REPORT

HUMAN HEALTH RISK ASSESSMENT

DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Prepared for

Motiva Enterprises LLC

October 2010

URS

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Glossary of Acronyms

ABS	absorption fraction
AF	adherence factor
ATc	carcinogenic averaging time
ATn	non-carcinogenic averaging time
bgs	below ground surface
BW	body weight
cfs	cubic feet per second
CSF	cancer slope factor
CSM	conceptual site model
COPC	constituent of potential concern
CWEC	Cooling Water Effluent Channel
CWIC	Cooling Water Influent Channel
DMSA	dredged material storage area
DNREC	Department of Natural Resources and Environmental Control
DPP	dissolved phase plume
DURBRS	Delaware Uniform Risk-Based Remediation Standard
ED	exposure duration
EF	exposure frequency
EPC	exposure point concentration
ET	exposure time
foc	fraction organic carbon
ft	feet
ft/day	feet per day
g/cm^3	grams per cubic centimeter
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IR	intake rate
IRIS	Integrated Risk Information System
Koc	organic carbon coefficient
MTBE	methyl tert-butyl ether (synonym: tert-butyl methyl ether)
OSHA	Occupational Safety and Health Administration
PADEP	Pennsylvania Department of Environmental Protection
PEF	particulate emission factor
PPE	personal protective equipment
ppm	parts per million

PPRTV	Provisional peer-reviewed toxicity values
PQL	Practical quantitation limit
RCRA	Resource Conservation and Recovery Act
RF	retention factor
RfD	reference dose
RME	reasonable maximum exposure
SA	skin available
SWMU	solid waste management unit
SMCL	secondary maximum contaminant level
TAME	tert-amyl methyl ether
TCEQ	Texas Commission on Environmental Quality
TF	transfer factor
TWIC	Transportation Worker Identification Credentials
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VF	volatilization factor
VKT	vehicle kilometers travelled
VOC	volatile organic compound

Executive Summary

URS Corporation (URS), on behalf of Motiva Enterprises LLC, has prepared a site-wide Human Health Risk Assessment (HHRA) for the Delaware City Refinery (DCR) located in Delaware City, Delaware. Three primary areas potentially affected by Facility-related operations were quantitatively evaluated for human health impacts. These areas include:

1. Thirty-six (36) solid waste management units)/areas of concern (SWMUs/AOCs) located within the DCR ("Facility");

2. The Cooling Water Channels (CWCs), engineered structures that are hydraulically connected to the Delaware River. These channels include the Cooling Water Influent Channel (CWIC) and the Cooling Water Effluent Channel (CWEC); and

3. Dragon Run and the non-developed land in the southern portion of the Facility. This non-developed land located to the south of the operating areas of the Facility historically has been used for agricultural purposes. In 2006, 285 acres of this land along Dragon Run was set aside by the Facility as the Conservation Easement Agreement area, and was recorded by Motiva as a natural wildlife area to remain as such in perpetuity.

The remaining portions of the Facility were not evaluated for risks to human health because no opportunity for exposure to operations-related constituents exists. These areas are:

- Land, surface water and groundwater west, northwest and southwest of the Facility. The area to the west is upgradient and the areas to the northwest and southwest are cross-gradient from SWMUs and AOCs and therefore no potential exists for SWMU or AOC-related soil or groundwater constituents to reach potential receptors. Immediate neighbors to the west consist of active and closed industrial facilities. Farther west and to the northwest and southwest are additional large tracts of undeveloped Facility property or property leased by the Facility for agricultural purposes; and

- Land and groundwater to the north of the Facility fence line. Although a portion of the groundwater in the north refinery operating areas moves to the north, the groundwater in the northern portion of the Facility nearest the northern property line shows either no impact or concentrations below regulatory criteria of SWMU-related constituents. Land use to the immediate north of the Facility fence line and south of Red Lion Creek consists of Facility-owned undeveloped land, land leased by the Facility for agriculture, and industrial and commercial facilities, including the Metachem Superfund site. Land use to

the north is unlikely to change in the foreseeable future. Therefore, human exposure to SWMU-related constituents in soil or groundwater to the north of the Facility property line is not a realistic possibility.

The objectives of the HHRA were to evaluate whether surface soil, surface water, sediment, or groundwater concentrations of Facility-related constituents from SWMUs pose a risk to human health under site-specific exposure conditions and to support decisions concerning the need for further evaluation or action based upon current and reasonably anticipated future land use.

Given the land use assumptions and hydrogeology described above, the following potential receptors were identified for each area evaluated:

- Industrial worker and construction worker (within the Facility operating areas);
- Recreational swimmers (adult and child) and recreational anglers (adult and child) using Dragon Run, and construction workers in the non-developed land surrounding Dragon Run; and
- Recreational swimmers (adult and child) and recreational anglers (adult and child) using the Delaware River, as conservatively assessed using information from the CWCs.

This risk assessment was performed to fulfill, in part, the requirements of the Delaware Department of Natural Resources and Environmental Control's (DNREC) remediation standards and completed in accordance with DNREC's *Remediation Standards Guidance under the Delaware Hazardous Substance Cleanup Act* (DNREC 1999). In addition, technical guidance related to risk assessment from the United States Environmental Protection Agency (USEPA) was applied, as appropriate.

Approach

The technical approach for the HHRA consisted of the following steps: data analysis and identification of constituents of potential concern (COPCs), exposure assessment, risk characterization, and uncertainty analysis. The exposure assessment and risk characterization sections of the HHRA evaluated potential exposure pathways and risk to receptors exposed to surface soil, surface water, sediment, and groundwater. Groundwater in the Columbia Formation aquifer, potentially impacted by operations-related activities, is not known to be used, nor is it expected to be used, as drinking water in the vicinity of the Facility. Therefore, the Columbia Formation aquifer drinking water pathway is incomplete and not evaluated. The Potomac Formation B-Horizon does provide potable water to a small number of residences downgradient

of the Facility, but operations-related constituents have not impacted the Potomac Formation B-Horizon groundwater (URS 2010).

Results – Facility SWMUs

Results of the risk evaluation for receptors at the Facility were as follows:

- A construction worker scenario was considered in the HHRA to account for the possibility of future construction at the Facility. However, potential exposure of a construction worker to Facility-related constituents in Facility soils or groundwater underlying the Facility was not quantitatively assessed for risk because it is assumed that proper personal protective equipment (PPE) and industrial safety controls, which are routine and standard for refinery operations, maintenance and construction work, will preclude exposure of these workers. Standard PPE, including hard hats, steel toed shoes, earplugs, leather gloves, safety glasses, NOMEX®, and a hydrogen sulfide meter, is upgraded in the event of HAZMAT operations to accommodate specific conditions as appropriate.

- Although concentrations of arsenic, naphthalene, and benzo(a)pyrene exceeded conservative human health screening criteria in some SWMUs, no unacceptable cancer or non-carcinogenic risks are posed to industrial workers exposed to Facility soils.

Results – Dragon Run and Surrounding Non-Developed Land

The results of the screening and risk evaluations for potential receptors in Dragon Run and surrounding non-developed land based on relevant exposure pathways are summarized below:

- Groundwater is present at depths of approximately 15 feet below ground surface (ft bgs) or greater, beyond the depth construction workers typically encounter. Therefore, exposure to groundwater is an incomplete pathway and no risks are posed to a hypothetical future construction worker; and

- There are no constituents in Dragon Run surface water or sediment with concentrations exceeding conservative screening values. Therefore, there are no unacceptable risks posed to recreational anglers or recreational swimmers potentially exposed to these media.

These results indicate that there are no COPCs in Dragon Run and there are no complete pathways in the surrounding non-developed land. Therefore, no unacceptable risks are posed to

construction workers, recreational swimmers, and recreational anglers under the conservative assumptions built into this HHRA.

Results – Cooling Water Channels

Previous investigations have found that groundwater flow appears to be limited along the eastern boundary of the Facility. However, a connection potentially exists for minor groundwater contribution to the CWCs. Since the CWCs are connected to the Delaware River, recent constituent concentrations in groundwater from monitoring wells at the Facility near the CWIC and CWEC were compared to conservative human health screening values to assess the potential for impacts to Delaware River receptors. Additionally, available surface water and sediment data collected to support the Baseline Ecological Risk Assessment (URS, 2009) from the CWEC were evaluated. Although concentrations of some constituents exceeded these conservative screening criteria, no risks from operations-related constituents are posed to recreational swimmers and anglers utilizing the Delaware River, based on the weight of evidence. It is noted that the application of data from the cooling water channels and from adjacent groundwater wells represents a highly conservative evaluation of potential human health impacts in the Delaware River given the attenuation that occurs as groundwater migrates, significant mixing that occurs between groundwater and channel water, and additional mixing that occurs between channel water and Delaware River water.

Conclusion

The results of the HHRA performed for the Facility indicate that current constituent concentrations in operations-related groundwater and surface soils are protective of human health, and in most areas, human exposure pathways are incomplete. As demonstrated in the Phase II RFI Groundwater Report (URS 2010), site-wide COPC trend analyses indicate that site plumes are generally stable or decreasing in concentration, where a trend is observed, which will further decrease the currently insignificant risks over time.

1.0 Introduction

URS Corporation (URS), on behalf of Motiva Enterprises LLC, has prepared a site-wide Human Health Risk Assessment (HHRA) for the Delaware City Refinery (DCR) located in Delaware City, Delaware (**Figure 1**). Three primary areas potentially affected by Facility-related operations were quantitatively evaluated for human health impacts. These areas include:

1. Thirty-six (36) solid waste management units)/areas of concern (SWMUs/AOCs) located within the DCR ("the Facility");

2. The Cooling Water Channels (CWCs), engineered structures that are hydraulically connected to the Delaware River. These channels include the Cooling Water Influent Channel (CWIC) and the Cooling Water Effluent Channel (CWEC); and

3. Dragon Run and the non-developed land in the southern portion of the Facility. This non-developed land located to the south of the operating areas of the Facility historically has been used for agricultural purposes. In 2006, 285 acres of this land along Dragon Run was set aside by the Facility as the Conservation Easement Agreement area, and was recorded by Motiva as a natural wildlife area to remain as such in perpetuity.

Large portions of property located to the north, west, and southwest of the operating areas are contained within Facility property boundaries, but have not been associated with industrial processes or operations. These areas have not been identified as SWMUs and no data collection has occurred in these portions of the site. Additionally, these areas are up- or side-gradient to the Facility and, as such, are not under the influence of Facility-related groundwater. Therefore, these areas were not assessed for human health risks. A map of the site depicting each of these areas is presented as **Figure 2**, and are summarized as follows:

- Land, surface water and groundwater west, northwest and southwest of the Facility. The area to the west is upgradient and the areas to the northwest and southwest are cross-gradient from SWMUs and AOCs and therefore no potential exists for SWMU or AOC-related soil or groundwater constituents to reach potential receptors. Immediate neighbors to the west consist of active and closed industrial facilities. Farther west and to the northwest and southwest are additional large tracts of undeveloped Facility property or property leased by the Facility for agricultural purposes.

- Land and groundwater to the north of the Facility fence line. Although a portion of the groundwater in the north refinery operating areas moves to the north, the groundwater in

the northern portion of the Facility nearest the northern property line shows either no impact or concentrations below regulatory criteria of SWMU-related constituents. Land use to the immediate north of the Facility fence line and south of Red Lion Creek consists of Facility-owned undeveloped land, land leased by the Facility for agriculture, and industrial and commercial facilities, including the Metachem Superfund site. Land use to the north is unlikely to change in the foreseeable future. Therefore, human exposure to SWMU-related constituents in soil or groundwater to the north of the Facility property line is not a realistic possibility.

This risk assessment was performed to fulfill, in part, the requirements of the Delaware Department of Natural Resources and Environmental Control's (DNREC) remediation standards and completed in accordance with DNREC's *Remediation Standards Guidance under the Delaware Hazardous Substance Cleanup Act* (DNREC 1999).

1.1 Background

The Facility includes a 5,050-acre tract of land approximately one mile northwest of Delaware City, Delaware (**Figure 1**). The main operating areas (areas within the property, which are actively in use and include the SWMUs) occupy approximately 1,000 of the 5,050 acres of the Facility property and historically produced mainly gasoline and heating oil. Several existing and former industrial and light industrial facilities are located north and west of the operating areas, including the Metachem Superfund site and the Occidental Chemical Corporation facility to the north, and AKZO, Formosa Plastics, and INEOS Films facilities to the west. To the south and west is Facility-owned property that is either undeveloped or is leased for agriculture. Additionally, a Conservation Easement and Dragon Run are located to the south. The Delaware River lies to the east of the Facility (**Figure 2**).

Environmental investigations and remediation activities have been ongoing at the Facility since 1983. Since 1988, this work has been performed under the modified Resource Conservation and Recovery Act (RCRA) Corrective Action Permit No. DED 00 202 9738, which was issued by the United States Environmental Protection Agency (USEPA) to Texaco Refining and Marketing, Inc., the owner at that time. Corrective Action Permit DED 00 202 9738 expired in December 1998, and was superseded by Corrective Action Permit HW09A13, which was issued on September 30, 2003 by DNREC. Prior to that time, DNREC had been authorized by the USEPA to be the lead agency overseeing the work. Previous submissions to USEPA and DNREC include the *Background Information Survey Report* (Dames & Moore 1991a), the *Identification of the Potential for an Occurring or Past Release Study (IPOPRS) Report* (Dames

& Moore 1991b), and the *Verification of Release Study (VRS) Report* (Dames & Moore 1995). The final *Phase I RCRA Facility Investigation Report* (URS 2005a) was approved in DNREC's letter dated May 19, 2005.

The recently-completed Phase II RFI Groundwater Report (URS 2010) addressed data gaps identified during the Phase I RFI and completed assessment of groundwater conditions. Groundwater data collected during the Phase II RFI Groundwater Report was used in the HHRA. URS has prepared this site-wide HHRA to assess potential areas of exposure to Facility-related constituents and associated risks. Media evaluated included Facility soils and groundwater, sediment and surface water in Dragon Run, and surface water in the Delaware River. The Delaware River is in direct contact with the CWIC and CWEC, therefore evaluations of the influent and effluent channels provide a conservative assessment of risk to potential Delaware River receptors.

1.2 Objectives and Approach

The objectives of the HHRA are as follows:

- To evaluate whether concentrations of operations-related constituents in surface soil, surface water, sediment, or groundwater pose potentially unacceptable risks to human health under site-specific exposure conditions; and
- To support decisions concerning the need for further evaluation or action based upon current and reasonably anticipated future land use.

Pathways that are incomplete (i.e., no potential for exposure of a receptor to an operations-related constituent) do not contribute to human health risks and thus were not considered in the risk assessment.

The technical approach for the HHRA consisted of the following steps: data analysis and identification of constituents of potential concern (COPCs)[1], exposure assessment, risk characterization, and uncertainty analysis. The risk characterization step includes an assessment of the uncertainty associated with each stage of the HHRA process.

The lists of COPCs for each area of human health investigation (e.g., SWMUs, CWCs, etc.) were developed based on knowledge of Facility operations and practices, as well as the results of

[1] Operations-related chemicals with concentrations exceeding conservative, screening-level health based benchmarks.

recent and historical sampling events. Analytical parameter suites have been amended over time; therefore, the quantity of historical soil data may differ for each analyte. Most samples were analyzed for a wide range of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

As documented in the *Interim Report, Dissolved Phase Plume Delineation – Phase II* (URS 2008), not all of the constituents originate from the Facility. Chlorinated volatile organic compounds are from up-gradient, offsite sources, and thus are not quantitatively evaluated further in this risk assessment.

The HHRA uses reasonable maximum exposure (RME) concentrations of COPCs to derive exposures and risks to potentially exposed human populations for exposure pathways determined to be complete, as identified in the human health conceptual site model (CSM) described in detail in Section 2.

Specific goals of the risk assessment include the following:

- Characterize potential human exposure pathways;
- Identify potentially complete exposure pathways between COPCs in surficial soil and shallow groundwater and receptors;
- Determine whether COPCs exceed their respective human health screening-levels considered to be protective of receptors;
- Determine if concentrations of COPCs in surficial soils or in operations-related groundwater potentially pose a risk to receptors; and
- Identify uncertainties and/or data gaps in the assessment of risk.

The SWMUs are industrial in nature; Dragon Run and the surrounding non-developed land, and the CWCs potentially include recreational, agricultural, and other non-industrial uses. Therefore, the risk assessment approach was modified as appropriate for each area. Area-specific approaches are described below.

1.2.1 SWMUs

The risk assessment approach for SWMUs and AOCs initially included a review of the operational history of each SWMU and AOC. SWMUs and AOCs that were previously evaluated, received a No Further Action, or were otherwise remediated such that potential

exposure pathways were eliminated (e.g., by capping) were not included in this HHRA. Data collected for the remaining SWMUs were evaluated, potential exposure was assessed, toxicity data were reviewed, and risk was characterized for each SWMU.

The CSM for the SWMUs describes the linkages between human receptors and operations-related chemicals in surficial soils (0-2 feet below ground surface [ft bgs]), where available. When surficial soil data were not available, subsurface soil data (2-15 ft bgs) were used to assess potential risks to receptors.

1.2.2 Dragon Run and Surrounding Non-Developed Land

COPCs in groundwater underlying the non-developed land north of Dragon Run were identified for evaluation of the groundwater-to-surface water pathway. The potential for southward migrating groundwater to adversely affect human receptors that may use Dragon Run for recreational purposes was additionally assessed by evaluating surface water and sediment data collected from Dragon Run. The human health CSM developed for this area describes the linkages between human receptors and operations-related chemicals in shallow (Columbia aquifer) groundwater.

1.2.3 Cooling Water Channels

The HHRA for the CWCs includes a characterization of the physical features of the Facility and analytical results from surface water, sediment, and recent groundwater sampling events to provide supporting data for evaluating risk. Although human exposure is highly unlikely to occur in the channels due to security restrictions, the CWCs are conservatively evaluated as surrogate systems for the Delaware River given that: 1) they are connected to the River, and 2) humans may use the River near the Facility for fishing and, although unlikely, swimming. The CSM describes the linkages between human receptors in the CWCs and chemical stressors related to operations in groundwater.

As part of the evaluation of potential risks to human health receptors in the Delaware River, analytical surface water and sediment data from the CWEC were conservatively used as surrogate data for the River. Additionally, recent groundwater data collected from monitoring wells within 1,000 ft of the influent and effluent channels were used to conservatively assess potential risk from the groundwater-to-surface water pathway. This is an extremely conservative approach because the use of groundwater concentrations does not take into account attenuation as chemicals migrate in groundwater, or mixing of groundwater as it enters the waterbody. Further, use of groundwater concentrations to evaluate potential human health risks in the CWCs

is inherently conservative, because the channels are engineered structures that are parts of the Facility's water management system, and typically passes through hundreds of millions of gallons of water per day during operations.

1.3 Report Organization

The risk evaluation is designed to: 1) characterize the Facility from an exposure/risk perspective and 2) conservatively estimate threats to potentially exposed human receptors.

The human health risk evaluation for the Facility includes a characterization of the physical features of the areas of investigation and analytical results from soil, groundwater, surface water, and sediment sampling events to provide supporting data for evaluating human health risk.

A human health conceptual site model (CSM) for the Facility is presented in Section 2, Conceptual Site Model. The CSM describes the media of concern, current and potential future receptors, and potential exposure pathways. Use of the data and identification of the COPCs are discussed in Section 3, Data Analysis. Determination of potentially complete pathways under current and future land use conditions is described in Section 4, Exposure Assessment. Additionally, Section 4 presents exposure assumptions for estimating chemical intake and describes the concentration terms used in the HHRA. Section 5, Toxicity Assessment provides the sources of toxicity factors used in the HHRA. Section 6, Risk Characterization presents the risk calculation methodology, results, and discussion, and discusses the key factors and assumptions that contributed to uncertainty in the risk assessment. Conclusions resulting from this assessment are presented in Section 7, Summary and Conclusions.

2.0 Conceptual Site Model

The CSM identifies potential sources of constituents, types of constituents, affected media, current and potential future receptors, and potential exposure pathways. The CSM is used as the foundation on which assessments of exposure and risk are based.

Current and probable future land use plays a significant role in the development of the CSM. The Facility is an industrial site and is assumed to remain industrial in perpetuity. Although the refinery is not currently operating, PBF Energy Company, the current owner, has indicated that the Facility will be operational as a refinery again in 2011. Much of the property not used for operations (i.e. portions located to the north, northwest, west, and southwest of the process areas) is undeveloped (**Figure 2**). No historic Facility industrial operations are associated with these areas and therefore, no SWMUs have been identified on them. Additionally, the area to the west is upgradient and the areas to the northwest and southwest are cross-gradient from SWMUs and AOCs and therefore no potential exists for SWMU or AOC-related soil or groundwater constituents to reach potential receptors. Immediate neighbors to the west and north consist of active and closed industrial facilities. Farther west and to the northwest and southwest are additional large tracts of Facility-owned property that are either undeveloped or are leased for agricultural purposes.

Although a portion of the groundwater in the northern Facility operating areas migrates to the north, the groundwater nearest the property line in these areas shows either no impact or concentrations below regulatory levels of operations-related constituents. Land use to the immediate north of the Facility property line and south of Red Lion Creek consists of industrial and commercial facilities, including the Metachem Superfund site and Occidental Chemical Corporation. Land use to the north is unlikely to change in the foreseeable future. Therefore, human exposure to constituents related to operations in soil or groundwater to the north of the Facility property line is not a realistic possibility.

Consequently, these undeveloped portions of Facility property and adjacent industrial or commercial facilities are not evaluated further for risks to human health.

Congress designated the Occupational Safety and Health Administration (OSHA) as the lead agency to regulate work health issues. Potential conflict between regulatory agencies was addressed by the U.S. Supreme Court in its decision in *Gade v. National Solid Waste Mgmt. Ass'n* (90-1676), 505 U.S. 88 (1992), where the Court states, "OSH Act precludes any state regulation of an occupational safety or health issue..." DNREC (2007a) also acknowledges that OSHA regulates worker exposure to chemicals in industrial settings. Additionally, in a letter

dated November 20, 2003, USEPA Region III informed Motiva Enterprises LLC, that for potential occupational exposures to vapor intrusion, OSHA has the primary regulatory role (USEPA 2003). In response to that letter, Motiva performed an indoor air screening in the basement of the administration building and control lab using a Rae Systems' UltraRae photoionization detector configured for benzene. No benzene vapors were detected at a detection limit of 0.1 parts per million (ppm). When compared to OSHA's 1.0 ppm permissible exposure limit (8-hour time weighted average), 5.0 ppm short-term exposure limit (15-minute exposure), and 0.5 ppm action limit, it is evident that benzene vapors do not pose a risk to indoor workers. Consequently, potential vapor intrusion risks to industrial workers at the Facility are governed by OSHA, as agreed in the 1990 Memorandum of Understanding between the U.S. Department of Labor OSHA and the USEPA. Thus, the potential vapor intrusion pathway is not evaluated further in this risk assessment.

The industrial nature of the site suggests that the most likely receptors at the Facility would be industrial workers and, perhaps, construction workers. For this HHRA, it is assumed that if construction workers are present at the Facility, personal protective equipment (PPE) typical for routine operations and maintenance would be used and institutional controls such as regular hazard assessments would be in place to protect these workers from exposure to operations-related constituents in surficial and sub-surface soils and therefore, no quantitative evaluation of risk for construction workers was undertaken. It is unlikely that trespassers would gain access to the site due to the extensive security measures in place, including site perimeter fencing, guard houses, Transportation Worker Identification Credential (TWIC) requirements, and Facility security procedures. Assuming continued industrial use, industrial workers during normal day-to-day operations at the Facility may be exposed to constituents in surficial soils in SWMU areas. Therefore, the surface soil direct contact pathway was quantitatively evaluated for an industrial worker.

Currently, the non-developed portion of the southern Facility property is used for non-residential (agricultural) purposes. Because future use of the site is likely to remain as a refinery, land use in the southern portion of the Facility is assumed to remain non-residential. Dragon Run, which is also within the southern portion of the Facility, is potentially used as a recreational swimming and fishing area. To the east of the Facility is the Delaware River, which exchanges water with both the CWIC and CWEC. These cooling water channels potentially receive groundwater from the Facility. Facility groundwater could potentially be impacted by dissolved phase constituents.

The CWIC and CWEC are essential to facility operations, providing cooling water supply and discharge. The Delaware River supplies water to and receives water from the CWIC and

CWEC, respectively. The River could potentially be used for swimming but is more popular for the recreational fishery it provides for anglers. Although no physical barriers are located in the CWIC or CWEC, it is unlikely that trespassers would enter these channels from the Delaware River due to post-September 11, 2001 security measures in place and availability of more desirable sites for fishing (or swimming). The U.S. Coast Guard conducts regular patrols of the Delaware River and associated maritime facilities and vessels. These water- and land-based security measures would make access to the channels unlikely and brief.

2.1 Facility Soils

The 1,000 acres comprising operating areas is primarily covered by buildings, industrial structures (e.g., tanks), roadways, and parking areas. Some of the Facility roads are gravel-lined and have been eroded or degraded, exposing underlying soils. Additionally, there are numerous small unpaved areas where human exposure to surficial soils is possible.

According to the New Castle County Soil Survey produced by the United States Department of Agriculture, two soil types are present within the boundaries of the operating areas. These soil types include the Matapeake-Sassafras association and tidal marshes.

According to the Soil Survey, the tidal marshes covered a strip of land approximately 3,000 feet wide adjacent to the Delaware River. Presently, the tidal marshes have been almost completely covered by fill material. The majority of the fill material consists of fine grained sediment dredged from the Delaware River, which is placed in diked dredged material storage areas (DMSAs). The remaining soils, located west of the DMSAs, consist of the Matapeake- Sassafras association. The following are descriptions of the two soil types:

- Matapeake-Sassafras Association – this soil association occupies an area that extends from the city of New Castle to the north of the complex, through the central portion of New Castle County, and continues to the Maryland state line in the southwestern portion of the county. The soils are typically described as being nearly level, but they range from being nearly level to steep. This association covers approximately 27 percent of New Castle County.

  The association is made up of approximately 68 percent Matapeake soils and 17 percent Sassafras soils, with minor soil types making up the remaining 15 percent. Matapeake and Sassafras soils are both described as being well drained. Matapeake soils consist of a silt loam surface layer with a silty clay loam subsoil. Sassafras soils have a sandy loam surface layer with a sandy loam and sandy subsoil.

Among the minor soil types in the association are the well drained Woodstown, the poorly drained Fallsington, and the poorly drained Johnston soils. Johnston soils are susceptible to flooding.

- Tidal Marshes – this soil type consists of areas that are flooded regularly by tidal waters. The soil material has not been examined in detail, but it ranges from sand to clay, and in some areas is peaty. It is more or less salty, and in some areas reportedly contains a relatively large amount of sulfur compounds and is therefore unsuitable for agricultural use. Areas of tidal marsh that extend inland appear to be less affected by salt than areas closer to the Delaware River. As discussed previously, much of the tidal marsh at the complex has been covered with fill material. Areas of tidal marsh, however, do exist on Facility property, such as along the banks of the CWIC.

2.2 Groundwater Migration Pathways

Groundwater on the west side of the Facility generally flows to the east before intersecting a north/south trending paleochannel. The geometry of the paleochannel, and its higher transmissivity as compared to surrounding areas, dominates local groundwater flow (URS 2010). Once groundwater enters the paleochannel, the majority of the water volume moves in either a northerly or a southerly direction, depending on where it enters the channel. The majority of the Columbia Formation groundwater flowing beneath the eastern portion of the Facility flows to the south with a smaller component flowing to the north. The divide between northerly and southerly groundwater flow within the paleochannel appears to occur beneath the northern portion of the Bulk Storage Tank Farm. Results of the groundwater investigations performed as part of the Phase II RFI indicate that the impact to groundwater from Facility operations is contained within the Facility property (URS 2010). Additionally, concentrations are largely stable or declining, which indicates that the plumes are not migrating off-site (URS 2010).

The closest surface waterbodies that could potentially receive groundwater underlying the operations area are Dragon Run approximately 3,600 feet to the south of the operations area and the Delaware River to the northeast. Since a portion of the southerly flowing groundwater may potentially discharge to Dragon Run, Dragon Run was retained for evaluation of potential groundwater impacts.

Red Lion Creek, north of the Facility, was not retained for evaluation of potential groundwater impacts, given that this is an incomplete pathway. The majority of Columbia Formation groundwater flowing beneath the eastern portion of the Facility flows to the south; only a small component flows to the north. COPC concentrations in site plumes are largely stable or

declining and wells along the northern property boundary are either not impacted (i.e., no detected concentrations) or contain COPCs below regulatory limits (URS 2010). Further, groundwater flowing northward would have to travel beneath the Metachem Superfund site and Occidental Chemical before approaching Red Lion Creek. Therefore, there is no potential for groundwater discharge of Facility-related constituents to surface water features to the north.

Overall, groundwater flow in the water table aquifer appears to be limited along the eastern boundary of the Facility (east of the paleochannel) by the presence of the lower permeability Cretaceous sediments, Quaternary silts and clays, and the apparent absence of the more permeable Columbia Formation sediments. Furthermore, the Guard Basins create a local zone of perched water, resulting in radial flow away from these features. This, in turn, further inhibits eastward groundwater flow in this area. Migration of groundwater from the operations area of the Facility to locations east of the paleochannel and to the Delaware River is likely limited. However, a connection potentially exists between the CWIC and the CWEC to the Delaware River. An evaluation of potential impacts from the Facility groundwater on the CWCs, as conservative surrogates for the River, is incorporated into this HHRA report.

Given the land use assumptions and hydrogeology described above, the following receptors were identified for each area evaluated:

- Industrial worker and construction worker (within the Facility operating areas);
- Recreational swimmers (adult and child) and recreational anglers (adult and child) using Dragon Run, and construction workers in the non-developed land surrounding Dragon Run; and
- Recreational swimmers (adult and child) and recreational anglers (adult and child) using the Delaware River, as conservatively assessed using information from the CWCs.

Construction workers represent potential future receptors at the Facility. Industrial workers represent current and likely future receptors in the operating areas of the Facility. The recreational angler and recreational swimmer represent both current and future exposure scenarios. The receptors selected for risk evaluation are considered those with the highest potential degree of exposure.

A description of the surface water features of concern and associated receptors are provided in the following sections. The CSMs developed for the non-developed area and the CWCs describe the linkages between chemical stressors in groundwater and soil potentially impacted by Facility

operations and the receptors selected for evaluation. The human health CSM is presented in **Figure 3**.

2.3 Surface Water Features

2.3.1 Cooling Water Influent Channel

The CWIC is a 10-acre man-made tidal channel that receives water from Delaware River. Through large pumps and controls located at the on-site wastewater treatment plant, the river water is conveyed from the CWIC to the facility process units for non-contact cooling of equipment. During normal operating conditions, approximately 400 million gallons per day of water are withdrawn from the influent channel. The potential for direct human exposure to CWIC surface water is very low, due to TWIC and U.S. Coast Guard security measures. However, the CWIC is in communication with the Delaware River, and recreational users of the River may potentially be exposed to operations-related constituents via the CWIC. Therefore, the CWIC was conservatively assessed for human health as a surrogate system for the River, where angling and swimming by humans may occur.

2.3.2 Cooling Water Effluent Channel

The CWEC consists of approximately 12 acres of man-made tidal channel that receives the cooling water from the Guard Basins and is connected to Delaware River. During normal operating conditions, approximately 400 million gallons per day of non-contact cooling water are returned to the Delaware River via the effluent channel. The CWEC is included in the evaluation of human health risk given the connection between the Channel and the Delaware River, which may be used by anglers and/or swimmers.

2.3.3 Dragon Run

The mainstem of Dragon Run is 7.7 miles long and flows east from north of Lums Pond to the Delaware River (DNREC 1998). A tidegate located at the mouth of Dragon Run allows discharge to the River only during low tides; therefore, there is no tidal influence in Dragon Run (DNREC 2006). Lower Dragon Run is classified as 'Category 5' for dissolved oxygen, pathogens (*Enterococcus*), nitrogen, and phosphorus, indicating that this portion does not support aquatic life use (DNREC 2008). However, Dragon Run supports fishing for rainbow smelt (*Osmerus mordax*), sunfish (Centrarchidae), and yellow perch (*Perca flavescens*) (Hook and Bullet 2009) and is used recreationally for canoeing (Delaware Nature Society 2008).

2.4 Human Receptors

The following subsections identify the receptors considered in the evaluation of potential human health risks for the Facility, Dragon Run and surrounding non-developed land, and CWCs. These include industrial workers at the Facility, construction workers in the agricultural fields or at the Facility, and recreational receptors that may swim or fish in Dragon Run or the Delaware River (evaluated via the CWCs as surrogates). Groundwater in the Columbia Formation, potentially impacted by Facility operations, is not known to be used, nor is it expected to be used, as drinking water in the vicinity of the Facility. This drinking water pathway is thus incomplete and is not evaluated in the assessments of human health risk. The Potomac Formation B-horizon does supply potable water to several residents along Cox Neck Road, south of the Facility property, but the Potomac Formation B-horizon is not impacted by operations-related constituents (URS, 2010). Potable water for use at the refinery does not come from onsite groundwater withdrawal wells.

2.4.1 Industrial Worker

As a result of the continued industrial use of the Facility, outdoor industrial workers were considered appropriate current and future receptors to be evaluated. The industrial worker is potentially exposed to COPCs in surface soil (0-2 ft bgs). Potentially complete exposure pathways for the industrial worker include incidental ingestion of soil, dermal exposure to soil, inhalation of fugitive dust, and inhalation of ambient vapors. An indoor industrial worker was not evaluated given that vapor intrusion of operations-related constituents into buildings is addressed under OSHA regulations, as discussed in Section 2.0.

2.4.2 Construction Worker

Although the future use of the Facility is expected to remain as it is currently, construction activities may occur. Therefore, a construction worker scenario is considered in the risk assessment. However, potential exposure of a construction worker to Facility constituents on the Facility is not quantitatively assessed for risk because it is assumed that proper PPE and industrial safety controls will preclude exposure of these workers. In the undeveloped land in the southern portion of the Facility, the water table is beyond the depth at which construction workers may incur exposure to groundwater[2]. Additionally, no impacts of operations-related constituents to subsurface soils in the undeveloped area south of the Facility have been identified

[2] Recent depth-to-water measurements were generally ≥ 15 feet below ground surface (ft bgs) at all wells in the undeveloped land in the southern portion of the Facility.

or are suspected. Consequently, exposure pathways for a future construction worker are incomplete.

2.4.3 Recreational Swimmer

Both adult and child recreational swimmers may be potentially exposed to operations-related constituents in Dragon Run surface water. Additionally, although unlikely, recreational users could swim in the Delaware River in the vicinity of the CWCs and could be exposed via mixed water potentially contributed from the CWCs. The recreational swimmer scenario was conservatively evaluated in this risk evaluation to assess possible human health risks from exposure to surface water while wading or swimming. Potentially complete exposure pathways to a recreational swimmer include dermal exposure to surface water and sediment, incidental ingestion of surface water, and inhalation of volatile vapors emanating from the surface water.

2.4.4 Recreational Angler

Anglers fishing in Dragon Run or the Delaware River (assessed by using data from the CWCs) could be potentially exposed to operations-related constituents through the ingestion of fish that have been exposed to impacted surface water via the groundwater-to-surface water migration pathway. Additionally, a recreational angler could fall into the water and briefly be exposed to potentially impacted surface water. This exposure assumption is conservatively assessed through the evaluation of a recreational swimmer in both surface water features.

3.0 Data Analysis

3.1 Data Summary

Descriptions of the data used for evaluation of risk in this HHRA are provided in the sections below.

3.1.1 SWMU Data

Surficial soil (0-2 ft bgs) is the medium of concern for potential exposure to receptors (i.e., industrial workers) at the Facility. Although investigations of site soils have been ongoing since the 1990s, many of the soil samples collected have been from deeper strata (up to approximately 15 ft bgs). For some SWMUs, all or most of the available soil data were from these deeper samples and, therefore, it was assumed that those data are representative of surface conditions in those areas. These deeper soil data were consequently used to evaluate risks to industrial workers when surficial data were not available. Soil depths for each sample are provided in **Appendix A**.

Thirty-six (36) SWMUs/AOCs have been identified during the remedial investigation. Soil samples in these areas were collected as part of the VRS (Dames & Moore 1995), Phase I RCRA Facility Investigation (URS 2005a) and Phase II RCRA Facility Investigation (URS 2010). Over the course of these investigations, 26 SWMUs/AOCs were either screened from further evaluation due to the absence of significant site constituents or have otherwise been addressed; these 26 SWMUs/AOCs are not addressed in this HHRA. In a letter dated November 20, 2008, DNREC indicated that no further action is required for the former Naphthalene Rail Car Area at this time. Given that no further action is required at this time, this area was not evaluated under this HHRA. The remaining SWMUs, listed in **Table 1**, are quantitatively evaluated in this HHRA. **Figure 4** presents the locations of these SWMUs.

Parameter suites have been amended over time; therefore, the quantity of available historical soil data may differ for each analyte. Most samples were analyzed for a wide range of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Data for the following list of constituents, including 24 inorganics, 33 VOCs, and 49 SVOCs, were quantitatively assessed for potential impacts to human health in this HHRA. The list of analytes is different from SWMU to SWMU and varies temporally over historic sampling events.

Table 1 provides a summary of the number of samples from each phase of the remedial investigation that were assessed for each of the 10 SWMUs screened in this HHRA. The total number of soil samples for each SWMU is as follows:

- SWMU 13 (Old Drum Storage Area): 9 samples;
- SWMU 14 (Unit F: Areas A through G, including the Wood Pile Area [Area A]): 63 samples (40 in the Woodpile Area, Area A and 23 in Areas B through G);
- SWMU 15 (Tank Bottom Weathering Areas): 144 samples;
- SWMU 18 (Fire Training Area): 20 samples;
- SWMU 20a & 20a.1 (Waste Water Treatment Plant): 15 samples;
- SWMU 26 (Tetraethyl Lead Laydown Area): 9 samples;
- SWMU 31 (Area of Stained Soil Near the Former Slurry Oil Dumpster): 33 samples;
- SWMU 32 (Stained Soil Within Oily Sewer Back-up Areas): 20 samples;
- SWMU 33 (Piers 1, 2, and 3): 33 samples; and
- SWMU 34 (Former Naphthalene Unit Tank Farm): 7 samples.

Sampling locations for each of the 10 SWMUs are depicted in **Figures 5** through **14**. **Tables 2** through **11** provide SWMU-specific data summaries. The entire soil dataset is provided in **Appendix A**.

3.1.2 Data from the Non-Developed Land in the Southern Portion of the Facility

Groundwater monitoring was performed quarterly for a subset of wells for two years in support of the Phase II RFI Groundwater (URS 2010) and is performed annually on selected representative wells on a voluntary basis, in addition to other permit-related groundwater monitoring. The most recent quarter of validated groundwater data, collected in February 2010, was used in this risk assessment, when available. If a well was not sampled during the February 2010 sampling event, the latest complete dataset from that well was used. The use of the most recent round of groundwater data is appropriate based on an evaluation of the plume-wide concentration trends, which appear to be generally stable or declining. Although concentrations of constituents in individual wells may vary, the concentrations in the overall groundwater plume

have remained relatively stable during the monitoring period. Therefore, conclusions drawn from groundwater data as applied to this risk assessment are expected to remain valid as long as there are no changes in observed concentration trends. Groundwater data used in the risk assessment, including sample collection dates, are provided in **Appendix A**.

The depth to groundwater was reviewed for the following 19 wells located in the non-developed land in the southern portion of the Facility during the February 2010 sampling event: D27, D29, D30R, D39, D40A, D42A, D42B, D48A, D48B, D51A, D51B, D52A, D52B, D53A, D53B, D54, PW-E107A, PW-E107B, and PW-E107C. Depth-to-water measurements were >15 ft bgs in all but two wells, D53A (14.56 ft bgs) and D53B (14.65 ft bgs). Otherwise, depth-to-water ranged from 19.52 ft bgs at Well D42A to 45.81 ft bgs at Well D40A. Groundwater at these depths is beyond the depth at which construction workers (the identified receptor) may incur exposure to groundwater. Groundwater monitoring well locations are presented in **Figure 15**.

3.1.3 Dragon Run Data

The most recent round of surface water samples collected from Dragon Run (January 28, 2010) were used to assess the potential migration of COPCs from the Facility to this water feature. Five locations were sampled from approximately one foot below the water surface and from one foot above the channel bottom. These 10 samples were analyzed for benzene, ethylbenzene, toluene, m,p-xylenes, o-xylene, total xylenes, MTBE, and tert-amyl methyl ether (TAME) via USEPA Method 8260B per the surface water analytical sampling program described in the *Work Plan Continued Delineation of Southern Extent of Groundwater Impacts* (URS 2005b) previously approved by DNREC in a letter dated April 28, 2005. The rationale for inclusion of these constituents is that they are related to Facility operations and are the compounds most likely to impact surface water via shallow groundwater migration. The constituents, however, are not unique to Facility operations and other sources of these constituents may exist. The surface water data used to assess risk from surface water exposure are presented in **Appendix A** and are summarized in **Table 12**. Surface water sampling locations are shown in **Figure 15**.

Surficial sediment samples were collected from 10 locations in Dragon Run in March 2006. Sediment samples were analyzed for operations-related constituents, including benzene, toluene, ethylbenzene, total xylenes, MTBE, and TAME per the DNREC-approved April 28, 2005 work plan (URS 2005b). Sediment data used for screening are presented in **Appendix A** and are summarized in **Table 13**. Sediment sampling locations are presented in **Figure 15**.

3.1.4 Cooling Water Channels Data

The CWIC and CWEC collectively were evaluated as a conservative surrogate system for the Delaware River, based on the assumption that each cooling water channel is potentially affected by groundwater discharge. Under historic and likely future operations, water is typically drawn into the CWIC from the Delaware River as part of the once-through non-contact cooling water process. Water is then returned to the Delaware River via the CWEC.

Recent groundwater data collected in the vicinity of the CWEC (from wells 13RA, 13RB, 30D, 30S, D18, D35, D36, D60, and 34) were used to evaluate potential risk associated with the effluent channel to Delaware River receptors. Additionally, three surface water and sediment samples collected from the CWEC in October 2003 were evaluated. For surface water, the total and dissolved fractions of 10 metals, total cyanide, 11 VOCs, and 29 SVOCs were evaluated for this HHRA. In sediment samples, 11 VOCs, 18 SVOCs, eight metals (total fraction), and total cyanide were evaluated (**Tables 16** and **17**). The evaluations of groundwater data adjacent to the CWEC are considered conservative approaches for assessing human health given the potential for attenuation and significant mixing of groundwater that may infiltrate the effluent channel.

Due to the absence of analytical surface water data for the CWIC, groundwater data from the monitoring wells located closest to the CWIC were used as surrogates for surface water samples to conservatively assess potential impacts by comparing groundwater data to surface water standards. Monitoring wells F1 through F7, D12, 24b-MW-15, and D33 were considered as representative of the local groundwater plume in the vicinity of the CWIC.

As discussed in Section 3.1.2, groundwater monitoring was performed quarterly for a subset of wells for two years in support of the Phase II RFI Groundwater (URS 2010), and is performed annually on selected representative wells on a voluntary basis, in addition to other permit-related groundwater monitoring. The concentrations of constituents detected in wells near the CWIC and CWEC are conservatively indicative of future groundwater values to assess the CWC surface water features. For several wells, data were available from the February 2010 sampling event. However, for monitoring well D12 near the CWIC and 13RA, 13RB, 30D, 34, and D35 near the CWEC, August and September 2009 data were used because these were the most recent and most complete dataset. Additionally, August 2008 data were used for monitoring wells F1 through F6 near the CWIC. Sampling in November 2009 provided the most recent data for Well 30S.

During these sampling events, seven metals (antimony, cadmium, chromium, iron, lead, nickel, and selenium) were analyzed in the dissolved and total fractions in the CWIC. Total and dissolved iron was analyzed in the CWEC wells. Twenty-three (23) VOCs were also evaluated.

The concentrations of constituents detected in the evaluated wells are presented in **Appendix A**. It should be noted that not all constituents were analyzed in samples from every CWC well during each sampling event. Summaries of the data for both areas (CWIC and CWEC) are shown in **Tables 14** and **15.**

Groundwater discharge to the CWIC and CWEC is considered a highly conservative surrogate for evaluating potential human exposures in the nearby Delaware River. Because the flow in Delaware River is relatively constant, the volume of the River is orders of magnitude greater than that in the channels, and under normal operating conditions, several hundred million gallons of water are withdrawn from the intake channel, potential risks associated with the River are presumably very low. Direct contact with surface water in the channels is precluded by Facility security measures and regular U.S Coast Guard patrol, as discussed in Section 2. **Figure 16** presents a map of monitoring well, surface water, and sediment locations used to assess risk for the CWCs.

3.2 Identification of COPCs

3.2.1 Screening Benchmarks

Maximum concentrations of detected constituents in soil samples were compared to Delaware Uniform Risk-Based Remediation Standards (DURBRSs; DNREC 1999) to establish a list of COPCs for each SWMU. Evaluating constituent concentrations against the DURBRSs is intended to be a generic, conservative approach to the protection of human health, and as such, does not take into consideration site-specific elements that may reduce the potential for actual impacts to human health.

For the COPC screening of Dragon Run, maximum surface water concentrations were compared to available DNREC (2004) Surface Water Quality Standards for Human Health based on fish ingestion. DNREC (2004) standards based on fish and water ingestion criteria were used secondarily because the waterbody is not listed as Public Water Supply Sources by DNREC (2004) and to account for the most likely human use of Dragon Run (angling or swimming). If Surface Water Quality Standards were not available, concentrations were conservatively compared to groundwater DURBRSs. The groundwater DURBRSs reflect a combination of standards, including USEPA maximum contaminant levels, health advisory limits, other

miscellaneous guidelines and values derived to reflect a carcinogenic risk of 1 in 1,000,000 (1 × 10-6) and a non-carcinogenic hazard index of 0.1. DNREC (1999) acknowledges the conservatism incorporated into the DURBRSs. Maximum sediment concentrations collected in Dragon Run were conservatively compared to both the DURBRSs for restricted use of surface soil in a critical water resource area and in a non-critical water resource area.

For the COPC screening of the CWIC and CWEC, maximum shallow groundwater concentrations and surface water concentrations (for the CWEC) were compared to available DNREC (2004) Surface Water Quality Standards for Human Health (based on fish ingestion) to account for the most likely human use of the Delaware River in this area (i.e., fishing). Similar to Dragon Run, DNREC (2004) standards based on fish and water ingestion criteria were used secondarily because the waterbody is not listed as Public Water Supply Sources in DNREC (2004). If Surface Water Quality Standards were not available, concentrations were conservatively compared to groundwater DURBRSs. Comparisons of groundwater concentrations to surface water benchmarks represent a highly conservative assessment of potential risk because neither attenuation as the COPCs migrate in groundwater, nor mixing in the receiving surface water feature, are considered. Consequently, an individual groundwater well exceedance of a human health surface water benchmark does not imply that adverse effects will occur since the benchmarks are applicable to the surface water medium, are highly conservative, and are purposefully set at low levels to minimize the risk of failing to identify a COPC. Sediment concentrations collected in the CWEC were compared to DURBRSs for restricted use of surface soil in a critical water resource area and in a non-critical water resource area.

3.2.2 Facility SWMUs

The results of the screening indicate that maximum concentrations of arsenic exceeded these conservative benchmarks at seven SWMUs: SWMUs 13, 14 (Unit F Area A [the "wood pile"] and Unit F Areas B through G), 15, 20a, 26, 33, and 34. A comprehensive background study completed in August 2005 (URS 2005c) indicated background arsenic levels ranged from 0.98 mg/kg to 8.91 mg/kg. The majority of arsenic detections associated with Facility SWMUs fell within the background range and are below the default background concentration in soil established by DNREC in 2007 (DNREC, 2007b)

The maximum concentrations of iron, benzo(a)pyrene, and naphthalene exceeded respective DURBRSs in SWMU 14, Unit F Area A. Unit F Area A of SWMU 14 was evaluated separately from the other Areas to assess the need for maintaining the soil cap currently in place there.

Iron is a naturally-occurring element found in the Columbia Formation and is not considered an operations-related compound (see Section 6.3 for a more detailed discussion). Therefore, arsenic is identified as the COPC for SWMUs 13, 15, 20a, 26, 33, and 34 (**Table 18**). COPCs for SWMU 14 (Unit F Area A) include arsenic, benzo(a)pyrene, and naphthalene (**Table 18**).

3.2.3 Dragon Run and Surrounding Non-Developed Land

Groundwater

The considerable depth to shallow groundwater in the non-developed land north of Dragon Run (approximately 15 feet bgs and deeper) in all likelihood precludes human exposure to this medium. Therefore, the direct contact exposure pathway for a future construction worker in this area is incomplete. Thus, further evaluation of direct human exposures and risks to shallow groundwater in the non-developed land in the southern portion of the Facility is not warranted.

Surface Water

The results of the screening process are presented in **Table 12**. No constituents were detected above respective groundwater DURBRSs. Based on the results of the screening, no risks are posed to human receptors potentially exposed to surface water in Dragon Run.

Sediment

No compounds in Dragon Run sediment had a maximum concentration that exceeded either DURBRS (i.e., for a critical water resource area or a non-critical water resource area) for residential soil (**Table 13**). Therefore, exposure to Dragon Run sediment is not considered to pose a human health risk.

3.2.4 Cooling Water Channels

CWIC

COPCs for possible human health exposure to surface water via the groundwater-to-surface water pathway in the CWIC are presented in **Table 14**. To maintain conservatism for this evaluation, operations-related COPCs in groundwater from the CWIC were assumed to have the potential to impact surface water.

Dissolved and total iron, benzene, MTBE, and naphthalene were detected in wells near the CWIC at concentrations above their respective screening values. The maximum concentrations of these compounds were 20,900 micrograms per liter (µg/L), 21,200 µg/L, 504 µg/L, 80 µg/L, and 54.4 µg/L (**Table 14**), respectively. All maximum concentrations were detected at Well F7 (**Figure 16**). It should be noted that benzene was either not detected at a detection limit of 1

µg/L (7 wells) or detected at a very low concentration (0.59 µg/L, 1 well) in 8 of the 10 wells in the vicinity of the CWIC. MTBE groundwater concentrations exceeded the screening value in three of the 10 wells near the CWIC. Groundwater concentrations of naphthalene exceeded the screening value in two of four wells.

CWEC

A conservative assessment of groundwater collected in the vicinity of the CWEC was also used to evaluate potential risk. COPCs for possible human health exposure to surface water in the CWEC are presented in **Table 15**.

For the CWEC, maximum concentrations of benzene (1,890 µg/L) and MTBE (37,700 µg/L) were detected above the screening value in Well D18 (**Table 15**). Benzene was generally detected at low concentrations in groundwater near the CWEC; only one well produced a benzene concentration in excess of the screening value. MTBE groundwater concentrations near the CWEC exceeded the screening value in only two of the nine wells in this area. Maximum concentrations of total iron (38,700 µg/L) in Well 34 also exceeded its screening value.

To further support this evaluation for the CWEC, surface water and sediment data collected from the CWEC in 2003 were also evaluated. COPCs for possible human health exposure to surface water and sediment are presented in **Tables 16** and **17** and summarized in **Table 18**.

No constituents in surface water were detected above the surface water benchmark. In sediment, arsenic was detected above the DURBRS for restricted use of surface soil in a critical water resource area and non-critical water resource area. The detections exceeded the DURBRS at all three sediment locations with a maximum detection of 25 mg/kg. It should be noted that human exposure to sediment for recreational receptors is highly unlikely in the Delaware River in the vicinity of the Facility.

3.3 Exposure Point Concentrations

The exposure point concentration (EPC) is the concentration of a constituent in a medium (e.g., surface soil) that is expected to be contacted by an individual and is assumed to be universally present throughout the Facility. For this HHRA, the 95 percent upper confidence limit (UCL_{95}) of the mean COPC concentration was utilized in the receptor-specific exposure models to develop conservative estimates of exposure and risk and to account for uncertainty associated with deriving a reasonable upper bound exposure concentration based on the available soil data.

The UCL_{95} is typically used as an appropriate RME estimate of concentrations likely to be contacted over time, and is the recommended exposure point concentration in human health risk assessments, except in cases where the UCL_{95} is higher than the maximum concentration (USEPA 1989, 1992a).

The USEPA's ProUCL (Version 4.00.04) software was used to calculate the UCL_{95}. Since the calculation of the UCL_{95} is dependent on the underlying distribution of sample data, this software tests for normality, lognormality, and a gamma distribution of the dataset (Singh and Singh 2009). Calculation of a reliable estimate of the UCL_{95} with this software requires sample data from five samples or more; for constituents with less than five data points, the maximum concentration is used as the exposure point concentration. For this HHRA, UCL_{95} concentrations could not be calculated for arsenic in SWMU 26 due to the limited quantity of data for arsenic. UCL_{95} concentrations were calculated for the remaining constituents.

The UCL based upon Kaplan-Meier estimates using the Student's t-distribution cutoff value (95% KM (t) UCL; Singh and Singh 2009) was used to calculate the UCL_{95} for the arsenic data in SWMUs 13, 20a, 33, 14 (Areas B-G), and 34 and the benzo(a)pyrene and naphthalene data in SWMU 14 (Unit F Area A). For arsenic data in SWMUs 14 (Unit F Area A) and 15, the UCL based upon Kaplan-Meier estimates using the bias-corrected accelerated bootstrap method were used (95% KM [BCA] UCL; Singh and Singh 2009). When the software provided two 'potential' values to use, the larger UCL_{95} was conservatively chosen as the EPC, except when the larger value was equal to the maximum concentration. This was the case for benzo(a)pyrene data from SWMU 14 (Unit F Area A) and arsenic data from SWMU 34 because the number of detected values in these datasets was small (two detections in 37 samples for benzo(a)pyrene and three detections in six samples for arsenic).

4.0 Exposure Assessment

An exposure pathway is the course a chemical takes from its source to the exposed receptor. In order for an exposure pathway to be complete, it must contain a source, a transport medium (e.g., soil, air), a point of contact (receptor), and an exposure route (e.g., ingestion, dermal, or inhalation). If any of these elements is missing, an exposure pathway is deemed incomplete and can be excluded from the quantitative evaluation of risk (USEPA 1989).

At the Facility SWMUs, the HHRA identified two potentially exposed receptors: future construction workers and current and future industrial workers. Owing to the industrial nature of the site, future construction work at the Facility will be governed by institutional controls and health and safety measures, including the use of proper PPE. Therefore, the exposure pathway is incomplete and no quantitative evaluation of risk to construction workers was performed. Soil concentrations of three operations-related constituents (arsenic, benzo[a]pyrene, and naphthalene) exceeded conservative screening values. Therefore, the exposure pathway for current and future industrial workers is potentially complete and these constituents were carried forward in the risk assessment process. Exposure was assessed by calculating intake (or dose) using USEPA equations and parameters, as described in Section 4.1, below.

The HHRA for Dragon Run and the surrounding non-developed land identified two general receptor populations that may come in contact with operations-related constituents: current and future recreational anglers and current and future recreational swimmers. Since surface water and sediment concentrations of constituents did not exceed conservative screening values, the pathway is incomplete and no further quantitative evaluation of risks to recreational swimmers or recreational anglers was necessary.

For the Delaware River evaluation, recreational swimmers and recreational anglers represent potential receptors exposed to Delaware River surface water potentially impacted by groundwater discharged to the cooling water channels. It is conservatively assumed that groundwater underlying the Facility may discharge to the CWCs and these channels are in communication with the Delaware River. Four constituents related to operations (arsenic, benzene, MTBE, and naphthalene) were identified as COPCs for the CWCs. Therefore, this pathway is potentially complete. Potential risks associated with the Delaware River, as evaluated using data from the CWCs, were evaluated qualitatively.

4.1 Facility SWMU Exposure Assessment

4.1.1 Intake Calculations

Chemical exposure/intake is expressed as the amount of the agent at the exchange boundaries of an organism (e.g., skin, lungs, and intestinal tract) that is available for systemic absorption. If the exposure occurs over time, the total exposure can be divided by the time of interest to obtain an average exposure rate (e.g., mg/kg-day). The general equation, as defined by USEPA (1989), for estimating a time-weighted average intake is as follows:

$$\text{Intake (mg/kg - day)} = \frac{C \times IR \times EF \times ED}{BW \times AT}$$

where:

C = Chemical concentration at the exposure point (mg/kg);

IR = Intake rate (mg/day);

EF = Exposure frequency (days/year);

ED = Exposure duration (years);

BW = Body weight of exposed individual (kg); and

AT = Averaging time (period over which exposure is averaged, usually measured in days).

The equation presented above, with alterations to include exposure-route specific parameters, was used herein to estimate average daily chemical intakes (or doses) for each exposure route for industrial workers. The equations and parameter values used to estimate non-carcinogenic hazards and carcinogenic risks to these receptors are presented in **Tables 19** through **42**.

4.1.2 General Exposure Parameters

While some of the exposure parameters used to estimate intake are exposure route-specific, others are general parameters that remain constant for each exposure route (e.g., oral, dermal) and are present in each intake calculation. These general exposure parameters are discussed below while route-specific exposure parameters are discussed in Section 4.1.3.

Constituent concentration, exposure frequency (EF), exposure duration (ED), averaging time (AT), and body weight (BW) are general parameters that are included in the intake calculations for each exposure route.

Exposure Frequency

The exposure frequency (EF) describes the number of times per year an event is likely to occur. Variables such as weather, vacations, and institutional controls are considered when determining reasonable and realistic exposure frequencies.

For the outdoor industrial worker scenario, an EF of 225 days was used. This frequency is provided by USEPA (2002) for outdoor industrial workers.

Exposure Duration

The exposure duration (ED) parameter in the intake equation represents the number of years over which an event is likely to occur. Factors affecting this parameter include variables such as age of the receptor and population mobility.

An ED value of 25 years was applied to the outdoor industrial worker scenarios, per USEPA (2002) recommendations for assessing non-residential exposures.

Exposure Time

For inhalation exposure scenarios, it is necessary to apply an exposure time (ET) to account for the number of hours spent in the potentially affected area and to calculate an hourly inhalation rate. Industrial workers were assumed to work a typical (8-hour) day at the Facility. Therefore, an ET of 8 hours was assumed for this receptor.

