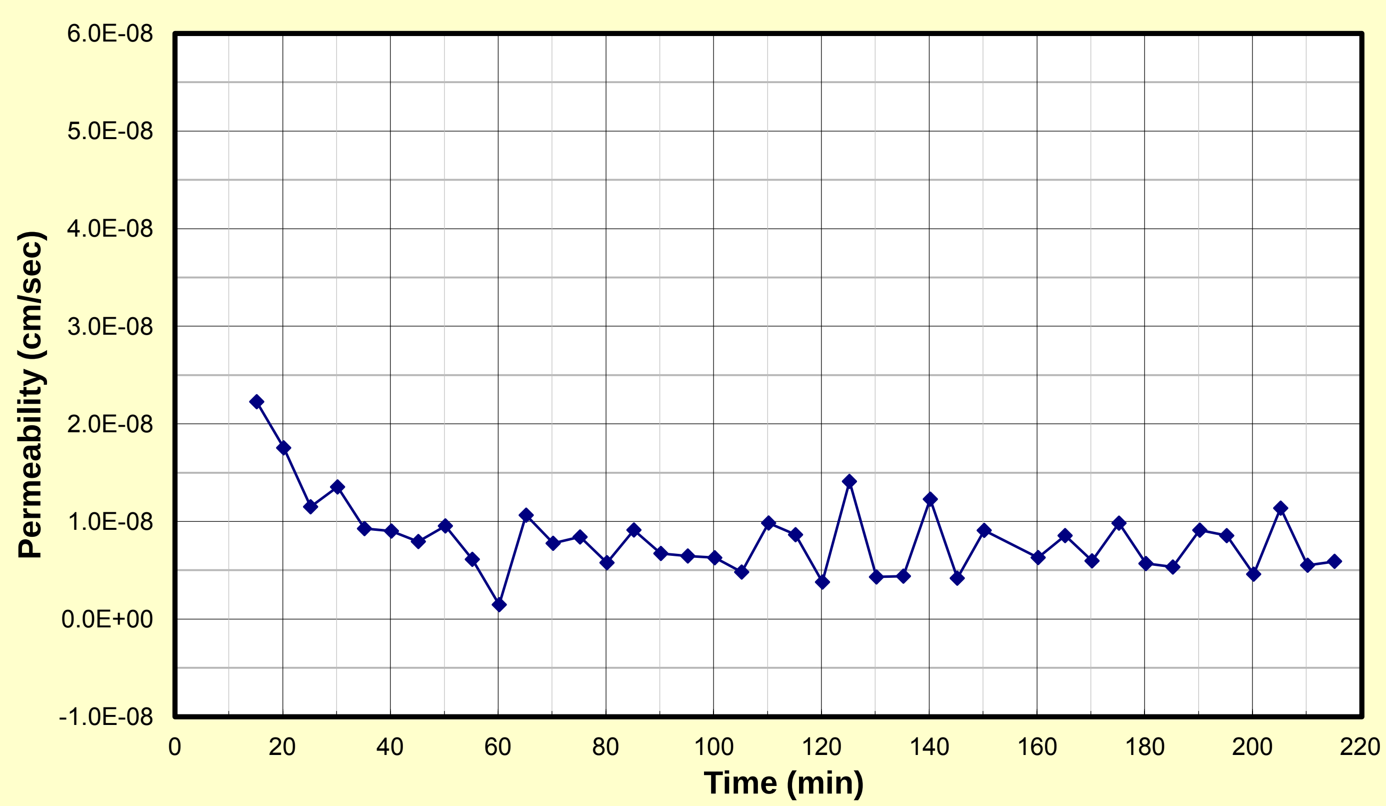
Ph. 610.265.1818
Fax 610.265.1833

GeoStructures, Inc
1000 W. 9th Ave., King of Prussia, PA 19406

www.geostructures.net

TRIAXIAL PERMEABILITY REPORT

ASTM D5084



	Specimen No.	1			
Initial	Water Content (%)	34.4%			
	Dry Density (pcf)	87.8			
	Saturation (%)	100.0%			
	Void Ratio	0.93			
	Diameter (in.)	2.843			
	Height (in.)	2.920			
At Test	Cell Press. (psi)	185.6			
	Back Press. (psi)	150.2			
	B Value	0.96			
	Consolidation Stress (psi)	35.4			
	Hydraulic Gradient	15.4			
	Pressure Head (psi)	1.62			
	Permeability (cm/sec)	7.21E-09			

Boring #	Sample #	Depth (ft)	Material Description	USCS	LL	PL	PI	Gs
S-39D2	ST-1	56.0 -56.3	Whitish red fat clay (visual)	ch				2.72

Remarks	Specific Gravity is an assumed value.

GeoStructures

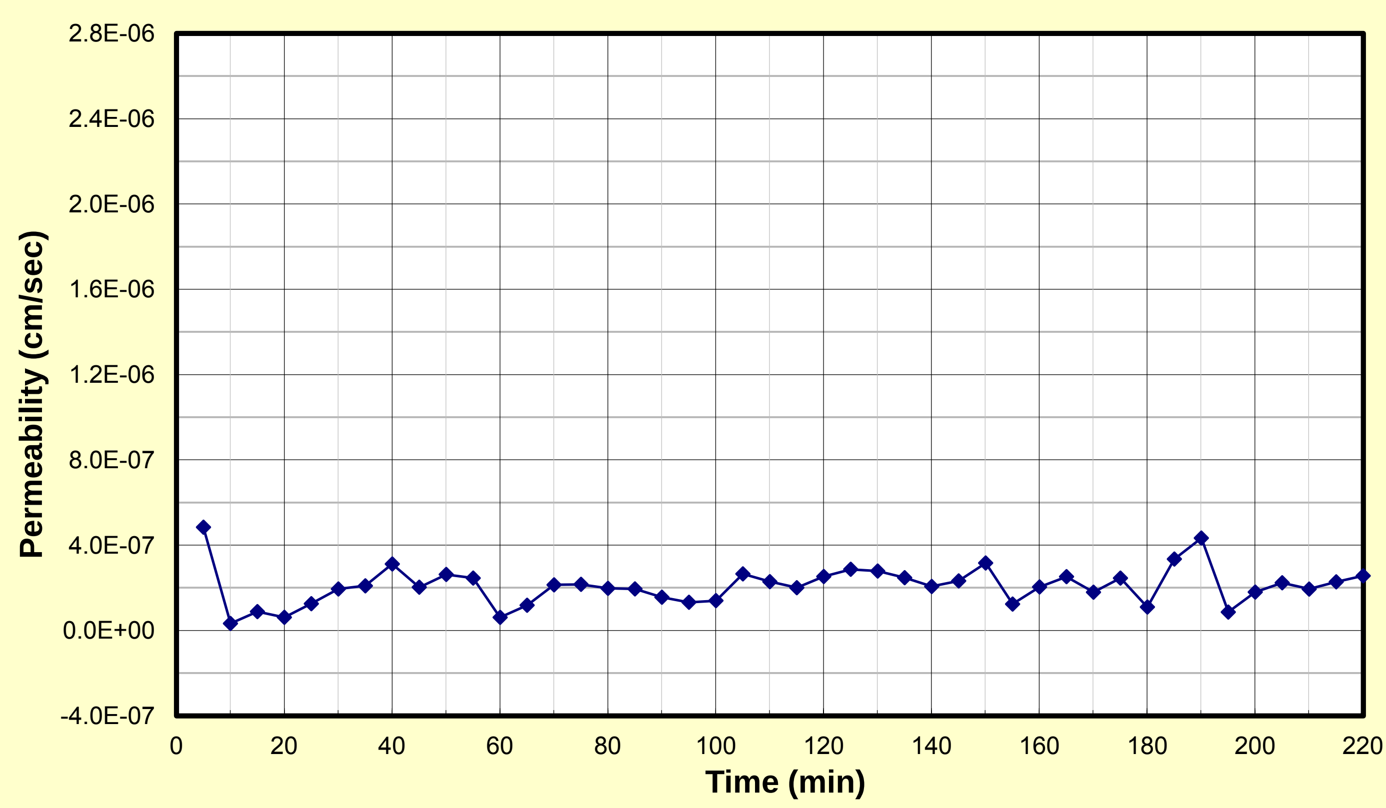
Philadelphia Refinery Complex (Area 4 Remedial Investigation)

GeoStructures Project No.: G16-109 — 5/4/2016

Ph. 610.265.1818
Fx. 610.265.1833
GeoStructures, Inc.
1000 West 9th Avenue, King of Prussia, PA 19406
www.geostructures.net

TRIAXIAL PERMEABILITY REPORT

ASTM D5084



	Specimen No.	1			
Initial	Water Content (%)	26.1%			
	Dry Density (pcf)	101.0			
	Saturation (%)	100.0%			
	Void Ratio	0.68			
	Diameter (in.)	2.810			
	Height (in.)	2.684			
At Test	Cell Press. (psi)	118.6			
	Back Press. (psi)	99.9			
	B Value	1.00			
	Consolidation Stress (psi)	18.8			
	Hydraulic Gradient	7.4			
	Pressure Head (psi)	0.72			
	Permeability (cm/sec)	2.16E-07			

Boring #	Sample #	Depth (ft)	Material Description	USCS	LL	PL	PI	Gs
S-218D2	ST-1	30.1 - 30.5	Brown clay with sand (visual)	cl				2.72

Remarks Specific Gravity is an assumed value.

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Philadelphia Refinery Complex (Area 4 Remedial Investigation)

GeoStructures Project No.: G16-109 | 5/6/2016

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Fx. 610.265.1833
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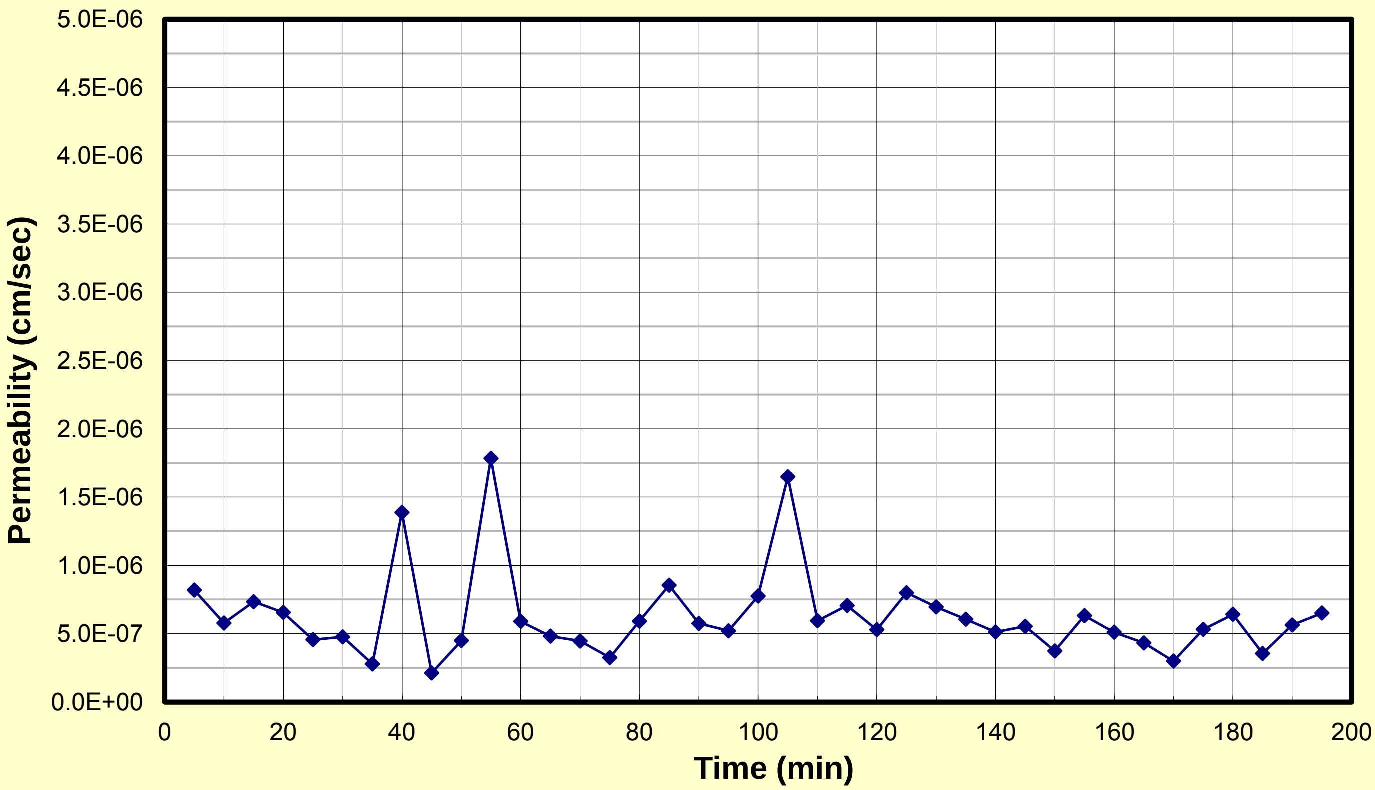
TRIAXIAL PERMEABILITY REPORT

ASTM D5084



	Specimen No.	1			
Initial	Water Content (%)	36.5%			
	Dry Density (pcf)	83.7			
	Saturation (%)	97.9%			
	Void Ratio	1.00			
	Diameter (in.)	2.795			
	Height (in.)	3.349			
At Test	Cell Press. (psi)	173.1			
	Back Press. (psi)	140.2			
	B Value	1.00			
	Consolidation Stress (psi)	32.9			
	Hydraulic Gradient	4.7			
	Pressure Head (psi)	0.56			
	Permeability (cm/sec)	6.0E-07			

Boring #	Sample #	Depth (ft)	Material Description	USCS	LL	PL	PI	Gs
S-218D2	ST-2	59.5 - 59.9	Dark brown silt with some sand or organic silt (visual)	ml or ol				2.68

Remarks Specific Gravity is an assumed value.

GeoStructures

Philadelphia Refinery Complex (Area 4 Remedial Investigation)

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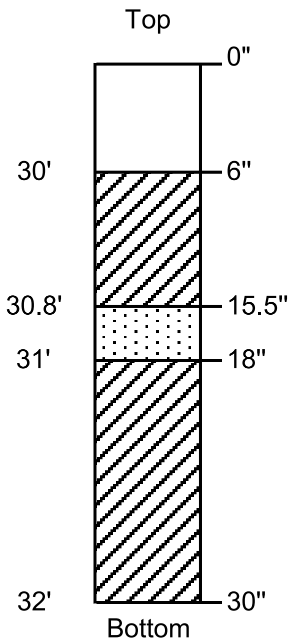
SHELBY TUBE LOG

Project Name:	Philadelphia Refinery Complex (Area 4 Remedial Investigation)			Boring No.:	S-218D2
Project No.:	G16-109	Sample No.: ST-1		Depth:	30.0 - 32.0
Sample Length (prior to ejection):	24.0"	Sample Length (after ejection): 22.0"	Ejected By: VM	Date:	4/29/2016



Description

Open tube.

[0.5 tsf]

Brown clay with sand (cl).

Brown fine clayey sand (sc).

[0.4 tsf]

Greenish brown clay with some sand (cl) and medium to fine sand lenses.

[0.7 tsf]

Measurements

Natural moisture : 26.1 %

Total Unit weight : 127.4 pcf

Dry Unit weight: 101.0 pcf

Depth : 30.1 - 30.5 ft

Photo

S-218D2 ST-1 30.0'-32.0' sample extruded from Shelby tube

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Fx. 610.265.1833
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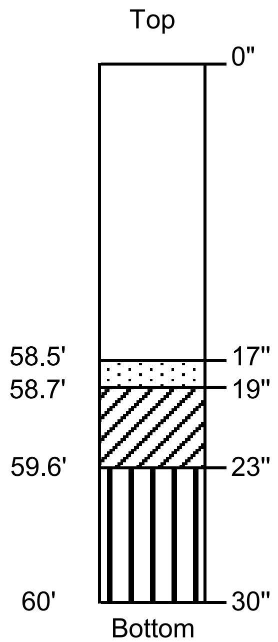
SHELBY TUBE LOG

Project Name:	Philadelphia Refinery Complex (Area 4 Remedial Investigation)				Boring No.:	S-218D2
Project No.:	G16-109	Sample No.: ST-2			Depth:	58.0 - 60.0
Sample Length (prior to ejection):	13.0"	Sample Length (after ejection):	13.5"	Ejected By: VM	Date:	4/29/2016



Description

Open tube.

Brown poorly graded sand with gravel (sp).

Grayish green silty, clayey sand (sc-sm) to sandy lean clay (cl).

Dark brown silt with some sand or organic silt (ml or ol).

Measurements

Natural moisture : 36.5 %

Total Unit weight : 114.2 pcf

Dry Unit weight: 83.7 pcf

Depth : 59.5 - 59.9 ft

Photo

S-218D2 ST-2 58.0'-60.0' sample extruded from Shelby tube

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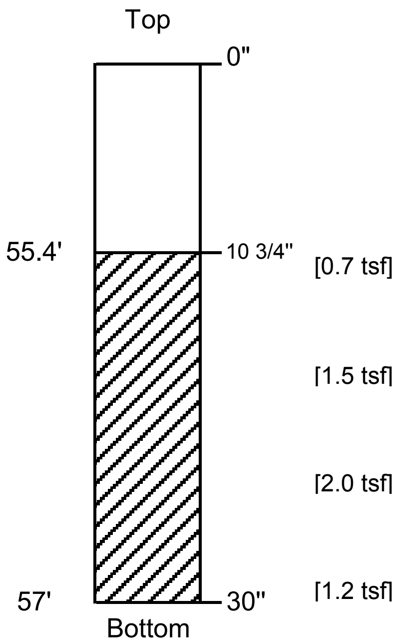
SHELBY TUBE LOG

GeoStructures

Project Name:	Philadelphia Refinery Complex (Area 4 Remedial Investigation)				Boring No.:	S-39D2
Project No.:	G16-109	Sample No.: ST-1			Depth:	55.0 - 57.0
Sample Length (prior to ejection):	19 1/4"	Sample Length (after ejection):	19.0"	Ejected By: VM	Date:	4/29/2016



Description

Open tube.

Whitish red fat clay (ch).

Measurements

Natural moisture : 34.4 %

Total Unit weight : 118.0 pcf

Dry Unit weight: 87.8 pcf

Depth : 56.0 - 56.3 ft

Photo

S-39D2 ST-1 55.0'-57.0' sample extruded from Shelby tube

GeoStructures
Bashar S. Qubain, Ph.D., P.E.
Eric J. Seksinsky, P.G., P.E.
Jianchao Li, P.E.
GEOTECHNICAL ENGINEERING CONSULTANTS

Project No. G15-104
November 30, 2015

Ms. Tiffani Doerr, PG
Aquaterra Technologies, Inc.
122 S. Church St.
West Chester, PA 19381

Re: Geotechnical Laboratory Testing Results
Philadelphia Refinery AOI-3

GeoStructures received four (4) *Shelby tube* soil samples from Aquaterra on October 29, 2015 (see attached chain of custody form). The soil parameters determined are as follows: moisture content; fraction organic carbon by loss on ignition; bulk density and dry density; and effective and total porosity. Refer to the testing summary below and the attached Shelby tube extrusion logs for sample descriptions and test results.

Laboratory Testing Summary

Sample ID	Test Specimen Depth	Visual Description & Remarks	Moist Bulk Density (pcf)[1]	Dry Bulk Density (pcf)[1]	Total Porosity[2] (%)	Effective Porosity[2] (%)	Water Content[3] (%)	Fraction Organic Carbon[4] (%)
S-412 10'-12'	10.7'-11.5'	Dk. brown silty, clayey sand with gravel	122.9	109.9	24.8	8.3	11.8	4.8
S-412 12'-14'	12.6'-13.4'	Dark brown silty sand with gvl., trace clay	123.6	105.4	29.0	6.6	17.3	3.0
S-411 10'-12'	10.5'-11.3'	Brown clay with sand	112.9	92.6	33.4	14.9	21.9	4.1
S-411 14'-16'	15.2'-15.7'	Brown clay with sand and gravel	112.9	93.1	31.9	10.4	21.3	5.4

[1] ASTM D7263
[2] ASTM D425M.
[3] ASTM D2216
[4] ASTM D2974, Method D.

We appreciate your request for services. Please call if you have any questions.

Sincerely,

Eric J. Seksinsky, P.G., P.E.
Associate

1000 West 9th Avenue, King of Prussia, PA 19406 Ph. 610.265.1818, Fx. 610.265.1833 www.geostructures.net

Analysis Request/ Environmental Services Chain of Custody

Client: Aquaterra Technologies
Project Name/#: PH Ref AOI-3
Project Manager: Tiffani Doerr
Sampler: NS/LM NOELLE STROIK
Name of State where samples were collected: PA

Matrix: Water (Potable ___ NPDES ___)

Analyses Requested

For Lab Use Only
FSC:
SCR:

Sample Identification	Date Collected	Time Collected	Grab	Composite	Soil	Water	Other	Total # of Containers	Bulk Density	Effective Porosity	FOC								Remarks	Temperature of samples upon receipt (if applicable)
AOI3_S-412_10-12_101915	10/19/15	900	X		X			1	X	X	X								Can you please	
AOI3_412_12-14_101915	10/19/15	1130	X		X			1	X	X	X								note if any	
AOI3_S-411_10-12_102015	10/20/15	1030	X		X			1	X	X	X								of the tubes	
AOI3_S-411_14-16_102015	10/20/15	1200	X		X			1	X	X	X								change	
																			lithologies?	
																			(e.g. top	
																			half is silt	
																			& bottom is	
																			S&G).	

Turnaround Time Requested (TAT) (please Ccircle): (Normal) Rush

Date results are needed: ____________

Rush results requested by (please circle): Phone Fax

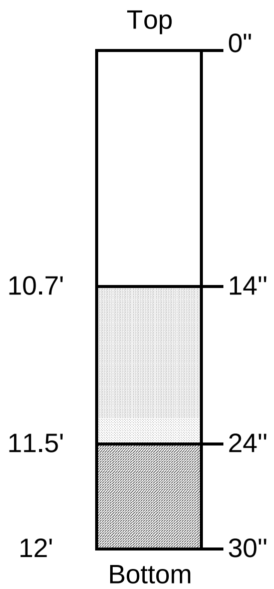
Phone #: ____________ Fax #: ____________

Relinquished by:	Date	Time	Received by:	Date	Time
Noelle Stroik [signature]	10/28/15	0800	Aquaterra STORAGE	10/28/15	0800
[signature]	10/29/15	1110	Blake Fish [signature]	10/29	1110

Environmental Engineers and Consultants
Copies: Original should accompany samples to laboratory. A photocopy should be retained by the client.

SHELBY TUBE LOG

Project Name: Philadelphia Refinery AOI-3		Boring No.: AOI-3 S-412	
Project No.: G15-104	Sample No.: 10-12_101915	Depth: 10.0 - 12.0	
Sample Length (prior to ejection):	Sample Length (after ejection):	Ejected By: VM	Date: 11/2/2015



Description

Open tube.

Dark brown silty, clayey sand with gravel (sc-sm).

Cobble at 11.5'

Light brown, gray, red gravelly clay with sand (cl).

Notes:

Lower 3 in. of the tube are bent.

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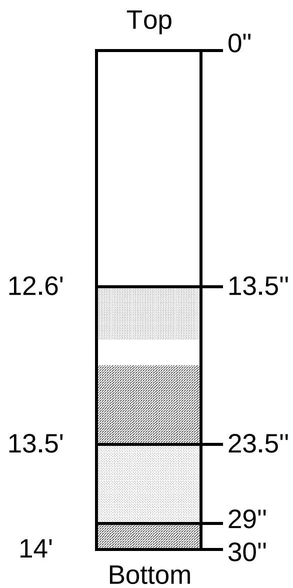
SHELBY TUBE LOG

Project Name:	Philadelphia Refinery AOI-3			Boring No.:	AOI-3 S-412
Project No.:	G15-104	Sample No.: 12-14_101915		Depth:	12.0 - 14.0
Sample Length (prior to ejection):		Sample Length (after ejection):	Ejected By: VM	Date: 11/2/2015	



Description

Open tube.

Dark brown silty sand with gravel (sm).

Grayish brown sandy clay with gravel (cl).

Light gray, brown poorly graded sand (sp-sm).

Light brown, gray sandy clay (cl).

Notes:

Lower 2 in. of the tube are bent.

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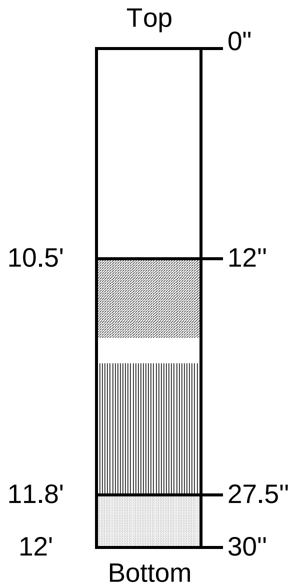
SHELBY TUBE LOG

GeoStructures

Project Name:	Philadelphia Refinery AOI-3			Boring No.:	AOI-3 S-411
Project No.:	G15-104	Sample No.: 10-12_102015		Depth:	10.0 - 12.0
Sample Length (prior to ejection):		Sample Length (after ejection):	Ejected By: VM	Date: 11/2/2015	



Description

Open tube.

Brown clay with sand (cl).

Grayish brown silt (ml).

Brown silty sand (sm).

Notes:

Ph. 610.265.1818
Fx. 610.265.1833

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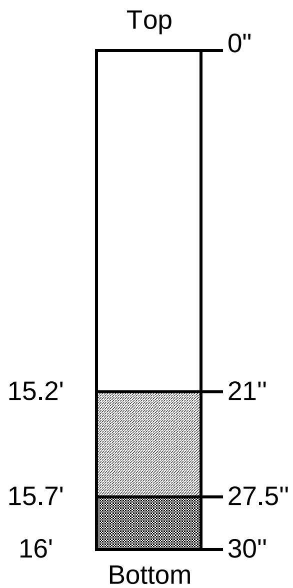
SHELBY TUBE LOG

Project Name:	Philadelphia Refinery AOI-3			Boring No.:	AOI-3 S-411
Project No.:	G15-104	Sample No.: 14-16_102015		Depth:	14.0 - 16.0
Sample Length (prior to ejection):		Sample Length (after ejection):	Ejected By: VM	Date: 11/2/2015	



Description

Open tube.

Brown clay with sand and gravel (cl).

Same with concrete fragments

Notes:

Lower 3 in. of the tube are bent.

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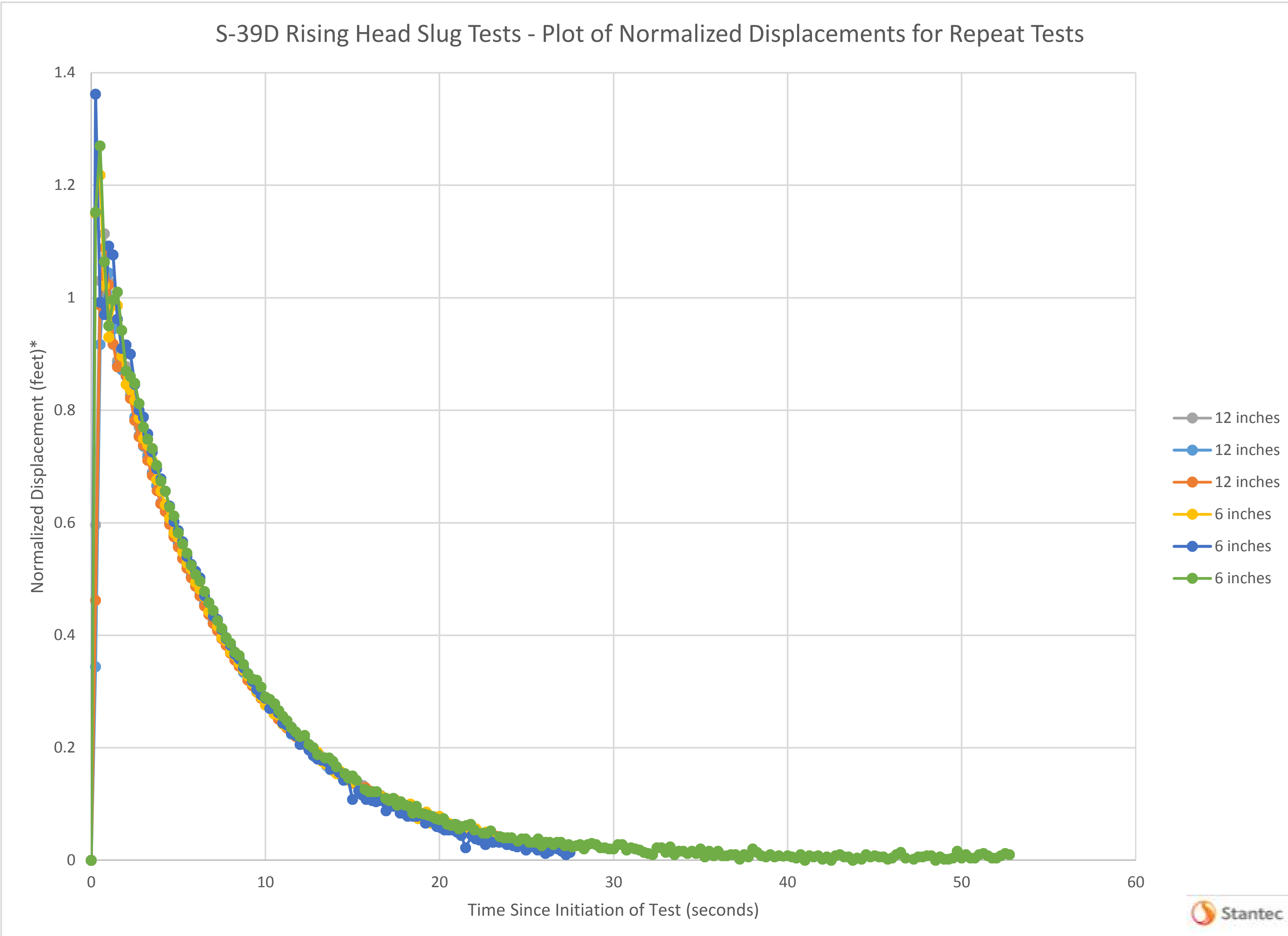
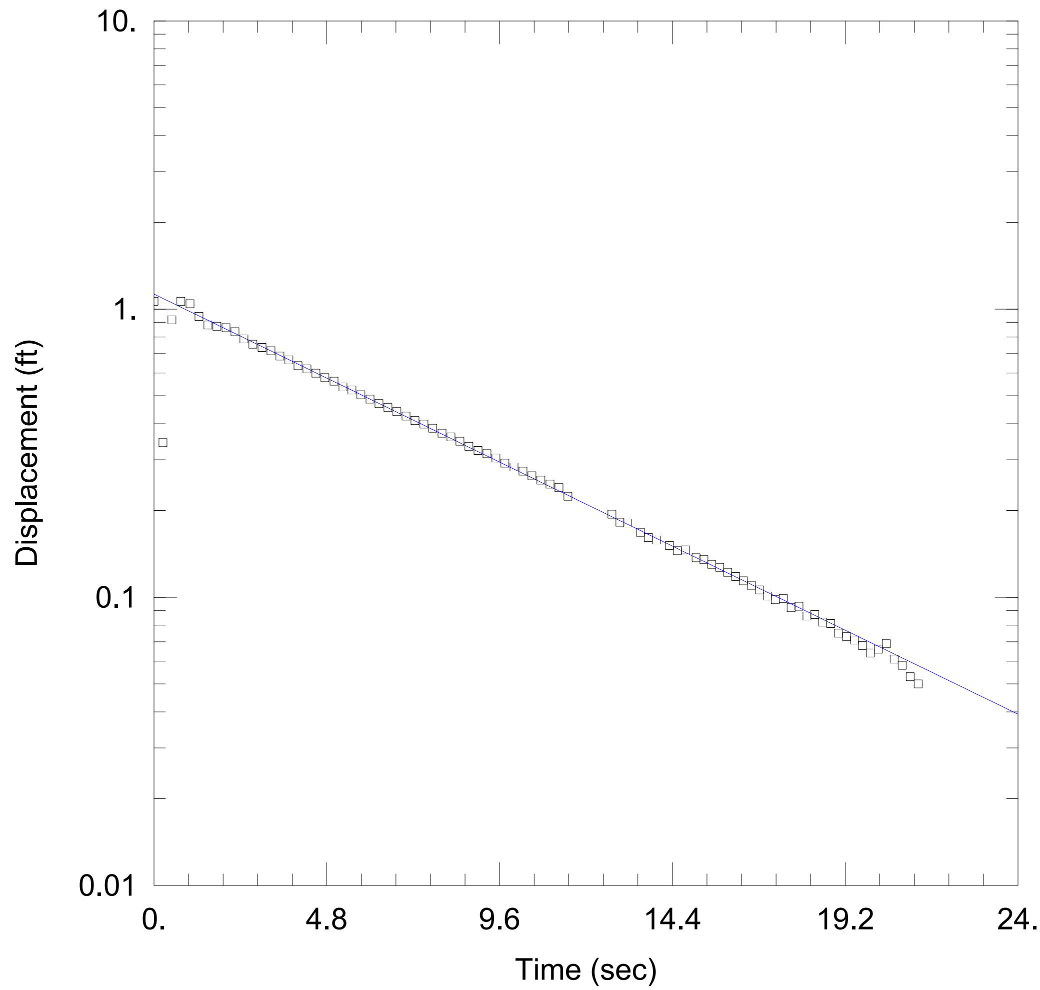


*Water-level displacement data was normalized by dividing the observed displacement data by the expected initial displacement, indicated in the plot legend (in inches of water).



AOI 4 REMEDIAL INVESTIGATION

Data Set: V:\...\s39d_risinghead_12inch_test2.aqt
Date: 02/24/17 Time: 15:31:56

PROJECT INFORMATION

Company: Stantec Consulting
Client: Evergreen Resources Management
Project: 213402602
Location: Philadelphia Refinery Complex
Test Well: S-39D
Test Date: 8/30/2016

AQUIFER DATA

Saturated Thickness: 84.5 ft
Anisotropy Ratio (Kz/Kr): 1.

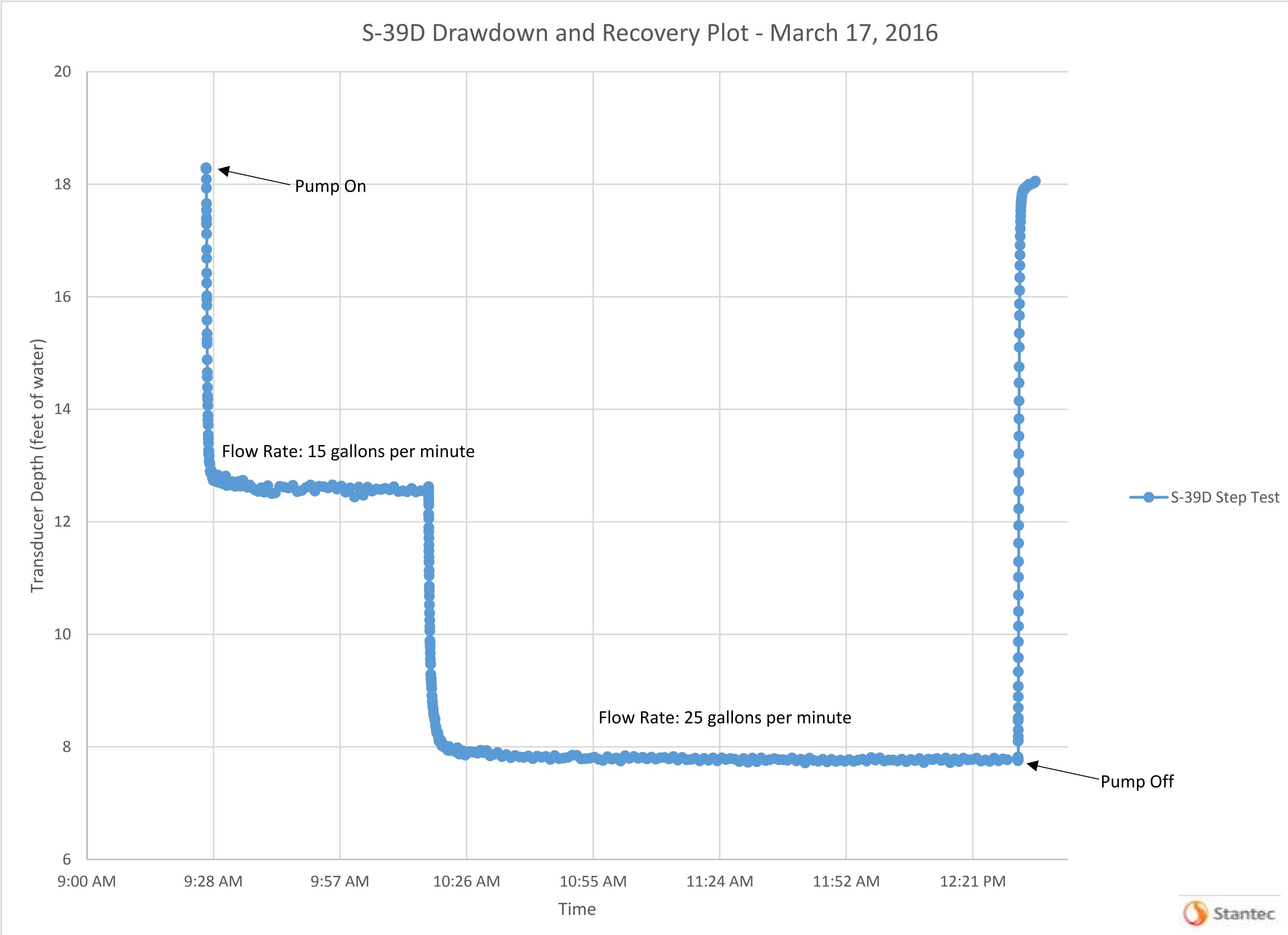
WELL DATA (S-39D)

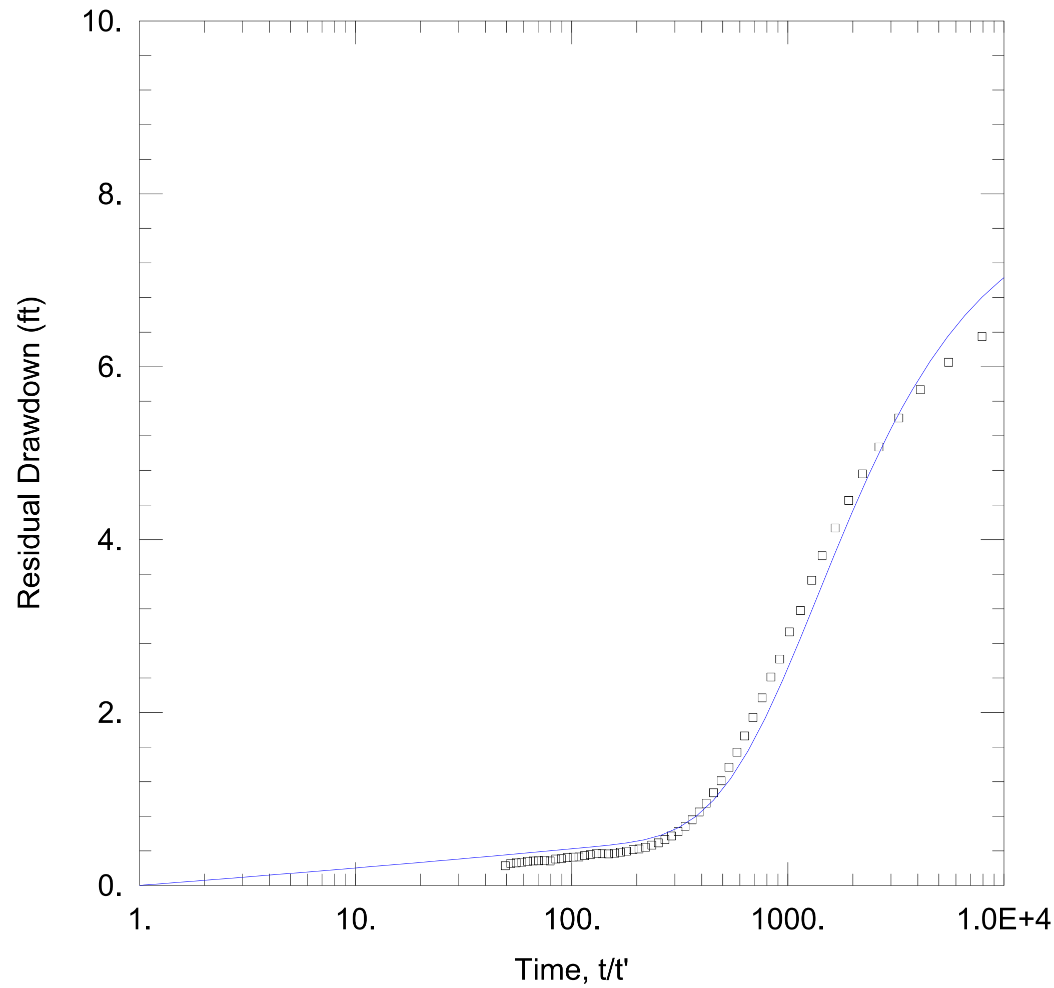
Initial Displacement: 1.064 ft
Total Well Penetration Depth: 58. ft
Casing Radius: 0.1663 ft
Static Water Column Height: 107. ft
Screen Length: 10. ft
Well Radius: 0.1663 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev

K = 66.19 ft/day
y0 = 1.127 ft


S-39D Drawdown and Recovery Plot - March 17, 2016
Transducer Depth (feet of water)
20
18
16
14
12
10
8
6
Pump On
Flow Rate: 15 gallons per minute
Flow Rate: 25 gallons per minute
Pump Off
S-39D Step Test
9:00 AM
9:28 AM
9:57 AM
10:26 AM
10:55 AM
11:24 AM
11:52 AM
12:21 PM
Time
Stantec



WELL TEST ANALYSIS

Data Set: V:\...\s39d_residualdrawdown.aqt
Date: 03/24/17 Time: 12:42:09

PROJECT INFORMATION

Company: Stantec Consulting
Client: Evergreen Resources Management
Project: 213402602
Location: Philadelphia Refining Complex
Test Well: S-39D
Test Date: 3/17/16

AQUIFER DATA

Saturated Thickness: 84.5 ft
Anisotropy Ratio (Kz/Kr): 0.7328

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
S-39D	0	0

Observation Wells

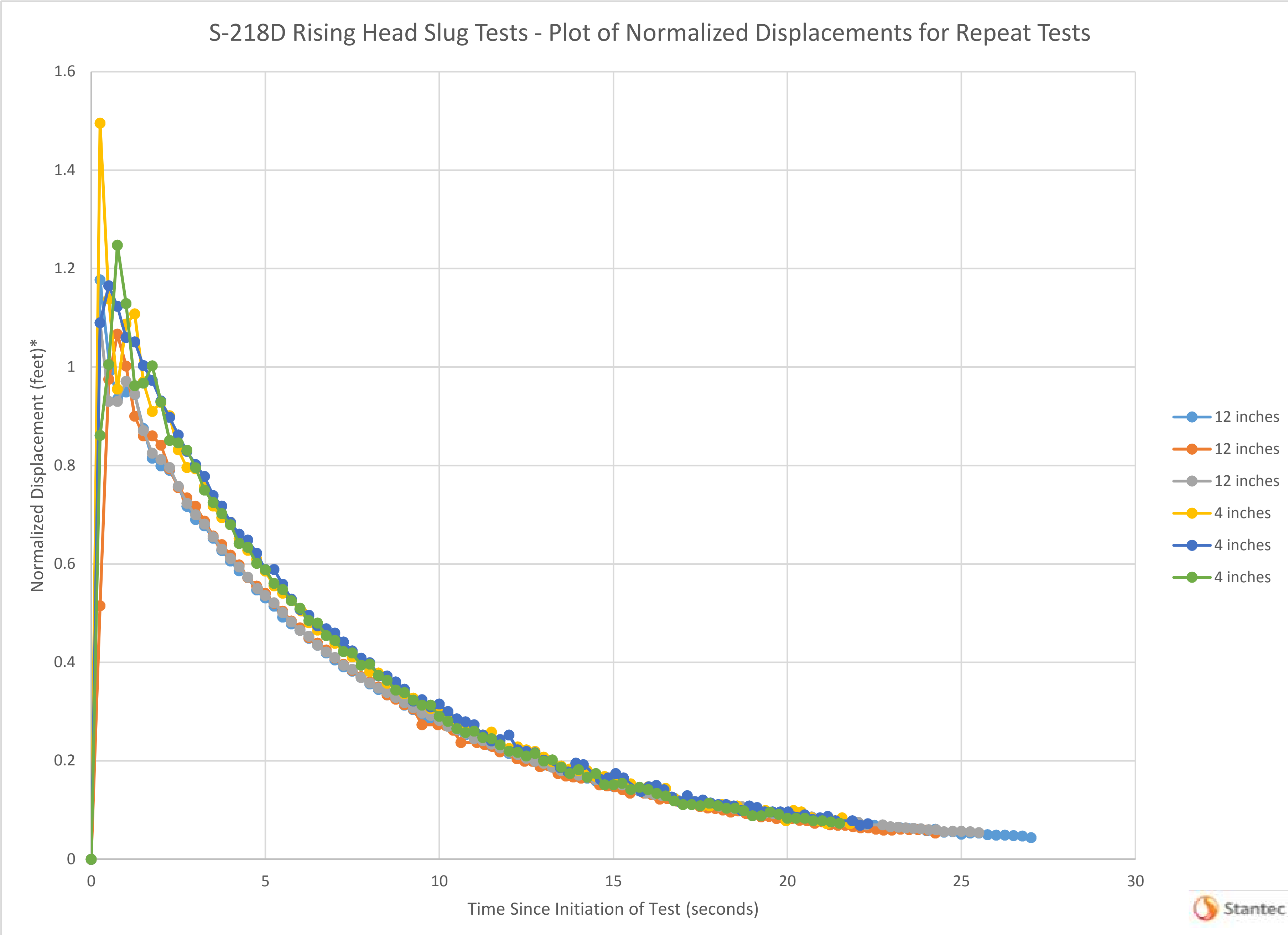
Well Name	X (ft)	Y (ft)
□ S-39D	0	0

SOLUTION

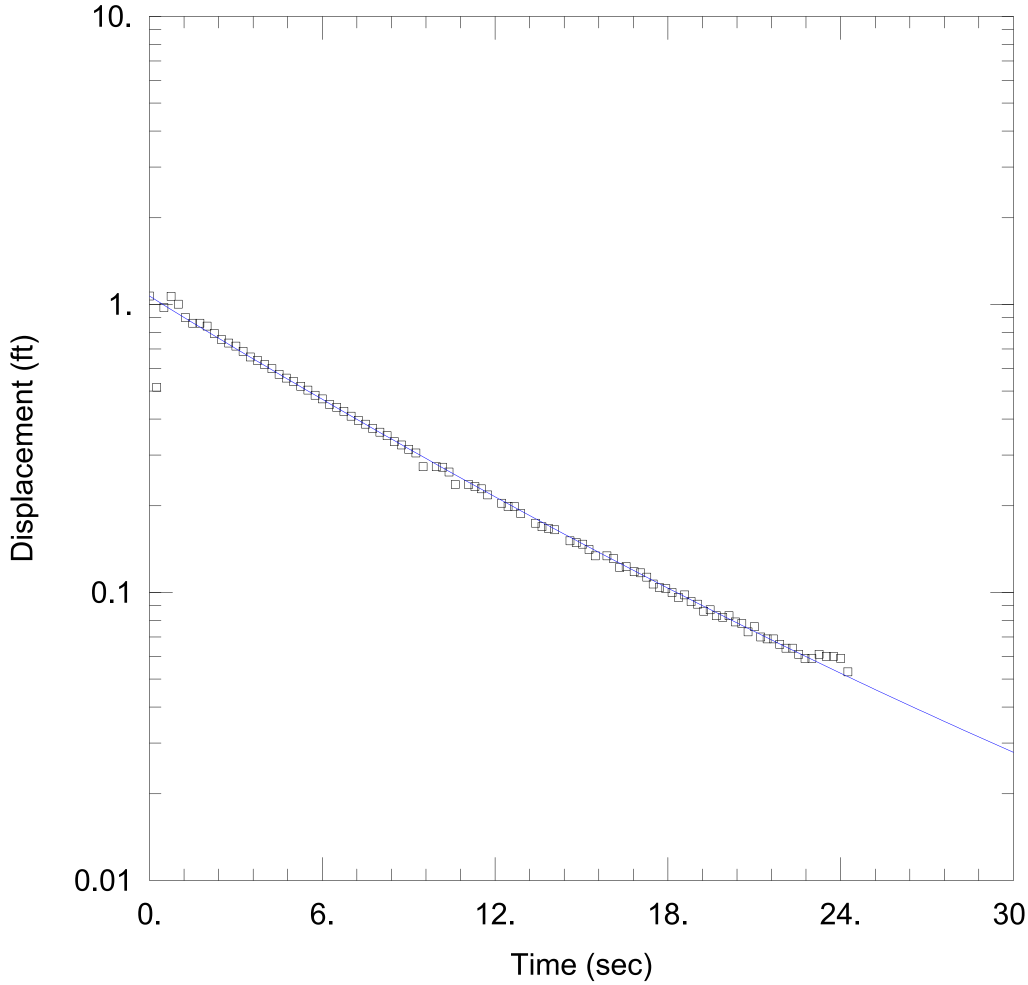
Aquifer Model: Confined
Solution Method: Dougherty-Babu

T = 4187.9 ft^2/day
Kz/Kr = 0.7328
r(w) = 0.1667 ft

S = 0.0001
Sw = 0.7807
r(c) = 0.1452 ft



*Water-level displacement data was normalized by dividing the observed displacement data by the expected initial displacement, indicated in the plot legend (in inches of water).



AOI 4 REMEDIAL INVESTIGATION

Data Set: V:\...\s218d_risinghead_12inch_t2_kgsmodel.aqt
Date: 02/24/17 Time: 15:27:55

PROJECT INFORMATION

Company: Stantec Consulting
Client: Evergreen Resources Management
Project: 213402602
Location: Philadelphia Refinery Complex
Test Well: S-218D
Test Date: 8/30/2016

AQUIFER DATA

Saturated Thickness: 47. ft

WELL DATA (S-218D)

Initial Displacement: 1.07 ft
Total Well Penetration Depth: 31. ft
Casing Radius: 0.1663 ft

Static Water Column Height: 71.16 ft
Screen Length: 10. ft
Well Radius: 0.1663 ft
Gravel Pack Porosity: 0.

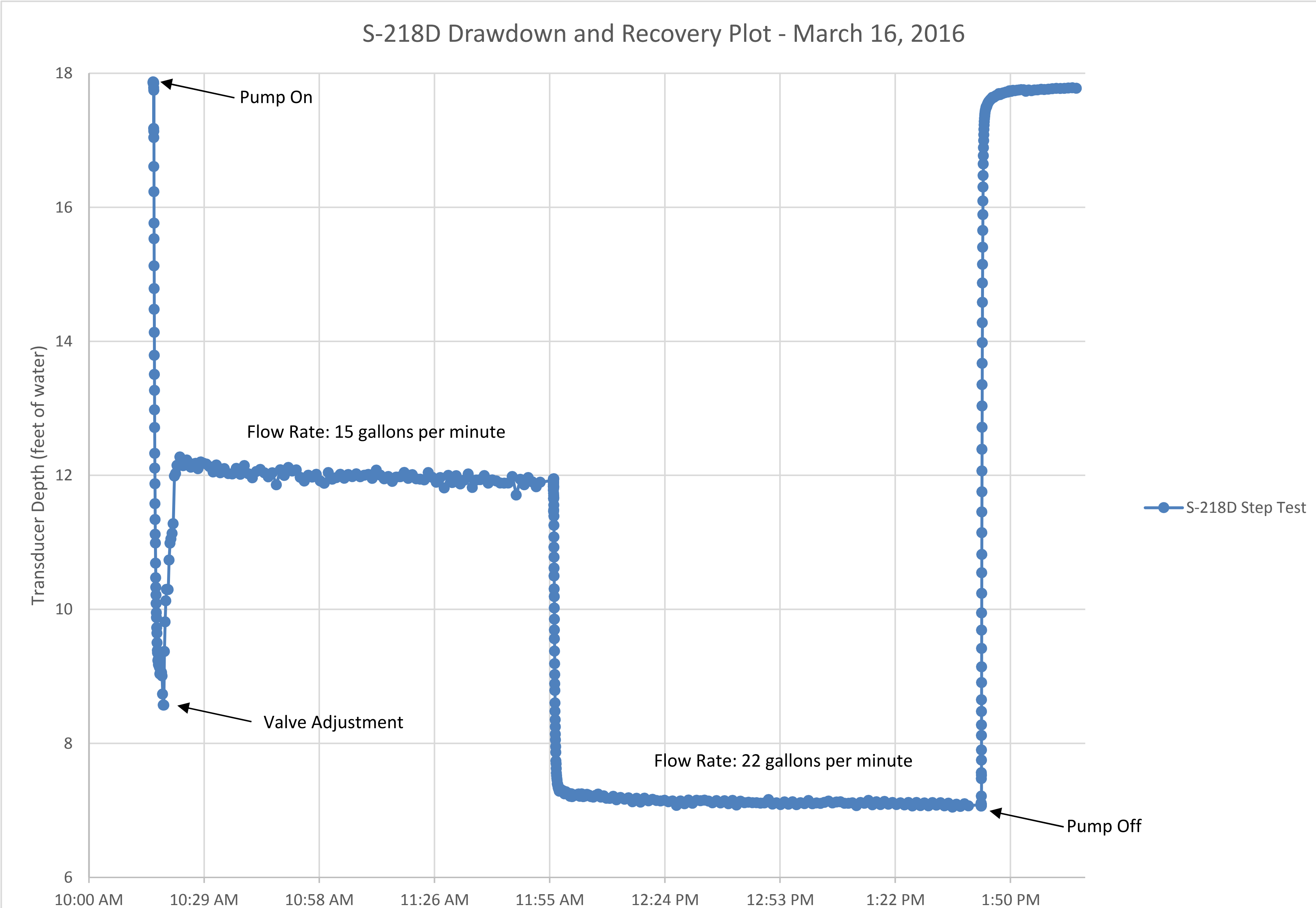
SOLUTION

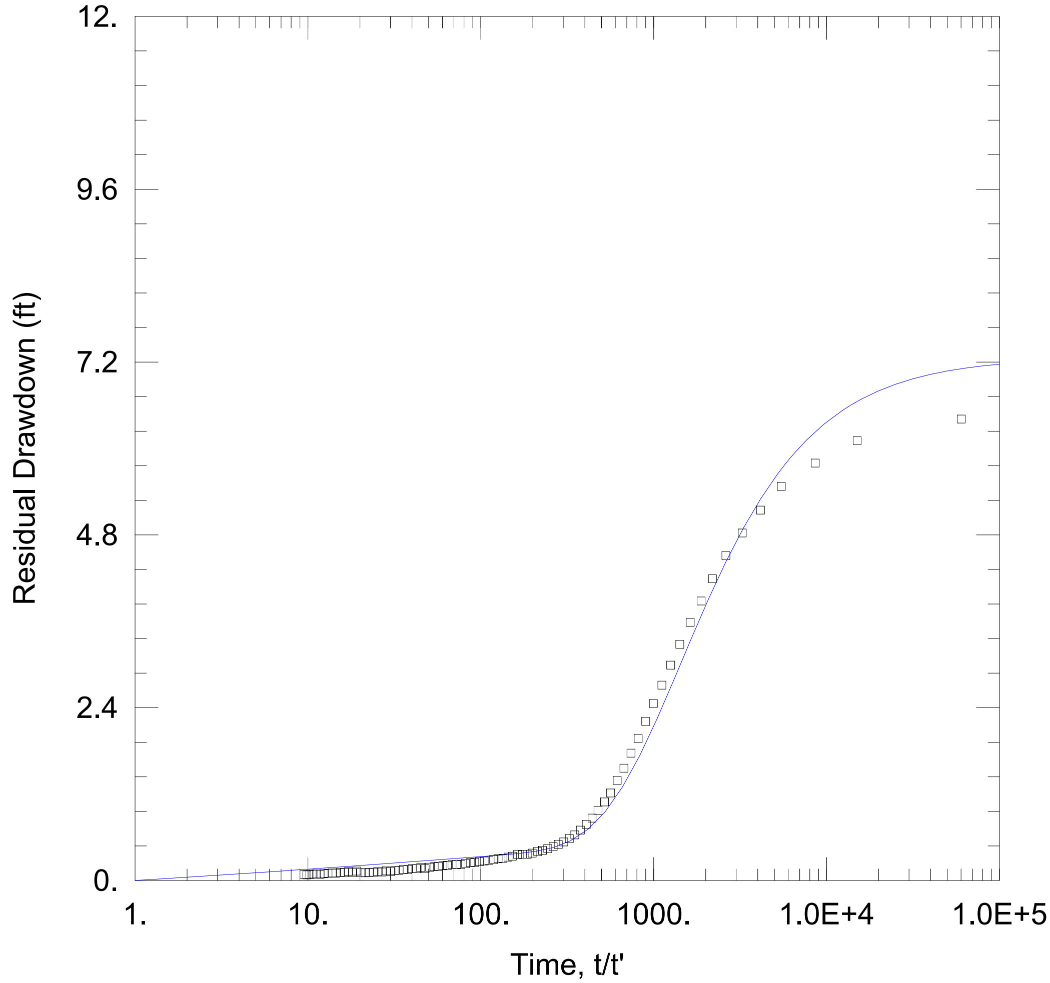
Aquifer Model: Confined

Solution Method: KGS Model

Kr = 84.64 ft/day
Kz/Kr = 1.