Averaging Time

The averaging time (AT) parameter is the period over which exposure is averaged. For non-carcinogenic effects, AT_n was used in calculating an average daily exposure, and is calculated as the product of the receptor-specific exposure duration and the 365 days of the year (USEPA 2002). The AT_n value for an industrial worker was set to 9,125 days (365 days $\times$ 25 years).

Exposures to carcinogens were averaged over a lifetime. The carcinogenic averaging time (AT_c) is the product of a 365-day year and a 70-year lifetime, or 25,550 days, per USEPA (2002).

Body Weight

The body weight used for the industrial worker was 70 kg, in accordance with USEPA (2002) regulations for adult body mass.

4.1.3 Route-Specific Exposure Parameters

Intakes due to contact with COPCs vary, depending largely on the physicochemical properties of the COPC and the pathway by which the COPC enters the body. Ingestion, dermal contact, and

inhalation exposure-specific parameters take these differences into account and are addressed in this section.

Incidental Ingestion of Soil

During the course of the activities they are involved in, receptors may incidentally consume small amounts of soil. The soil ingestion rate for an industrial worker is the USEPA (2002) default soil ingestion rate for nonresidential (outdoor worker) exposures of 100 mg/day.

Dermal Exposure to Soil

The following route-specific parameters were included in the general intake equation to estimate dermal uptake of COPCs from soil for the industrial worker: skin surface area available for exposure, skin soil adherence factor, and dermal absorption factor.

Skin Surface Area Available for Exposure

The amount of skin available for exposure (SA) is strongly dependent on the age of the receptor and the nature of activity or work they are doing. The most recent dermal exposure guidance from the USEPA (2004) recommends applying an exposed surface area of 3,300 cm^2 for adults in a commercial or industrial setting. This value assumes that the head, hands, and forearms are exposed. This value was utilized for outdoor industrial workers in this HHRA.

Soil-to-Skin Adherence Factor

The soil-to-skin adherence factor (AF) is influenced by soil types and varies considerably across different parts of the body (USEPA 2004). A value of 0.2 mg/cm^2 was used in the dermal exposure assessment for the industrial worker based on two studies of utility workers dermally exposed to soil.

Dermal Absorption Fraction

The dermal absorption fraction (ABS) is used to estimate an absorbed dose that reflects the absorption of a chemical across the skin and into the blood stream. The absorbed dose is typically a fraction of the amount of the chemical that actually contacts the skin. Chemical-specific ABS values used to estimate dermal exposures to COPCs are as follows:

- Arsenic: 0.03 (USEPA 2004); and
- Benzo(a)pyrene and naphthalene: 0.13 (USEPA 1995, 2004).

Inhalation Exposure

Due to the nature of their work, industrial workers at the Facility may be exposed to soil particles that become airborne during work-related activities involving disturbance of soils. An inhalation rate of 0.83 m^3/hr (20 m^3/day) was applied to the worker exposure scenario to estimate potential inhalation risks. This value is the default inhalation rate used by USEPA (2002) for non-residential outdoor workers.

According to the International Commission on Radiological Protection (ICRP 1968), 75 percent of respirable dust particles (PM_{10}, or particles less than 10 microns in aerodynamic diameter) are retained when inhaled, the majority of which is probably swallowed after inhalation. Therefore, a retention factor (RF) of 0.75 was included in the HHRA to evaluate fugitive dust inhalation exposure.

4.1.4 Exposure to Fugitive Dust in Ambient Air

Based on the available data, a mathematical model was required for the inhalation pathway for workers to convert the chemical concentration in soil to a corresponding concentration in ambient air. This was accomplished by calculating a soil-to-air particulate emission factor (PEF). The PEF converts concentrations of constituents in soil to concentrations on dust particles in the air (PM_{10}) as a result of fugitive dust emissions from bare surfaces of fine-grained soils. Particulate emissions from soil-impacted sites are due to wind erosion, and therefore depend on the erodibility of the soils USEPA (2002) recommends that the fugitive dust inhalation pathway be focused on semivolatile compounds and metals (volatile compounds are not anticipated to adhere to air-borne soil particles and are addressed separately). Also in this guidance document, the USEPA provides the methodology required to calculate the PEF. Chemical-specific concentrations in soil are multiplied by the inverse of the PEF to derive chemical-specific concentrations of soil dust in the ambient air (C_a), as follows:

$$C_a = C_s \times (1/PEF)$$

where:

C_s = Concentration in soil (mg/kg); and

PEF = Particulate emission factor (m^3/kg).

Inhalation exposures to dust-entrained chemicals for the industrial receptor were estimated using a methodology originally developed by the USEPA for commercial/industrial land uses (USEPA 1991, 1996, and 2002).

The equation used to derive the PEF for the industrial worker scenarios is as follows:

$$PEF\,(m^3/kg) = Q/C \times \frac{3600}{0.036 \times (1 \times V) \times (U_m/U_t)^3 \times F(x)}$$

where:

Q/C	=	Dispersion factor for wind erosion (g/m^2-s per kg/m^3);
V	=	Fraction of vegetative cover (unitless);
U_m	=	Mean annual wind speed (m/s);
U_t	=	Equivalent threshold value of windspeed at 7 m (m/s); and
F(x)	=	Function dependent on U_m/U_t (unitless).

Site-specific values for mean annual wind speed (U_m) and fraction of vegetative cover (V) were used to derive the PEF. An average wind speed (9.0 miles/hour; 4.00 m/s) was based on average wind speed data from the Wilmington, DE National Oceanic and Atmospheric Administration (NOAA 2010). In addition, SWMU-specific vegetative cover values (V) ranging from zero to 100 percent were applied based on the predicted proportions of vegetation and paved surface assuming continued industrial use. Default parameter values provided in USEPA (2002) were utilized for the equivalent threshold value of wind speed at 7 meters (U_t) and F(x).

The resulting PEFs calculated for each SWMU for the industrial worker ranged from 6.96×10^8 m^3/kg to 1.76×10^{18} m^3/kg (**Tables 21, 24, 27, 30, 33, 36, 39,** and **42**).

5.0 Toxicity Assessment

Toxicity assessment involves the evaluation of available toxicity information to be used in the risk assessment process. Toxicity values derived from dose-response relationships can be used to estimate the potential for the occurrence of adverse effects in individuals exposed to various constituent levels. In accordance with recent USEPA guidance, toxicity values specific to the oral and inhalation pathways were obtained from the sources listed hierarchically below and provided in the DNREC Remediation Standards regulations:

- Integrated Risk Information System (IRIS) on-line database;
- Provisional peer-reviewed toxicity values (PPRTV) obtained from the USEPA's Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center;
- Health Effects Assessment Summary Tables (HEAST); and
- Other peer-reviewed sources of toxicity data.

The toxicity values used to evaluate the potential for human health effects from exposure to Facility-associated constituents are presented in **Table 43**.

5.1 Non-Carcinogenic Toxicity Values

Adverse effects can be caused by acute exposure, which is a single or short-term exposure to a toxic substance or by chronic exposure to lower levels on a continuous or repeated basis over an extended period. "Acceptable" acute or chronic levels of exposure to non-carcinogens are considered levels without any anticipated adverse effects. Such exposure levels are commonly expressed as reference doses (RfDs). An acceptable exposure level is calculated to provide an adequate margin of safety.

RfDs have been developed by the USEPA for chronic (e.g., lifetime) exposure to constituents based on the most sensitive non-carcinogenic effects. Chronic RfDs, which have been derived for a number of chemicals, are used to evaluate exposures lasting 7 to 70 years (USEPA 1989) for exposure scenarios such as the groundskeeper. Subchronic RfDs, if available, are used to evaluate exposures of shorter duration (two weeks to seven years). Only chronic RfDs were used in this HHRA. Oral and inhalation RfDs used in the HHRA were extracted from appropriate sources as listed in the DNREC Remediation Standards regulations.

5.2 Carcinogenic Toxicity Values

Carcinogenic risk refers to the probability of developing cancer as a result of exposure to known or suspected carcinogens. A cancer slope factor (CSF) is a plausible upper-bound estimate of the probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen. Cancer slope factors were used to determine the oral and inhalation excess cancer risks associated with COPCs at the Site. Oral and inhalation CSFs used in the HHRA were extracted from appropriate sources as listed in the DNREC Remediation Standards regulations.

5.3 Adjustment for Dermal Absorption

Toxicity criteria have not been developed by the USEPA specifically for dermal absorption; instead, oral toxicity criteria are adjusted to assess the dermal exposure pathway. In order to have a meaningful comparison between the dermal absorption dose estimates, which represent internal (or absorbed) doses, and oral toxicity criteria, which typically represent potential (or administered) doses, toxicity criteria are modified to represent absorbed doses.

Oral toxicity values used to evaluate dermal absorption were adjusted for use in risk assessment using the recommended criteria as found in the USEPA's most recent dermal exposure assessment guidance (USEPA 2004). Following the guidance document, toxicity values were adjusted for gastrointestinal absorption only if chemical-specific gastrointestinal absorption values are less than 50 percent. Based on the COPCs identified, no dermal absorption adjustment was necessary.

6.0 Risk Characterization

The objective of the risk characterization is to determine potential risk to receptors based on the concentrations of operations-related constituents in groundwater, surface soil, surface water, and sediment and receptor exposures to these constituents. The following sections discuss the potential risks posed to receptors in the Facility SWMUs, Dragon Run and the surrounding non-developed land, and the CWCs (as surrogates for the Delaware River).

6.1 Facility SWMUs

The potential for non-cancer health effects was evaluated by comparing the Facility-specific exposure level (the average daily intake of a COPC calculated using the general intake equation with appropriate adjustments depending on the route of exposure) with the RfD. This ratio of exposure to toxicity (intake/RfD) is called the hazard quotient (HQ). For evaluating the non-carcinogenic risks for multiple constituents, the HQs are summed to produce a hazard index (HI). If the Site-specific exposure level exceeds the effects-based threshold (i.e., the HI exceeds a value greater than 1.0), there may be concern for potential non-carcinogenic effects.

The product of the lifetime daily intake and the CSF was used to estimate the upper bound excess cancer risk for carcinogenic (or potentially carcinogenic) constituents. The DNREC endorses a target risk level of 1×10^{-5} for exposure to multiple carcinogens. This target risk level represents a 1 in 100,000 chance of developing cancer over a lifetime.

The calculated non-carcinogenic and carcinogenic risks from all COPCs for the industrial worker for each SWMU are provided in **Table 44**.

The HQs associated with ingestion of Facility soils, dermal exposure to Facility soils, and inhalation of fugitive dust for the industrial worker scenario were all below the acceptable cumulative hazard threshold of 1.0 (**Table 44**). Summing the risks across exposure pathways yielded a HI of 0.2 or less for all SWMUs evaluated (**Table 44**). All calculated excess cancer risks were less than or equal to 8×10^{-6}, which is below the target risk level. The calculated non-cancer and cancers hazards and risks are acceptable under the DNREC remediation standards.

6.2 Dragon Run and Surrounding Non-Developed Land

Human receptors evaluated in Dragon Run and the surrounding non-developed land included hypothetical construction workers, adult and child recreational anglers, and adult and child recreational swimmers. Exposure of hypothetical construction workers to groundwater is precluded by the substantial depth to groundwater in this area (generally $\geq$ 15 ft bgs) (Section

2.4.2); therefore, there are no risks to construction workers from Facility-associated groundwater.

Maximum concentrations of constituents in Dragon Run surface water and sediment did not exceed conservative screening values derived to protect human health, indicating that no risk is posed to recreational swimmers and anglers that may be exposed directly (e.g., dermally) or indirectly (e.g., fish ingestion) to Dragon Run (Sections 2.4.3 and 2.4.4).

6.3 Cooling Water Channels

Human receptors evaluated for the CWCs included adult and child recreational swimmers and recreational anglers utilizing the Delaware River. As discussed previously, data for the CWCs were used to conservatively evaluate the potential threats to recreational users of the River. A weight of evidence approach is used to evaluate risk from surface water and sediment in the CWCs. As discussed in Section 3.1.4, recent groundwater data were conservatively evaluated for both CWCs along with historic surface water and sediment data from the CWEC.

6.3.1 Cooling Water Influent Channel

Iron: Concentrations of dissolved iron in wells near the CWIC exceeded the groundwater DURBRS of 300 µg/L. This DURBRS was derived from the list of USEPA Secondary Maximum Contaminant Levels (SMCL). DNREC (1999) recognizes that constituents regulated using USEPA-promulgated, non-mandatory water quality standards are not considered risks to human health (USEPA 1992b), but were included in the list of DURBRSs for completeness and because they can be used as indicators of water quality. The DNREC (1999) acknowledges that the SMCL may not be appropriate for a given site, and suggests the use of a site-specific approach in these cases.

In the Columbia Formation, Woodruff (1970), writing for the Delaware Geological Survey, found that iron is "moderately high," with average concentrations of dissolved iron equal to 110 µg/L. While maximum concentrations in CWC wells are greater than these values by one to two orders of magnitude, Marine and Rasmussen (1955) found that the distribution of iron in Delaware aquifers is sporadic and ranges widely. Marine and Rasmussen (1955) report that "Excessive iron in water from the Pleistocene sediments is one of the most serious water-quality problems in Delaware," and Woodruff (1970) calls the "pattern of iron occurrence in Delaware's ground waters, particularly in the Columbia Formation," a "puzzling hydrologic problem." These studies indicate that although iron concentrations exceed the highly conservative DURBRS, this constituent is a naturally-occurring element found in the Columbia Formation and

concentrations found in the area are not derived from operations-related operations. Because iron is dissolved from the soil and sediment in this area of Delaware and groundwater concentrations are usually greater than surface water concentrations (Rasmussen et al. 1957), the exceedance of the DURBRS for iron does not indicate that adult and child recreational swimmers that may use the Delaware River will be adversely affected. Furthermore, iron does not bioaccumulate in fish tissue, and therefore does not present a risk to recreational anglers.

Benzene: Two of the 10 groundwater samples analyzed for benzene had concentrations exceeding the screening value of 14 µg/L. These samples were collected from Well F7 and Well 24b-MW15. Well F7 is one of the furthest up-gradient of those evaluated. Non detections in the wells immediately downgradient of F7 (F2, F3, and F4) indicate that benzene from this location is not migrating towards the CWIC. Well D33 is located adjacent to the CWIC and is likely most representative of the groundwater potentially discharging to the channel. Benzene sampled from this well was detected at a laboratory-estimated ("J"-qualified) concentration of 0.59 µg/L, which is below the human health screening value. Seven of the 10 wells evaluated had benzene concentrations < 1 µg/L. Therefore, concentrations of benzene in groundwater near the CWIC are highly unlikely to pose a threat to receptors due to the low concentrations near the channel. Additionally, if groundwater were to discharge to the channel, benzene concentrations would be subject to considerable mixing in the CWIC.

Naphthalene: Naphthalene was detected in groundwater samples at concentrations exceeding the screening value in two of four well samples. The constituent was not detected (at 4 µg/L) in a sample collected from Well D12, which is located in close proximity to Well F7, where the maximum concentration was detected (54.4 µg/L), suggesting that groundwater impacts are localized. Additionally, naphthalene was detected at the estimated concentration of 1.45 µg/L in a sample from Well D33, which is below the screening benchmark of 20 µg/L. Since Well D33 is located adjacent to the CWIC, it is likely most representative of the groundwater that could discharge to the channel. The low detection in this well adjacent to the CWIC, in addition to the localized nature of the contamination and the mixing capacity of the channel, indicates that naphthalene concentrations in groundwater are unlikely to pose a risk to receptors.

MTBE: MTBE was detected in groundwater samples at concentrations exceeding the screening value of 20 ug/L at four out of 10 locations. The exceedences occurred at wells F2, F3, F4, and F7, which are located in close proximity to each other. MTBE was not detected at Well D33, which is located adjacent to the CWIC, and is likely most representative of the groundwater that could discharge to the channel. The non-detection of MTBE in the well adjacent to the CWIC, in addition to the apparent localized nature of the contamination and the mixing capacity of the

channel, indicates that MTBE concentrations in groundwater are unlikely to pose a risk to receptors.

6.3.2 Cooling Water Effluent Channel

Arsenic: Arsenic was detected in sediment collected from the CWEC at concentrations above DURBRSs (2.9 mg/kg for a critical water resource area and 3.8 mg/kg for a non-critical water resource area) at the three locations sampled in 2003. Arsenic however, was not detected in co-located surface water samples; reporting limits were also less than the screening value. This indicates that arsenic is not migrating from sediment to surface water. Considering that it is unlikely for a receptor to come in contact with sediments in the CWEC or the Delaware River outside the Facility because of security measures and that the receptor is more likely to come in contact with surface water, it can be concluded that arsenic concentrations in sediment are unlikely to pose a risk to receptors in the Delaware River.

Iron: Groundwater concentrations of total iron exceeded the groundwater DURBRS of 300 ug/L at two out of three locations sampled. As discussed in the weight of evidence for iron in the CWIC, this DURBRS may not be an appropriate screening value because it was derived from the list of USEPA SMCLs and was intended to be an indicator of water quality, not necessarily risk. Furthermore, studies by Woodruff (1970) and Marine and Rasmussen (1955), indicate that iron is a naturally-occuring element found in the Columbia Formation and concentrations found in the area are not derived from operations-related operations. Because iron is dissolved from the soil and sediment in this area of Delaware and groundwater concentrations are usually greater than surface water concentrations (Rasmussen et al. 1957), the exceedance of the DURBRS for iron does not indicate that adult and child recreational swimmers that may use the Delaware River will be adversely affected. Furthermore, iron does not bioaccumulate in fish tissue, and therefore does not present a risk to recreational anglers.

Benzene: Benzene exceeded the screening value in one of nine groundwater samples. This exceedance occurred at Well D18. Benzene was detected at low, laboratory-estimated ("J"-qualified) concentrations at the four wells (D35, D60, D36, and 34) located immediately downgradient of Well D18. The low detections at Wells D60 and D36, which are located adjacent to the CWEC, are likely most representative of the groundwater potentially discharging to the channel. Furthermore, benzene was not detected in the surface water or sediment samples collected in the CWEC. Therefore, concentrations of benzene in and near the CWEC are highly unlikely to pose a threat to receptors due to the low groundwater concentrations near the channel and the lack of detections in surface water and sediment in the channel.

MTBE: MTBE was detected at concentrations above the screening value at two out of six groundwater locations. The two locations with exceedances (30D and D18) are located furthest from the CWEC. Wells D60 and D36, which are located adjacent to the CWEC, are likely most representative of the groundwater potentially discharging to the channel. MTBE was only detected at low, laboratory-estimated ("J"-qualified) concentrations at these two wells and these concentrations did not exceed the screening benchmark. The low detections in these wells adjacent to the CWEC, in addition to the localized nature of the contamination and the mixing capacity of the channel, indicates that MTBE concentrations in groundwater are unlikely to pose a risk to receptors.

6.4 Uncertainty

Assumptions and other factors that influence the findings of the risk assessment are addressed below as a discussion of uncertainties in each phase of the evaluation.

6.4.1 Absence of DURBS Screening Values

Delaware Uniform Risk-Based Remediation Standards for surface water, groundwater, and soil matrices were available for the majority of the constituents analyzed in the risk evaluation. However, no appropriate DURBRS for groundwater and surface water samples were available for the following detected constituents from CWC wells and surface water samples collected in Dragon Run: methylcyclohexane, TAME, and tert-butyl alcohol. Additionally, DURBRSs for the protection of human health were not available for the following constituents detected in Facility soils, CWEC sediments, and Dragon Run sediments: cyclohexane, methylcyclohexane, benzo(g,h,i)perylene, total cresols, 7,12-dimethylbenz(a)anthracene, tert-butyl alcohol, and acenaphthylene. Given that a lack of DURBRS for these chemicals contributes uncertainty to the risk assessment, alternative national and state health-related benchmarks were reviewed. For constituents with inadequate toxicology data to support development of a screening benchmark, structurally similar compounds with available toxicity values are used as a standard-of-practice to permit evaluation.

Based on the toxicity data review, alternative benchmarks from the USEPA, the Pennsylvania Department of Environmental Protection (PADEP), and the Texas Commission on Environmental Quality (TCEQ) were selected for the compounds described above. The maximum detected concentration from all areas evaluated for human health risk was then compared to the alternative benchmarks for these compounds to assess the potential for impacts to human health, as follows:

Groundwater and Surface Water

Constituent	Maximum Concentration (µg/L)	Location of Maximum Concentration	Benchmark (µg/L)
Methylcyclohexane	14	CWIC, GW	13,000[1]
TAME	33.9	CWIC, GW	2,900[2]
TBA	3,230	CWEC, GW	6,600[2]

[1]USEPA Tapwater Regional Screening Level (RSL) for cyclohexane, May 2010
[2]Texas Commission on Environmental Quality (TCEQ) Groundwater Risk-Based Exposure Limit (RBEL) (based on primary MCL, when available), March 2010

Soil and Sediment

Constituent	Maximum Concentration (mg/kg)	Location of Maximum Concentration	Benchmark (mg/kg)
Cyclohexane	1.89	SMWU 14, WPA	29,000[1]
Methylcyclohexane	3.42	SMWU 14, WPA	29,000[2]
Benzo(g,h,i)perylene	1.03	SMWU 14, WPA	170,000[3]
Total Cresols	0.919	SMWU 14, WPA	3,100[4]
7,12-Dimethylbenz(a)anthracene	0.36	SMWU 31	6,200[1]
TBA	0.0407	SMWU 20a	8,700[5]
Acenaphthylene	1.02	SMWU 32	33,000[6]

[1]USEPA RSL for industrial soils, May 2010
[2]USEPA value for cyclohexane used as surrogate, May 2010
[3]Pennsylvania Department of Environmental Protection Act 2 Non-Residential Direct Contact value for surficial soils, October 2010
[4]USEPA RSL for *p*-cresol for industrial soils, May 2010
[5]TCEQ Tier I Commercial/Industrial Soil Protective Concentration Level (PCL) (30-acre source area), March 2010
[6]USEPA RSL for acenaphthene for industrial soils, May 2010

Results of the screening indicated that maximum concentrations of detected compounds lacking DURBRS did not exceed the respective alternative benchmarks. Consequently, these constituents do not pose a risk to human health. No screening values are available for calcium, magnesium, potassium, and sodium. Although these constituents were detected, they are not considered to pose a human health risk because they are essential nutrients.

6.4.2 Reporting Limits Exceeding Screening Benchmarks

The minimum reporting limits for tetraethyl lead in samples collected from SWMUs 15, 26, and 33 exceeded the soil screening benchmark. Additionally, the reporting limits for the two historic samples of mercury collected in SWMU 33 were not available and therefore it is not possible to determine if the reporting limit would exceed the respective screening value. In samples collected in the CWCs the following constituents had a minimum reporting limit that exceeded the screening value:

- Groundwater – ethylene dibromide and methyl isobutyl ketone

- Surface Water – ethylene dibromide, 4,6-dinitro-2-methylphenol, 7,12-dimethylbenz(a)anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- Sediment - ethylene dibromide, nitrobenzene, 4,6-dinitro-2-methylphenol, and 7,12-dimethylbenz(a)anthracene

These constituents were not identified as COPCs, an assumption that may underestimate risk.

6.4.3 Conceptual Site Model

The uncertainties associated with the CSM are due to the nature of what exposure scenarios actually occur as opposed to what may occur. For the CWIC and CWEC, the extent of mixing with the Delaware River surface waters is unknown, but is expected to be considerable. Nonetheless, the channels were assessed for human health as highly conservative surrogate systems for the Delaware River. In terms of potential human exposure to operations-related constituent concentrations in the Delaware River, the levels of mixing and volatilization within the channels would greatly decrease the potential effects from Facility groundwater on the Delaware River.

6.4.4 Soil Sampling Representativeness

For most SWMUs, a limited number of surface soil samples were available, and samples collected from subsurface strata (generally 2 to 16 ft bgs, but up to 35 ft bgs for SWMU 34) were included in the dataset with the assumption that constituent concentrations at these depths are representative of the entire soil column, including surface soil. Historic soil samples collected prior to 1999 were not included in the evaluation if sufficient spatial coverage could be achieved with more recent data. In the absence of surface soil samples for comparison, it is uncertain if this assumption overestimates or underestimates risk.

6.4.5 Exposure Point Concentrations

In the derivation of EPCs, the inclusion of the reporting limits (RLs) as a proxy concentration for chemicals below the RL (e.g., non-detects) could overestimate risks for chemicals with a low frequency of detection. Alternatively, it could underestimate risks by lowering the mean for a constituent. Likewise, the use of a UCL_{95} as the EPC for highly skewed data sets could also underestimate risks. Only four samples were analyzed for arsenic in SWMU 26 and therefore, reliable statistics could not be calculated. The maximum concentration of arsenic detected in

samples from SWMU 26 was used in the models to calculate exposure and risk. This assumption overestimates risk.

For the arsenic dataset from SWMU 34 and the benzo(a)pyrene data from SWMU 14-Unit F Area A, two 'potential' UCL_{95} values were provided by the software. Usually the higher, more conservative value would be selected as the EPC. However, for these two datasets, the higher value was equal to the maximum value. Therefore, the alternative UCL_{95} calculated by ProUCL was selected as a more realistic representative concentration. The selection of the alternative UCL_{95} as the RME concentration for SWMU 14 Unit F Area A may result in an underestimation of risk.

Arsenic datasets for SWMUs 13, 20a & 20a.1, and 34 had nine or fewer data points. Although ProUCL calculated UCL_{95} values from these data, the software warns, "It is recommended to have 10-15 or more distinct observations for accurate and meaningful results." It is unknown how the use of the calculated UCL_{95} based on fewer than 10 data points biases the estimates of risk.

6.4.6 Exposure Assessment

Samples collected from beneath the asphalt, gravel, or buildings at the Site were conservatively included in the surface soil data set for risk assessment for all SWMUs. For SWMU 14, Unit F, Area A (the "wood pile"), soil samples collected from areas subsequently topped with a soil and vegetative cap were included in the dataset to evaluate the need for future maintenance of the cap. The highly conservative process of including soil samples from beneath buildings and other forms of cover for the other SWMUs overestimates risk because exposure to these soils is not likely.

Values assumed for exposure parameters (e.g., ingestion rate and exposure frequency) used in calculations of intakes were based primarily on agency (e.g., USEPA) guidance. These assumptions might result in underestimating or overestimating the intakes calculated for specific receptors, depending on the accuracy of the assumptions relative to actual site conditions and land uses. For the industrial worker, an ED of 25 years and an EF of 225 days/year was used. These values are considered highly conservative, and are likely to result in overestimation of risks. Conservative values were applied to maintain a conservative assessment of exposure and risk.

Bioavailability of some COPCs to target tissues may be reduced due to their binding capacities and the presence of other naturally occurring compounds. Carcinogenic PAHs, for example, are

often present in association with high molecular weight constituents that hinder their uptake (LaGoy and Quirk 1994).

6.4.7 Toxicity Factors

Uncertainty is inherent in the toxicity values utilized in evaluating the carcinogenic and noncarcinogenic risks. Such uncertainty is chemical-specific and is incorporated into the toxicity value during its development to ensure that the risk assessment provides a protective evaluation of potential toxicity. For example, an uncertainty factor may be applied for interspecies and intrahuman variability, for extrapolation from subchronic to chronic exposures, or for epidemiological data limitations. Application of uncertainty factors to the RfD is expected to overestimate risks.

The absence of toxicity values for some of the COPCs may tend to underestimate risks and hazards. For example, an RfD was not available for benzo(a)pyrene and a CSF was not available for naphthalene. Toxicity information is not available for dermal exposure; hence, assumptions are made in order to calculate dermal-adjusted RfDs and CSFs, where appropriate. These assumptions may overestimate or underestimate risk.

6.4.8 Risk and Hazard Estimation

Although the methods used to calculate carcinogenic and systemic risk at the Facility comply with federal and state standards, there are uncertainties associated with the quantitative risk estimates discussed above. These uncertainties are introduced because of: (1) the need to extrapolate below the dose range of experimental tests; (2) the variability of the receptor population (e.g., smoker vs. non-smoker, genetic predisposition); (3) assumed dose-response relationship between animals and humans; (4) differences in exposure routes; (5) conservative assumptions; and (6) ignoring background risks. These recognized uncertainties are raised to point out the limitations of this type of study. The assumptions used to estimate exposure in this HHRA were consistently conservative in nature and biased toward protecting human health.

In addition to chemical concentration, route, and duration of exposure, many other factors may influence the likelihood of developing cancer. These include differences in individual nutrition, health status, age, sex, and inherited characteristics, which may affect susceptibility (Versar 1991). Uncertainty is also compounded with regard to assumptions about scenario settings and availability of contaminated soil for contact.

The hazards and risks derived based on the data analysis, exposure assessment, and toxicity assessment steps of the risk assessment are inherently uncertain given the uncertainties within

each step of the HHRA process. The uncertainty in the risk characterization may be compounded from the uncertainties at these prior stages. The reliance on conservative inputs for various exposure parameters are anticipated to result in overestimations of risks from Facility-related chemical stressors. Summing HQ values to derive an HI is a conservative approach given that different chemicals often exert their effects on distinct target organs (USEPA 1989).

7.0 Summary and Conclusions

Under the provisions of DNREC Remediation Guidance, a HHRA was conducted for three general areas associated with the Facility: Facility SWMUs, the CWCs, and Dragon Run and the surrounding non-developed land. The objectives of the HHRA were to determine whether surface soil, surface water, sediment, or groundwater concentrations of Facility-related constituents pose potentially unacceptable risks to human health under site-specific exposure conditions, and to support decisions concerning the need for further evaluation or action based upon current and reasonably anticipated future land use.

Based on the assumed continued land use as an industrial facility, outdoor industrial workers and construction workers were identified as potential receptor populations in the Facility SWMUs. Recreational swimmers (adult and child), recreational anglers (adult and child), and construction workers were identified in Dragon Run and the surrounding non-developed land. Receptors evaluated for the Delaware River included recreational swimmers (adult and child) and recreational anglers (adult and child); data for the CWCs were conservatively used to evaluate potential threats to recreational users of the River. Human exposures in the channels themselves are highly unlikely due to security measures established for these features.

7.1 Data Evaluation Process

In accordance with DNREC (1999) and USEPA (1989, 1991, 1992a, 1992b, 1995, 2002, 2004) risk assessment guidance, a tiered approach was used to evaluate the potential for human health risk at the Facility. This section describes the three step process used to evaluate, qualitatively and quantitatively, the analytical data collected from Facility soil, groundwater, sediment, and surface water for risks to human health. The data were subjected to the following evaluations:

Step 1) Identification of COPCs via comparison of maximum concentrations to media-appropriate screening benchmarks:

- surface soil and sediment data: comparison to soil DURBS;
- groundwater data: comparison to groundwater DURBS; and
- surface water data: comparison to groundwater DURBS or DNREC Water Quality Criteria for Protection of Human Health.

Step 2) Estimation of exposure to COPCs:

- surface soil: USEPA intake equations and parameters were used to calculate exposure to soil COPCs;
- sediment: qualitative evaluation of whether exposure is realistic;
- groundwater: For direct contact, depth to groundwater was evaluated to determine if potential exposure exists; and
- surface water: No COPCs identified, therefore this step was not necessary.

Step 3). Characterization of risk:

- surface soil: estimated doses of COPCs were compared to TRVs to calculate HQs and excess cancer risk. HQs greater than 1.0 or excess cancer risks greater than 1×10^{-5} indicate there may be concern for potential non-carcinogenic or cancer effects, respectively;
- sediment: No COPCs were identified for Dragon Run sediment data and no realistic exposure is likely for CWEC sediment. Therefore, this step was not necessary;
- groundwater: a weight-of-evidence approach was qualitatively used to characterize risk. Seven lines of evidence were used, where appropriate:
    - The number of detected concentrations;
    - The number of concentrations exceeding the benchmark;
    - Whether the constituent was detected in the wells closest to the CWCs (i.e., Wells D33, D60, and D36);
    - Whether the detected concentration in Well D33, Well D60, or Well D36 (or reporting limit for a non-detect) exceeded the benchmark;
    - Magnitude of exceedances;
    - The appropriateness of the screening benchmark for human health risk assessment; and

- Site-specific geology and hydrogeology information.

- Surface water: No COPCs identified, therefore this step was not necessary.

The evaluation for each area of investigation (i.e., SWMUs, CWCs, Dragon Run and the surrounding undeveloped land) started with Step 1 and continued to Steps 2 and 3 only if COPCs were identified. No further action is recommended for areas where the risk characterization step resulted in no unacceptable risks. If unacceptable risks were determined to be present, then additional investigation or corrective measures are recommended.

7.2 SWMUs 18, 31, and 32

Media Assessed: surface soil, groundwater.

Potential Receptors: outdoor industrial workers, construction workers.

Data Screening Results: No soil COPCs were identified in any of these SWMUs. Therefore, the risk evaluation for soil was completed at Step 1.

Exposure Summary: There is no complete exposure pathway to potential receptors from groundwater because it is assumed that PPE typical for routine operations and maintenance would be used and institutional controls such as regular hazard assessments would be in place to protect these receptors. Therefore, the evaluation of risk from groundwater was completed at Step 2.

Recommendation: There are no unacceptable risks; no further action recommended for SWMUs 18, 31, and 32.

7.3 SWMUs 13, 14 (Unit F, Areas B-G), 15, 20A & 20A.1, 26, 33, 34

Media Assessed: surface soil, groundwater.

Potential Receptors: outdoor industrial workers, construction workers.

Data Screening Results: Arsenic was identified as a soil COPC in each of these SWMUs.

Exposure Summary: There is no complete exposure pathway to potential receptors from groundwater because it is assumed that PPE typical for routine operations and maintenance would be used and institutional controls such as regular hazard assessments would be in place to protect these receptors. Therefore, the evaluation of risk from groundwater was completed at Step 2. Evaluation of risk from surface soil was completed at Step 3 (follows).

Risk Summary (arsenic in soil):

SWMU 13: HQ = 0.01; cancer risk = 2×10^{-6}.

SWMU 14 (Unit F, Areas B – G): HQ = 0.01; cancer risk = 2×10^{-6}

SWMU 15: HQ = 0.01; cancer risk = 2×10^{-6}

SWMU 20A & 20A.1: HQ = 0.02; cancer risk = 3×10^{-6}

SWMU 26: HQ = 0.05; cancer risk = 7×10^{-6}

SWMU 33: HQ = 0.05; cancer risk = 8×10^{-6}

SWMU 34: HQ = 0.01; cancer risk = 2×10^{-6}

Recommendation: There are no unacceptable risks; no further action recommended for SWMUs 13, 14 (Unit F, Areas B – G), 15, 20A & 20A.1, 26, 33, 34.

7.4 SMWU 14 (Unit F, Area A, Woodpile Area)

Media Assessed: surface soil, groundwater.

Potential Receptors: outdoor industrial workers, construction workers.

Data Screening Results: Arsenic, benzo(a)pyrene, and naphthalene were identified as soil COPCs.

Exposure Summary: There is no complete exposure pathway to potential receptors from groundwater because it is assumed that PPE typical for routine operations and maintenance would be used and institutional controls such as regular hazard assessments would be in place to protect these receptors. Therefore, the evaluation of risk from groundwater was completed at Step 2. Evaluation of risk from surface soil was completed at Step 3 (follows).

Risk Summary (soil COPCs): HI = 0.2; cancer risk = 5×10^{-6}.

Recommendation: There are no unacceptable risks; no further action recommended for SWMUs 14 (Unit F, Area A, Woodpile Area). (Note: this evaluation assumed no protective soil cover was present).

7.5 Dragon Run and the Non-Developed Land in the Southern Portion of the Facility

Media Assessed: surface water and sediment (Dragon Run); groundwater (non-developed land in southern portion).

Potential Receptors: recreational swimmers and anglers (Dragon Run); construction workers (non-developed land in southern portion).

Data Screening Results: No surface water or sediment COPCs were identified for Dragon Run. Therefore, the risk evaluation for these media was completed at Step 1.

Exposure Summary: Depth to groundwater is greater than what is expected for direct contact for construction workers. Therefore, there is no complete exposure pathway and the risk evaluation for groundwater in the non-developed land in the southern portion of the Facility was completed at Step 2.

Recommendation: There are no unacceptable risks; no further action recommended for Dragon Run and the non-developed land in the southern portion of the Facility.

7.6 CWIC

Media Assessed: groundwater (as a conservative surrogate for surface water).

Potential Receptors: recreational swimmers and anglers (using the Delaware River).

Data Screening Results: Dissolved and total iron, benzene, MTBE, and naphthalene were identified as COPCs in groundwater.

Exposure Summary: It was conservatively assumed that groundwater may discharge to the CWIC, which is in communication with the Delaware River. Therefore, exposure may occur. Evaluation of risk was completed at Step 3 (follows).

Risk Summary: The weight-of-evidence suggests that iron is a naturally-occurring element found in the Columbia Formation and concentrations found in the area are not derived from operations-related operations. Concentrations of benzene in groundwater for seven of ten wells are below surface water screening values, and the well adjacent to the channel is below the surface water screening value. Concentrations of naphthalene above screening values appear localized to two wells approximately 1,000 feet from the channel, and the well adjacent to the channel is below screening values. Concentrations of MTBE in groundwater are below surface

water screening values in six of ten wells, concentrations of MTBE above surface water screening values occur in closely grouped wells approximately 700 feet from the channel, and MTBE was not detected in the well adjacent to the channel. For organic constituents, the comparatively low detected concentrations in groundwater monitoring wells within 1,000 feet of the CWIC, the concentrations below surface water screening values in the well adjacent to the channel, the mixing effects of comparatively minor potential groundwater discharge with the orders-of-magnitude larger volume of CWIC water, and the normal operational condition of withdrawal of 400 million gallons per day from the CWIC, all combine to mitigate potential risk in surface water.

Recommendation: There are no unacceptable risks; no further action recommended for CWIC.

7.7 CWEC

Media Assessed: groundwater (as a conservative surrogate for surface water), surface water, and sediment.

Potential Receptors: recreational swimmers and anglers (using the Delaware River).

Data Screening Results: Total iron, benzene, and MTBE were identified as COPCs in groundwater; arsenic was identified as a COPC in sediment. No surface water COPCs were identified and therefore the risk evaluation for surface water in the CWEC was completed at Step 1.

Exposure Summary: Although limited surface water data did not indicate the presence of COPCs, for the purposes of this assessment it was conservatively assumed that groundwater may discharge to the CWEC, which is in communication with the Delaware River. Therefore, exposure to potentially impacted surface water or sediment may occur. Evaluation of risk was completed in Step 3 (follows).

Risk Summary: The weight-of-evidence suggests arsenic is not migrating from sediment to surface water and a receptor is unlikely to come in contact with sediment. Iron is a naturally-occurring element found in the Columbia Formation and concentrations found in the area are not derived from operations-related operations. Benzene concentrations in groundwater were below the surface water screening value in eight of nine groundwater samples and were below surface water screening standards in the wells closest to the channel; benzene was not detected in surface water or sediment. MTBE concentrations in groundwater were below the surface water

screening value in four of six wells; the two wells with groundwater concentrations above surface water screening values are approximately 800 feet from the channel; concentrations of MTBE in groundwater in the wells located closest to the channel did not exceed surface water screening values. The comparatively low detected concentrations in groundwater monitoring wells in the vicinity of the CWEC, the concentrations below surface water screening values in the wells closest to the channel, the mixing effects of comparatively minor potential groundwater discharge with the orders-of-magnitude larger volume of CWEC water, and the normal operational condition of discharge of 400 million gallons per day through the CWEC, all combine to mitigate potential risk in surface water.

Recommendation: There are no unacceptable risks; no further action recommended for CWEC.

7.8 Conclusion

The results of the human health risk assessment performed for the Facility indicate that, based on the current operations-related constituent concentrations in the groundwater and Facility surface soils, there are no unacceptable human health risks to potential on-site or offsite receptors. As demonstrated in the Phase II RFI Groundwater Report (URS 2010), site-wide COPC trend analyses indicate that site plumes are generally stable or decreasing in concentration, where a trend is observed, which will further decrease currently insignificant risks over time.

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TABLE 1
SOIL SAMPLE SUMMARY
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

SWMU	Area	Verification of Release Study Samples (VRS)	Phase I RCRA Facility Investigation	Phase II RCRA Facility Investigation	Wood Pile Area Investigation	Total Number of Samples
13	Old Drum Storage Area	4	4	1		9
14	Unit F: Area A, Woodpile Area	1	2		37	40
14	Unit F: Areas B through G	6	5	12		23
15	Tank Bottom Weathering Areas	35	22	87		144
18	Fire Training Area	3	2	15		20
20a & 20a.1	Waste Water Treatment Plant	3	2	10		15
26	Tetraethyl Lead Laydown Area	2	4	3		9
31	Area of Stained Soil Near the Former Slurry Oil Dumpster	4	2	27		33
32	Stained Soil Within Oily Sewer Back-up Areas	4	2	14		20
33	Piers 1, 2, and 3		14	19		33
34	Former Naphthalene Unit Tank Farm			7		7

TABL
SOIL DATA SC..EENING
OLD DRUM STORAGE AREA - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Metals (mg/kg)								
7429-90-5	ALUMINUM	4	4	19,127	29	200,000	N	N
7440-36-0	ANTIMONY	4	0	--	8.8	82	--	N
7440-38-2	ARSENIC	8	7	4.9	0.05	4	Y	N
7440-39-3	BARIUM	8	8	62.1	0.05	14,000	N	N
7440-69-9	BISMUTH	4	0	--	29	NA	--	N
7440-43-9	CADMIUM	8	7	1.2	0.05	100	N	N
7440-47-3	CHROMIUM, TOTAL	8	8	40	0.05	310000	N	N
7439-92-1	LEAD	8	8	8.7	0.05	1,000	N	N
7439-97-6	MERCURY	8	2	0.6	0.013	610	N	N
7440-02-0	NICKEL	8	8	110	0.05	4,100	N	N
7782-49-2	SELENIUM	8	3	0.85	0.05	1,000	N	N
7440-22-4	SILVER	8	0	--	1	1,000	--	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	6	0	--	0.0008	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	5	0	--	0.234	520	--	N
71-43-2	BENZENE	6	0	--	0.0008	200	--	N
75-15-0	CARBON DISULFIDE	6	0	--	0.0008	5,000	--	N
100-41-4	ETHYLBENZENE	6	1	0.00123	0.0008	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	6	1	0.0122	0.0008	5,000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	1	0	--	0.0008	1,000	--	N
95-47-6	ORTHO-XYLENE	2	0	--	0.0008	5,000	--	N
100-42-5	STYRENE	6	0	--	0.0008	5,000	--	N
108-88-3	TOLUENE	6	2	0.0034	0.0008	5,000	N	N
1330-20-7	TOTAL XYLENES	6	2	0.0045	0.001	5,000	N	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE
SOIL DATA SCREENING
UNIT F, AREA A (WOOD PILE AREA) - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS Number	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Inorganics (mg/kg)								
ALUMINUM	7429-90-5	37	37	35500	9.54	200000	N	N
ANTIMONY	7440-36-0	37	0	--	9.54	82	--	N
ARSENIC	7440-38-2	37	26	31.2	0.954	4	Y	N
BARIUM	7440-39-3	37	37	180	1.91	14000	N	N
BERYLLIUM	7440-41-7	37	8	1.69	0.954	410	N	N
CADMIUM	7440-43-9	37	1	1.54	0.954	100	N	N
CALCIUM	7440-70-2	37	37	19300	9.54	NA	N	Y
CHROMIUM, TOTAL	7440-47-3	37	37	463	0.954	310000	N	N
COBALT	7440-48-4	37	37	816	0.954	12000	N	N
COPPER	7440-50-8	37	36	485	1.91	8200	N	N
IRON	7439-89-6	37	37	89100	9.54	61000	Y	N
LEAD	7439-92-1	37	37	140	0.954	1000	N	N
MAGNESIUM	7439-95-4	37	37	2830	9.54	NA	N	Y
MANGANESE	7439-96-5	37	37	1170	0.954	4100	N	N
MERCURY	7439-97-6	37	11	2.07	0.0962	610	N	N
NICKEL	7440-02-0	37	37	575	0.954	4100	N	N
POTASSIUM	7440-09-7	37	33	922	95.4	NA	N	Y
SELENIUM	7782-49-2	37	4	26.7	1.91	1000	N	N
SILVER	7440-22-4	37	0	--	0.954	1000	--	N
SODIUM	7440-23-5	37	9	1460	191	NA	N	Y
THALLIUM	7440-28-0	37	0	--	1.91	220	--	N
VANADIUM	7440-62-2	37	36	644	9.54	1400	N	N
ZINC	7440-66-6	37	35	357	9.54	61000	N	N
VOCs (mg/kg)								
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	37	0	--	0.00435	4	--	N
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4	37	0	--	0.00174	0.07	--	N
2-HEXANONE	591-78-6	37	0	--	0.0435	5000	--	N
ACETONE	67-64-1	37	17	0.503	0.0435	5000	N	N
BENZENE	71-43-2	37	11	19.3	0.00174	200	N	N
BROMOFORM	75-25-2	37	0	--	0.00174	720	--	N
BROMOMETHANE	74-83-9	37	0	--	0.00174	290	--	N
CARBON DISULFIDE	75-15-0	37	7	1.08	0.00435	5000	N	N
CYCLOHEXANE	110-82-7	37	2	1.89	0.0087	NA	N	Y
ETHYLBENZENE	100-41-4	37	10	49.7	0.00174	5000	N	N
ISOPROPYLBENZENE (CUMENE)	98-82-8	37	5	3.88	0.00174	5000	N	N
METHYL ACETATE	79-20-9	37	1	6.98	0.0087	5000	N	N
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	37	0	--	0.0435	5000	--	N

TABLE
SOIL DATA SCREENING
UNIT F, AREA A (WOOD PILE AREA) - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS Number	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1	37	0	--	0.0435	5000	--	N
METHYL TERT-BUTYL ETHER	1634-04-4	37	1	0.00662	0.00174	1000	N	N
METHYLCYCLOHEXANE	108-87-2	37	2	3.42	0.0087	NA	N	**Y**
STYRENE	100-42-5	37	0	--	0.00174	5000	--	N
TOLUENE	108-88-3	37	10	4	0.00174	5000	N	N
TOTAL XYLENES	1330-20-7	37	10	54.2	0.00435	5000	N	N
SVOCs (mg/kg)								
2,4-DIMETHYLPHENOL	105-67-9	37	1	4.9	0.323	4100	N	N
2,4-DINITROPHENOL	51-28-5	37	0	--	0.807	410	--	N
2,4-DINITROTOLUENE	121-14-2	37	0	--	0.323	410	--	N
2,6-DINITROTOLUENE	606-20-2	37	0	--	0.323	200	--	N
2-METHYLNAPHTHALENE	91-57-6	37	12	2820	0.323	4100	N	N
2-METHYLPHENOL (O-CRESOL)	95-48-7	37	1	2.74	0.323	5000	N	N
2-NITROANILINE	88-74-4	37	0	--	0.807	12	--	N
2-NITROPHENOL	88-75-5	37	0	--	0.323	NA	--	N
3-NITROANILINE	99-09-2	37	0	--	0.807	NA	--	N
4,6-DINITRO-2-METHYLPHENOL	534-52-1	37	0	--	0.807	2	--	N
4-BROMOPHENYL PHENYL ETHER	101-55-3	37	0	--	0.323	NA	--	N
4-NITROPHENOL	100-02-7	37	0	--	0.807	1600	--	N
ACENAPHTHENE	83-32-9	37	3	87.6	0.323	5000	N	N
ACENAPHTHYLENE	208-96-8	37	0	--	0.323	NA	--	N
ANTHRACENE	120-12-7	37	1	46.5	0.323	5000	N	N
BENZO(A)ANTHRACENE	56-55-3	37	1	1.22	0.323	7.8	N	N
BENZO(A)PYRENE	50-32-8	37	2	0.996	0.323	0.78	**Y**	N
BENZO(B)FLUORANTHENE	205-99-2	37	1	1.07	0.323	7.8	N	N
BENZO(G,H,I)PERYLENE	191-24-2	37	3	1.03	0.323	NA	N	**Y**
BENZO(K)FLUORANTHENE	207-08-9	37	0	--	0.323	78	--	N
BENZYL BUTYL PHTHALATE	85-68-7	37	0	--	0.323	5000	--	N
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	37	2	1.82	0.323	410	N	N
CARBAZOLE	86-74-8	37	0	--	0.323	NA	--	N
CHRYSENE	218-01-9	37	6	42.7	0.323	780	N	N
CRESOLS, TOTAL	1319-77-3	37	1	0.919	0.323	NA	N	**Y**
DIBENZ(A,H)ANTHRACENE	53-70-3	37	0	--	0.323	0.8	--	N
DIBENZOFURAN	132-64-9	37	0	--	0.323	820	--	N
DIETHYL PHTHALATE	84-66-2	37	0	--	0.323	5000	--	N
DIMETHYL PHTHALATE	131-11-3	37	0	--	0.323	5000	--	N
DI-N-BUTYL PHTHALATE	84-74-2	37	0	--	0.323	5000	--	N
DI-N-OCTYLPHTHALATE	117-84-0	37	0	--	0.323	4100	--	N

TABLE
SOIL DATA SCREENING
UNIT F, AREA A (WOOD PILE AREA) - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS Number	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
FLUORANTHENE	206-44-0	37	3	1.29	0.323	5000	N	N
FLUORENE	86-73-7	37	3	146	0.323	5000	N	N
INDENO(1,2,3-C,D)PYRENE	193-39-5	37	0	--	0.323	8	--	N
ISOPHORONE	78-59-1	37	0	--	0.323	5000	--	N
NAPHTHALENE	91-20-3	37	18	17300	0.323	4100	Y	N
NITROBENZENE	98-95-3	37	0	--	0.323	100	--	N
N-NITROSODI-N-PROPYLAMINE	621-64-7	37	0	--	0.323	0.8	--	N
N-NITROSODIPHENYLAMINE	86-30-6	37	0	--	0.323	1200	--	N
PHENANTHRENE	85-01-8	37	9	505	0.323	5000	N	N
PHENOL	108-95-2	37	0	--	0.323	5000	--	N
P-NITROANILINE	100-01-6	37	0	--	0.807	NA	--	N
PYRENE	129-00-0	37	8	122	0.323	5000	N	N
Other Parameters								
% DRY SOLIDS	DRY	37	23	95.3	--	NA	--	--

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- Not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE
SOIL DATA SCREENING
UNIT F, AREAS B THROUGH G - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Inorganics (mg/kg)								
7440-36-0	ANTIMONY	16	0	--	7.75	82	--	N
7440-38-2	ARSENIC	22	17	7.47	0.5	4	Y	N
7440-39-3	BARIUM	16	16	125	2	14,000	N	N
7440-43-9	CADMIUM	16	10	3.3	0.5	100	N	N
7440-47-3	CHROMIUM, TOTAL	15	15	544	1.03	310000	N	N
57-12-5	CYANIDE	6	2	0.4	0.3	4,100	N	N
7439-92-1	LEAD	16	16	287	0.4	1,000	N	N
7439-97-6	MERCURY	8	2	0.141	0.05	610	N	N
7440-02-0	NICKEL	16	16	389.7	1.03	4,100	N	N
7782-49-2	SELENIUM	15	5	2.47	0.5	1,000	N	N
7440-22-4	SILVER	16	3	1.31	1	1,000	N	N
7440-62-2	VANADIUM	5	5	214	6.46	1,400	N	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	10	0	--	0.00197	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	10	0	--	0.197	520	--	N
71-43-2	BENZENE	10	0	--	0.00197	200	--	N
75-15-0	CARBON DISULFIDE	10	0	--	0.00494	5,000	--	N
100-41-4	ETHYLBENZENE	10	0	--	0.00197	5,000	--	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	10	0	--	0.0494	5,000	--	N
95-47-6	ORTHO-XYLENE	4	0	--	0.00197	5,000	--	N
100-42-5	STYRENE	10	0	--	0.00197	5,000	--	N
108-88-3	TOLUENE	10	2	0.004	0.00197	5,000	N	N
1330-20-7	TOTAL XYLENES	10	5	0.0038	0.00296	5,000	N	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	16	0	--	0.324	4,100	--	N
51-28-5	2,4-DINITROPHENOL	17	0	--	0.33	410	--	N
121-14-2	2,4-DINITROTOLUENE	16	0	--	0.324	410	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	17	0	--	0.324	5,000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	11	0	--	0.81	2	--	N
106-44-5	4-METHYLPHENOL (P-CRESOL)	6	0	--	0.33	5,000	--	N
100-02-7	4-NITROPHENOL	16	0	--	0.66	1,600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	17	0	--	0.324	NA	--	N
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	17	0	--	0.66	1,000	--	N
120-12-7	ANTHRACENE	16	0	--	0.324	5,000	--	N
56-55-3	BENZO(A)ANTHRACENE	17	2	0.581	0.324	7.8	N	N
50-32-8	BENZO(A)PYRENE	16	2	0.551	0.324	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	16	2	0.757	0.324	7.8	N	N

TABLE
SOIL DATA SCREENING
UNIT F, AREAS B THROUGH G - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
207-08-9	BENZO(K)FLUORANTHENE	16	1	0.215	0.324	78	N	N
85-68-7	BENZYL BUTYL PHTHALATE	17	0	--	0.324	5,000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	16	5	2.74	0.324	410	N	N
218-01-9	CHRYSENE	16	3	0.821	0.324	780	N	N
--	CRESOLS, TOTAL	10	0	--	0.324	NA	--	N
53-70-3	DIBENZ(A,H)ANTHRACENE	17	0	--	0.324	0.8	--	N
84-66-2	DIETHYL PHTHALATE	17	0	--	0.324	5,000	--	N
131-11-3	DIMETHYL PHTHALATE	16	0	--	0.324	5,000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	17	6	3.44	0.324	5,000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	16	0	--	0.324	4,100	--	N
206-44-0	FLUORANTHENE	16	5	0.843	0.324	5,000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	16	0	--	0.324	8	--	N
91-20-3	NAPHTHALENE	17	0	--	0.324	4,100	--	N
98-95-3	NITROBENZENE	17	0	--	0.324	100	--	N
85-01-8	PHENANTHRENE	17	2	0.422	0.324	5,000	N	N
108-95-2	PHENOL	16	0	--	0.324	5,000	--	N
129-00-0	PYRENE	16	5	0.985	0.324	5,000	N	N
110-86-1	PYRIDINE	16	0	--	0.33	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

N = No; Y=Yes

TABLE 4
SOIL DATA SCREENING
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Inorganics (mg/kg)								
7440-36-0	ANTIMONY	126	5	8.5	7.72	82	N	N
7440-38-2	ARSENIC	75	66	16.8	0.5	4	Y	N
7440-39-3	BARIUM	55	55	520	2	14,000	N	N
7440-41-7	BERYLLIUM	49	36	5.72	0.3	410	N	N
7440-43-9	CADMIUM	55	31	4	0.5	100	N	N
7440-47-3	CHROMIUM, TOTAL	55	55	111	1.29	310000	N	N
7440-48-4	COBALT	49	46	26.0	2	12,000	N	N
57-12-5	CYANIDE	39	3	0.9	0.3	4,100	N	N
7439-92-1	LEAD	55	55	523	0.2	1,000	N	N
78-00-2	LEAD, TETRAETHYL	19	0	--	0.11	0.02	--	Y
7439-97-6	MERCURY	39	1	0.05	0.017	610	N	N
7440-02-0	NICKEL	55	55	124	2	4,100	N	N
7782-49-2	SELENIUM	55	16	1.3	0.5	1,000	N	N
7440-22-4	SILVER	55	11	1.87	1	1,000	N	N
7440-62-2	VANADIUM	49	49	287	2	1,400	N	N
7440-66-6	ZINC	49	49	2,084	2	61,000	N	N
VOCs (mg/kg)								
71-55-6	1,1,1-TRICHLOROETHANE	126	1	0.00252	0.001	4,100	N	N
79-34-5	1,1,2,2-TETRACHLOROETHANE	33	0	--	0.01	29	--	N
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	126	0	--	0.001	0.07	--	N
107-06-2	1,2-DICHLOROETHANE	126	0	--	0.001	63	--	N
78-87-5	1,2-DICHLOROPROPANE	126	0	--	0.001	84	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	126	0	--	0.001	520	--	N
67-64-1	ACETONE	33	20	0.251	0.1	5,000	N	N
71-43-2	BENZENE	126	3	0.00158	0.001	200	N	N
75-15-0	CARBON DISULFIDE	126	1	0.00578	0.001	5,000	N	N
108-90-7	CHLOROBENZENE	126	0	--	0.001	4,100	--	N
67-66-3	CHLOROFORM	126	1	0.0018	0.001	940	N	N
100-41-4	ETHYLBENZENE	126	9	0.14	0.001	5,000	N	N
08-38-3/106-42-	META & PARA-XYLENES	93	9	0.2	0.002	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	126	4	0.0174	0.001	5,000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	93	0	--	0.001	1,000	--	N
95-47-6	ORTHO-XYLENE	93	5	0.12	0.001	5,000	N	N
127-18-4	TETRACHLOROETHENE	126	0	--	0.001	110	--	N
108-88-3	TOLUENE	126	13	0.0091	0.001	5,000	N	N
1330-20-7	TOTAL XYLENES	33	3	0.0098	0.01	5,000	N	N
108-05-4	VINYL ACETATE	33	0	--	0.01	5,000	--	N