Ss = 2.128E-12 ft^{-1}


S-218D Drawdown and Recovery Plot - March 16, 2016
Transducer Depth (feet of water)
18
16
14
12
10
8
6
10:00 AM
10:29 AM
10:58 AM
11:26 AM
11:55 AM
12:24 PM
12:53 PM
1:22 PM
1:50 PM
Time
Pump On
Flow Rate: 15 gallons per minute
Valve Adjustment
Flow Rate: 22 gallons per minute
Pump Off
S-218D Step Test



WELL TEST ANALYSIS

Data Set: V:\...\s218d_recovery.aqt
Date: 03/24/17 Time: 15:22:56

PROJECT INFORMATION

Company: Stantec Consulting
Client: Evergreen Resources Management
Project: 213402602
Location: Philadelphia Refining Complex
Test Well: S-218D
Test Date: 3/16/16

AQUIFER DATA

Saturated Thickness: 47. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
S-218D	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
□ S-218D	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Dougherty-Babu

T = 4613.4 ft^2/day
S = 0.0001
Kz/Kr = 1.
Sw = 5.871
r(w) = 0.1667 ft
r(c) = 0.1452 ft

Appendix L
Predictive Analysis of the Potential Fate-and-Transport of Benzene Near the Penrose Avenue Remediation System Using Quick Domenico
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

1.0 BACKGROUND AND APPROACH

An analysis of the potential fate-and-transport of benzene in unconfined aquifer groundwater near the Penrose Avenue Remediation System (Penrose system) in Area of Interest (AOI) 4 of the Philadelphia Energy Solutions Refining and Marketing LLC (PES) Philadelphia Refining Complex (Complex) is presented herein (**Figure 1**). Stantec Consulting Services, LLC (Stantec) performed the analysis on behalf of Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC (Evergreen). The goals of this analysis are as follows: to utilize an analytical groundwater model and recent characterization data to build upon previous findings by Langan (2013) and the qualitative fate-and-transport assessment presented in the AOI 4 Remedial Investigation Report (RIR); to address PADEP comments provided in response to the Langan (2013) Quick Domenico (QD) models in a letter dated January 16, 2014 (Report Comments); and to apply a conservative analytical modeling approach to reasonably predict a “worst case” dissolved benzene plume length so that the possible extent of offsite impacts in the Penrose system area can be delineated.

This analysis was performed using the QD groundwater fate-and-transport model spreadsheet developed by the PADEP, in general accordance with the User’s Manual for the Quick Domenico Groundwater Fate-and-Transport Model (PADEP, 2014) and Pennsylvania’s Land Recycling Program Technical Guidance Manual Section IV.A.2 (Fate-and-Transport Analysis) (PADEP, 2002). It is noted that the QD solution (Domenico, 1987) is most applicable in aquifers exhibiting relatively uniform hydrogeologic conditions and impacted by a contaminant source that remains constant in time. As summarized in the RIR, AOI 4 subsurface conditions and contaminant source(s) are relatively complex and when considered in conjunction with numerous anthropogenic and natural influences, result in a dynamic environment. Conservative input values were utilized in the approach to allow for constructive inference from the model results regarding potential benzene plume length and offsite impacts. It is the intention of Evergreen to present a numerical groundwater flow model to the PADEP that may be used to comprehensively simulate and more reliably predict the future extent of groundwater contamination and potential impacts to identified receptors within and around the PES Complex. The model is presently being developed and calibrated to recently collected hydrogeologic data. Upon completion, the numerical groundwater model may be used to refine QD predictions presented in this and other fate-and-transport assessments at the PES Complex.

2.0 QD APPLICABILITY, LIMITATIONS, AND INPUT VALUES

PADEP (2014) discusses the applicability of QD to contaminant transport problems and outlines the limitations of the model that must be considered by the user. In the following sections, Stantec presents a summary of the input values utilized in this assessment and a discussion of the QD applicability under the observed conditions. QD model input values, model sensitivity, and input value ranges considered in the model calibration are discussed in the following sections and are also summarized in **Table 1**.

2.1 AQUIFER PROPERTIES

In general, QD applies to solute transport in homogeneous and isotropic aquifers. Section 5 of the AOI 4 RIR presents a detailed discussion of the site-specific hydrogeologic conditions present near the Penrose system unconfined aquifer groundwater plume. From the RIR discussion, it is apparent that the unconfined aquifer in this area is composed of both Quaternary and Cretaceous deposits of varying lithologies. An analytical model such as QD cannot account for the variability noted, which would primarily affect the groundwater seepage velocity and flow path(s) through the model calculation domain. However, aquifers that have a high degree of heterogeneity and anisotropy in their geologic and hydrogeologic properties may be approximated through simulation of representative properties based upon the study scale and purpose. The following sub-sections document the methodology and assumptions related to aquifer properties.

2.1.1 Hydraulic Conductivity

To apply QD as a conservative metric for a fate-and-transport assessment of benzene migration from the Penrose system area, Stantec reviewed select subsurface data and observed that dissolved impacts in the Penrose system area appear to be spread throughout a heterogeneous aquifer dominated by silty sand and gravel deposits. For this assessment, it is assumed that the saturated thickness of the unconfined aquifer is composed entirely of sand and gravel deposits. The hydraulic conductivity of these deposits is represented in the QD model by a relatively high value estimated for a large portion of AOI 4 during a regional pumping test of recovery well RW-2 (IST, 1998). Based on the pumping test results (see AOI 4 **RIR Figure 2-9**) and on the conservative approach noted, an input hydraulic conductivity value of 400 feet per day (ft/d) was applied to the QD analyses presented. This value is biased toward the high end of hydraulic conductivities based on the range established during previous testing at the PES Complex (Stantec, 2016). It is also comparable to the Trenton gravel (unconfined) median hydraulic conductivity value of 430 ft/d suggested by the PADEP in the above-referenced comment letter (Low et al., 2002). Hydraulic conductivity values as high as 450 ft/d were evaluated and co-varied with longitudinal dispersivity and the transport decay constant in the model sensitivity analysis and calibration to site data. Once the hydraulic conductivity value was selected, QD model calibration to the AOI 4 benzene data was limited to refining the longitudinal dispersivity and decay constant to obtain a best fit at "steady state" conditions, based on reasonable ranges for those parameters found in literature (see below).

2.1.2 Soils Laboratory Data

Stantec collected soil samples for site-specific geotechnical laboratory testing as a part of the AOI 4 RIR (see **RIR Appendix J**). The samples were collected from inferred minimally contaminated zones of the aquifer matrices within a depth range applicable to this assessment. Based on the relevant data (some samples were collected from the lower aquifer), the weight fraction of organic carbon is reported to range from 0.4 to 1.9 percent. An additional sample collected by Langan in AOI 3 in November 2015 (well S-412) indicated a weight fraction of organic carbon of 4.8 percent for similar deposits (silty, clayey sand with gravel; data also included in **RIR Appendix J**). In general, relatively high organic carbon contents are common to the geologically recent deposits at the PES Complex. Because organic carbon acts to retard transport of dissolved hydrocarbons in groundwater plumes by way of adsorption to the solid phase, higher weight contents such as those estimated for AOI 4 tend to reduce the extent of contamination predicted. To be somewhat conservative and knowing that the model is relatively insensitive to this parameter, Stantec has assumed that the organic carbon weight fraction present in the aquifer is one percent. An effective porosity of 22.5% and a sediment bulk density of 1.76 grams per cubic centimeter (g/cm^3) were also estimated from the sample data provided and from other available geotechnical laboratory data at the PES Complex (Langan, 2017).

2.2 GROUNDWATER FLOW DIRECTION AND GRADIENT

Stantec evaluated unconfined aquifer groundwater flow pattern(s) and gradients near the Penrose system as a part of the AOI 4 RIR for three annual gauging events performed in May 2014, May 2015, and May 2016 (see AOI 4 **RIR Figures 5-2 through 5-4**). The hydraulic head data from up to 117 selected monitoring wells (within AOI 4 and the surrounding area) was utilized in a geographic information system (GIS) to interpolate and contour the water-table surfaces. Ordinary block Kriging was selected as the gridding method and grid residuals were reviewed with the goal of producing a reasonable interpolation of the water-table surface from the well gauging data each year. Further details are provided in the RIR. Because the Penrose system was operational during May 2015 and May 2016 gauging, the May 2014 filtered dataset was chosen to be reflective of near static conditions and was applied to the conservative modeling approach (**Figure 1**). It is noted that outside of the immediate Penrose system influence area, the three annual datasets presented in the AOI 4 RIR demonstrate that the general pattern of groundwater flow is persistent.

Based on the May 2014 contoured data, water-table elevations in the model area ranged from a maximum of approximately 3.25 feet referenced to the North American Vertical Datum of 1988 (NAVD 88) near well S-371 to a minimum of approximately 1.5 feet NAVD 88 near well S-370. The pattern of groundwater flow appears divergent from a subtle southwest-northeast trending drainage divide broadly defined by well S-371 and appears to be the result of natural topography in the area [see **Figure 1** Light Detection and Ranging (LiDAR) elevation model]. The water-table map produced by Paulachok and Wood (1984) for the period 1976-1980 also agrees with the general pattern shown. As indicated in **Table 1**, hydraulic gradients in the area may range from approximately 0.001 feet per foot (ft/ft) to 0.004 ft/ft. Near the Penrose system, topography becomes relatively flat (except for filled areas) and the inferred direction of groundwater flow is southeast. The lower of the estimated gradients seems more representative to calculate groundwater velocity under static conditions in the Penrose system area. Within the QD model calculation domain presented, the inferred groundwater flow direction is southeast and the hydraulic gradient is estimated at approximately 0.001 ft/ft.

The QD solution assumes that groundwater flow within the modeled area is unidirectional and that velocities are constant (PADEP, 2014). It is clear from the data presented that these conditions are not present in the unconfined aquifer at the Penrose system due to groundwater pumping. However, because one of the goals of this modeling effort is to evaluate the potential distance that dissolved benzene could have migrated prior to remediation (assuming constant source), it can be reasonably assumed in a worst case scenario that a “steady-state” southeastern hydraulic gradient/groundwater flow direction is applicable. In addition, while there is some degree of radial flow indicated, the flow direction is consistently away from a groundwater divide located in the central portion of AOI 4.

2.3 BENZENE SOURCE

To evaluate concentrations and distribution of dissolved benzene in unconfined aquifer groundwater near the Penrose system through the period of record (approximately 12 years), Stantec reviewed groundwater analytical data as a part of the AOI 4 RIR and identified the most complete datasets available. These datasets were used to produce plume maps to qualitatively evaluate plume stability and trends as presented in the RIR. Based on those maps, it is apparent that benzene concentrations in the model area have remained relatively stable through time and that during the 2016 groundwater characterization sampling, the maximum concentration of benzene may be a reasonable value to utilize in the model as both a proxy for any historical migration from the source area, and from which to estimate the future potential for migration. The highest benzene groundwater concentration in the Penrose system area was observed at well RW-703 at a concentration of 20,900 micrograms per liter (ug/L) (February 15, 2016) (**Figure 2**). This concentration of benzene is the maximum quantified at that well and as such is utilized as the source concentration in this conservative assessment (see **Table 2**).

Assuming a southeastern hydraulic gradient, downgradient well S-235 had a 2016 maximum groundwater benzene concentration of 9,730 ug/L [sample from beneath light non-aqueous phase liquid (LNAPL)] and nearer the property boundary, well RW-708 had a 2016 maximum groundwater benzene concentration of 2,640 ug/L. These wells are utilized for model calibration to the longitudinal extent practical. The benzene plume source area shown on **Figure 2** is generally delineated by monitoring well groundwater analytical data which supports a source width of approximately 500 feet. Boring log photoionization detector (PID) readings and observations indicate that the source thickness for the benzene plume in this area is approximately 20 feet. QD assumes that these source dimensions and concentration are constant throughout the analysis period.

Elevated benzene is also observed at other wells along the AOI 4 property boundary in the Penrose system area. In a few instances, the benzene concentration in recent times was higher at those locations than at the centerline concentration used in the above-referenced calibration scenario. To evaluate a potential plume length attenuating from one of those wells as a source area (downgradient limit of the identified source), Stantec selected the maximum observed benzene concentration at well S-223 and applied that source concentration (11,400 ug/L; January 6, 2015) to a second model (using the input parameters from the calibrated RW-703 model) in this assessment (**Table 3**). Those results are also discussed below for comparative purposes.

It is noted that LNAPL is present in the Penrose system area. The primary remediation goals of the Penrose system are to recover LNAPL, and to mitigate potential offsite migration of impacted groundwater. Recent LNAPL characterization and site operational data indicate that at least a portion of the LNAPL presently observed at the Penrose system may be from recent releases. During July/August 2016, product soaked soil was identified at the ground surface from an underground product pipeline located north of well, S-241. PES has excavated and repaired portions of the product line. In addition, there is a product line that is suspected to have leaked, which runs north-south along the access road leading to the Penrose System wells. Although the Penrose system continues to recover LNAPL, there is the potential for dissolved benzene concentrations in the groundwater plume to increase above what has been modeled in this assessment, particularly if product releases continue to occur.

2.4 DISPERSIVITIES

Stantec utilized values of 50 feet, 5 feet, and 0.001 feet for the longitudinal, transverse, and vertical components of mechanical dispersion to estimate spreading of dissolved benzene from a well RW-703 source through the model calculation domain based on guidance provided by the PADEP (2014). For a well S-223 source, these same values were utilized in the model. Longitudinal dispersion from a RW-703 source was evaluated as a calibration parameter and was co-varied along with the decay constant until a best fit was obtained to the calibration well concentrations. Of the values considered, the modeled value is reasonably estimated at approximately 1/10th the distance to the nearest identified receptor, the Penrose Avenue Sewer (**Figure 2**).

The small value for vertical dispersivity applied to both models conservatively approximates two-dimensional transport. Transverse dispersivity is estimated at 1/10th the longitudinal value. The longitudinal dispersivities applied to the models generally result in slightly longer steady-state plumes with slightly lower benzene endpoint concentrations (more mixing ahead of the advective front) than those utilizing values estimated by the Xu and Eckstein equation (PADEP, 2014) but are deemed more conservative in evaluating the potentially impacted downgradient properties and/or other receptors.

2.5 DECAY CONSTANT

The range of decay constants utilized in this assessment to characterize the biodegradation rate of benzene after leaving the source area were estimated from literature. PADEP estimates this decay rate (degradation coefficient) at 35 percent per year (approximately 0.1 percent per day) in Table 5A of Appendix A of Act 2. The Environmental Protection Agency (EPA) estimates this decay rate at 0.1 to 1 percent per day from field and laboratory studies (EPA, 2002). Stantec used the referenced decay constant range during model calibration and based on evaluation of plume attenuation in the context of field data, utilized a decay constant of 0.5 percent per day in the analysis of dissolved benzene attenuation from a well RW-703 source area. Because well S-223 is in the same general plume area, it is assumed that the constant for transport decay in the aquifer should be similar and as such 0.5 percent per day is utilized in that model as well.

2.6 ORGANIC CARBON PARTITION COEFFICIENT

A benzene organic carbon partitioning coefficient of 58 liters per kilogram (L/kg) was utilized per Table 5A in Appendix A of Act 2 (PADEP, 2014).

2.7 QD MODEL CALCULATION DOMAIN

The QD model calculation domain for the RW-703 scenario is presented on **Figure 2,** and the model domains for the RW-703 and S-223 scenarios are summarized on **Tables 2** and **3**, respectively. **Figure 2** also shows the locations of plume centerlines from each modeled source. These areas generally represent the steady-state plume centerline lengths predicted by QD for benzene to attenuate below the PADEP Medium Specific Concentration (MSC) of 5 ug/L for non-residential properties overlying used aquifers with Total Dissolved Solids (TDS) less than or equal to 2,500 mg/L [the Statewide Health Standard (SHS)]. Simulation of the RW-703 source area results in an estimated plume that is approximately 900 feet long by 500 feet wide and extends southeast from the source area, across Penrose Avenue, and onto offsite properties. Per City of Philadelphia property records, those non-residential properties are 2600 Penrose Ferry Road, 3600 South 26th Street, 3606 South 26th Street (2 parcels on either side of Penrose Avenue), 3700 South 26th Street, and 2560 Penrose Avenue. Simulation of the S-223 source area results in an estimated plume centerline that is approximately 770 feet long and extends to the southeast, intersecting the same offsite properties. Parcel ownership information obtained from the online Philadelphia Water Department (PWD) Stormwater Map Viewer for the identified properties is included in this appendix.

3.0 QD MODEL RESULTS

The QD analyses presented in this report indicate that dissolved benzene in unconfined aquifer groundwater near the southern AOI 4 boundary has the potential to migrate offsite. Moreover, it can be reasonably assumed that prior to the commencement of remedial pumping at the Penrose system, historical benzene contamination in the unconfined aquifer may have migrated offsite. This is based on trend analyses presented in the AOI 4 RIR that indicate similar benzene concentrations were present in this area of the aquifer within the timeframe predicted by the model to achieve steady-state conditions (i.e., 5-6 years from introduction of the constant source into the aquifer). The maximum plume centerline distances where the concentration of benzene is predicted in these conservative assessments to attenuate below the PADEP SHS are approximately 900 feet and 770 feet for sources originating near wells RW-703 (plume "core") and S-223 (property boundary), respectively (**Figure 2**). These assessments are based on simulation times of approximately 5 to 6 years to "steady-state" conditions and provide "worst-case" scenarios of potential benzene fate-and-transport.

Analyses indicate that plumes of the estimated lengths would extend onto adjacent non-residential properties (as summarized in **Section 2.7**) and information pertaining to those properties is included in this appendix. Importantly, no buildings or apparent occupied structures are present within the model domain, or within the 30-foot horizontal proximity distance for petroleum products, based on current aerial photographs. The Penrose Avenue Sewer is the only identified potential receptor (preferential flow path) within the modeled plume area. At this location, the Penrose Avenue Sewer consists of two reinforced concrete box culverts that are 7 feet (height) by 9 feet (width) and 7 feet (height) by 6 feet (width), respectively. Invert elevations on drawings received from the Philadelphia Water Department (AOI 4 **RIR Appendix M**) indicate that the sewer spans an elevation range of approximately -6 feet to +1 foot (undisclosed vertical datum). If it is assumed that these elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29), the NAVD 88 elevations would be approximately 0 feet (top of sewer) to -7 feet (bottom of sewer). At these elevations, it is likely that the Penrose Avenue Sewer remains submerged in the unconfined aquifer for most of the year but could intersect the water table during periods of dry climate.

Evergreen intends to collect additional water-level and dissolved contaminant data in this area to support refinement and calibration of the numerical model.

4.0 REFERENCES

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TABLES

PREDICTIVE ANALYSIS OF THE POTENTIAL FATE-AND-TRANSPORT OF BENZENE NEAR THE PENROSE AVENUE REMEDIATION SYSTEM USING QUICK DOMENICO
AREA OF INTEREST 4
Philadelphia Refining Complex
3144 Passyunk Ave, Philadelphia, Pennsylvania

Table 1
Summary of Quick Domenico Model Input Parameter Values - RW-703 Source Area
Potential Fate-and-Transport of Benzene Near Penrose System Area
Area of Interest (AOI) 4
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

Model Parameter/ Field Data	Symbol	Model Units	Values Considered in Model Sensitivity Analysis and/or Calibration				Justification for QD Model Value	Data Source or Reference
			Minimum	Maximum	Model Value	Model Parameter Sensitivity (PADEP, 2014)		
Source Concentration	C_o	mg/L	18.8	20.9	20.90	high	Maximum observed benzene concentration at well RW-703 in 2016; highest concentration observed for the period of record at that well (since 2010)	AOI 4 RIR Table 4-2
Longitudinal Dispersivity	α_x (Ax)	ft	0	100	50	high	calibration parameter to allow for reasonable spreading along the plume length estimated to the nearest identified receptor (Penrose Ave. Sewer); provides an acceptable calibration to site data while utilizing other more conservative parameters; may be more appropriate considering aquifer heterogeneity	PADEP, 2014
Transverse Dispersivity	α_y (Ay)	ft	0	10	5	high	1/10th the longitudinal dispersivity; conservative approach minimizes lateral spreading	PADEP, 2014
Vertical Dispersivity	α_z (Az)	ft	0.001	0.1	0.001	high	conservative approach; approximates 2-dimensional transport; vertical contaminant distribution data in unconfined aquifer insufficient for site-specific calibration	PADEP, 2014
Decay Constant	λ	day^{-1}	0.001	0.01	0.005	high	Calibration parameter along inferred axis of plume; evaluated 0.1-1% per day biodegradation rate; covaried with longitudinal dispersivity to obtain best match to field data and historical data (model validation)	EPA, PADEP Guidance
Source Width	Y	ft	100	500	500	medium	Well analytical data near modeled source area; width has remained fairly constant through period of record	Figure 2
Source Thickness	Z	ft	20	30	20	low	Inferred smear zone beneath the seasonal high water table near well RW-703	RW-705 and other well logs with detailed subsurface data in the plume area
Time	t	days	100	2000	1800	medium	Time to steady-state (note 2100 days to steady-state for S-223 model)	PADEP, 2014
Hydraulic Conductivity	K	ft/day	12	450	400	high	conservative scenario based upon the upper end of the range established from aquifer testing in and near AOI 4	AOI 4 RIR Figure 2-7; RW-2 pump test analysis (IST, 1998), S-120 and S-122 slug test analyses (SECOR, 2003)
Hydraulic Gradient	i	ft/ft	0.001	0.004	0.001	medium	Interpolation of November 2014 water-level elevation data; hydraulic gradient measured in Penrose System area under non-pumping conditions (2016 gradients influenced by system operation)	Figure 1
Effective Porosity	n_e	- -	0.066	0.282	0.225	low	Laboratory testing data S-412 (10-12' bgs) and S-110DSRTF (10-12' bgs)	RIR Appendix J
Bulk Density	ρ_b	g/cm^3	- -	- -	1.760	low	Laboratory testing data S-412 (10-12' bgs) for Quaternary sand and gravel deposits; similar value to previous AOI 4 SCR/RIR modeling	RIR Appendix J
Organic Carbon Partition Coefficient	K_{oc}	L/kg	- -	- -	58	low	Act 2 Appendix A Table 5	PADEP, 2014
Fraction of Organic Carbon	f_{oc}	- -	0.004	0.048	0.01	low	Laboratory testing data S-39D (26-28' bgs) and S-218D (38-40' bgs) indicate relatively high organic carbon contents are present in the water-table aquifer; S-412 (10-14' bgs) in AOI 3	RIR Appendix J
Point Concentration Location	x_s,y_s,z_s	ft	- -	- -	500, 0, 0	- -	Approximate distance to nearest offsite receptor (Penrose Avenue Sewer)	Figure 2
Model Calculation Domain	L,W	ft, ft	- -	- -	900, 250	- -	Steady-state plume length and half-width predicted for attenuation of benzene to a plume centerline concentration below the SHS (5 ug/L)	Figure 2

Notes:
1. in = inches
2. ft = feet
3. cm = centimeter
4. L = liter
5. kg = kilogram
6. g= gram
7. mg = milligram
8. SHS = Statewide Health Standard
9. bgs - feet below ground surface
10. ug/L = micrograms per liter of groundwater; mg/L = milligrams per liter of groundwater
11. PID = photoionization detector

Table 2
NEW QUICK DOMENICO

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

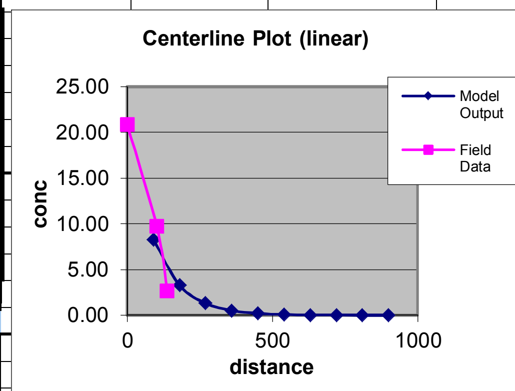
Project:	Fate and Transport Simulation of Benzene - AOI 4 Penrose System Area Plume (RW-703 Source)						
Date:	2/26/2017	Prepared by:	ADK				
		Contaminant:	Benzene				
SOURCE CONC (MG/L)	**Ax (ft)**	**Ay (ft)**	**Az (ft) >=.001**	**LAMBDA day-1**	**SOURCE WIDTH (ft)**	**SOURCE THICKNESS (ft)**	**Time (days) (days)**
20.9	**5.00E+01**	**5.00E+00**	**1.00E-03**	**0.005**	**500**	**20**	**1800**
Hydraulic Cond (ft/day)	**Hydraulic Gradient (ft/ft)**	**Porosity (dec. frac.)**	**Soil Bulk Density (g/cm³)**	**KOC**	**Frac. Org. Carb.**	**Retard-ation (R)**	**V (=K*i/n*R) (ft/day)**
4.00E+02	**0.001**	**0.225**	**1.76**	**58**	**1.00E-02**	**5.536888889**	**0.321078825**

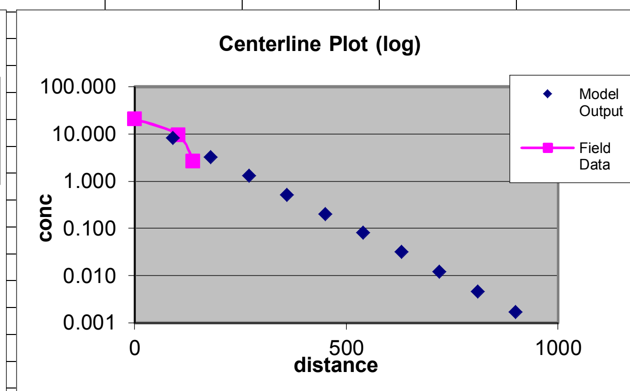
NEW QUICK_DOMENICO.XLS

SPREADSHEET APPLICATION OF
"AN ANALYTICAL MODEL FOR
MULTIDIMENSIONAL TRANSPORT OF A
DECAYING CONTAMINANT SPECIES"
P.A. Domenico (1987)
Modified to Include Retardation

Point Concentration

x(ft)	**y(ft)**	**z(ft)**	
500	**0**	**0**	
	x(ft)	**y(ft)**	**z(ft)**
Conc. At	**500**	**0**	**0**
at	**1800**	**days =**	**0.122** mg/l





AREAL CALCULATION
MODEL DOMAIN

Length (ft)	900
Width (ft)	250

	90	*180*	*270*	*360*	*450*	*540*	*630*	*720*	*810*	*900*
250	**4.141**	**1.641**	**0.650**	**0.258**	**0.102**	**0.040**	**0.016**	**0.006**	**0.002**	**0.001**
125	**8.283**	**3.277**	**1.290**	**0.506**	**0.198**	**0.077**	**0.030**	**0.011**	**0.004**	**0.002**
0	**8.283**	**3.282**	**1.301**	**0.515**	**0.204**	**0.081**	**0.032**	**0.012**	**0.005**	**0.002**
-125	**8.283**	**3.277**	**1.290**	**0.506**	**0.198**	**0.077**	**0.030**	**0.011**	**0.004**	**0.002**
-250	**4.141**	**1.641**	**0.650**	**0.258**	**0.102**	**0.040**	**0.016**	**0.006**	**0.002**	**0.001**

Field Data:	**Centerline C Concentration**	20.9	9.73	2.64	
	Distance from Source	0	102	138	

Table 3
NEW QUICK DOMENICO

ADVECTIVE TRANSPORT WITH THREE DIMENSIONAL DISPERSION,1ST ORDER DECAY and RETARDATION - WITH CALIBRATION TOOL

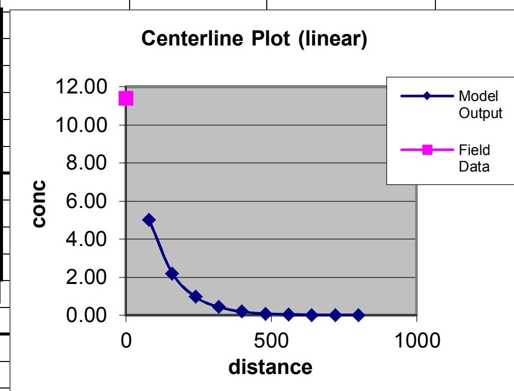
Project:	Fate and Transport Simulation of Benzene - AOI 4 Penrose System Area Plume (S-223 Source)						
Date:	2/26/2017	Prepared by:	ADK				
		Contaminant:	**Benzene**				
SOURCE CONC (MG/L)	**Ax (ft)**	**Ay (ft)**	**Az (ft) >=.001**	**LAMBDA day-1**	**SOURCE WIDTH (ft)**	**SOURCE THICKNESS (ft)**	**Time (days) (days)**
11.4	**5.00E+01**	**5.00E+00**	**1.00E-03**	**0.005**	**500**	**20**	**2100**
Hydraulic Cond (ft/day)	**Hydraulic Gradient (ft/ft)**	**Porosity (dec. frac.)**	**Soil Bulk Density (g/cm^3)**	**KOC**	**Frac. Org. Carb.**	**Retard-ation (R)**	**V (=K*i/n*R) (ft/day)**
4.00E+02	**0.001**	**0.225**	**1.76**	**58**	**1.00E-02**	**5.536888889**	**0.321078825**

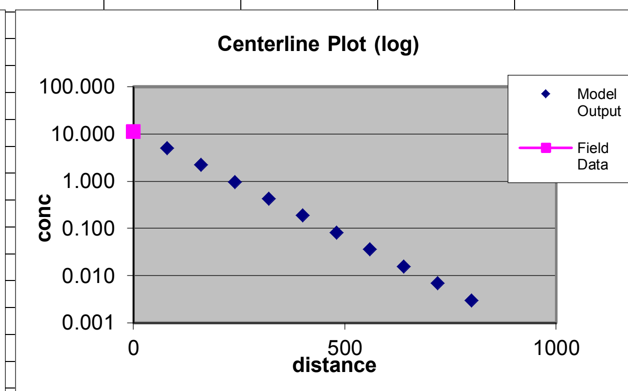
NEW QUICK_DOMENICO.XLS

SPREADSHEET APPLICATION OF "AN ANALYTICAL MODEL FOR MULTIDIMENSIONAL TRANSPORT OF A DECAYING CONTAMINANT SPECIES"
P.A. Domenico (1987)
Modified to Include Retardation

Point Concentration

x(ft)	**y(ft)**	**z(ft)**	
770	**0**	**0**	
	x(ft)	**y(ft)**	**z(ft)**
Conc. At	**770**	**0**	**0**
at **2100**	**days =**		**0.004** mg/l





AREAL MODEL	**CALCULATION DOMAIN**
Length (ft)	800
Width (ft)	250

	80	*160*	*240*	*320*	*400*	*480*	*560*	*640*	*720*	*800*
250	**2.504**	**1.100**	**0.483**	**0.212**	**0.093**	**0.041**	**0.018**	**0.008**	**0.003**	**0.002**
125	**5.007**	**2.197**	**0.961**	**0.419**	**0.182**	**0.079**	**0.034**	**0.015**	**0.006**	**0.003**
0	**5.007**	**2.199**	**0.966**	**0.424**	**0.186**	**0.082**	**0.036**	**0.016**	**0.007**	**0.003**
-125	**5.007**	**2.197**	**0.961**	**0.419**	**0.182**	**0.079**	**0.034**	**0.015**	**0.006**	**0.003**
-250	**2.504**	**1.100**	**0.483**	**0.212**	**0.093**	**0.041**	**0.018**	**0.008**	**0.003**	**0.002**

Field Data:	**Centerline C Concentration**	11.4					
	Distance from Source	0					

FIGURES

PREDICTIVE ANALYSIS OF THE POTENTIAL FATE-AND-TRANSPORT OF BENZENE NEAR THE PENROSE AVENUE REMEDIATION SYSTEM USING QUICK DOMENICO
AREA OF INTEREST 4
Philadelphia Refining Complex
3144 Passyunk Ave, Philadelphia, Pennsylvania

Stantec

Figure No.

APPENDIX L - FIGURE 1

Title

PENROSE SYSTEM AREA QD MODEL PLAN

Client/Project

PHILADELPHIA REFINERY OPERATIONS
A SERIES OF EVERGREEN RESOURCES GROUP, LLC
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 213402602
Philadelphia Refining Complex
No. 4 Tank Farm

Prepared by ADK on 3/2/2017
Technical Review by JT on 3/3/2017
Independent Review by JD on 3/8/2017

0 80 160 Feet

1:3,500 (At original document size of 11x17)

N

Legend

Existing Well Location

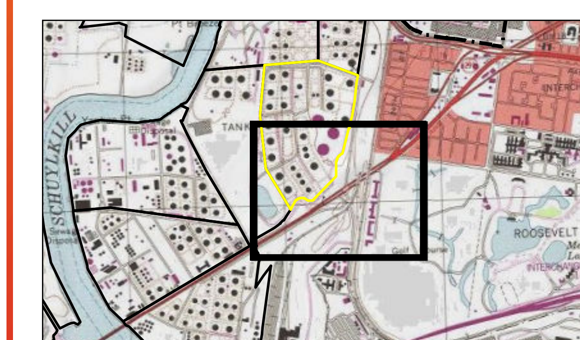
- Recovery Well (Active)
- Recovery Well (Dormant)
- Monitoring Well
- PROPOSED WELL LOCATION*
- MAY 2014 WATER-TABLE ELEVATION (FT NAVD 88)**
- AREA OF INTEREST (AOI) 4
- 26TH STREET INTERCEPTING SEWER
- PENROSE AVENUE SEWER
- Stream (National Hydrography Dataset)

5-FOOT LiDAR DEM (2015 City of Philadelphia)

High : 61 ft NAVD 88

Low : -2 ft NAVD 88

NOTES:
*MONITORING WELLS WERE PROPOSED HOWEVER NEGOTIATIONS FOR OFFSITE PROPERTY ACCESS HAVE BEEN UNSUCCESSFUL TO DATE.
**2014 WATER-TABLE ELEVATION CONTOURS REFLECT NEAR-STATIC CONDITIONS (PENROSE SYSTEM WAS NOT OPERATING DURING THE WELL GAUGING EVENT)
DEM = DIGITAL ELEVATION MODEL; FT = FEET
NAVD 88 = NORTH AMERICAN VERTICAL DATUM OF 1988



Notes

1. Coordinate System: NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet
2. Source: Camp Dressor & McKee and Stantec
   Service Layer Credits: Image courtesy of USGS Earthstar Geographics SIO ©
3. 2017 Microsoft Corporation
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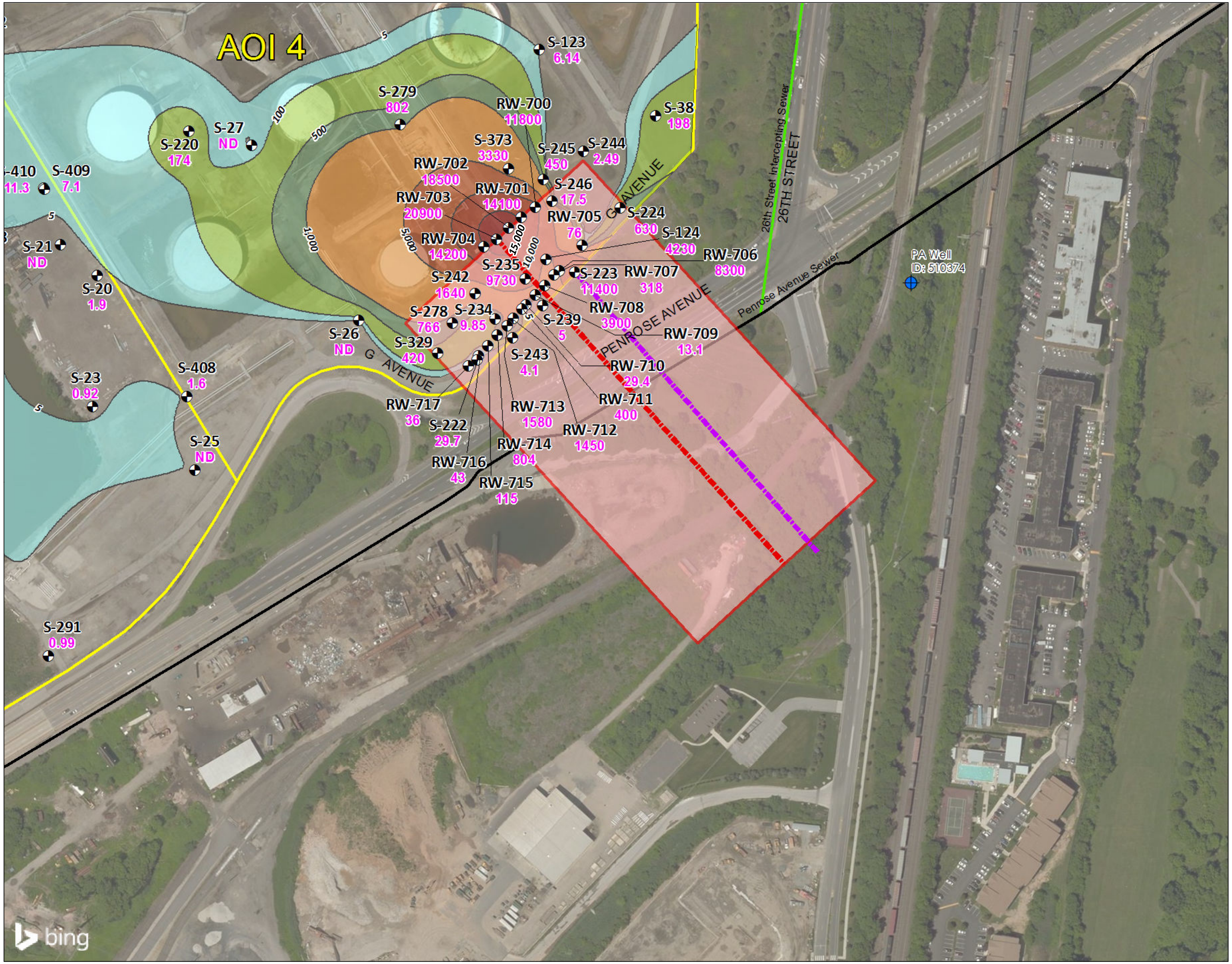


Figure No.

APPENDIX L - FIGURE 2

Title

PENROSE SYSTEM
QD MODEL CALCULATION DOMAIN

Client/Project

PHILADELPHIA REFINERY OPERATIONS
A SERIES OF EVERGREEN RESOURCES GROUP, LLC
3144 PASSYUNK AVENUE
PHILADELPHIA, PA 19145

Project Location 213402602

Philadelphia Refining Complex
No. 4 Tank Farm

Prepared by ADK on 3/2/2017
Technical Review by JT on 3/3/2017
Independent Review by JD on 3/8/2017

0 80 160 Feet

1:2,500 (At original document size of 11x17)

N

Legend

- MONITORING/RECOVERY WELL
- PaGWIS Identified Offsite Monitoring Wells
- 2014-2016 MAXIMUM BENZENE CONCENTRATION (ug/L)

2014-2016 MAXIMUM BENZENE CONCENTRATION (ug/L)

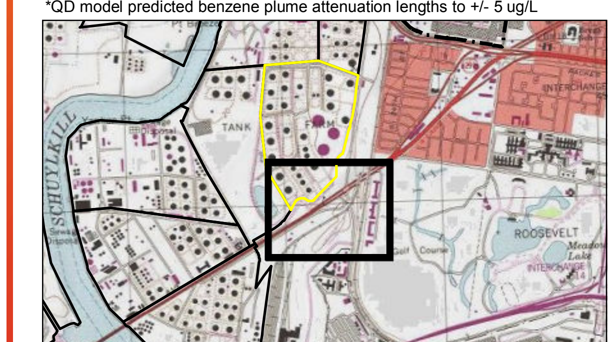
- 5 (SHS) - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 5,000
- 5,000 - 10,000
- 10,000 - 15,000
- > 15,000
- AREA OF INTEREST (AOI) 4
- QD MODEL CALCULATION DOMAIN

Approximate Benzene Plume Centerline*

- RW-703 Source
- S-223 Source

20,900 2014-2016 Maximum Benzene Concentration (ug/L)

NOTES:
ug/L = micrograms per liter
QD = Quick Domenico
SHS = Statewide Health Standard
PaGWIS = Pennsylvania Groundwater Information System
*QD model predicted benzene plume attenuation lengths to +/- 5 ug/L



Notes

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   Service Layer Credits: Image courtesy of USGS Earthstar Geographics SIO ©
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PWD STORMWATER BILLING PARCEL OWNERSHIP INFORMATION

PREDICTIVE ANALYSIS OF THE POTENTIAL FATE-AND-TRANSPORT OF BENZENE NEAR THE PENROSE AVENUE REMEDIATION SYSTEM USING QUICK DOMENICO
AREA OF INTEREST 4
Philadelphia Refining Complex
3144 Passyunk Ave, Philadelphia, Pennsylvania

Stantec

PHILADELPHIA WATER

BRT/OPA Account Number: 884095250

Stormwater Billing Class: Non-Residential

Parcel Address: 2600 PENROSE FERRY RD

Parcel Owner: PRESTON TERMINALS INC

Legend

Selected Parcel

Other Parcels

Impervious Surfaces

Roof

Other Impervious

Parcel Area (square feet)

	Gross Area	Impervious Area
Total:	251,820	0
Credit:	0	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$284.39**	**$299.55**	**$299.55**	**$307.80**	**$321.42**
Account # - 041-64090-02600-004	$284.39	$299.55	$299.55	$307.80	$321.42

BRT/OPA Account Number: 874500510

Stormwater Billing Class: Non-Residential

Parcel Address: 2560 PENROSE AVE

Parcel Owner: CONRAIL

Legend

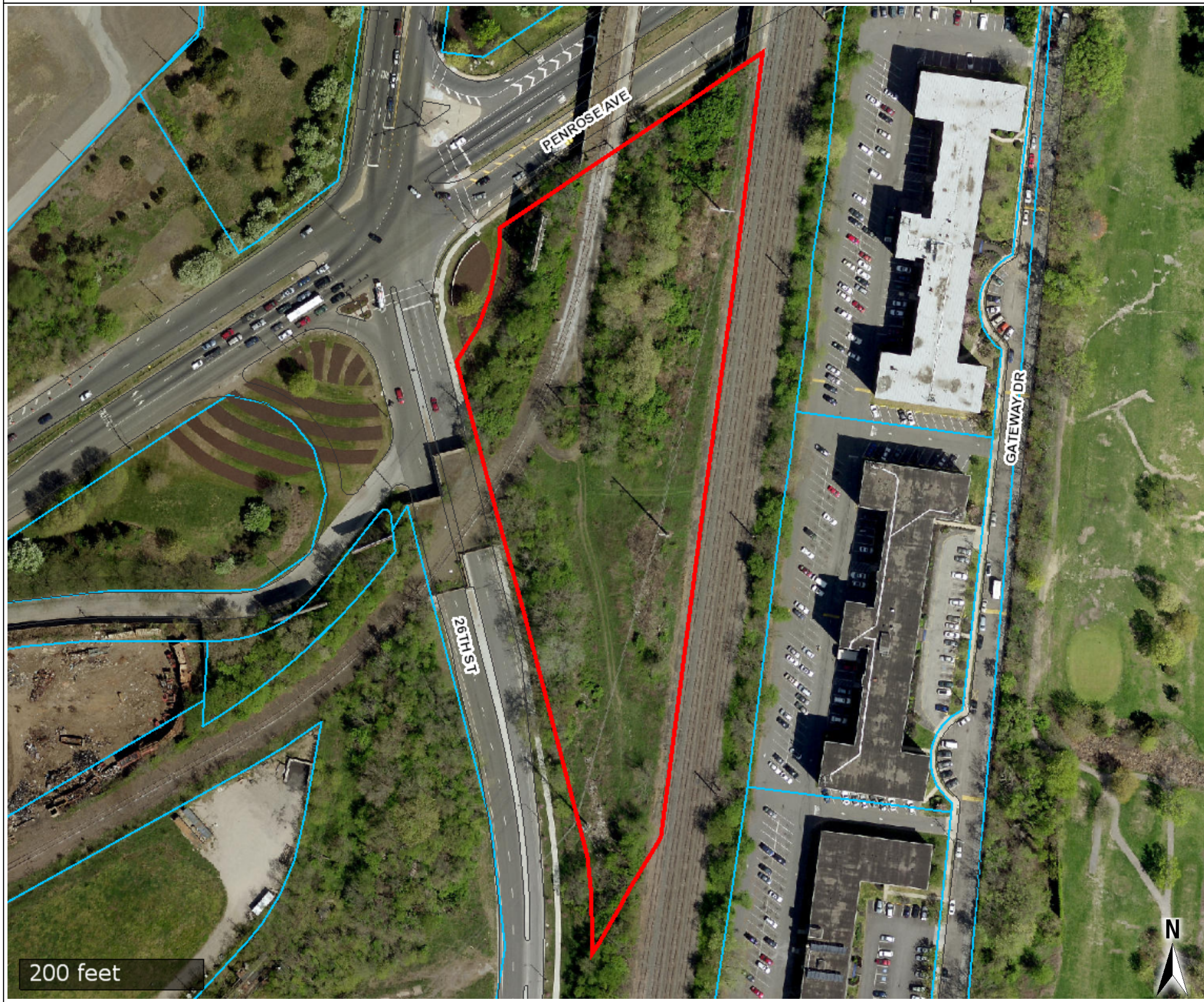
Selected Parcel

Other Parcels

Impervious Surfaces

Roof

Other Impervious



Parcel Area (square feet)

	Gross Area		Impervious Area
Total:	166,470	Total:	0
Credit:	0	Credit:	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$188.63**	**$198.66**	**$198.66**	**$204.35**	**$213.35**
Account # - 041-64080-02560-001	$188.63	$198.66	$198.66	$204.35	$213.35

BRT/OPA Account Number:

Stormwater Billing Class: Unknown

Parcel Address: 3606 S 26TH ST

Parcel Owner: DEKAP PROPERTIES L P

Legend

- Selected Parcel
- Other Parcels
- Impervious Surfaces
  - Roof
  - Other Impervious

Parcel Area (square feet)

	Gross Area		Impervious Area
Total:	157,228	Total:	56
Credit:	0	Credit:	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**

PHILADELPHIA WATER

BRT/OPA Account Number: 875105910

Stormwater Billing Class: Non-Residential

Parcel Address: 3600 S 26TH ST

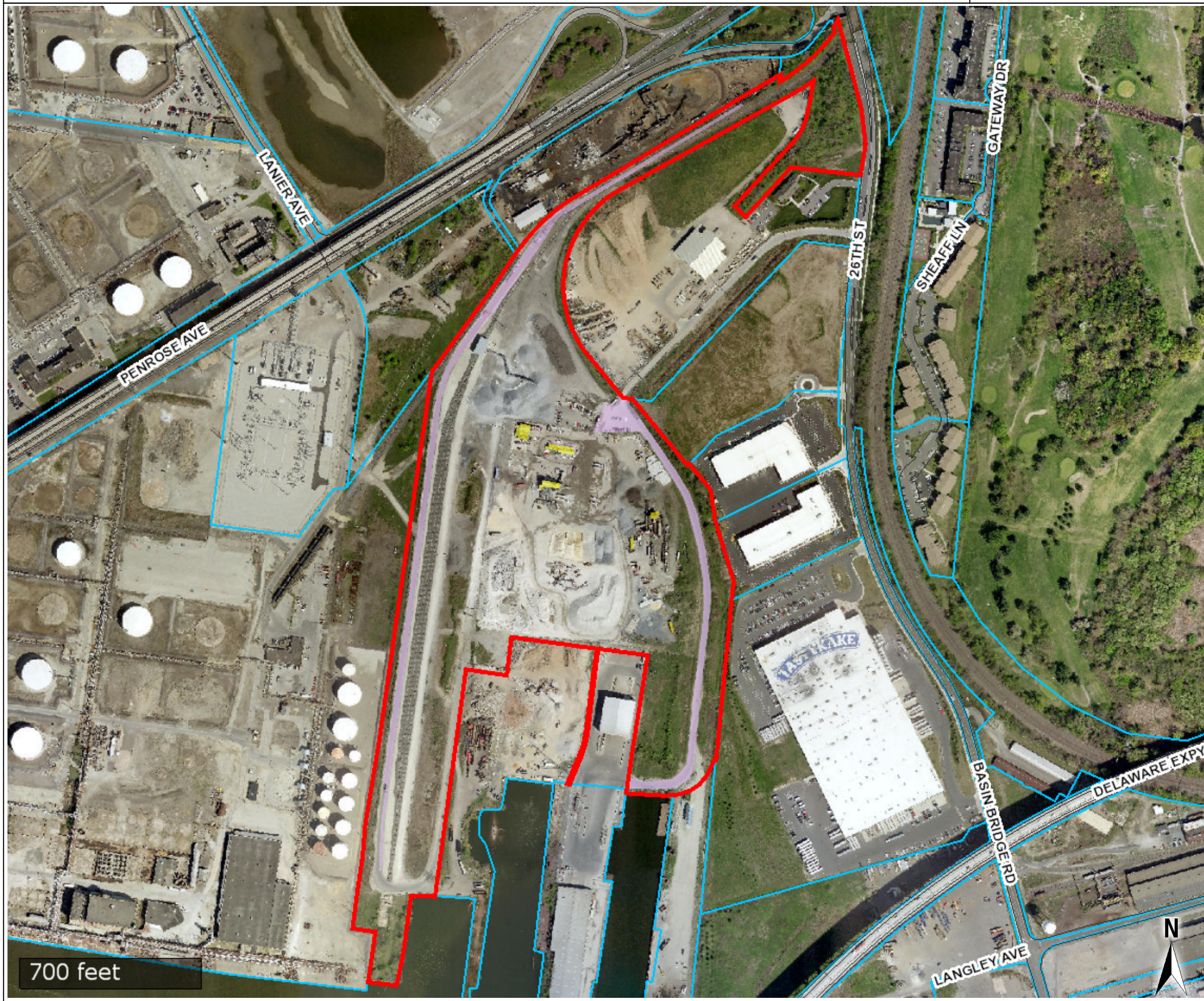
Parcel Owner: CONRAIL

Legend

- Selected Parcel
- Other Parcels

Impervious Surfaces

- Roof
- Other Impervious



Parcel Area (square feet)

	Gross Area	Impervious Area
Total:	2,098,798	149,319
Credit:	0	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$3697.63**	**$3898.06**	**$3898.06**	**$3947.97**	**$4124.71**
Account # - 041-88310-03600-001	$3697.63	$3898.06	$3898.06	$3947.97	$4124.71

PHILADELPHIA WATER

BRT/OPA Account Number: 874597320

Stormwater Billing Class: Non-Residential

Parcel Address: 3606 S 26TH ST

Parcel Owner: DEKAP PROPERTIES L P

Legend

Selected Parcel

Other Parcels

Impervious Surfaces

Roof

Other Impervious

Parcel Area (square feet)

	Gross Area	Impervious Area
Total:	12,579	0
Credit:	10,591	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$13.95**	**$14.65**	**$14.65**	**$14.79**	**$15.38**
Account # - 041-88310-03606-001	$13.95	$14.65	$14.65	$14.79	$15.38

BRT/OPA Account Number: 884095200

Stormwater Billing Class: Non-Residential

Parcel Address: 3700 S 26TH ST

Parcel Owner: DANBRO LP

Legend

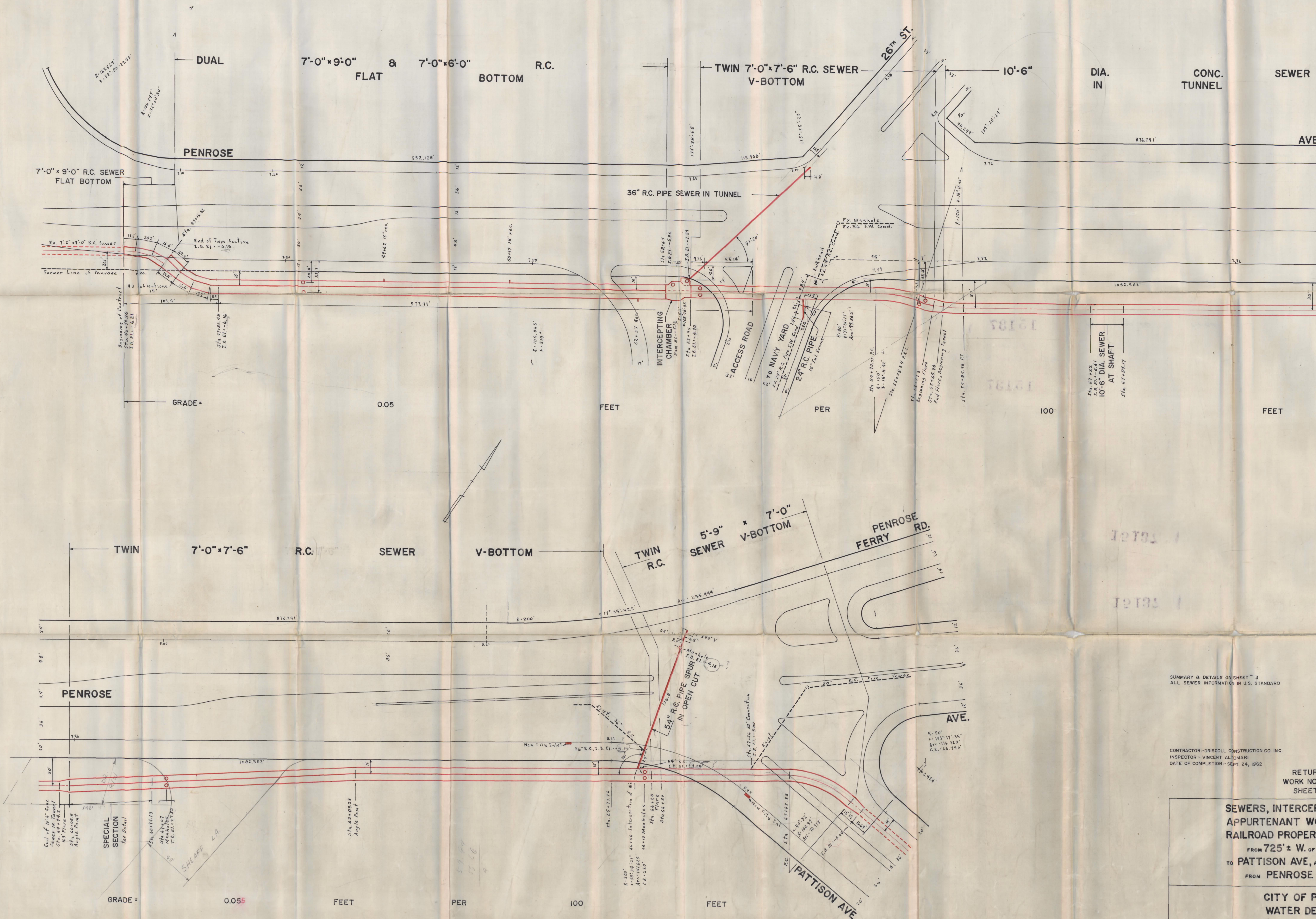
- Selected Parcel
- Other Parcels
- Impervious Surfaces
  - Roof
  - Other Impervious

Parcel Area (square feet)

	Gross Area	Impervious Area
Total:	690,699	98,432
Credit:	0	0

Monthly Stormwater Charge

Fiscal Year	*07/01/2013 - 06/30/2014*	*07/01/2014 - 06/30/2015*	*07/01/2015 - 06/30/2016*	*07/01/2016 - 06/30/2017*	*07/01/2017 - 06/30/2018*
Parcel - Total	**$1661.98**	**$1752.53**	**$1752.53**	**$1764.89**	**$1843.98**
Account # - 041-88310-03700-001	$1661.98	$1752.53	$1752.53	$1764.89	$1843.98



SUMMARY & DETAILS ON SHEET # 3
ALL SEWER INFORMATION IN U.S. STANDARD

CONTRACTOR:-DRISCOLL CONSTRUCTION CO. INC.
INSPECTOR:- VINCENT ALTOMARI
DATE OF COMPLETION:- SEPT. 24, 1962

RETURN PLAN
WORK NO.- S-2810-A
SHEET 1 OF 3

SEWERS, INTERCEPTING CHAMBER AND APPURTENANT WORK IN PENROSE AVE, RAILROAD PROPERTY & CITY PROPERTY FROM 725'± W. OF W.H.L. OF 26TH ST. TO PATTISON AVE, AND IN PATTISON AVE. FROM PENROSE AVE TO 20TH ST.