TABLE 4
SOIL DATA SCREENING
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	126	0	--	0.0531	4,100	--	N
51-28-5	2,4-DINITROPHENOL	126	0	--	0.1328	410	--	N
121-14-2	2,4-DINITROTOLUENE	126	0	--	0.1328	410	--	N
91-57-6	2-METHYLNAPHTHALENE	18	1	7.87	0.33	4,100	N	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	125	0	--	0.0531	5,000	--	N
108-39-4	3-METHYLPHENOL	31	0	--	0.33	5,000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	93	0	--	0.1328	2	--	N
106-44-5	4-METHYLPHENOL (P-CRESOL)	39	0	--	0.0531	5,000	--	N
100-02-7	4-NITROPHENOL	126	1	0.331	0.1328	1,600	N	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	126	0	--	0.1593	NA	--	N
208-96-8	ACENAPHTHYLENE	18	0	--	0.33	NA	--	N
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	125	0	--	0.1328	1,000	--	N
120-12-7	ANTHRACENE	126	3	0.579	0.0531	5,000	N	N
56-55-3	BENZO(A)ANTHRACENE	126	3	0.28	0.0531	7.8	N	N
50-32-8	BENZO(A)PYRENE	126	4	0.391	0.0531	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	126	3	0.681	0.0531	7.8	N	N
207-08-9	BENZO(K)FLUORANTHENE	126	1	0.0925	0.0531	78	N	N
85-68-7	BENZYL BUTYL PHTHALATE	126	0	--	0.0531	5,000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	126	14	1.2	0.0531	410	N	N
218-01-9	CHRYSENE	126	2	0.45	0.0531	780	N	N
--	CRESOLS, TOTAL	87	0	--	0.339	NA	--	N
53-70-3	DIBENZ(A,H)ANTHRACENE	126	0	--	0.0531	0.8	--	N
84-66-2	DIETHYL PHTHALATE	126	8	1.15	0.0531	5,000	N	N
131-11-3	DIMETHYL PHTHALATE	126	2	0.229	0.0531	5,000	N	N
84-74-2	DI-N-BUTYL PHTHALATE	126	22	2.7	0.0531	5,000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	126	1	0.356	0.0531	4,100	N	N
206-44-0	FLUORANTHENE	126	3	1.03	0.0531	5,000	N	N
86-73-7	FLUORENE	18	1	0.644	0.33	5,000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	126	1	0.118	0.0531	8	N	N
91-20-3	NAPHTHALENE	126	3	2.55	0.0531	4,100	N	N
98-95-3	NITROBENZENE	126	0	--	0.0531	100	--	N
85-01-8	PHENANTHRENE	126	5	1.8	0.0531	5,000	N	N
108-95-2	PHENOL	125	2	0.597	0.0531	5,000	N	N
129-00-0	PYRENE	126	5	0.75	0.0531	5,000	N	N
110-86-1	PYRIDINE	125	0	--	0.1328	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE
SOIL DATA SC NING
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty[b]
VOCs (mg/kg)								
95-63-6	1,2,4-TRIMETHYLBENZENE	3	1	0.14	0.01	5,000	N	N
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	18	0	--	0.00162	0.07	--	N
108-67-8	1,3,5-TRIMETHYLBENZENE (MESITYLENE)	3	1	0.187	0.01	5,000	N	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	18	0	--	0.162	520	--	N
591-78-6	2-HEXANONE	5	0	--	0.007	5,000	--	N
67-64-1	ACETONE	5	4	0.116	0.007	5,000	N	N
71-43-2	BENZENE	20	2	0.0607	0.00162	200	N	N
75-25-2	BROMOFORM	5	0	--	0.007	720	--	N
74-83-9	BROMOMETHANE	5	0	--	0.007	290	--	N
75-15-0	CARBON DISULFIDE	20	1	0.0097	0.00406	5,000	N	N
74-95-3	DIBROMOMETHANE	3	0	--	0.01	5,000	--	N
75-71-8	DICHLORODIFLUOROMETHANE	3	0	--	0.01	5,000	--	N
64-17-5	ETHANOL	3	0	--	0.5	NA	--	N
97-63-2	ETHYL METHACRYLATE	3	0	--	0.1	5,000	--	N
100-41-4	ETHYLBENZENE	20	3	0.067	0.00162	5,000	N	N
98-82-8	ISOPROPYLBENZENE (CUMENE)	3	1	0.031	0.01	5,000	N	N
08-38-3/106-42-	META & PARA-XYLENES	2	2	0.1488	0.0141	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	20	3	0.0215	0.007	5,000	N	N
108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	5	0	--	0.007	5,000	--	N
1634-04-4	METHYL TERT-BUTYL ETHER	20	2	0.0423	0.00162	1,000	N	N
104-51-8	N-BUTYLBENZENE	3	1	0.215	0.01	2,000	N	N
103-65-1	N-PROPYLBENZENE	3	1	0.153	0.01	2,000	N	N
95-47-6	ORTHO-XYLENE	17	2	0.4849	0.00162	5,000	N	N
135-98-8	SEC-BUTYLBENZENE	3	1	0.17	0.01	2,000	N	N
100-42-5	STYRENE	20	0	--	0.00162	5,000	--	N
98-06-6	T-BUTYLBENZENE	3	0	--	0.01	2,000	--	N
108-88-3	TOLUENE	20	5	0.0431	0.00162	5,000	N	N
1330-20-7	TOTAL XYLENES	18	1	0.275	0.00244	5,000	N	N
108-05-4	VINYL ACETATE	3	0	--	0.1	5,000	--	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	15	0	--	0.323	4,100	--	N
51-28-5	2,4-DINITROPHENOL	15	0	--	0.807	410	--	N
121-14-2	2,4-DINITROTOLUENE	15	0	--	0.323	410	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	15	0	--	0.323	5,000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	15	0	--	0.807	2	--	N
100-02-7	4-NITROPHENOL	15	0	--	0.807	1,600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	15	0	--	0.323	NA	--	N
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	15	0	--	1.62	1,000	--	N
120-12-7	ANTHRACENE	15	0	--	0.323	5,000	--	N
56-55-3	BENZO(A)ANTHRACENE	15	0	--	0.323	7.8	--	N
50-32-8	BENZO(A)PYRENE	15	0	--	0.323	0.78	--	N
205-99-2	BENZO(B)FLUORANTHENE	15	0	--	0.323	7.8	--	N
207-08-9	BENZO(K)FLUORANTHENE	15	0	--	0.323	78	--	N
85-68-7	BENZYL BUTYL PHTHALATE	15	0	--	0.323	5,000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	15	0	--	0.323	410	--	N
218-01-9	CHRYSENE	15	0	--	0.323	780	--	N
--	CRESOLS, TOTAL	15	0	--	0.323	NA	--	N

TABLE
SOIL DATA SCREENING
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty[b]
53-70-3	DIBENZ(A,H)ANTHRACENE	15	0	--	0.323	0.8	--	N
84-66-2	DIETHYL PHTHALATE	15	0	--	0.323	5,000	--	N
131-11-3	DIMETHYL PHTHALATE	15	0	--	0.323	5,000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	15	0	--	0.323	5,000	--	N
117-84-0	DI-N-OCTYLPHTHALATE	15	0	--	0.323	4,100	--	N
206-44-0	FLUORANTHENE	15	0	--	0.323	5,000	--	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	15	0	--	0.323	8	--	N
91-20-3	NAPHTHALENE	15	2	6.43	0.323	4,100	N	N
98-95-3	NITROBENZENE	15	0	--	0.323	100	--	N
85-01-8	PHENANTHRENE	15	0	--	0.323	5,000	--	N
108-95-2	PHENOL	15	0	--	0.323	5,000	--	N
129-00-0	PYRENE	15	0	--	0.323	5,000	--	N
110-86-1	PYRIDINE	15	0	--	0.646	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 6
SOIL DATA SCREENING
WASTEWATER TREATMENT PLANT - SWMU 20a AND 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Metals (mg/kg)								
7440-36-0	ANTIMONY	6	2	5.86	8.8	82	N	N
7440-38-2	ARSENIC	9	7	6.36	0.5	4	Y	N
7440-39-3	BARIUM	9	9	677	1.98	14,000	N	N
7440-43-9	CADMIUM	9	8	7.42	0.5	100	N	N
7440-47-3	CHROMIUM, TOTAL	9	9	461	0.988	310000	N	N
57-12-5	CYANIDE	1	0	--	0.3	4,100	--	N
7439-92-1	LEAD	9	9	286	0.2	1,000	N	N
7439-97-6	MERCURY	9	1	0.017	0.05	610	N	N
7440-02-0	NICKEL	9	9	62.8	0.988	4,100	N	N
7782-49-2	SELENIUM	9	2	2.86	0.5	1,000	N	N
7440-22-4	SILVER	9	3	1.78	0.988	1,000	N	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	13	0	--	0.00188	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	13	0	--	0.188	520	--	N
71-43-2	BENZENE	13	10	0.0527	0.00188	200	N	N
75-15-0	CARBON DISULFIDE	13	6	0.00644	0.0047	5,000	N	N
100-41-4	ETHYLBENZENE	13	7	0.142	0.00188	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	13	9	0.0502	0.047	5,000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	10	7	0.0302	0.00188	1,000	N	N
95-47-6	ORTHO-XYLENE	10	5	0.0145	0.00188	5,000	N	N
100-42-5	STYRENE	13	0	--	0.00188	5,000	--	N
994-05-8	TERT-AMYL METHYL ETHER	10	0	--	0.00188	NA	--	N
75-65-0	TERT-BUTYL ALCOHOL	10	6	0.0407	0.047	NA	N	Y
108-88-3	TOLUENE	13	6	0.012	0.00188	5,000	N	N
1330-20-7	TOTAL XYLENES	13	10	0.0908	0.00282	5,000	N	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	3	0	--	0.0534	4,100	--	N
51-28-5	2,4-DINITROPHENOL	2	0	--	0.1335	410	--	N
121-14-2	2,4-DINITROTOLUENE	8	0	--	0.1335	410	--	N
606-20-2	2,6-DINITROTOLUENE	5	0	--	0.335	200	--	N
91-57-6	2-METHYLNAPHTHALENE	5	0	--	0.335	4,100	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	3	0	--	0.0534	5,000	--	N
88-74-4	2-NITROANILINE	5	0	--	0.838	12	--	N
108-39-4	3-METHYLPHENOL	2	0	--	0.33	5,000	--	N
99-09-2	3-NITROANILINE	5	0	--	0.838	NA	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	1	0	--	0.1335	2	--	N
101-55-3	4-BROMOPHENYL PHENYL ETHER	5	0	--	0.335	NA	--	N
106-44-5	4-METHYLPHENOL (P-CRESOL)	3	0	--	0.0534	5,000	--	N
100-02-7	4-NITROPHENOL	3	0	--	0.1335	1,600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	3	0	--	0.1602	NA	--	N
83-32-9	ACENAPHTHENE	5	0	--	0.335	5,000	--	N
208-96-8	ACENAPHTHYLENE	5	0	--	0.335	NA	--	N

TABLE 6
SOIL DATA SCREENING
WASTEWATER TREATMENT PLANT - SWMU 20a AND 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	3	0	--	0.1335	1,000	--	N
120-12-7	ANTHRACENE	8	1	0.21	0.0534	5,000	N	N
56-55-3	BENZO(A)ANTHRACENE	8	3	0.276	0.0534	7.8	N	N
50-32-8	BENZO(A)PYRENE	8	1	0.161	0.0534	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	8	2	0.181	0.0534	7.8	N	N
191-24-2	BENZO(G,H,I)PERYLENE	5	1	0.092	0.335	NA	N	Y
207-08-9	BENZO(K)FLUORANTHENE	8	1	0.133	0.0534	78	N	N
85-68-7	BENZYL BUTYL PHTHALATE	8	0	--	0.0534	5,000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	8	1	0.1522	0.0534	410	N	N
86-74-8	CARBAZOLE	5	0	--	0.335	NA	--	N
218-01-9	CHRYSENE	8	2	0.31	0.0534	780	N	N
53-70-3	DIBENZ(A,H)ANTHRACENE	8	0	--	0.0534	0.8	--	N
132-64-9	DIBENZOFURAN	5	0	--	0.335	820	--	N
84-66-2	DIETHYL PHTHALATE	8	0	--	0.0534	5,000	--	N
131-11-3	DIMETHYL PHTHALATE	8	0	--	0.0534	5,000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	8	3	5.75	0.0534	5,000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	8	0	--	0.0534	4,100	--	N
206-44-0	FLUORANTHENE	8	3	0.741	0.0534	5,000	N	N
86-73-7	FLUORENE	5	1	0.044	0.335	5,000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	8	1	0.0752	0.0534	8	N	N
78-59-1	ISOPHORONE	5	0	--	0.335	5,000	--	N
91-20-3	NAPHTHALENE	8	1	0.12	0.0534	4,100	N	N
98-95-3	NITROBENZENE	8	0	--	0.0534	100	--	N
621-64-7	N-NITROSODI-N-PROPYLAMINE	5	0	--	0.335	0.8	--	N
86-30-6	N-NITROSODIPHENYLAMINE	5	0	--	0.335	1,200	--	N
85-01-8	PHENANTHRENE	8	2	0.709	0.0534	5,000	N	N
108-95-2	PHENOL	3	1	0.382	0.0534	5,000	N	N
100-01-6	P-NITROANILINE	5	0	--	0.838	NA	--	N
129-00-0	PYRENE	8	3	0.801	0.0534	5,000	N	N
110-86-1	PYRIDINE	8	0	--	0.1335	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE
SOIL DATA SCREENING
TEL EQUIPMENT LAYDOWN AREA - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Metals (mg/kg)								
7440-36-0	ANTIMONY	4	0	--	8	82	--	N
7440-38-2	ARSENIC	4	4	12.9	1.3	4	Y	N
7440-39-3	BARIUM	4	4	50.5	26.5	14,000	N	N
7440-43-9	CADMIUM	4	2	1.8	0.7	100	N	N
7440-47-3	CHROMIUM, TOTAL	4	4	51.7	1.3	310,000	N	N
7439-92-1	LEAD	9	9	74.2	0.4	1,000	N	N
78-00-2	LEAD, TETRAETHYL	4	0	--	0.0502	0.02	--	Y
7439-97-6	MERCURY	4	2	0.5	0	610	N	N
7440-02-0	NICKEL	4	4	21.9	5.3	4,100	N	N
7782-49-2	SELENIUM	4	2	0.9	0.7	1,000	N	N
7440-22-4	SILVER	4	1	1.7	1.3	1,000	N	N
VOCs (mg/kg)								
71-43-2	BENZENE	6	0	--	0.0008	200	--	N
100-41-4	ETHYLBENZENE	6	3	0.004	0.0008	5,000	N	N
108-38-3/106-42-3	META & PARA-XYLENES	4	1	0.003	0.0016	5,000	N	N
95-47-6	ORTHO-XYLENE	4	0	--	0.0008	5,000	--	N
108-88-3	TOLUENE	6	2	0.039	0.0008	5,000	N	N
1330-20-7	TOTAL XYLENES	2	2	0.018	0.01	5,000	N	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 8
SOIL DATA SCREENING
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Metals (mg/kg)								
7440-36-0	ANTIMONY	4	0	--	8.6	82	--	N
7440-38-2	ARSENIC	4	2	2.1	1.45	4	N	N
7440-39-3	BARIUM	4	4	44.3	2	14,000	N	N
7440-43-9	CADMIUM	4	4	0.69	0.5	100	N	N
7440-47-3	CHROMIUM, TOTAL	4	4	14.1	1.4	310,000	N	N
57-12-5	CYANIDE	1	0	--	0.3	4,100	--	N
7439-92-1	LEAD	4	4	25.7	0.2	1,000	N	N
7439-97-6	MERCURY	3	0	--	0.05	610	--	N
7440-02-0	NICKEL	4	4	10.3	2	4,100	N	N
7782-49-2	SELENIUM	4	2	0.7	0.5	1,000	N	N
7440-22-4	SILVER	4	1	0.6	1	1,000	N	N
7440-62-2	VANADIUM	1	1	27.1	7.54	1,400	N	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	30	0	--	0.0009	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	30	0	--	0.0885	520	--	N
71-43-2	BENZENE	30	2	0.0028	0.0009	200	N	N
75-15-0	CARBON DISULFIDE	30	0	--	0.0009	5,000	--	N
100-41-4	ETHYLBENZENE	30	3	0.0296	0.0009	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	30	0	--	0.0009	5,000	--	N
1634-04-4	METHYL TERT-BUTYL ETHER	13	0	--	0.0009	1,000	--	N
95-47-6	ORTHO-XYLENE	28	1	0.1314	0.0009	5,000	N	N
100-42-5	STYRENE	30	0	--	0.0009	5,000	--	N
108-88-3	TOLUENE	30	6	0.0652	0.0009	5,000	N	N
1330-20-7	TOTAL XYLENES	30	4	0.0797	0.0018	5,000	N	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	30	0	--	0.0603	4,100	--	N
51-28-5	2,4-DINITROPHENOL	30	0	--	0.1507	410	--	N
121-14-2	2,4-DINITROTOLUENE	28	0	--	0.1507	410	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	28	0	--	0.0603	5,000	--	N
108-39-4	3-METHYLPHENOL	2	0	--	0.33	5,000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	28	0	--	0.1507	2	--	N
106-44-5	4-METHYLPHENOL (P-CRESOL)	1	0	--	0.0603	5,000	--	N
100-02-7	4-NITROPHENOL	28	0	--	0.1507	1,600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	30	2	0.36	0.1	NA	N	**Y**
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	30	0	--	0.1507	1,000	--	N
120-12-7	ANTHRACENE	30	3	0.996	0.0603	5,000	N	N
56-55-3	BENZO(A)ANTHRACENE	30	3	0.334	0.0603	7.8	N	N
50-32-8	BENZO(A)PYRENE	30	2	0.245	0.0603	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	30	1	0.1037	0.0603	7.8	N	N
207-08-9	BENZO(K)FLUORANTHENE	30	0	--	0.0603	78	--	N
85-68-7	BENZYL BUTYL PHTHALATE	30	0	--	0.0603	5,000	--	N

TABLE 8
SOIL DATA SCREENING
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	28	2	0.4353	0.0603	410	N	N
218-01-9	CHRYSENE	30	3	0.547	0.0603	780	N	N
--	CRESOLS, TOTAL	27	0	--	0.342	NA	--	N
53-70-3	DIBENZ(A,H)ANTHRACENE	30	0	--	0.0603	0.8	--	N
84-66-2	DIETHYL PHTHALATE	30	0	--	0.0603	5,000	--	N
131-11-3	DIMETHYL PHTHALATE	30	0	--	0.0603	5,000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	30	3	0.217	0.0603	5,000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	30	0	--	0.0603	4,100	--	N
206-44-0	FLUORANTHENE	28	1	0.1031	0.0603	5,000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	28	0	--	0.0603	8	--	N
91-20-3	NAPHTHALENE	28	1	1.1288	0.0603	4,100	N	N
98-95-3	NITROBENZENE	28	0	--	0.0603	100	--	N
85-01-8	PHENANTHRENE	28	1	1.1915	0.0603	5,000	N	N
108-95-2	PHENOL	28	0	--	0.0603	5,000	--	N
129-00-0	PYRENE	28	1	0.7211	0.0603	5,000	N	N
110-86-1	PYRIDINE	28	0	--	0.1507	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 9
SOIL DATA SCREENING
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
Metals (mg/kg)								
7440-36-0	ANTIMONY	3	0	--	8.71	82	--	N
7440-38-2	ARSENIC	6	2	2.1	0.5	4	N	N
7440-39-3	BARIUM	6	6	28.6	2	14,000	N	N
7440-41-7	BERYLLIUM	5	4	0.5	0.3	410	N	N
7440-43-9	CADMIUM	6	2	2.2	0.5	100	N	N
7440-47-3	CHROMIUM, TOTAL	6	6	37	1.45	310,000	N	N
7440-48-4	COBALT	6	5	3.7	2	12,000	N	N
57-12-5	CYANIDE	5	1	0.4	0.3	4,100	N	N
7439-92-1	LEAD	6	6	21	0.2	1,000	N	N
7439-97-6	MERCURY	5	0	--	0.014	610	--	N
7440-02-0	NICKEL	6	5	6.97	2	4,100	N	N
7782-49-2	SELENIUM	6	1	0.5	0.5	1,000	N	N
7440-22-4	SILVER	6	1	0.8	1	1,000	N	N
7440-62-2	VANADIUM	6	6	102	2	1,400	N	N
7440-66-6	ZINC	6	6	24	2	61,000	N	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	19	0	--	0.0009	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	19	0	--	0.0859	520	--	N
67-64-1	ACETONE	5	5	0.320	0.0009	5,000	N	N
71-43-2	BENZENE	19	0	--	0.0009	200	--	N
75-15-0	CARBON DISULFIDE	19	1	0.00093	0.0009	5,000	N	N
100-41-4	ETHYLBENZENE	19	7	0.356	0.0009	5,000	N	N
108-38-3/106-42-3	META & PARA-XYLENES	1	1	2.57	0.0017	5,000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	19	2	0.094	0.0009	5,000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	1	0	--	0.0009	1,000	--	N
95-47-6	ORTHO-XYLENE	15	3	3.815	0.0009	5,000	N	N
100-42-5	STYRENE	19	0	--	0.0009	5,000	--	N
108-88-3	TOLUENE	19	6	0.083	0.0009	5,000	N	N
1330-20-7	TOTAL XYLENES	18	6	0.026	0.00279	5,000	N	N
108-05-4	VINYL ACETATE	5	0	--	0.0009	5,000	--	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	5	0	--	0.0569	4,100	--	N
51-28-5	2,4-DINITROPHENOL	5	0	--	0.1421	410	--	N
121-14-2	2,4-DINITROTOLUENE	19	0	--	0.1421	410	--	N
606-20-2	2,6-DINITROTOLUENE	14	0	--	0.341	200	--	N
91-57-6	2-METHYLNAPHTHALENE	19	3	132	0.33	4,100	N	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	5	0	--	0.0569	5,000	--	N
88-74-4	2-NITROANILINE	14	0	--	0.854	12	--	N
108-39-4	3-METHYLPHENOL	4	0	--	0.33	5,000	--	N
99-09-2	3-NITROANILINE	14	0	--	0.854	NA	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	1	0	--	0.1421	2	--	N
101-55-3	4-BROMOPHENYL PHENYL ETHER	14	0	--	0.341	NA	--	N

TABLE 9
SOIL DATA SCREENING
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Maximum Detection	Minimum Reporting Limit	DURBRS for Protection of Human Health[a,b]	Maximum Exceeds Screening Value	Uncertainty[c]
106-44-5	4-METHYLPHENOL (P-CRESOL)	5	0	--	0.0569	5,000	--	N
100-02-7	4-NITROPHENOL	5	0	--	0.1421	1,600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	5	0	--	0.1706	NA	--	N
83-32-9	ACENAPHTHENE	15	1	0.0399	0.0569	5,000	N	N
208-96-8	ACENAPHTHYLENE	18	2	1.02	0.33	NA	N	Y
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	5	0	--	0.1421	1,000	--	N
120-12-7	ANTHRACENE	19	1	3.31	0.0569	5,000	N	N
56-55-3	BENZO(A)ANTHRACENE	19	1	0.1683	0.0569	7.8	N	N
50-32-8	BENZO(A)PYRENE	19	1	0.2456	0.0569	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	19	1	0.17	0.0569	7.8	N	N
191-24-2	BENZO(G,H,I)PERYLENE	14	2	0.461	0.341	NA	N	Y
207-08-9	BENZO(K)FLUORANTHENE	19	0	--	0.0569	78	--	N
85-68-7	BENZYL BUTYL PHTHALATE	19	0	--	0.0569	5,000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	19	1	0.8073	0.0569	410	N	N
86-74-8	CARBAZOLE	14	0	--	0.341	NA	--	N
218-01-9	CHRYSENE	19	1	0.2263	0.0569	780	N	N
53-70-3	DIBENZ(A,H)ANTHRACENE	19	0	--	0.0569	0.8	--	N
132-64-9	DIBENZOFURAN	14	0	--	0.341	820	--	N
84-66-2	DIETHYL PHTHALATE	19	1	0.654	0.0569	5,000	N	N
131-11-3	DIMETHYL PHTHALATE	19	0	--	0.0569	5,000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	19	3	2.08	0.0569	5,000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	19	0	--	0.0569	4,100	--	N
206-44-0	FLUORANTHENE	19	1	0.3559	0.0569	5,000	N	N
86-73-7	FLUORENE	19	2	7.34	0.33	5,000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	19	0	--	0.0569	8	--	N
78-59-1	ISOPHORONE	14	0	--	0.341	5,000	--	N
91-20-3	NAPHTHALENE	19	2	27.1	0.33	4,100	N	N
98-95-3	NITROBENZENE	19	0	--	0.0569	100	--	N
621-64-7	N-NITROSODI-N-PROPYLAMINE	14	0	--	0.341	0.8	--	N
86-30-6	N-NITROSODIPHENYLAMINE	14	0	--	0.341	1,200	--	N
85-01-8	PHENANTHRENE	19	4	23.9	0.33	5,000	N	N
108-95-2	PHENOL	5	0	--	0.0569	5,000	--	N
100-01-6	P-NITROANILINE	14	0	--	0.854	NA	--	N
129-00-0	PYRENE	19	2	5.62	0.0569	5,000	N	N
110-86-1	PYRIDINE	18	0	--	0.1421	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

[b] Chromium screening value is for Chromium III

[c] A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 10
SOIL DATA SCREENING
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Minimum Reporting Limit	Maximum Detection	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty
Metals (mg/kg)								
7440-36-0	ANTIMONY	2	0	8.1	--	82	--	N
7440-38-2	ARSENIC	21	20	0.3	28.7	4	Y	N
7440-39-3	BARIUM	2	2	30.4	40.8	14000	N	N
7440-43-9	CADMIUM	2	1	0.4	2.3	100	N	N
7440-47-3	CHROMIUM, TOTAL	2	2	0.5	18.5	310000	N	N
7439-92-1	LEAD	2	2	0.1	11.6	1000	N	N
78-00-2	LEAD, TETRAETHYL	3	0	0.35	--	0.02	--	Y
7439-97-6	MERCURY	2	0	Not Available	--	610	--	Y
7440-02-0	NICKEL	2	2	1.1	55.8	4100	N	N
7782-49-2	SELENIUM	2	0	0.7	--	1000	--	N
7440-22-4	SILVER	2	0	0.4	--	1000	--	N
7440-62-2	VANADIUM	19	19	9.9	65.3	1400	N	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	22	0	0.00181	--	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	22	0	0.16	--	520	--	N
71-43-2	BENZENE	33	9	0.001	1.59	200	N	N
75-15-0	CARBON DISULFIDE	22	7	0.002	0.0092	5000	N	N
100-41-4	ETHYLBENZENE	33	12	0.001	530	5000	N	N
108-38-3/106-42-3	META & PARA-XYLENES	12	4	0.001	3.2	5000	N	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	22	3	0.002	0.36	5000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	22	6	0.00181	7.9	1000	N	N
95-47-6	ORTHO-XYLENE	33	10	0.001	148	5000	N	N
100-42-5	STYRENE	22	0	0.00181	--	5000	--	N
108-88-3	TOLUENE	33	10	0.001	7.58	5000	N	N
1330-20-7	TOTAL XYLENES	21	9	0.00271	1610	5000	N	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	22	0	0.34	--	4100	--	N
51-28-5	2,4-DINITROPHENOL	22	0	0.851	--	410	--	N
121-14-2	2,4-DINITROTOLUENE	22	0	0.34	--	410	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	22	0	0.34	--	5000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	22	0	0.851	--	2	--	N
106-44-5	4-METHYLPHENOL (P-CRESOL)	3	0	0.35	--	5000	--	N
100-02-7	4-NITROPHENOL	22	0	0.851	--	1600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	22	0	0.34	--	NA	--	N
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	22	0	0.89	--	1000	--	N
120-12-7	ANTHRACENE	22	5	0.34	1.53	5000	N	N
56-55-3	BENZO(A)ANTHRACENE	22	3	0.34	0.964	7.8	N	N
50-32-8	BENZO(A)PYRENE	22	1	0.34	0.56	0.78	N	N
205-99-2	BENZO(B)FLUORANTHENE	22	1	0.34	0.558	7.8	N	N
207-08-9	BENZO(K)FLUORANTHENE	22	1	0.34	0.461	78	N	N
85-68-7	BENZYL BUTYL PHTHALATE	22	0	0.34	--	5000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	22	4	0.34	2.1	410	N	N
218-01-9	CHRYSENE	22	3	0.34	0.87	780	N	N

TABLE 10
SOIL DATA SCREENING
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Minimum Reporting Limit	Maximum Detection	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty
--	CRESOLS, TOTAL	19	0	0.34	--	NA	--	N
53-70-3	DIBENZ(A,H)ANTHRACENE	22	0	0.34	--	0.8	--	N
84-66-2	DIETHYL PHTHALATE	22	0	0.34	--	5000	--	N
131-11-3	DIMETHYL PHTHALATE	22	0	0.34	--	5000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	22	2	0.34	4.2	5000	N	N
117-84-0	DI-N-OCTYLPHTHALATE	22	0	0.34	--	4100	--	N
206-44-0	FLUORANTHENE	22	5	0.34	2.67	5000	N	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	22	1	0.34	0.199	8	N	N
91-20-3	NAPHTHALENE	22	4	0.34	1.63	4100	N	N
98-95-3	NITROBENZENE	22	0	0.34	--	100	--	N
85-01-8	PHENANTHRENE	22	7	0.34	7.53	5000	N	N
108-95-2	PHENOL	22	0	0.34	--	5000	--	N
129-00-0	PYRENE	22	4	0.34	2.48	5000	N	N
110-86-1	PYRIDINE	22	0	0.681	--	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 11
SOIL DATA SCREENING
NAPTHALENE TANK FARM - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Minimum Reporting Limit	Maximum Detection	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty
Metals (mg/kg)								
7440-36-0	ANTIMONY	6	0	10.7	--	82	--	N
7440-38-2	ARSENIC	6	2	1.07	4.45	4	Y	N
7440-39-3	BARIUM	6	6	2.15	46.4	14000	N	N
7440-43-9	CADMIUM	6	2	1.07	0.701	100	N	N
7440-47-3	CHROMIUM, TOTAL	6	6	1.07	54.4	310000	N	N
7439-92-1	LEAD	6	6	1.07	6.68	1000	N	N
7439-97-6	MERCURY	6	0	0.107	--	610	--	N
7440-02-0	NICKEL	6	6	1.07	9.2	4100	N	N
7782-49-2	SELENIUM	6	1	2.15	3.37	1000	N	N
7440-22-4	SILVER	6	0	1.07	--	1000	--	N
VOCs (mg/kg)								
106-93-4	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	6	0	0.00189	--	0.07	--	N
123-91-1	1,4-DIOXANE (P-DIOXANE)	6	0	0.189	--	520	--	N
71-43-2	BENZENE	6	0	0.00189	--	200	--	N
75-15-0	CARBON DISULFIDE	6	0	0.00472	--	5000	--	N
100-41-4	ETHYLBENZENE	6	0	0.00189	--	5000	--	N
78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	6	4	0.0472	1.15	5000	N	N
1634-04-4	METHYL TERT-BUTYL ETHER	6	0	0.00189	--	1000	--	N
95-47-6	ORTHO-XYLENE	6	0	0.00189	--	5000	--	N
100-42-5	STYRENE	6	0	0.00189	--	5000	--	N
108-88-3	TOLUENE	6	0	0.00189	--	5000	--	N
1330-20-7	TOTAL XYLENES	6	2	0.00283	0.00389	5000	N	N
SVOCs (mg/kg)								
105-67-9	2,4-DIMETHYLPHENOL	6	0	0.349	--	4100	--	N
51-28-5	2,4-DINITROPHENOL	6	0	0.874	--	410	--	N
121-14-2	2,4-DINITROTOLUENE	6	0	0.349	--	410	--	N
95-48-7	2-METHYLPHENOL (O-CRESOL)	6	0	0.349	--	5000	--	N
534-52-1	4,6-DINITRO-2-METHYLPHENOL	6	0	0.874	--	2	--	N
100-02-7	4-NITROPHENOL	6	0	0.874	--	1600	--	N
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE	6	0	0.349	--	NA	--	N
62-53-3	ANILINE (PHENYLAMINE, AMINOBENZENE)	6	0	1.75	--	1000	--	N
120-12-7	ANTHRACENE	6	0	0.349	--	5000	--	N
56-55-3	BENZO(A)ANTHRACENE	6	0	0.349	--	7.8	--	N
50-32-8	BENZO(A)PYRENE	6	0	0.349	--	0.78	--	N
205-99-2	BENZO(B)FLUORANTHENE	6	0	0.349	--	7.8	--	N
207-08-9	BENZO(K)FLUORANTHENE	6	0	0.349	--	78	--	N
85-68-7	BENZYL BUTYL PHTHALATE	6	0	0.349	--	5000	--	N
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	6	1	0.349	0.242	410	N	N
218-01-9	CHRYSENE	6	0	0.349	--	780	--	N
--	CRESOLS, TOTAL	6	0	0.349	--	NA	--	N
53-70-3	DIBENZ(A,H)ANTHRACENE	6	0	0.349	--	0.8	--	N

TABLE 11
SOIL DATA SCREENING
NAPTHALENE TANK FARM - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Number of Samples	Number of Detections	Minimum Reporting Limit	Maximum Detection	DURBRS for Protection of Human Health[a]	Maximum Exceeds Screening Value	Uncertainty
84-66-2	DIETHYL PHTHALATE	6	0	0.349	--	5000	--	N
131-11-3	DIMETHYL PHTHALATE	6	0	0.349	--	5000	--	N
84-74-2	DI-N-BUTYL PHTHALATE	6	0	0.349	--	5000	--	N
117-84-0	DI-N-OCTYLPHTHALATE	6	0	0.349	--	4100	--	N
206-44-0	FLUORANTHENE	6	0	0.349	--	5000	--	N
193-39-5	INDENO(1,2,3-C,D)PYRENE	6	0	0.349	--	8	--	N
91-20-3	NAPHTHALENE	6	0	0.349	--	4100	--	N
98-95-3	NITROBENZENE	7	0	0.349	--	100	--	N
85-01-8	PHENANTHRENE	6	0	0.349	--	5000	--	N
108-95-2	PHENOL	6	0	0.349	--	5000	--	N
129-00-0	PYRENE	6	0	0.349	--	5000	--	N
110-86-1	PYRIDINE	6	0	0.7	--	200	--	N

NOTES:

[a] Delaware Uniform Risk-Based Remediation Standard (DURBRS)(DNREC 1999); Non-critical water resource area, restricted use

-- not applicable

NA - Screening value not available

N = No; Y=Yes

TABLE 12
SURFACE WATER DATA SCREENING - DRAGON RUN
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concnetration	Location of Maximum Concentration	Minimum Detection Limit	Maximum Detection Limit	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty[a]
Benzene	71432	10	4	40	0.25	0.40	SW-18b	1	1	14	1	N	N
Ethylbenzene	100414	10	0	0	--	--	--	2	2	11000	1	N	N
Methyl tert-butyl ether	1634044	10	5	50	0.62	4.24	SW-18a	2	2	20	3	N	N
tert-Amyl Methyl Ether	994058	10	0	0	--	--	--	8	8	NS	---	N	N
Toluene	108883	10	2	20	0.26	0.27	SW-18b	2	2	75000	1	N	N
m,p-Xylenes	179601231	10	0	0	--	--	--	2	2	1200	4	N	N
o-Xylene (1,2-Dimethylbenzene)	95476	10	0	0	--	--	--	2	2	1200	3	N	N
Dimethylbenzene (Total Xylenes)	1330207	10	0	0	--	--	--	4	4	10000	3	N	N

Notes:
Units are in micrograms per liter (ug/L).
NS= No screening value available
a) A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.
Screening Value Sources:
1. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish Ingestion). When both the systemic toxicant and human carcinogen criteria were provided, the lower value was used. The document does not definitively report whether the standards are for "total" or "dissolved," therefore the standards were used for both fractions.
2. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish and Water Ingestion). Fish and Water Ingestion criteria were used secondarily because the waterbodies are not listed as Public Water Supply Sources in DNREC (2004).
3. Groundwater Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999). DNREC provides two DURBRSs for some constituents. The higher values were used in this risk evaluation given that the drinking water ingestion pathway, on which the URSs are based, is incomplete. Because the groundwater samples are not from a water supply, the standards are for the dissolved fraction.
4. Groundwater DURBRS for individual isomers conservatively used (DNREC 1999).

TABLE 13
SEDIMENT DATA SCREENING - DRAGON RUN
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS	Number of Samples	Number of Detections	Frequency of Detection (%)	Minimum Detected Sediment Concentration (µg/kg)	Maximum Detected Sediment Concentration (µg/kg)	Location of Maximum Concentration	Minimum Detection Limit	Maximum Detection Limit	DNREC Surface Soil DURBRS[1] (µg/kg)	DNREC Surface Soil DURBRS[2] (µg/kg)	Exceeds Screening Value?	Uncertainty[3]
Benzene	71432	10	0	0	---	---	---	2.0	2.0	500	200,000	N	N
Ethylbenzene	100414	10	0	0	---	---	---	2.0	2.0	70,000	5,000,000	N	N
MTBE	1634044	10	3	30	2.21	3.78	SD-018	2.0	2.0	2,000	1,000,000	N	N
TAME	994058	10	0	0	---	---	---	2.0	2.0	NS	NS	N	N
Toluene	108883	10	1	10	5.49	5.49	SD-020	2.0	2.0	100,000	5,000,000	N	N
Xylenes (total)	1330207	10	1	10	8.86	8.86	SD-020	5.0	5.0	420,000	5,000,000	N	N

Notes:

1. Surface Soil, Restricted Use Critical Water Resource Area Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999)

2. Surface Soil, Restricted Use Non-Critical Water Resource Area DURBRS (DNREC 1999)

3. A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.

NS= No screening value available

TABLE
GROUNDWATER DATA SCREENING - COOLING WATER INFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	CAS Number	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concnetration	Location of Maximum Concentration	Minimum Detection Limit	Maximum Detection Limit	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty[2]
Organic Compounds (ug/L)														
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	106934	2	0	0	--	--	--	2	10	0.05	3	N	Y
2-Hexanone	591-78-6	591786	2	0	0	--	--	--	15	75	150	3	N	N
Acetone	67-64-1	67641	2	0	0	--	--	--	15	75	61	3	N	N
Benzene	71-43-2	71432	10	3	30	0.59	504	F7	1	1	14	1	Y	N
Bromoform	75-25-2	75252	2	0	0	--	--	--	2	10	61	1	N	N
Bromomethane	74-83-9	74839	2	0	0	--	--	--	3	15	10	3	N	N
Carbon Disulfide	75-15-0	75150	2	0	0	--	--	--	8	40	100	3	N	N
Cyclohexane	110-82-7	110827	2	0	0	--	--	--	2	10	NS	---	N	N
Dimethylbenzene (Total Xylenes)[1]	1330-20-7	1330207	8	1	12.5	33.1	33.1	F7	3	3	10000	3	N	N
Ethylbenzene	100-41-4	100414	8	1	12.5	3.46	3.46	F7	1	1	11000	1	N	N
Isopropylbenzene (Cumene)	98-82-8	98828	2	1	50	13.4	13.4	F7	1	1	66	3	N	N
m,p-Xylenes	179601-23-1	179601231	2	1	50	23.1	23.1	F7	2	2	1200	4	N	N
Methyl Acetate	79-20-9	79209	2	0	0	--	--	--	2	10	610	3	N	N
Methyl Ethyl Ketone (2-Butanone)	78-93-3	78933	2	0	0	--	--	--	20	100	190	3	N	N
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	108101	2	0	0	--	--	--	40	200	14	3	N	Y
Methylcyclohexane	108-87-2	108872	2	1	50	14	14	F7	2	2	NS	---	N	Y
Naphthalene	91-20-3	91203	4	3	75	1.45	54.4	F7	4	4	20	3	Y	N
o-Xylene (1,2-Dimethylbenzene)	95-47-6	95476	2	0	0	--	--	--	2	10	1200	3	N	N
Styrene	100-42-5	100425	2	0	0	--	--	--	1	5	100	3	N	N
tert-Amylmethylether	994-05-8	994058	4	1	25	33.9	33.9	F7	5	8	NS	---	N	Y
tert-Butyl Alcohol	75-65-0	75650	4	1	25	75.3	75.3	F7	4	50	NS	---	N	Y
tert-Butyl Methyl Ether	1634-04-4	1634044	10	5	50	4.64	80	F7	1	6	20	3	Y	N
Toluene	108-88-3	108883	8	1	12.5	5.55	5.55	F7	1	1	75000	1	N	N
Dissolved Metals (ug/L)														
Antimony	7440-36-0	7440360	6	0	0	--	--	--	10	10	1600	1	N	N
Cadmium	7440-43-9	7440439	6	3	50	1	1.5	F3	1	1	31	1	N	N
Chromium, Total	7440-47-3	7440473	6	0	0	--	--	--	5	5	380000	5	N	N
Iron	7439-89-6	7439896	2	1	50	20900	20900	F7	200	200	300	3	Y	N
Lead	7439-92-1	7439921	6	0	0	--	--	--	5	5	15	2	N	N
Nickel	7440-02-0	7440020	6	0	0	--	--	--	10	10	1700	1	N	N
Selenium	7782-49-2	7782492	6	0	0	--	--	--	10	10	4200	1	N	N
Total Metals (ug/L)														
Antimony	7440-36-0	7440360	6	0	0	--	--	--	10	10	1600	1	N	N
Cadmium	7440-43-9	7440439	6	2	33.3	1	1.2	F3	1	10	31	1	N	N
Chromium, Total	7440-47-3	7440473	6	2	33.3	5.9	8.9	F1	5	5	380000	5	N	N
Iron	7439-89-6	7439896	2	1	50	21200	21200	F7	200	200	300	3	Y	N
Lead	7439-92-1	7439921	6	1	16.7	8.29	8.29	F2	5	5	15	2	N	N
Nickel	7440-02-0	7440020	6	1	16.7	10.7	10.7	F4	10	10	1700	1	N	N
Selenium	7782-49-2	7782492	6	0	0	--	--	--	10	10	4200	1	N	N

TABLE
GROUNDWATER DATA SCREENING - COOLING WATER INFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	CAS Number	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concnetration	Location of Maximum Concentration	Minimum Detection Limit	Maximum Detection Limit	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty[2]
Other														
Alkalinity, Total (as $CaCO_3$) (mg/L)	ALK	ALK	1	1	100	308	308	F7	--	--	NS	---	N	NA
Chloride (As Cl) (mg/L)	16887-00-6	16887006	2	2	100	64.2	466	F7	--	--	NS	---	N	NA
Ethane (ug/L)	74-84-0	74840	2	0	0	--	--	--	21.7	21.7	NS	---	N	NA
Ethene (ug/L)	74-85-1	74851	2	0	0	--	--	--	28.7	28.7	NS	---	N	NA
Methane (ug/L)	74-82-8	74828	2	1	50	1280	1280	F7	10.8	10.8	NS	---	N	NA
Nitrogen, Nitrate (As N) (mg/L)	7727-37-9	7727379	2	1	50	5.4	5.4	D12	0.1	0.1	NS	---	N	NA
Nitrogen, Ammonia (As N) (mg/L)	14797-55-8	14797558	1	1	100	22.4	22.4	F7	--	--	NS	---	N	NA
Sulfate (as SO_4) (mg/L)	14808-79-8	14808798	2	1	50	46.7	46.7	D12	1	1	NS	---	N	NA
Sulfide, Total (mg/L)	105-05-2	105052	2	0	0	--	--	--	5	5	NS	---	N	NA
Total Carbon (mg/L)	7440-44-0	7440440	1	1	100	3.26	3.26	D12	--	--	NS	---	N	NA

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
NA - Not applicable
1) Total xylenes concentration was calculated as the sum of m,p-Xylenes plus o-Xylene (1,2-Dimethylbenzene) where applicable
2) A constituent is considered an uncertainty f it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.
Screening Value Sources:
1. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish Ingestion). When both the systemic toxicant and human carcinogen criteria were provided, the lower value was used. The document does not definitively report whether the standards are for "total" or "dissolved," therefore the standards were used for both fractions.
2. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish and Water Ingestion). Fish and Water Ingestion criteria were used secondarily because the waterbodies are not listed as Public Water Supply Sources in DNREC (2004).
3. Groundwater Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999). DNREC provides two DURBRSs for some constituents. The higher values were used in this risk evaluation given that the drinking water ingestion pathway, on which the URSs are based, is incomplete. Because the groundwater samples are not from a water supply, the standards are for the dissolved fraction.
4. Groundwater DURBRS for individual isomers conservatively used (DNREC 1999).
5. Groundwater DURBRS for chromium(III) used (DNREC 1999).
NS - no screening value is available

TABLE
GROUNDWATER DATA SCREENING - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Number of Samples	Number of Detections	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concnetration	Location of Maximum Concentration	Minimum Detection Limit	Maximum Detection Limit	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty[2]
Organic Compounds (ug/L)													
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	5	0	0	--	--	--	2	2	0.05	3	N	Y
2-Hexanone	591-78-6	5	0	0	--	--	--	15	15	150	3	N	N
Acetone	67-64-1	5	0	0	--	--	--	15	15	61	3	N	N
Benzene	71-43-2	9	9	100	0.23	1890	D18	--	--	14	1	Y	N
Bromoform	75-25-2	5	0	0	--	--	--	2	2	61	1	N	N
Bromomethane	74-83-9	5	0	0	--	--	--	3	3	10	3	N	N
Carbon Disulfide	75-15-0	5	0	0	--	--	--	8	8	100	3	N	N
Cyclohexane	110-82-7	5	0	0	--	--	--	2	2	NS	---	N	N
Dimethylbenzene (Total Xylenes)[1]	1330-20-7	5	4	80	1.33	3.01	34	--	--	10000	3	N	N
Ethylbenzene	100-41-4	5	4	80	0.33	0.82	34	1	1	11000	1	N	N
Isopropylbenzene (Cumene)	98-82-8	5	0	0	--	--	--	1	1	66	3	N	N
m,p-Xylenes	179601-23-1	5	4	80	0.99	2.26	34	2	2	1200	4	N	N
Methyl Acetate	79-20-9	5	0	0	--	--	--	2	2	610	3	N	N
Methyl Ethyl Ketone (2-Butanone)	78-93-3	5	0	0	--	--	--	20	20	190	3	N	N
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	5	0	0	--	--	--	40	40	14	3	N	Y
Methylcyclohexane	108-87-2	5	0	0	--	--	--	2	2	NS	---	N	N
Naphthalene	91-20-3	9	0	0	--	--	--	4	250	20	3	N	N
o-Xylene (1,2-Dimethylbenzene)	95-47-6	5	4	80	0.34	0.75	34	2	2	1200	3	N	N
Styrene	100-42-5	5	0	0	--	--	--	1	1	100	3	N	N
tert-Amylmethylether	994-05-8	9	2	22	4.72	18.3	30D	5	250	NS	---	N	Y
tert-Butyl Alcohol	75-65-0	9	2	22	14.8	3230	D18	4	50	NS	---	N	Y
tert-Butyl Methyl Ether	1634-04-4	9	6	67	0.27	37700	D18	2	2	20	3	Y	N
Toluene	108-88-3	5	4	80	2.31	4.21	34	1	1	75000	1	N	N
Dissolved Metals (ug/L)													
Iron	7439-89-6	3	1	33	90	90	D35	200	200	300	3	N	N
Total Metals (ug/L)													
Iron	7439-89-6	3	3	100	210	38700	34	--	--	300	3	Y	N
Other													
Chloride (as CL) (mg/L)	16887-00-6	5	5	100	241	1770	D35	--	--	NS	---	N	NA
Ethane (ug/L)	74-84-0	3	0	0	--	--	--	21.7	21.7	NS	---	N	NA
Ethene (ug/L)	74-85-1	3	0	0	--	--	--	28.7	28.7	NS	---	N	NA
Methane (ug/L)	74-82-8	3	2	67	21.6	27.3	D35	10.8	10.8	NS	---	N	NA
Nitrogen (mg/L)	7727-37-9	5	5	100	0.208	3.51	13RA	--	--	NS	---	N	NA
Sulfate (as SO_4) (mg/L)	14808-79-8	5	5	100	172	324	30D	--	--	NS	---	N	NA
Sulfide, Total (mg/L)	105-05-2	5	0	0	--	--	--	5	5	NS	---	N	NA
Total Carbon (mg/L)	7440-44-0	3	3	100	3.07	3.88	34	--	--	NS	---	N	NA

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
NA - Not applicable
1) Total xylenes concentration was calculated as the sum of m,p-Xylenes plus o-Xylene (1,2-Dimethylbenzene) where applicable
2) A constituent is considered an uncertainty if it is detected and a screening value is not available or if the minimum reporting limit exceeds the available screening value.
Screening Value Sources:
1. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish Ingestion). When both the systemic toxicant and human carcinogen criteria were provided, the lower value was used. The document does not definitively report whether the standards are for "total" or "dissolved," therefore the standards were used for both fractions.
2. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish and Water Ingestion). Fish and Water Ingestion criteria were used secondarily because the waterbodies are not listed as Public Water Supply Sources in DNREC (2004).
3. Groundwater Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999). DNREC provides two DURBRSs for some constituents. The higher values were used in this risk evaluation given that the drinking water ingestion pathway, on which the URSs are based, is incomplete. Because the groundwater samples are not from a water supply, the standards are for the dissolved fraction.
4. Groundwater DURBRS for individual isomers conservatively used (DNREC 1999).
NS - no screening value is available

TABLE 16
SURFACE WATER DATA SCREENING - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Reporting Limit	Maximum Reporting Limit	Minimum Detected Concentration	Maximum Detected Concentration	Location of Maximum	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty
Volatile Organic Compounds (VOCs) (ug/L)													
1,4-Dioxane	123-91-1	3	0	0	1	1				6.1	3	N	N
2-Butanone	78-93-3	3	0	0	5	5				190	3	N	N
Benzene	71-43-2	3	0	0	1	1				14	1	N	N
Carbon Disulfide	75-15-0	3	0	0	1	1				100	3	N	N
Ethylbenzene	100-41-4	3	0	0	1	1				11000	1	N	N
Ethylene Dibromide	106-93-4	3	0	0	1	1				0.05	3	N	Y
m&p-Xylene	1330-20-7	3	0	0	2	2				1200	4	N	N
Nitrobenzene	98-95-3	3	0	0	1	1				690	1	N	N
o-Xylene	95-47-6	3	0	0	1	1				1200	3	N	N
Styrene	100-42-5	3	0	0	1	1				100	3	N	N
Toluene	108-88-3	3	0	0	1	1				75000	1	N	N
Semivolatile Organic Compounds (SVOCs) (ug/L)													
2,4-Dimethylphenol	105-67-9	3	0	0	10	10				850	1	N	N
2,4-Dinitrophenol	51-28-5	3	0	0	5	5				5300	1	N	N
2,4-Dinitrotoluene	121-14-2	3	0	0	1	1				3.4	1	N	N
2-Methylphenol	95-48-7	3	0	0	1	1				180	3	N	N
4,6-Dinitro-2-methylphenol	534-52-1	3	0	0	5	5				0.37	3	N	Y
4-Methylphenol	106-44-5	3	0	0	1	1				18	3	N	N
4-Nitrophenol	100-02-7	3	0	0	5	5				60	3	N	N
7,12-Dimethylbenz(a)anthracene	119-93-7	3	0	0	2	2				0.073	3	N	Y
Aniline	62-53-3	3	0	0	2	2				12	3	N	N
Anthracene	120-12-7	3	0	0	1	1				40000	1	N	N
Benzo(a)anthracene	56-55-3	3	0	0	1	1				0.18	1	N	Y
Benzo(a)pyrene	50-32-8	3	0	0	1	1				0.018	1	N	Y
Benzo(b)fluoranthene	205-99-2	3	0	0	1	1				0.18	1	N	Y
Benzo(k)fluoranthene	207-08-9	3	0	0	1	1				0.92	3	N	Y
bis(2-Ethylhexyl)phthalate	117-81-7	3	0	0	3	3				2.2	1	N	Y
Butyl benzyl phthalate	85-68-7	3	0	0	1	1				1900	1	N	N
Chrysene	218-01-9	3	0	0	1	1				0.18	1	N	Y
Dibenz(a,h)anthracene	53-70-3	3	0	0	1	1				0.018	1	N	Y
Diethyl phthalate	84-66-2	3	0	0	1	1				44000	1	N	N
Dimethyl phthalate	131-11-3	3	0	0	1	1				1100000	1	N	N
Di-n-butylphthalate	84-74-2	3	0	0	3	3				4500	1	N	N
Di-n-octyl phthalate	117-84-0	3	3	100	3	3	2.4	13	SWEF-1	73	3	N	N
Fluoranthene	206-44-0	3	0	0	1	1				140	1	N	N
Indeno(1,2,3-cd)pyrene	193-39-5	3	0	0	1	1				0.18	1	N	Y
Naphthalene	91-20-3	3	0	0	1	1				20	3	N	N
Phenanthrene	85-01-8	3	0	0	1	1				120	3	N	N
Phenol	108-95-2	3	0	0	2	2				860000	1	N	N
Pyrene	129-00-0	3	0	0	1	1				4000	1	N	N
Pyridine	110-86-1	3	0	0	2	2				3.7	3	N	N

TABLE 16
SURFACE WATER DATA SCREENING - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Reporting Limit	Maximum Reporting Limit	Minimum Detected Concentration	Maximum Detected Concentration	Location of Maximum	Screening Value	Screening Value Source	Exceeds Screening Value?	Uncertainty
Inorganics (ug/L)													
Dissolved Antimony	7440-36-0	3	0	0	5	5				1600	1	N	N
Dissolved Arsenic	7440-38-2	3	0	0	5	5				10	2	N	N
Dissolved Barium	7440-39-3	3	3	100	5	5	20	23	SWEF-1	2000	2	N	N
Dissolved Cadmium	7440-43-9	3	0	0	5	5				31	1	N	N
Dissolved Chromium	7440-47-3	3	0	0	5	5				380000	5	N	N
Dissolved Lead	7439-92-1	3	0	0	2	2				15	2	N	N
Dissolved Mercury	7439-97-6	3	0	0	0.2	0.2				2	3	N	N
Dissolved Nickel	7440-02-0	3	1	33	5	5	6	6	SWEF-2	1700	1	N	N
Dissolved Selenium	7782-49-2	3	0	0	5	5				4200	1	N	N
Dissolved Silver	7440-22-4	3	0	0	5	5				40000	1	N	N
Total Antimony	7440-36-0	3	0	0	5	5				1600	1	N	N
Total Arsenic	7440-38-2	3	0	0	5	5				10	2	N	N
Total Barium	7440-39-3	3	3	100	5	5	24	29	SWEF-2	2000	2	N	N
Total Cadmium	7440-43-9	3	0	0	5	5				31	1	N	N
Total Chromium	7440-47-3	3	1	33	5	5	5	5	SWEF-2	380000	5	N	N
Total Cyanide	57-12-5	3	0	0	100	100				80000	6	N	N
Total Lead	7439-92-1	3	3	100	2	2	3	4	SWEF-2	15	2	N	N
Total Mercury	7439-97-6	3	0	0	0.2	0.2				2	3	N	N
Total Nickel	7440-02-0	3	3	100	5	5	5	6	SWEF-2	1700	1	N	N
Total Selenium	7782-49-2	3	0	0	5	5				4200	1	N	N
Total Silver	7440-22-4	3	0	0	5	5				40000	1	N	N
Other													
Hardness (mg/L)	--	3	3	100	2	2	86	94	SWEF-1	NS	NS	N	NA

Notes:
Units are in ug/L.
NS - No screening value available
NA - Not applicable
1. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish Ingestion). When both the systemic toxicant and human carcinogen criteria were provided, the lower value was used. The document does not definitively report whether the standards are for "total" or "dissolved," therefore the standards were used for both fractions.
2. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish and Water Ingestion). Fish and Water Ingestion criteria were used secondarily because the waterbodies are not listed as Public Water Supply Sources in DNREC (2004).
3. Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999). DNREC provides two DURBRSs for some constituents. The higher values were used in this risk evaluation because the lower standards are based on tap water ingestion risk-based concentrations. The drinking water pathway is incomplete and therefore the less conservative value was selected.
4. Groundwater DURBRS for individual isomers conservatively used (DNREC 1999).
5. Screening value for chromium (III) was used as a surrogate.
6. Screening value for free cyanide was used as a surrogate.

TABLE 17
SEDIMENT DATA SCREENING - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	Number of Samples	Number of Detections	Detection Frequency (%)	Minimum Reporting Limit	Maximum Reporting Limit	Minimum Detected Concentration	Maximum Detected Concentration	Location of Maximum Concentration	DNREC Surface Soil DURBRS[1]	DNREC Surface Soil DURBRS[2]	Exceeds Screening Value?	Uncertainty
Volatile Organic Compounds (VOCs) (ug/kg)													
1,4-Dioxane	123-91-1	3	0	0	110	250				610	520000	N	N
2-Butanone	78-93-3	3	0	0	540	1200				19000	5000000	N	N
Benzene	71-43-2	3	0	0	110	250				500	200000	N	N
Carbon Disulfide	75-15-0	3	0	0	110	250				10000	5000000	N	N
Ethylbenzene	100-41-4	3	0	0	110	250				70000	5000000	N	N
Ethylene Dibromide	106-93-4	3	0	0	110	250				10	67	N	Y
m&p-Xylene	1330-20-7	3	0	0	220	490				420000	5000000	N	N
Nitrobenzene	98-95-3	3	0	0	75	110				40	100000	N	Y
o-Xylene	95-47-6	3	0	0	110	250				410000	5000000	N	N
Styrene	100-42-5	3	0	0	110	250				24000	5000000	N	N
Toluene	108-88-3	3	0	0	110	250				100000	5000000	N	N
Semivolatile Organic Compounds (SVOCs) (ug/kg)													
2,4-Dimethylphenol	105-67-9	3	0	0	750	1100				7300	4100000	N	N
2,4-Dinitrophenol	51-28-5	3	0	0	370	570				730	410000	N	N
2,4-Dinitrotoluene	121-14-2	3	0	0	75	110				730	410000	N	N
2-Methylphenol	95-48-7	3	0	0	75	110				18000	5000000	N	N
4,6-Dinitro-2-methylphenol	534-52-1	3	0	0	370	570				37	2000	N	Y
4-Methylphenol	106-44-5	3	0	0	75	110				1800	5000000	N	N
4-Nitrophenol	100-02-7	3	0	0	370	570				6000	1600000	N	N
7,12-Dimethylbenz(a)anthracene	119-93-7	3	0	0	150	230				7.3	620	N	Y
Anthracene	120-12-7	3	0	0	75	110				5000000	5000000	N	N
Benzo(a)pyrene	50-32-8	3	0	0	75	110				780	780	N	N
Benzo(k)fluoranthene	207-08-9	3	0	0	75	110				78000	78000	N	N
Butyl benzyl phthalate	85-68-7	3	0	0	75	110				5000000	5000000	N	N
Dibenz(a,h)anthracene	53-70-3	3	0	0	75	110				780	780	N	N
Dimethyl phthalate	131-11-3	3	0	0	75	110				3700000	5000000	N	N
Di-n-octyl phthalate	117-84-0	3	3	100	160	230	110	180	SDEF-2	7300	4100000	N	N
Indeno(1,2,3-cd)pyrene	193-39-5	3	0	0	75	110				7800	7800	N	N
Phenanthrene	85-01-8	3	0	0	75	110				5000000	5000000	N	N
Pyrene	129-00-0	3	0	0	75	110				1700000	5000000	N	N
Inorganics (mg/kg)													
Total Arsenic	7440-38-2	3	3	100	0.85	1.35	8.49	25	SDEF-2	2.9	3.8	Y	N
Total Cadmium	7440-43-9	3	3	100	0.42	0.67	1.44	2.43	SDEF-1	38	100	N	N
Total Chromium[3]	7440-47-3	3	3	100	0.42	0.67	28	70	SDEF-2	310000	310000	N	N
Total Cyanide[4]	57-12-5	3	0	0	0.25	0.37				200	4100	N	N
Total Lead	7439-92-1	3	3	100	0.42	0.67	22	54	SDEF-2	1000	1000	N	N
Total Mercury	7439-97-6	3	2	67	0.112	0.212	0.153	0.303	SDEF-2	10	610	N	N
Total Nickel	7440-02-0	3	3	100	0.42	0.67	22	34	SDEF-3	650	4100	N	N
Total Selenium	7782-49-2	3	0	0	0.85	1.35				26	1000	N	N
Total Silver	7440-22-4	3	0	0	0.42	0.67				84	1000	N	N
Other													
Total Organic Carbon (%)	--	3	3	100	0.03			4.70	SDEF-2	NS	NS	N	NA

Notes:
NS= No screening value available
NA - Not applicable
1. Surface Soil, Restricted Use Critical Water Resource Area Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999)
2. Surface Soil, Restricted Use Non-Critical Water Resource Area DURBRS (DNREC 1999)
3. Screening value for chromium (III) was used as a surrogate.
4. Screening value for free cyanide was used as a surrogate.