CITY OF PHILADELPHIA
WATER DEPARTMENT

122284
PWD

SCALE:- 1" = 40'
FIELD BOOK NO:- 550 & 296 P. 123
DRAWN BY:- F.L. LOZOWICKI
CHECKED BY:- W.G. THOMAS
SURVEYED BY:- E.L. HUBER

CORRECT:-
Walter G. Thomas
2-18-64.
CHIEF SURVEYOR


PENROSE AVENUE SEWER
Sheet #2 of 2
UNION TANK CAR CO.
PENNSYLVANIA R.R. CO.
ATLANTIC REFINING CO.
ATLANTIC REFINING CO.
GULF OIL CORP.
LANIER AVE.
PENROSE AVE.
PENROSE AVE.
PHILA. OPEN MOUTH GRATE INLETS
GULF OIL CORP.
7'-0"x9'-0" REINFORCED CONCRETE STORMWATER CONDUIT
GRADE = 0.05FT. PER 100 FT.
PENNSYLVANIA R.R. CO.
MANOR REAL ESTATE AND TRUST COMPANY
END OF CONDUIT
EXISTING 54" DIA. REINFORCED CONCRETE PIPE STORMWATER CONDUIT
ACCESS ROAD
TO NAVY YARD
309046

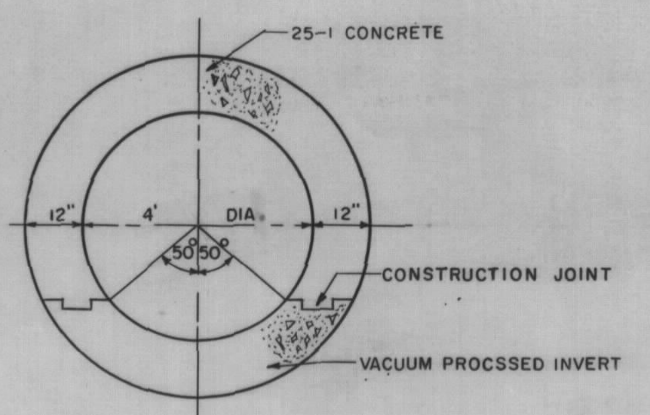
Return Plan

191975 PWD

SD-273-SW

86-A-61

NOTE: SEWER INFORMATION IN U.S. STANDARD



SECTION 4' DIA. CONCRETE SEWER IN TUNNEL

SCALE - 3/8" = 1'-0"

SUMMARY			
ITEM	QUANTITY		DESCRIPTION
1	1,865.92	CU. YDS.	EXCAVATION IN TUNNEL
2	808.70	CU. YDS.	OPEN CUT EXCAVATION FOR M.H. & SHAFTS
3	2,310.79	CU. YDS.	OPEN CUT EXCAVATION FOR SEWER
5	1,242.50	LIN. FT.	4' CONCRETE SEWER IN TUNNEL
7	692.95	LIN FT.	3' R.C. PIPE
8A	2		2' DIA. M.H. ON TUNNEL
8B	2		2' DIA. M.H IN OPEN CUT
9	176.10	SQ YDS.	ASPHALT PAVING
11	41.84	CU. YDS.	10" PAVING BASE
13	100%	COMP.	MAINTENANCE OF TRAFFIC
CONT #19	310	LIN FT.	SUBDRAIN LET. 8-21-62
CONT #54	70.08	TONS	BROKEN STONE LET. 8-21-62

SD-273-SW

LOWER SCHUYLKILL EAST SIDE INTERCEPTING SYSTEM

INTERCEPTING SEWER IN 26TH STREET FROM PENROSE AVE. STA. 141+90.95 NORTH TO STA. 122+55.50

AS-BUILT

CITY OF PHILADELPHIA
WATER DEPARTMENT

WORK NO.	SD-273-SW
CONTRACTOR	DRISCOLL CONST. CO.
INSPECTOR	H. PALMER
DATE OF COMPLETION	AUG. 30, 1963
SCALE	1" = 30'
FIELD BK. NO.	580
SURVEYED BY	J. HOLDEN
DRAWN BY	C. WHITE
CHECKED BY	R. KNOX
APPROVED BY	

CORRECT
Walter G. Thomas
11-18-65
CHIEF SURVYOR

Appendix N
PAGWIS Well Search
Philadelphia Refining Complex, 1 Mile Radius
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
64410639.89804-75.21938	0	Point	644106	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/27/2016	NEW WELL	39.89804	-75.21938	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	35	0	16	4		FALSE				
64410639.89804-75.21938	1	Point	644106	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/27/2016	NEW WELL	39.89804	-75.21938	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	35	16	18	4		FALSE				
64410539.89573-75.22036	2	Point	644105	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/21/2016	NEW WELL	39.89573	-75.22036	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	60	0	36	4		FALSE				
64410539.89573-75.22036	3	Point	644105	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/21/2016	NEW WELL	39.89573	-75.22036	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	60	36	38	4		FALSE				
64410439.89757-75.2196	4	Point	644104	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/14/2016	NEW WELL	39.89757	-75.2196	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	70	0	55	4		FALSE				
64410439.89757-75.2196	5	Point	644104	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/14/2016	NEW WELL	39.89757	-75.2196	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	70	55	58	4		FALSE				
64410339.89945-75.22197	6	Point	644103	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/15/2016	NEW WELL	39.89945	-75.22197	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	45	0	21	4		FALSE				
64410339.89945-75.22197	7	Point	644103	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/15/2016	NEW WELL	39.89945	-75.22197	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	45	21	23	4		FALSE				
64410239.90225-75.22167	8	Point	644102	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/20/2016	NEW WELL	39.90225	-75.22167	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	39	0	20	4		FALSE				
64410239.90225-75.22167	9	Point	644102	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/20/2016	NEW WELL	39.90225	-75.22167	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	39	20	22	4		FALSE				
64409039.8942-75.22347	10	Point	644090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.8942	-75.22347	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	90	75	78	2		FALSE				
64409039.8942-75.22347	11	Point	644090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.8942	-75.22347	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	90	0	75	2		FALSE				
64408939.89582-75.21969	12	Point	644089	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/22/2016	NEW WELL	39.89582	-75.21969	PARRATT-WOLFF INC	Evergreen Resources Group		OTHER	45	0	25.5	4		FALSE				
64408939.89582-75.21969	13	Point	644089	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/22/2016	NEW WELL	39.89582	-75.21969	PARRATT-WOLFF INC	Evergreen Resources Group		OTHER	45	25.5	28	4		FALSE				
64403239.89823-75.22238	14	Point	644032	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/19/2016	NEW WELL	39.89823	-75.22238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	40	0	21	4		FALSE				
64403239.89823-75.22238	15	Point	644032	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/19/2016	NEW WELL	39.89823	-75.22238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	40	21	23	4		FALSE				
64403139.90035-75.2238	16	Point	644031	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.90035	-75.2238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	15	0	2	4		FALSE				
64403139.90035-75.2238	17	Point	644031	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	9/6/2016	NEW WELL	39.90035	-75.2238	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	15	2	4	4		FALSE				
64367239.9232-75.1939	18	Point	643672	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	Porter Station 28th Street	19145	9/13/2016	NEW WELL	39.9232	-75.1939	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	33	0	13	2		TRUE	1	23		60
64363839.92181-75.19477	19	Point	643638	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	Walter Street	19145	9/12/2016	NEW WELL	39.92181	-75.19477	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	35	0	15	2		TRUE	1	22		60
64361739.92252-75.19415	20	Point	643617	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	W. Porter Street	19145	9/12/2016	NEW WELL	39.92252	-75.19415	EAST COAST DRILLING INC	Gas Works	MONITORING	OTHER	34	0	14	2		TRUE	1	25		60
64340139.92517-75.20346	21	Point	643401	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/25/2016	NEW WELL	39.92517	-75.20346	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	66	0	51	4		TRUE		8		
64340139.92517-75.20346	22	Point	643401	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/25/2016	NEW WELL	39.92517	-75.20346	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	66	51	54	4		TRUE		8		
64340039.92419-75.19915	23	Point	643400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/23/2016	NEW WELL	39.92419	-75.19915	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	65	0	50	4		TRUE		12		
64340039.92419-75.19915	24	Point	643400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/23/2016	NEW WELL	39.92419	-75.19915	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	65	50	53	4		TRUE		12		
64339939.9217-75.20739	25	Point	643399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/17/2016	NEW WELL	39.9217	-75.20739	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	80.3	0	67	4		TRUE		14		
64339939.9217-75.20739	26	Point	643399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/17/2016	NEW WELL	39.9217	-75.20739	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	80.3	67	70	4		TRUE		14		
64290539.92402-75.20774	27	Point	642905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/8/2016	NEW WELL	39.92402	-75.20774	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	14	0	1	4		TRUE		10		
64290539.92402-75.20774	28	Point	642905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/8/2016	NEW WELL	39.92402	-75.20774	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	14	1	8	4		TRUE		10		
64289339.92394-75.20592	29	Point	642893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92394	-75.20592	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	33	0	1	4		TRUE				
64289339.92394-75.20592	30	Point	642893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92394	-75.20592	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	33	1	22	4		TRUE				
64282339.92429-75.20617	31	Point	642823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92429	-75.20617	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	16	0	1	4		TRUE		10		
64282339.92429-75.20617	32	Point	642823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/9/2016	NEW WELL	39.92429	-75.20617	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	16	1	6	4		TRUE		10		
64282239.92395-75.2059	33	Point	642822	PHILADELPHIA	PHILADELPHIA				8/4/2016	NEW WELL	39.92395	-75.2059	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	25	0	1	4		FALSE				
64282239.92395-75.2059	34	Point	642822	PHILADELPHIA	PHILADELPHIA				8/4/2016	NEW WELL	39.92395	-75.2059	PARRATT-WOLFF INC	Evergreen Resources Group LLC		OTHER	25	1	6	4		FALSE				
64282139.92521-75.20528	35	Point	642821	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/4/2016	NEW WELL	39.92521	-75.20528	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	25	1	8	4		TRUE		8		
64282139.92521-75.20528	36	Point	642821	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/4/2016	NEW WELL	39.92521	-75.20528	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	25	0	1	4		TRUE		8		
64282039.9235-75.2056	37	Point	642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	14	18	4		TRUE		23		
64282039.9235-75.2056	38	Point	642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	0	1	4		TRUE		23		
64282039.9235-75.2056	39	Point	642820	PHILADELPHIA	PHILADELPHIA				8/5/2016	NEW WELL	39.9235	-75.2056	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	OTHER	37	1	14	4		TRUE		23		
64163939.91634-75.18079	40	Point	641639	PHILADELPHIA	PHILADELPHIA		20th & Johnston Sts	19145	4/8/2015	NEW WELL	39.91634	-75.18079	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	28.5	0	13.5	2		FALSE				
64163839.91644-75.17987	41	Point	641638	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91644	-75.17987	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	24	0	9	2		FALSE				
64163739.91415-75.18027	42	Point	641637	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91415	-75.18027	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	29	0	14	2		FALSE				
64163639.91422-75.18151	43	Point	641636	PHILADELPHIA	PHILADELPHIA		20th and Johnston Sts	19145	4/8/2015	NEW WELL	39.91422	-75.18151	ALLIED WELL DRILLING	Septa	MONITORING	OTHER	24	0	14	2		FALSE				
64162239.90231-75.20244	44	Point	641622	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90231	-75.20244	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
64162039.90267-75.20254	45	Point	641620	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.20254	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
64161939.90257-75.20232	46	Point	641619	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90257	-75.20232	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64161839.90257-75.20232	47	Point	641618	PHILADELPHIA	PHILADELPHIA		6301 Pssyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90257	-75.20232	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64161739.90256-75.20252	48	Point	641617	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90256	-75.20252	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64161639.9022-75.20266	49	Point	641616	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9022	-75.20266	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64161539.90024-75.20027	50	Point	641615	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
64161339.91571-75.21602	51	Point	641613	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.91571	-75.21602	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
64161239.90024-75.21668	52	Point	641612	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.21668	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
64161139.90024-75.21667	53	Point	641611	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
64161039.90023-75.21667	54	Point	641610	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90023	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
64160939.9002-75.20027	55	Point	641609	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9002	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	29	0	0	0		FALSE				
64160839.90021-75.20027	56	Point	641608	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90021	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
64155539.90244-75.2024	57	Point	641555	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90244	-75.2024	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64155439.90243-75.21672	58	Point	641554	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90243	-75.21672	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
64155339.90239-75.20001	59	Point	641553	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90239	-75.20001	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	13	0	0	0		FALSE				
64155239.90267-75.2026	60	Point	641552	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.2026	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
64155139.90267-75.20259	61	Point	641551	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90267	-75.20259	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64155039.90227-75.20244	62	Point	641550	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90227	-75.20244	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	31	0	0	0		FALSE				
64154939.90024-75.20025	63	Point	641549	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20025	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64154839.90024-75.20026	64	Point	641548	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20026	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
64154739.90024-75.20027	65	Point	641547	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	15	0	0	0		FALSE				
64154639.90024-75.20027	66	Point	641546	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20027	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64154539.90024-75.20028	67	Point	641545	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90024	-75.20028	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
64154439.90023-75.21667	68	Point	641544	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90023	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	14	0	0	0		FALSE				
64154339.90022-75.21667	69	Point	641543	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90022	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	11	0	0	0		FALSE				
64154239.90021-75.21668	70	Point	641542	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90021	-75.21668	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64154139.9002-75.21667	71	Point	641541	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.9002	-75.21667	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	10	0	0	0		FALSE				
64052439.90242-75.21676	72	Point	640524	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90242	-75.21676	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64052339.90252-75.2167	73	Point	640523	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90252	-75.2167	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64052239.90245-75.21676	74	Point	640522	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90245	-75.21676	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	16	0	0	0		FALSE				
64046739.90262-75.20273	75	Point	640467	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.90262	-75.20273	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	12	0	0	0		FALSE				
64044439.90918-75.19379	76	Point	640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	81	84	4		FALSE				
64044439.90918-75.19379	77	Point	640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	0	81	4		FALSE				
64044439.90918-75.19379	78	Point	640444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3450 S 26th St	19145	2/8/2016	NEW WELL	39.90918	-75.19379	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	96	84	86	4		FALSE				
64007439.90912-75.19723	79	Point	640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	0	115	4		FALSE				
64007439.90912-75.19723	80	Point	640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	115	119	4		FALSE				
64007439.90912-75.19723	81	Point	640074	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA		Not F	2/24/2016	NEW WELL	39.90912	-75.19723	PARRATT-WOLFF INC	Evergreen	MONITORING	OTHER	132	119	122	4		FALSE				
63831739.91321-75.21703	82	Point	638317	PHILADELPHIA	PHILADELPHIA		6301 Passyunk Ave	19153	12/18/2014	WELL ABANDONMENT	39.91321	-75.21703	ALLIED WELL DRILLING	121 Point Breeze Terminal	ABANDONED	OTHER	13	0	0	0		FALSE				
63749239.91594-75.17836	83	Point	637492	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1800 Bigler Street	19145	2/3/2016	CLOSED-LOOP GEOTHERMAL	39.91594	-75.17836	CHRISTROPHER C W COOK FOUNDATION INC.	City of Phila	UNUSED	UNUSED	505	0	0	0	146	FALSE				
63600339.90778-75.20278	84	Point	636003	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
63600239.90778-75.20278	85	Point	636002	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
63571639.90778-75.20278	86	Point	635716	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.		2/6/2003	NEW WELL	39.90778	-75.20278	EICHELBERGERS INC.	SUNOCO	OBSERVATION	UNUSED	30	0	5	4		TRUE				
63259639.90259-75.23553	87	Point	632596	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19153	11/24/2015	NEW WELL	39.90259	-75.23553	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	35	0	5	2		FALSE				
63256939.90193-75.23588	88	Point	632569	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19173	11/24/2015	NEW WELL	39.90193	-75.23588	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	35	0	5	2		FALSE				
63256839.90214-75.23757	89	Point	632568	PHILADELPHIA	PHILADELPHIA		7625 Suffolk Ave	19153	11/24/2015	NEW WELL	39.90214	-75.23757	ALLIED WELL DRILLING	Delaware Ave Enterprises Inc	MONITORING	OTHER	38	0	3	2		FALSE				
63101539.91417-75.1775	90	Point	631015	PHILADELPHIA	PHILADELPHIA		6201 N. BROAD STREET	19145	5/4/2005	NEW WELL	39.91417	-75.1775	EICHELBERGERS INC.	EXXON/MOBIL	OBSERVATION	UNUSED	30	0	10	4		TRUE				
63101439.91417-75.1775	91	Point	631014	PHILADELPHIA	PHILADELPHIA		6201 N. BROAD STREET	19145	5/4/2005	NEW WELL	39.91417	-75.1775	EICHELBERGERS INC.	EXXON/MOBIL	OBSERVATION	UNUSED	30	0	10	4		TRUE				
62548939.92222-75.22473	92	Point	625489	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22473	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
62548839.92222-75.22472	93	Point	625488	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
62548039.92222-75.22471	94	Point	625480	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22471	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
62516539.92222-75.22472	95	Point	625165	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	4		TRUE				
62516439.92222-75.22472	96	Point	625164	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
62516339.92222-75.22471	97	Point	625163	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22471	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
62516239.92222-75.22472	98	Point	625162	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6700 ESSINGTON AVE.	19153	11/3/2006	NEW WELL	39.92222	-75.22472	EICHELBERGERS INC.	ESSINGTON PATRIOT L.P.	OBSERVATION	UNUSED	15	0	10	2		TRUE				
62394539.90455-75.22322	99	Point	623945	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	7/27/2015	NEW WELL	39.90455	-75.22322	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	15	0	4	4		FALSE				
62378039.91948-75.19126	100	Point	623780	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	3/3/2015	NEW WELL	39.91948	-75.19126	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	35	0	15	6		FALSE				
62377939.91906-75.19562	101	Point	623779	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	Not F	2/20/2015	NEW WELL	39.91906	-75.19562	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	34	0	14	4		FALSE				
62363439.90186-75.22443	102	Point	623634	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/23/2015	NEW WELL	39.90186	-75.22443	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	60	0	40	4		FALSE				
62361239.89961-75.22514	103	Point	623612	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/15/2015	NEW WELL	39.89961	-75.22514	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	20	0	5	4		FALSE				
62361139.89669-75.22565	104	Point	623611	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	Not F	6/19/2015	NEW WELL	39.89669	-75.22565	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	80	0	60	4		FALSE				
62358939.899-75.22534	105	Point	623589	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	1708 Mingo Avenue	19153	6/12/2015	NEW WELL	39.899	-75.22534	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	60	0	40	4		FALSE				
62347939.91974-75.19122	106	Point	623479	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	2/26/2015	NEW WELL	39.91974	-75.19122	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	35	0	15	6		FALSE				
62347839.91957-75.19125	107	Point	623478	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3144 Passyunk Avenue	19145	2/27/2015	NEW WELL	39.91957	-75.19125	PARRATT-WOLFF INC	Evergreen Resources Group LLC	MONITORING	UNKNOWN	34	0	14	6		FALSE				
62337739.93959-75.19896	108	Point	623377	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93959	-75.19896	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	26.5	0	16.5	2		FALSE				
62337639.93922-75.19968	109	Point	623376	PHILADELPHIA	PHILADELPHIA		1201 S 35th st		8/13/2015	NEW WELL	39.93922	-75.19968	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	25	0	15	2		FALSE				
62337539.93968-75.19963	110	Point	623375	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93968	-75.19963	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	25	0	15	2		FALSE				
62333339.93889-75.19966	111	Point	623333	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93889	-75.19966	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	27.5	0	17.5	2		FALSE				
62333239.93865-75.20003	112	Point	623332	PHILADELPHIA	PHILADELPHIA		1201 S 35th St		8/13/2015	NEW WELL	39.93865	-75.20003	ODYSSEY ENVIRONMENTAL SERVICES INC.	Philadelphia Authority for Industrial Development	MONITORING	UNKNOWN	30	0	20	2		FALSE				
62161239.90278-75.23056	113	Point	621612	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
62161139.90278-75.23056	114	Point	621611	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
62161039.90278-75.23056	115	Point	621610	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
62160939.90278-75.23056	116	Point	621609	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23056	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
62122639.90278-75.23057	117	Point	621226	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	7001 ESSINGTON AVE.	19153	2/28/2008	NEW WELL	39.90278	-75.23057	EICHELBERGERS INC.	MEISSNER CHEVROLET	OBSERVATION	UNUSED	20	0	10	2		FALSE				
62035139.9232-75.19409	118	Point	620351	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/15/2015	NEW WELL	39.9232	-75.19409	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
62035039.92268-75.19418	119	Point	620350	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/18/2015	NEW WELL	39.92268	-75.19418	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
62034939.92257-75.19422	120	Point	620349	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/22/2015	NEW WELL	39.92257	-75.19422	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
62034839.92336-75.19393	121	Point	620348	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/29/2015	NEW WELL	39.92336	-75.19393	EAST COAST DRILLING INC	Gas Works		UNUSED	21	0	16	2		TRUE		0		
62034239.92171-75.19509	122	Point	620342	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/16/2015	NEW WELL	39.92171	-75.19509	EAST COAST DRILLING INC	Gas Works		UNUSED	19	0	14	2		TRUE		0		
62032839.92193-75.19496	123	Point	620328	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92193	-75.19496	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
62032739.92257-75.19477	124	Point	620327	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92257	-75.19477	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
62030139.92265-75.1946	125	Point	620301	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/26/2015	NEW WELL	39.92265	-75.1946	EAST COAST DRILLING INC	Gas Works		UNUSED	21	0	16	2		TRUE		0		
62030039.92242-75.19491	126	Point	620300	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92242	-75.19491	EAST COAST DRILLING INC	Gas Works		UNUSED	22	0	17	2		TRUE		0		
62029439.9226-75.19474	127	Point	620294	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.9226	-75.19474	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	21		60
62029339.92258-75.19419	128	Point	620293	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/22/2015	NEW WELL	39.92258	-75.19419	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
62029239.92259-75.19439	129	Point	620292	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/25/2015	NEW WELL	39.92259	-75.19439	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	0.5	20		60
62029139.92258-75.19427	130	Point	620291	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/25/2015	NEW WELL	39.92258	-75.19427	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	21		60
62027839.92219-75.19492	131	Point	620278	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/25/2015	NEW WELL	39.92219	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	18.5	0	13.5	2		TRUE		0		
62027739.92199-75.19494	132	Point	620277	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92199	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	20	0	15	2		TRUE		0		
62009039.92262-75.19458	133	Point	620090	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92262	-75.19458	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
62008039.92271-75.19409	134	Point	620080	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2814 W Porter St	19145	6/16/2015	NEW WELL	39.92271	-75.19409	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
62007939.92274-75.1941	135	Point	620079	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2814 W Porter St	19145	6/17/2015	NEW WELL	39.92274	-75.1941	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
62007839.92154-75.19506	136	Point	620078	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2511 S Newkirk St	19145	6/17/2015	NEW WELL	39.92154	-75.19506	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	1.5	20		30
62007139.92262-75.19447	137	Point	620071	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/26/2015	NEW WELL	39.92262	-75.19447	EAST COAST DRILLING INC	Gas Works		UNUSED	33.5	0	30.5	2		TRUE	0.5	20		60
62007039.92333-75.19389	138	Point	620070	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/10/2015	NEW WELL	39.92333	-75.19389	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	20		60
62006939.92336-75.19383	139	Point	620069	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/10/2015	NEW WELL	39.92336	-75.19383	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	0.5	20		60
62006839.92297-75.19414	140	Point	620068	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/12/2015	NEW WELL	39.92297	-75.19414	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
62006439.92169-75.19503	141	Point	620064	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/19/2015	NEW WELL	39.92169	-75.19503	EAST COAST DRILLING INC	Gas Works		UNUSED	34	0	31	2		TRUE	1.5	20		30
62005939.92227-75.19492	142	Point	620059	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/26/2015	NEW WELL	39.92227	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
62005739.92217-75.19492	143	Point	620057	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/26/2015	NEW WELL	39.92217	-75.19492	EAST COAST DRILLING INC	Gas Works		UNUSED	31	0	28	2		TRUE	1	20		30
62005639.92175-75.195	144	Point	620056	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/19/2015	NEW WELL	39.92175	-75.195	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
62005539.9216-75.19504	145	Point	620055	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/18/2015	NEW WELL	39.9216	-75.19504	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1	20		40
62005139.92266-75.19467	146	Point	620051	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/30/2015	NEW WELL	39.92266	-75.19467	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
62005039.9219-75.19499	147	Point	620050	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/23/2015	NEW WELL	39.9219	-75.19499	EAST COAST DRILLING INC	Gas Works		UNUSED	31.5	0	28.5	2		TRUE	1			30
62004839.92216-75.19493	148	Point	620048	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/24/2015	NEW WELL	39.92216	-75.19493	EAST COAST DRILLING INC	Gas Works		UNUSED	30	0	27	2		TRUE	1	20		30
62003839.92197-75.19494	149	Point	620038	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/23/2015	NEW WELL	39.92197	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	30.5	0	27.5	2		TRUE	1.5	20		30
62000339.92225-75.19493	150	Point	620003	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/25/2015	NEW WELL	39.92225	-75.19493	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	1.5	20		30
62000239.92203-75.19494	151	Point	620002	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/24/2015	NEW WELL	39.92203	-75.19494	EAST COAST DRILLING INC	Gas Works		UNUSED	32	0	29	2		TRUE	1	20		30
61998039.92146-75.19508	152	Point	619980	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2519 S Newkirk St	19145	6/16/2015	NEW WELL	39.92146	-75.19508	EAST COAST DRILLING INC	Gas Works		UNUSED	35	0	32	2		TRUE	1	20		40
61997939.92138-75.1951	153	Point	619979	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2521 S Newkirk St	19145	6/15/2015	NEW WELL	39.92138	-75.1951	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1	20		50
61997539.92321-75.19385	154	Point	619975	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/11/2015	NEW WELL	39.92321	-75.19385	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61997439.92314-75.19405	155	Point	619974	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/11/2015	NEW WELL	39.92314	-75.19405	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61997339.92304-75.19408	156	Point	619973	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/17/2015	NEW WELL	39.92304	-75.19408	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61997239.92298-75.19397	157	Point	619972	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2401 S 28th St	19145	6/12/2015	NEW WELL	39.92298	-75.19397	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61997139.92279-75.19445	158	Point	619971	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/16/2015	NEW WELL	39.92279	-75.19445	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61997039.92263-75.19419	159	Point	619970	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2818 W Porter St	19145	6/17/2015	NEW WELL	39.92263	-75.19419	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61996939.92258-75.1943	160	Point	619969	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2820 W Porter St	19145	6/18/2015	NEW WELL	39.92258	-75.1943	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61996839.92255-75.19433	161	Point	619968	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2820 W Porter St	19145	6/23/2015	NEW WELL	39.92255	-75.19433	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61996739.92257-75.1944	162	Point	619967	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/23/2015	NEW WELL	39.92257	-75.1944	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	0.5	20		60
61996039.92187-75.19497	163	Point	619960	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2830 Ernest St	19145	6/22/2015	NEW WELL	39.92187	-75.19497	EAST COAST DRILLING INC	Philadelphia		UNUSED	31	0	28	2		TRUE	1			30
61995939.92249-75.19487	164	Point	619959	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92249	-75.19487	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
61995839.92231-75.1949	165	Point	619958	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2822 W Porter St	19145	6/29/2015	NEW WELL	39.92231	-75.1949	EAST COAST DRILLING INC	Gas Works		UNUSED	33	0	30	2		TRUE	1.5	20		30
61828539.89972-75.20306	166	Point	618285	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	25	0	0	0		FALSE				
61828439.89972-75.20305	167	Point	618284	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20305	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	27	0	0	0		FALSE				
61828339.89973-75.20305	168	Point	618283	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89973	-75.20305	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	14	0	0	0		FALSE				
61828239.89972-75.20307	169	Point	618282	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	20	0	0	0		FALSE				
61828139.89972-75.20306	170	Point	618281	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	16	0	0	0		FALSE				
61828039.89973-75.20307	171	Point	618280	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89973	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	12	0	0	0		FALSE				
61700339.89972-75.20306	172	Point	617003	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	16	0	0	0		FALSE				
61700239.89972-75.20307	173	Point	617002	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	17	0	0	0		FALSE				
61700139.89971-75.20306	174	Point	617001	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89971	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	15	0	0	0		FALSE				
61700039.89972-75.20307	175	Point	617000	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20307	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	22	0	0	0		FALSE				
61699939.89972-75.20306	176	Point	616999	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	20	0	0	0		FALSE				
61699839.89972-75.20306	177	Point	616998	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89972	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	18	0	0	0		FALSE				
61691439.89971-75.20306	178	Point	616914	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA NAVAL BASE	19145	6/25/2008	WELL ABANDONMENT	39.89971	-75.20306	EICHELBERGERS INC.	US NAVY	ABANDONED	UNUSED	18	0	0	0		FALSE				
59690539.90588-75.19399	179	Point	596905	PHILADELPHIA	PHILADELPHIA		2601 PENROSE AVE.	19145	10/15/2012	NEW WELL	39.90588	-75.19399	EICHELBERGERS INC.	SUN COMPANY INC.	OBSERVATION	UNUSED	25	0	5	4		TRUE				
59666139.91899-75.19127	180	Point	596661	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3112 S 26th St	19145	1/12/2015	OTHER	39.91899	-75.19127	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59666039.91887-75.1913	181	Point	596660	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3118 S 26th St	19145	1/13/2015	OTHER	39.91887	-75.1913	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59620439.91751-75.1931	182	Point	596204	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/9/2014	NEW WELL	39.91751	-75.1931	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
59471239.9192-75.19123	183	Point	594712	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3102 S 26th St	19145	1/9/2015	NEW WELL	39.9192	-75.19123	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59471139.91923-75.19124	184	Point	594711	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/8/2015	NEW WELL	39.91923	-75.19124	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59471039.9193-75.1912	185	Point	594710	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/7/2015	NEW WELL	39.9193	-75.1912	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59465039.91913-75.19124	186	Point	594650	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3106 S 26th St	19145	1/8/2015	OTHER	39.91913	-75.19124	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59452739.89462-75.22914	187	Point	594527	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89462	-75.22914	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	15	0	5	2		TRUE				
59452639.89459-75.22897	188	Point	594526	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89459	-75.22897	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	20	0	5	2		TRUE				
59452539.89489-75.22905	189	Point	594525	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	8000 ESSINGTON AVE	19153	12/10/2010	NEW WELL	39.89489	-75.22905	EICHELBERGERS INC.	UNITED AIRLINES	OBSERVATION	UNUSED	15	0	5	2		TRUE				
59416539.91936-75.19122	190	Point	594165	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3100 S 26th St	19145	1/6/2015	OTHER	39.91936	-75.19122	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59416439.91919-75.19123	191	Point	594164	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	3102 S 26th St	19145	1/7/2015	OTHER	39.91919	-75.19123	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	6		FALSE				
59416339.91707-75.19437	192	Point	594163	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/5/2014	NEW WELL	39.91707	-75.19437	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	30	0	10	4		FALSE				
59416239.91684-75.19541	193	Point	594162	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/10/2014	NEW WELL	39.91684	-75.19541	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				

Appendix N
PAGWIS Well Search
Philadelphia Refining Complex, 1 Mile Radius
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
59416039.91953-75.19478	194	Point	594160	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/8/2014	NEW WELL	39.91953	-75.19478	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
59415939.91919-75.19563	195	Point	594159	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/9/2014	OTHER	39.91919	-75.19563	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	35	0	15	4		FALSE				
55253839.91569-75.19208	196	Point	552538	PHILADELPHIA	PHILADELPHIA				12/3/2013	NEW WELL	39.91569	-75.19208	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	89	0	79	4		FALSE				
55252939.91752-75.19219	197	Point	552529	PHILADELPHIA	PHILADELPHIA				2/27/2014	NEW WELL	39.91752	-75.19219	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	44	0	39	4		FALSE				
55252839.92107-75.19153	198	Point	552528	PHILADELPHIA	PHILADELPHIA				2/25/2014	NEW WELL	39.92107	-75.19153	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	45	0	35	4		FALSE				
55252739.9208-75.19148	199	Point	552527	PHILADELPHIA	PHILADELPHIA				2/4/2014	NEW WELL	39.9208	-75.19148	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	102	0	92	4		FALSE				
55252639.91301-75.19408	200	Point	552526	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	2615 Hartranft St		1/9/2014	NEW WELL	39.91301	-75.19408	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	72	0	62	4		FALSE				
55252539.91783-75.19622	201	Point	552525	PHILADELPHIA	PHILADELPHIA				1/15/2014	NEW WELL	39.91783	-75.19622	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	98	0	88	4		FALSE				
55252439.91667-75.19388	202	Point	552524	PHILADELPHIA	PHILADELPHIA				12/18/2013	NEW WELL	39.91667	-75.19388	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	92	0	82	4		FALSE				
55240639.91773-75.1962	203	Point	552406	PHILADELPHIA	PHILADELPHIA				3/11/2014	NEW WELL	39.91773	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	55	0	50	4		FALSE				
55239239.91779-75.1962	204	Point	552392	PHILADELPHIA	PHILADELPHIA				3/12/2014	NEW WELL	39.91779	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	74	0	69	4		FALSE				
55235139.91779-75.1962	205	Point	552351	PHILADELPHIA	PHILADELPHIA				3/6/2014	NEW WELL	39.91779	-75.1962	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	45	0	40	4		FALSE				
55235039.91576-75.19208	206	Point	552350	PHILADELPHIA	PHILADELPHIA				3/5/2014	NEW WELL	39.91576	-75.19208	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	54	0	49	4		FALSE				
55234039.91665-75.19384	207	Point	552340	PHILADELPHIA	PHILADELPHIA				3/4/2014	NEW WELL	39.91665	-75.19384	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	57	0	52	4		FALSE				
55233939.9209-75.19156	208	Point	552339	PHILADELPHIA	PHILADELPHIA				2/20/2014	NEW WELL	39.9209	-75.19156	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	80	0	70	4		FALSE				
55233839.9175-75.19216	209	Point	552338	PHILADELPHIA	PHILADELPHIA				12/19/2013	NEW WELL	39.9175	-75.19216	PARRATT-WOLFF INC	Evergreen Resource Management	MONITORING	OTHER	82	0	72	4		FALSE				
51496839.92686-75.22872	210	Point	514968	PHILADELPHIA	PHILADELPHIA		2231 S. 62nd St.	19142	3/6/2014	NEW WELL	39.92686	-75.22872	SUBSURFACE ENVIRONMENTAL TECHNOLOGIES LLC	Eckelmeyer	WITHDRAWAL	UNKNOWN	27	0	17	2		FALSE	2	21		30
51423339.92399-75.17616	211	Point	514233	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92399	-75.17616	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
51423239.92414-75.17605	212	Point	514232	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92414	-75.17605	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
51416639.92411-75.17622	213	Point	514166	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92411	-75.17622	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	25	0	0	0		FALSE				
51416439.92412-75.17613	214	Point	514164	PHILADELPHIA	PHILADELPHIA		18 & Passyunk Ave	19145	5/27/2014	WELL ABANDONMENT	39.92412	-75.17613	ODYSSEY ENVIRONMENTAL SERVICES INC.	Sunoco Inc. (R&M)	MONITORING	UNKNOWN	23	0	0	0		FALSE				
51248839.90253-75.19467	215	Point	512488	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90253	-75.19467	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	2		FALSE				
51248739.90339-75.19633	216	Point	512487	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90339	-75.19633	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	4		FALSE				
51248639.90158-75.19606	217	Point	512486	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90158	-75.19606	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	22	0	22	2		FALSE				
51248539.90114-75.19694	218	Point	512485	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90114	-75.19694	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	17	0	17	2		FALSE				
51248439.90172-75.19647	219	Point	512484	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90172	-75.19647	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	17	0	17	2		FALSE				
51248339.90214-75.19578	220	Point	512483	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90214	-75.19578	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	25	0	25	2		FALSE				
51248239.90308-75.19547	221	Point	512482	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90308	-75.19547	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	35	0	35	2		FALSE				
51246739.90161-75.19622	222	Point	512467	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90161	-75.19622	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	22	0	22	4		FALSE				
51246639.90167-75.19744	223	Point	512466	PHILADELPHIA	PHILADELPHIA		26th Street	19145	7/13/2013	WELL ABANDONMENT	39.90167	-75.19744	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	30	0	30	4		FALSE				
51246539.90258-75.19628	224	Point	512465	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90258	-75.19628	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	27	0	27	2		FALSE				
51246439.90328-75.19667	225	Point	512464	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90328	-75.19667	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	26	0	26	2		FALSE				
51246339.90233-75.19761	226	Point	512463	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90233	-75.19761	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	26	0	26	2		FALSE				
51246239.90403-75.19439	227	Point	512462	PHILADELPHIA	PHILADELPHIA		26th Street	19145	6/13/2013	WELL ABANDONMENT	39.90403	-75.19439	ALLIED WELL DRILLING	Danbro L.P.	MONITORING	UNKNOWN	32	0	32	4		FALSE				
51099739.9379-75.21642	228	Point	510997	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.9379	-75.21642	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	24	0	9	2	12	FALSE	1	12	12	
51099339.9379-75.2162	229	Point	510993	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.9379	-75.2162	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	23	0	8	2	11	FALSE	1	12	12	
51098539.938-75.2161	230	Point	510985	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/4/2013	NEW WELL	39.938	-75.2161	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	UNUSED	UNUSED	24	0	9	2	11	FALSE	1	11	11	
51098339.93808-75.21626	231	Point	510983	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodland Ave. Philadelphia PA	19143	12/5/2013	NEW WELL	39.93808	-75.21626	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	TEST	UNUSED	23	0	8	2	22	FALSE		12	12	
51095939.93807-75.21633	232	Point	510959	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	5200 Woodlsnd Ave. Philadelphia	19143	12/4/2013	NEW WELL	39.93807	-75.21633	A LEXANDER MACPHEE--CVM INDUSTRIES	Woodland Gulf	TEST	UNUSED	23	0	8	2	13	FALSE	1	11	11	
51037439.90555-75.19301	233	Point	510374	PHILADELPHIA					5/8/2013	NEW WELL	39.90555	-75.19301	TPI ENVIRONMENTAL INC.	Geosyntec Consultants	WITHDRAWAL	UNKNOWN	20	0	10	2		FALSE				
50491839.92636-75.21412	234	Point	504918	PHILADELPHIA			2751 S. 58th Street Philadelphia PA		2/13/2013	NEW WELL	39.92636	-75.21412	AMERIDRILL INC.	Philadelphia Industrial Development Corp.	MONITORING	UNKNOWN	15	0	5	4		TRUE				
50447539.91443-75.18673	235	Point	504475	PHILADELPHIA			S. 23rd Street Philadelphia PA 19145		1/14/2013	NEW WELL	39.91443	-75.18673	AMERIDRILL INC.	Defense Logistics Agency	MONITORING	UNKNOWN	45	0	15	4		TRUE				
50255539.91021-75.2181	236	Point	502555	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.91021	-75.2181	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	15	0	0	0		TRUE		4		
50255439.91034-75.21808	237	Point	502554	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.91034	-75.21808	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	15	0	0	0		TRUE		4		
50251939.90593-75.21824	238	Point	502519	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19153	10/15/2012	NEW WELL	39.90593	-75.21824	ENVIRONMENTAL FIELD SERVICE INC	Pacific Atlantic Terminals LLC	MONITORING	UNUSED	14.5	0	0	0		TRUE		4		
50037739.92537-75.22092	239	Point	500377	PHILADELPHIA			5245 Lindbergh Blvd Philadelphia	19143	9/14/2010	NEW WELL	39.92537	-75.22092	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	25	0	5	2		TRUE				
50037639.92565-75.22125	240	Point	500376	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia	19143	9/14/2010	NEW WELL	39.92565	-75.22125	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	WITHDRAWAL	UNKNOWN	25	0	5	2		TRUE				
50037539.92561-75.22165	241	Point	500375	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia	19143	9/13/2010	NEW WELL	39.92561	-75.22165	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	25	0	5	2		TRUE				
50014539.90485-75.17715	242	Point	500145	PHILADELPHIA			1515 Arch St. Philadelphia	19102	4/26/2012	WELL ABANDONMENT	39.90485	-75.17715	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50014439.90485-75.177	243	Point	500144	PHILADELPHIA			1515 Arch St. Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90485	-75.177	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50014339.90491-75.17716	244	Point	500143	PHILADELPHIA			1515 Arch Street Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90491	-75.17716	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50014239.90515-75.17674	245	Point	500142	PHILADELPHIA			1515 Arch Street Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90515	-75.17674	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50006939.90472-75.17722	246	Point	500069	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90472	-75.17722	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50006839.90479-75.1773	247	Point	500068	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90479	-75.1773	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50006739.90486-75.17737	248	Point	500067	PHILADELPHIA			1515 Arch St Philadelphia	19102	7/6/2006	WELL ABANDONMENT	39.90486	-75.17737	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
50006639.90501-75.17699	249	Point	500066	PHILADELPHIA			1515 Arch St Philadelphia	19102	4/26/2006	WELL ABANDONMENT	39.90501	-75.17699	ODYSSEY ENVIRONMENTAL SERVICES INC.	City of Philadelphia	MONITORING	UNKNOWN	20	0	0	0		FALSE				
49980339.92536-75.2209	250	Point	499803	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia PA	19143	12/22/2011	NEW WELL	39.92536	-75.2209	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	30	0	5	2		TRUE				
49972639.92527-75.22082	251	Point	499726	PHILADELPHIA			5945 Lindbergh Blvd Philadelphia PA	19143	10/22/2011	NEW WELL	39.92527	-75.22082	ODYSSEY ENVIRONMENTAL SERVICES INC.	Saini	MONITORING	UNKNOWN	30	0	5	2		TRUE				
49950839.91599-75.21521	252	Point	499508	PHILADELPHIA	PHILADELPHIA		6310 Passyunk Ave. Phila. PA		5/18/2012	WELL ABANDONMENT	39.91599	-75.21521	B L MYERS BROS. OF PA. INC.	Point Breeze Terminal	MONITORING	UNKNOWN	15	0	0	0		FALSE				
49950639.91599-75.21521	253	Point	499506	PHILADELPHIA	PHILADELPHIA		6310 Passyunk Ave. Phila. PA		5/18/2012	NEW WELL	39.91599	-75.21521	B L MYERS BROS. OF PA. INC.	Point Breeze Terminal	MONITORING	UNKNOWN	15	0	3	4		FALSE				
49797539.90143-75.21995	254	Point	497975	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6770 Essington Avenue	19153	7/7/2011	NEW WELL	39.90143	-75.21995	THOMAS G KEYES INC	Auto Parts	WITHDRAWAL	INDUSTRIAL	182	0	101	6	90	FALSE	20	15	75	120
49784239.91771-75.23501	255	Point	497842	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/30/2012	NEW WELL	39.91771	-75.23501	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
49782439.91692-75.23498	256	Point	497824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avnue	19140	1/27/2012	NEW WELL	39.91692	-75.23498	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
49782339.91706-75.23489	257	Point	497823	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/30/2012	NEW WELL	39.91706	-75.23489	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
49776739.91713-75.23495	258	Point	497767	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6901 Buist Avenue	19140	1/31/2012	NEW WELL	39.91713	-75.23495	TALON DRILLING COMPANY	Singh	MONITORING	UNKNOWN	20	0	5	4		TRUE				
49745639.91386-75.20112	259	Point	497456	PHILADELPHIA	PHILADELPHIA				6/10/2010	NEW WELL	39.91386	-75.20112	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
49745539.91509-75.19739	260	Point	497455	PHILADELPHIA	PHILADELPHIA				6/4/2010	NEW WELL	39.91509	-75.19739	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	18	0	8	4		FALSE		8		
49745439.90783-75.21133	261	Point	497454	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.90783	-75.21133	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	12	0	4	4		FALSE		2		
49680039.90421-75.20569	262	Point	496800	PHILADELPHIA	PHILADELPHIA				6/15/2010	NEW WELL	39.90421	-75.20569	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	3		FALSE		4		
49679739.91566-75.20127	263	Point	496797	PHILADELPHIA	PHILADELPHIA				5/7/2010	NEW WELL	39.91566	-75.20127	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
49679639.91554-75.20161	264	Point	496796	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91554	-75.20161	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
49679539.91554-75.20161	265	Point	496795	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91554	-75.20161	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
49679139.91556-75.20143	266	Point	496791	PHILADELPHIA	PHILADELPHIA				5/11/2010	NEW WELL	39.91556	-75.20143	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		22		
49679039.91556-75.20126	267	Point	496790	PHILADELPHIA	PHILADELPHIA				5/7/2010	NEW WELL	39.91556	-75.20126	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
49678939.91301-75.19746	268	Point	496789	PHILADELPHIA	PHILADELPHIA				5/18/2010	NEW WELL	39.91301	-75.19746	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	34	0	19	4		FALSE		23		
49678839.91551-75.20012	269	Point	496788	PHILADELPHIA	PHILADELPHIA				5/21/2010	NEW WELL	39.91551	-75.20012	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
49678739.90966-75.21112	270	Point	496787	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90966	-75.21112	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		8		
49654239.94667-75.19917	271	Point	496542	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94667	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	5	FALSE	0.1	13		
49654239.94667-75.19917	272	Point	496542	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94667	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	5	FALSE	0.1	13		
49528439.915-75.19222	273	Point	495284	PHILADELPHIA	PHILADELPHIA				2/16/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
49528339.915-75.19222	274	Point	495283	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
49071839.93015-75.20083	275	Point	490718	PHILADELPHIA	PHILADELPHIA				9/16/2011	NEW WELL	39.93015	-75.20083	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		23		
49071639.9303-75.20139	276	Point	490716	PHILADELPHIA	PHILADELPHIA				9/19/2011	NEW WELL	39.9303	-75.20139	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	23	0	13	2		TRUE		15		
49071539.9311-75.20052	277	Point	490715	PHILADELPHIA	PHILADELPHIA				9/14/2011	NEW WELL	39.9311	-75.20052	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	34	0	24	2		TRUE		28		
49058639.93277-75.21628	278	Point	490586	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93277	-75.21628	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	36	0	0	0		FALSE				
49058539.93254-75.21639	279	Point	490585	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93254	-75.21639	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49058439.93267-75.21629	280	Point	490584	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93267	-75.21629	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49058339.93279-75.2163	281	Point	490583	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93279	-75.2163	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49058239.93264-75.21636	282	Point	490582	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93264	-75.21636	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49058139.93267-75.21635	283	Point	490581	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93267	-75.21635	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49036339.92997-75.20042	284	Point	490363	PHILADELPHIA	PHILADELPHIA				9/15/2011	NEW WELL	39.92997	-75.20042	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		25		
49028039.93276-75.21637	285	Point	490280	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93276	-75.21637	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	35	0	0	0		FALSE				
49027939.93292-75.21645	286	Point	490279	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93292	-75.21645	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	55	0	0	0		FALSE				
49027839.93285-75.21667	287	Point	490278	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93285	-75.21667	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	45	0	0	0		FALSE				
49027739.9328-75.21621	288	Point	490277	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.9328	-75.21621	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	48	0	0	0		FALSE				
49012139.93272-75.21634	289	Point	490121	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93272	-75.21634	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				
49012039.93274-75.2164	290	Point	490120	PHILADELPHIA	PHILADELPHIA		5364 Lindbergh Blvd Philadelphai	19143	8/30/2011	WELL ABANDONMENT	39.93274	-75.2164	ODYSSEY ENVIRONMENTAL SERVICES INC.	BP	MONITORING	UNKNOWN	28	0	0	0		FALSE				