TABLE
SUMMARY OF COPCs
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Location/ Medium	Chemical	CAS	Maximum Detected Concentration	Location of Maximum Detected Concentration	Number of Detections	Number of Samples	Detection Frequency (%)	Number of Exceedances	Screening Value	Screening Value Source
SWMUs - Soils										
SWMU 13	Arsenic	7440-38-2	4.9	13B1	7	8	88	2	4.0	a
SWMU 14, Unit F, Area A, Woodpile Area	Arsenic	7440-38-2	31.2	TP11	26	37	70	5	3.8	a
SWMU 14, Unit F, Area A, Woodpile Area	Iron	7439-89-6	89100	TP11	37	37	100	1	61000	a
SWMU 14, Unit F, Area A, Woodpile Area	Benzo(a)pyrene	50-32-8	0.996	TP3B	2	37	5.4	2	0.78	a
SWMU 14, Unit F, Area A, Woodpile Area	Naphthalene	91-20-3	17300	TP16B	18	37	49	3	4100	a
SWMU 14, Unit F, Areas B through G	Arsenic	7440-38-2	7.47	FSSB	18	23	78	7	4	a
SWMU 15	Arsenic	7440-38-2	16.8	S15-SB49	66	75	88	12	3.8	a
SWMU 18	No COPCs									
SWMU 20a & 20a.1	Arsenic	7440-38-2	6.36	S20A1-SB7 & S20A1-SB9	7	9	78	4	3.8	a
SWMU 26	Arsenic	7440-38-2	12.9	26B-3	4	4	100	2	3.8	a
SWMU 31	No COPCs									
SWMU 32	No COPCs									
SWMU 33	Arsenic	7440-38-2	28.7	S33-SB8	20	21	95	19	3.8	a
SWMU 34	Arsenic	7440-38-2	4.5	S34-SB1K	2	6	33	1	3.8	a
Dragon Run and Surrounding Non-developed Land - Surface Water and Sediment										
Dragon Run	No COPCs									
Cooling Water Intake Channel and Cooling Water Effluent Channel - Groundwater										
CWIC	Iron (diss.)	7439-89-6	20900	F7	1	2	50	1	300	b
CWIC	Iron (total)	7439-89-6	21200	F7	1	2	50	1	300	b
CWIC	Benzene	71-43-2	504	F7	3	10	30	2	14	c
CWIC	MTBE	1634-04-4	80	F7	5	10	50	4	20	b
CWIC	Naphthalene	91-20-3	54.4	F7	3	4	75	2	20	b
CWEC	Iron (total)	7439-89-6	38700	34	3	3	100	2	300	b
CWEC	Benzene	71-43-2	1890	D18	9	9	100	1	14.0	c
CWEC	MTBE	1634-04-4	37770	D18	6	9	67	2	20	b
Cooling Water Effluent Channel - Surface Water										
CWEC	No COPCs									
Cooling Water Effluent Channel - Sediment										
CWEC	Arsenic	7440-38-2	25	SDEF-2	3	3	100	3	2.9	d

Notes:

Groundwater and surface water values shown in ug/L; soil and sediment values shown in mg/kg.

CWIC = cooling water intake channel; CWEC = cooling water effluent channel; SWMU = solid waste management unit

MTBE = methyl tert-butyl ether

a. Non-critical water resource area, restricted use Delaware Uniform Risk-Based Remediation Standard (DURBRS) (DNREC 1999).

b. Groundwater DURBRS (DNREC 1999). DNREC provides two DURBRSs for some constituents. The higher values were used in this risk evaluation given that the drinking water ingestion pathway, on which the URSs are based, is incomplete. Because the groundwater samples are not from a water supply, the standards are for the dissolved fraction.

c. DNREC (2004) Water Quality Criteria for Protection of Human Health (Fish Ingestion). When both the systemic toxicant and human carcinogen criteria were provided, the lower value was used. "Fish and Water Ingestion" criteria were not used because the waterbodies are not listed as Public Water Supply Sources in DNREC (2004). The document does not definitively report whether the standards are for "total" or "dissolved," therefore the standards were used for both fractions.

d. Critical water resource area, restricted useDURBRS (DNREC 1999)

TABLE 19
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF}{BW * AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	RME Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.74E+00	3.30E-06	3.00E-04	0.01	1.18E-06	1.50E+00	2E-06

Hazard Index = 0.01 **Total Cancer Risk =** 2E-06

TABLE 20
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	RME Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.74E+00	6.53E-07	3.00E-04	0.002	2.33E-07	1.50E+00	3E-07
			Hazard Index =	0.002		**Total Cancer Risk =**	3E-07

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 21
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	1.11E+09	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	57.21	Calculated
V - Fraction of vegetative cover =		0.40	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	6.11	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	3.74E+00	3.36E-09	1.47E-10	3.00E-04	0.0000005	5.53E-12	1.50E+01	8E-11

Hazard Index = 0.0000005 **Total Cancer Risk =** 8E-11

TABLE 22
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREA A (WOODPILE AREA)
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF}{BW * AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	RME Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Metals							
Arsenic	4.66E+00	4.10E-06	3.00E-04	0.01	1.47E-06	1.50E+00	2E-06
SVOCs							
Naphthalene	2.15E+03	1.89E-03	2.00E-02	0.09	6.76E-04	NA	--
Benzo(a)pyrene	8.57E-01	7.55E-07	NA	--	2.70E-07	7.30E+00	2E-06
			Hazard Index =	0.1		**Total Cancer Risk =**	4E-06

NA = Not Available

TABLE 23
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREA A (WOODPILE AREA)
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 1995, 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	RME Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Metals							
Arsenic	4.66E+00	8.13E-07	3.00E-04	0.003	2.90E-07	1.50E+00	4E-07
SVOCs							
Naphthalene	2.15E+03	1.62E-03	2.00E-02	0.08	5.80E-04	NA	--
Benzo(a)pyrene	8.57E-01	6.48E-07	NA	--	2.31E-07	7.30E-01	2E-07
			Hazard Index =	0.08		**Total Cancer Risk =**	6E-07

1 - Values are chemical-specific. Arsenic ABS = 0.03 (USEPA 2004); naphthalene ABS = 0.13 (USEPA 1995); benzo(a)pyrene ABS = 0.13 (USEPA 2004).
NA = Not Available

TABLE 24
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREA A (WOODPILE AREA)
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	8.87E+08	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	67.55	Calculated
V - Fraction of vegetative cover =		0.11	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	2.2	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Metals								
Arsenic	4.66E+00	5.26E-09	2.30E-10	3.00E-04	0.000001	8.64E-12	1.50E+01	1E-10
SVOCs								
Naphthalene	2.15E+03	2.42E-06	1.06E-07	8.60E-04	0.0001	3.99E-09	NA	--
Benzo(a)pyrene	8.57E-01	9.67E-10	4.24E-11	NA	--	1.59E-12	3.10E+00	5E-12
				Hazard Index =	0.0001		**Total Cancer Risk =**	1E-10

NA = Not Available

TABLE 25
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREAS B THROUGH G
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Intake (mg/kg-day) = $\frac{Cs*IngR*EF*ED*CF}{BW*AT}$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	RME Concentration In Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Metals							
Arsenic	3.86E+00	3.40E-06	3.00E-04	0.01	1.21E-06	1.50E+00	2E-06

Hazard Index = 0.01 **Total Cancer Risk =** 2E-06

Notes:
NA = Not Available

TABLE 26
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREAS B THROUGH G
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 1995, 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	RME Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg-day)^{-1}$	Cancer Risk
Metals							
Arsenic	3.86E+00	6.73E-07	3.00E-04	0.002	2.40E-07	1.50E+00	4E-07
			Hazard Index =	0.002		**Total Cancer Risk =**	4E-07

Notes:

1 - Values are chemical-specific. Arsenic ABS = 0.03 (USEPA 2004); naphthalene ABS = 0.13 (USEPA 1995); benzo(a)pyrene ABS = 0.13 (USEPA 2004).

NA = Not Available

TABLE 27
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER
SWMU 14, UNIT F, AREAS B THROUGH G
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	7.08E+08	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	53.91	Calculated
V - Fraction of vegetative cover =		0.11	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	8.94	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Metals								
Arsenic	3.86E+00	5.46E-09	2.39E-10	3.00E-04	0.000001	8.97E-12	1.50E+01	1E-10

Notes:
NA = Not Available

Hazard Index = 0.000001 **Total Cancer Risk =** 1E-10

TABLE 28
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Intake (mg/kg-day) = $\frac{Cs*IngR*EF*ED*CF}{BW*AT}$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.36E+00	2.96E-06	3.00E-04	0.01	1.06E-06	1.50E+00	2E-06

Hazard Index = 0.01 **Total Cancer Risk =** 2E-06

TABLE 29
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.36E+00	5.87E-07	3.00E-04	0.002	2.10E-07	1.50E+00	3E-07
			Hazard Index =	0.002		**Total Cancer Risk =**	3E-07

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 30
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca*InhR*EF*ED*ET*RF}{BW*AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	7.57E+08	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	64.78	Calculated
V - Fraction of vegetative cover =		0	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	2.83	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	3.36E+00	4.45E-09	1.95E-10	3.00E-04	0.000001	7.31E-12	1.50E+01	1E-10

Hazard Index = 0.000001 **Total Cancer Risk =** 1E-10

TABLE 31
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 20a AND 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF}{BW * AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	5.00E+00	4.41E-06	3.00E-04	0.01	1.57E-06	1.50E+00	2E-06

Hazard Index = 0.01 **Total Cancer Risk =** 2E-06

TABLE 32
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 20a AND 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	5.00E+00	8.72E-07	3.00E-04	0.003	3.12E-07	1.50E+00	5E-07
			Hazard Index =	0.003		**Total Cancer Risk =**	5E-07

NOTE:

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 33
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 20a AND 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	6.96E+08	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	47.64	Calculated
V - Fraction of vegetative cover =		0.20	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	20.27	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	5.00E+00	7.19E-09	3.15E-10	3.00E-04	0.000001	1.18E-11	1.50E+01	2E-10

Hazard Index = 0.000001 **Total Cancer Risk =** 2E-10

TABLE 34
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Intake (mg/kg-day) = $\frac{Cs*IngR*EF*ED*CF}{BW*AT}$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Metals							
Arsenic	1.29E+01	1.14E-05	3.00E-04	0.04	4.06E-06	1.50E+00	6E-06

Hazard Index = 0.04 **Total Cancer Risk =** 6E-06

TABLE 35
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg-day)^{-1}$	Cancer Risk
Metals							
Arsenic	1.29E+01	2.25E-06	3.00E-04	0.007	8.03E-07	1.50E+00	1E-06
			Hazard Index =	0.007		**Total Cancer Risk =**	1E-06

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 36
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	1.76E+18	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	150.26	Calculated
V - Fraction of vegetative cover =		1.00	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	0.03	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	1.29E+01	7.35E-18	3.22E-19	3.00E-04	1.07E-15	1.21E-20	1.50E+01	2E-19

Hazard Index = 1.07E-15 **Total Cancer Risk =** 2E-19

TABLE 37
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF}{BW * AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	1.42E+01	1.25E-05	3.00E-04	0.04	4.47E-06	1.50E+00	7E-06

Hazard Index = 0.04 **Total Cancer Risk =** 7E-06

TABLE 38
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	1.42E+01	2.48E-06	3.00E-04	0.01	8.85E-07	1.50E+00	1E-06
			Hazard Index =	0.01		**Total Cancer Risk =**	1E-06

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 39
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Intake (mg/kg-day) = $\frac{Ca*InhR*EF*ED*ET*RF}{BW*AT}$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	3.12E+09	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	106.67	Calculated
V - Fraction of vegetative cover =		0.60	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	0.17	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	1.42E+01	4.56E-09	2.00E-10	3.00E-04	0.000001	7.50E-12	1.50E+01	1E-10

Hazard Index = 0.000001 **Total Cancer Risk =** 1E-10

TABLE 40
RISKS AND HAZARDS FROM INGESTION OF SOIL BY AN INDUSTRIAL WORKER - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs * IngR * EF * ED * CF}{BW * AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
IngR - Ingestion rate for soil =	mg/day	100	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Oral RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.23E+00	2.85E-06	3.00E-04	0.01	1.02E-06	1.50E+00	2E-06

Hazard Index = 0.01 **Total Cancer Risk =** 2E-06

TABLE 41
RISKS AND HAZARDS FROM DERMAL EXPOSURE TO SOIL BY AN INDUSTRIAL WORKER - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Cs*SA*AH*ABS*EF*ED*CF}{BW*AT}$$

Parameter	Unit	Value	Source
Cs - Concentration in soil =	mg/kg	see below	
SA - Surface area available for exposure =	cm^2/day	3300	USEPA 2004
AF - Adherence factor =	mg/cm^2	0.2	USEPA 2004
ABS - Absorption fraction =		see Note 1	USEPA 2004
EF - Exposure frequency =	days/year	225	USEPA 2004
ED - Exposure duration =	years	25	USEPA 2004
CF - Conversion factor =	kg/mg	1.00E-06	
BW - Body weight =	kg	70	USEPA 2004
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2004
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2004

Constituent	Maximum Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Dermal RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Risk
Arsenic	3.23E+00	5.64E-07	3.00E-04	0.002	2.01E-07	1.50E+00	3E-07
			Hazard Index =	0.002		**Total Cancer Risk =**	3E-07

1 - Values are chemical-specific; arsenic ABS = 0.03 (USEPA 2004).

TABLE 42
RISKS AND HAZARDS FROM INHALATION OF FUGITIVE DUST BY AN INDUSTRIAL WORKER - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

$$\text{Intake (mg/kg-day)} = \frac{Ca * InhR * EF * ED * ET * RF}{BW * AT}$$

Parameter	Unit	Value	Source
Ca - Concentration in air =	mg/m^3	see below	Calculated
InhR - Inhalation rate =	m^3/hr	0.83	USEPA 2002
EF - Exposure frequency =	days/year	225	USEPA 2002
ED - Exposure duration =	years	25	USEPA 2002
ET - Exposure time =	hr/day	8	Site-specific
RF - Retention factor =		0.75	ICRP 1968
BW - Body weight =	kg	70	USEPA 2002
AT_n - Averaging time - noncarcinogenic =	days	9125	USEPA 2002
AT_c - Averaging time - carcinogenic =	days	25550	USEPA 2002
Ca - Concentration in air (mg/m^3) =	Cs * 1/PEF	see below	Calculated
Cs - Concentration in soil =	mg/kg	see below	
PEF - Particulate Emission Factor =	m^3/kg	8.48E+17	Calculated
PEF (m^3/kg) =	$(Q/C)*3600/(0.036*(1-V)*(U_m/U_t)^3*F(x)$		
Q/C - Dispersion factor =	g/m^2 per kg/m^3	72.56	Calculated
V - Fraction of vegetative cover =		1.00	Site-specific
U_m - Mean annual windspeed =	m/sec	4.00	Site-specific
U_t - Equivalent threshold value of windspeed at 7 m =	m/sec	11.32	USEPA 2002
F(x) - Um/Ut-dependent function =		1.94E-01	USEPA 2002
Q/C (g/m^2 per kg/m^3) =	$A*(\exp((\ln A_{site}-B)^2/C)$		
A - dispersion constant =		14.0111	USEPA 2002
B - dispersion constant =		19.6154	USEPA 2002
C - dispersion constant =		225.3397	USEPA 2002
A_{site} - affected area of site (acres) =	acres	1.44	Site-specific

Constituent	RME Concentration in Soil mg/kg	Concentration in Air mg/m^3	Average Daily Intake mg/kg-day	Inhalation RfD mg/kg-day	Hazard Quotient	Average Lifetime Daily Intake mg/kg-day	Inhalation Cancer Slope Factor 1/(mg/kg-day)	Cancer Risk
Arsenic	3.23E+00	3.82E-18	1.67E-19	3.00E-04	6E-16	6.28E-21	1.50E+01	9E-20

Hazard Index = 6E-16 **Total Cancer Risk =** 9E-20

TABLE 43
SUMMARY OF TOXICITY VALUES
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Oral Toxicity Values

Chemical	CAS #	Oral RfD mg/kg-day	Source	Oral CSF 1/(mg/kg-day)	Source
METALS					
Arsenic	7440382	3.00E-04	IRIS	1.50E+00	IRIS
SVOCs					
Naphthalene	91203	2.00E-02	IRIS	NA	--
Benzo(a)pyrene	50328	NA	--	7.30E+00	IRIS

Dermal Toxicity Values

Chemical	CAS #	Dermal RfD mg/kg-day	Source	Dermal CSF 1/(mg/kg-day)	Source
METALS					
Arsenic	7440382	3.00E-04	IRIS	1.50E+00	IRIS
SVOCs					
Naphthalene	91203	2.00E-02	IRIS	NA	--
Benzo(a)pyrene	50328	NA	--	7.30E-01	IRIS

Inhalation Toxicity Values

Chemical	CAS #	Inhalation RfD mg/kg/day	Source	Inhalation CSF 1/(mg/kg-day)	Source
METALS					
Arsenic	7440382	3.00E-04	IRIS	1.50E+01	IRIS
SVOCs					
Naphthalene	91203	8.60E-04	IRIS	NA	--
Benzo(a)pyrene	50328	NA	--	3.10E+00	NCEA

Notes:
CSF = Cancer Slope Factor
RfD = Reference Dose
NA = Not Available

Sources:
IRIS - Integrated Risk Information System
NCEA - National Center for Environmental Assessment Provisional Value

TABLE
HAZARD AND RISK SUMMARY FOR INDUSTRIAL WORKERS AT THE FACILITY
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

SWMU 13	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.002	3E-07	0.0000005	3E-07	0.01	2E-06
							0.01	**2E-06**

SWMU 14 - Unit F, Area A, Woodpile Area	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.003	4E-07	0.000001	1E-10	0.02	3E-06
Benzo(a)pyrene	--	2E-06	--	2E-07	--	5E-12	--	2E-06
Naphthalene	0.1	--	0.1	--	0.0001	--	0.2	--
							0.2	**5E-06**

SWMU 14 - Unit F, Areas B through G	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.002	4E-07	0.000001	1E-10	0.01	2E-06
							0.01	**2E-06**

SWMU 15	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.002	3E-07	0.000001	1E-10	0.01	2E-06
							0.01	**2E-06**

SWMU 20a & 20a.1	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.003	5E-07	0.000001	2E-10	0.02	3E-06
							0.02	**3E-06**

SWMU 26	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.04	6E-06	0.007	1E-06	1.07E-15	2E-19	0.05	7E-06
							0.05	**7E-06**

SWMU 33	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.04	7E-06	0.01	1E-06	0.000001	1E-10	0.05	8E-06
							0.05	**8E-06**

SWMU 34	Incidental Ingestion of Soil		Dermal Exposure to Soil		Inhalation of Fugitive Dust		Total Hazard and Risk	
Chemical	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**	**HQ**	**Cancer Risk**
Arsenic	0.01	2E-06	0.002	3E-07	5.58E-16	9E-20	0.01	2E-06
							0.01	**2E-06**

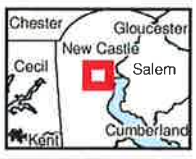
Legend

DCR Property Boundary

0 1,750 3,500 7,000 Feet

1 inch = 3,500 feet

Reference:
USGS 7.5 Min Topographical Maps
Newark East, Saint Georges, 1993
Wilmington South, 2000
Delaware City, 2001
NAD 1983 State Plane Delaware
Projection: Transverse Mercator
Linear Unit: Foot US



URS

335 Commerce Drive, Suite 300
Fort Washington, PA 19034
Phone: (215) 367-2500 Fax: (215) 367-1000

Job: 19998564.00000	
Prepared by: VP	
Checked by: MR	
Date: 10/05/2010	

Figure 1
Site Vicinity Map

Delaware City Refinery
Delaware City, Delaware

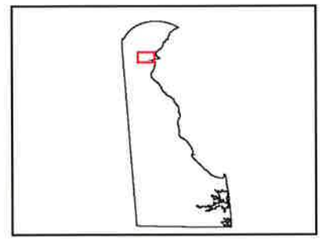
O:\GIS_Data\MOTIVA\Projects\BERAAddendum\Figure 1 - Site Vicinity Map.mxd

580452
590452
600452
610452
588418
578418

DELAWARE RIVER
Red Lion Creek
OCCIDENTAL CHEMICAL
METACHEM
BULK STORAGE TANK FARM & MARKET LOADING TERMINAL
NORTHERN PROCESS AREA
Effluent Channel
NORFOLK SOUTHERN
AKZO
FORMOSA PLASTICS
INEOS FILMS
AIR LIQUIDE
Cooling Water Influent Channel
SOUTHERN PROCESS AREA
Dragon Run and Surrounding Non-Developed Land
Dragon Run

Legend

- Cooling Water Channels
- Dragon Run and Surrounding Non-Developed Land
- Areas Not Risk Assessed in this HHRA
- DCR Property Boundary



Key Map
Not to Scale

N

Reference:
2002 DE State Imagery

NAD1983 StatePlane Delaware
Projection: Transverse Mercator
Linear Unit: Foot US

0 1,300 2,600 5,200
Feet

URS

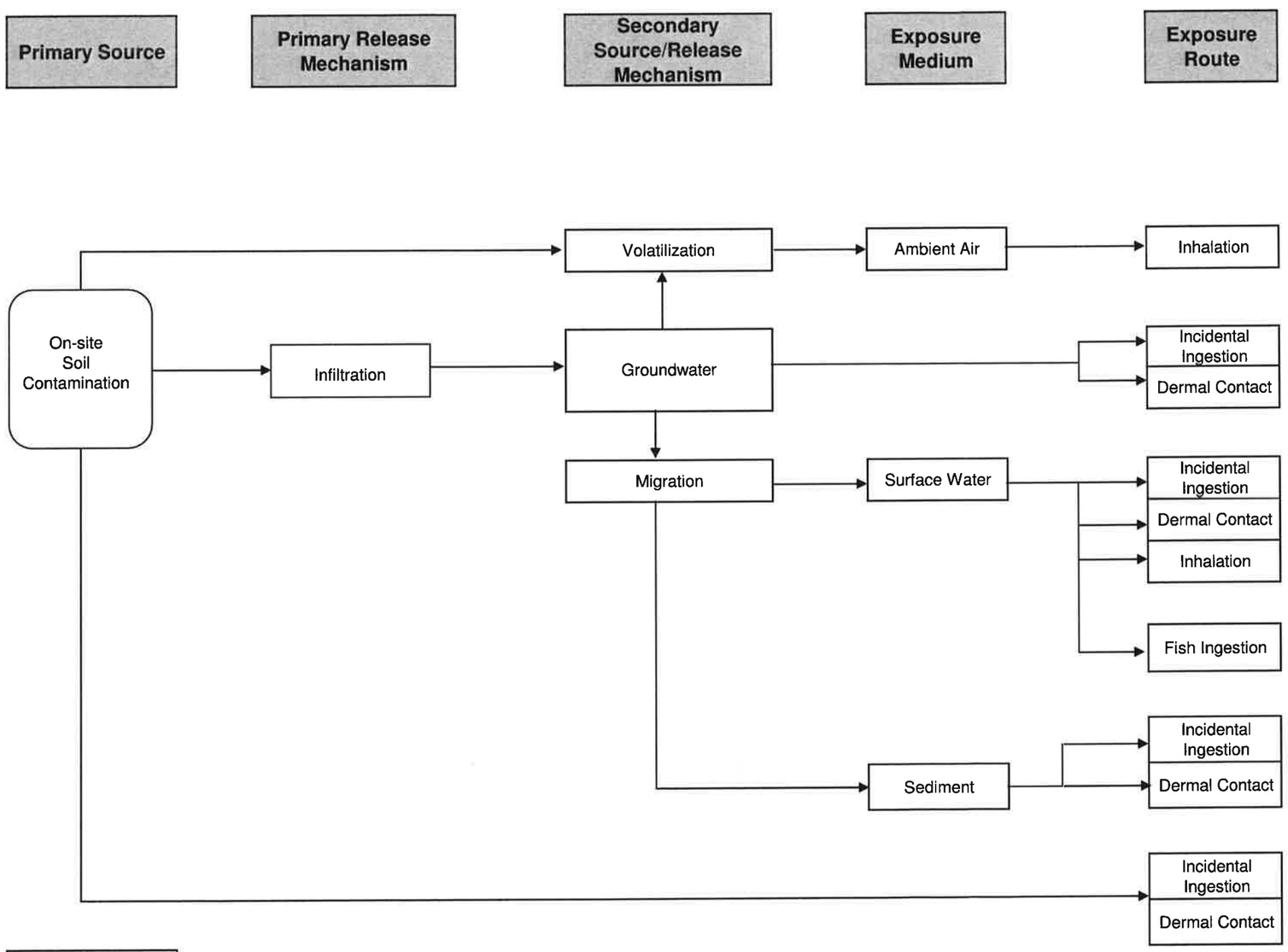
Figure 2
Site Map

Delaware City Refinery
Delaware City, Delaware

Prepared By: VP	Checked By: DGR
Job: 19998564.00000	Date: 10/20/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Assess Site Map Fig2.mxd

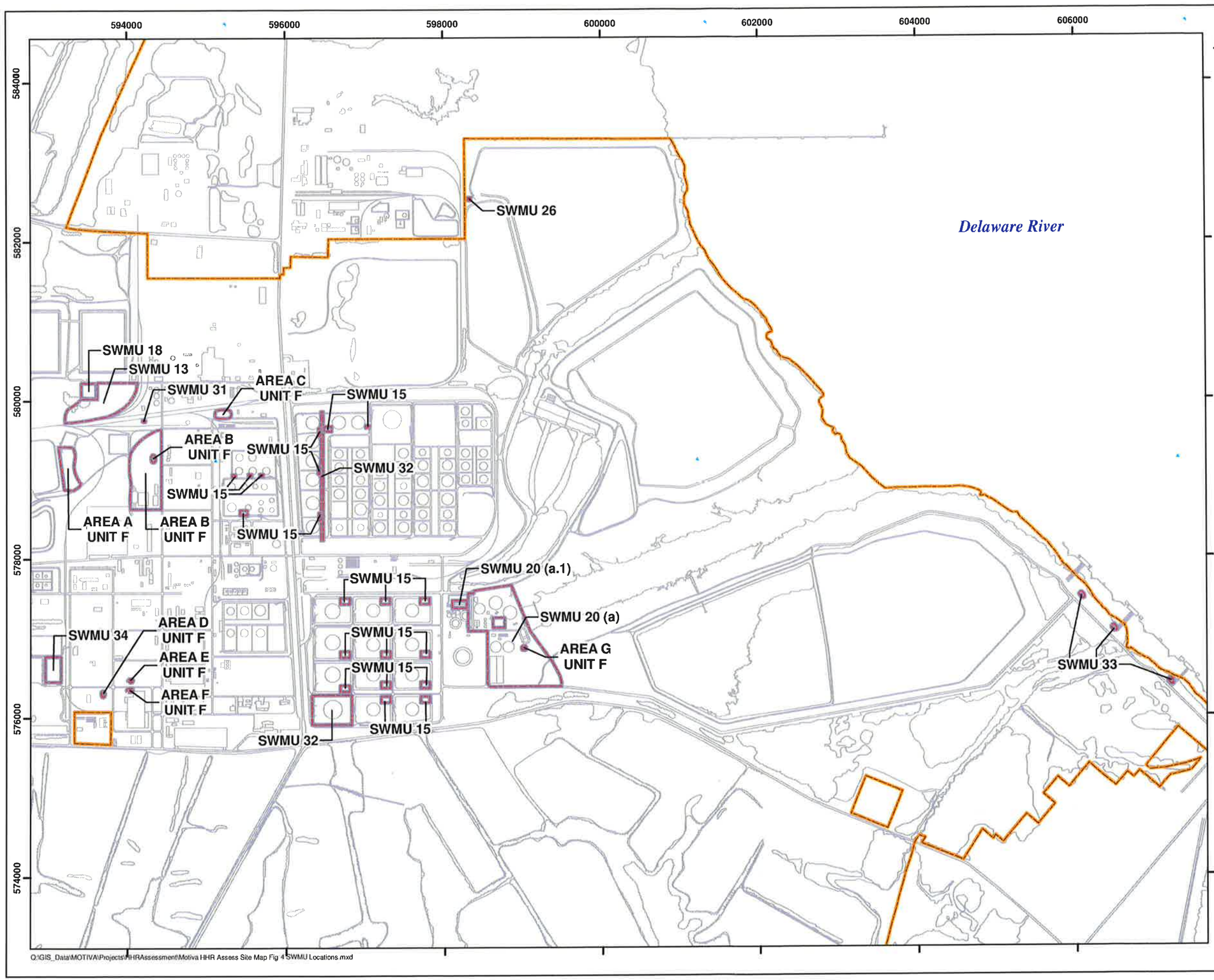
FIGURE 3
HUMAN HEALTH CONCEPTUAL SITE MODEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE



Potential Human Health Receptors			
SWMUs	SWMUs & Southern Lands	Dragon Run & Delaware River*	
Industrial Worker	Future Construction Worker	Adult/Child Recreational Swimmer	Adult/Child Recreational Angler
●	O	●	O
O	O	O	O
O	O	O	O
O	O	●	O
O	O	●	O
O	O	●	O
O	O	O	●
O	O	O	O
O	O	●	O
●	O	O	O
●	O	O	O

● = Potentially Complete Exposure Pathway
O = Incomplete Exposure Pathway

SWMUs = solid wast management units
Southern Lands = non-developed lands in the southern portion of the Facility
*Delaware River receptors conservatively evaluated using data from the cooling water channels.


594000
596000
598000
600000
602000
604000
606000
584000
582000
580000
578000
576000
574000
Delaware River
SWMU 26
SWMU 18
SWMU 13
SWMU 31
AREA C
UNIT F
SWMU 15
AREA B
UNIT F
SWMU 15
SWMU 32
SWMU 15
AREA A
UNIT F
AREA B
UNIT F
SWMU 15
SWMU 15
SWMU 20 (a.1)
SWMU 20 (a)
SWMU 15
SWMU 15
SWMU 15
AREA G
UNIT F
SWMU 34
AREA D
UNIT F
AREA E
UNIT F
AREA F
UNIT F
SWMU 32
SWMU 15
SWMU 33
Legend
SWMU Boundary
DCR Property Boundary
Key Map
Not to Scale
N
NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000
GCS North American 1983
0
600
1,200
2,400
Feet
1 inch = 1,225 feet
URS
Figure 4
SWMU Location Map for
Soil Sampling Locations
Delaware City Refinery
Delaware City, Delaware 19805
Prepared By: VP
Checked By: DR
Job: 20240412.W1000
Date: 04/23/2010
Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Assess Site Map Fig 4 SWMU Locations.mxd

592370 592870 593370 593870 594370

580541

580041

579541

579041

13B2-1994
13B2
13B3-1994
13B3
13B1-1994
S13-SB4
13B1

Legend

S13-SB4 — Phase II Soil Boring Location

15B12A — Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 100 200 400 Feet

URS

Figure 5
Soil Sampling Locations
SWMU 13
Old Drum Storage Area

Delaware City Refinery
Delaware City, Delaware

Prepared By: VP	Checked By: DR
Job: 19998564.00000	Date: 10/20/2010

O:\GIS_Data\MOTIVA\Projects\RFI\Soil\RFI Phase II Fig3 SWMU13 .mxd

593029 593529 594029 594529 595029

580065 579565 579065 578565

S14FB-SB13
S14FB-SB12
S14FB-SB6
S14FB-SB7
S14FB-SB8
S14FB-SB9
WPA-TP11
WPA-TP10A
WPA-TP12
WPA-TP9
AREA A
UNIT F
WPA-TP7A
WPA-TP7B
FAB1
WPA-TP6
WPA-TP8
WPA-TP15
FSSA
WPA-TP4a
WPA-TP5
FAB3
WPA-TP3B
WPA-TP3C
WPA-TP3A
WPA-TP4b
WPA-TP16B
WPA-TP2
WPA-TP14
WPA-TP1
WPA-TP16C
WPA-TP13
AREA B
UNIT F
FSSB
FBB5
FCB1
AREA C
UNIT F
FSSC

Legend

- S14FB-SB6 — Phase II Soil Boring Location
- FBB1 — Previous Soil Boring Location (Phase I RFI and VRS)
- WPA-TP1 — Test Pit (Wood Pile Area) (WPA Investigation Report, 2007
- SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 100 200 400 Feet

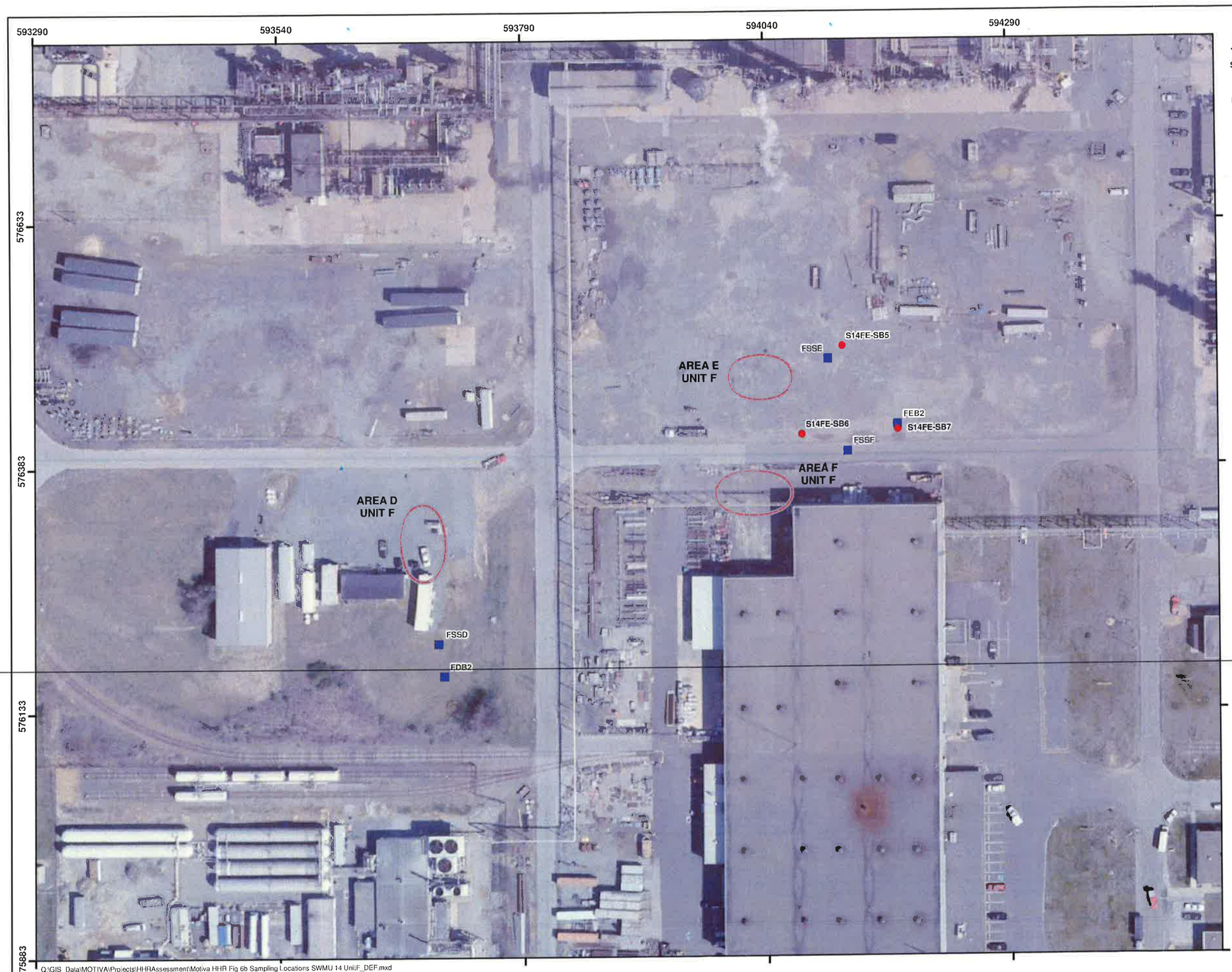
URS

Figure 6a
Soil Sampling Locations
SWMU 14
Unit F (Areas A, B and C)

Delaware City Refinery
Delaware City, Delaware

Prepared By: VP	Checked By: DR
Job: 19998564.00000	Date: 10/07/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 6a Sampling Locations SWMU 14 UnitF_ABC_revised.mxd



Legend

- S14FE-SB6 — Phase II Soil Boring Location
- FEB2 — Previous Soil Boring Location (Phase I RFI and VRS)
- SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 50 100 200 Feet

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 6b Sampling Locations SWMU 14 Unit F_DEF.mxd

URS

Figure 6b
Soil Sampling Locations
SWMU 14
Unit F (Areas D, E and F)

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/23/2010

598317 598567 598817 599067 599317

577106

576856

576606

576356

AREA G
UNIT F

FSSG

FGB2

Legend

FEB2 — Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 50 100 200 Feet

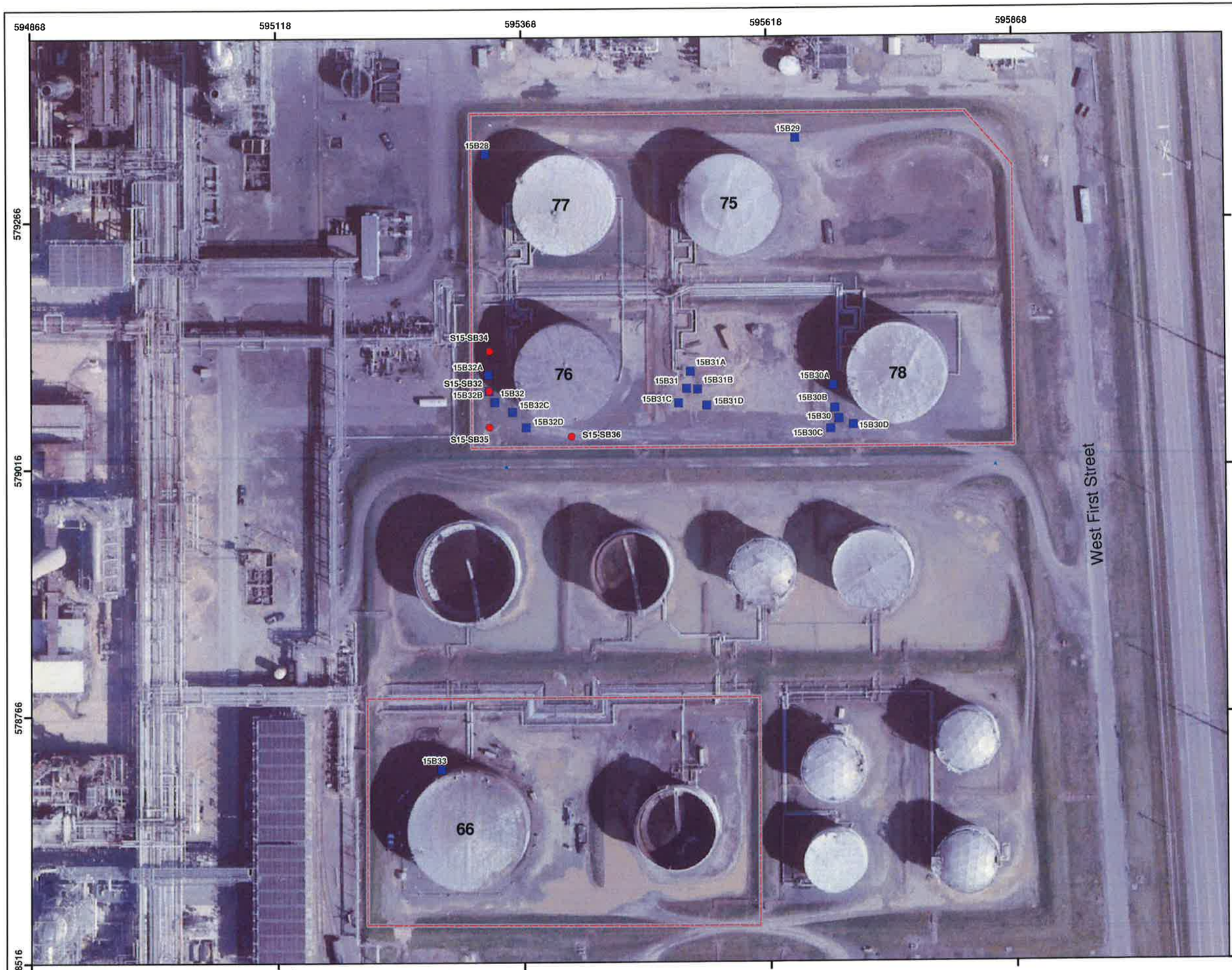
URS

Figure 6c
Soil Sampling Locations
SWMU 14
Unit F (Area G)

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/23/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 6c Sampling Locations SWMU 14 UnitF_G.mxd



Legend

- S15-SB56 — Phase II Soil Boring Location
- 15B12A — Previous Soil Boring Location (Phase I RFI and VRS)
- SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 50 100 200 Feet

URS

Figure 7a
Soil Sampling Locations
SWMU 15
Tank Bottom Weathering Areas

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 7a Sampling Locations SWMU 15 Tank Bottom Weathering Area.mxd

Legend

S15-SB56 — Phase II Soil Boring Location

15B12A — Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 100 200 400 Feet

URS

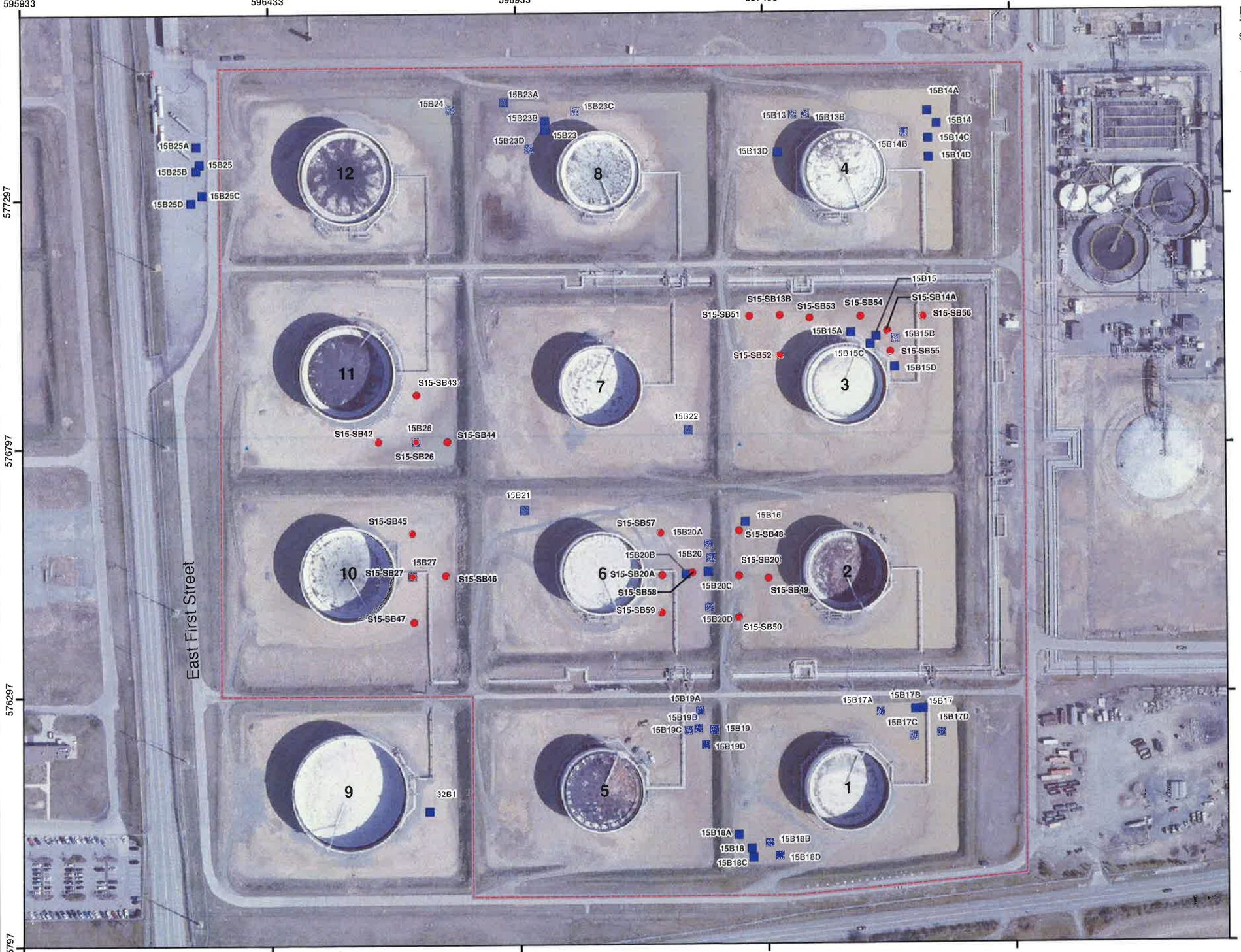
Figure 7b
Soil Sampling Locations
SWMU 15
Tank Bottom Weathering Areas

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

595933 596433 596933 597433 597933

577297 576797 576297 575797



Legend

S15-SB56 — Phase II Soil Boring Location

15B12A — Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 100 200 400 Feet

URS

Figure 7c
Soil Sampling Locations
SWMU 15
Tank Bottom Weathering Areas

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

O:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 7c Sampling Locations SWMU 15 Tank Bottom Weathering Area.mxd

593054 593179 593304 593429 593554

580284 580159 580034 579909

S18-SB7
18B5
S18-SB6
18B1
18B3
S18-SB8
18B2
18B2C
SWMU18
S18-SB10
S18-SB9

Legend

S18-SB8 — Phase II Soil Boring Location

18B3C — Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 25 50 100 Feet

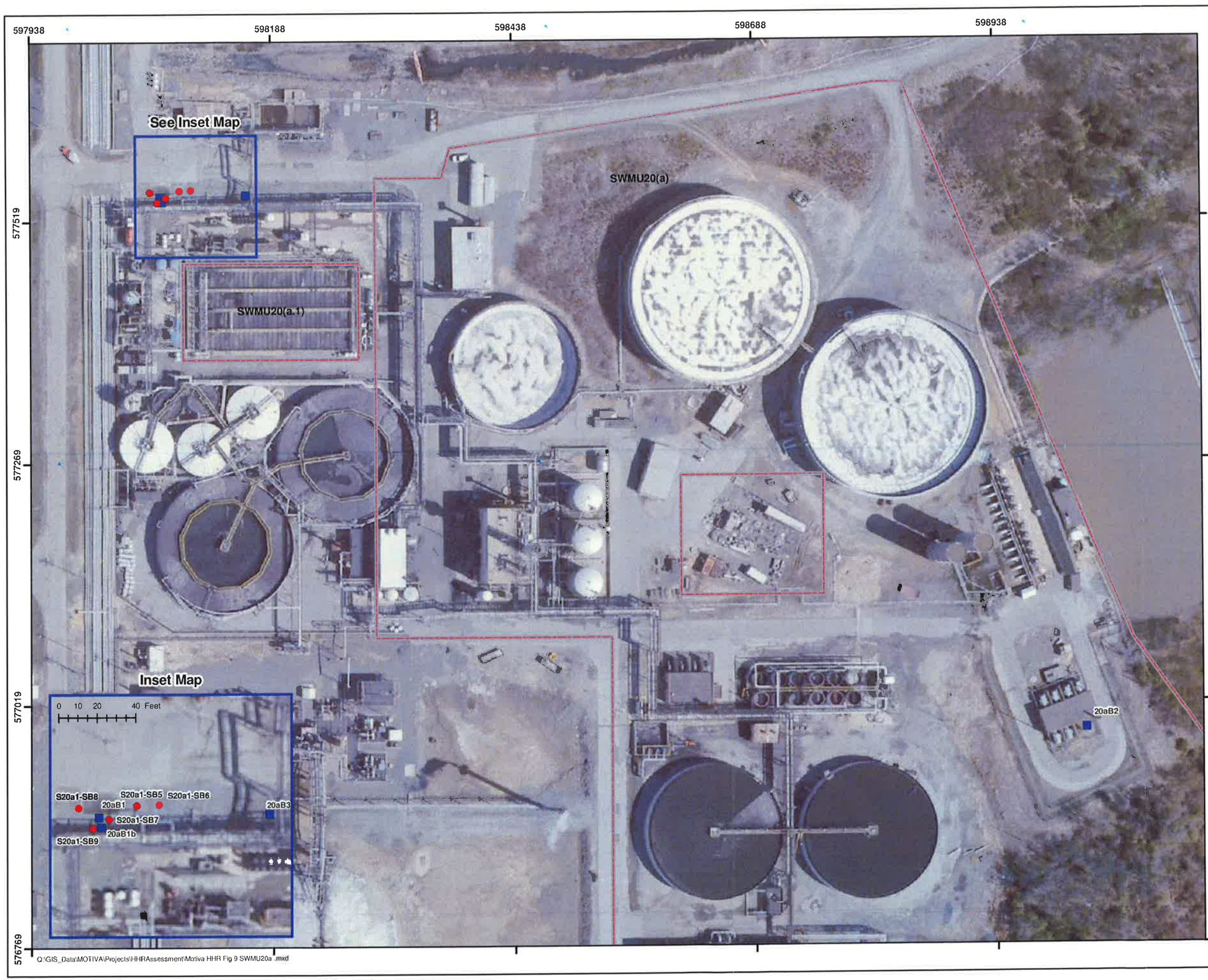
URS

Figure 8
Soil Sampling Locations
SWMU 18
Fire Training Area

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 8 SWMU18 .mxd



Legend

- S20a1-SB4 — Phase II Soil Boring Location
- 20aB1a — Previous Soil Boring Location (Phase I RFI and VRS)
- SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 50 100 200 Feet

URS

Figure 9
Soil Sampling Locations
SWMU 20a & 20a.1
Wastewater Treatment Plant

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

598011 598136 598261 598386 598511

582689 582564 582439 582314

SWMU24(a)

SWMU26

26B-1 26B-2 26B-3 26B-5 26B-4

Property of
Occidental\Chemical

S26-SB21
S26-SB19
S26-SB20

SWMU25
(Closed RCRA Landfill)

Legend

S26-SB24 — Phase II Soil Boring Location

26B-5 — Previous Soil Boring Location (Phase I RFI and VRS)

DCR Property Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 25 50 100 Feet

URS

Figure 10
Soil Sampling Locations
SWMU 26
TEL Equipment Laydown Area

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 10 SWMU26 TEL .mxd

Legend

S31-SB7 — Phase II Soil Boring Location

31B-4 — Previous Soil Boring Location (Phase I RFI and VRS)

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 25 50 100 Feet

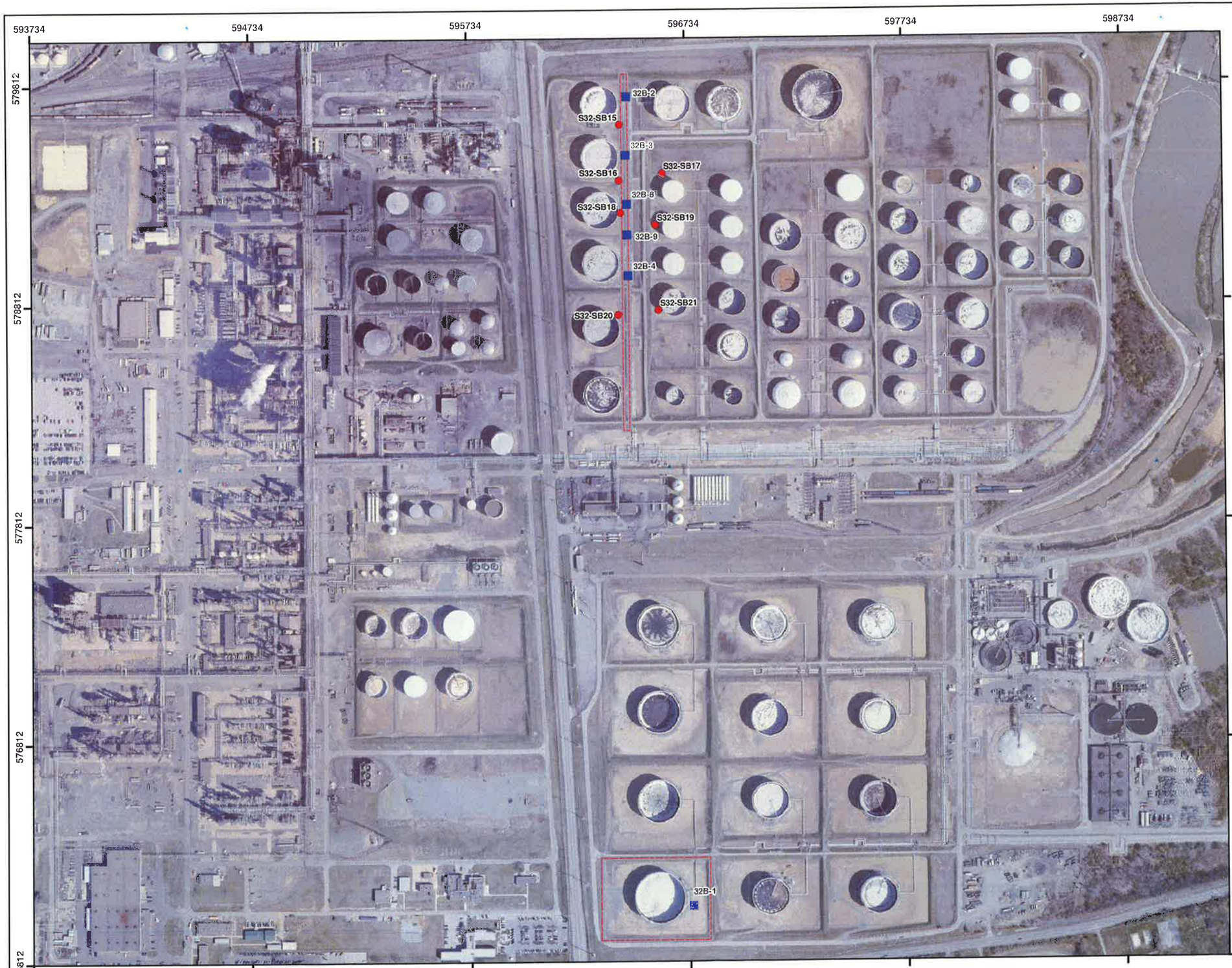
URS

Figure 11
Soil Sampling Locations
SWMU 31
Former Slurry Oil Dumpster

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssesment\Motiva HHR Fig 11 SWMU31 Former Slurry.mxd



Legend

- S32-SB17 — Phase II Soil Boring Location
- 32B-2 — Previous Soil Boring Location (Phase I RFI and VRS)
- SWMU Boundary

Key Map
Not to Scale

N

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

0 225 450 900 Feet

URS

Figure 12
Soil Sampling Locations
SWMU 32
Oil Sewer Backup Area

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 12 SWMU32 Oil Sewer.mxd

605350 605850 606350 606850 607350

577575

577075

576575

576075

Pier 3

Pier 2

Pier 1

33B-6 33B10 33B13 33-MW2 33B11 33B12 33B-5 33B-4

33-MW1 33B7 33B-2 33B-3 33B8 33B9 33B-1

33B14 33B18 33B15 33B17 33B16

Legend

33B8 Phase II Soil Boring Location

33B-6 Previous Soil Boring Location (Phase I RFI and VRS)

SWMU Boundary

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 100 200 400 Feet

URS

Figure 13
Soil Sampling Locations
SWMU 33
Piers 1, 2, and 3

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 13 SWMU33 Piers.mxd

592500 592750 593000 593250 593500

577000 576750 576500 576250

Legend

S34-SB1Z — Phase II Soil Boring Location

Previous Soil Boring Location

SWMU Boundary

1O 1N 1M
S34-SB10
1L 1K 1J
S34-SB1K S34-SB1J
1I 1H 1G
S34-SB1G
SWMU34
1F 1E 1D
S34-SB1E
1C 1B 1A
S34-SB1C
1Z
S34-SB1Z
1Y

Key Map
Not to Scale

NAD1983 StatePlane Delaware
FIPS 0700 Feet
Projection: Transverse Mercator
False Easting: 656166.666667
False Northing: 0.000000
Central Meridian: -75.416667
Scale Factor: 0.999995
Latitude Of Origin: 38.000000

GCS North American 1983

Reference:
DE Datamil Aerial, 2007

N

0 50 100 200 Feet

URS

Figure 14
Soil Sampling Locations
SWMU 34
Naphthalene Tank Farm

Delaware City Refinery
Delaware City, Delaware 19805

Prepared By: VP	Checked By: DR
Job: 20240412.W1000	Date: 04/27/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 14 SWMU34 NRC .mxd

Legend

- Monitoring Well - Columbia
- Monitoring Well - Potomac
- Surface Water
- Sediment
- Surface Water and Sediment
- DCR Property Boundary

Key Map
Not to Scale

N

Reference:
Delaware Datamil 2007
Aerial Imagery

NAD1983 StatePlane Delaware
Projection: Transverse Mercator
GCS North American 1983

0 250 500 1,000 Feet

1 inch = 500 feet

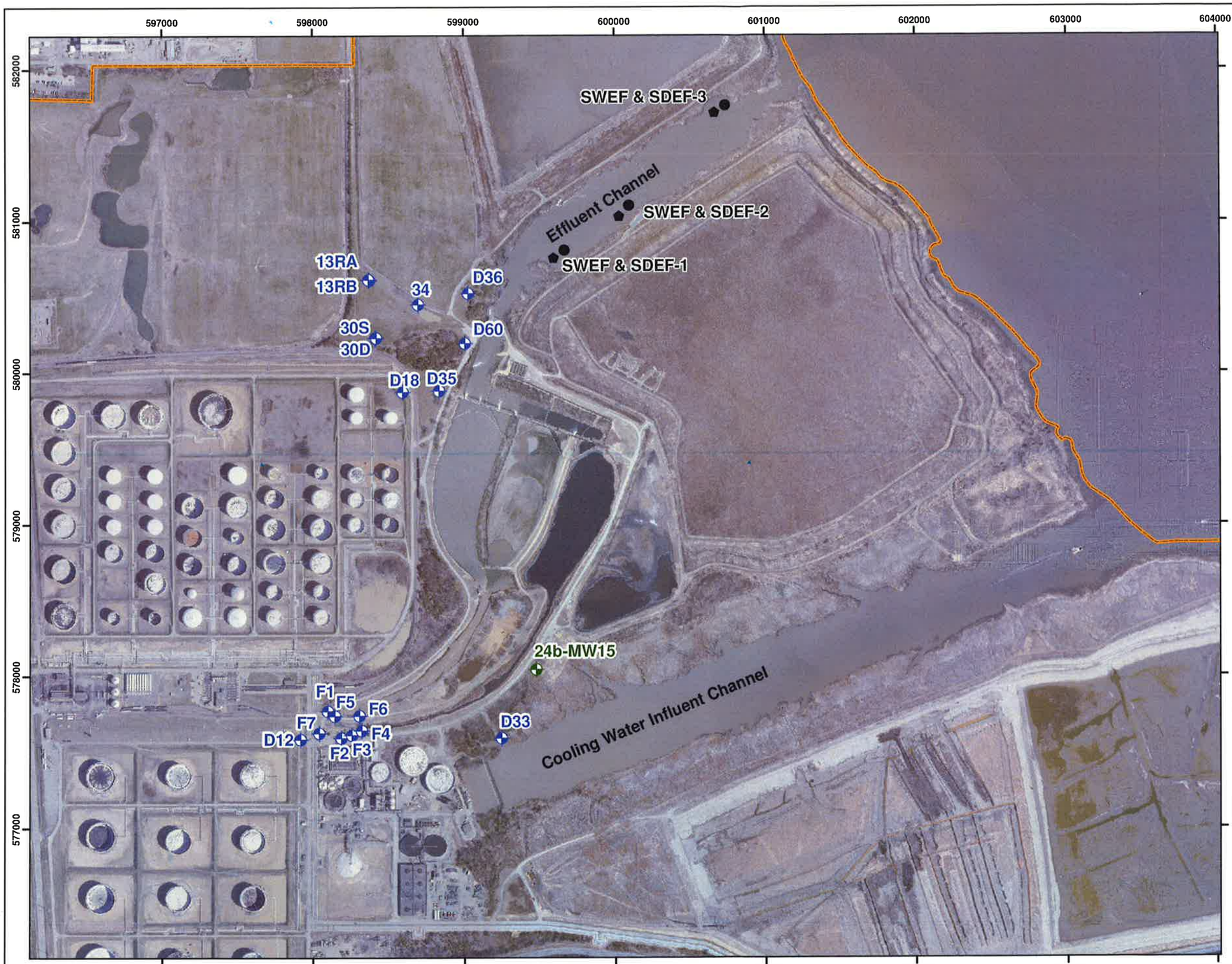
URS

Figure 15
Map of Sampling Locations
Dragon Run and Surrounding Non-Developed Land

Delaware City Refinery
Delaware City, Delaware

Prepared By: VP	Checked By: EGS
Job: 19998564.00000	Date: 10/18/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig15 Sampling Locations.mxd



Legend

- Surface Water Location
- Sediment Location
- Monitoring Well - Riverine
- Monitoring Well - Columbia
- DCR Property Boundary

Key Map
Not to Scale

N

Reference:
Delaware Datamil 2007
Aerial Imagery

NAD1983 StatePlane Delaware
Projection: Transverse Mercator
GCS North American 1983

0 250 500 1,000 Feet

1 inch = 650 feet

URS

Figure 16
Map of Sampling Locations
Cooling Water Channels

Delaware City Refinery
Delaware City, Delaware

Prepared By: VP	Checked By: EGS
Job: 19998564.00000	Date: 10/18/2010

Q:\GIS_Data\MOTIVA\Projects\HHRAssessment\Motiva HHR Fig 16 Sampling Locations North.mxd

APPENDIX A-1
GROUNDWATER DATA - COOLING WATER INFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Well									
		24b-MW16	D12	D33	F1	F2	F3	F4	F5	F6	F7
		2/18/2010	8/20/2009	2/17/2010	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/20/2009
Organic Compounds (ug/L)											
1,1,1-Trichloroethane	71-55-6		1 U								5 U
1,1,2,2-Tetrachloroethane	79-34-5		1 U								5 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1		8 U								40 U
1,1,2-Trichloroethane	79-00-5		2 U								10 U
1,1-Dichloroethane	75-34-3		2 U								10 U
1,1-Dichloroethene	75-35-4		2 U								10 U
1,2,4-Trichlorobenzene	120-82-1		5 U								25 U
1,2-Dibromo-3-Chloropropane	96-12-8		4 U								20 U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4		2 U								10 U
1,2-Dichlorobenzene	95-50-1		2 U								10 U
1,2-Dichloroethane	107-06-2		2 U								10 U
1,2-Dichloropropane	78-87-5		2 U								10 U
1,3-Dichlorobenzene	541-73-1		1 U								5 U
1,4-Dichlorobenzene	106-46-7		1 U								5 U
2-Hexanone	591-78-6		15 U								75 U
Acetone	67-64-1		15 U								75 U
Benzene	71-43-2	101	1 U	0.59 J	1 U	1 U	1 U	1 U	1 U	1 U	504
Bromodichloromethane	75-27-4		1 U								5 U
Bromoform	75-25-2		2 U								10 U
Bromomethane	74-83-9		3 U								15 U
Carbon Disulfide	75-15-0		8 U								40 U
Carbon Tetrachloride	56-23-5		1 U								5 U
Chlorobenzene	108-90-7		1 U								5 U
Chloroethane	75-00-3		2 U								10 U
Chloroform	67-66-3		16.1 B								10 U
Chloromethane	74-87-3		2 U								10 U
cis-1,2-Dichloroethylene	156-59-2		2 U								10 U
cis-1,3-Dichloropropene	10061-01-5		1 U								5 U
Cyclohexane	110-82-7		2 U								10 U
Dibromochloromethane	124-48-1		2 U								10 U
Dichlorodifluoromethane	75-71-8		2 U								10 U
Dimethylbenzene (Total Xylenes)[1]	1330-20-7		4 U		3 U	3 U	3 U	3 U	3 U	3 U	33.1
Ethylbenzene	100-41-4		1 U		1 U	1 U	1 U	1 U	1 U	1 U	3.46 J
Isopropylbenzene (Cumene)	98-82-8		1 U								13.4
m,p-Xylenes	179601-23-1		2 U								23.1
Methyl Acetate	79-20-9		2 U								10 U
Methyl Ethyl Ketone (2-Butanone)	78-93-3		20 U								100 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1		40 U								200 U
Methylcyclohexane	108-87-2		2 U								14
Methylene Chloride	75-09-2		5 U								25 U
Naphthalene	91-20-3	29.8	4 U	1.45 J							54.4
o-Xylene (1,2-Dimethylbenzene)	95-47-6		2 U								10 U
Styrene	100-42-5		1 U								5 U
tert-Amylmethylether	994-05-8	8 U	8 U	5 U							33.9 J
tert-Butyl Alcohol	75-65-0	50 U	4 U	10 U							75.3
tert-Butyl Methyl Ether	1634-04-4	2 U	2 U	6 U	1 U	58.1	51.5	68.9	1 U	4.64	80
Tetrachloroethylene (PCE)	127-18-4		2 U								10 U
Toluene	108-88-3		1 U		1 U	1 U	1 U	1 U	1 U	1 U	5.55
trans-1,2-Dichloroethene	156-60-5		2 U								10 U
trans-1,3-Dichloropropene	10061-02-6		2 U								10 U

APPENDIX
GROUNDWATER DATA - COOLING WATER INFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Well									
		24b-MW15	D12	D33	F1	F2	F3	F4	F5	F6	F7
		2/18/2010	8/20/2009	2/17/2010	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/26/2008	8/20/2009
Trichloroethylene (TCE)	79-01-6		2 U								10 U
Trichlorofluoromethane	75-69-4		2 U								10 U
Vinyl Chloride	75-01-4		1 U								5 U
Dissolved Metals (ug/L)											
Antimony	7440-36-0				10 U	10 U	10 U	10 U	10 U	10 U	
Cadmium	7440-43-9				1 U	1.2	1.5	1 U	1	1 U	
Chromium, Total	7440-47-3				5 U	5 U	5 U	5 U	5 U	5 U	
Iron	7439-89-6		200 U								20,900
Lead	7439-92-1				5 U	5 U	5 U	5 U	5 U	5 U	
Nickel	7440-02-0				10 U	10 U	10 U	10 U	10 U	10 U	
Selenium	7782-49-2				10 U	10 U	10 U	10 U	10 U	10 U	
Total Metals (ug/L)											
Antimony	7440-36-0				10 U	10 U	10 U	10 U	10 U	10 U	
Cadmium	7440-43-9				10 U	1	1.2	1 U	1 U	1 U	
Chromium, Total	7440-47-3				8.9	5.9	5 U	5 U	5 U	5 U	
Iron	7439-89-6		200 U								21,200
Lead	7439-92-1				5 U	8.29	5 U	5 U	5 U	5 U	
Nickel	7440-02-0				10 U	10 U	10 U	10.7	10 U	10 U	
Selenium	7782-49-2				10 U	10 U	10 U	10 U	10 U	10 U	
Other											
Alkalinity, Total (as $CaCO_3$) (mg/L)	ALK										308
Chloride (As Cl) (mg/L)	16887-00-6		64.2								466
Ethane (ug/L)	74-84-0		21.7 U								21.7 U
Ethene (ug/L)	74-85-1		28.7 U								28.7 U
Methane (ug/L)	74-82-8		10.8 U								1280 B
Nitrogen, Nitrate (As N) (mg/L)	7727-37-9		5.4								0.1 U
Nitrogen, Ammonia (As N) (mg/L)	14797-55-8										22.4 L
Sulfate (as SO_4) (mg/L)	14808-79-8		46.7 K								1 U
Sulfide, Total (mg/L)	105-05-2		5 U								5 U
Total Carbon (mg/L)	7440-44-0		3.26								

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

B = Result is potentially biased high due to blank contamination

K = An associated QC sample had an outlier; the sample result may be biased high.

J = Reported result is between the method detection limit and the reporting limit. Value is estimated

L = Result is estimated and potentially biased low due to a minor quality control anomal

U = Analyte not detected above the method detection limit

UJ = Non-detect result (reporting limit) is estimated due to a minor quality control anomaly

Blank cells indicate constituent was not analyzed

1) Total xylenes concentration was calculated as the sum of m,p-Xylenes plus o-Xylene (1,2-Dimethylbenzene) where applicable

APPENDIX A-2
GROUNDWATER DATA - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Well															
		13RA		13RB		30D		30S		34		D18		D35		D36		D60	
		9/2/2009		9/2/2009		8/18/2009		11/12/2009		9/2/2009		2/16/2010		8/27/2009		2/17/2010		2/15/2010	
Organic Compounds (ug/L)																			
1,1,1-Trichloroethane	71-55-6	1	U	1	U	1	U			1	U			1	U				
1,1,2,2-Tetrachloroethane	79-34-5	1	U	1	U	1	U			1	U			1	U				
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	8	U	8	U	8	U			8	U			8	U				
1,1,2-Trichloroethane	79-00-5	2	U	2	U	2	U			2	U			2	U				
1,1-Dichloroethane	75-34-3	2	U	2	U	2	U			2	U			2	U				
1,1-Dichloroethene	75-35-4	2	U	2	U	2	U			2	U			2	U				
1,2,4-Trichlorobenzene	120-82-1	5	U	5	U	5	U			5	U			5	U				
1,2-Dibromo-3-Chloropropane	96-12-8	4	U	4	U	4	U			4	U			4	U				
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	2	U	2	U	2	U			2	U			2	U				
1,2-Dichlorobenzene	95-50-1	2	U	2	U	2	U			2	U			2	U				
1,2-Dichloroethane	107-06-2	2	U	2	U	2	U			2	U			2	U				
1,2-Dichloropropane	78-87-5	2	U	2	U	2	U			2	U			2	U				
1,3-Dichlorobenzene	541-73-1	1	U	1	U	1	U			1	U			1	U				
1,4-Dichlorobenzene	106-46-7	1	U	1	U	1	U			1	U			1	U				
2-Hexanone	591-78-6	15	U	15	U	15	U			15	U			15	U				
Acetone	67-64-1	15	U	15	U	15	U			15	U			15	U				
Benzene	71-43-2	0.33	J	0.32	J	1.74		3.18		0.48	J	1890		0.53	J	0.23	J	0.34	J
Bromodichloromethane	75-27-4	1	U	1	U	1	U			1	U			1	U				
Bromoform	75-25-2	2	U	2	U	2	U			2	U			2	U				
Bromomethane	74-83-9	3	U	3	U	3	U			3	U			3	U				
Carbon Disulfide	75-15-0	8	U	8	U	8	U			8	U			8	U				
Carbon Tetrachloride	56-23-5	1	U	1	U	1	U			1	U			1	U				
Chlorobenzene	108-90-7	1	U	1	U	1	U			1	U			1	U				
Chloroethane	75-00-3	2	U	2	U	2	U			2	U			2	U				
Chloroform	67-66-3	0.7	J	1.69	J	2	U			3.38	B			2	U				
Chloromethane	74-87-3	2	U	2	U	2	U			2	U			2	U				
cis-1,2-Dichloroethylene	156-59-2	2	U	2	U	2	U			2	U			2	U				
cis-1,3-Dichloropropene	10061-01-5	1	U	1	U	1	U			1	U			1	U				
Cyclohexane	110-82-7	2	U	2	U	2	U			2	U			2	U				
Dimethylbenzene (Total Xylenes)[1]	1330-20-7	1.55		1.33		4	U			3.01				1.95					
Dibromochloromethane	124-48-1					2	U												
Dichlorodifluoromethane	75-71-8	2	U	2	U	2	U			2	U			2	U				
Ethylbenzene	100-41-4	0.39	J	0.33	J	1	U			0.82	J			0.48	J				
Isopropylbenzene (Cumene)	98-82-8	1	U	1	U	1	U			1	U			1	U				
m,p-Xylenes	179601-23-1	1.15	J	0.99	J	2	U			2.26				1.42	J				
Methyl Acetate	79-20-9	2	U	2	U	2	U			2	U			2	U				
Methyl Ethyl Ketone (2-Butanone)	78-93-3	20	U	20	U	20	U			20	U			20	U				
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	40	U	40	U	40	U			40	U			40	U				
Methylcyclohexane	108-87-2	2	U	2	U	2	U			2	U			2	U				
Methylene Chloride	75-09-2	5	U	5	U	5	U			5	U			5	U				
Naphthalene	91-20-3	4	U	4	U	4	U	4	U	4	U	250	U	4	U	5	U	4	UJ
o-Xylene (1,2-Dimethylbenzene)	95-47-6	0.4	J	0.34	J	2	U			0.75	J			0.53	J				
Styrene	100-42-5	1	U	1	U	1	U			1	U			1	U				
tert-Amylmethylether	994-05-8	8	U	8	U	18.3		4.72	J	8	U	250	U	8	U	5	U	8	U
tert-Butyl Alcohol	75-65-0	4	U	4	U	14.8		50	U	4	U	3230		4	U	10	U	50	U

APPENDIX A-2
GROUNDWATER DATA - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Well								
		13RA	13RB	30D	30S	34	D18	D35	D36	D60
		9/2/2009	9/2/2009	8/18/2009	11/12/2009	9/2/2009	2/16/2010	8/27/2009	2/17/2010	2/15/2010
tert-Butyl Methyl Ether	1634-04-4	2 U	2 U	27.2	6.9	2 U	37700	0.66 J	0.27 J	0.5 J
tetrachloroethylene (PCE)	127-18-4	2.92 J	23.8 J	11.2		33.9 J		2 U		
Toluene	108-88-3	2.31 J	2.36 J	1 U		4.21 J		3.77		
trans-1,2-Dichloroethene	156-60-5	2 U	2 U	2 U		2 U		2 U		
trans-1,3-Dichloropropene	10061-02-6	2 U	2 U	2 U		2 U		2 U		
Trichloroethylene (TCE)	79-01-6	2 U	0.48 J	0.749 J		0.82 J		2 U		
Trichlorofluoromethane	75-69-4	2 U	2 U	2 U		2 U		2 U		
Vinyl Chloride	75-01-4	1 U	1 U	1 U		1 U		1 U		
Dissolved Metals (ug/L)										
Iron	7439-89-6			200 U		200 U		90 J		
Total Metals (ug/L)										
Iron	7439-89-6			210 B		38,700		942		
Other										
Chloride (as CL) (mg/L)	16887-00-6	241 J	1230	1710		616		1770		
Ethane (ug/L)	74-84-0			21.7 U		21.7 U		21.7 U		
Ethene (ug/L)	74-85-1			28.7 U		28.7 U		28.7 U		
Methane (ug/L)	74-82-8			21.6		10.8 U		27.3		
Nitrogen (mg/L)	7727-37-9	3.51	2.15	1.21 B		2.33		0.208 J		
Sulfate (as SO_4) (mg/L)	14808-79-8	172	223	324		197		183		
Sulfide, Total (mg/L)	105-05-2	5 U	5 U	5 U		5 U		5 U		
Total Carbon (mg/L)	7440-44-0			3.14		3.88		3.07 B		

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

B = Result is potentially biased high due to blank contamination

J = Reported result is between the method detection limit and the reporting limit. Value is estimated

U = Analyte not detected above the method detection limit

UJ = Non-detect result (reporting limit) is estimated due to a minor quality control anomaly

Blank cells indicate constituent was not analyzed

1) Total xylenes concentration was calculated as the sum of m,p-Xylenes plus o-Xylene (1,2-Dimethylbenzene) where applicable

APPENDIX A-3
SURFACE WATER DATA - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	SWEF-1 10/8/2003			SWEF-2 10/8/2003			SWEF-3 10/9/2003		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Volatile Organic Compounds (VOCs) (ug/L)										
1,1,1-Trichloroethane	71-55-6		U	1		U	1		U	1
1,2-Dichlorobenzene	95-50-1		U	1		U	1		U	1
1,2-Dichloroethane	107-06-2		U	1		U	1		U	1
1,2-Dichloropropane	78-87-5		U	1		U	1		U	1
1,3-Dichlorobenzene	541-73-1		U	1		U	1		U	1
1,4-Dichlorobenzene	106-46-7		U	1		U	1		U	1
1,4-Dioxane	123-91-1		U	1		U	1		U	1
2-Butanone	78-93-3		U	5		U	5		U	5
2-Chlorophenol	95-57-8		U	2		U	2		U	2
Benzene	71-43-2		U	1		U	1		U	1
Carbon Disulfide	75-15-0		U	1		U	1		U	1
Chlorobenzene	108-90-7		U	1		U	1		U	1
Chloroform	67-66-3		U	1		U	1		U	1
Ethylbenzene	100-41-4		U	1		U	1		U	1
Ethylene Dibromide	106-93-4		U	1		U	1		U	1
m&p-Xylene	1330-20-7		U	2		U	2		U	2
Nitrobenzene	98-95-3		U	1		U	1		U	1
o-Xylene	95-47-6		U	1		U	1		U	1
Styrene	100-42-5		U	1		U	1		U	1
Tetrachloroethene	127-18-4		U	1		U	1		U	1
Toluene	108-88-3		U	1		U	1		U	1
Semivolatile Organic Compounds (SVOCs) (ug/L)										
2,4,5-Trichlorophenol	95-95-4		U	2		U	2		U	2
2,4,6-Trichlorophenol	88-06-2		U	2		U	2		U	2
2,4-Dimethylphenol	105-67-9		U	10		U	10		U	10
2,4-Dinitrophenol	51-28-5		U	5		U	5		U	5
2,4-Dinitrotoluene	121-14-2		U	1		U	1		U	1
2-Methylphenol	95-48-7		U	1		U	1		U	1
4,6-Dinitro-2-methylphenol	534-52-1		U	5		U	5		U	5
4-Methylphenol	106-44-5		U	1		U	1		U	1
4-Nitrophenol	100-02-7		U	5		U	5		U	5
7,12-Dimethylbenz(a)anthracene	119-93-7		U	2		U	2		U	2
Aniline	62-53-3		U	2		U	2		U	2
Anthracene	120-12-7		U	1		U	1		U	1
Benzo(a)anthracene	56-55-3		U	1		U	1		U	1
Benzo(a)pyrene	50-32-8		U	1		U	1		U	1
Benzo(b)fluoranthene	205-99-2		U	1		U	1		U	1
Benzo(k)fluoranthene	207-08-9		U	1		U	1		U	1
bis(2-Ethylhexyl)phthalate	117-81-7		U	3		U	3		U	3
Butyl benzyl phthalate	85-68-7		U	1		U	1		U	1
Chrysene	218-01-9		U	1		U	1		U	1
Dibenz(a,h)anthracene	53-70-3		U	1		U	1		U	1
Diethyl phthalate	84-66-2		U	1		U	1		U	1
Dimethyl phthalate	131-11-3		U	1		U	1		U	1
Di-n-butylphthalate	84-74-2		U	3		U	3		U	3
Di-n-octyl phthalate	117-84-0	13	B	3	2.4	JB	3	2.8	JB	3
Fluoranthene	206-44-0		U	1		U	1		U	1
Indeno(1,2,3-cd)pyrene	193-39-5		U	1		U	1		U	1
Naphthalene	91-20-3		U	1		U	1		U	1
Phenanthrene	85-01-8		U	1		U	1		U	1
Phenol	108-95-2		U	2		U	2		U	2
Pyrene	129-00-0		U	1		U	1		U	1
Pyridine	110-86-1		U	2		U	2		U	2
Metals (ug/L)										
Dissolved Antimony	7440-36-0		U	5		U	5		U	5
Dissolved Arsenic	7440-38-2		U	5		U	5		U	5
Dissolved Barium	7440-39-3	23		5	20		5	21		5
Dissolved Cadmium	7440-43-9		U	5		U	5		U	5
Dissolved Chromium	7440-47-3		U	5		U	5		U	5
Dissolved Lead	7439-92-1		U	2		U	2		U	2
Dissolved Mercury	7439-97-6		U	0.2		U	0.2		U	0.2
Dissolved Nickel	7440-02-0		U	5	6		5		U	5
Dissolved Selenium	7782-49-2		U	5		U	5		U	5
Dissolved Silver	7440-22-4		U	5		U	5		U	5
Total Antimony	7440-36-0		U	5		U	5		U	5
Total Arsenic	7440-38-2		U	5		U	5		U	5
Total Barium	7440-39-3	24		5	29		5	24		5
Total Cadmium	7440-43-9		U	5		U	5		U	5
Total Chromium	7440-47-3		U	5	5		5		U	5
Total Cyanide	--		U	100		U	100		U	100
Total Lead	7439-92-1	3		2	4		2	3		2
Total Mercury	7439-97-6		U	0.2		U	0.2		U	0.2
Total Nickel	7440-02-0	5		5	6		5	5		5
Total Silver	7440-22-4		U	5		U	5		U	5
Other										
Hardness (mg/L)	--	94		2	88		2	86		2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
B = Result is potentially biased high due to blank contamination
J = Reported result is between the method detection limit and the reporting limit. Value is estimated
U = Analyte not detected above the method detection limit

APPENDIX A-4
SEDIMENT DATA - COOLING WATER EFFLUENT CHANNEL
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	SDEF-1 10/8/2003			SDEF-2 10/8/2003			SDEF-3 10/8/2003		
		Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Volatile Organic Compounds (VOCs) (ug/kg)										
1,1,1-Trichloroethane	71-55-6		U	150		U	250		U	110
1,2-Dichlorobenzene	95-50-1		U	81		U	110		U	75
1,2-Dichloroethane	107-06-2		U	150		U	250		U	110
1,2-Dichloropropane	78-87-5		U	150		U	250		U	110
1,3-Dichlorobenzene	541-73-1		U	81		U	110		U	75
1,4-Dichlorobenzene	106-46-7		U	81		U	110		U	75
1,4-Dioxane	123-91-1		U	150		U	250		U	110
2-Butanone	78-93-3		U	750		U	1200		U	540
2-Chlorophenol	95-57-8		U	160		U	230		U	150
Benzene	71-43-2		U	150		U	250		U	110
Carbon Disulfide	75-15-0		U	150		U	250		U	110
Chlorobenzene	108-90-7		U	150		U	250		U	110
Chloroform	67-66-3		U	150		U	250		U	110
Ethylbenzene	100-41-4		U	150		U	250		U	110
Ethylene Dibromide	106-93-4		U	150		U	250		U	110
m&p-Xylene	1330-20-7		U	300		U	490		U	220
Nitrobenzene	98-95-3		U	81		U	110		U	75
o-Xylene	95-47-6		U	150		U	250		U	110
Styrene	100-42-5		U	150		U	250		U	110
Tetrachloroethene	127-18-4		U	150		U	250		U	110
Toluene	108-88-3		U	150		U	250		U	110
Semivolatile Organic Compounds (SVOCs) (ug/kg)										
2,4,5-Trichlorophenol	95-95-4		U	160		U	230		U	150
2,4,6-Trichlorophenol	88-06-2		U	160		U	230		U	150
2,4-Dimethylphenol	105-67-9		U	810		U	1100		U	750
2,4-Dinitrophenol	51-28-5		U	410		U	570		U	370
2,4-Dinitrotoluene	121-14-2		U	81		U	110		U	75
2-Methylphenol	95-48-7		U	81		U	110		U	75
4,6-Dinitro-2-methylphenol	534-52-1		U	410		U	570		U	370
4-Methylphenol	106-44-5		U	81		U	110		U	75
4-Nitrophenol	100-02-7		U	410		U	570		U	370
7,12-Dimethylbenz(a)anthracene	119-93-7		U	160		U	230		U	150
Anthracene	120-12-7		U	81		U	110		U	75
Benzo(a)pyrene	50-32-8		U	81		U	110		U	75
Benzo(k)fluoranthene	207-08-9		U	81		U	110		U	75
Butyl benzyl phthalate	85-68-7		U	81		U	110		U	75
Dibenz(a,h)anthracene	53-70-3		U	81		U	110		U	75
Dimethyl phthalate	131-11-3		U	81		U	110		U	75
Di-n-octyl phthalate	117-84-0	110	J	160	180	J	230	120	J	220
Indeno(1,2,3-cd)pyrene	193-39-5		U	81		U	110		U	75
Phenanthrene	85-01-8		U	81		U	110		U	75
Pyrene	129-00-0		U	81		U	110		U	75
Metals (mg/kg)										
Total Arsenic	7440-38-2	8.49		1.35	25		0.85	21		1.02
Total Cadmium	7440-43-9	2.43		0.67	1.44		0.42	1.74		0.51
Total Chromium[3]	7440-47-3	28		0.67	70		0.42	30		0.51
Total Cyanide[4]	--		U	0.26		U	0.37		U	0.25
Total Lead	7439-92-1	23		0.67	54		0.42	22		0.51
Total Mercury	7439-97-6	0.153		0.153	0.303		0.112		U	0.212
Total Nickel	7440-02-0	26		0.67	22		0.42	34		0.51
Total Selenium	7782-49-2		U	1.35		U	0.85		U	1.02
Total Silver	7440-22-4		U	0.67		U	0.42		U	0.51
Other										
Total Organic Carbon (%)	--	2.45		0.03	4.70		0.04	2.50		0.03

Notes:

ug/kg - micrograms per kilogram.

mg/kg - milligrams per kilogram.

J = Reported result is between the method detection limit and the reporting limit. Value is estimated

U = Analyte not detected above the method detection limit

APPENDIX A-5
SURFACE WATER DATA - DRAGON RUN
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Location																			
		SW-11a		SW-11b		SW-14a		SW-14b		SW-18a		SW-18b		SW-19a		SW-19b		SW-21a		SW-21b	
		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010		1/28/2010	
Benzene	71432	1.0	U	1.0	U	0.28	J	0.25	J	0.37	J	0.40	J	1.0	U	1.0	U	1.0	U	1.0	U
Ethylbenzene	100414	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Methyl tert-butyl ether	1634044	2.0	U	2.0	U	3.05		2.71		4.24		4.12		2.0	U	0.62	J	2.0	U	2.0	U
tert-Amyl Methyl Ether	994058	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U	8.0	U
Toluene	108883	2.0	U	2.0	U	2.0	U	2.0	U	0.26	J	0.27	J	2.0	U	2.0	U	2.0	U	2.0	U
m,p-Xylenes	179601231	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
o-Xylene (1,2-Dimethylbenzene)	95476	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
Dimethylbenzene (Total Xylenes)[1]	1330207	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U

Notes:

Units are in micrograms per liter (ug/L).

U = Analyte not detected above the method detection limit

J = Reported result is between the method detection limit and the reporting limit. Value is estimated.

1) Total xylenes concentration was calculated as the sum of m,p-Xylenes plus o-Xylene (1,2-Dimethylbenzene) where applicable

APPENDIX A-6
SEDIMENT DATA - DRAGON RUN
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Constituent	CAS Number	Sampling Location																	
		SD-011		SD-012		SD-013		SD-014		SD-015		SD-016		SD-017		SD-018		SD-019		SD-020	
		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006		3/24/2006	
Benzene	71432	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Ethylbenzene	100414	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Methyl tert-Butyl Ether	1634044	2	U	2	U	2	U	2.21		2	U	2.41		2	U	3.78		2	U	2	U
tert-Amyl Methyl Ether	994058	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Toluene	108883	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	5.49	
Xylenes (total)	1330207	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	8.86	

Notes:

Units are in micrograms per kilogram (µg/kg).

U = Analyte not detected above the method detection limit

TABLE
SOIL DATA - VRS
OLD DRUM STORAGE AREA - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID: / Sample ID: / Sample Depth:	13B1-1994 13B1111794SO 0-2 ft		13B2-1994 13B2b111794SO 2-4 ft		13B2-1994 13B2a111794SO 1-2 ft		13B3-1994 13B3111794SO 1-2 ft	
Metals (mg/kg)										
7440-36-0	ANTIMONY		< 10	UR	< 10	UR	< 10	UR	< 10	UR
7440-38-2	ARSENIC		4.9		3.2		4.1		2.8	
7440-39-3	BARIUM		56		32		28		54	
7440-43-9	CADMIUM		0.85		0.73		1.2		1.2	
7440-47-3	CHROMIUM, TOTAL		16		13		40		27	
7439-92-1	LEAD		8.6		6.2		6.6		8.7	
7439-97-6	MERCURY		< 0.05	U	< 0.05	U	< 0.05	U	< 0.05	U
7440-02-0	NICKEL		14		8		7.2		85	
7782-49-2	SELENIUM		0.85	L	< 0.05	UL	0.85	L	0.63	L
7440-22-4	SILVER		< 1	U	< 1	U	< 1	U	< 1	U
VOCs (mg/kg)										
71-55-6	1,1,1-TRICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
106-93-4	ETHYLENE DIBROMIDE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
107-06-2	1,2-DICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
78-87-5	1,2-DICHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
123-91-1	1,4-DIOXANE		< 1	U	< 1	U	< 1	U	< 1	U
71-43-2	BENZENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
75-15-0	CARBON DISULFIDE		< 0.05	U	< 0.05	U	< 0.05	U	< 0.05	U
108-90-7	CHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
67-66-3	CHLOROFORM		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
100-41-4	ETHYLBENZENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
78-93-3	2-BUTANONE		< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
100-42-5	STYRENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
127-18-4	TETRACHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
108-88-3	TOLUENE		0.0034	J	0.0023	J	< 0.01	U	< 0.001	U
1330-20-7	TOTAL XYLENES		0.0045	J	0.0028	J	< 0.01	U	< 0.001	U

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
R - Value rejected, not included in screening.
Blank cells indicate constituent not analyzed.

TABLE A-8
SOIL DATA - PHASE I RI
OLD DRUM STORAGE AREA - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	Location ID: / Sample ID: / Sample Depth:	SWMU 13B-1 2-4 ft 5/18/1999		SWMU 13B-2 2-4 ft 5/18/1999		SWMU 13B-3 0-2 ft 5/18/1999		SWMU 13B-3 2-4 ft 5/18/1999	
Inorganics (mg/kg)									
Aluminum		11,534		19,127		15,034		16,032	
Antimony		8.8	U	9.5	U			8.9	U
Arsenic		2.7		1.3	B			3	
Barium		62.1		41.6				51.6	
Bismuth		29.2	U	31.6	U	29	U	29.5	U
Cadmium		0.9		1.1				1	
Chromium		16.1		17.6				20.7	
Lead		7.8		6.6				8.7	
Mercury		0.04	U	0.016	U			0.6	
Nickel		17.4		12				110	
Selenium		0.7	U	0.8	U			0.7	U
Silver		1.5	U	1.6	U			1.5	U
VOCs (mg/kg)									
1,1,1 Trichloroethane						0.0008	U		
1,2 Dichloroethane						0.0008	U		
1,2 Dichloropropane						0.0008	U		
1,4 Dioxane						0.0765	U		
2 Butanone						0.0008	U		
Benzene						0.0008	U		
Carbon Disulfide						0.0008	U		
Chlorobenzene						0.0008	U		
Chloroform						0.0008	U		
Ethylbenzene						0.0008	U		
Ethylene dibromide						0.0008	U		
m&p Xylene						0.0015	U		
o Xylene						0.0008	U		
Styrene						0.0008	U		
Tetrachloroethene						0.0008	U		
Toluene						0.0008	U		

Notes:
mg/kg - milligrams per kilogram
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
Blank cells indicate constituent not analyzed.

TABLE A-9
SOIL DATA - PHASE II RI
OLD DRUM STORAGE AREA - SWMU 13
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	Location ID: / Sample ID: / Sample Depth:	S13-SB4-SO-0-2 / 12/5/07 12:40 / 0-2 ft	
Metals (mg/kg)			
Antimony		11.8	U
Arsenic		1.18	UJ
Barium		28.8	J
Cadmium		1.18	U
Chromium		3.99	J
Lead		1.96	J
Mercury		0.124	U
Nickel		3.87	J
Selenium		2.36	U
Silver		1.18	U
VOCs (mg/kg)			
1,1,1-Trichloroethane		0.00234	UJ
1,2-Dibromoethane (EDB)		0.00234	UJ
1,2-Dichloroethane (EDC)		0.00234	UJ
1,2-Dichloropropane		0.00234	UJ
1,4-Dioxane		0.234	UJ
2-Butanone		0.0122	J
Benzene		0.00234	UJ
Carbon disulfide		0.00584	UJ
Chlorobenzene		0.00234	UJ
Chloroform		0.00234	UJ
Ethylbenzene		0.00123	J
m,p-Xylene		0.0032	UJ
o-Xylene		0.00213	UJ
Styrene		0.00234	UJ
Tetrachloroethene (PCE)		0.00234	UJ
Toluene		0.00234	UJ
Wet Chemistry			
Percent Solids		81.5	%

Notes:

mg/kg - milligrams per kilogram

U - Compound was not detected above the method detection limit (MDL).

UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

J - Compound was detected above the MDL but below the reporting limit. Result is estimated.

TABLE [illegible]
SOIL DATA [illegible]S
UNIT F - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID: / Sample Date: / Sample ID: / Sample Depth:	FSSA 11/23/1994 FSSA34661SO 0.5-1.0 ft	FSSB 11/22/1994 FSSB34660SO 0.5-1.0 ft	FSSC 11/22/1994 FSSC34660SO 0.5-1.0 ft	FSSD 11/22/1994 FSSD34660SO 0.5-1.0 ft	FSSE 11/22/1994 FSSE34660SO 0.5-1.0 ft	FSSF 11/22/1994 FSSF34660SO 0-0.25 ft	FSSG 11/22/1994 FSSG34660SO 0.5-1.0 ft
Metals (mg/kg)									
7440-36-0	ANTIMONY		< 10 U	< 10 UL	< 10 UL	< 10 UL	< 10 UL	< 10 UL	< 10 UL
7440-38-2	ARSENIC		2.54 K	7.47 K	2.65 K	6.03 K	5.18 K	1.66 K	< 2 U
7440-39-3	BARIUM		45	57.8	66.9	68.6	26.6	13.9	80
7440-43-9	CADMIUM		1.32 UL	3.3	0.514	2.48	1.78	1.22	1.51
7440-47-3	CHROMIUM, TOTAL		832	544	4.7	31.2	74.8	28.6	31.6
57-12-5	CYANIDE		< 0.0003 U	0.0004	< 0.0003 U	< 0.0003 U	< 0.0003 U	0.0004	< 0.0003 U
7439-92-1	LEAD		62.7	114.8	14.4	229.6	37.3	18.9	23.3
7439-97-6	MERCURY		0.182		< 0.05 U	< 0.05 U		0.141	0.065
7440-02-0	NICKEL		72.3	389.7	3.74	262	298.8	37.8	59.3
7782-49-2	SELENIUM		1.15	2.47	< 0.5 U	0.603	0.568	< 0.5 U	0.979
7440-22-4	SILVER		< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
VOCs (mg/kg)									
71-55-6	1,1,1-TRICHLOROETHANE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
106-93-4	ETHYLENE DIBROMIDE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
107-06-2	1,2-DICHLOROETHANE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
78-87-5	1,2-DICHLOROPROPANE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
123-91-1	1,4-DIOXANE		< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
71-43-2	BENZENE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
75-15-0	CARBON DISULFIDE		< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U	< 0.05 U
108-90-7	CHLOROBENZENE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
67-66-3	CHLOROFORM		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
100-41-4	ETHYLBENZENE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
78-93-3	2-BUTANONE		< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U	< 0.1 U
100-42-5	STYRENE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
127-18-4	TETRACHLOROETHENE		< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
108-88-3	TOLUENE		< 0.01 U	< 0.01 U	0.004 J	< 0.01 U	< 0.01 U	< 0.01 U	0.0032 J
1330-20-7	TOTAL XYLENES		< 0.01 U	< 0.01 U	0.0038 J	< 0.01 U	< 0.01 U	< 0.01 U	< 0.01 U
SVOCs (mg/kg)									
95-50-1	1,2-DICHLOROBENZENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
541-73-1	1,3-DICHLOROBENZENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
106-46-7	1,4-DICHLOROBENZENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
95-95-4	2,4,5-TRICHLOROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
88-06-2	2,4,6-TRICHLOROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
105-67-9	2,4-DIMETHYLPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
51-28-5	2,4-DINITROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
121-14-2	2,4-DINITROTOLUENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
95-57-8	2-CHLOROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
95-48-7	2-METHYLPHENOL (O-CRESOL)		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
106-44-5	4-METHYLPHENOL (P-CRESOL)		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
100-02-7	4-NITROPHENOL		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE		< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U	< 1 U
62-53-3	ANILINE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
120-12-7	ANTHRACENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
56-55-3	BENZO(A)ANTHRACENE		0.215	0.581	< 0.33 U	< 0.33 U	0.336	< 0.33 U	< 0.33 U
50-32-8	BENZO(A)PYRENE		< 0.33 U	0.551	< 0.33 U	< 0.33 U	0.248 J	< 0.33 U	< 0.33 U
205-99-2	BENZO(B)FLUORANTHENE		< 0.33 U	0.757	< 0.33 U	< 0.33 U	0.451	< 0.33 U	< 0.33 U
207-08-9	BENZO(K)FLUORANTHENE		< 0.33 U	0.215 J	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
85-68-7	BENZYL BUTYL PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE		< 0.33 U	1.65	< 0.33 U	0.223 J	0.416	2.74	0.28 J

TABLE A
SOIL DATA - SVOCs
UNIT F - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID: / Sample Date: / Sample ID: / Sample Depth:	FSSA 11/23/1994 FSSA34661SO 0.5-1.0 ft	FSSB 11/22/1994 FSSB34660SO 0.5-1.0 ft	FSSC 11/22/1994 FSSC34660SO 0.5-1.0 ft	FSSD 11/22/1994 FSSD34660SO 0.5-1.0 ft	FSSE 11/22/1994 FSSE34660SO 0.5-1.0 ft	FSSF 11/22/1994 FSSF34660SO 0-0.25 ft	FSSG 11/22/1994 FSSG34660SO 0.5-1.0 ft
218-01-9	CHRYSENE		0.246	0.821	< 0.33 U	0.204 J	0.402	< 0.33 U	< 0.33 U
53-70-3	DIBENZ(A,H)ANTHRACENE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
84-66-2	DIETHYL PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
131-11-3	DIMETHYL PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
84-74-2	DI-N-BUTYL PHTHALATE		4.47	2.36 B	3.44	1.86 B	1.39 B	1.17 B	0.503 B
117-84-0	DI-N-OCTYLPHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
206-44-0	FLUORANTHENE		0.267	0.843	< 0.33 U	0.365	0.635	0.261 J	< 0.33 U
193-39-5	INDENO(1,2,3-C,D)PYRENE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
91-20-3	NAPHTHALENE		1.1	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
98-95-3	NITROBENZENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
85-01-8	PHENANTHRENE		< 0.33 U	0.417	< 0.33 U	< 0.33 U	0.422	< 0.33 U	< 0.33 U
108-95-2	PHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
129-00-0	PYRENE		0.326	0.985	< 0.33 U	0.292 J	0.624	0.361	< 0.33 U
110-86-1	PYRIDINE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U

Notes:
mg/kg - milligrams per kilogram.
U - Not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - Detected below the method detection limit. Concentration is estimated.
R - Value rejected, not included in screening.
UL - Non detect and the reporting limit is biased low
K - Result is biased high
Blank cells indicate constituent not analyzed.

TABLE A-11
SOIL DATA - PHASE I RI
UNIT F - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	Sample ID:	rfab1ss		rfbb5ss		rfcb1ss		rfdb2ss		rfeb2ss		rfgb2ss		rfab3d2-4	
	Sample Depth:	Surface		Surface		Surface		Surface		Surface		Surface		2-4 ft	
	Laboratory ID:	J0602-05		J0602-05		J0602-05		J0602-05		J0602-05		J0602-05		J0521-06	
	Sample Date:	05/28/1999		05/28/1999		05/28/1999		05/28/1999		05/28/1999		05/28/1999		05/20/1999	
Inorganics (mg/kg)															
Antimony		9.56	U	8.38	U	8.86	U	8.88	U	7.75	U	8.2	U	8.6	U
Arsenic		2.9		4.21		1.08	B	2.26		1.44		1.69		5.5	
Barium		51.7		77.3		30.9		63.6		39.8		36.9		50.2	
Cadmium		1.13		3.21		1.28		1.32		0.88		0.68	U	1.4	
Chromium		219.3		66.3		19.3		51.6		28.5		15.1		33.9	
Cyanide														0.3	U
Lead		42.6		139.1		286.8		204.1		9.09		55.4		40.9	
Mercury		0.41		0.28		0.03		0.08		0.14		0.47		0.4	
Nickel		59.7		126.5		53.4		75.96		83.9		25.9		83.9	
Selenium		0.42	B	1.01		0.74	U	0.73	U	0.66	U	0.68	U	0.7	U
Silver		0.73	B	1.31	B	1.48	U	0.98	B	0.8	B	1.37	U	1.4	U
Vanadium		168.1		66.9		214		55.7		22.3		415		NA	
Volatile Organic Compound (mg/kg)															
1,1,1 Trichloroethane														0.0009	U
1,2 Dichloroethane														0.0009	U
1,2 Dichloropropane														0.0009	U
1,4 Dioxane														0.0009	U
2 Butanone														0.0373	
Benzene														0.0009	U
Carbon Disulfide														0.0352	
Chlorobenzene														0.0155	
Chloroform														0.0009	U
Ethylbenzene														0.0009	U
Ethylene dibromide														0.0009	U
m&p Xylene														0.0019	U
o Xylene														0.0013	
Styrene														0.0009	U
Methyl tert-butyl ether														0.0009	U
Tetrachloroethene														0.0009	U
Toluene														0.014	
Semivolatile Organic Compound (mg/kg)															
1,2 Dichlorobenzene														0.5836	UD
1,3 Dichlorobenzene														0.5836	UD
1,4 Dichlorobenzene														0.5836	UD
2 Chlorophenol														0.5836	UD
2 Methylphenol														0.5836	UD
2,4 Dimethylphenol														0.5836	UD
2,4 Dinitrophenol														1.459	UD
2,4 Dinitrotoluene														1.459	UD
2,4,5 Trichlorophenol														0.5836	UD
2,4,6 Trichlorophenol														0.5836	UD
4 Nitrophenol														1.459	UD
4 Methylphenol														0.5836	UD
4,6 Dinitro 2 Methylphenol														1.459	UD
7,12 Dimethylbenz[a]anthracene														1.7508	UD
Aniline														1.459	UD
Anthracene														2.8422	D
Benzo(a)anthracene														0.8696	D
Benzo(a)pyrene														0.5836	UD
Benzo(b)fluoranthene														0.7704	D
Benzo(k)fluoranthene														0.5836	UD
Bis(2 ethylhexyl)phthalate														0.5836	UD
Butyl benzyl phthalate														0.5836	UD
Chrysene														0.7295	D
Di n butyl phthalate														0.5836	UD
Di n octyl phthalate														0.5836	UD
Dibenz(a,h)anthracene														0.5836	UD
Diethyl phthalate														0.5836	UD
Dimethyl phthalate														0.5836	UD
Fluoranthene														4.3654	D
Indeno(1,2,3 cd)pyrene														0.5836	UD
Naphthalene														57.225	D
Nitrobenzene														0.5836	UD
Phenanthrene														6.8282	D
Phenol														0.5836	UD
Pyrene														3.3207	D
Pyridine														1.459	UD

Notes:
mg/kg - milligrams per kilogram.
U - Not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
UD - Non detect and sample was analyzed at a dilution
D - Sample was analyzed at a dilution

TABLE A
SOIL DATA - PHASE II RI
UNIT F AREA B - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S14FB-SB6-SO-10-12		S14FB-SB7-SO-5-7		S14FB-SB8-SO-5-7		S14FB-SB9-SO-0-2		S14FB-SB12-SO-8-10		S14FB-SB13-SO-0-2	
	11/5/2007 9:55		11/5/2007 13:00		11/5/2007 10:25		11/5/2007 12:00		11/5/2007 9:00		11/5/2007 13:35	
	10-12 ft		5-7 ft		5-7 ft		0-2 ft		8-10 ft		0-2 ft	
Metals (mg/kg)												
Antimony	11.4	U	12	U	10.3	U	10.3	U	11.6	U	10.5	U
Arsenic	1.78		1.2	U	1.03	U	1.03	U	1.16	U	1.05	U
Barium	69.4	J	125	J	99	J	73.7	J	73.1	J	66	J
Cadmium	1.14	U	1.2	U	1.03	U	1.03	U	1.16	U	1.05	U
Chromium	22.8	J	14.6	J	20.4	J	12.3	J	20.5	J	12	J
Lead	10.9	J	7.72	J	5.55	J	8.64	J	9.31	J	7.05	J
Mercury	0.0336	J	0.12	U	0.103	U	0.106	U	0.112	U	0.108	U
Nickel	13.7		10.7		7.77		8.02		8.87		7.03	
Selenium	2.28	U	2.4	U	2.06	U	2.07	U	2.32	U	2.11	U
Silver	1.14	U	1.2	U	1.03	U	1.03	U	1.16	U	1.05	U
SVOCs (mg/kg)												
1,2-Dichlorobenzene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
1,3-Dichlorobenzene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
1,4-Dichlorobenzene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
2,4,5-Trichlorophenol	0.935	U	0.992	U	0.865	U	0.893	U	0.931	U	0.88	U
2,4,6-Trichlorophenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
2,4-Dimethylphenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
2,4-Dinitrophenol	0.935	U	0.992	U	0.865	U	0.893	U	0.931	U	0.88	U
2,4-Dinitrotoluene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
2-Chlorophenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
2-Methylphenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
3/4-Methylphenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
4,6-Dinitro-2-methylphenol	0.935	U	0.992	U	0.865	U	0.893	U	0.931	U	0.88	U
4-Nitrophenol	0.935	U	0.992	U	0.865	U	0.893	U	0.931	U	0.88	U
7,12-Dimethylbenz(a)anthracene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Aniline	1.87	U	1.99	U	1.73	U	1.79	U	1.87	U	1.76	U
Anthracene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Benzo(a)anthracene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Benzo(a)pyrene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Benzo(b)fluoranthene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Benzo(k)fluoranthene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Bis(2-ethylhexyl)phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Butyl benzyl phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Chrysene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Dibenz(a,h)anthracene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Diethyl phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Dimethyl phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Di-n-butyl phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Di-n-octyl phthalate	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U

TABLE A
SOIL DATA - PHASE II RI
UNIT F AREA B - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S14FB-SB6-SO-10-12		S14FB-SB7-SO-5-7		S14FB-SB8-SO-5-7		S14FB-SB9-SO-0-2		S14FB-SB12-SO-8-10		S14FB-SB13-SO-0-2	
	11/5/2007 9:55		11/5/2007 13:00		11/5/2007 10:25		11/5/2007 12:00		11/5/2007 9:00		11/5/2007 13:35	
	10-12 ft		5-7 ft		5-7 ft		0-2 ft		8-10 ft		0-2 ft	
Fluoranthene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Indeno(1,2,3-cd)pyrene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Naphthalene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Nitrobenzene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Phenanthrene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Phenol	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Pyrene	0.374	U	0.397	U	0.346	U	0.357	U	0.372	U	0.352	U
Pyridine	0.749	U	0.795	U	0.693	U	0.715	U	0.745	U	0.704	U
VOC (mg/kg)												
1,1,1-Trichloroethane	0.00211	U	0.00212	U	0.00314		0.00197	U	0.00206	U	0.00208	U
1,2-Dibromoethane (EDB)	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
1,2-Dichloroethane	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
1,2-Dichloropropane	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
1,4-Dioxane	0.211	U	0.212	U	0.234	U	0.197	U	0.206	U	0.208	U
2-Butanone	0.0529	U	0.053	U	0.0586	U	0.0494	U	0.0515	U	0.052	U
Benzene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Carbon disulfide	0.00529	U	0.0053	U	0.00586	U	0.00494	U	0.00515	U	0.0052	U
Chlorobenzene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Chloroform	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Ethylbenzene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
m,p-Xylene	0.00151	B	0.00153	B	0.00178	B	0.0014	B	0.00166	B	0.0014	B
o-Xylene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Styrene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Tetrachloroethene	0.00211	U	0.00212	U	0.00234	U	0.00197	U	0.00206	U	0.00208	U
Toluene	0.00211	U	0.00212	U	0.00241		0.00197	U	0.00206	U	0.00208	U
Wet Chemistry												
Percent Solids (%)	87.9		83.1		93.8		92.1		86.9		92.4	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.

TABLE A
SOIL DATA - PHASE II RI
UNIT F AREA E - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S14FE-SB5-SO-0-2		S14FE-SB5-SO-8-10		S14FE-SB6-SO-0-2		S14FE-SB6-SO-8-10		S14FE-SB7-SO-0-2		S14FE-SB7-SO-8-10	
	10/30/07 12:00		10/30/07 12:15		10/30/07 13:00		10/30/07 13:10		10/30/07 12:35		10/30/07 12:45	
	0-2 ft		8-10 ft		0-2 ft		8-10 ft		0-2 ft		8-10 ft	
Metals (mg/kg)												
Arsenic	4.54		2.54		7.3		5.41		3.17		3.83	
SVOCs (mg/kg)												
1,2-Dichlorobenzene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
1,3-Dichlorobenzene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
1,4-Dichlorobenzene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
2,4,5-Trichlorophenol	0.813	U	0.81	U	0.818	U	0.815	U	0.832	U	0.817	U
2,4,6-Trichlorophenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
2,4-Dimethylphenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
2,4-Dinitrophenol	0.813	U	0.81	U	0.818	U	0.815	U	0.832	U	0.817	U
2,4-Dinitrotoluene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
2-Chlorophenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
2-Methylphenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
3/4-Methylphenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
4,6-Dinitro-2-methylphenol	0.813	U	0.81	U	0.818	U	0.815	U	0.832	U	0.817	U
4-Nitrophenol	0.813	U	0.81	U	0.818	U	0.815	U	0.832	U	0.817	U
7,12-Dimethylbenz(a)anthracene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Aniline	1.63	U	1.62	U	1.64	U	1.63	U	1.67	U	1.64	U
Anthracene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Benzo(a)anthracene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Benzo(a)pyrene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Benzo(b)fluoranthene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Benzo(k)fluoranthene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Bis(2-ethylhexyl)phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Butyl benzyl phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Chrysene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Dibenz(a,h)anthracene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Diethyl phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Dimethyl phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Di-n-butyl phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Di-n-octyl phthalate	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Fluoranthene	0.325	U	0.324	U	0.327	U	0.326	U	0.0972	J	0.327	U
Indeno(1,2,3-cd)pyrene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Naphthalene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Nitrobenzene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Phenanthrene	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Phenol	0.325	U	0.324	U	0.327	U	0.326	U	0.332	U	0.327	U
Pyrene	0.325	U	0.324	U	0.327	U	0.326	U	0.078	J	0.327	U
Pyridine	0.651	U	0.648	U	0.655	U	0.652	U	0.666	U	0.654	U
Wet Chemistry												
Percent Dry Solids	87.5	%	94.1	%	87.7	%	87.3	%	92.1	%	93.6	%

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

J - detected below the method detection limit. Concentration is estimated.