Appendix N
PAGWIS Well Search
Philadelphia Refining Complex, 1 Mile Radius
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
48993439.91763-75.201	291	Point	489934	PHILADELPHIA					8/26/2011	NEW WELL	39.91763	-75.201	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
48864539.91555-75.20272	292	Point	488645	PHILADELPHIA					8/22/2011	NEW WELL	39.91555	-75.20272	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	25	0	5	2		TRUE				
48853739.91215-75.19235	293	Point	488537	PHILADELPHIA					6/29/2011	NEW WELL	39.91215	-75.19235	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	39	0	19	4		TRUE		24		
48800739.91776-75.20135	294	Point	488007	PHILADELPHIA					8/25/2011	NEW WELL	39.91776	-75.20135	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
48800639.91698-75.20149	295	Point	488006	PHILADELPHIA					8/25/2011	NEW WELL	39.91698	-75.20149	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	20	0	3	2		TRUE				
48800539.91721-75.20174	296	Point	488005	PHILADELPHIA					8/23/2011	NEW WELL	39.91721	-75.20174	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	25	0	5	2		TRUE				
48800439.91549-75.20251	297	Point	488004	PHILADELPHIA					8/22/2011	NEW WELL	39.91549	-75.20251	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	30	0	10	2		TRUE				
48786439.91278-75.19201	298	Point	487864	PHILADELPHIA					6/28/2011	NEW WELL	39.91278	-75.19201	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	40	0	20	4		TRUE				
48786239.91258-75.19209	299	Point	487862	PHILADELPHIA					7/7/2011	NEW WELL	39.91258	-75.19209	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	75	0	65	4		TRUE				
48786239.91258-75.19209	300	Point	487862	PHILADELPHIA					7/7/2011	NEW WELL	39.91258	-75.19209	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	75	0	44	6		TRUE				
48786039.91324-75.19208	301	Point	487860	PHILADELPHIA					6/29/2011	NEW WELL	39.91324	-75.19208	PARRATT-WOLFF INC	ARCO	MONITORING	UNKNOWN	40	0	20	4		TRUE		24		
48785739.9169-75.2351	302	Point	487857	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/2/2011	NEW WELL	39.9169	-75.2351	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
48785639.9171-75.235	303	Point	487856	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/2/2011	NEW WELL	39.9171	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
48785539.917-75.235	304	Point	487855	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/1/2011	NEW WELL	39.917	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
48648739.9171-75.235	305	Point	486487	PHILADELPHIA	PHILADELPHIA		6901 Buist Ave. Phila. PA		8/1/2011	NEW WELL	39.9171	-75.235	B L MYERS BROS. OF PA. INC.	United Gas	MONITORING	UNKNOWN	20	0	5	4		FALSE				
48601839.90252-75.2247	306	Point	486018	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA	6850 Essington Avenue	19153	7/20/2009	NEW WELL	39.90252	-75.2247	ENVIRONMENTAL PROBING INVESTIGATIONS INC	Oil Terminal	MONITORING	INDUSTRIAL	30	0	10	4		TRUE	1	11		30
48507739.91878-75.20344	307	Point	485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	0	57	4		TRUE				
48507739.91878-75.20344	308	Point	485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	57	63	4		TRUE				
48507739.91878-75.20344	309	Point	485077	PHILADELPHIA					4/6/2011	NEW WELL	39.91878	-75.20344	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	77	63	67	4		TRUE				
48490439.92218-75.21929	310	Point	484904	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92218	-75.21929	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	46	0	0	0		FALSE		42		
48490339.92117-75.21998	311	Point	484903	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92117	-75.21998	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	29	0	0	0		FALSE		15		
48490239.92158-75.21834	312	Point	484902	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92158	-75.21834	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	30	0	0	0		FALSE		24		
48490139.92057-75.21847	313	Point	484901	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.92057	-75.21847	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	24	0	0	0		FALSE		12		
48485339.91644-75.20606	314	Point	484853	PHILADELPHIA					4/18/2011	NEW WELL	39.91644	-75.20606	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	13	2	3	4		FALSE				
48485139.91787-75.20547	315	Point	484851	PHILADELPHIA					4/19/2011	NEW WELL	39.91787	-75.20547	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	2	4	4		FALSE				
48480839.91472-75.20708	316	Point	484808	PHILADELPHIA					4/15/2011	NEW WELL	39.91472	-75.20708	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	15	0	5	4		FALSE				
48480739.91442-75.20888	317	Point	484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	0	37	4		FALSE				
48480739.91442-75.20888	318	Point	484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	37	39	4		FALSE				
48480739.91442-75.20888	319	Point	484807	PHILADELPHIA					4/18/2011	NEW WELL	39.91442	-75.20888	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	53	39	41	4		FALSE				
48459139.94528-75.19917	320	Point	484591	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94528	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	7	FALSE	0.1	7		
48459139.94528-75.19917	321	Point	484591	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		3/31/2009	NEW WELL	39.94528	-75.19917	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	7	FALSE	0.1	7		
48429339.915-75.19222	322	Point	484293	PHILADELPHIA	PHILADELPHIA				2/19/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	36	0	0	0		FALSE				
48429239.915-75.19222	323	Point	484292	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	36	0	0	0		FALSE				
48426639.91557-75.21262	324	Point	484266	PHILADELPHIA					4/20/2011	NEW WELL	39.91557	-75.21262	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	16	0	6	4		FALSE				
48426539.91549-75.20993	325	Point	484265	PHILADELPHIA					4/20/2011	NEW WELL	39.91549	-75.20993	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	0	4	10		FALSE				
48426439.91445-75.20898	326	Point	484264	PHILADELPHIA					4/18/2011	NEW WELL	39.91445	-75.20898	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	13	2	3	4		FALSE				
48426339.91709-75.20435	327	Point	484263	PHILADELPHIA					4/19/2011	NEW WELL	39.91709	-75.20435	PARRATT-WOLFF INC	Sunoco	MONITORING	UNKNOWN	14	2	4	4		FALSE				
48416439.915-75.19222	328	Point	484164	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48416339.915-75.19222	329	Point	484163	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
48416239.915-75.19222	330	Point	484162	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
48416139.915-75.19222	331	Point	484161	PHILADELPHIA	PHILADELPHIA				2/16/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
48416039.915-75.19222	332	Point	484160	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48415839.915-75.19222	333	Point	484158	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	38	0	0	0		FALSE				
48415639.915-75.19222	334	Point	484156	PHILADELPHIA	PHILADELPHIA				2/19/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40.5	0	0	0		FALSE				
48415539.915-75.19222	335	Point	484155	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48415439.915-75.19222	336	Point	484154	PHILADELPHIA	PHILADELPHIA				2/4/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48415339.915-75.19222	337	Point	484153	PHILADELPHIA	PHILADELPHIA				2/3/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48415239.915-75.19222	338	Point	484152	PHILADELPHIA	PHILADELPHIA				1/29/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48415139.915-75.19222	339	Point	484151	PHILADELPHIA	PHILADELPHIA				1/28/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48405739.9212-75.21658	340	Point	484057	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.9212	-75.21658	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	25	0	0	0		FALSE		15		
48405539.9197-75.21704	341	Point	484055	PHILADELPHIA	PHILADELPHIA		3062 S. 61ST STREET		10/21/2011	WELL ABANDONMENT	39.9197	-75.21704	C S GARBER & SONS INC	ESSINGTON AVENUE PARTNERS II L.P.	ABANDONED	UNKNOWN	20	0	0	0		FALSE		7		
4839539.92778-75.21111	342	Point	48395	PHILADELPHIA		PHILADELPHIA			5/31/1995		39.92778	-75.21111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	15	0	0	0		FALSE	1	5	16	168
4839439.9275-75.20667	343	Point	48394	PHILADELPHIA		PHILADELPHIA			11/5/1981		39.9275	-75.20667	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	25	0	0	0		FALSE	9	12	20	168
4839339.92722-75.20278	344	Point	48393	PHILADELPHIA		PHILADELPHIA			5/12/1994		39.92722	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	0.5	15	24	168
4839239.92722-75.20222	345	Point	48392	PHILADELPHIA		PHILADELPHIA			5/11/1994		39.92722	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	2.3	15	24	168
4839139.92722-75.20167	346	Point	48391	PHILADELPHIA		PHILADELPHIA			5/12/1994		39.92722	-75.20167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	0.4	15	24	168
4839039.92694-75.20333	347	Point	48390	PHILADELPHIA		PHILADELPHIA			5/10/1994		39.92694	-75.20333	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	26	0	0	0		FALSE	0.8	15	24	168
48389039.91016-75.21783	348	Point	483890	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave. Phila. Pa		4/5/2010	WELL ABANDONMENT	39.91016	-75.21783	B L MYERS BROS. OF PA. INC.	Pacific Atlantic Terminal LLC	MONITORING	UNKNOWN	6	0	0	0		FALSE				
4838939.92694-75.20222	349	Point	48389	PHILADELPHIA		PHILADELPHIA			6/2/1995		39.92694	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.1	15	24	168
48388239.91013-75.21785	350	Point	483882	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave. Phila. Pa		4/5/2010	NEW WELL	39.91013	-75.21785	B L MYERS BROS. OF PA. INC.	Pacific Atlantic Terminal LLC	MONITORING	OTHER	26	0	0	0		FALSE				
4838839.92694-75.20139	351	Point	48388	PHILADELPHIA		PHILADELPHIA			6/5/1995		39.92694	-75.20139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.8	15	24	168
4838739.92694-75.20111	352	Point	48387	PHILADELPHIA		PHILADELPHIA			5/13/1994		39.92694	-75.20111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	0.5	15	24	
4838639.92694-75.20083	353	Point	48386	PHILADELPHIA		PHILADELPHIA			6/5/1995		39.92694	-75.20083	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	13	6		FALSE	0.5	15	24	168
4838539.92694-75.20056	354	Point	48385	PHILADELPHIA		PHILADELPHIA			5/11/1994		39.92694	-75.20056	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	1.7	15	24	168
4838439.92667-75.21167	355	Point	48384	PHILADELPHIA		PHILADELPHIA			6/1/1995		39.92667	-75.21167		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	10	9	14	168
4838339.92361-75.20028	356	Point	48383	PHILADELPHIA		PHILADELPHIA			<Null>		39.92361	-75.20028		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	5	22	25	168
4838239.92333-75.20083	357	Point	48382	PHILADELPHIA		PHILADELPHIA			10/11/1994		39.92333	-75.20083	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	50	0	0	0		FALSE	6.5	22	27	168
4838139.92306-75.20222	358	Point	48381	PHILADELPHIA		PHILADELPHIA			5/19/1994		39.92306	-75.20222	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	37	0	0	0		FALSE	1.8	22	29	168
4838039.92306-75.20167	359	Point	48380	PHILADELPHIA		PHILADELPHIA			10/19/1994		39.92306	-75.20167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	35	0	0	0		FALSE	2	22	27	168
4837939.92278-75.20333	360	Point	48379	PHILADELPHIA		PHILADELPHIA			5/18/1994		39.92278	-75.20333	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	35	0	0	0		FALSE	7.5	22	27	168
4837839.92278-75.20278	361	Point	48378	PHILADELPHIA		PHILADELPHIA			5/17/1994		39.92278	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	34	0	0	0		FALSE	1	22	29	168
4837639.92194-75.20778	362	Point	48376	PHILADELPHIA		PHILADELPHIA			6/1/1995		39.92194	-75.20778		SUN COMPANY	WITHDRAWAL	OTHER	0	0	0	0		FALSE	20	5	10	168
4837439.91972-75.19056	363	Point	48374	PHILADELPHIA		PHILADELPHIA			5/26/1994		39.91972	-75.19056	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	37	0	0	0		FALSE	0.1	25	32	168
4837339.91833-75.19167	364	Point	48373	PHILADELPHIA		PHILADELPHIA			9/9/1993		39.91833	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	50	0	0	0		FALSE	2	22	30	168
4837239.91806-75.19139	365	Point	48372	PHILADELPHIA		PHILADELPHIA			5/24/1994		39.91806	-75.19139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	33	0	0	0		FALSE	0.9	22	30	168
4837139.91778-75.19167	366	Point	48371	PHILADELPHIA		PHILADELPHIA			7/1/1994		39.91778	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	49	0	0	0		FALSE	1.1	22	30	168
4837039.91722-75.19167	367	Point	48370	PHILADELPHIA		PHILADELPHIA			8/25/1994		39.91722	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	32	0	22	6		FALSE	0.1	24	30	168
4836939.91639-75.19167	368	Point	48369	PHILADELPHIA		PHILADELPHIA			5/20/1994		39.91639	-75.19167	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	36	0	26	6		FALSE	0.3	24	26	168
4836839.91556-75.20278	369	Point	48368	PHILADELPHIA		PHILADELPHIA			8/9/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	3.5	8	15	168
4836739.91556-75.20111	370	Point	48367	PHILADELPHIA		PHILADELPHIA			5/9/1994		39.91556	-75.20111	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	28	0	0	0		FALSE	0.5	18	24	168
4836639.91528-75.20278	371	Point	48366	PHILADELPHIA		PHILADELPHIA			8/3/1995		39.91528	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	0.4	8	15	168
4836539.91528-75.20139	372	Point	48365	PHILADELPHIA		PHILADELPHIA			5/5/1994		39.91528	-75.20139	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	29	0	0	0		FALSE	3	18	24	168
4836439.91528-75.20028	373	Point	48364	PHILADELPHIA		PHILADELPHIA			5/10/1994		39.91528	-75.20028	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	27	0	0	0		FALSE	1	18	24	168
4836339.91528-75.19972	374	Point	48363	PHILADELPHIA		PHILADELPHIA			5/9/1994		39.91528	-75.19972	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	31	0	0	0		FALSE	1.6	18	24	168
4836239.915-75.20306	375	Point	48362	PHILADELPHIA		PHILADELPHIA			8/9/1995		39.915	-75.20306	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	0.3	10	15	168
4836039.91444-75.20306	376	Point	48360	PHILADELPHIA		PHILADELPHIA			8/2/1995		39.91444	-75.20306	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	0	0		FALSE	0.1	10	15	168
48351539.915-75.19222	377	Point	483515	PHILADELPHIA	PHILADELPHIA				2/11/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48349339.915-75.19222	378	Point	483493	PHILADELPHIA	PHILADELPHIA				2/13/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48349239.915-75.19222	379	Point	483492	PHILADELPHIA	PHILADELPHIA				2/12/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48349139.915-75.19222	380	Point	483491	PHILADELPHIA	PHILADELPHIA				2/10/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48349039.915-75.19222	381	Point	483490	PHILADELPHIA	PHILADELPHIA				2/11/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48348939.915-75.19222	382	Point	483489	PHILADELPHIA	PHILADELPHIA				2/17/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48348839.915-75.19222	383	Point	483488	PHILADELPHIA	PHILADELPHIA				2/18/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				
48348739.915-75.19222	384	Point	483487	PHILADELPHIA	PHILADELPHIA				2/10/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	44	0	0	0		FALSE				
48348639.915-75.19222	385	Point	483486	PHILADELPHIA	PHILADELPHIA				2/6/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48348439.915-75.19222	386	Point	483484	PHILADELPHIA	PHILADELPHIA				2/4/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	42	0	0	0		FALSE				
48348339.915-75.19222	387	Point	483483	PHILADELPHIA	PHILADELPHIA				1/27/2009	NEW WELL	39.915	-75.19222	PARRATT-WOLFF INC	SUNOCO	INJECTION	UNKNOWN	40	0	0	0		FALSE				

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
48235439.9145-75.2172	388	Point	482354	PHILADELPHIA	PHILADELPHIA		6310 Passayunk Ave. Phila. Pa		8/13/2010	NEW WELL	39.9145	-75.2172	B L MYERS BROS. OF PA. INC.	121 Point Breeze Terminal	MONITORING	OTHER	15	0	5	2		FALSE				
4820439.92806-75.21028	389	Point	48204	PHILADELPHIA		PHILADELPHIA			2/25/1994		39.92806	-75.21028	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	85	0	75	2		FALSE				
4820339.91944-75.19972	390	Point	48203	PHILADELPHIA		PHILADELPHIA			3/4/1994		39.91944	-75.19972	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	99	0	89	2		FALSE				
4820239.91556-75.20278	391	Point	48202	PHILADELPHIA		PHILADELPHIA			8/10/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	0.2	8	15	168
4820139.91556-75.20278	392	Point	48201	PHILADELPHIA		PHILADELPHIA			8/18/1995		39.91556	-75.20278	UNKNOWN	SUN COMPANY	WITHDRAWAL	OTHER	18	0	8	6		FALSE	4	8	15	168
4820039.90889-75.20528	393	Point	48200	PHILADELPHIA		PHILADELPHIA			3/2/1994		39.90889	-75.20528	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	64	0	54	2		FALSE				
4819939.90667-75.19444	394	Point	48199	PHILADELPHIA		PHILADELPHIA			3/14/1994		39.90667	-75.19444	EMPIRE SOILS INVESTIGATIONS INC	SUN COMPANY	OBSERVATION	UNUSED	130	0	120	2		FALSE				
4819839.88528-75.21278	395	Point	48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	55	8		FALSE	6			
4819839.88528-75.21278	396	Point	48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	102	4		FALSE	6			
4819839.88528-75.21278	397	Point	48198	PHILADELPHIA		PHILADELPHIA			2/2/1994		39.88528	-75.21278	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	114	0	14	12		FALSE	6			
4819739.88472-75.21861	398	Point	48197	PHILADELPHIA		PHILADELPHIA			2/16/1994		39.88472	-75.21861	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	128	0	78	8		FALSE	6			
4819739.88472-75.21861	399	Point	48197	PHILADELPHIA		PHILADELPHIA			2/16/1994		39.88472	-75.21861	CHESAPEAKE GEOSYSTEMS INC.	PHILA DEPT OF AVIATION	OBSERVATION	UNUSED	128	0	116	4		FALSE	6			
48194239.91521-75.20211	400	Point	481942	PHILADELPHIA	PHILADELPHIA				5/21/2010	NEW WELL	39.91521	-75.20211	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
48179939.91602-75.20011	401	Point	481799	PHILADELPHIA	PHILADELPHIA				6/11/2010	NEW WELL	39.91602	-75.20011	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
48179839.91584-75.2014	402	Point	481798	PHILADELPHIA	PHILADELPHIA				5/12/2010	NEW WELL	39.91584	-75.2014	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
48179339.91435-75.19581	403	Point	481793	PHILADELPHIA	PHILADELPHIA				5/19/2010	NEW WELL	39.91435	-75.19581	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	32	0	17	4		FALSE		18		
48179239.91671-75.19776	404	Point	481792	PHILADELPHIA	PHILADELPHIA				5/20/2010	NEW WELL	39.91671	-75.19776	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		21		
48179139.91709-75.20012	405	Point	481791	PHILADELPHIA	PHILADELPHIA				6/8/2010	NEW WELL	39.91709	-75.20012	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	25	0	10	4		FALSE		14		
48179039.91783-75.19931	406	Point	481790	PHILADELPHIA	PHILADELPHIA				5/25/2010	NEW WELL	39.91783	-75.19931	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	5	4		FALSE		10		
48178939.92019-75.19679	407	Point	481789	PHILADELPHIA	PHILADELPHIA				5/26/2010	NEW WELL	39.92019	-75.19679	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	40	0	25	4		FALSE		31		
48178739.91913-75.20033	408	Point	481787	PHILADELPHIA	PHILADELPHIA				6/16/2010	NEW WELL	39.91913	-75.20033	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	10	4		FALSE		10		
48178239.90987-75.20477	409	Point	481782	PHILADELPHIA	PHILADELPHIA				5/18/2010	NEW WELL	39.90987	-75.20477	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	24	0	9	4		FALSE		13		
48178139.91163-75.20079	410	Point	481781	PHILADELPHIA	PHILADELPHIA				5/1/2010	NEW WELL	39.91163	-75.20079	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	25	0	10	4		FALSE		15		
48177839.90982-75.21231	411	Point	481778	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90982	-75.21231	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		8		
48177639.9061-75.21426	412	Point	481776	PHILADELPHIA	PHILADELPHIA				5/26/2010	NEW WELL	39.9061	-75.21426	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	11	0	1	4		FALSE		1		
48177039.90672-75.21071	413	Point	481770	PHILADELPHIA	PHILADELPHIA				5/27/2010	NEW WELL	39.90672	-75.21071	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
48176439.90485-75.20739	414	Point	481764	PHILADELPHIA	PHILADELPHIA				6/15/2010	NEW WELL	39.90485	-75.20739	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
48176339.90421-75.20569	415	Point	481763	PHILADELPHIA	PHILADELPHIA				6/3/2010	NEW WELL	39.90421	-75.20569	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE				
48176239.90896-75.20578	416	Point	481762	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.90896	-75.20578	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	15	0	5	4		FALSE		5		
48176139.91001-75.20656	417	Point	481761	PHILADELPHIA	PHILADELPHIA				6/2/2010	NEW WELL	39.91001	-75.20656	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	6	4		FALSE		7		
48133239.91354-75.22156	418	Point	481332	PHILADELPHIA	PHILADELPHIA		6850 Essington Ave	19019	10/13/2011	NEW WELL	39.91354	-75.22156	ENVIRONMENTAL PROBING INVESTIGATIONS INC	Oil	MONITORING	INDUSTRIAL	26	0	1	4		TRUE	1	1		60
48122939.9216-75.21833	419	Point	481229	PHILADELPHIA			3062 South 61st.Street Philadelphia Pa		8/10/2009	NEW WELL	39.9216	-75.21833	B L MYERS BROS. OF PA. INC.	Essington Ave Partners II L.P.	MONITORING	OTHER	30	0	10	2		FALSE				
48102339.91602-75.20174	420	Point	481023	PHILADELPHIA	PHILADELPHIA				5/12/2010	NEW WELL	39.91602	-75.20174	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		20		
48102139.91585-75.19702	421	Point	481021	PHILADELPHIA	PHILADELPHIA				6/8/2010	NEW WELL	39.91585	-75.19702	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	30	0	15	4		FALSE		30		
48102039.91846-75.20013	422	Point	481020	PHILADELPHIA	PHILADELPHIA				5/5/2010	NEW WELL	39.91846	-75.20013	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	36	0	21	4		FALSE		24		
48101839.91921-75.19765	423	Point	481018	PHILADELPHIA	PHILADELPHIA				6/9/2010	NEW WELL	39.91921	-75.19765	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	26	0	11	4		FALSE		16		
48101639.90708-75.20293	424	Point	481016	PHILADELPHIA	PHILADELPHIA				6/16/2010	NEW WELL	39.90708	-75.20293	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	16	0	6	4		FALSE		6		
48101339.91004-75.20221	425	Point	481013	PHILADELPHIA	PHILADELPHIA				5/14/2010	NEW WELL	39.91004	-75.20221	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	20	0	5	4		FALSE		8		
48100239.90545-75.21198	426	Point	481002	PHILADELPHIA	PHILADELPHIA				5/27/2010	NEW WELL	39.90545	-75.21198	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	12	0	2	4		FALSE		2		
48099439.90693-75.20995	427	Point	480994	PHILADELPHIA	PHILADELPHIA				6/10/2010	NEW WELL	39.90693	-75.20995	PARRATT-WOLFF INC	SUNOCO	MONITORING	UNKNOWN	14	0	4	4		FALSE		4		
47977039.91889-75.19167	428	Point	479770	PHILADELPHIA					8/5/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47941539.91889-75.19167	429	Point	479415	PHILADELPHIA					8/12/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47888939.91806-75.19167	430	Point	478889	PHILADELPHIA					8/13/2008	NEW WELL	39.91806	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47888639.91556-75.19361	431	Point	478886	PHILADELPHIA					8/27/2008	NEW WELL	39.91556	-75.19361	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
47885339.91917-75.19167	432	Point	478853	PHILADELPHIA					7/31/2008	NEW WELL	39.91917	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47885239.91917-75.19167	433	Point	478852	PHILADELPHIA					7/30/2008	NEW WELL	39.91917	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47866739.91583-75.19528	434	Point	478667	PHILADELPHIA					8/27/2008	NEW WELL	39.91583	-75.19528	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
47864839.91944-75.19167	435	Point	478648	PHILADELPHIA					7/29/2008	NEW WELL	39.91944	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	36	0	0	0		FALSE				
47809839.94556-75.19889	436	Point	478098	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		10/29/2008	NEW WELL	39.94556	-75.19889	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	0	0	9	FALSE	0.75	22		
47809839.94556-75.19889	437	Point	478098	PHILADELPHIA	PHILADELPHIA		UNIVERSITY AVENUE		10/29/2008	NEW WELL	39.94556	-75.19889	C S GARBER & SONS INC	PHILADELPHIA V.A. HOSPITAL	MONITORING	UNKNOWN	30	0	5	2	9	FALSE	0.75	22		
47782439.93593-75.21456	438	Point	477824	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93593	-75.21456	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	33	0	0	0		FALSE				
47782339.93483-75.21365	439	Point	477823	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93483	-75.21365	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	26	0	0	0		FALSE				
47782139.93588-75.2148	440	Point	477821	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93588	-75.2148	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	15	0	0	0		FALSE				
47781939.93598-75.214	441	Point	477819	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93598	-75.214	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	40	0	0	0		FALSE				
47774539.9396-75.1916	442	Point	477745	PHILADELPHIA	PHILADELPHIA		30th Street & Grays Ferry Ave. Phila. Pa		2/9/2011	NEW WELL	39.9396	-75.1916	B L MYERS BROS. OF PA. INC.	The Grays Ferry Shopping Center	MONITORING	UNKNOWN	36	0	16	2		FALSE				
47757039.9399-75.1913	443	Point	477570	PHILADELPHIA	PHILADELPHIA		30th Street & Grays Ferry Ave. Phila. Pa		2/9/2011	NEW WELL	39.9399	-75.1913	B L MYERS BROS. OF PA. INC.	The Grays Ferry Shopping Center	MONITORING	UNKNOWN	35	0	20	2		FALSE				
47716539.93556-75.21501	444	Point	477165	PHILADELPHIA	PHILADELPHIA		5201 Grays Ave Philadelphia	19143	4/1/2011	WELL ABANDONMENT	39.93556	-75.21501	ODYSSEY ENVIRONMENTAL SERVICES INC.	M A Bruder & Sons	MONITORING	UNKNOWN	31	0	0	0		FALSE				
47603139.8992-75.2265	445	Point	476031	PHILADELPHIA	PHILADELPHIA		1952 Bryn Mawr Ave. Phila. PA		9/29/2011	NEW WELL	39.8992	-75.2265	B L MYERS BROS. OF PA. INC.	Former Bill's Auto	MONITORING	UNKNOWN	20	0	10	2		FALSE				
47599439.93008-75.20006	446	Point	475994	PHILADELPHIA	PHILADELPHIA				9/13/2011	NEW WELL	39.93008	-75.20006	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		22		
47599339.93133-75.2003	447	Point	475993	PHILADELPHIA	PHILADELPHIA				9/14/2011	NEW WELL	39.93133	-75.2003	PARRATT-WOLFF INC	SAIC	MONITORING	UNKNOWN	33	0	23	2		TRUE		22		
47528339.93166-75.20069	448	Point	475283	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93166	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
47517139.93162-75.20051	449	Point	475171	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93162	-75.20051	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
47517039.93143-75.20034	450	Point	475170	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93143	-75.20034	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
47516939.93176-75.20069	451	Point	475169	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93176	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
47516839.93166-75.20069	452	Point	475168	PHILADELPHIA	PHILADELPHIA		1851 S 34TH ST.	19145	5/23/2011	NEW WELL	39.93166	-75.20069	EICHELBERGERS INC.	VERIZON- PHILA	WITHDRAWAL	UNUSED	33	0	30	2		TRUE				
47451539.91889-75.19167	453	Point	474515	PHILADELPHIA					8/5/2008	NEW WELL	39.91889	-75.19167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	35	0	0	0		FALSE				
47393339.93655-75.21016	454	Point	473933	PHILADELPHIA	PHILADELPHIA		1630	19143	11/21/2010	NEW WELL	39.93655	-75.21016	ENVIRONMENTAL PROBING INVESTIGATIONS INC	hess	MONITORING	INDUSTRIAL	23	0	3	4		TRUE	1	6		30
42457839.93139-75.20306	455	Point	424578	PHILADELPHIA	PHILADELPHIA				6/13/2008	NEW WELL	39.93139	-75.20306	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42457739.92611-75.20778	456	Point	424577	PHILADELPHIA	PHILADELPHIA				5/13/2008	NEW WELL	39.92611	-75.20778	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
42457639.92417-75.20028	457	Point	424576	PHILADELPHIA	PHILADELPHIA				6/17/2008	NEW WELL	39.92417	-75.20028	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
42457239.92833-75.20194	458	Point	424572	PHILADELPHIA	PHILADELPHIA				6/20/2008	NEW WELL	39.92833	-75.20194	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	22	0	0	0		FALSE				
42457139.9275-75.20111	459	Point	424571	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.9275	-75.20111	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
42457039.92833-75.20111	460	Point	424570	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.92833	-75.20111	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
42456539.92361-75.20167	461	Point	424565	PHILADELPHIA	PHILADELPHIA				7/1/2008	NEW WELL	39.92361	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
42456339.90194-75.23833	462	Point	424563	PHILADELPHIA	PHILADELPHIA		4101 ISLAND AVENUE	19153	11/9/2007	NEW WELL	39.90194	-75.23833	ENVIRONMENTAL PROBING INVESTIGATIONS INC	SHERATON HOTEL	MONITORING	INDUSTRIAL	18	0	8	2		TRUE	1	8		30
42452439.90194-75.23833	463	Point	424524	PHILADELPHIA	PHILADELPHIA		4101 ISLAND AVENUE	19153	11/9/2007	NEW WELL	39.90194	-75.23833	ENVIRONMENTAL PROBING INVESTIGATIONS INC	SHERATON HOTEL	MONITORING	INDUSTRIAL	17	0	7	2		TRUE	1	8		30
42451439.9325-75.20306	464	Point	424514	PHILADELPHIA	PHILADELPHIA				6/19/2008	NEW WELL	39.9325	-75.20306	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	28	0	0	0		FALSE				
42451339.92833-75.19972	465	Point	424513	PHILADELPHIA	PHILADELPHIA				6/5/2008	NEW WELL	39.92833	-75.19972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
42451239.92861-75.20194	466	Point	424512	PHILADELPHIA	PHILADELPHIA				6/5/2008	NEW WELL	39.92861	-75.20194	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42451139.92667-75.2025	467	Point	424511	PHILADELPHIA	PHILADELPHIA				6/4/2008	NEW WELL	39.92667	-75.2025	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42451039.93-75.20028	468	Point	424510	PHILADELPHIA	PHILADELPHIA				6/2/2008	NEW WELL	39.93	-75.20028	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
42450939.92667-75.20167	469	Point	424509	PHILADELPHIA	PHILADELPHIA				5/23/2008	NEW WELL	39.92667	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42450839.92361-75.20278	470	Point	424508	PHILADELPHIA	PHILADELPHIA				5/28/2008	NEW WELL	39.92361	-75.20278	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	34	0	0	0		FALSE				
42450739.9275-75.2	471	Point	424507	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.9275	-75.2	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42450639.92528-75.20167	472	Point	424506	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.92528	-75.20167	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
42450539.92806-75.20222	473	Point	424505	PHILADELPHIA	PHILADELPHIA				5/29/2008	NEW WELL	39.92806	-75.20222	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42450439.92583-75.19444	474	Point	424504	PHILADELPHIA	PHILADELPHIA				5/22/2008	NEW WELL	39.92583	-75.19444	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42450339.92472-75.20667	475	Point	424503	PHILADELPHIA	PHILADELPHIA				5/13/2008	NEW WELL	39.92472	-75.20667	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				
42449039.92722-75.20722	476	Point	424490	PHILADELPHIA	PHILADELPHIA				7/9/2008	NEW WELL	39.92722	-75.20722	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42448739.92889-75.19917	477	Point	424487	PHILADELPHIA	PHILADELPHIA				6/16/2008	NEW WELL	39.92889	-75.19917	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42447939.92778-75.20056	478	Point	424479	PHILADELPHIA	PHILADELPHIA				6/9/2008	NEW WELL	39.92778	-75.20056	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42447839.92611-75.20139	479	Point	424478	PHILADELPHIA	PHILADELPHIA				6/6/2008	NEW WELL	39.92611	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	30	0	0	0		FALSE				
42447739.92639-75.19889	480	Point	424477	PHILADELPHIA	PHILADELPHIA				5/22/2008	NEW WELL	39.92639	-75.19889	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42447639.925-75.1975	481	Point	424476	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.925	-75.1975	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	20	0	0	0		FALSE				
42447539.925-75.19639	482	Point	424475	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.925	-75.19639	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				
42447439.92583-75.20139	483	Point	424474	PHILADELPHIA	PHILADELPHIA				5/21/2008	NEW WELL	39.92583	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42447339.92417-75.20139	484	Point	424473	PHILADELPHIA	PHILADELPHIA				5/20/2008	NEW WELL	39.92417	-75.20139	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	26	0	0	0		FALSE				