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP10a-SO-10			WPA-TP11-SO-1			WPA-TP11-SO-10			WPA-TP12-SO-10			WPA-TP13-SO-10		
		8/24/2007			8/24/2007			8/24/2007			8/24/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	14700	10.1		35500	9.58		5030	9.58		8670	9.73		22600	9.92	
ANTIMONY	7440-36-0		10.1	U		9.58	U		9.58	U		9.73	U		9.92	U
ARSENIC	7440-38-2		1.01	U	31.2	0.958		1.65	0.958			0.973	U		0.992	U
BARIUM	7440-39-3	61.2	2.02		27.8	1.92		23.9	1.92		30.1	1.95		105	1.98	
BERYLLIUM	7440-41-7	1.01	1.01			0.958	U	0.958	0.958			0.973	U		0.992	U
CADMIUM	7440-43-9		1.01	U		0.958	U		0.958	U		0.973	U		0.992	U
CALCIUM	7440-70-2	288	10.1		220	9.58		246	9.58		110	9.73		261	9.92	
CHROMIUM, TOTAL	7440-47-3	14.6	1.01		116	0.958		34.6	0.958		5.66	0.973		11.9	0.992	
COBALT	7440-48-4	1.25	1.01		5.21	0.958		10.9	0.958		3.02	0.973		5.73	0.992	
COPPER	7440-50-8	26.1	2.02		324	1.92		5.57	1.92		2.49	1.95		2.58	1.98	
CYANIDE	57-12-5															
IRON	7439-89-6	9670	10.1		89100	95.8		18200	9.58		7650	9.73		16100	9.92	
LEAD	7439-92-1	7.58	1.01		26.7	0.958		5.88	0.958		2.72	0.973		8.08	0.992	
MAGNESIUM	7439-95-4	579	10.1		115	9.58		211	9.58		199	9.73		392	9.92	
MANGANESE	7439-96-5	36.2	1.01		183	0.958		270	0.958		70.9	0.973		195	0.992	
MERCURY	7439-97-6		0.0984	U		0.099	U		0.0993	U		0.101	U		0.0995	U
NICKEL	7440-02-0	9.09	1.01		134	0.958		5.4	0.958		3.56	0.973		6.59	0.992	
POTASSIUM	7440-09-7	458	101		390	95.8		97	95.8			97.3	U	203	99.2	
SELENIUM	7782-49-2		2.02	U	26.7	1.92			1.92	U		1.95	U		1.98	U
SILVER	7440-22-4		1.01	U		0.958	U		0.958	U		0.973	U		0.992	U
SODIUM	7440-23-5		202	U	1460	192			192	U		195	U	263	198	
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		2.02	U		1.92	U		1.92	U		1.95	U		1.98	U
VANADIUM	7440-62-2	25.9	10.1		89.4	9.58		23.6	9.58		9.73	9.73		30.3	9.92	
ZINC	7440-66-6	19.4	10.1			9.58	U	13.2	9.58		10.3	9.73		10.3	9.92	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00469	U		0.335	U		0.00506	U		0.00559	U		0.00644	U
1,1-DICHLOROETHANE	75-34-3		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,1-DICHLOROETHENE	75-35-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00469	U		0.335	U		0.00506	U		0.00559	U		0.00644	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,2-DICHLOROBENZENE	95-50-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
1,2-DICHLOROETHANE	107-06-2		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,2-DICHLOROPROPANE	78-87-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
1,3-DICHLOROBENZENE	541-73-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
1,4-DICHLOROBENZENE	106-46-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2-HEXANONE	591-78-6		0.0469	U		3.35	U		0.0506	U		0.0559	U		0.0644	U
ACETONE	67-64-1		0.0469	U		3.35	U	0.126	0.0506			0.0559	U		0.0644	U
BENZENE	71-43-2		0.00188	U	0.144	0.134			0.00202	U		0.00224	U		0.00258	U
BROMOCHLOROMETHANE	74-97-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
BROMODICHLOROMETHANE	75-27-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
BROMOFORM	75-25-2		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
BROMOMETHANE	74-83-9		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CARBON DISULFIDE	75-15-0		0.00469	U	1.08	0.335			0.00506	U		0.00559	U		0.00644	U
CARBON TETRACHLORIDE	56-23-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CHLOROBENZENE	108-90-7		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CHLOROETHANE	75-00-3		0.00469	U		0.335	U		0.00506	U		0.00559	U		0.00644	U
CHLOROFORM	67-66-3		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CHLOROMETHANE	74-87-3		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
CYCLOHEXANE	110-82-7		0.00938	U		0.67	U		0.0101	U		0.0112	U		0.0129	U
DIBROMOCHLOROMETHANE	124-48-1		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP10a-SO-10			WPA-TP11-SO-1			WPA-TP11-SO-10			WPA-TP12-SO-10			WPA-TP13-SO-10		
		8/24/2007			8/24/2007			8/24/2007			8/24/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
ETHYLBENZENE	100-41-4		0.00188	U	3.52	0.134			0.00202	U		0.00224	U		0.00258	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.00188	U	0.532	0.134			0.00202	U		0.00224	U		0.00258	U
METHYL ACETATE	79-20-9		0.00938	U	6.98	0.67			0.0101	U		0.0112	U		0.0129	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0469	U		3.35	U		0.0506	U		0.0559	U		0.0644	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0469	U		3.35	U		0.0506	U		0.0559	U		0.0644	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
METHYLCYCLOHEXANE	108-87-2		0.00938	U		0.67	U		0.0101	U		0.0112	U		0.0129	U
METHYLENE CHLORIDE	75-09-2		0.00938	U		0.67	U		0.0101	U		0.0112	U		0.0129	U
STYRENE	100-42-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
TETRACHLOROETHENE	127-18-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
TOLUENE	108-88-3		0.00188	U	1.37	0.134			0.00202	U		0.00224	U		0.00258	U
TOTAL XYLENES	1330-20-7		0.00469	U	18.2	0.335			0.00506	U		0.00559	U		0.00644	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
TRICHLOROETHENE	79-01-6		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
TRICHLOROFLUOROMETHANE	75-69-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
VINYL CHLORIDE	75-01-4		0.00188	U		0.134	U		0.00202	U		0.00224	U		0.00258	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2,4-DICHLOROPHENOL	120-83-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2,4-DIMETHYLPHENOL	105-67-9		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2,4-DINITROPHENOL	51-28-5		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
2,4-DINITROTOLUENE	121-14-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2,6-DINITROTOLUENE	606-20-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2-CHLORONAPHTHALENE	91-58-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2-CHLOROPHENOL	95-57-8		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2-METHYLNAPHTHALENE	91-57-6		0.326	U	2820	328			0.332	U		0.326	U		0.329	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
2-NITROANILINE	88-74-4		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
2-NITROPHENOL	88-75-5		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.653	U		32.9	U		0.666	U		0.654	U		0.659	U
3-NITROANILINE	99-09-2		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
4-CHLOROANILINE	106-47-8		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
4-NITROPHENOL	100-02-7		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
ACENAPHTHENE	83-32-9		0.326	U	87.6	16.4			0.332	U		0.326	U		0.329	U
ACENAPHTHYLENE	208-96-8		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
ANTHRACENE	120-12-7		0.326	U	46.5	16.4			0.332	U		0.326	U		0.329	U
BENZO(A)ANTHRACENE	56-55-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BENZO(A)PYRENE	50-32-8		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BENZO(B)FLUORANTHENE	205-99-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BENZO(G,H,I)PERYLENE	191-24-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BENZO(K)FLUORANTHENE	207-08-9		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BENZYL BUTYL PHTHALATE	85-68-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
CARBAZOLE	86-74-8		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
CHRYSENE	218-01-9		0.326	U	42.7	16.4			0.332	U		0.326	U		0.329	U
CRESOLS, TOTAL	1319-77-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP10a-SO-10			WPA-TP11-SO-1			WPA-TP11-SO-10			WPA-TP12-SO-10			WPA-TP13-SO-10		
		8/24/2007			8/24/2007			8/24/2007			8/24/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
DIBENZOFURAN	132-64-9		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
DIETHYL PHTHALATE	84-66-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
DIMETHYL PHTHALATE	131-11-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
DI-N-BUTYL PHTHALATE	84-74-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
DI-N-OCTYLPHTHALATE	117-84-0		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
FLUORANTHENE	206-44-0		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
FLUORENE	86-73-7		0.326	U	146	16.4			0.332	U		0.326	U		0.329	U
HEXACHLOROBENZENE	118-74-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
HEXACHLOROBUTADIENE	87-68-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
HEXACHLOROETHANE	67-72-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
ISOPHORONE	78-59-1		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
NAPHTHALENE	91-20-3		0.326	U	280	82.1			0.332	U		0.326	U		0.329	U
NITROBENZENE	98-95-3		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
N-NITROSODIPHENYLAMINE	86-30-6		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
PENTACHLOROPHENOL	87-86-5		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
PHENANTHRENE	85-01-8		0.326	U	505	82.1			0.332	U		0.326	U		0.329	U
PHENOL	108-95-2		0.326	U		16.4	U		0.332	U		0.326	U		0.329	U
P-NITROANILINE	100-01-6		0.815	U		41.1	U		0.831	U		0.817	U		0.823	U
PYRENE	129-00-0		0.326	U	122	16.4			0.332	U		0.326	U		0.329	U
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	80	0.5		76	0.5		88.3	0.5		95.3	0.5		90.6	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP13-SO-3			WPA-TP14-SO-14			WPA-TP14-SO-4			WPA-TP14-SO-5			WPA-TP15-SO-14		
		8/16/2007			8/28/2007			8/28/2007			8/28/2007			8/28/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	4400	10		20300	10		2580	10.1		3630	9.62		7420	10.1	
ANTIMONY	7440-36-0		10	U		10	U		10.1	U		9.62	U		10.1	U
ARSENIC	7440-38-2		1	U	1.83	1		5.62	1.01		6	0.962			1.01	U
BARIUM	7440-39-3	29.9	2.01		53.4	2.01		35.6	2.02		53.3	1.92		35.4	2.02	
BERYLLIUM	7440-41-7		1	U		1	U		1.01	U		0.962	U		1.01	U
CADMIUM	7440-43-9		1	U		1	U		1.01	U		0.962	U		1.01	U
CALCIUM	7440-70-2	1100	10		279	10		895	10.1		2660	9.62		1240	10.1	
CHROMIUM, TOTAL	7440-47-3	13.3	1		14.3	1		72.6	1.01		463	0.962		17.8	1.01	
COBALT	7440-48-4	3.96	1		5.58	1		29.9	1.01		13.4	0.962		7.11	1.01	
COPPER	7440-50-8	18.7	2.01		5.64	2.01		85.7	2.02		205	1.92		92	2.02	
CYANIDE	57-12-5															
IRON	7439-89-6	6470	10		13300	10		5990	10.1		20600	9.62		9610	10.1	
LEAD	7439-92-1	20.3	1		7.71	1		29.3	1.01		44.5	0.962		38.5	1.01	
MAGNESIUM	7439-95-4	514	10		828	10		315	10.1		2490	9.62		556	10.1	
MANGANESE	7439-96-5	102	1		103	1		74.1	1.01		196	0.962		127	1.01	
MERCURY	7439-97-6		0.098	U		0.0966	U	2.07	0.498		0.123	0.0966		0.455	0.1	
NICKEL	7440-02-0	25	1		6.73	1		63.6	1.01		563	0.962		98.9	1.01	
POTASSIUM	7440-09-7	132	100		486	100			101	U	494	96.2		238	101	
SELENIUM	7782-49-2		2.01	U		2.01	U	2.6	2.02		7.02	1.92		3.52	2.02	
SILVER	7440-22-4		1	U		1	U		1.01	U		0.962	U		1.01	U
SODIUM	7440-23-5		201	U	285	201			202	U	379	192		276	202	
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		2.01	U		2.01	U		2.02	U		1.92	U		2.02	U
VANADIUM	7440-62-2	68.6	10		29	10		52.5	10.1		88.2	9.62		135	10.1	
ZINC	7440-66-6	69.7	10		14.8	10		110	10.1		126	9.62		80.6	10.1	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00576	U		0.00496	U		0.405	U		0.277	U		0.00592	U
1,1-DICHLOROETHANE	75-34-3		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,1-DICHLOROETHENE	75-35-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00576	U		0.00496	U		0.405	U		0.277	U		0.00592	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,2-DICHLOROBENZENE	95-50-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
1,2-DICHLOROETHANE	107-06-2		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,2-DICHLOROPROPANE	78-87-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
1,3-DICHLOROBENZENE	541-73-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
1,4-DICHLOROBENZENE	106-46-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2-HEXANONE	591-78-6		0.0576	U		0.0496	U		4.05	U		2.77	U		0.0592	U
ACETONE	67-64-1		0.0576	U	0.121	0.0496			4.05	U		2.77	U		0.0592	U
BENZENE	71-43-2		0.0023	U		0.00198	U		0.162	U	1.41	0.111			0.00237	U
BROMOCHLOROMETHANE	74-97-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
BROMODICHLOROMETHANE	75-27-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
BROMOFORM	75-25-2		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
BROMOMETHANE	74-83-9		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CARBON DISULFIDE	75-15-0		0.00576	U		0.00496	U		0.405	U		0.277	U		0.00592	U
CARBON TETRACHLORIDE	56-23-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CHLOROBENZENE	108-90-7		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CHLOROETHANE	75-00-3		0.00576	U		0.00496	U		0.405	U		0.277	U		0.00592	U
CHLOROFORM	67-66-3		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CHLOROMETHANE	74-87-3		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
CYCLOHEXANE	110-82-7		0.0115	U		0.00992	U		0.809	U	1.89	0.554			0.0118	U
DIBROMOCHLOROMETHANE	124-48-1		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP13-SO-3			WPA-TP14-SO-14			WPA-TP14-SO-4			WPA-TP14-SO-5			WPA-TP15-SO-14		
		8/16/2007			8/28/2007			8/28/2007			8/28/2007			8/28/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
ETHYLBENZENE	100-41-4		0.0023	U		0.00198	U		0.162	U	4.49	0.111			0.00237	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.0023	U		0.00198	U		0.162	U	0.749	0.111			0.00237	U
METHYL ACETATE	79-20-9		0.0115	U		0.00992	U		0.809	U		0.554	U		0.0118	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0576	U		0.0496	U		4.05	U		2.77	U		0.0592	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0576	U		0.0496	U		4.05	U		2.77	U		0.0592	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
METHYLCYCLOHEXANE	108-87-2		0.0115	U		0.00992	U		0.809	U	3.42	0.554			0.0118	U
METHYLENE CHLORIDE	75-09-2		0.0115	U		0.00992	U		0.809	U		0.554	U		0.0118	U
STYRENE	100-42-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
TETRACHLOROETHENE	127-18-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
TOLUENE	108-88-3		0.0023	U		0.00198	U		0.162	U	0.759	0.111			0.00237	U
TOTAL XYLENES	1330-20-7		0.00576	U		0.00496	U		0.405	U	5.54	0.277			0.00592	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
TRICHLOROETHENE	79-01-6		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
TRICHLOROFLUOROMETHANE	75-69-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
VINYL CHLORIDE	75-01-4		0.0023	U		0.00198	U		0.162	U		0.111	U		0.00237	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2,4-DICHLOROPHENOL	120-83-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2,4-DIMETHYLPHENOL	105-67-9		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2,4-DINITROPHENOL	51-28-5		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
2,4-DINITROTOLUENE	121-14-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2,6-DINITROTOLUENE	606-20-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2-CHLORONAPHTHALENE	91-58-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2-CHLOROPHENOL	95-57-8		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2-METHYLNAPHTHALENE	91-57-6		0.332	U		0.328	U	18.5	8.26		318	82.9			0.33	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
2-NITROANILINE	88-74-4		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
2-NITROPHENOL	88-75-5		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.665	U		0.658	U		16.5	U		16.6	U		0.661	U
3-NITROANILINE	99-09-2		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
4-CHLOROANILINE	106-47-8		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
4-NITROPHENOL	100-02-7		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
ACENAPHTHENE	83-32-9		0.332	U		0.328	U		8.26	U	14.6	8.29			0.33	U
ACENAPHTHYLENE	208-96-8		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
ANTHRACENE	120-12-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZO(A)ANTHRACENE	56-55-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZO(A)PYRENE	50-32-8		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZO(B)FLUORANTHENE	205-99-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZO(G,H,I)PERYLENE	191-24-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZO(K)FLUORANTHENE	207-08-9		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BENZYL BUTYL PHTHALATE	85-68-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
CARBAZOLE	86-74-8		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
CHRYSENE	218-01-9		0.332	U		0.328	U		8.26	U	8.37	8.29		0.343	0.33	
CRESOLS, TOTAL	1319-77-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP13-SO-3			WPA-TP14-SO-14			WPA-TP14-SO-4			WPA-TP14-SO-5			WPA-TP15-SO-14		
		8/16/2007			8/28/2007			8/28/2007			8/28/2007			8/28/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
DIBENZOFURAN	132-64-9		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
DIETHYL PHTHALATE	84-66-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
DIMETHYL PHTHALATE	131-11-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
DI-N-BUTYL PHTHALATE	84-74-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
DI-N-OCTYLPHTHALATE	117-84-0		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
FLUORANTHENE	206-44-0		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
FLUORENE	86-73-7		0.332	U		0.328	U		8.26	U	24.4	8.29			0.33	U
HEXACHLOROBENZENE	118-74-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
HEXACHLOROBUTADIENE	87-68-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
HEXACHLOROETHANE	67-72-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
ISOPHORONE	78-59-1		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
NAPHTHALENE	91-20-3	0.576	0.332			0.328	U	12000	1650		273	82.9		0.852	0.33	
NITROBENZENE	98-95-3		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
N-NITROSODIPHENYLAMINE	86-30-6		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
PENTACHLOROPHENOL	87-86-5		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
PHENANTHRENE	85-01-8		0.332	U		0.328	U		8.26	U	82.7	8.29		0.343	0.33	
PHENOL	108-95-2		0.332	U		0.328	U		8.26	U		8.29	U		0.33	U
P-NITROANILINE	100-01-6		0.83	U		0.821	U		20.7	U		20.7	U		0.826	U
PYRENE	129-00-0	0.418	0.332			0.328	U		8.26	U	10.5	8.29		1	0.33	
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	87.7	0.5		91.3	0.5		72.7	0.5		84.9	0.5		80.8	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP15-SO-18			WPA-TP16B-SO-4			WPA-TP16C-SO-11			WPA-TP16C-SO-4			WPA-TP1-SO-10.5		
		8/28/2007			8/23/2007			8/23/2007			8/23/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	15500	9.9		4610	9.82		12500	9.63		3890	9.69		10200	9.9	
ANTIMONY	7440-36-0		9.9	U		9.82	U		9.63	U		9.69	U		9.9	U
ARSENIC	7440-38-2	2.79	0.99			0.982	U	2.04	0.963			0.969	U	1.07	0.99	
BARIUM	7440-39-3	60.9	1.98		31.7	1.96		38.2	1.93		21	1.94		50.7	1.98	
BERYLLIUM	7440-41-7		0.99	U		0.982	U	0.963	0.963			0.969	U		0.99	U
CADMIUM	7440-43-9		0.99	U		0.982	U		0.963	U		0.969	U		0.99	U
CALCIUM	7440-70-2	2030	9.9		2910	9.82		661	9.63		19300	9.69		933	9.9	
CHROMIUM, TOTAL	7440-47-3	18.9	0.99		10.7	0.982		19.6	0.963		24.1	0.969		10.8	0.99	
COBALT	7440-48-4	5.68	0.99		816	0.982		3.95	0.963		38.1	0.969		3.41	0.99	
COPPER	7440-50-8	15	1.98		25.3	1.96		7.21	1.93		408	1.94		5.25	1.98	
CYANIDE	57-12-5															
IRON	7439-89-6	16400	9.9		14200	9.82		19500	9.63		15400	9.69		9900	9.9	
LEAD	7439-92-1	11.2	0.99		68	0.982		8.03	0.963		21.6	0.969		6.97	0.99	
MAGNESIUM	7439-95-4	1930	9.9		698	9.82		1780	9.63		2830	9.69		842	9.9	
MANGANESE	7439-96-5	279	0.99		363	0.982		167	0.963		1170	0.969		160	0.99	
MERCURY	7439-97-6		0.0982	U	0.353	0.0988			0.0969	U	0.406	0.0977			0.0984	U
NICKEL	7440-02-0	9.35	0.99		44.8	0.982		8.32	0.963		55.8	0.969		5.88	0.99	
POTASSIUM	7440-09-7	640	99		105	98.2		413	96.3		250	96.9		403	99	
SELENIUM	7782-49-2		1.98	U		1.96	U		1.93	U		1.94	U		1.98	U
SILVER	7440-22-4		0.99	U		0.982	U		0.963	U		0.969	U		0.99	U
SODIUM	7440-23-5	338	198			196	U		193	U		194	U		198	U
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		1.98	U		1.96	U		1.93	U		1.94	U		1.98	U
VANADIUM	7440-62-2	28	9.9		28.2	9.82		27.6	9.63		58.3	9.69		17.5	9.9	
ZINC	7440-66-6	35.4	9.9		280	9.82		30.9	9.63		87.3	9.69		17	9.9	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.00194	U		0.233	U		0.00215	U		0.00334	U	0.00352	0.00199	
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00485	U		0.583	U		0.00536	U		0.00836	U		0.00498	U
1,1-DICHLOROETHANE	75-34-3		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,1-DICHLOROETHENE	75-35-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00485	U		0.583	U		0.00536	U		0.00836	U		0.00498	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,2-DICHLOROBENZENE	95-50-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
1,2-DICHLOROETHANE	107-06-2		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,2-DICHLOROPROPANE	78-87-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
1,3-DICHLOROBENZENE	541-73-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
1,4-DICHLOROBENZENE	106-46-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2-HEXANONE	591-78-6		0.0485	U		5.83	U		0.0536	U		0.0836	U		0.0498	U
ACETONE	67-64-1		0.0485	U		5.83	U	0.0739	0.0536		0.26	0.0836		0.126	0.0498	
BENZENE	71-43-2	0.0045	0.00194		19.3	0.233			0.00215	U	0.0336	0.00334			0.00199	U
BROMOCHLOROMETHANE	74-97-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
BROMODICHLOROMETHANE	75-27-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
BROMOFORM	75-25-2		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
BROMOMETHANE	74-83-9		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CARBON DISULFIDE	75-15-0		0.00485	U		0.583	U		0.00536	U	0.0369	0.00836			0.00498	U
CARBON TETRACHLORIDE	56-23-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CHLOROBENZENE	108-90-7		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CHLOROETHANE	75-00-3		0.00485	U		0.583	U		0.00536	U		0.00836	U		0.00498	U
CHLOROFORM	67-66-3		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CHLOROMETHANE	74-87-3		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
CYCLOHEXANE	110-82-7		0.00971	U		1.17	U		0.0107	U		0.0167	U		0.00996	U
DIBROMOCHLOROMETHANE	124-48-1		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP15-SO-18			WPA-TP15B-SO-4			WPA-TP15C-SO-11			WPA-TP15C-SO-4			WPA-TP1-SO-10.5		
		8/28/2007			8/23/2007			8/23/2007			8/23/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
ETHYLBENZENE	100-41-4		0.00194	U	49.7	0.233			0.00215	U	0.077	0.00334			0.00199	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.00194	U	3.88	0.233			0.00215	U	0.00628	0.00334			0.00199	U
METHYL ACETATE	79-20-9		0.00971	U		1.17	U		0.0107	U		0.0167	U		0.00996	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0485	U		5.83	U		0.0536	U		0.0836	U		0.0498	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0485	U		5.83	U		0.0536	U		0.0836	U		0.0498	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
METHYLCYCLOHEXANE	108-87-2		0.00971	U		1.17	U		0.0107	U		0.0167	U		0.00996	U
METHYLENE CHLORIDE	75-09-2		0.00971	U		1.17	U	0.0151	0.0107		0.0215	0.0167			0.00996	U
STYRENE	100-42-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
TETRACHLOROETHENE	127-18-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
TOLUENE	108-88-3	0.0025	0.00194		4	0.233			0.00215	U		0.00334	U		0.00199	U
TOTAL XYLENES	1330-20-7		0.00485	U	54.2	0.583			0.00536	U	0.037	0.00836			0.00498	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
TRICHLOROETHENE	79-01-6		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
TRICHLOROFLUOROMETHANE	75-69-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
VINYL CHLORIDE	75-01-4		0.00194	U		0.233	U		0.00215	U		0.00334	U		0.00199	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2,4-DICHLOROPHENOL	120-83-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2,4-DIMETHYLPHENOL	105-67-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2,4-DINITROPHENOL	51-28-5		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
2,4-DINITROTOLUENE	121-14-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2,6-DINITROTOLUENE	606-20-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2-CHLORONAPHTHALENE	91-58-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2-CHLOROPHENOL	95-57-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2-METHYLNAPHTHALENE	91-57-6		0.325	U	32.9	16.3			0.331	U	18.8	16.2			0.332	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
2-NITROANILINE	88-74-4		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
2-NITROPHENOL	88-75-5		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.651	U		32.7	U		0.662	U		32.5	U		0.665	U
3-NITROANILINE	99-09-2		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
4-CHLOROANILINE	106-47-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
4-NITROPHENOL	100-02-7		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
ACENAPHTHENE	83-32-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
ACENAPHTHYLENE	208-96-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
ANTHRACENE	120-12-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZO(A)ANTHRACENE	56-55-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZO(A)PYRENE	50-32-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZO(B)FLUORANTHENE	205-99-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZO(G,H,I)PERYLENE	191-24-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZO(K)FLUORANTHENE	207-08-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BENZYL BUTYL PHTHALATE	85-68-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
CARBAZOLE	86-74-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
CHRYSENE	218-01-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
CRESOLS, TOTAL	1319-77-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP15-SO-18			WPA-TP16B-SO-4			WPA-TP16C-SO-11			WPA-TP16C-SO-4			WPA-TP1-SO-10.5		
		8/28/2007			8/23/2007			8/23/2007			8/23/2007			8/16/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
DIBENZOFURAN	132-64-9		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
DIETHYL PHTHALATE	84-66-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
DIMETHYL PHTHALATE	131-11-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
DI-N-BUTYL PHTHALATE	84-74-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
DI-N-OCTYLPHTHALATE	117-84-0		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
FLUORANTHENE	206-44-0		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
FLUORENE	86-73-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
HEXACHLOROBENZENE	118-74-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
HEXACHLOROBUTADIENE	87-68-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
HEXACHLOROETHANE	67-72-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
ISOPHORONE	78-59-1		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
NAPHTHALENE	91-20-3		0.325	U	17300	4080			0.331	U	9050	812			0.332	U
NITROBENZENE	98-95-3		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
N-NITROSODIPHENYLAMINE	86-30-6		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
PENTACHLOROPHENOL	87-86-5		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
PHENANTHRENE	85-01-8		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
PHENOL	108-95-2		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
P-NITROANILINE	100-01-6		0.813	U		40.8	U		0.827	U		40.6	U		0.831	U
PYRENE	129-00-0		0.325	U		16.3	U		0.331	U		16.2	U		0.332	U
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	86.1	0.5		83.4	0.5		83.5	0.5		66.6	0.5		84.6	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP1-SO-2.5			WPA-TP2-SO-12			WPA-TP2-SO-6			WPA-TP3A-SO-10.5			WPA-TP3A-SO-7.5		
		8/16/2007			8/27/2007			8/27/2007			8/14/2007			8/14/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	5840	10.1		11100	10.1		3460	10.1		15300	9.96		9590	10.1	
ANTIMONY	7440-36-0		10.1	U		10.1	U		10.1	U		9.96	U		10.1	U
ARSENIC	7440-38-2		1.01	U	1.43	1.01			1.01	U	4.2	0.996		1.85	1.01	
BARIUM	7440-39-3	37.7	2.01		100	2.02		33.4	2.01		56.5	1.99		66.6	2.01	
BERYLLIUM	7440-41-7		1.01	U		1.01	U		1.01	U		0.996	U		1.01	U
CADMIUM	7440-43-9		1.01	U		1.01	U		1.01	U		0.996	U		1.01	U
CALCIUM	7440-70-2	1310	10.1		503	10.1		3110	10.1		1280	9.96	B	2190	10.1	B
CHROMIUM, TOTAL	7440-47-3	39.9	1.01		14.3	1.01		50.6	1.01		21.4	0.996		12.9	1.01	
COBALT	7440-48-4	3.86	1.01		4.66	1.01		8.05	1.01		5.58	0.996		3.4	1.01	
COPPER	7440-50-8	62.7	2.01		5.12	2.02		55.3	2.01		7.21	1.99		10.9	2.01	
CYANIDE	57-12-5															
IRON	7439-89-6	7940	10.1		12400	10.1		8320	10.1		18800	9.96		8910	10.1	
LEAD	7439-92-1	38.6	1.01		11.4	1.01		36.4	1.01		10.4	0.996		19.4	1.01	
MAGNESIUM	7439-95-4	958	10.1		1020	10.1		1120	10.1		2170	9.96		979	10.1	
MANGANESE	7439-96-5	126	1.01	K	194	1.01		466	1.01		264	0.996		197	1.01	
MERCURY	7439-97-6		0.0997	U		0.0977	U	0.174	0.0993			0.0977	U		0.0971	U
NICKEL	7440-02-0	38.2	1.01		6.23	1.01		63.7	1.01		9.36	0.996		32	1.01	
POTASSIUM	7440-09-7	204	101		298	101		126	101		636	99.6		458	101	
SELENIUM	7782-49-2		2.01	U		2.02	U		2.01	U		1.99	U		2.01	U
SILVER	7440-22-4		1.01	U		1.01	U		1.01	U		0.996	U		1.01	U
SODIUM	7440-23-5		201	U		202	U		201	U	374	199			201	U
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		2.01	U		2.02	U		2.01	U		1.99	U		2.01	U
VANADIUM	7440-62-2	50.8	10.1		20	10.1		144	10.1		32.8	9.96		75.1	10.1	
ZINC	7440-66-6	38.4	10.1		20.8	10.1		49.4	10.1		27	9.96		42.8	10.1	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6	9.68	0.169			0.00209	U		0.156	U		0.00174	U		0.139	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00583	U		0.00522	U		0.389	U		0.00435	U		0.346	U
1,1-DICHLOROETHANE	75-34-3	0.0415	0.00233			0.00209	U		0.156	U		0.00174	U		0.139	U
1,1-DICHLOROETHENE	75-35-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00583	U		0.00522	U		0.389	U		0.00435	U		0.346	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,2-DICHLOROBENZENE	95-50-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
1,2-DICHLOROETHANE	107-06-2		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,2-DICHLOROPROPANE	78-87-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
1,3-DICHLOROBENZENE	541-73-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
1,4-DICHLOROBENZENE	106-46-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2-HEXANONE	591-78-6		0.0583	U		0.0522	U		3.89	U		0.0435	U		3.46	U
ACETONE	67-64-1	0.113	0.0583		0.144	0.0522			3.89	U		0.0435	U		3.46	U
BENZENE	71-43-2		0.00233	U		0.00209	U	0.232	0.156			0.00174	U	0.916	0.139	
BROMOCHLOROMETHANE	74-97-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
BROMODICHLOROMETHANE	75-27-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
BROMOFORM	75-25-2		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
BROMOMETHANE	74-83-9		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CARBON DISULFIDE	75-15-0		0.00583	U		0.00522	U		0.389	U	0.00625	0.00435			0.346	U
CARBON TETRACHLORIDE	56-23-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CHLOROBENZENE	108-90-7		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CHLOROETHANE	75-00-3		0.00583	U		0.00522	U		0.389	U		0.00435	U		0.346	U
CHLOROFORM	67-66-3		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CHLOROMETHANE	74-87-3		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
CYCLOHEXANE	110-82-7		0.0117	U		0.0104	U	1.07	0.779			0.0087	U		0.693	U
DIBROMOCHLOROMETHANE	124-48-1		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP1-SO-2.5			WPA-TP2-SO-12			WPA-TP2-SO-6			WPA-TP3A-SO-10.5			WPA-TP3A-SO-7.5		
		8/16/2007			8/27/2007			8/27/2007			8/14/2007			8/14/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
ETHYLBENZENE	100-41-4		0.00233	U		0.00209	U	0.454	0.156			0.00174	U	2.7	0.139	
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.00233	U		0.00209	U	0.203	0.156			0.00174	U		0.139	U
METHYL ACETATE	79-20-9		0.0117	U		0.0104	U		0.779	U		0.0087	U		0.693	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0583	U		0.0522	U		3.89	U		0.0435	U		3.46	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0583	U		0.0522	U		3.89	U		0.0435	U		3.46	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
METHYLCYCLOHEXANE	108-87-2		0.0117	U		0.0104	U	1.68	0.779			0.0087	U		0.693	U
METHYLENE CHLORIDE	75-09-2		0.0117	U		0.0104	U		0.779	U		0.0087	U		0.693	U
STYRENE	100-42-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
TETRACHLOROETHENE	127-18-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
TOLUENE	108-88-3		0.00233	U		0.00209	U	0.906	0.156			0.00174	U	0.221	0.139	
TOTAL XYLENES	1330-20-7		0.00583	U		0.00522	U	3.34	0.389			0.00435	U	2.52	0.346	
TRANS-1,2-DICHLOROETHENE	156-60-5		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
TRICHLOROETHENE	79-01-6		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
TRICHLOROFLUOROMETHANE	75-69-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
VINYL CHLORIDE	75-01-4		0.00233	U		0.00209	U		0.156	U		0.00174	U		0.139	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2,4-DICHLOROPHENOL	120-83-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2,4-DIMETHYLPHENOL	105-67-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2,4-DINITROPHENOL	51-28-5		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
2,4-DINITROTOLUENE	121-14-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2,6-DINITROTOLUENE	606-20-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2-CHLORONAPHTHALENE	91-58-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2-CHLOROPHENOL	95-57-8		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2-METHYLNAPHTHALENE	91-57-6		0.326	U		0.331	U	18.1	16.6			0.327	U	208	32.7	
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
2-NITROANILINE	88-74-4		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
2-NITROPHENOL	88-75-5		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.652	U		0.663	U		33.2	U		0.655	U		65.4	U
3-NITROANILINE	99-09-2		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
4-CHLOROANILINE	106-47-8		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
4-NITROPHENOL	100-02-7		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
ACENAPHTHENE	83-32-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
ACENAPHTHYLENE	208-96-8		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
ANTHRACENE	120-12-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZO(A)ANTHRACENE	56-55-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZO(A)PYRENE	50-32-8		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZO(B)FLUORANTHENE	205-99-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZO(G,H,I)PERYLENE	191-24-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZO(K)FLUORANTHENE	207-08-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BENZYL BUTYL PHTHALATE	85-68-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
CARBAZOLE	86-74-8		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
CHRYSENE	218-01-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
CRESOLS, TOTAL	1319-77-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP1-SO-2.5			WPA-TP2-SO-12			WPA-TP2-SO-5			WPA-TP3A-SO-10.5			WPA-TP3A-SO-7.5		
		8/16/2007			8/27/2007			8/27/2007			8/14/2007			8/14/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
DIBENZOFURAN	132-64-9		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
DIETHYL PHTHALATE	84-66-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
DIMETHYL PHTHALATE	131-11-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
DI-N-BUTYL PHTHALATE	84-74-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
DI-N-OCTYLPHTHALATE	117-84-0		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
FLUORANTHENE	206-44-0		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
FLUORENE	86-73-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
HEXACHLOROBENZENE	118-74-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
HEXACHLOROBUTADIENE	87-68-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
HEXACHLOROETHANE	67-72-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
ISOPHORONE	78-59-1		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
NAPHTHALENE	91-20-3	0.784	0.326			0.331	U	414	82.9			0.327	U	259	32.7	
NITROBENZENE	98-95-3		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
N-NITROSODIPHENYLAMINE	86-30-6		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
PENTACHLOROPHENOL	87-86-5		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
PHENANTHRENE	85-01-8		0.326	U		0.331	U	21.7	16.6			0.327	U		32.7	U
PHENOL	108-95-2		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
P-NITROANILINE	100-01-6		0.814	U		0.828	U		41.5	U		0.818	U		81.7	U
PYRENE	129-00-0		0.326	U		0.331	U		16.6	U		0.327	U		32.7	U
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	87.6	0.5		85.8	0.5		88.3	0.5		83.3	0.5		77	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP3B-SO-5 8/15/2007			WPA-TP3B-SO-9.5 8/15/2007			WPA-TP3C-SO-2.5 8/15/2007			WPA-TP3C-SO-8.5 8/15/2007			WPA-TP4a-SO-10 8/27/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	5160	10.1		13400	9.58		5130	10		10500	9.6		8070	9.94	
ANTIMONY	7440-36-0		10.1	U		9.58	U		10	U		9.6	U		9.94	U
ARSENIC	7440-38-2	3.34	1.01		3.77	0.958		1.08	1		3.09	0.96		1.75	0.994	
BARIUM	7440-39-3	33.4	2.01		64.4	1.92		25.6	2		83.9	1.92		58	1.99	
BERYLLIUM	7440-41-7	1.69	1.01			0.958	U		1	U		0.96	U	1.03	0.994	
CADMIUM	7440-43-9		1.01	U		0.958	U		1	U		0.96	U		0.994	U
CALCIUM	7440-70-2	1670	10.1	B	689	9.58	B	1650	10	B	1150	9.6	B	2740	9.94	
CHROMIUM, TOTAL	7440-47-3	19.5	1.01		20.6	0.958		14.8	1		12.1	0.96		19.4	0.994	
COBALT	7440-48-4	71.8	1.01		5.1	0.958		4.56	1		4.09	0.96		8.59	0.994	
COPPER	7440-50-8	158	2.01		6.86	1.92		14.2	2		4.68	1.92		55.9	1.99	
CYANIDE	57-12-5															
IRON	7439-89-6	9290	10.1		19100	9.58		9940	10		9680	9.6		15800	9.94	
LEAD	7439-92-1	57.1	1.01		10.2	0.958		20	1		15.7	0.96		38.9	0.994	
MAGNESIUM	7439-95-4	714	10.1		1460	9.58		607	10		1160	9.6		863	9.94	
MANGANESE	7439-96-5	194	1.01		212	0.958		206	1		152	0.96		212	0.994	
MERCURY	7439-97-6	0.132	0.101			0.0984	U		0.101	U		0.1	U	0.414	0.0977	
NICKEL	7440-02-0	575	1.01		10.3	0.958		64.3	1		5.49	0.96		130	0.994	
POTASSIUM	7440-09-7	204	101		503	95.8		299	100		463	96		279	99.4	
SELENIUM	7782-49-2		2.01	U		1.92	U		2	U		1.92	U		1.99	U
SILVER	7440-22-4		1.01	U		0.958	U		1	U		0.96	U		0.994	U
SODIUM	7440-23-5		201	U		192	U	296	200			192	U		199	U
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		2.01	U		1.92	U		2	U		1.92	U		1.99	U
VANADIUM	7440-62-2	644	10.1		34	9.58		77.2	10		16.9	9.6		42	9.94	
ZINC	7440-66-6	233	10.1		23.7	9.58		76.8	10		27.5	9.6		74.6	9.94	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,1,2-TRICHLOROETHANE	79-00-5		0.389	U		0.00517	U		0.011	U		0.0052	U		0.397	U
1,1-DICHLOROETHANE	75-34-3		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,1-DICHLOROETHENE	75-35-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.389	U		0.00517	U		0.011	U		0.0052	U		0.397	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,2-DICHLOROBENZENE	95-50-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
1,2-DICHLOROETHANE	107-06-2		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,2-DICHLOROPROPANE	78-87-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
1,3-DICHLOROBENZENE	541-73-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
1,4-DICHLOROBENZENE	106-46-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2-HEXANONE	591-78-6		3.89	U		0.0517	U		0.11	U		0.052	U		3.97	U
ACETONE	67-64-1		3.89	U	0.168	0.0517			0.11	U	0.0885	0.052			3.97	U
BENZENE	71-43-2	0.253	0.156			0.00207	U		0.00439	U		0.00208	U		0.159	U
BROMOCHLOROMETHANE	74-97-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
BROMODICHLOROMETHANE	75-27-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
BROMOFORM	75-25-2		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
BROMOMETHANE	74-83-9		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CARBON DISULFIDE	75-15-0		0.389	U		0.00517	U		0.011	U	0.0185	0.0052			0.397	U
CARBON TETRACHLORIDE	56-23-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CHLOROBENZENE	108-90-7		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CHLOROETHANE	75-00-3		0.389	U		0.00517	U		0.011	U		0.0052	U		0.397	U
CHLOROFORM	67-66-3		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CHLOROMETHANE	74-87-3		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
CYCLOHEXANE	110-82-7		0.779	U		0.0103	U		0.0219	U		0.0104	U		0.794	U
DIBROMOCHLOROMETHANE	124-48-1		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP3B-SO-5			WPA-TP3B-SO-9.5			WPA-TP3C-SO-2.5			WPA-TP3C-SO-8.5			WPA-TP4s-SO-10		
		8/15/2007			8/15/2007			8/15/2007			8/15/2007			8/27/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
ETHYLBENZENE	100-41-4	0.486	0.156			0.00207	U		0.00439	U		0.00208	U		0.159	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
METHYL ACETATE	79-20-9		0.779	U		0.0103	U		0.0219	U		0.0104	U		0.794	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		3.89	U		0.0517	U		0.11	U		0.052	U		3.97	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		3.89	U		0.0517	U		0.11	U		0.052	U		3.97	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
METHYLCYCLOHEXANE	108-87-2		0.779	U		0.0103	U		0.0219	U		0.0104	U		0.794	U
METHYLENE CHLORIDE	75-09-2		0.779	U	0.0177	0.0103			0.0219	U	0.0111	0.0104			0.794	U
STYRENE	100-42-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
TETRACHLOROETHENE	127-18-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
TOLUENE	108-88-3	0.383	0.156			0.00207	U		0.00439	U		0.00208	U		0.159	U
TOTAL XYLENES	1330-20-7	0.718	0.389			0.00517	U		0.011	U		0.0052	U		0.397	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
TRICHLOROETHENE	79-01-6	0.289	0.156			0.00207	U		0.00439	U		0.00208	U		0.159	U
TRICHLOROFLUOROMETHANE	75-69-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
VINYL CHLORIDE	75-01-4		0.156	U		0.00207	U		0.00439	U		0.00208	U		0.159	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2,4-DICHLOROPHENOL	120-83-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2,4-DIMETHYLPHENOL	105-67-9		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2,4-DINITROPHENOL	51-28-5		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
2,4-DINITROTOLUENE	121-14-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2,6-DINITROTOLUENE	606-20-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2-CHLORONAPHTHALENE	91-58-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2-CHLOROPHENOL	95-57-8		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2-METHYLNAPHTHALENE	91-57-6	2.86	0.658			0.329	U		0.325	U		0.328	U	1.34	0.324	
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
2-NITROANILINE	88-74-4		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
2-NITROPHENOL	88-75-5		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
3,3'-DICHLOROBENZIDINE	91-94-1		1.32	U		0.659	U		0.65	U		0.658	U		0.649	U
3-NITROANILINE	99-09-2		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
4-CHLOROANILINE	106-47-8		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
4-NITROPHENOL	100-02-7		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
ACENAPHTHENE	83-32-9		0.658	U		0.329	U		0.325	U		0.328	U	0.379	0.324	
ACENAPHTHYLENE	208-96-8		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
ANTHRACENE	120-12-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BENZO(A)ANTHRACENE	56-55-3	1.22	0.658			0.329	U		0.325	U		0.328	U		0.324	U
BENZO(A)PYRENE	50-32-8	0.996	0.658			0.329	U		0.325	U		0.328	U		0.324	U
BENZO(B)FLUORANTHENE	205-99-2	1.07	0.658			0.329	U		0.325	U		0.328	U		0.324	U
BENZO(G,H,I)PERYLENE	191-24-2	1.02	0.658			0.329	U		0.325	U		0.328	U		0.324	U
BENZO(K)FLUORANTHENE	207-08-9		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BENZYL BUTYL PHTHALATE	85-68-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	1.82	0.658			0.329	U		0.325	U		0.328	U		0.324	U
CARBAZOLE	86-74-8		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
CHRYSENE	218-01-9	1.53	0.658			0.329	U		0.325	U		0.328	U	0.472	0.324	
CRESOLS, TOTAL	1319-77-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP3B-SO-5			WPA-TP3B-SO-9.5			WPA-TP3C-SO-2.5			WPA-TP3C-SO-8.5			WPA-TP4s-SO-10		
		8/15/2007			8/15/2007			8/15/2007			8/15/2007			8/27/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
DIBENZOFURAN	132-64-9		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
DIETHYL PHTHALATE	84-66-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
DIMETHYL PHTHALATE	131-11-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
DI-N-BUTYL PHTHALATE	84-74-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
DI-N-OCTYLPHTHALATE	117-84-0		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
FLUORANTHENE	206-44-0	1.29	0.658			0.329	U		0.325	U		0.328	U	0.553	0.324	
FLUORENE	86-73-7		0.658	U		0.329	U		0.325	U		0.328	U	0.497	0.324	
HEXACHLOROBENZENE	118-74-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
HEXACHLOROBUTADIENE	87-68-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
HEXACHLOROETHANE	67-72-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
ISOPHORONE	78-59-1		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
NAPHTHALENE	91-20-3	153	32.9			0.329	U	0.561	0.325			0.328	U	2.78	0.324	
NITROBENZENE	98-95-3		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
N-NITROSODIPHENYLAMINE	86-30-6		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
PENTACHLOROPHENOL	87-86-5		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
PHENANTHRENE	85-01-8	1.31	0.658			0.329	U		0.325	U		0.328	U	0.752	0.324	
PHENOL	108-95-2		0.658	U		0.329	U		0.325	U		0.328	U		0.324	U
P-NITROANILINE	100-01-6		1.65	U		0.823	U		0.812	U		0.821	U		0.81	U
PYRENE	129-00-0	2.23	0.658			0.329	U		0.325	U		0.328	U	0.704	0.324	
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	84.8	0.5		83.3	0.5		85.3	0.5		79.3	0.5		87	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP4a-SO-18			WPA-TP4b-SO-18			WPA-TP5-SO-10			WPA-TP6-SO-15			WPA-TP6-SO-19		
		8/27/2007			8/27/2007			8/27/2007			8/17/2007			8/17/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	15700	9.86		6640	9.9		8670	10.1		3490	9.88		11000	9.54	
ANTIMONY	7440-36-0		9.86	U		9.9	U		10.1	U		9.88	U		9.54	U
ARSENIC	7440-38-2	2.11	0.986			0.99	U	1.37	1.01		1.3	0.988			0.954	U
BARIUM	7440-39-3	108	1.97		13.2	1.98		23.6	2.01		25.9	1.98		180	1.91	
BERYLLIUM	7440-41-7	1.66	0.986			0.99	U		1.01	U		0.988	U	1.56	0.954	
CADMIUM	7440-43-9		0.986	U		0.99	U		1.01	U		0.988	U		0.954	U
CALCIUM	7440-70-2	1300	9.86		234	9.9		488	10.1		1530	9.88		846	9.54	
CHROMIUM, TOTAL	7440-47-3	18.8	0.986		5.31	0.99		10.8	1.01		17.5	0.988		12.2	0.954	
COBALT	7440-48-4	5.05	0.986		10.7	0.99		3.48	1.01		17.3	0.988		5.23	0.954	
COPPER	7440-50-8	7.2	1.97			1.98	U	5.77	2.01		77.6	1.98		4.71	1.91	
CYANIDE	57-12-5															
IRON	7439-89-6	14100	9.86		5120	9.9		12300	10.1		6780	9.88		11800	9.54	
LEAD	7439-92-1	17.6	0.986		3.56	0.99		5.47	1.01		25.1	0.988		9.41	0.954	
MAGNESIUM	7439-95-4	1720	9.86		135	9.9		1170	10.1		471	9.88		1320	9.54	
MANGANESE	7439-96-5	267	0.986		159	0.99		119	1.01		131	0.988		728	0.954	
MERCURY	7439-97-6		0.0992	U		0.1	U		0.0985	U	0.173	0.099			0.0962	U
NICKEL	7440-02-0	10.5	0.986		12.1	0.99		6.34	1.01		67.5	0.988		7.46	0.954	
POTASSIUM	7440-09-7	922	98.6			99	U	355	101		109	98.8		314	95.4	
SELENIUM	7782-49-2		1.97	U		1.98	U		2.01	U		1.98	U		1.91	U
SILVER	7440-22-4		0.986	U		0.99	U		1.01	U		0.988	U		0.954	U
SODIUM	7440-23-5		197	U		198	U		201	U		198	U	914	191	
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		1.97	U		1.98	U		2.01	U		1.98	U		1.91	U
VANADIUM	7440-62-2	25.5	9.86			9.9	U	21.5	10.1		158	9.88		17.9	9.54	
ZINC	7440-66-6	39	9.86			9.9	U	16	10.1		65.8	9.88		25.4	9.54	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00532	U		0.00566	U		0.0047	U		0.466	U		0.00523	U
1,1-DICHLOROETHANE	75-34-3		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,1-DICHLOROETHENE	75-35-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00532	U		0.00566	U		0.0047	U		0.466	U		0.00523	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,2-DICHLOROBENZENE	95-50-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
1,2-DICHLOROETHANE	107-06-2		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,2-DICHLOROPROPANE	78-87-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
1,3-DICHLOROBENZENE	541-73-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
1,4-DICHLOROBENZENE	106-46-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2-HEXANONE	591-78-6		0.0532	U		0.0566	U		0.047	U		4.66	U		0.0523	U
ACETONE	67-64-1	0.103	0.0532			0.0566	U		0.047	U		4.66	U	0.183	0.0523	
BENZENE	71-43-2		0.00213	U		0.00226	U	0.00377	0.00188			0.187	U		0.00209	U
BROMOCHLOROMETHANE	74-97-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
BROMODICHLOROMETHANE	75-27-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
BROMOFORM	75-25-2		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
BROMOMETHANE	74-83-9		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CARBON DISULFIDE	75-15-0	0.0803	0.00532		0.0181	0.00566			0.0047	U		0.466	U	0.0212	0.00523	
CARBON TETRACHLORIDE	56-23-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CHLOROBENZENE	108-90-7		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CHLOROETHANE	75-00-3		0.00532	U		0.00566	U		0.0047	U		0.466	U		0.00523	U
CHLOROFORM	67-66-3		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CHLOROMETHANE	74-87-3		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
CYCLOHEXANE	110-82-7		0.0106	U		0.0113	U		0.0094	U		0.933	U		0.0105	U
DIBROMOCHLOROMETHANE	124-48-1		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP4a-SO-18			WPA-TP4b-SO-18			WPA-TP5-SO-10			WPA-TP6-SO-15			WPA-TP6-SO-19		
		8/27/2007			8/27/2007			8/27/2007			9/17/2007			9/17/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
ETHYLBENZENE	100-41-4		0.00213	U		0.00226	U	0.0202	0.00188			0.187	U	0.00454	0.00209	
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
METHYL ACETATE	79-20-9		0.0106	U		0.0113	U		0.0094	U		0.933	U		0.0105	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0532	U		0.0566	U		0.047	U		4.66	U		0.0523	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0532	U		0.0566	U		0.047	U		4.66	U		0.0523	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
METHYLCYCLOHEXANE	108-87-2		0.0106	U		0.0113	U		0.0094	U		0.933	U		0.0105	U
METHYLENE CHLORIDE	75-09-2		0.0106	U		0.0113	U		0.0094	U		0.933	U		0.0105	U
STYRENE	100-42-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
TETRACHLOROETHENE	127-18-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
TOLUENE	108-88-3		0.00213	U		0.00226	U		0.00188	U	0.265	0.187		0.00642	0.00209	
TOTAL XYLENES	1330-20-7		0.00532	U		0.00566	U	0.013	0.0047			0.466	U	0.0272	0.00523	
TRANS-1,2-DICHLOROETHENE	156-60-5		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
TRICHLOROETHENE	79-01-6		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
TRICHLOROFLUOROMETHANE	75-69-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
VINYL CHLORIDE	75-01-4		0.00213	U		0.00226	U		0.00188	U		0.187	U		0.00209	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2,4-DICHLOROPHENOL	120-83-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2,4-DIMETHYLPHENOL	105-67-9		0.329	U		0.327	U		0.331	U		0.328	U	4.9	0.646	
2,4-DINITROPHENOL	51-28-5		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
2,4-DINITROTOLUENE	121-14-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2,6-DINITROTOLUENE	606-20-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2-CHLORONAPHTHALENE	91-58-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2-CHLOROPHENOL	95-57-8		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
2-METHYLNAPHTHALENE	91-57-6		0.329	U	15	3.27			0.331	U		0.328	U		0.323	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.329	U		0.327	U		0.331	U		0.328	U	2.74	0.323	
2-NITROANILINE	88-74-4		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
2-NITROPHENOL	88-75-5		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.659	U		0.655	U		0.664	U		0.658	U		0.647	U
3-NITROANILINE	99-09-2		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
4-CHLOROANILINE	106-47-8		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
4-NITROPHENOL	100-02-7		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
ACENAPHTHENE	83-32-9		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
ACENAPHTHYLENE	208-96-8		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
ANTHRACENE	120-12-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZO(A)ANTHRACENE	56-55-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZO(A)PYRENE	50-32-8		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZO(B)FLUORANTHENE	205-99-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZO(G,H,I)PERYLENE	191-24-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZO(K)FLUORANTHENE	207-08-9		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BENZYL BUTYL PHTHALATE	85-68-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
CARBAZOLE	86-74-8		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
CHRYSENE	218-01-9		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
CRESOLS, TOTAL	1319-77-3		0.329	U		0.327	U		0.331	U		0.328	U	0.919	0.323	

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP4a-SO-18 8/27/2007			WPA-TP4b-SO-18 8/27/2007			WPA-TP5-SO-10 8/27/2007			WPA-TP6-SO-15 8/17/2007			WPA-TP6-SO-19 8/17/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
DIBENZOFURAN	132-64-9		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
DIETHYL PHTHALATE	84-66-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
DIMETHYL PHTHALATE	131-11-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
DI-N-BUTYL PHTHALATE	84-74-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
DI-N-OCTYLPHTHALATE	117-84-0		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
FLUORANTHENE	206-44-0		0.329	U		0.327	U		0.331	U	0.487	0.328			0.323	U
FLUORENE	86-73-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
HEXACHLOROBENZENE	118-74-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
HEXACHLOROBUTADIENE	87-68-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
HEXACHLOROETHANE	67-72-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
ISOPHORONE	78-59-1		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
NAPHTHALENE	91-20-3		0.329	U	28.2	3.27			0.331	U	4.18	0.328			0.323	U
NITROBENZENE	98-95-3		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
N-NITROSODIPHENYLAMINE	86-30-6		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
PENTACHLOROPHENOL	87-86-5		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
PHENANTHRENE	85-01-8		0.329	U	0.562	0.327			0.331	U		0.328	U		0.323	U
PHENOL	108-95-2		0.329	U		0.327	U		0.331	U		0.328	U		0.323	U
P-NITROANILINE	100-01-6		0.823	U		0.818	U		0.829	U		0.821	U		0.808	U
PYRENE	129-00-0		0.329	U		0.327	U		0.331	U	0.657	0.328			0.323	U
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	82.2	0.5		92.5	0.5		85	0.5		80.2	0.5		80.2	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP7A-SO-5			WPA-TP7A-SO-9			WPA-TP7B-SO-4			WPA-TP7B-SO-9.5			WPA-TP8-SO-10		
		8/22/2007			8/22/2007			8/22/2007			8/22/2007			8/24/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)																
ALUMINUM	7429-90-5	3110	10.1		10300	9.78		3100	9.8		11600	9.54		12400	10.1	
ANTIMONY	7440-36-0		10.1	U		9.78	U		9.8	U		9.54	U		10.1	U
ARSENIC	7440-38-2	1.66	1.01		2.8	0.978		2.53	0.98		3.38	0.954		1.68	1.01	
BARIUM	7440-39-3	16.6	2.02		111	1.96		23.8	1.96		33.6	1.91		96.3	2.02	
BERYLLIUM	7440-41-7		1.01	U		0.978	U		0.98	U		0.954	U	1.35	1.01	
CADMIUM	7440-43-9	1.54	1.01			0.978	U		0.98	U		0.954	U		1.01	U
CALCIUM	7440-70-2	450	10.1		887	9.78		716	9.8		697	9.54		1690	10.1	
CHROMIUM, TOTAL	7440-47-3	40.8	1.01		10.6	0.978		14.5	0.98		16	0.954		15.7	1.01	
COBALT	7440-48-4	92.6	1.01		3.17	0.978		75.4	0.98		3.65	0.954		5.29	1.01	
COPPER	7440-50-8	322	2.02		2.49	1.96		112	1.96		7.44	1.91		6.08	2.02	
CYANIDE	57-12-5															
IRON	7439-89-6	6590	10.1		10100	9.78		11000	9.8		16700	9.54		12200	10.1	
LEAD	7439-92-1	27.2	1.01		9.32	0.978		93.8	0.98		9.22	0.954		20.1	1.01	
MAGNESIUM	7439-95-4	193	10.1		1280	9.78		309	9.8		1630	9.54		1780	10.1	
MANGANESE	7439-96-5	52.5	1.01		123	0.978		103	0.98		94.9	0.954		243	1.01	
MERCURY	7439-97-6		0.0984	U		0.0992	U	0.167	0.0982			0.0968	U		0.101	U
NICKEL	7440-02-0	117	1.01		5.21	0.978		194	0.98		6.93	0.954		8.14	1.01	
POTASSIUM	7440-09-7		101	U	345	97.8		102	98		437	95.4		487	101	
SELENIUM	7782-49-2		2.02	U		1.96	U		1.96	U		1.91	U		2.02	U
SILVER	7440-22-4		1.01	U		0.978	U		0.98	U		0.954	U		1.01	U
SODIUM	7440-23-5		202	U		196	U		196	U		191	U		202	U
SULFIDE	18496-25-8															
THALLIUM	7440-28-0		2.02	U		1.96	U		1.96	U		1.91	U		2.02	U
VANADIUM	7440-62-2	198	10.1		15.3	9.78		27.4	9.8		26.7	9.54		22.2	10.1	
ZINC	7440-66-6	66.6	10.1		24.7	9.78		357	9.8		24.4	9.54		34.2	10.1	
VOCs (mg/kg)																
1,1,1-TRICHLOROETHANE	71-55-6		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,1,2-TRICHLOROETHANE	79-00-5		0.348	U		0.00468	U		0.00588	U		0.00525	U		0.00541	U
1,1-DICHLOROETHANE	75-34-3		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,1-DICHLOROETHENE	75-35-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,2,4-TRICHLOROBENZENE	120-82-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.348	U		0.00468	U		0.00588	U		0.00525	U		0.00541	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,2-DICHLOROBENZENE	95-50-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
1,2-DICHLOROETHANE	107-06-2		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,2-DICHLOROPROPANE	78-87-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
1,3-DICHLOROBENZENE	541-73-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
1,4-DICHLOROBENZENE	106-46-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2-HEXANONE	591-78-6		3.48	U		0.0468	U		0.0588	U		0.0525	U		0.0541	U
ACETONE	67-64-1		3.48	U	0.0817	0.0468		0.114	0.0588		0.503	0.0525		0.231	0.0541	
BENZENE	71-43-2		0.139	U		0.00187	U	0.00742	0.00235		0.00585	0.0021			0.00216	U
BROMOCHLOROMETHANE	74-97-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
BROMODICHLOROMETHANE	75-27-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
BROMOFORM	75-25-2		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
BROMOMETHANE	74-83-9		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CARBON DISULFIDE	75-15-0		0.348	U		0.00468	U		0.00588	U		0.00525	U		0.00541	U
CARBON TETRACHLORIDE	56-23-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CHLOROBENZENE	108-90-7		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CHLOROETHANE	75-00-3		0.348	U		0.00468	U		0.00588	U		0.00525	U		0.00541	U
CHLOROFORM	67-66-3		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CHLOROMETHANE	74-87-3		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
CYCLOHEXANE	110-82-7		0.696	U		0.00936	U		0.0118	U		0.0105	U		0.0108	U
DIBROMOCHLOROMETHANE	124-48-1		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP7A-SO-5			WPA-TP7A-SO-9			WPA-TP7B-SO-4			WPA-TP7B-SO-9.5			WPA-TP8-SO-10		
		8/22/2007			8/22/2007			8/22/2007			8/22/2007			8/24/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
ETHYLBENZENE	100-41-4		0.139	U	0.00857	0.00187			0.00235	U		0.0021	U		0.00216	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
METHYL ACETATE	79-20-9		0.696	U		0.00936	U		0.0118	U		0.0105	U		0.0108	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		3.48	U		0.0468	U		0.0588	U		0.0525	U		0.0541	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		3.48	U		0.0468	U		0.0588	U		0.0525	U		0.0541	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.139	U		0.00187	U		0.00235	U	0.00662	0.0021			0.00216	U
METHYLCYCLOHEXANE	108-87-2		0.696	U		0.00936	U		0.0118	U		0.0105	U		0.0108	U
METHYLENE CHLORIDE	75-09-2		0.696	U		0.00936	U		0.0118	U		0.0105	U		0.0108	U
STYRENE	100-42-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
TETRACHLOROETHENE	127-18-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
TOLUENE	108-88-3		0.139	U	0.00322	0.00187			0.00235	U		0.0021	U		0.00216	U
TOTAL XYLENES	1330-20-7		0.348	U	0.0452	0.00468			0.00588	U		0.00525	U		0.00541	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
TRICHLOROETHENE	79-01-6		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
TRICHLOROFLUOROMETHANE	75-69-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
VINYL CHLORIDE	75-01-4		0.139	U		0.00187	U		0.00235	U		0.0021	U		0.00216	U
SVOCs (mg/kg)																
2,4,5-TRICHLOROPHENOL	95-95-4		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
2,4,6-TRICHLOROPHENOL	88-06-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2,4-DICHLOROPHENOL	120-83-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2,4-DIMETHYLPHENOL	105-67-9		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2,4-DINITROPHENOL	51-28-5		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
2,4-DINITROTOLUENE	121-14-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2,6-DINITROTOLUENE	606-20-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2-CHLORONAPHTHALENE	91-58-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2-CHLOROPHENOL	95-57-8		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2-METHYLNAPHTHALENE	91-57-6		1.65	U		0.329	U	2.61	0.658			0.328	U		0.323	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
2-NITROANILINE	88-74-4		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
2-NITROPHENOL	88-75-5		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
3,3'-DICHLOROBENZIDINE	91-94-1		3.31	U		0.658	U		1.32	U		0.656	U		0.646	U
3-NITROANILINE	99-09-2		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
4-CHLORO-3-METHYLPHENOL	59-50-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
4-CHLOROANILINE	106-47-8		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
4-NITROPHENOL	100-02-7		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
ACENAPHTHENE	83-32-9		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
ACENAPHTHYLENE	208-96-8		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
ANTHRACENE	120-12-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BENZO(A)ANTHRACENE	56-55-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BENZO(A)PYRENE	50-32-8		1.65	U		0.329	U	0.839	0.658			0.328	U		0.323	U
BENZO(B)FLUORANTHENE	205-99-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BENZO(G,H,I)PERYLENE	191-24-2		1.65	U		0.329	U	1.03	0.658			0.328	U		0.323	U
BENZO(K)FLUORANTHENE	207-08-9		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BENZYL BUTYL PHTHALATE	85-68-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
CARBAZOLE	86-74-8		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
CHRYSENE	218-01-9		1.65	U		0.329	U	1.31	0.658			0.328	U		0.323	U
CRESOLS, TOTAL	1319-77-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP7A-SO-5			WPA-TP7A-SO-9			WPA-TP7B-SO-4			WPA-TP7B-SO-9.5			WPA-TP8-SO-10		
		8/22/2007			8/22/2007			8/22/2007			8/22/2007			8/24/2007		
		Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
DIBENZOFURAN	132-64-9		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
DIETHYL PHTHALATE	84-66-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
DIMETHYL PHTHALATE	131-11-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
DI-N-BUTYL PHTHALATE	84-74-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
DI-N-OCTYLPHTHALATE	117-84-0		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
FLUORANTHENE	206-44-0		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
FLUORENE	86-73-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
HEXACHLOROBENZENE	118-74-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
HEXACHLOROBUTADIENE	87-68-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
HEXACHLOROETHANE	67-72-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
ISOPHORONE	78-59-1		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
NAPHTHALENE	91-20-3	1.69	1.65			0.329	U	1610	329			0.328	U		0.323	U
NITROBENZENE	98-95-3		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
N-NITROSODIPHENYLAMINE	86-30-6		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
PENTACHLOROPHENOL	87-86-5		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
PHENANTHRENE	85-01-8		1.65	U		0.329	U	1.31	0.658			0.328	U		0.323	U
PHENOL	108-95-2		1.65	U		0.329	U		0.658	U		0.328	U		0.323	U
P-NITROANILINE	100-01-6		4.14	U		0.822	U		1.65	U		0.82	U		0.807	U
PYRENE	129-00-0		1.65	U		0.329	U	1.01	0.658			0.328	U		0.323	U
PYRIDINE	110-86-1															
Other Parameters																
TOTAL ORGANIC HALIDES (TOX)	TOX															
% DRY SOLIDS	DRY	77.9	0.5		81.4	0.5		75.6	0.5		84.9	0.5		89.6	0.5	
IGNITABILITY	IGNITB															
PH	pH															
TOTAL HYDROCARBONS AS HEXANE	THCHX															

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP9-SO-10 8/22/2007			WPA-TP9-SO-18 8/22/2007		
		Result	RL	Qualifier	Result	RL	Qualifier
Inorganics (mg/kg)							
ALUMINUM	7429-90-5	4560	9.71		12600	10	
ANTIMONY	7440-36-0		9.71	U		10	U
ARSENIC	7440-38-2	2.45	0.971		4.88	1	
BARIUM	7440-39-3	60.6	1.94		60.5	2.01	
BERYLLIUM	7440-41-7		0.971	U		1	U
CADMIUM	7440-43-9		0.971	U		1	U
CALCIUM	7440-70-2	1830	9.71		600	10	
CHROMIUM, TOTAL	7440-47-3	63.4	0.971		19.6	1	
COBALT	7440-48-4	17.8	0.971		4.78	1	
COPPER	7440-50-8	485	1.94		6.43	2.01	
CYANIDE	57-12-5						
IRON	7439-89-6	15200	9.71		16100	10	
LEAD	7439-92-1	140	0.971		9.63	1	
MAGNESIUM	7439-95-4	1640	9.71		2080	10	
MANGANESE	7439-96-5	225	0.971		165	1	
MERCURY	7439-97-6	0.611	0.096			0.0974	U
NICKEL	7440-02-0	176	0.971		7.97	1	
POTASSIUM	7440-09-7	264	97.1		642	100	
SELENIUM	7782-49-2		1.94	U		2.01	U
SILVER	7440-22-4		0.971	U		1	U
SODIUM	7440-23-5		194	U		201	U
SULFIDE	18496-25-8						
THALLIUM	7440-28-0		1.94	U		2.01	U
VANADIUM	7440-62-2	143	9.71		28.2	10	
ZINC	7440-66-6	268	9.71		25.8	10	
VOCs (mg/kg)							
1,1,1-TRICHLOROETHANE	71-55-6		0.00353	U		0.00189	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.00353	U		0.00189	U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76-13-1		0.00353	U		0.00189	U
1,1,2-TRICHLOROETHANE	79-00-5		0.00883	U		0.00472	U
1,1-DICHLOROETHANE	75-34-3		0.00353	U		0.00189	U
1,1-DICHLOROETHENE	75-35-4		0.00353	U		0.00189	U
1,2,4-TRICHLOROBENZENE	120-82-1		0.331	U		0.333	U
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8		0.00883	U		0.00472	U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	106-93-4		0.00353	U		0.00189	U
1,2-DICHLOROBENZENE	95-50-1		0.331	U		0.333	U
1,2-DICHLOROETHANE	107-06-2		0.00353	U		0.00189	U
1,2-DICHLOROPROPANE	78-87-5		0.00353	U		0.00189	U
1,3-DICHLOROBENZENE	541-73-1		0.331	U		0.333	U
1,4-DICHLOROBENZENE	106-46-7		0.331	U		0.333	U
2-HEXANONE	591-78-6		0.0883	U		0.0472	U
ACETONE	67-64-1	0.0893	0.0883		0.119	0.0472	
BENZENE	71-43-2		0.00353	U		0.00189	U
BROMOCHLOROMETHANE	74-97-5		0.00353	U		0.00189	U
BROMODICHLOROMETHANE	75-27-4		0.00353	U		0.00189	U
BROMOFORM	75-25-2		0.00353	U		0.00189	U
BROMOMETHANE	74-83-9		0.00353	U		0.00189	U
CARBON DISULFIDE	75-15-0		0.00883	U		0.00472	U
CARBON TETRACHLORIDE	56-23-5		0.00353	U		0.00189	U
CHLOROBENZENE	108-90-7		0.00353	U		0.00189	U
CHLOROETHANE	75-00-3		0.00883	U		0.00472	U
CHLOROFORM	67-66-3		0.00353	U		0.00189	U
CHLOROMETHANE	74-87-3		0.00353	U		0.00189	U
CIS-1,2-DICHLOROETHYLENE	156-59-2		0.00353	U		0.00189	U
CIS-1,3-DICHLOROPROPENE	10061-01-5		0.00353	U		0.00189	U
CYCLOHEXANE	110-82-7		0.0177	U		0.00943	U
DIBROMOCHLOROMETHANE	124-48-1		0.00353	U		0.00189	U

TABLE A
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP9-SO-10			WPA-TP9-SO-18		
		8/22/2007			8/22/2007		
		Result	RL	Qualifier	Result	RL	Qualifier
DICHLORODIFLUOROMETHANE	75-71-8		0.00353	U		0.00189	U
ETHYLBENZENE	100-41-4		0.00353	U		0.00189	U
ISOPROPYLBENZENE (CUMENE)	98-82-8		0.00353	U		0.00189	U
METHYL ACETATE	79-20-9		0.0177	U		0.00943	U
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3		0.0883	U		0.0472	U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108-10-1		0.0883	U		0.0472	U
METHYL TERT-BUTYL ETHER	1634-04-4		0.00353	U		0.00189	U
METHYLCYCLOHEXANE	108-87-2		0.0177	U		0.00943	U
METHYLENE CHLORIDE	75-09-2		0.0177	U		0.00943	U
STYRENE	100-42-5		0.00353	U		0.00189	U
TETRACHLOROETHENE	127-18-4		0.00353	U		0.00189	U
TOLUENE	108-88-3		0.00353	U		0.00189	U
TOTAL XYLENES	1330-20-7		0.00883	U		0.00472	U
TRANS-1,2-DICHLOROETHENE	156-60-5		0.00353	U		0.00189	U
TRANS-1,3-DICHLOROPROPENE	10061-02-6		0.00353	U		0.00189	U
TRICHLOROETHENE	79-01-6		0.00353	U		0.00189	U
TRICHLOROFLUOROMETHANE	75-69-4		0.00353	U		0.00189	U
VINYL CHLORIDE	75-01-4		0.00353	U		0.00189	U
SVOCs (mg/kg)							
2,4,5-TRICHLOROPHENOL	95-95-4		0.827	U		0.832	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.331	U		0.333	U
2,4-DICHLOROPHENOL	120-83-2		0.331	U		0.333	U
2,4-DIMETHYLPHENOL	105-67-9		0.331	U		0.333	U
2,4-DINITROPHENOL	51-28-5		0.827	U		0.832	U
2,4-DINITROTOLUENE	121-14-2		0.331	U		0.333	U
2,6-DINITROTOLUENE	606-20-2		0.331	U		0.333	U
2-CHLORONAPHTHALENE	91-58-7		0.331	U		0.333	U
2-CHLOROPHENOL	95-57-8		0.331	U		0.333	U
2-METHYLNAPHTHALENE	91-57-6	0.699	0.331			0.333	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.331	U		0.333	U
2-NITROANILINE	88-74-4		0.827	U		0.832	U
2-NITROPHENOL	88-75-5		0.331	U		0.333	U
3,3'-DICHLOROBENZIDINE	91-94-1		0.663	U		0.666	U
3-NITROANILINE	99-09-2		0.827	U		0.832	U
4,6-DINITRO-2-METHYLPHENOL	534-52-1		0.827	U		0.832	U
4-BROMOPHENYL PHENYL ETHER	101-55-3		0.331	U		0.333	U
4-CHLORO-3-METHYLPHENOL	59-50-7		0.331	U		0.333	U
4-CHLOROANILINE	106-47-8		0.331	U		0.333	U
4-CHLOROPHENYL PHENYL ETHER	7005-72-3		0.331	U		0.333	U
4-NITROPHENOL	100-02-7		0.827	U		0.832	U
ACENAPHTHENE	83-32-9		0.331	U		0.333	U
ACENAPHTHYLENE	208-96-8		0.331	U		0.333	U
ANTHRACENE	120-12-7		0.331	U		0.333	U
BENZO(A)ANTHRACENE	56-55-3		0.331	U		0.333	U
BENZO(A)PYRENE	50-32-8		0.331	U		0.333	U
BENZO(B)FLUORANTHENE	205-99-2		0.331	U		0.333	U
BENZO(G,H,I)PERYLENE	191-24-2	0.444	0.331			0.333	U
BENZO(K)FLUORANTHENE	207-08-9		0.331	U		0.333	U
BENZYL BUTYL PHTHALATE	85-68-7		0.331	U		0.333	U
BIS(2-CHLOROETHOXY) METHANE	111-91-1		0.331	U		0.333	U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	111-44-4		0.331	U		0.333	U
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9		0.331	U		0.333	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	0.498	0.331			0.333	U
CARBAZOLE	86-74-8		0.331	U		0.333	U
CHRYSENE	218-01-9		0.331	U		0.333	U
CRESOLS, TOTAL	1319-77-3		0.331	U		0.333	U

TABLE A-
SOIL DATA - WOOD PILE AREA INVESTIGATION
UNIT F AREA A - SWMU 14
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS #	WPA-TP9-SO-10 8/22/2007			WPA-TP9-SO-18 8/22/2007		
		Result	RL	Qualifier	Result	RL	Qualifier
DIBENZ(A,H)ANTHRACENE	53-70-3		0.331	U		0.333	U
DIBENZOFURAN	132-64-9		0.331	U		0.333	U
DIETHYL PHTHALATE	84-66-2		0.331	U		0.333	U
DIMETHYL PHTHALATE	131-11-3		0.331	U		0.333	U
DI-N-BUTYL PHTHALATE	84-74-2		0.331	U		0.333	U
DI-N-OCTYLPHTHALATE	117-84-0		0.331	U		0.333	U
FLUORANTHENE	206-44-0		0.331	U		0.333	U
FLUORENE	86-73-7		0.331	U		0.333	U
HEXACHLOROBENZENE	118-74-1		0.331	U		0.333	U
HEXACHLOROBUTADIENE	87-68-3		0.331	U		0.333	U
HEXACHLOROCYCLOPENTADIENE	77-47-4		0.331	U		0.333	U
HEXACHLOROETHANE	67-72-1		0.331	U		0.333	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.331	U		0.333	U
ISOPHORONE	78-59-1		0.331	U		0.333	U
NAPHTHALENE	91-20-3	4.01	0.662			0.333	U
NITROBENZENE	98-95-3		0.331	U		0.333	U
N-NITROSODI-N-PROPYLAMINE	621-64-7		0.331	U		0.333	U
N-NITROSODIPHENYLAMINE	86-30-6		0.331	U		0.333	U
PENTACHLOROPHENOL	87-86-5		0.827	U		0.832	U
PHENANTHRENE	85-01-8	0.421	0.331			0.333	U
PHENOL	108-95-2		0.331	U		0.333	U
P-NITROANILINE	100-01-6		0.827	U		0.832	U
PYRENE	129-00-0		0.331	U		0.333	U
PYRIDINE	110-86-1						
Other Parameters							
TOTAL ORGANIC HALIDES (TOX)	TOX						
% DRY SOLIDS	DRY	74.8	0.5		82.4	0.5	
IGNITABILITY	IGNITB						
PH	pH						
TOTAL HYDROCARBONS AS HEXANE	THCHX						

Notes:
RL - Reporting Limit
Qualifiers:
U - non detect
B - analyte was detected in the blank sample
K - an associated QC sample had an outlier therfore the sample result may be biased high

TABLE A
SOIL DATA
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	15B1034632SO 10/25/1994			15B11-SO-102694 10/26/1994			15B1234634SO 10/27/1994			15B1334628SO 10/21/1994			15B134632SO 10/25/1994			15B1434628SO 10/21/1994			15B1534628SO 10/21/1994			15B16-SO-102694 10/26/1994			15B1734628SO 10/21/1994		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																												
ARSENIC	7440-38-2	6	0.5			2	U	3.9	0.5	K	4	0.5		3.9	0.5		2.7	0.5		0.81	0.5		2.3		K	0.73	0.5	
ANTIMONY	7440-36-0		10	UL		10	R		10	R		10	UL		10	UL		10	UL		10	UL		10	R		10	UL
BARIUM	7440-39-3	73	2		31			79	2		29	2		35	2		55	2		26	2		17			12	2	
BERYLLIUM	7440-41-7	0.63	0.3			0.3	U	0.73	0.3		0.46	0.3		0.71	0.3		0.42	0.3		0.32	0.3			0.3	U		0.3	U
CADMIUM	7440-43-9	0.79	0.5			0.5	U	1.5	0.5		0.77	0.5		1.4	0.5		0.58	0.5	U		0.5	U		0.5	U		0.5	U
CHROMIUM, TOTAL	7440-47-3	20	2		18			20	2		15	2		18	2		22	2		19	2		6.9			8.8	2	
COBALT	7440-48-4	7.1	2		2.8			6.6	2		5.4	2		9.2	2		4.2	2		2.4	2		2.1				2	U
CYANIDE	57-12-5		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U
LEAD	7439-92-1	13	5		8.2			52	5		5.9	0.2	J	3.7	0.2	J	16	0.2	J	10	0.2	J	3.3			3.5	0.2	J
NICKEL	7440-02-0	12	2		4.9			9.5	2		6.9	2		9.2	2		8.3	2		5.6	2		3.4			2.2	2	
SELENIUM	7782-49-2	1.3	0.5			0.5	U	0.87	0.5			0.5	U		0.5	U		0.5	UL		0.5	UL		0.5	U		0.5	U
SILVER	7440-22-4	1.6	1			1	U		1	U	1.5	1			1	U		1	U		1	U		1	U		1	U
VANADIUM	7440-62-2	35	2		14			28	2		30	2		21	2		32	2		30	2		14			17	2	
ZINC	7440-66-6	27	2		18			43	2		23	2		23	2		22	2		17	2		18			5.1	2	
MERCURY	7439-97-6		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
VOCs (mg/kg)																												
1,1,1-TRICHLOROETHANE	71-55-6		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,1,2,2-TETRACHLOROETHANE	79-34-5		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
ETHYLENE DIBROMIDE	106-93-4		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROETHANE	107-06-2		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROPROPANE	78-87-5		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,4-DIOXANE	123-91-1		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACETONE	67-64-1		0.1	U	0.059	0.1	B	0.071	0.2	B		0.1	U		0.1	U		0.1	U		0.1	U	0.054	0.1	B		0.1	U
BENZENE	71-43-2		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CARBON DISULFIDE	75-15-0		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
CHLOROBENZENE	108-90-7		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CHLOROFORM	67-66-3		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
ETHYLBENZENE	100-41-4		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
2-BUTANONE	78-93-3		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U
STYRENE	100-42-5		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TETRACHLOROETHENE	127-18-4		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TOLUENE	108-88-3		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TOTAL XYLENES	1330-20-7		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
VINYL ACETATE	108-05-4		0.1	U		0.01	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.01	U		0.1	U
SVOCs (mg/kg)																												
1,2-DICHLOROBENZENE	95-50-1		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,3-DICHLOROBENZENE	541-73-1		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,4-DICHLOROBENZENE	106-46-7		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,5-TRICHLOROPHENOL	95-95-4		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,6-TRICHLOROPHENOL	88-06-2		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DIMETHYLPHENOL	105-67-9		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROPHENOL	51-28-5		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROTOLUENE	121-14-2		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-CHLOROPHENOL	95-57-8		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-METHYLNAPHTHALENE	91-57-6	7.87	0.33						0.33	U		0.33	U		0.33	U		0.33	U		0.33	U					0.33	U
2-METHYLPHENOL (O-CRESOL)	95-48-7		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
3-METHYLPHENOL	108-39-4		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-CHLOROANILINE	106-47-8		0.66	U					0.66	U		0.66	U		0.66	U		0.66	U		0.66	U					0.66	U
4-METHYLPHENOL (P-CRESOL)	106-44-5		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-NITROPHENOL	100-02-7		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
7,12-DIMETHYLBENZ(A)ANTHRACENE	57-97-6		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACENAPHTHYLENE	208-96-8		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U					0.33	U

TABLE A
SOIL DATA
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	CAS	15B1034632SO 10/25/1994			15B11-SO-102694 10/26/1994			15B1234634SO 10/27/1994			15B1334628SO 10/21/1994			15B13463ZSO 10/25/1994			15B1434628SO 10/21/1994			15B1534628SO 10/21/1994			15B16-SO-102694 10/26/1994			15B1734628SO 10/21/1994		
		Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
ANILINE	62-53-3		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
ANTHRACENE	120-12-7	0.579	0.33			0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)ANTHRACENE	56-55-3		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)PYRENE	50-32-8		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(B)FLUORANTHENE	205-99-2		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(K)FLUORANTHENE	207-08-9		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZYL BUTYL PHTHALATE	85-68-7		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
CHRYSENE	218-01-9		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIBENZ(A,H)ANTHRACENE	53-70-3		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
DIETHYL PHTHALATE	84-66-2		0.33	U		0.33	U		0.33	U	1.15	0.33			0.33	U	0.379	0.33		0.422	0.33			0.33	U	0.588	0.33	
DIMETHYL PHTHALATE	131-11-3		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DI-N-BUTYL PHTHALATE	84-74-2		0.33	U		0.33	U	0.187	0.33	B		0.33	U		0.33	U		0.33	U		0.33	U	0.24	0.33		0.512	0.33	B
DI-N-OCTYLPHTHALATE	117-84-0		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORANTHENE	206-44-0		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORENE	86-73-7	0.644	0.33						0.33	U		0.33	U		0.33	U		0.33	U		0.33	U					0.33	U
INDENO(1,2,3-C,D)PYRENE	193-39-5		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
NAPHTHALENE	91-20-3	2.55	0.33			0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
NITROBENZENE	98-95-3		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENANTHRENE	85-01-8	1.01	0.33			0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENOL	108-95-2		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRENE	129-00-0		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRIDINE	110-86-1		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - *Result is potentially biased high due to blank contamination.*

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

K - an associated QC sample had an outlier; the sample result may be biased high.

UL - reporting limit is biased low.

Blank cells indicate constituent not analyzed.

TABLE A
SOIL DATA
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B1834628SO 10/21/1994			15B1834631SO 10/24/1994			15B1934634SO 10/27/1994			15B2034631SO 10/24/1994			15B2034632SO 10/25/1994			15B21-SO-102494 10/24/1994			15B22-SO-102494 10/24/1994			15B2334633SO 10/26/1994			15B24-SO-102494 10/24/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																											
ARSENIC				1.3	0.5		3.4	0.5	K	3	0.5					0.8			1.9			3.3	0.5	K	1.4		
ANTIMONY					10	UL		10	R		10	UL					10	UL		10	UL		10	R		10	UL
BARIUM				19	2		49	2		29	2					13			29			46	2		17		
BERYLLIUM		0.3	U				0.41	0.3		0.37	0.3						0.3	U	0.35			0.52	0.3			0.3	U
CADMIUM					0.5	U	0.69	0.5			0.5	U					0.5	U		0.5	U	1.5	0.5			0.5	U
CHROMIUM, TOTAL				7.3	2		13	2		13	2					6			11			18	2		8		
COBALT		2	U				5.5	2		4.4	2					2			5.7			5.2	2		3.3		
CYANIDE					0.3	U		0.3	U		0.3	U					0.3	U		0.3	U		0.3	U		0.3	U
LEAD				3.3	0.2	J	8.4	0.2		18	5					3.8			17			8.1	0.2		45		
NICKEL				2.9	2		6.2	2		7.3	2					2.7			13			7.4	2		4.7		
SELENIUM					0.5	UL	0.55	0.5			0.5	U					0.5	U		0.5	UL	0.81	0.5			0.5	U
SILVER					1	U		1	U		1	U					1	U		1	U		1	U		1	U
VANADIUM	12	2					19	2		25	2					10			20			28	2		17		
ZINC	8	2					16	2		22	2					8			55			25	2		13		
MERCURY					0.05	U		0.05	U		0.05	U					0.05	U		0.05	U		0.05	U		0.05	U
VOCs (mg/kg)																											
1,1,1-TRICHLOROETHANE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
1,1,2,2-TETRACHLOROETHANE		0.01	U					0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
ETHYLENE DIBROMIDE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROETHANE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROPROPANE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
1,4-DIOXANE					1	U		1	U		1	U					1	U		1	U		1	U		1	U
ACETONE		0.1	U				0.095	0.2	B		0.1	U					0.1	U		0.1	U	0.048	0.2	B		0.1	U
BENZENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
CARBON DISULFIDE					0.05	U		0.05	U		0.05	U					0.05	U		0.05	U		0.05	U		0.05	U
CHLOROBENZENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
CHLOROFORM					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
ETHYLBENZENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
2-BUTANONE					0.1	U		0.1	U		0.1	U					0.1	U		0.1	U		0.1	U		0.1	U
STYRENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
TETRACHLOROETHENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
TOLUENE					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
TOTAL XYLENES					0.01	U		0.01	U		0.01	U					0.01	U		0.01	U		0.01	U		0.01	U
VINYL ACETATE		0.1	U					0.1	U		0.1	U					0.01	U		0.01	U		0.1	U		0.01	U
SVOCs (mg/kg)																											
1,2-DICHLOROBENZENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,3-DICHLOROBENZENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,4-DICHLOROBENZENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,5-TRICHLOROPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,6-TRICHLOROPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DIMETHYLPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROTOLUENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-CHLOROPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-METHYLNAPHTHALENE		0.33	U					0.33	U		0.33	U											0.33	U			
2-METHYLPHENOL (O-CRESOL)					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
3-METHYLPHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-CHLOROANILINE		0.66	U					0.66	U		0.66	U											0.66	U			
4-METHYLPHENOL (P-CRESOL)					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-NITROPHENOL					0.66	U		0.66	U					0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
7,12-DIMETHYLBENZ(A)ANTHRACENE					1	U		1	U					1	U		1	U		1	U		1	U		1	U
ACENAPHTHYLENE		0.33	U					0.33	U		0.33	U											0.33	U			

TABLE A
SOIL DATA S
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B1834628SO 10/21/1994			15B1834631SO 10/24/1994			15B1934634SO 10/27/1994			15B2034631SO 10/24/1994			15B2034632SO 10/25/1994			15B21-SO-102494 10/24/1994			15B22-SO-102494 10/24/1994			15B2334633SO 10/26/1994			15B24-SO-102494 10/24/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
ANILINE					0.66	U		0.66	U					0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
ANTHRACENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)ANTHRACENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)PYRENE					0.33	U		0.33	U				0.391	0.33			0.33	U		0.33	U		0.33	U		0.33	U
BENZO(B)FLUORANTHENE					0.33	U		0.33	U				0.681	0.33			0.33	U		0.33	U		0.33	U		0.33	U
BENZO(K)FLUORANTHENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZYL BUTYL PHTHALATE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BIS(2-ETHYLHEXYL) PHTHALATE					0.33	U	1.2	0.33						0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
CHRYSENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIBENZ(A,H)ANTHRACENE					0.66	U		0.66	U					0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
DIETHYL PHTHALATE				0.588	0.33			0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIMETHYL PHTHALATE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DI-N-BUTYL PHTHALATE				0.492	0.33	B		0.33	U					0.33	U		0.33	U		0.33	U	0.218	0.33	B		0.33	U
DI-N-OCTYLPHTHALATE					0.33	U	0.356	0.33						0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORANTHENE					0.33	U		0.33	U				1.03	0.33			0.33	U		0.33	U		0.33	U		0.33	U
FLUORENE		0.33	U					0.33	U		0.33	U											0.33	U			
INDENO(1,2,3-C,D)PYRENE					0.66	U		0.66	U					0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
NAPHTHALENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
NITROBENZENE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENANTHRENE					0.33	U		0.33	U				0.755	0.33			0.33	U		0.33	U		0.33	U		0.33	U
PHENOL					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRENE					0.33	U		0.33	U				0.714	0.33			0.33	U		0.33	U		0.33	U		0.33	U
PYRIDINE					0.33	U		0.33	U					0.33	U		0.33	U		0.33	U		0.33	U		0.33	U

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

K - an associated QC sample had an outlier; the sample result may be biased high.

UL - reporting limit is biased low.

Blank cells indicate constituent not analyzed.

TABLE A[illegible]
SOIL DATA[illegible]S
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B2534645SO 11/7/1994			15B26-SO-102494 10/24/1994			15B27-SO-102494 10/24/1994			15B28-SO-102894 10/28/1994			15B29-SO-102894 10/28/1994			15B2-SO-102594 10/25/1994			15B3034635SO 10/28/1994			15B3134666SO 11/28/1994			15B3234666SO 11/28/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																											
ARSENIC	3.7	0.5	J	1.9			0.77			3.1		K		2	U	1.2			2.9	0.5	K	1.52	0.5	K	3.28	0.5	K
ANTIMONY		10	R		10	UL		10	UL		10	R		10	R		10	UL		10	R		10	UL		10	UL
BARIUM	62	2		52			21			51			58			23			76	2		80	2		62.6	2	
BERYLLIUM	0.54	0.3		0.48				0.3	U	0.42				0.3	U	0.34			0.7	0.3		0.694	0.3		1.76	0.3	
CADMIUM	1	0.5		0.55				0.5	U	0.7				0.5	U		0.5	U	1.4	0.5		0.694	0.5		2.24	0.5	
CHROMIUM, TOTAL	40	2	L	8.3			4.2			9.2			6.1			6.7			20	2		11.7	2		111.3	2	
COBALT	4.4	2		4.8			4.9			5.6			2			2			4.2	2		4.86	2		9.37	2	
CYANIDE		0.3	UL		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U
LEAD	24	5		13			2.9			10			3.6			1.9			10	5		6.02	0.2		68.1	5	
NICKEL	8	2		4.1			2.8			7			3.4			2.7			13	2		6.18	2		32.7	2	
SELENIUM	0.61	0.5	L		0.5	UL		0.5	U	1.3			0.61				0.5	U		0.5	U	0.831	0.5		0.957	0.5	
SILVER		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
VANADIUM	43	2	L	22			11			19			11			12			51	2		18	2		42.7	2	
ZINC	42	2		16			7			114			15			8			40	2		15.1	2		558.4	2	
MERCURY		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
VOCs (mg/kg)																											
1,1,1-TRICHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,1,2,2-TETRACHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
ETHYLENE DIBROMIDE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROPROPANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,4-DIOXANE		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACETONE	0.025	0.1	JB	0.125	0.1	B	0.125	0.1	B	0.056	0.1	B	0.046	0.1	B		0.1	U	0.041	0.2	B	0.068	0.1	B	0.061	0.1	B
BENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CARBON DISULFIDE		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
CHLOROBENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CHLOROFORM		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U	0.002	0.01	J
ETHYLBENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
2-BUTANONE		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U		0.1	U
STYRENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TETRACHLOROETHENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TOLUENE	0.009	0.01	J		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U	0.003	0.01	J	0.003	0.01	J
TOTAL XYLENES	0.01	0.01	J		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U	0.002	0.01	J	0.004	0.01	J
VINYL ACETATE		0.1	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.1	U		0.1	U		0.1	U
SVOCs (mg/kg)																											
1,2-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,3-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,4-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,5-TRICHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,6-TRICHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DIMETHYLPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROTOLUENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-CHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-METHYLNAPHTHALENE		0.33	U																	0.33	U		0.33	U		0.33	U
2-METHYLPHENOL (O-CRESOL)		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
3-METHYLPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U						
4-CHLOROANILINE		0.66	U																	0.66	U		0.66	U		0.66	U
4-METHYLPHENOL (P-CRESOL)		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-NITROPHENOL		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
7,12-DIMETHYLBENZ(A)ANTHRACENE		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACENAPHTHYLENE		0.33	U																	0.33	U		0.33	U		0.33	U

TABLE A
SOIL DATA
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B2534645SO 11/7/1994			15B26-SO-102494 10/24/1994			15B27-SO-102494 10/24/1994			15B28-SO-102894 10/28/1994			15B29-SO-102894 10/28/1994			15B2-SO-102594 10/25/1994			15B3034635SO 10/28/1994			15B3134666SO 11/28/1994			15B3234666SO 11/28/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
ANILINE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
ANTHRACENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)ANTHRACENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)PYRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(B)FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(K)FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZYL BUTYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BIS(2-ETHYLHEXYL) PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
CHRYSENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIBENZ(A,H)ANTHRACENE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
DIETHYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIMETHYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DI-N-BUTYL PHTHALATE	2.7	0.33	B		0.33	U	0.405	0.33		0.411	0.33		0.403	0.33			0.33	U	0.198	0.33	B	0.213	0.33	B	0.198	0.33	B
DI-N-OCTYLPHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORENE		0.33	U																	0.33	U		0.33	U		0.33	U
INDENO(1,2,3-C,D)PYRENE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
NAPHTHALENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
NITROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENANTHRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENOL	0.325	0.33	J		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRIDINE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

K - an associated QC sample had an outlier; the sample result may be biased high.

UL - reporting limit is biased low.

Blank cells indicate constituent not analyzed.

TABLE
SOIL DATA
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B33-SO-102894 10/28/1994			15B3-SO-102694 10/26/1994			15B4-SO-102794 10/27/1994			15B53464SO 10/27/1994			15B6-SO-102694 10/26/1994			15B734634SO 10/27/1994			15B8-SO-102594 10/25/1994			15B934634SO 10/27/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																								
ARSENIC	2.4		K	1.8		K	4.9		K		2	U	3.6		K	3.1	0.5	K	0.84			5.5	0.5	K
ANTIMONY		10	R		10	R		10	R		10	R		10	R		10	R		10	UL		10	R
BARIUM	72			30			63			63	2		73			36	2		22			57	2	
BERYLLIUM	0.69				0.3	U	0.61			0.75	0.3		0.57			0.42	0.3			0.3	U	0.62	0.3	
CADMIUM	0.69				0.5	U	0.76			0.75	0.5		0.71			0.56	0.5			0.5	U	1.6	0.5	
CHROMIUM, TOTAL	11			5.5			15			8.2	2		16			8.4	2		5.6			26	2	
COBALT	5.5			3.4			5.3			7.5	2		5.7			4.9	2		2.1			5.4	2	
CYANIDE		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U		0.3	U
LEAD	7.9			2.6			12			4.3	0.2		12			10	5		6.6			20	0.2	
NICKEL	6.2			2.7			7.6			5.2	2		9.3			15	2		2.8			9.3	2	
SELENIUM	0.98				0.5	U	0.76				0.5	U	0.86			0.55	0.5			0.5	U	0.93	0.5	
SILVER		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
VANADIUM	22			10			23			20	2		24			24	2		7.7			34	2	
ZINC	18			6.8			24			19	2		26			15	2		9.1			30	2	
MERCURY		0.05	U		0.05	U	0.05	0.05			0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
VOCs (mg/kg)																								
1,1,1-TRICHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,1,2,2-TETRACHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
ETHYLENE DIBROMIDE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROETHANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,2-DICHLOROPROPANE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
1,4-DIOXANE		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACETONE	0.051	0.1	B	0.069	0.10	B	0.19	0.10	B	0.141	0.20	B	0.041	0.10	B	0.251	0.20	B		0.10	U	0.158	0.20	B
BENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CARBON DISULFIDE		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U		0.05	U
CHLOROBENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
CHLOROFORM		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
ETHYLBENZENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
2-BUTANONE		0.1	U		0.10	U		0.10	U		0.10	U		0.10	U		0.10	U		0.10	U		0.10	U
STYRENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TETRACHLOROETHENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TOLUENE		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
TOTAL XYLENES		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U		0.01	U
VINYL ACETATE		0.01	U		0.01	U		0.01	U		0.10	U		0.01	U		0.10	U		0.01	U		0.10	U
SVOCs (mg/kg)																								
1,2-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,3-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
1,4-DICHLOROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,5-TRICHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4,6-TRICHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DIMETHYLPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2,4-DINITROTOLUENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
2-CHLOROPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U	0.672	0.33			0.33	U		0.33	U
2-METHYLNAPHTHALENE											0.33	U					0.33	U					0.33	U
2-METHYLPHENOL (O-CRESOL)		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
3-METHYLPHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-CHLOROANILINE											0.66	U					0.66	U					0.66	U
4-METHYLPHENOL (P-CRESOL)		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
4-NITROPHENOL		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U	0.331	0.66	J		0.66	U		0.66	U
7,12-DIMETHYLBENZ(A)ANTHRACENE		1	U		1	U		1	U		1	U		1	U		1	U		1	U		1	U
ACENAPHTHYLENE											0.33	U					0.33	U					0.33	U

TABLE A
SOIL DATA RESULTS
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	15B33-SO-102894 10/28/1994			15B3-SO-102694 10/26/1994			15B4-SO-102794 10/27/1994			15B534634SO 10/27/1994			15B6-SO-102694 10/26/1994			15B734634SO 10/27/1994			15B8-SO-102594 10/25/1994			15B934634SO 10/27/1994		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
ANILINE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
ANTHRACENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)ANTHRACENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(A)PYRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(B)FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZO(K)FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BENZYL BUTYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
BIS(2-ETHYLHEXYL) PHTHALATE		0.33	U	0.438	0.33			0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
CHRYSENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIBENZ(A,H)ANTHRACENE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
DIETHYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DIMETHYL PHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
DI-N-BUTYL PHTHALATE	0.336	0.33		0.187	0.33		0.209	0.33		0.219	0.33	B		0.33	U		0.33	U		0.33	U		0.33	U
DI-N-OCTYLPHTHALATE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORANTHENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
FLUORENE											0.33	U					0.33	U					0.33	U
INDENO(1,2,3-C,D)PYRENE		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U		0.66	U
NAPHTHALENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
NITROBENZENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENANTHRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PHENOL		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U	0.597	0.33			0.33	U		0.33	U
PYRENE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U
PYRIDINE		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U		0.33	U

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

K - an associated QC sample had an outlier; the sample result may be biased high.

UL - reporting limit is biased low.

Blank cells indicate constituent not analyzed.

TABLE
SOIL DATA - PHASE I RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID: / Sample Depth: / Sample Date:	SWMU 15B-13b 6-8 ft 03/25/99	SWMU 15B-14a 0-2 ft 05/11/99	SWMU 15B-17a 0-2 ft 05/11/99	SWMU 15B-20a 0-2 ft 03/24/99	SWMU 15B-23c 6-8 ft 03/24/99	SWMU 15B-30d 8-10 ft 05/13/99	SWMU r15b1bss Surface 05/28/1999	SWMU r15b3dss Surface 05/28/1999	SWMU r15b7ass Surface 05/28/1999	SWMU r15b9bss Surface 05/28/1999	SWMU r15b10bss Surface 05/28/1999
Inorganics (mg/kg)												
Antimony		8.3 UL	8.5 UL	8.9 UL	9.2 UL	8.6 UL	8.2 UL	8.21 UL	8.17 UL	8.2 UL	9.23 UL	7.89 UL
Arsenic		1.7	4.4 J	1.2 J	11	3.5	1.5 U	2.19	1.38	2.7	3.5	1.5
Barium		8.9	27.8 B	22.7 B	56.8	33.7	11.4 B	31.76	31.86	33.7	48.5	41.9
Beryllium								0.68 UL	0.68 UL	0.3 L	0.7 L	0.1 L
Cadmium		1 B	0.8	0.7 U	4	2.1	0.7 U	0.75 L	0.68 UL	0.68 UL	0.7 L	0.66 UL
Chromium		8.8 K	13	8.7	44.1 K	19 K	3.3	16.42 L	9.68 L	32.0 L	35.1 L	14.3 L
Cyanide		0.5	0.2 U	0.2 U	0.6	0.9	0.2 U					
Cobalt								5.47 B	1.52 B	1.7 B	5.2 B	1.6 B
Lead		2.4 K	7.5 K	3.8 K	6.6 K	4.5 K	1.6 K	65.55 K	59.49 K	107.8 K	156.0 K	523.5 K
Mercury		0.017 U	0.019 UL	0.02 UL	0.02 U	0.018 U	0.017 UL	0.26	0.027	0.027	0.065	0.027 U
Nickel		2.6 L	8.6 K	5.2 K	14.2 L	7.9 L	3.2 K	65.97 L	11.71 L	21.5 L	37.5 L	20.2 L
Selenium		0.7 U	0.7 UJ	0.7 U	0.8 UJ	0.7 U	0.7 U	0.69 U	0.66 U	0.67 U	0.77 U	0.67 U
Silver		1.4 U	1.5 U	0.5 B	0.6 B	0.6 B	0.5 B	1.37 U	1.36 U	1.37 U	1.54 U	1.31 U
Tetraethyl Lead		0.11 U			0.12 U	0.11 U		0.176 U	0.166 U	0.168 U	0.195 U	0.165 U
Vanadium								287.2	56.3	97.9	74.2	106.1
Zinc								52.8	13.2	170.2	326.0	23.5
VOCs (mg/kg)												
1,1,1 Trichloroethane		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
1,2 Dichloroethane		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
1,2 Dichloropropane		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
1,4 Dioxane		4.7 R	0.11 R	0.1 R	4.7 R	0.14 R	0.1 R					
2 Butanone		0.047 U	0.0011 U	0.001 U	0.047 U	0.01	0.0154					
Benzene		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Carbon Disulfide		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Chlorobenzene		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Chloroform		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Ethylbenzene		0.048	0.0022	0.008	0.14 J	0.001 U	0.001 U					
Ethylene Dibromide		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
1,2-Dichloroethane		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
m&p Xylene		0.2	0.0087	0.0317	0.12 J	0.002 U	0.002 U					
o Xylene		0.093	0.0011 U	0.0117	0.12 J	0.001 U	0.001 U					
Styrene		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Methyl tert-butyl ether		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Tetrachloroethene		0.047 U	0.0011 U	0.001 U	0.047 U	0.001 U	0.001 U					
Toluene		0.047 U	0.0037	0.0073	0.047 U	0.001 U	0.0089					
SVOCs (mg/kg)												
1,2 Dichlorobenzene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
1,3 Dichlorobenzene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
1,4 Dichlorobenzene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
2 Chlorophenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
2 Methylphenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
2,4 Dimethylphenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					

TABLE
SOIL DATA - PHASE I RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID: / Sample Depth: / Sample Date:	SWMU 15B-13b 6-8 ft 03/25/99	SWMU 15B-14a 0-2 ft 05/11/99	SWMU 15B-17a 0-2 ft 05/11/99	SWMU 15B-20a 0-2 ft 03/24/99	SWMU 15B-23c 6-8 ft 03/24/99	SWMU 15B-30d 8-10 ft 05/13/99	SWMU r15b1bss Surface 05/28/1999	SWMU r15b3dss Surface 05/28/1999	SWMU r15b7ass Surface 05/28/1999	SWMU r15b9bss Surface 05/28/1999	SWMU r15b10bss Surface 05/28/1999
2,4 Dinitrophenol		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 R					
2,4 Dinitrotoluene		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 U					
2,4,5 Trichlorophenol		0.27 U	0.0551 U	0.0546 U	0.29 U	0.27 U	0.0531 U					
2,4,6 Trichlorophenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
4 Nitrophenol		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 U					
4 Methylphenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
4,6 Dinitro 2 Methylphenol		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 R					
7,12 Dimethylbenz[a]anthracene		0.32 U	0.1653 U	0.1639 U	0.35 U	0.32 U	0.1593 U					
Aniline		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 U					
Anthracene		0.38	0.0551 U	0.0546 U	0.46	0.11 U	0.0531 U					
Benzo(a)anthracene		0.11 U	0.0766	0.0546 U	0.28	0.11 U	0.0531 U					
Benzo(a)pyrene		0.11 U	0.0551 U	0.0546 U	0.3	0.11 U	0.0531 U					
Benzo(b)fluoranthene		0.11 U	0.0551 U	0.0546 U	0.23	0.11 U	0.0531 U					
Benzo(k)fluoranthene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Bis(2 ethylhexyl)phthalate		0.38 B	0.2083 B	0.7377 B	0.64 B	0.37 B	1.0154 B					
Butyl benzyl phthalate		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Chrysene		0.11 U	0.0551 U	0.0546 U	0.45	0.11 U	0.0531 U					
Di n butyl phthalate		0.19 B	0.1769 B	0.1191 B	0.4 B	0.13 B	0.0876 B					
Di n octyl phthalate		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Dibenz(a,h)anthracene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Diethyl phthalate		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Dimethyl phthalate		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Fluoranthene		0.11 U	0.0551 U	0.0546 U	0.39	0.11 U	0.0531 U					
Indeno(1,2,3 cd)pyrene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Naphthalene		1.8	0.0551 U	0.0546 U	1.4	0.11 U	0.0531 U					
Nitrobenzene		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Phenanthrene		1.8	0.2596	0.0546 U	1.6	0.11 U	0.0531 U					
Phenol		0.11 U	0.0551 U	0.0546 U	0.12 U	0.11 U	0.0531 U					
Pyrene		0.3	0.081	0.0546 U	0.75	0.11 U	0.0531 U					
Pyridine		0.27 U	0.1378 U	0.1366 U	0.29 U	0.27 U	0.1328 U					

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

K - an associated QC sample had an outlier; the sample result may be biased high.

UL - reporting limit is biased low.

L - Result is estimated and potentially biased low due to a minor quality control anomaly.

Blank cells indicate constituent not analyzed.

TABLE
SOIL DATA - PHASE I RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID: / Sample Depth: / Sample Date:	SWMU r15b12dss Surface 05/28/1999	SWMU r15b14bss Surface 05/28/1999	SWMU r15b15dss Surface 05/28/1999	SWMU r15b18ass Surface 05/28/1999	SWMU r15b19cse Surface 05/28/1999	SWMU r15b20ass Surface 05/28/1999	SWMU r15b23cse Surface 05/28/1999	SWMU r15b25ces Surface 05/28/1999	SWMU r15b30ese Surface 05/28/1999	SWMU r15b31dss Surface 05/28/1999	SWMU r15b32ces Surface 05/28/1999
Inorganics (mg/kg)												
Antimony		8.31 UL	8.24 UL	7.9 UL	8.21 UL	7.72 UL	8.33 UL	8.11 UL	8.21 UL	7.9 UL	7.98 UL	7.9 UL
Arsenic		3.3	2.3	1.9	3.9	2.8	1.37 B	2.7	1.71	0.59 B	2.31	4.54
Barium		58.6	73.4	34.1	32.8	57.3	11.27 B	41.7	56.53	70.76	157.9	520.2
Beryllium		0.2 L	0.4 L	2.3 L	0.1 L	0.4 L	0.69 UL	0.2 L	0.53 L	1.33 L	4.75 L	5.72 L
Cadmium		0.69 UL	0.6 L	0.7 UL	0.68 UL	0.64 UL	0.69 UL	0.6 L	1.48 L	0.55 L	1.01 L	2.62 L
Chromium		19.0 L	16.2 L	11.1 L	13.2 L	13.3 L	4.36 L	12.2 L	26.06 L	25.88 L	50.31 L	92.69 L
Cyanide												
Cobalt		3.4 B	5.6 B	8.4	3.1 B	3.6 B	6.94 U	3.9 B	3.23 B	7.07	24.79	25.99
Lead		13.6 K	10.4 K	205.4 K	24.9 K	38.8 K	62.69 K	16.8 K	89.55 K	77.25 K	242.5 K	194.5 K
Mercury		0.027	0.027 U	0.03 U	0.027 U	0.027 U	0.03	0.0 U	0.05	0.03	0.044	0.063
Nickel		10.0 L	11.2 L	66.7 L	10.2 L	9.5 L	2.73 L	18.2 L	25.77 L	40.19 L	124.0 L	87.0 L
Selenium		0.7 U	0.65 U	0.7 U	0.65 U	0.66 U	0.69 U	0.7 U	0.65 U	0.66 U	0.39 J	0.42 J
Silver		0.6 B	1.37 U	0.6 B	1.37 U	1.29 U	1.39 U	0.6 B	1.37 U	1.32 U	0.82 B	1.87
Tetraethyl Lead		0.178 U	0.17 U	0.168 U	0.169 U	0.167 U	0.167 U	0.168 U	1.67 R	0.165 U	1.65 R	0.164 U
Vanadium		28.2	26.0	10.6	40.9	26.7	12.4	21.9	48.7	60.5	66.0	85.7
Zinc		37.3	98.2	871.3	26.2	86.8	9.3	44.5	473.6	627.7	2084.3	1485.6
VOCs (mg/kg)												
1,1,1 Trichloroethane												
1,2 Dichloroethane												
1,2 Dichloropropane												
1,4 Dioxane												
2 Butanone												
Benzene												
Carbon Disulfide												
Chlorobenzene												
Chloroform												
Ethylbenzene												
Ethylene Dibromide												
1,2-Dichloroethane												
m&p Xylene												
o Xylene												
Styrene												
Methyl tert-butyl ether												
Tetrachloroethene												
Toluene												
SVOCs (mg/kg)												
1,2 Dichlorobenzene												
1,3 Dichlorobenzene												
1,4 Dichlorobenzene												
2 Chlorophenol												
2 Methylphenol												
2,4 Dimethylphenol												

TABLE
SOIL DATA - PHASE I RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID: / Sample Depth: / Sample Date:	SWMU r15b12dss Surface 05/28/1999	SWMU r15b14bss Surface 05/28/1999	SWMU r15b15dss Surface 05/28/1999	SWMU r15b18ass Surface 05/28/1999	SWMU r15b19css Surface 05/28/1999	SWMU r15b20ass Surface 05/28/1999	SWMU r15b23css Surface 05/28/1999	SWMU r15b25css Surface 05/28/1999	SWMU r16b30ass Surface 05/28/1999	SWMU r15b31dss Surface 05/28/1999	SWMU r15b32css Surface 05/28/1999
2,4 Dinitrophenol												
2,4 Dinitrotoluene												
2,4,5 Trichlorophenol												
2,4,6 Trichlorophenol												
4 Nitrophenol												
4 Methylphenol												
4,6 Dinitro 2 Methylphenol												
7,12 Dimethylbenz[a]anthracene												
Aniline												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Bis(2 ethylhexyl)phthalate												
Butyl benzyl phthalate												
Chrysene												
Di n butyl phthalate												
Di n octyl phthalate												
Dibenz(a,h)anthracene												
Diethyl phthalate												
Dimethyl phthalate												
Fluoranthene												
Indeno(1,2,3 cd)pyrene												
Naphthalene												
Nitrobenzene												
Phenanthrene												
Phenol												
Pyrene												
Pyridine												

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

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UL - reporting limit is biased low.

L - Result is estimated and potentially biased low due to a minor quality control anomaly.

Blank cells indicate constituent not analyzed.

TABLE A-17
SOIL DATA - PHASE II RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S15-SB13B-SO-14-16 11/16/07 14-16 ft		S15-SB14A-SO-14-16 11/16/07 14-16 ft		S15-SB20-SO-14-16 11/12/07 14-16 ft		S15-SB20A-SO-14-16 11/13/07 14-16 ft		S15-SB26-SO-14-16 11/14/07 14-16 ft		S15-SB27-SO-14-16 11/14/07 14-16 ft		S15-SB42-SO-0-2 11/14/07 0-2 ft		S15-SB42-SO-6-8 11/14/07 6-8 ft		S15-SB42-SO-14-16 11/14/07 14-16 ft		S15-SB43-SO-0-2 11/14/07 0-2 ft		S15-SB43-SO-6-8 11/14/07 6-8 ft		S15-SB43-SO-14-16 11/14/07 14-16 ft		S15-SB44-SO-0-2 11/14/07 0-2 ft		S15-SB44-SO-6-8 11/14/07 6-8 ft		S15-SB44-SO-14-16 11/14/07 14-16 ft		S15-SB45-SO-0-2 11/13/07 0-2 ft		S15-SB45-SO-6-8 11/13/07 6-8 ft	
Metals (mg/kg)																																
Antimony	10.5	U	11.8	U	10.2	U	10.8	U	10.7	U	10.7	U	10.3	U	11.3	U	10.5	U	10.7	U	10.4	U	11	U	10.7	U	10.8	U	10.8	U	10.9	U	10.7	U
Arsenic					1.02	U	1.23																											
SVOCs (mg/kg)																																		
1,2-Dichlorobenzene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
1,3-Dichlorobenzene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
1,4-Dichlorobenzene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
2,4,5-Trichlorophenol	0.906	U	0.958	U	0.883	U	0.909	U	0.905	U	0.884	U	0.887	U	0.967	U	0.882	U	0.898	U	0.866	U	0.901	U	0.87	U	0.903	U	0.895	U	0.902	U	0.893	U
2,4,6-Trichlorophenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
2,4-Dimethylphenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
2,4-Dinitrophenol	0.906	U	0.958	U	0.883	U	0.909	U	0.905	U	0.884	U	0.887	U	0.967	U	0.882	U	0.898	U	0.866	U	0.901	U	0.87	U	0.903	U	0.895	U	0.902	U	0.893	U
2,4-Dinitrotoluene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
2-Chlorophenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
2-Methylphenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
3/4-Methylphenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
4,6-Dinitro-2-methylphenol	0.906	U	0.958	U	0.883	U	0.909	U	0.905	U	0.884	U	0.887	U	0.967	U	0.882	U	0.898	U	0.866	U	0.901	U	0.87	U	0.903	U	0.895	U	0.902	U	0.893	U
4-Nitrophenol	0.906	U	0.958	U	0.883	U	0.909	U	0.905	U	0.884	U	0.887	U	0.967	U	0.882	U	0.898	U	0.866	U	0.901	U	0.87	U	0.903	U	0.895	U	0.902	U	0.893	U
7,12-Dimethylbenz(a)anthracene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Aniline	1.82	U	1.92	U	1.77	U	1.82	U	1.81	U	1.77	U	1.78	R	1.94	U	1.77	U	1.8	U	1.74	U	1.81	U	1.75	U	1.81	U	1.79	U	1.81	U	1.79	U
Anthracene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Benzo(a)anthracene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Benzo(a)pyrene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Benzo(b)fluoranthene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Benzo(k)fluoranthene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Bis(2-ethylhexyl)phthalate	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Butyl benzyl phthalate	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Chrysene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Dibenz(a,h)anthracene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Diethyl phthalate	0.362	UJ	0.383	UJ	0.353	UJ	0.363	UJ	0.362	U	0.353	UJ	0.355	U	0.387	U	0.353	U	0.359	UJ	0.346	UJ	0.36	UJ	0.348	U	0.361	U	0.358	U	0.361	UJ	0.357	UJ
Dimethyl phthalate	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Di-n-butyl phthalate	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Di-n-octyl phthalate	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Fluoranthene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Indeno(1,2,3-cd)pyrene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Naphthalene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Nitrobenzene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Phenanthrene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Phenol	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	R	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Pyrene	0.362	U	0.383	U	0.353	U	0.363	U	0.362	U	0.353	U	0.355	U	0.387	U	0.353	U	0.359	U	0.346	U	0.36	U	0.348	U	0.361	U	0.358	U	0.361	U	0.357	U
Pyridine	0.726	U	0.767	U	0.707	U	0.728	U	0.725	U	0.708	U	0.71	U	0.774	U	0.706	U	0.719	U	0.693	U	0.722	U	0.697	U	0.723	U	0.717	U	0.723	U	0.715	U
VOCs (mg/kg)																																
1,1,1-Trichloroethane	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
1,2-Dibromoethane (EDB)	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
1,2-Dichloroethane	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	UJ	0.00231	U	0.0026	U	0.00208	U	0.00236	UJ	0.0022	UJ	0.00211	UJ	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
1,2-Dichloropropane	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
1,4-Dioxane	0.225	U	0.236	U	0.23	U	0.214	U	0.234	U	0.221	UJ	0.231	U	0.26	U	0.208	U	0.236	UJ	0.22	UJ	0.211	UJ	0.241	U	0.243	U	0.212	U	0.214	U	0.25	U
2-Butanone	0.0563	U	0.0591	U	0.0576	U	0.0536	U	0.0585	U	0.0554	U	0.0174	J	0.0651	U	0.052	U	0.059	U	0.055	U	0.0528	U	0.0603	U	0.0608	U	0.0531	U	0.0535	U	0.0624	U
Benzene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Carbon disulfide	0.00563	U	0.00591	U	0.00576	U	0.00536	U	0.00585	U	0.00554	U	0.00578	U	0.00651	U	0.0052	U	0.0059	U	0.0055	U	0.00528	U	0.00603	U	0.00608	U	0.00531	U	0.00535	U	0.00624	U
Chlorobenzene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Chloroform	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Ethylbenzene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
m,p-Xylene	0.00338	U	0.00355	U	0.00346	U	0.00321	U	0.00351	U	0.00332	U	0.00347	U	0.0039	U	0.00312	U	0.00354	U	0.0033	U	0.00317	U	0.00362	U	0.00365	U	0.00318	U	0.00321	U	0.00375	U
Methyl tert-Butyl ether	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
o-Xylene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Styrene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Tetrachloroethene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.0026	U	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Toluene	0.00225	U	0.00236	U	0.0023	U	0.00214	U	0.00234	U	0.00221	U	0.00231	U	0.00199	J	0.00208	U	0.00236	U	0.0022	U	0.00211	U	0.00241	U	0.00243	U	0.00212	U	0.00214	U	0.0025	U
Wet Chemistry																																
% Dry Solids	90.6		85.6		93.1		90.8		9.6		93.1		93		85.2		92		91.7		93.7		91.3		92.7		91.8		91.1		90.7		93.1	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
R - Value rejected, not included in screening.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-17
SOIL DATA - PHASE II RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S15-SB45-SO-14-16 11/13/07 14-16 ft	S15-SB46-SO-0-2 11/13/07 0-2 ft	S15-SB46-SO-6-8 11/13/07 6-8 ft	S15-SB46-SO-14-16 11/13/07 14-16 ft	S15-SB47-SO-0-2 11/14/07 0-2 ft	S15-SB47-SO-6-8 11/14/07 6-8 ft	S15-SB47-SO-14-16 11/14/07 14-16 ft	S15-SB48-SO-0-2 11/08/07 0-2 ft	S15-SB48-SO-6-8 11/08/07 6-8 ft	S15-SB48-SO-14-16 11/08/07 14-16 ft	S15-SB49-SO-0-2 11/12/07 0-2 ft	S15-SB49-SO-6-8 11/12/07 6-8 ft	S15-SB49-SO-14-16 11/12/07 14-16 ft	S15-SB50-SO-0-2 11/12/07 0-2 ft	S15-SB50-SO-6-8 11/12/07 6-8 ft	S15-SB50-SO-14-16 11/12/07 14-16 ft
Metals (mg/kg)																
Antimony	10.5 U	10.6 U	10.8 U	10.6 U	10.3 U	10.6 U	10.9 U	10.6 U	11.1 U	10.4 U	10.6 U	11.2 U	12 U	11.1 U	11.6 U	11.9 U
Arsenic								3.69	3.52	0.933	1.06 U	3.55	16.8	2.27	4.68	5.36
SVOCs (mg/kg)																
1,2-Dichlorobenzene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
1,3-Dichlorobenzene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
1,4-Dichlorobenzene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
2,4,5-Trichlorophenol	0.856 U	0.905 U	0.902 U	0.879 U	0.887 U	0.892 U	0.884 U	0.878 U	0.904 U	0.886 U	0.892 U	1.14 U	1.19 U	0.913 U	0.988 U	0.992 U
2,4,6-Trichlorophenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
2,4-Dimethylphenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
2,4-Dinitrophenol	0.856 U	0.905 U	0.902 U	0.879 U	0.887 U	0.892 U	0.884 U	0.878 U	0.904 U	0.886 U	0.892 U	1.14 U	1.19 U	0.913 U	0.988 U	0.992 U
2,4-Dinitrotoluene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
2-Chlorophenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
2-Methylphenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
3/4-Methylphenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
4,6-Dinitro-2-methylphenol	0.856 U	0.905 U	0.902 U	0.879 U	0.887 U	0.892 U	0.884 U	0.878 U	0.904 U	0.886 U	0.892 U	1.14 U	1.19 U	0.913 U	0.988 U	0.992 U
4-Nitrophenol	0.856 U	0.905 U	0.902 U	0.879 U	0.887 U	0.892 U	0.884 U	0.878 U	0.904 U	0.886 U	0.892 U	1.14 U	1.19 U	0.913 U	0.988 U	0.992 U
7,12-Dimethylbenz(a)anthracene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Aniline	1.72 U	1.81 U	1.81 U	1.76 U	1.78 U	1.79 U	1.77 U	1.76 U	1.81 U	1.78 U	1.79 U	2.29 UJ	2.38 UJ	1.83 U	1.98 U	1.99 U
Anthracene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Benzo(a)anthracene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Benzo(a)pyrene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Benzo(b)fluoranthene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Benzo(k)fluoranthene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Bis(2-ethylhexyl)phthalate	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Butyl benzyl phthalate	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Chrysene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Dibenz(a,h)anthracene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Diethyl phthalate	0.342 UJ	0.362 UJ	0.361 UJ	0.351 UJ	0.355 UJ	0.357 UJ	0.353 UJ	0.351 UJ	0.361 UJ	0.354 UJ	0.357 UJ	0.456 U	0.475 U	0.365 UJ	0.395 UJ	0.397 UJ
Dimethyl phthalate	0.342 U	0.229 J	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Di-n-butyl phthalate	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Di-n-octyl phthalate	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Fluoranthene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Indeno(1,2,3-cd)pyrene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Naphthalene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Nitrobenzene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Phenanthrene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Phenol	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Pyrene	0.342 U	0.362 U	0.361 U	0.351 U	0.355 U	0.357 U	0.353 U	0.351 U	0.361 U	0.354 U	0.357 U	0.456 U	0.475 U	0.365 U	0.395 U	0.397 U
Pyridine	0.685 U	0.725 U	0.722 U	0.704 U	0.71 U	0.715 U	0.708 U	0.703 U	0.724 U	0.709 U	0.714 U	0.913 U	0.952 U	0.731 U	0.791 U	0.794 U
VOCs (mg/kg)																
1,1,1-Trichloroethane	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
1,2-Dibromoethane (EDB)	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
1,2-Dichloroethane	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 UJ	0.00248 UJ	0.00252 UJ	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
1,2-Dichloropropane	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
1,4-Dioxane	0.213 U	0.239 U	0.21 U	0.214 U	0.222 UJ	0.248 UJ	0.252 UJ	0.215 U	0.225 U	0.243 U	0.206 U	0.213 U	0.241 U	0.211 U	0.233 U	0.221 U
2-Butanone	0.0533 U	0.0597 U	0.0526 U	0.0536 U	0.0554 U	0.0619 U	0.063 U	0.0538 U	0.0561 U	0.0607 U	0.0516 U	0.0532 U	0.0603 U	0.0527 U	0.0582 U	0.0553 U
Benzene	0.00213 U	0.00239 U	0.00124 J	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Carbon disulfide	0.00533 U	0.00597 U	0.00526 U	0.00536 U	0.00554 U	0.00619 U	0.0063 U	0.00538 U	0.00561 U	0.00607 U	0.00516 U	0.00532 U	0.00603 U	0.00527 U	0.00582 U	0.00553 U
Chlorobenzene	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Chloroform	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Ethylbenzene	0.00213 U	0.00239 U	0.0335 J	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
m,p-Xylene	0.0032 U	0.00358 U	0.00316 U	0.00321 U	0.00332 U	0.00371 U	0.00378 U	0.00323 U	0.00337 U	0.00364 U	0.0031 U	0.00319 U	0.00362 U	0.00316 U	0.00349 U	0.00332 U
Methyl tert-Butyl ether	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
o-Xylene	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Styrene	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Tetrachloroethene	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00215 U	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Toluene	0.00213 U	0.00239 U	0.0021 U	0.00214 U	0.00222 U	0.00248 U	0.00252 U	0.00098 J	0.00225 U	0.00243 U	0.00206 U	0.00213 U	0.00241 U	0.00211 U	0.00233 U	0.00221 U
Wet Chemistry																
% Dry Solids	94.5	90.1	90	92.8	93.8	92.2	91.9	92.9	90.9	92.4	93	85.7	82.4	89.2	83.5	81.8