Appendix N
PAGWIS Well Search
Philadelphia Refining Complex, 1 Mile Radius
AOI 4 Remedial Investigation Report
Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
42447239.925-75.20333	485	Point	424472	PHILADELPHIA	PHILADELPHIA				5/20/2008	NEW WELL	39.925	-75.20333	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
42447139.92306-75.20389	486	Point	424471	PHILADELPHIA	PHILADELPHIA				5/16/2008	NEW WELL	39.92306	-75.20389	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	32	0	0	0		FALSE				
42447039.92361-75.21	487	Point	424470	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92361	-75.21	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
42446939.92278-75.20972	488	Point	424469	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92278	-75.20972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
42446839.92194-75.20944	489	Point	424468	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92194	-75.20944	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	14	0	0	0		FALSE				
42446739.92528-75.20417	490	Point	424467	PHILADELPHIA	PHILADELPHIA				5/15/2008	NEW WELL	39.92528	-75.20417	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42446639.92694-75.21083	491	Point	424466	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92694	-75.21083	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42446239.92778-75.20972	492	Point	424462	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92778	-75.20972	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	18	0	0	0		FALSE				
42446139.92722-75.2075	493	Point	424461	PHILADELPHIA	PHILADELPHIA				5/14/2008	NEW WELL	39.92722	-75.2075	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	25	0	0	0		FALSE				
42445739.92472-75.20917	494	Point	424457	PHILADELPHIA	PHILADELPHIA				6/18/2008	NEW WELL	39.92472	-75.20917	PARRATT-WOLFF INC	SUNOCO	WITHDRAWAL	UNKNOWN	15	0	0	0		FALSE				
41674239.92167-75.22472	495	Point	416742	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	15	0	5	2		TRUE				
41674139.92167-75.22472	496	Point	416741	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	20	0	5	2		TRUE				
41673139.92167-75.22472	497	Point	416731	PHILADELPHIA	PHILADELPHIA		67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	25	0	10	2		TRUE				
41673039.92167-75.22472	498	Point	416730	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	20	0	15	2		TRUE				
41672939.92167-75.22472	499	Point	416729	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	35	0	25	2		TRUE				
41672839.92167-75.22472	500	Point	416728	PHILADELPHIA			67TH ST & ESSINGTON AVE	19153	4/28/2006	NEW WELL	39.92167	-75.22472	EICHELBERGERS INC.	ESSINGTON CORVEST PATRIOT L.P.		UNUSED	25	0	10	2		TRUE				
3047039.93972-75.19167	501	Point	30470	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.93972	-75.19167	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	100	0	0	12		FALSE	50	20		
3047039.93972-75.19167	502	Point	30470	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.93972	-75.19167	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	100	0	80	8		FALSE	50	20		
3046839.93944-75.19944	503	Point	30468	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974		39.93944	-75.19944	THOMAS G KEYES INC	SEABOARD SUPPLY CO	UNUSED	UNUSED	160	0	46	6		FALSE	50		159	1
3046839.93944-75.19944	504	Point	30468	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974		39.93944	-75.19944	THOMAS G KEYES INC	SEABOARD SUPPLY CO	UNUSED	UNUSED	160	0	46	6		FALSE	11.1		43	2
3046739.93944-75.19139	505	Point	30467	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1934		39.93944	-75.19139	ARTESIAN WELL DRLG CO	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	80	0	80	12		FALSE	115	33		
3046239.93722-75.20389	506	Point	30462	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.93722	-75.20389	RIDPATH AND POTTER COMPANY	ZUCKERMAN & HONICKMA	UNUSED	UNUSED	300	0	18	8		FALSE	78	9.89		
3046039.93667-75.19917	507	Point	30460	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/27/1936		39.93667	-75.19917	RIDPATH AND POTTER COMPANY	COCA-COLA BOTTLING C	DESTROYED	UNUSED	383	0	50	8		FALSE	120	25	85	
3044639.92806-75.20306	508	Point	30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	20		FALSE	201	20.98709	42.6	
3044639.92806-75.20306	509	Point	30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	16		FALSE	201	20.98709	42.6	
3044639.92806-75.20306	510	Point	30446	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.92806	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	54	12		FALSE	201	20.98709	42.6	
3044439.92667-75.20333	511	Point	30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	0	16		FALSE		23		
3044439.92667-75.20333	512	Point	30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	58	12		FALSE		23		
3044439.92667-75.20333	513	Point	30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	0	16		FALSE	300			
3044439.92667-75.20333	514	Point	30444	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1948		39.92667	-75.20333	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	78	0	58	12		FALSE	300			
3044339.92639-75.20389	515	Point	30443	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.92639	-75.20389	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	6		FALSE	325			
3044339.92639-75.20389	516	Point	30443	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1904		39.92639	-75.20389	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	120		FALSE	325			
3044239.92611-75.185	517	Point	30442	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/1/1936		39.92611	-75.185	RIDPATH AND POTTER COMPANY	PRESIDENT THEATER	UNUSED	UNUSED	86	0	65	8		FALSE	15	29.1	31.6	2
3044239.92611-75.185	518	Point	30442	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/1/1936		39.92611	-75.185	RIDPATH AND POTTER COMPANY	PRESIDENT THEATER	UNUSED	UNUSED	86	0	65	8		FALSE	90			
3043939.92583-75.2025	519	Point	30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE	614			
3043939.92583-75.2025	520	Point	30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE		10.6		
3043939.92583-75.2025	521	Point	30439	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/15/1946		39.92583	-75.2025	RIDPATH AND POTTER COMPANY	ATLANTIC REFINING CO	UNUSED	UNUSED	78	0	60	10		FALSE	64	11.23158	14.6	1
3043139.92278-75.19972	522	Point	30431	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.92278	-75.19972	UNKNOWN	PHILA GAS WORKS	UNUSED	UNUSED	360	0	132	6		FALSE	19	31.7814	36.2	2
3043139.92278-75.19972	523	Point	30431	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.92278	-75.19972	UNKNOWN	PHILA GAS WORKS	UNUSED	UNUSED	360	0	132	6		FALSE	120	29.4		
3043039.92222-75.19722	524	Point	30430	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1933		39.92222	-75.19722	ARTESIAN WELL DRLG CO	MIRTO CULLET SUPPLY	DESTROYED	UNUSED	66	0	66	6		FALSE	45	32		
3042239.9175-75.18222	525	Point	30422	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1912		39.9175	-75.18222	THOMAS B HARPER	GIRARD ESTATE	UNUSED	UNUSED	612	0	153	8		FALSE	120	22.3		
3042139.91639-75.23472	526	Point	30421	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/20/1976		39.91639	-75.23472	UNKNOWN	CITY OF PHILA	OBSERVATION	UNUSED	25	0	20	1.5		FALSE	0.08	15.5	23.5	2
3041439.91222-75.19972	527	Point	30414	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1903		39.91222	-75.19972	THOMAS B HARPER	PRINTZ DEGREASING CO	DESTROYED	UNUSED	253	0	106	6		FALSE	60	14		
3040439.90833-75.23194	528	Point	30404	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/2/1946		39.90833	-75.23194	UNKNOWN	HOG ISLAND LUMBER CO	DESTROYED	UNUSED	97	0	0	6		FALSE	1.5	16	58.5	
3040239.90806-75.18056	529	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	24		FALSE		10.2		
3040239.90806-75.18056	530	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	117	10		FALSE		10.2		
3040239.90806-75.18056	531	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	24		FALSE	560	24	44	
3040239.90806-75.18056	532	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	16		FALSE		10.2		
3040239.90806-75.18056	533	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	0	16		FALSE	560	24	44	
3040239.90806-75.18056	534	Point	30402	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/11/1942		39.90806	-75.18056	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	142	0	117	10		FALSE	560	24	44	
3040039.90722-75.17722	535	Point	30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	0	24		FALSE	440	28.2		
3040039.90722-75.17722	536	Point	30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	107	10		FALSE	440	28.2		
3040039.90722-75.17722	537	Point	30400	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/7/1942		39.90722	-75.17722	LAYNE CHRISTENSEN COMPANY	U S NAVAL HOSPITAL	DESTROYED	UNUSED	132	0	0	16		FALSE	440	28.2		
3039939.90278-75.20194	538	Point	30399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	0	12		FALSE	420	11.6		4
3039939.90278-75.20194	539	Point	30399	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE	420	11.6		4
3039839.90278-75.20194	540	Point	30398	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE	310		35	
3039839.90278-75.20194	541	Point	30398	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1946		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	WITHDRAWAL	INDUSTRIAL	82	0	72	6		FALSE		11.9		
3039739.90083-75.18028	542	Point	30397	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90083	-75.18028	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	82	0	0	6		FALSE	100	9.4		
3039639.90028-75.17889	543	Point	30396	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90028	-75.17889	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	0	0	0	6		FALSE	100			
3039139.89667-75.18306	544	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE		19.2		
3039139.89667-75.18306	545	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE	725		80	
3039139.89667-75.18306	546	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE		19.2		
3039139.89667-75.18306	547	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE		19.2		
3039139.89667-75.18306	548	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	18		FALSE	17.6		20.2	1
3039139.89667-75.18306	549	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE	17.6		20.2	1
3039139.89667-75.18306	550	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE	17.6		20.2	1
3039139.89667-75.18306	551	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	0	30		FALSE	725		80	
3039139.89667-75.18306	552	Point	30391	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/20/1942		39.89667	-75.18306	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	163	0	138	12		FALSE	725		80	
3037639.88972-75.18556	553	Point	30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	0	30		FALSE	735	28.4		
3037639.88972-75.18556	554	Point	30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	148	12		FALSE	735	28.4		
3037639.88972-75.18556	555	Point	30376	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/21/1942		39.88972	-75.18556	LAYNE CHRISTENSEN COMPANY	U S NAVY	UNUSED	UNUSED	173	0	0	18		FALSE	735	28.4		
3037439.88833-75.22083	556	Point	30374	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88833	-75.22083	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	10	12		FALSE				
2993739.94417-75.20667	557	Point	29937	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.94417	-75.20667	THOMAS B HARPER	BREYER ICE CREAM CO	DESTROYED	UNUSED	393	0	56	8		FALSE	100	20		
2993739.94417-75.20667	558	Point	29937	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.94417	-75.20667	JOHN RULON	BREYER ICE CREAM CO	DESTROYED	UNUSED	393	0	0	0		FALSE	100	20		
2993039.94222-75.20444	559	Point	29930	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1914		39.94222	-75.20444	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	47	0	11	6		FALSE	50	20		
2992739.94194-75.20472	560	Point	29927	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.94194	-75.20472	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	40	0	40	8		FALSE	37	18		
2992639.94167-75.20472	561	Point	29926	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.94167	-75.20472	THOMAS B HARPER	F G VOGT & SONS	DESTROYED	UNUSED	102	0	38	8		FALSE		18		
2992539.94167-75.2025	562	Point	29925	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			2/1/1931		39.94167	-75.2025	JOHN RULON	PHILA ABATTOIR CO	UNUSED	UNUSED	31	0	0	16		FALSE	60	4.56		
2992439.94167-75.19194	563	Point	29924	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1929		39.94167	-75.19194	ARTESIAN WELL DRLG CO	HYMAN BRODSKY & SON	DESTROYED	UNUSED	65	0	65	8		FALSE	300	11		
2992039.94083-75.19139	564	Point	29920	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/19/1938		39.94083	-75.19139	RIDPATH AND POTTER COMPANY	VICTOR DAIRIES INC	UNUSED	UNUSED	490	0	21	8		FALSE	10	19	124	7.5
2991839.93944-75.19139	565	Point	29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	0	16		FALSE		34		
2991839.93944-75.19139	566	Point	29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	79	10		FALSE		34		
2991839.93944-75.19139	567	Point	29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	0	16		FALSE	185	34.18841	61	
2991839.93944-75.19139	568	Point	29918	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1930		39.93944	-75.19139	JOHN RULON	HENRY BOWER CHEMICAL	DESTROYED	UNUSED	130	0	79	10		FALSE	185	34.18841	61	
2991739.93917-75.185	569	Point	29917	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/1/1940		39.93917	-75.185	JOHN RULON	PA RANGE & BOILER CO	DESTROYED	UNUSED	78	0	0	6		FALSE	12			
2991639.93861-75.18556	570	Point	29916	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1902		39.93861	-75.18556	THOMAS B HARPER	AMERICAN ICE CO	DESTROYED	UNUSED	487	0	72	8		FALSE	75	40		
2991539.93833-75.20389	571	Point	29915	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			11/25/1949		39.93833	-75.20389	KOHL BROS. INC.	ANDERSON INC	DESTROYED	UNUSED	404	0	48	6		FALSE	50	40		
2990539.93722-75.20083	572	Point	29905	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			4/24/1951		39.93722	-75.20083	RIDPATH AND POTTER COMPANY	MILLAR BROS & CO	UNUSED	UNUSED	230	0	54	8		FALSE	80	20.7		
2990439.93694-75.19833	573	Point	29904	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1934		39.93694	-75.19833	ARTESIAN WELL DRLG CO	PURITAN LOOMS	DESTROYED	UNUSED	58	0	58	12		FALSE	180	19		
2990139.93611-75.20694	574	Point	29901	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1905		39.93611	-75.20694	QUINN & HERRON	CITY OF PHILA	DESTROYED	UNUSED	442	0	28	8		FALSE	100	5		
2990039.93583-75.19056	575	Point	29900	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/3/1940		39.93583	-75.19056	LAYNE CHRISTENSEN COMPANY	EARL THEATER	DESTROYED	UNUSED	51	0	0	12		FALSE	114	33.875	41	
2990039.93583-75.19056	576	Point	29900	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/3/1940		39.93583	-75.19056	LAYNE CHRISTENSEN COMPANY	EARL THEATER	DESTROYED	UNUSED	51	0	41	8		FALSE	114	33.875	41	
2989839.93556-75.21222	577	Point	29898	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1902		39.93556	-75.21222	THOMAS B HARPER	JOS RYERSON & SON IN	DESTROYED	UNUSED	200	0	9	8		FALSE	40	25		
2989639.93528-75.2125	578	Point	29896	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.93528	-75.2125	THOMAS B HARPER	JOS RYERSON & SON IN	DESTROYED	UNUSED	528	0	0	8		FALSE	50			
2989539.935-75.19917	579	Point	29895	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1897		39.935	-75.19917	THOMAS B HARPER	EDMUND WEBSTERS BRIC	DESTROYED	UNUSED	68	0	0	8		FALSE				
2989439.935-75.18722	580	Point	29894	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.935	-75.18722	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	1400	0	85	10		FALSE	15	27		
2989339.93472-75.18667	581	Point	29893	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1920		39.93472	-75.18667	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	490	0	80	8		FALSE	18	22		

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
2989239.93444-75.18694	582	Point	29892	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.93444	-75.18694	THOMAS B HARPER	FLEISHER IND CENTER	DESTROYED	UNUSED	580	0	83	8		FALSE	60	20		
2988639.93194-75.18639	583	Point	29886	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1916		39.93194	-75.18639	ARTESIAN WELL DRLG CO	AMERICAN ICE CO	DESTROYED	UNUSED	90	0	70	6		FALSE	50			
2988139.92944-75.18528	584	Point	29881	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92944	-75.18528	UNKNOWN	BREEZE THEATER	DESTROYED	UNUSED	70	0	60	8		FALSE	47	41.2		
2987739.92722-75.20667	585	Point	29877	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1977		39.92722	-75.20667	UNKNOWN	ATLANTIC RICHFIELD C	OBSERVATION	UNUSED	18	0	9	12		FALSE		12		
2987639.92722-75.20306	586	Point	29876	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92722	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	0	0		FALSE				
2987539.92694-75.205	587	Point	29875	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/1/1979		39.92694	-75.205	UNKNOWN	ATLANTIC RICHFIELD C	OBSERVATION	UNUSED	25.4	0	16.4	16		FALSE		1.39		
2986539.925-75.20667	588	Point	29865	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.925	-75.20667	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	66	16		FALSE				
2986539.925-75.20667	589	Point	29865	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1921		39.925	-75.20667	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	76	0	0	20		FALSE				
2986339.92472-75.20639	590	Point	29863	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.20639	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	104	0	0	18		FALSE		18.7		
2986339.92472-75.20639	591	Point	29863	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.20639	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	104	0	0	24		FALSE		18.7		
2986239.92472-75.19889	592	Point	29862	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92472	-75.19889	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	94	0	0	0		FALSE				
2986039.92444-75.20583	593	Point	29860	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1933		39.92444	-75.20583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	68	0	62	60		FALSE	200	6.5		
2985739.92389-75.20278	594	Point	29857	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92389	-75.20278	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	95	0	0	0		FALSE				
2985539.92333-75.21972	595	Point	29855	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/24/1947		39.92333	-75.21972	RIDPATH AND POTTER COMPANY	REGAL PETROLEUM PROD	DESTROYED	UNUSED	351	0	22	8		FALSE	153	4	78.7	7.5
2984939.92167-75.18889	596	Point	29849	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.92167	-75.18889	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	215	0	96	6		FALSE	70			
2984839.92167-75.18861	597	Point	29848	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1908		39.92167	-75.18861	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	240	0	90	6		FALSE	60			
2984539.92139-75.18889	598	Point	29845	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1923		39.92139	-75.18889	QUINN & HERRON	JARDIN BRICK CO	DESTROYED	UNUSED	250	0	96	6		FALSE	50			
2984039.92083-75.19278	599	Point	29840	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1930		39.92083	-75.19278	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	150	0	95	16		FALSE		34		
2984039.92083-75.19278	600	Point	29840	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1930		39.92083	-75.19278	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	150	0	95	16		FALSE	30			
2983239.92056-75.1925	601	Point	29832	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1925		39.92056	-75.1925	LAYNE CHRISTENSEN COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	90	0	0	38		FALSE	300	20	35	
2983239.92056-75.1925	602	Point	29832	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1925		39.92056	-75.1925	LAYNE CHRISTENSEN COMPANY	ATLANTIC REFINING CO	DESTROYED	UNUSED	90	0	56	26		FALSE	300	20	35	
2983139.92028-75.19417	603	Point	29831	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92028	-75.19417	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	85	0	0	40		FALSE				
2983139.92028-75.19417	604	Point	29831	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92028	-75.19417	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	85	0	62	24		FALSE				
2982739.92-75.19333	605	Point	29827	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92	-75.19333	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	97	0	75	20		FALSE				
2982739.92-75.19333	606	Point	29827	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.92	-75.19333	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	97	0	77	16		FALSE				
2982439.91944-75.19583	607	Point	29824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1937		39.91944	-75.19583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	0	20		FALSE	300	20		
2982439.91944-75.19583	608	Point	29824	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1937		39.91944	-75.19583	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	101	0	81	16		FALSE	300	20		
2981539.915-75.20306	609	Point	29815	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.915	-75.20306	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	0	0	0	0		FALSE				
2981339.91389-75.20917	610	Point	29813	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/5/1938		39.91389	-75.20917	RIDPATH AND POTTER COMPANY	WFIL TRANSMISSION ST	DESTROYED	UNUSED	71	0	62	6		FALSE	50	9	10	
2981239.91361-75.20028	611	Point	29812	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			<Null>		39.91361	-75.20028	UNKNOWN	ATLANTIC REFINING CO	DESTROYED	UNUSED	0	0	0	0		FALSE				
2980839.91083-75.19583	612	Point	29808	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			6/24/1987		39.91083	-75.19583	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	30	0	10	14		FALSE	225	12.5	20.2	337
2980539.90972-75.19111	613	Point	29805	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1914		39.90972	-75.19111	THOMAS B HARPER	BROOKE H	DESTROYED	UNUSED	0	0	72	8		FALSE	75	25		
2980339.90944-75.235	614	Point	29803	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1918		39.90944	-75.235	THOMAS B HARPER	PA FLEX MET TUBING C	DESTROYED	UNUSED	620	0	42	8		FALSE	60			
2980239.90944-75.19917	615	Point	29802	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/27/1987		39.90944	-75.19917	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	27	0	17	6		FALSE	5.45	23.9	27	22
2980139.90944-75.19861	616	Point	29801	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/28/1987		39.90944	-75.19861	AC SCHULTES INC	ARCO PETROLEUM PROD CO	WITHDRAWAL	OTHER	27	0	17	6		FALSE	3.5	24.2	27	30.5
2979139.90861-75.2125	617	Point	29791	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90861	-75.2125	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	106	0	0	2		FALSE				
2978939.90806-75.20917	618	Point	29789	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1936		39.90806	-75.20917	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	79	0	0	6		FALSE				
2978839.90806-75.19667	619	Point	29788	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1915		39.90806	-75.19667	ARTESIAN WELL DRLG CO	ATLANTIC REFINING CO	DESTROYED	UNUSED	74	0	0	6		FALSE	100	35.3		
2978139.90667-75.21222	620	Point	29781	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90667	-75.21222	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	90	0	0	2		FALSE				
2977939.90611-75.20833	621	Point	29779	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1936		39.90611	-75.20833	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	70	0	0	2		FALSE				
2977839.90444-75.21278	622	Point	29778	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1936		39.90444	-75.21278	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	73	0	0	2		FALSE				
2977739.90417-75.20944	623	Point	29777	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.90417	-75.20944	SPRAGUE & HENWOOD INC	GULF OIL CORP	DESTROYED	UNUSED	81	0	0	2		FALSE				
2977539.90278-75.20194	624	Point	29775	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/1/1936		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	98	0	0	12		FALSE	100			
2977539.90278-75.20194	625	Point	29775	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			8/1/1936		39.90278	-75.20194	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	98	0	88	6		FALSE	100			
2977339.9025-75.20889	626	Point	29773	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/1/1936		39.9025	-75.20889	JOHN RULON	GULF OIL CORP	DESTROYED	UNUSED	90	0	0	6		FALSE				
2977239.9025-75.20056	627	Point	29772	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/26/1940		39.9025	-75.20056	RIDPATH AND POTTER COMPANY	PA RAILROAD	DESTROYED	UNUSED	90.5	0	74	6		FALSE	170	6.33	36.8	
2977239.9025-75.20056	628	Point	29772	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			12/26/1940		39.9025	-75.20056	RIDPATH AND POTTER COMPANY	PA RAILROAD	DESTROYED	UNUSED	90.5	0	0	8		FALSE	170	6.33	36.8	
2977139.90222-75.17778	629	Point	29771	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90222	-75.17778	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	UNUSED	UNUSED	0	0	0	6		FALSE	100	12.7		
2976939.90111-75.17806	630	Point	29769	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1919		39.90111	-75.17806	ARTESIAN WELL DRLG CO	LEAGUE ISLAND PARK	DESTROYED	UNUSED	176	0	0	6		FALSE		31.4		
2976839.90056-75.17833	631	Point	29768	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1952		39.90056	-75.17833	RIDPATH AND POTTER COMPANY	LEAGUE ISLAND PARK	DESTROYED	UNUSED	71	0	71	6		FALSE	50	18.84211	32	
2976639.89694-75.19833	632	Point	29766	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1906		39.89694	-75.19833	THOMAS B HARPER	PA RAILROAD	DESTROYED	UNUSED	154	0	100	6		FALSE	6	20.3		
2976339.89611-75.21417	633	Point	29763	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89611	-75.21417	UNKNOWN	PENN DOT	OBSERVATION	OTHER	45	0	40	4		FALSE				
2975839.89528-75.19167	634	Point	29758	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			5/1/1942		39.89528	-75.19167	LAYNE CHRISTENSEN COMPANY	U S NAVY	DESTROYED	UNUSED	0	0	0	0		FALSE				
2975639.89222-75.2225	635	Point	29756	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89222	-75.2225	UNKNOWN	PENN DOT	OBSERVATION	OTHER	88	0	82	4		FALSE				
2975539.89222-75.2225	636	Point	29755	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.89222	-75.2225	UNKNOWN	PENN DOT	OBSERVATION	OTHER	34	0	29	4		FALSE				
2975339.89111-75.22306	637	Point	29753	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89111	-75.22306	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
2975139.89083-75.22333	638	Point	29751	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89083	-75.22333	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
2975039.89083-75.22306	639	Point	29750	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89083	-75.22306	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
2974939.89083-75.22111	640	Point	29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	0	6		FALSE		14		
2974939.89083-75.22111	641	Point	29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	75	4		FALSE		14		
2974939.89083-75.22111	642	Point	29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	0	6		FALSE	30			2
2974939.89083-75.22111	643	Point	29749	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	80	0	75	4		FALSE	30			2
2974839.89083-75.22111	644	Point	29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	18	4		FALSE	15			2
2974839.89083-75.22111	645	Point	29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	0	6		FALSE		14.1		
2974839.89083-75.22111	646	Point	29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	18	4		FALSE		14.1		
2974839.89083-75.22111	647	Point	29748	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.89083	-75.22111	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	23	0	0	6		FALSE	15			2
2974639.89056-75.22333	648	Point	29746	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			10/1/1981		39.89056	-75.22333	GRIFFIN WELL POINT	CITY OF PHILA	DESTROYED	UNUSED	40	0	20	12		FALSE	250			
2974539.89-75.22583	649	Point	29745	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1918		39.89	-75.22583	THOMAS B HARPER	PA RAILROAD	DESTROYED	UNUSED	49	0	41	8		FALSE	50	8		
2974439.88972-75.22194	650	Point	29744	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88972	-75.22194	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	27	0	10	12		FALSE				
2974339.88972-75.22167	651	Point	29743	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88972	-75.22167	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	32	0	10	12		FALSE				
2974239.88944-75.22222	652	Point	29742	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88944	-75.22222	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	29	0	10	12		FALSE				
2974139.88917-75.22194	653	Point	29741	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88917	-75.22194	GRIFFIN WELL POINT	CITY OF PHILA	UNUSED	UNUSED	25	0	19	12		FALSE				
2974039.88889-75.2175	654	Point	29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE		18.4		
2974039.88889-75.2175	655	Point	29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE		18.4		
2974039.88889-75.2175	656	Point	29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE	10			2
2974039.88889-75.2175	657	Point	29740	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE	10			2
2973939.88889-75.2175	658	Point	29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	95	4		FALSE		19.5		
2973939.88889-75.2175	659	Point	29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	0	6		FALSE		19.5		
2973939.88889-75.2175	660	Point	29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	0	6		FALSE	50			2
2973939.88889-75.2175	661	Point	29739	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88889	-75.2175	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	100	0	95	4		FALSE	50			2
2973839.88861-75.22139	662	Point	29738	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88861	-75.22139	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	0	0	0	12		FALSE				
2973739.88861-75.22083	663	Point	29737	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88861	-75.22083	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	10	12		FALSE				
2973639.88861-75.21917	664	Point	29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE		19.4		
2973639.88861-75.21917	665	Point	29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE		19.4		
2973639.88861-75.21917	666	Point	29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	0	6		FALSE	7			2
2973639.88861-75.21917	667	Point	29736	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	30	0	25	4		FALSE	7			2
2973539.88861-75.21917	668	Point	29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	0	6		FALSE		20.6		
2973539.88861-75.21917	669	Point	29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	105	4		FALSE		20.6		
2973539.88861-75.21917	670	Point	29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	105	4		FALSE	30			2
2973539.88861-75.21917	671	Point	29735	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88861	-75.21917	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	110	0	0	6		FALSE	30			2
2973439.88833-75.22139	672	Point	29734	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			3/1/1980		39.88833	-75.22139	GRIFFIN WELL POINT	CITY OF PHILA	WITHDRAWAL	DEWATER	40	0	14	12		FALSE				
2973339.88694-75.21333	673	Point	29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	0	6		FALSE		14.3		
2973339.88694-75.21333	674	Point	29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	35	4		FALSE		14.3		
2973339.88694-75.21333	675	Point	29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	0	6		FALSE	15			2
2973339.88694-75.21333	676	Point	29733	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	40	0	35	4		FALSE	15			2
2973239.88694-75.21333	677	Point	29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	125	4		FALSE		15.7		
2973239.88694-75.21333	678	Point	29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	0	6		FALSE		15.7		

	FID	Shape *	PAWellID	County	Municipali	QuadName	WellAddres	WellZipCod	DateDrille	TypeOfActi	LatitudeDD	LongitudeD	Driller	OriginalOw	WellUse	WaterUse	WellDepth_	TopOfCasin	BottomOfCa	CasingDiam	DepthToBed	BedrockNot	WellYield_	StaticWate	WaterLevel	LengthOfTe
2973239.88694-75.21333	679	Point	29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	0	6		FALSE	50			2
2973239.88694-75.21333	680	Point	29732	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1981		39.88694	-75.21333	A C SCHULTES & SONS	CITY OF PHILA	OBSERVATION	UNUSED	130	0	125	4		FALSE	50			2
2973139.88611-75.19722	681	Point	29731	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/1/1944		39.88611	-75.19722	ARTESIAN WELL DRLG CO	U S NAVY	DESTROYED	UNUSED	0	0	66	10		FALSE		19.1		
2973039.88417-75.21222	682	Point	29730	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			9/8/1981		39.88417	-75.21222	A C SCHULTES & SONS	CITY OF PHILA	TEST	UNKNOWN	0	0	0	0		FALSE				
2972939.88389-75.21472	683	Point	29729	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.88389	-75.21472	UNKNOWN	PENN DOT	OBSERVATION	OTHER	116	0	110	4		FALSE				
2972839.88389-75.21472	684	Point	29728	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			1/1/1984		39.88389	-75.21472	UNKNOWN	PENN DOT	OBSERVATION	OTHER	36	0	31	4		FALSE				
13606839.93917-75.19917	685	Point	136068	PHILADELPHIA	PHILADELPHIA	PHILADELPHIA			7/30/1974	NEW WELL	39.93917	-75.19917	THOMAS G KEYES INC	SEABOARD SUPPLY CO	WITHDRAWAL	DOMESTIC	160	0	46	6	40	FALSE	50	29	159	1

Legend

Water Use

- Unknown
- Dewater
- Domestic
- Industrial
- Other
- Public Supply
- Unused
- 1 Mile Buffer of Site
- AOI Boundary

Notes:
1. World aerial imagery basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online. Source of aerial imagery is USDA FSA from 8/16/2015. Credits: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community.
2. Well search results provided by PaGWIS, November 2016.

2016 One Mile Radius Well Search
PES Philadelphia Refinery
Philadelphia, Pennsylvania

Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

0 1,200 2,400 Feet

SCALE: 1" = 1200'
DATE: 11/30/2016
DRN. BY: AJC
CKD. BY: DW
JOB#: 2574601

Path: \\Langan.com\data\DYL\data6\2574601\ArcGIS\MapDocuments\AOI 11 SCR\Appendix\Figure X - Well Search_113016.mxd