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit.
Concentration is estimated.
R - Value rejected, not included in screening.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-17
SOIL DATA - PHASE II RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S15-SB51-SO-0-2 11/19/07 0-2 ft	S15-SB51-SO-6-8 11/19/07 6-8 ft	S15-SB51-SO-14-16 11/19/07 14-16 ft	S15B52-SO-0-2 11/20/07 0-2 ft	S15B52-SO-6-8 11/20/07 6-8 ft	S15B52-SO-14-16 11/20/07 14-16 ft	S15-SB53-SO-0-2 11/19/07 0-2 ft	S15-SB53-SO-6-8 11/19/07 6-8 ft	S15-SB53-SO-14-16 11/19/07 14-16 ft	S15-SB54-SO-0-2 11/16/07 0-2 ft	S15-SB54-SO-6-8 11/16/07 6-8 ft	S15-SB54-SO-14-16 11/16/07 14-16 ft	S15-SB55-SO-0-2 11/15/07 0-2 ft	S15-SB55-SO-6-8 11/15/07 6-8 ft	S15-SB55-SO-14-16 11/15/07 14-16 ft	S15-SB56-SO-0-2 11/16/07 0-2 ft	S15-SB56-SO-6-8 11/16/07 6-8 ft	S15-SB56-SO-14-16 11/16/07 14-16 ft
Metals (mg/kg)																		
Antimony	11.1 U	10.5 U	11.4 U	10.9 U	10.9 U	11.2 U	10.4 U	10.8 U	11.1 U	11.9 U	10.7 U	12.2 U	10.6 U	11.1 U	11.7 U	10.6 U	10.8 U	11.9 U
Arsenic																		
SVOCs (mg/kg)																		
1,2-Dichlorobenzene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
1,3-Dichlorobenzene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
1,4-Dichlorobenzene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
2,4,5-Trichlorophenol	0.913 U	0.89 U	0.924 U	0.885 U	0.891 U	0.944 U	0.888 U	0.903 U	0.928 U	0.982 U	0.892 U	1.03 U	0.86 U	0.901 U	0.949 U	0.891 U	0.897 U	0.972 U
2,4,6-Trichlorophenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
2,4-Dimethylphenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
2,4-Dinitrophenol	0.913 U	0.89 U	0.924 U	0.885 U	0.891 U	0.944 U	0.888 U	0.903 U	0.928 U	0.982 U	0.892 U	1.03 U	0.86 U	0.901 U	0.949 U	0.891 U	0.897 U	0.972 U
2,4-Dinitrotoluene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
2-Chlorophenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
2-Methylphenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
3/4-Methylphenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
4,6-Dinitro-2-methylphenol	0.913 U	0.89 U	0.924 U	0.885 U	0.891 U	0.944 U	0.888 U	0.903 U	0.928 U	0.982 U	0.892 U	1.03 U	0.86 U	0.901 U	0.949 U	0.891 U	0.897 U	0.972 U
4-Nitrophenol	0.913 U	0.89 U	0.924 U	0.885 U	0.891 U	0.944 U	0.888 U	0.903 U	0.928 U	0.982 U	0.892 U	1.03 U	0.86 U	0.901 U	0.949 U	0.891 U	0.897 U	0.972 U
7,12-Dimethylbenz(a)anthracene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Aniline	1.83 U	1.78 U	1.85 U	1.77 U	1.79 U	1.89 U	1.78 U	1.81 U	1.86 U	1.97 U	1.79 U	2.07 U	1.72 U	1.81 U	1.9 U	1.79 U	1.8 U	1.95 U
Anthracene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Benzo(a)anthracene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Benzo(a)pyrene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Benzo(b)fluoranthene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Benzo(k)fluoranthene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Bis(2-ethylhexyl)phthalate	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.146 B	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Butyl benzyl phthalate	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Chrysene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Dibenz(a,h)anthracene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Diethyl phthalate	0.365 UJ	0.356 UJ	0.369 UJ	0.354 UJ	0.356 UJ	0.377 UJ	0.355 UJ	0.361 UJ	0.371 UJ	0.393 UJ	0.357 UJ	0.412 UJ	0.0699 B	0.36 UJ	0.379 UJ	0.356 UJ	0.358 UJ	0.389 UJ
Dimethyl phthalate	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Di-n-butyl phthalate	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Di-n-octyl phthalate	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Fluoranthene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Indeno(1,2,3-cd)pyrene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Naphthalene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Nitrobenzene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Phenanthrene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Phenol	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Pyrene	0.365 U	0.356 U	0.369 U	0.354 U	0.356 U	0.377 U	0.355 U	0.361 U	0.371 U	0.393 U	0.357 U	0.412 U	0.344 U	0.36 U	0.379 U	0.356 U	0.358 U	0.389 U
Pyridine	0.731 U	0.712 U	0.74 U	0.709 U	0.714 U	0.756 U	0.711 U	0.723 U	0.743 U	0.786 U	0.714 U	0.825 U	0.689 U	0.721 U	0.76 U	0.713 U	0.718 U	0.778 U
VOCs (mg/kg)																		
1,1,1-Trichloroethane	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 UJ	0.00218 UJ	0.00254 UJ	0.00262 U	0.00254 U	0.00214 U
1,2-Dibromoethane (EDB)	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
1,2-Dichloroethane	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 UJ	0.00218 UJ	0.00254 UJ	0.00262 U	0.00254 U	0.00214 U
1,2-Dichloropropane	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
1,4-Dioxane	0.216 U	0.231 U	0.239 U	0.209 U	0.232 U	0.221 U	0.216 U	0.241 U	0.215 U	0.273 U	0.233 U	0.228 U	0.223 U	0.218 U	0.254 U	0.262 U	0.254 U	0.214 U
2-Butanone	0.0539 U	0.0576 U	0.0599 U	0.0522 U	0.0579 U	0.0553 U	0.0541 U	0.0601 U	0.0537 U	0.0681 U	0.0583 U	0.057 U	0.0558 U	0.0545 U	0.0636 U	0.0655 U	0.0635 U	0.0536 U
Benzene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Carbon disulfide	0.00539 U	0.00576 U	0.00599 U	0.00522 U	0.00579 U	0.00553 U	0.00541 U	0.00601 U	0.00537 U	0.00681 U	0.00583 U	0.0057 U	0.00558 U	0.00545 U	0.00636 U	0.00655 U	0.00635 U	0.00536 U
Chlorobenzene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Chloroform	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Ethylbenzene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00114 J	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
m,p-Xylene	0.00324 U	0.00346 U	0.00359 U	0.00313 U	0.00348 U	0.00332 U	0.00324 U	0.00361 U	0.00322 U	0.00409 U	0.0035 U	0.00342 U	0.00335 U	0.00327 U	0.00381 U	0.00393 U	0.00381 U	0.00321 U
Methyl tert-Butyl ether	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
o-Xylene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Styrene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Tetrachloroethene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Toluene	0.00216 U	0.00231 U	0.00239 U	0.00209 U	0.00232 U	0.00221 U	0.00216 U	0.00241 U	0.00215 U	0.00273 U	0.00233 U	0.00228 U	0.00223 U	0.00218 U	0.00254 U	0.00262 U	0.00254 U	0.00214 U
Wet Chemistry																		
% Dry Solids	90.7	91.7	88.3	91.9	92.2	87	91.2	89.4	89.5	83.2	91.4	78.5	93.9	89.7	85.3	92.4	91.1	83.8

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit.
Concentration is estimated.
R - Value rejected, not included in screening.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-17
SOIL DATA - PHASE II RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S15-SB57-SO-0-2 11/13/07 0-2 ft	S15-SB57-SO-6-8 11/13/07 6-8 ft	S15-SB57-SO-14-16 11/13/07 14-16 ft	S15-SB58-SO-0-2 11/13/07 0-2 ft	S15-SB58-SO-6-8 11/13/07 6-8 ft	S15-SB58-SO-14-16 11/13/07 14-16 ft	S15-SB59-SO-0-2 11/13/07 0-2 ft	S15-SB59-SO-6-8 11/13/07 6-8 ft	S15-SB59-SO-14-16 11/13/07 14-16 ft	S15-SB34-SO-0-2 11/07/07 0-2 ft	S15-SB34-SO-6-8 11/07/07 6-8 ft	S15-SB34-SO-14-16 11/07/07 14-16 ft	S15-SB32-SO-14-16 11/07/07 14-16 ft	S15-SB35-SO-0-2 11/07/07 0-2 ft	S15-SB35-SO-6-8 11/07/07 6-8 ft	S15-SB35-SO-14-16 11/07/07 14-16 ft	S15-SB36-SO-6-8 11/07/07 6-8 ft	S15-SB36-SO-14-16 11/07/07 14-16 ft
Metals (mg/kg)																		
Antimony	10.7 U	11.2 U	10.8 U	3.44 J	11.5 U	10.5 U	11 U	11.2 U	10.2 U	11 U	10.4 U	10.3 U	10.5 U	2.26 J	10.3 U	10.1 U	11.2 U	10.6 U
Arsenic	2.16	5.27	1.08 U	2.66	5.0	1.05 U	3.35	5.74	1.02 U									
SVOCs (mg/kg)																		
1,2-Dichlorobenzene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
1,3-Dichlorobenzene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
1,4-Dichlorobenzene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
2,4,5-Trichlorophenol	0.886 U	0.951 U	0.892 U	0.902 U	0.972 U	0.895 U	0.894 U	0.944 U	0.864 U	0.908 U	0.849 U	0.86 U	0.881 U	0.899 U	0.885 U	0.882 U	0.921 U	0.882 U
2,4,6-Trichlorophenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
2,4-Dimethylphenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
2,4-Dinitrophenol	0.886 U	0.951 U	0.892 U	0.902 U	0.972 U	0.895 U	0.894 U	0.944 U	0.864 U	0.908 UJ	0.849 UJ	0.86 UJ	0.881 UJ	0.899 UJ	0.885 UJ	0.882 UJ	0.921 UJ	0.882 UJ
2,4-Dinitrotoluene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
2-Chlorophenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
2-Methylphenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
3/4-Methylphenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
4,6-Dinitro-2-methylphenol	0.886 U	0.951 U	0.892 U	0.902 U	0.972 U	0.895 U	0.894 U	0.944 U	0.864 U	0.908 U	0.849 U	0.86 U	0.881 U	0.899 U	0.885 U	0.882 U	0.921 U	0.882 U
4-Nitrophenol	0.886 U	0.951 U	0.892 U	0.902 U	0.972 U	0.895 U	0.894 U	0.944 U	0.864 U	0.908 U	0.849 U	0.86 U	0.881 U	0.899 U	0.885 U	0.882 U	0.921 U	0.882 U
7,12-Dimethylbenz(a)anthracene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Aniline	1.78 U	1.91 U	1.79 U	1.81 U	1.95 U	1.79 U	1.79 U	1.89 U	1.73 U	1.82 UJ	1.7 UJ	1.72 UJ	1.77 UJ	1.8 UJ	1.78 UJ	1.77 UJ	1.85 UJ	1.77 UJ
Anthracene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Benzo(a)anthracene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.0723 J	0.354 U	0.352 U	0.368 U	0.352 U
Benzo(a)pyrene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.082 J	0.354 U	0.352 U	0.368 U	0.352 U
Benzo(b)fluoranthene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.157 J	0.354 U	0.352 U	0.368 U	0.352 U
Benzo(k)fluoranthene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.0925 J	0.354 U	0.352 U	0.368 U	0.352 U
Bis(2-ethylhexyl)phthalate	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Butyl benzyl phthalate	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Chrysene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.0813 J	0.354 U	0.352 U	0.368 U	0.352 U
Dibenz(a,h)anthracene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Diethyl phthalate	0.354 UJ	0.38 UJ	0.357 UJ	0.361 UJ	0.0899 B	0.0738 B	0.357 UJ	0.377 UJ	0.345 UJ	0.363 UJ	0.339 UJ	0.344 UJ	0.352 UJ	0.359 UJ	0.354 UJ	0.352 UJ	0.368 UJ	0.352 UJ
Dimethyl phthalate	0.354 U	0.38 U	0.357 U	0.214 J	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Di-n-butyl phthalate	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Di-n-octyl phthalate	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Fluoranthene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.138 J	0.354 U	0.352 U	0.368 U	0.352 U
Indeno(1,2,3-cd)pyrene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.118 J	0.354 U	0.352 U	0.368 U	0.352 U
Naphthalene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Nitrobenzene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Phenanthrene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Phenol	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.359 U	0.354 U	0.352 U	0.368 U	0.352 U
Pyrene	0.354 U	0.38 U	0.357 U	0.361 U	0.389 U	0.358 U	0.357 U	0.377 U	0.345 U	0.363 U	0.339 U	0.344 U	0.352 U	0.112 J	0.354 U	0.352 U	0.368 U	0.352 U
Pyridine	0.71 U	0.761 U	0.714 U	0.722 U	0.779 U	0.716 U	0.716 U	0.756 U	0.692 U	0.727 U	0.68 U	0.689 U	0.706 U	0.72 U	0.709 U	0.706 U	0.738 U	0.706 U
VOCs (mg/kg)																		
1,1,1-Trichloroethane	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.00252	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
1,2-Dibromoethane (EDB)	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
1,2-Dichloroethane	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
1,2-Dichloropropane	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
1,4-Dioxane	0.238 U	0.204 U	0.217 U	0.193 U	0.236 U	0.215 U	0.216 U	0.21 U	0.214 U	0.208 U	0.24 U	0.223 U	0.212 U	0.203 U	0.218 U	0.216 U	0.239 U	0.221 U
2-Butanone	0.0596 U	0.0509 U	0.0542 U	0.0482 U	0.059 U	0.0538 U	0.0541 U	0.0525 U	0.0535 U	0.0558 U	0.052 U	0.0517 U	0.0559 U	0.0516 U	0.0516 U	0.057 U	0.0551 U	0.0519 U
Benzene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.000904 J	0.00218 U	0.00216 U	0.00239 U	0.00221 U
Carbon disulfide	0.00596 U	0.00509 U	0.00542 U	0.00482 U	0.0059 U	0.00538 U	0.00541 U	0.00525 U	0.00535 U	0.00519 U	0.00599 U	0.00556 U	0.00531 U	0.00578	0.00545 U	0.00541 U	0.00598 U	0.00552 U
Chlorobenzene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
Chloroform	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
Ethylbenzene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00284	0.00216 U	0.00239 U	0.00221 U
m,p-Xylene	0.00358 U	0.00305 U	0.00325 U	0.00289 U	0.00354 U	0.00323 U	0.00325 U	0.00315 U	0.00321 U	0.00312 U	0.00359 U	0.00334 U	0.00319 U	0.00261 J	0.0056	0.00324 U	0.00359 U	0.00331 U
Methyl tert-Butyl ether	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
o-Xylene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00175 J	0.00216 U	0.00239 U	0.00221 U
Styrene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
Tetrachloroethene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.0021 U	0.00214 U	0.00208 U	0.0024 U	0.00223 U	0.00212 U	0.00203 U	0.00218 U	0.00216 U	0.00239 U	0.00221 U
Toluene	0.00238 U	0.00204 U	0.00217 U	0.00193 U	0.00236 U	0.00215 U	0.00216 U	0.00148 J	0.00214 U	0.00223 U	0.00208 U	0.00207 U	0.00224 U	0.000908 J	0.00862	0.00228 U	0.0022 U	0.00207 U
Wet Chemistry																		
% Dry Solids	92	87.1	92.1	90.6	85.4	91.1	91.5	87	94.9	89.5	95.1	94.8	93.2	92	92.3	94.2	88.8	93.6

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit.
Concentration is estimated.
R - Value rejected, not included in screening.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-17
SOIL DATA - PHASE II RI
TANK BOTTOM WEATHERING AREAS - SWMU 15
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S15-SB36-SO-0-2 11/07/07 0-2 ft		S15-SB37-SO-0-2 11/27/07 0-2 ft		S15-SB37-SO-6-8 11/27/07 6-8 ft		S15-SB37-SO-14-16 11/27/07 14-16 ft		S15-SB38-SO-0-2 11/27/07 0-2 ft		S15-SB38-SO-6-8 11/27/07 6-8 ft		S15-SB38-SO-14-16 11/27/07 14-16 ft		S15-SB10-SO-14-16 11/27/07 14-16 ft		S15-SB39-SO-0-2 11/26/07 0-2 ft		S15-SB39-SO-6-8 11/26/07 6-8 ft		S15-SB39-SO-14-16 11/26/07 14-16 ft		S15-SB40-SO-0-2 11/26/07 0-2 ft		S15-SB40-SO-6-8 11/26/07 6-8 ft		S15-SB40-SO-14-16 11/26/07 14-16 ft		S15-SB7-SO-14-16 11/26/07 14-16 ft		S15-SB41-SO-6-8 11/26/07 6-8 ft		S15-SB41-SO-14-16 11/26/07 14-16 ft		S15-SB41-SO-0-2 11/26/07 0-2 ft	
Metals (mg/kg)																																		
Antimony	10.8	U	11.7	U	11.4	U	11.1	U	11.4	U	11.9	U	11.1	U	10.6	U	7.95	J	10.6	U	10.8	U	10.7	U	11.1	U	10.5	U	11.1	U	10.6	U	10.8	U	11	U
Arsenic																																				
SVOCs (mg/kg)																																				
1,2-Dichlorobenzene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
1,3-Dichlorobenzene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
1,4-Dichlorobenzene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
2,4,5-Trichlorophenol	0.884	U	0.977	U	0.954	U	0.899	U	0.973	U	0.995	U	0.919	U	0.875	U	0.892	U	0.86	U	0.891	U	0.866	U	0.907	U	0.89	U	0.923	U	0.896	U	0.903	U	0.905	U
2,4,6-Trichlorophenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
2,4-Dimethylphenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
2,4-Dinitrophenol	0.884	UJ	0.977	U	0.954	U	0.899	U	0.973	U	0.995	U	0.919	UJ	0.875	UJ	0.892	U	0.86	UJ	0.891	UJ	0.866	UJ	0.907	UJ	0.89	U	0.923	UJ	0.896	UJ	0.903	UJ	0.905	U
2,4-Dinitrotoluene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
2-Chlorophenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
2-Methylphenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
3/4-Methylphenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
4,6-Dinitro-2-methylphenol	0.884	U	0.977	U	0.954	U	0.899	U	0.973	U	0.995	U	0.919	UJ	0.875	UJ	0.892	U	0.86	UJ	0.891	UJ	0.866	UJ	0.907	UJ	0.89	U	0.923	UJ	0.896	UJ	0.903	UJ	0.905	U
4-Nitrophenol	0.884	U	0.977	U	0.954	U	0.899	U	0.973	U	0.995	U	0.919	U	0.875	U	0.892	U	0.86	U	0.891	U	0.866	U	0.907	U	0.89	U	0.923	U	0.896	U	0.903	U	0.905	U
7,12-Dimethylbenz(a)anthracene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Aniline	1.77	UJ	1.96	U	1.91	U	1.8	U	1.95	U	1.99	U	1.84	U	1.75	U	1.79	U	1.72	U	1.79	U	1.74	U	1.82	U	1.78	U	1.85	U	1.8	U	1.81	U	1.81	U
Anthracene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Benzo(a)anthracene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Benzo(a)pyrene	0.353	U	0.391	U	0.382	U	0.36	U	0.155	J	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Benzo(b)fluoranthene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Benzo(k)fluoranthene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Bis(2-ethylhexyl)phthalate	0.353	U	0.391	U	0.382	U	0.87		0.551		0.398	U	0.368	U	0.35	U	0.183	J	0.344	U	0.356	U	0.346	U	0.362	U	0.225	J	0.369	U	0.358	U	0.161	J	0.362	U
Butyl benzyl phthalate	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Chrysene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Dibenz(a,h)anthracene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Diethyl phthalate	0.353	UJ	0.391	UJ	0.382	UJ	0.36	UJ	0.389	UJ	0.398	UJ	0.368	UJ	0.35	UJ	0.356	UJ	0.344	UJ	0.356	UJ	0.346	UJ	0.362	UJ	0.356	UJ	0.369	UJ	0.358	UJ	0.361	UJ	0.362	UJ
Dimethyl phthalate	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Di-n-butyl phthalate	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Di-n-octyl phthalate	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Fluoranthene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Indeno(1,2,3-cd)pyrene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Naphthalene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Nitrobenzene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Phenanthrene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Phenol	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Pyrene	0.353	U	0.391	U	0.382	U	0.36	U	0.389	U	0.398	U	0.368	U	0.35	U	0.356	U	0.344	U	0.356	U	0.346	U	0.362	U	0.356	U	0.369	U	0.358	U	0.361	U	0.362	U
Pyridine	0.708	U	0.782	U	0.764	U	0.72	U	0.779	U	0.797	U	0.736	U	0.7	U	0.714	U	0.689	U	0.714	U	0.694	U	0.726	U	0.712	U	0.739	U	0.718	U	0.723	U	0.725	R
VOCs (mg/kg)																																		
1,1,1-Trichloroethane	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
1,2-Dibromoethane (EDB)	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
1,2-Dichloroethane	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
1,2-Dichloropropane	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
1,4-Dioxane	0.24	U	0.218	U	0.212	U	0.223	U	0.198	U	0.235	U	0.202	U	0.213	U	0.205	U	0.232	U	0.247	U	0.232	U	0.251	U	0.231	U	0.232	U	0.251	U	0.23	U	0.214	U
2-Butanone	0.0599	U	0.0117	J	0.0531	U	0.0557	U	0.0495	U	0.0587	U	0.0505	U	0.0533	U	0.00659	J	0.058	U	0.0617	U	0.0581	U	0.0629	U	0.0576	U	0.0581	U	0.0628	U	0.0576	U	0.0536	U
Benzene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00158	J	0.00251	U	0.0023	U	0.00214	U
Carbon disulfide	0.00599	U	0.00544	U	0.00531	U	0.00557	U	0.00495	U	0.00587	U	0.00505	U	0.00533	U	0.00513	U	0.0058	U	0.00617	U	0.00581	U	0.00629	U	0.00576	U	0.00581	U	0.00628	U	0.00576	U	0.00536	U
Chlorobenzene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Chloroform	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Ethylbenzene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00183	J	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.0018	J	0.00251	U	0.0023	U	0.00214	U
m,p-Xylene	0.0036	U	0.00327	U	0.00318	U	0.00334	U	0.00297	U	0.00352	U	0.00303	U	0.0032	U	0.00308	U	0.00263	J	0.00259	J	0.00413		0.00377	U	0.00346	U	0.00349	U	0.00377	U	0.00346	U	0.00322	U
Methyl tert-Butyl ether	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
o-Xylene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00102	J	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Styrene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Tetrachloroethene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00247	U	0.00232	U	0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Toluene	0.0024	U	0.00218	U	0.00212	U	0.00223	U	0.00198	U	0.00235	U	0.00202	U	0.00213	U	0.00205	U	0.00232	U	0.00123	J	0.0069		0.00251	U	0.00231	U	0.00232	U	0.00251	U	0.0023	U	0.00214	U
Wet Chemistry																																		
% Dry Solids	92.9		83.8		86.3		90.8		84.4		83.4		89.5		94		90.7		94.3		91.1		93.4		90.8		91.3		88.5		92.8		91.2		92	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit.
Concentration is estimated.
R - Value rejected, not included in screening.
UJ - Non-detect result (reporting limit) is estimated
due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE
SOIL DATA - VRS
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample ID Sample Depth	18B1 18B134647SO 0-2 ft		18B2 18B234647SO 2-4 ft		18B3 18B334649SO 0-2 ft	
VOCs (mg/kg)								
630-20-6	1,1,1,2-TETRACHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
71-55-6	1,1,1-TRICHLOROETHANE		0.0019	J	< 0.01	U	0.0024	J
79-34-5	1,1,2,2-TETRACHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
79-00-5	1,1,2-TRICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-34-3	1,1-DICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-35-4	1,1-DICHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	
96-18-4	1,2,3-TRICHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	
95-63-6	1,2,4-TRIMETHYLBENZENE		< 0.01	U	0.14		< 0.01	
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	
106-93-4	ETHYLENE DIBROMIDE		< 0.01	U	< 0.01	U	< 0.01	
95-50-1	1,2-DICHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	
107-06-2	1,2-DICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
78-87-5	1,2-DICHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	
108-67-8	1,3,5-TRIMETHYLBENZENE (MESITYLENE)		< 0.01	U	0.187		< 0.01	
541-73-1	1,3-DICHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	
106-46-7	1,4-DICHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	
123-91-1	1,4-DIOXANE		< 1	U	< 1	U	< 1	
95-49-8	2-CHLOROTOLUENE		< 0.01	U	< 0.01	U	< 0.01	
591-78-6	2-HEXANONE		< 0.1	U	< 0.1	U	< 0.1	
106-43-4	4-CHLOROTOLUENE		< 0.01	U	< 0.01	U	< 0.01	
67-64-1	ACETONE		0.088	JB	0.116	B	0.04	B
71-43-2	BENZENE		< 0.01	U	< 0.01	U	< 0.01	
74-97-5	BROMOCHLOROMETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-27-4	BROMODICHLOROMETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-25-2	BROMOFORM		< 0.01	U	< 0.01	U	< 0.01	
74-83-9	BROMOMETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-15-0	CARBON DISULFIDE		< 0.05	U	< 0.05	U	< 0.05	
56-23-5	CARBON TETRACHLORIDE		< 0.01	U	< 0.01	U	< 0.01	
108-90-7	CHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	
75-00-3	CHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	
67-66-3	CHLOROFORM		< 0.01	U	< 0.01	U	< 0.01	
74-87-3	CHLOROMETHANE		< 0.01	U	< 0.01	U	< 0.01	
156-59-2	CIS-1,2-DICHLOROETHYLENE		< 0.01	U	< 0.01	U	< 0.01	
10061-01-5	CIS-1,3-DICHLOROPROPENE		< 0.01	U	< 0.01	U	< 0.01	
124-48-1	DIBROMOCHLOROMETHANE		< 0.01	U	< 0.01	U	< 0.01	

TABLE
SOIL DATA - VRS
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample ID Sample Depth	18B1 18B134647SO 0-2 ft		18B2 18B234647SO 2-4 ft		18B3 18B334649SO 0-2 ft	
74-95-3	DIBROMOMETHANE		< 0.01	U	< 0.01	U	< 0.01	
75-71-8	DICHLORODIFLUOROMETHANE		< 0.01	U	< 0.01	U	< 0.01	
64-17-5	ETHANOL		< 0.5	U	< 0.5	U	< 0.5	
97-63-2	ETHYL METHACRYLATE		< 0.1	U	< 0.1	U	< 0.1	
100-41-4	ETHYLBENZENE		< 0.01	U	0.038		< 0.01	
98-82-8	ISOPROPYLBENZENE (CUMENE)		< 0.01	U	0.031		< 0.01	
78-93-3	2-BUTANONE		< 0.1	U	< 0.1	U	< 0.1	
108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)		< 0.1	U	< 0.1	U	< 0.1	
1634-04-4	METHYL TERT-BUTYL ETHER		< 0.05	U	< 0.05	U	< 0.05	
75-09-2	METHYLENE CHLORIDE		0.039	B	0.065	B	0.053	B
104-51-8	N-BUTYLBENZENE		< 0.01	U	0.215		< 0.01	
103-65-1	N-PROPYLBENZENE		< 0.01	U	0.153		< 0.01	
135-98-8	SEC-BUTYLBENZENE		< 0.01	U	0.17		< 0.01	
100-42-5	STYRENE		< 0.01	U	< 0.01	U	< 0.01	
98-06-6	T-BUTYLBENZENE		< 0.01	U	< 0.01	U	< 0.01	
127-18-4	TETRACHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	
108-88-3	TOLUENE		0.002	J	0.013		0.004	J
1330-20-7	TOTAL XYLENES		< 0.01	U	0.275		< 0.01	
156-60-5	TRANS-1,2-DICHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	
10061-02-6	TRANS-1,3-DICHLOROPROPENE		< 0.01	U	< 0.01	U	< 0.01	
79-01-6	TRICHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	
75-69-4	TRICHLOROFLUOROMETHANE		< 0.2	U	< 0.2	U	< 0.2	
108-05-4	VINYL ACETATE		< 0.1	U	< 0.1	U	< 0.1	
75-01-4	VINYL CHLORIDE		< 0.01	U	< 0.01	U	< 0.01	
PHCGRO	TPH GRO (GASOLINE RANGE)		2.93		54		< 0.5	
PHCDRO	TPH DRO (DIESEL RANGE)		10		1780		23	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
JB - Result is potentially biased high due to blank contamination; result is estimated.

TABLE A-19
SOIL DATA - PHASE I RI
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 18B-2c 6-8 ft 05/19/99		SWMU 18B-5 4-6 ft 06/10/99	
VOCs (mg/kg)					
1,1,1 Trichloroethane		0.007	U	0.0083	U
1,1,2 Trichloroethane		0.007	U	0.0083	U
1,1,2,2 Tetrachloroethane		0.007	U	0.0083	U
1,1 Dichloroethane		0.007	U	0.0083	U
1,1 Dichloroethene		0.007	U	0.0083	U
1,2 Dichloroethane		0.007	U	0.0083	U
1,2 Dichloropropane		0.007	U	0.0083	U
2 Butanone		0.007	U	0.0215	
2 Hexanone		0.007	U	0.0083	U
4 Methyl 2 pentanone		0.007	U	0.0083	U
Acetone		0.007	U	0.0308	
Benzene		0.0607		0.0029	J
Bromodichloromethane		0.007	U	0.0083	U
Bromoform		0.007	U	0.0083	U
Bromomethane		0.007	U	0.0083	U
Carbon Disulfide		0.007	U	0.0097	
Carbon Tetrachloride		0.007	U	0.0083	U
Chlorobenzene		0.007	U	0.0083	U
Chlorodibromomethane		0.007	U	0.0083	U
Chloroethane		0.007	U	0.0083	U
Chloroform		0.007	U	0.0083	U
Chloromethane		0.007	U	0.0083	U
cis 1,2 Dichloroethene		0.007	U	0.0083	U
cis 1,3 Dichloropropene		0.007	U	0.0083	U
Ethylbenzene		0.067		0.0564	
m&p Xylene		0.0703		0.1488	
o Xylene		0.4849		0.1438	
Methylene Chloride		0.007	U	0.0127	
Styrene		0.007	U	0.0083	U
Methyl tert-butyl ether		0.0423		0.0132	
Tetrachloroethene		0.007	U	0.0083	U
Toluene		0.0122		0.0431	
trans 1,2 Dichloroethene		0.007	U	0.0083	U
trans 1,3 Dichloropropene		0.007	U	0.0083	U
Trichloroethene		0.007	U	0.0083	U
Vinyl Chloride		0.007	U	0.0083	U

Notes:
mg/kg - micrograms per kilogram.
U - not detected above method detection limit.
J - estimated concentration. Compound was detected below the method detection limit.

TABLE A-20
SOIL DATA - PHASE II RI
FIRE TRAINING AREA - SWMU 18
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S18-SB10-SO-0-2	S18-SB10-SO-14-16	S18-SB10-SO-4-6	S18-SB6-SO-0-2	S18-SB6-SO-14-16	S18-SB6-SO-4-6	S18-SB7-SO-0-2	S18-SB7-SO-14-16	S18-SB7-SO-4-6	S18-SB8-SO-16.0	S18-SB8-SO-2.0	S18-SB8-SO-6.0	S18-SB9-SO-1.0	S18-SB9-SO-16.0	S18-SB9-SO-6.0
	10/30/07	10/30/07	10/30/07	10/30/07	10/30/07	10/30/07	10/30/07	10/30/07	10/30/07	10/29/07	10/29/07	10/29/07	10/29/07	10/29/07	10/29/07
	0-2 ft	14-16 ft	4-6 ft	0-2 ft	14-16 ft	4-6 ft	0-2 ft	14-16 ft	4-6 ft	16 ft	2 ft	6 ft	1.0 ft	16 ft	6 ft
SVOCs (mg/kg)															
1,2-Dichlorobenzene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
1,3-Dichlorobenzene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
1,4-Dichlorobenzene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
2,4,5-Trichlorophenol	0.807 U	0.832 U	0.825 U	0.811 U	0.824 U	0.813 U	0.82 U	0.812 U	0.832 U	0.827 U	0.821 U	0.818 U	0.824 U	0.808 U	0.807 U
2,4,6-Trichlorophenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
2,4-Dimethylphenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
2,4-Dinitrophenol	0.807 U	0.832 U	0.825 U	0.811 U	0.824 U	0.813 U	0.82 U	0.812 U	0.832 U	0.827 U	0.821 U	0.818 U	0.824 U	0.808 U	0.807 U
2,4-Dinitrotoluene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
2-Chlorophenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
2-Methylphenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
3/4-Methylphenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
4,6-Dinitro-2-methylphenol	0.807 U	0.832 U	0.825 U	0.811 U	0.824 U	0.813 U	0.82 U	0.812 U	0.832 U	0.827 U	0.821 U	0.818 U	0.824 U	0.808 U	0.807 U
4-Nitrophenol	0.807 U	0.832 U	0.825 U	0.811 U	0.824 U	0.813 U	0.82 U	0.812 U	0.832 U	0.827 U	0.821 U	0.818 U	0.824 U	0.808 U	0.807 U
7,12-Dimethylbenz(a)anthracene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Aniline	1.62 U	1.67 U	1.65 U	1.63 U	1.65 U	1.63 U	1.64 U	1.63 U	1.67 U	1.66 U	1.65 U	1.64 U	1.65 U	1.62 U	1.62 U
Anthracene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Benzo(a)anthracene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Benzo(a)pyrene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Benzo(b)fluoranthene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Benzo(k)fluoranthene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Bis(2-ethylhexyl)phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Butyl benzyl phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Chrysene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Dibenz(a,h)anthracene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Diethyl phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Dimethyl phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Di-n-butyl phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Di-n-octyl phthalate	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Fluoranthene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Indeno(1,2,3-cd)pyrene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Naphthalene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.87	0.328 U	0.325 U	6.43	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Nitrobenzene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Phenanthrene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Phenol	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Pyrene	0.323 U	0.332 U	0.33 U	0.324 U	0.329 U	0.325 U	0.328 U	0.325 U	0.333 U	0.331 U	0.328 U	0.327 U	0.329 U	0.323 U	0.323 U
Pyridine	0.646 U	0.666 U	0.661 U	0.65 U	0.66 U	0.651 U	0.656 U	0.651 U	0.666 U	0.662 U	0.658 U	0.655 U	0.66 U	0.647 U	0.646 U
VOCs (mg/kg)															
1,1,1-Trichloroethane	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
1,2-Dibromoethane (EDB)	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
1,2-Dichloroethane	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
1,2-Dichloropropane	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
1,4-Dioxane	0.191 U	0.206 U	0.202 U	0.179 U	0.191 U	0.203 U	0.192 U	0.188 U	0.179 U	0.228 U	0.162 U	0.202 U	0.179 U	0.172 U	0.188 U
2-Butanone	0.00498 J	0.0515 U	0.0506 U	0.0448 U	0.0478 U	0.0508 U	0.048 U	0.0469 U	0.0448 U	0.0571 U	0.0406 U	0.00727 J	0.0447 U	0.0429 U	0.0471 U
Benzene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Carbon disulfide	0.00477 U	0.00515 U	0.00506 U	0.00448 U	0.00478 U	0.00508 U	0.0048 U	0.00469 U	0.00448 U	0.00571 U	0.00406 U	0.00506 U	0.00447 U	0.00429 U	0.00471 U
Chlorobenzene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Chloroform	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Ethylbenzene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
m,p-Xylene	0.00286 U	0.00309 U	0.00304 U	0.00269 U	0.00287 U	0.00305 U	0.00288 U	0.00281 U	0.00269 U	0.00342 U	0.00244 U	0.00304 U	0.00268 U	0.00257 U	0.00282 U
Methyl tert-Butyl ether	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
o-Xylene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Styrene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Tetrachloroethene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Toluene	0.00191 U	0.00206 U	0.00202 U	0.00179 U	0.00191 U	0.00203 U	0.00192 U	0.00188 U	0.00179 U	0.00228 U	0.00162 U	0.00202 U	0.00179 U	0.00172 U	0.00188 U
Wet Chemistry															
Percent Solids	86.3 %	89.3 %	92.3 %	85.4 %	92.9 %	94.4 %	94 %	92 %	87 %	89.7 %	84.9 %	85.3 %	83.9 %	87.2 %	87.3 %

Notes:
mg/kg - micrograms per kilogram.
U - not detected above method detection limit.
J - estimated concentration. Compound was detected below the method detection limit.
UJ - Non-detect result (reporting limit) is estimated
due to a minor quality control anomaly.

TABLE A-21
SOIL DATA - VRS
WASTEWATER TREATMENT PLANT - SWMU 20a 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample ID Sample Depth	20aB1 20AB134645SO 2-4 ft		20aB2 20AB234655SO 1.5-2 ft		20aB3 20AB334655SO 1.5-2 ft	
Metals (mg/kg)								
7440-36-0	ANTIMONY		< 10	R	< 10	R	< 10	R
7440-38-2	ARSENIC		2.1	J	< 2	U	< 2	U
7440-39-3	BARIUM		32		21		35	
7440-43-9	CADMIUM		0.82		< 0.5	U	0.56	
7440-47-3	CHROMIUM, TOTAL		14	L	6.3		6.1	
57-12-5	CYANIDE		< 0.3	UL				
7439-92-1	LEAD		4.9		3.2		2.3	
7439-97-6	MERCURY		< 0.05	U	< 0.05	U	< 0.05	U
7440-02-0	NICKEL		7.2		3.3		3.9	
7782-49-2	SELENIUM		< 0.5	UL	< 0.5	UL	< 0.5	UL
7440-22-4	SILVER		< 1	U	< 1	U	< 1	U
VOCs (mg/kg)								
71-55-6	1,1,1-TRICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U
106-93-4	ETHYLENE DIBROMIDE		< 0.01	U	< 0.01	U	< 0.01	U
107-06-2	1,2-DICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U
78-87-5	1,2-DICHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	U
123-91-1	1,4-DIOXANE		< 1	U	< 1	U	< 1	U
71-43-2	BENZENE		< 0.01	U	< 0.01	U	< 0.01	U
75-15-0	CARBON DISULFIDE		< 0.05	U	< 0.05	U	< 0.05	U
108-90-7	CHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	U
67-66-3	CHLOROFORM		< 0.01	U	< 0.01	U	< 0.01	U
100-41-4	ETHYLBENZENE		0.0022	J	< 0.01	U	< 0.01	U
78-93-3	2-BUTANONE		< 0.1	U	< 0.1	U	< 0.1	U
100-42-5	STYRENE		< 0.01	U	< 0.01	U	< 0.01	U
127-18-4	TETRACHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	U
108-88-3	TOLUENE		0.012		< 0.01	U	< 0.01	U
1330-20-7	TOTAL XYLENES		0.015		< 0.01	U	< 0.01	U
SVOCs (mg/kg)								
95-50-1	1,2-DICHLOROBENZENE		< 0.33	U			< 0.33	U
541-73-1	1,3-DICHLOROBENZENE		< 0.33	U			< 0.33	U
106-46-7	1,4-DICHLOROBENZENE		< 0.33	U			< 0.33	U
95-95-4	2,4,5-TRICHLOROPHENOL		< 0.33	U			< 0.33	U
88-06-2	2,4,6-TRICHLOROPHENOL		< 0.33	U			< 0.33	U
105-67-9	2,4-DIMETHYLPHENOL		< 0.33	U			< 0.33	U
51-28-5	2,4-DINITROPHENOL		< 0.33	U			< 0.33	R
121-14-2	2,4-DINITROTOLUENE		< 0.33	U			< 0.33	U
95-57-8	2-CHLOROPHENOL		< 0.33	U			< 0.33	U
95-48-7	2-METHYLPHENOL (O-CRESOL)		< 0.33	U			< 0.33	U
108-39-4	3-METHYLPHENOL		< 0.33	U			< 0.33	U
106-44-5	4-METHYLPHENOL (P-CRESOL)		< 0.33	U			< 0.33	U
100-02-7	4-NITROPHENOL		< 0.66	U			< 0.66	U
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE		< 1	U			< 1	U
62-53-3	ANILINE		< 0.66	U			< 0.66	U
120-12-7	ANTHRACENE		< 0.33	U			< 0.33	U
56-55-3	BENZO(A)ANTHRACENE		0.263	J			< 0.33	U
50-32-8	BENZO(A)PYRENE		< 0.33	U			< 0.33	U
205-99-2	BENZO(B)FLUORANTHENE		0.181	J			< 0.33	U
207-08-9	BENZO(K)FLUORANTHENE		< 0.33	U			< 0.33	U
85-68-7	BENZYL BUTYL PHTHALATE		< 0.33	U			< 0.33	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE		< 0.33	U			< 0.33	U
218-01-9	CHRYSENE		0.263	J			< 0.33	U
53-70-3	DIBENZ(A,H)ANTHRACENE		< 0.66	U			< 0.66	U
84-66-2	DIETHYL PHTHALATE		< 0.33	U			< 0.33	U
131-11-3	DIMETHYL PHTHALATE		< 0.33	U			< 0.33	U
84-74-2	DI-N-BUTYL PHTHALATE		0.251	B			5.75	B
117-84-0	DI-N-OCTYLPHTHALATE		< 0.33	U			< 0.33	U
206-44-0	FLUORANTHENE		0.348				< 0.33	U
193-39-5	INDENO(1,2,3-C,D)PYRENE		< 0.66	U			< 0.66	U
91-20-3	NAPHTHALENE		< 0.33	U			< 0.33	U
98-95-3	NITROBENZENE		< 0.33	U			< 0.33	U
85-01-8	PHENANTHRENE		< 0.33	U			< 0.33	U
108-95-2	PHENOL		0.382				< 0.33	U
129-00-0	PYRENE		0.36				< 0.33	U
110-86-1	PYRIDINE		< 0.33	U			< 0.33	U

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
R - Value rejected, not included in screening
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-22
SOIL DATA - PHASE I RI
WASTEWATER TREATMENT PLANT - SWMU 20a 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 20a B-1b 0-2 ft 05/27/99		SWMU 20a B-1b 6-8 ft 05/27/99	
Inorganics (mg/kg)					
Antimony		8.8	UL		
Arsenic		5.5			
Barium		123.3			
Cadmium		4.3			
Chromium		139.1			
Lead		170			
Mercury		0.017	B		
Nickel		62.8			
Selenium		0.7	U		
Silver		0.9	B		
SVOCs (mg/kg)					
1,2 Dichlorobenzene				0.0534	U
1,3 Dichlorobenzene				0.0534	U
1,4 Dichlorobenzene				0.0534	U
2 Chlorophenol				0.0534	UJ
2 Methylphenol				0.0534	U
2,4 Dimethylphenol				0.0534	U
2,4 Dinitrophenol				0.1335	UJ
2,4 Dinitrotoluene				0.1335	U
2,4,5 Trichlorophenol				0.0534	U
2,4,6 Trichlorophenol				0.0534	U
4 Nitrophenol				0.1335	U
4 Methylphenol				0.0534	U
4,6 Dinitro 2 Methylphenol				0.1335	UJ
7,12 Dimethylbenz[a]anthracene				0.1602	U
Aniline				0.1335	U
Anthracene				0.0534	U
Benzo(a)anthracene				0.0534	U
Benzo(a)pyrene				0.0534	U
Benzo(b)fluoranthene				0.0534	U
Benzo(k)fluoranthene				0.0534	U
Bis(2 ethylhexyl)phthalate				0.1522	U
Butyl benzyl phthalate				0.0534	U
Chrysene				0.0534	U
Di n butyl phthalate				0.077	U
Di n octyl phthalate				0.0534	U
Dibenz(a,h)anthracene				0.0534	U
Diethyl phthalate				0.0534	U
Dimethyl phthalate				0.0534	U
Fluoranthene				0.0534	U
Indeno(1,2,3 cd)pyrene				0.0534	U
Naphthalene				0.0534	U
Nitrobenzene				0.0534	U
Phenanthrene				0.0534	U
Phenol				0.0534	U
Pyrene				0.0534	U
Pyridine				0.1335	UJ

Notes:
mg/kg - milligrams per kilogram.
U - not detected above the method detection limit.
B - Result is potentially biased high due to blank contamination.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A
SOIL DATA - PHASE II RI
WASTEWATER TREATMENT PLANT - SWMU 20a 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S20A1-SB5-SO-0-2		S20A1-SB5-SO-2-3		S20A1-SB6-SO-0-2		S20A1-SB6-SO-2-3		S20A1-SB7-SO-0-2		S20A1-SB7-SO-2-3		S20A1-SB8-SO-0-2		S20A1-SB8-SO-2-3		S20A1-SB9-SO-0-2		S20A1-SB9-SO-2-3	
	12/21/07		12/21/07		12/21/07		12/21/07		12/21/07		12/21/07		12/21/07		12/21/07		12/21/07		12/21/07	
	0-2 ft		2-3 ft		0-2 ft		2-3 ft		0-2 ft		2-3 ft		0-2 ft		2-3 ft		0-2 ft		2-3 ft	
Metals (mg/kg)																				
Antimony	9.88	U			10.2	U			5.86				10.8	U			5.25			
Arsenic	2.02				2.4				6.36				4.95				6.36			
Barium	677	L			29.5	L			124	L			42.9	L			146	L		
Cadmium	0.632				0.548				7.42				0.926				5.36			
Chromium	18.2				17.1				367				29.6				461			
Lead	9.06				9.53				286				24.7				258			
Mercury	0.102	U			0.105	U			0.115	U			0.106	U			0.108	U		
Nickel	9.58				7.19				38.2				15.9				51.7			
Selenium	1.98	U			2.03	U			2.8				2.15	U			2.86			
Silver	0.988	U			1.02	U			1.78				1.08	U			1.74			
SVOCs (mg/kg)																				
1,2,4-Trichlorobenzene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
1,2-Dichlorobenzene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
1,3-Dichlorobenzene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
1,4-Dichlorobenzene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
2,4-Dinitrotoluene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
2,6-Dinitrotoluene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
2-Chloronaphthalene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
2-Methylnaphthalene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
2-Nitroaniline	0.838	U			0.858	U			0.94	U			0.899	U			0.923	U		
3,3-Dichlorobenzidine	0.671	U			0.687	U			0.752	U			0.72	U			0.739	U		
3-Nitroaniline	0.838	U			0.858	U			0.94	U			0.899	U			0.923	U		
4-Bromophenyl phenyl ether	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
4-Chloroaniline	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
4-Chlorophenyl phenyl ether	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
4-Nitroaniline	0.838	U			0.858	U			0.94	U			0.899	U			0.923	U		
Acenaphthene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
Acenaphthylene	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
Anthracene	0.335	U			0.21				0.376	U			0.36	U			0.369	U		
Benzo(a)anthracene	0.0392				0.276				0.376	U			0.36	U			0.369	U		
Benzo(a)pyrene	0.335	U			0.161				0.376	U			0.36	U			0.369	U		
Benzo(b)fluoranthene	0.335	U			0.161				0.376	U			0.36	U			0.369	U		
Benzo (g,h,i) perylene	0.335	U			0.092				0.376	U			0.36	U			0.369	U		
Benzo(k)fluoranthene	0.335	U			0.133				0.376	U			0.36	U			0.369	U		
Bis(2-chloroethoxy)methane	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
Bis(2-chloroethyl)ether	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		
Bis(2-chloroisopropyl)ether	0.335	U			0.343	U			0.376	U			0.36	U			0.369	U		

TABLE /
SOIL DATA - PHASE II RI
WASTEWATER TREATMENT PLANT - SWMU 20a 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S20A1-SB5-SO-0-2	S20A1-SB5-SO-2-3	S20A1-SB6-SO-0-2	S20A1-SB6-SO-2-3	S20A1-SB7-SO-0-2	S20A1-SB7-SO-2-3	S20A1-SB8-SO-0-2	S20A1-SB8-SO-2-3	S20A1-SB9-SO-0-2	S20A1-SB9-SO-2-3
	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07
	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft
Bis(2-ethylhexyl)phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Butyl benzyl phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Carbazole	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Chrysene	0.335 U		0.31		0.376 U		0.36 U		0.369 U	
Dibenz(a,h)anthracene	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Dibenzofuran	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Diethyl phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Dimethyl phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Di-n-butyl phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Di-n-octyl phthalate	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Fluoranthene	0.0905		0.741		0.376 U		0.36 U		0.369 U	
Fluorene	0.335 U		0.044		0.376 U		0.36 U		0.369 U	
Hexachlorobenzene	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Hexachlorobutadiene	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Hexachlorocyclopentadiene	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Hexachloroethane	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Indeno(1,2,3-cd)pyrene	0.335 U		0.0752		0.376 U		0.36 U		0.369 U	
Isophorone	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Naphthalene	0.335 U		0.343 U		0.12		0.36 U		0.369 U	
Nitrobenzene	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
N-Nitrosodi-n-propylamine	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
N-Nitrosodiphenylamine	0.335 U		0.343 U		0.376 U		0.36 U		0.369 U	
Phenanthrene	0.112		0.709		0.376 U		0.36 U		0.369 U	
Pyrene	0.0875		0.801		0.376 U		0.36 U		0.369 U	
Pyridine	0.671 U		0.687 U		0.752 U		0.72 U		0.739 U	
VOCs (mg/kg)										
1,1,1-Trichloroethane	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
1,2-Dibromoethane (EDB)	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
1,2-Dichloroethane	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
1,2-Dichloropropane	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
1,4-Dioxane	0.188 U	0.207 U	0.192 U	0.19 U	0.22 U	0.218 U	0.213 U	0.206 U	0.222 U	0.195 U
2-Butanone	0.0316	0.0439	0.042 K	0.0502	0.0176	0.0206	0.0238	0.0149	0.0554 U	0.0147
Benzene	0.0101	0.0131	0.0527 K	0.00171	0.0315	0.00233	0.0013	0.00202	0.00218	0.00172
Carbon disulfide	0.0047 U	0.00517 U	0.00335 K	0.00239	0.00219	0.00546 U	0.00644	0.000987	0.00198	0.00488 U
Chlorobenzene	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
Chloroform	0.00188 U	0.00997	0.149 K	0.0019 U	0.0022 U	0.00218 U	0.00203	0.00148	0.00222 U	0.00195 U
Ethylbenzene	0.0148	0.0481	0.142 J	0.00725	0.00208	0.00805	0.00213 U	0.00206 U	0.00222 U	0.00195 U
m,p-Xylene	0.00532	0.0194	0.0908 K	0.00834	0.00791	0.00223	0.00179	0.00154	0.00332 U	0.00122

TABLE /
SOIL DATA - PHASE II RI
WASTEWATER TREATMENT PLANT - SWMU 20a 20a.1
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S20A1-SB5-SO-0-2	S20A1-SB5-SO-2-3	S20A1-SB6-SO-0-2	S20A1-SB6-SO-2-3	S20A1-SB7-SO-0-2	S20A1-SB7-SO-2-3	S20A1-SB8-SO-0-2	S20A1-SB8-SO-2-3	S20A1-SB9-SO-0-2	S20A1-SB9-SO-2-3
	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07	12/21/07
	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft	0-2 ft	2-3 ft
Methyl tert-Butyl ether	0.00741 J	0.0213 J	0.0144 J	0.0302 J	0.0022 UJ	0.00218 UJ	0.0049 UJ	0.0187 UJ	0.00222 UJ	0.00777 J
o-Xylene	0.00139	0.00525	0.0145 K	0.00231	0.00218	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
Styrene	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
Tert-Amyl Methyl Ether	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
Tert-Butyl alcohol	0.0229	0.0407	0.0184 K	0.0357	0.0551 U	0.0546 U	0.0532 U	0.0151	0.0554 U	0.0125
Tetrachloroethene	0.00188 U	0.00207 U	0.00192 U	0.0019 U	0.0022 U	0.00218 U	0.00213 U	0.00206 U	0.00222 U	0.00195 U
Toluene	0.00146	0.00428	0.00525 K	0.0019 U	0.0111	0.00218 U	0.00213 U	0.00206 U	0.00244	0.00195 U
Wet Chemistry										
% Dry Solids	97.5	88.5	94.9	91.3	86.8	87.7	91.8	90.2	89.7	91.3

Notes:
mg/kg - milligrams per kilogram.
U - not detected above the method detection limit.
K - Result is estimated and potentially biased high due to a minor quality control anomaly.
L - Result is estimated and potentially biased low due to a minor quality control anomaly.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
J - detected below the method detection limit. Concentration is estimated.
Blank cells indicate constituent not analyzed.

TABLE
SOIL DATA - VRS
TEL EQUIPMENT LAYDOWN AREA - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample Date Sample ID Sample Depth	26B-1 11/10/1994 26B134648SO 6-8 ft	26B-2 11/10/1994 26B234648SO 4-6 ft
Metals (mg/kg)				
7439-92-1	LEAD		16	16
VOCs (mg/kg)				
71-43-2	BENZENE		< 0.01 U	< 0.01 U
100-41-4	ETHYLBENZENE		0.003 J	0.004 J
108-88-3	TOLUENE		0.031	0.039
1330-20-7	TOTAL XYLENES		0.018	0.015

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit. Concentration is estimated.

TABLE .
SOIL DATA - PHASE I RI
TEL EQUIPMENT LAYDOWN AREA - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 26B-3 0-2 ft 05/18/1999		SWMU 26B-3 8-10 ft 05/18/1999		SWMU 26B-4 8-10 ft 05/18/1999		SWMU 26B-5 8-10 ft 05/18/1999	
Inorganics (mg/kg)									
Antimony		9.6	UL	10.3	UL	8.4	UL	8	UL
Arsenic		11.3		12.9		2.1		0.5	B
Barium		50.5		44.8		9.6	B	9.6	B
Cadmium		1.8		1.5		0.7	U	0.7	U
Chromium		51.7		48.8		4.5		3.6	
Lead		71.6	K	74.2	K	2.3	K	4	K
Mercury		0.5		0.3		0.01	U	0.01	U
Nickel		21.6	K	21.9	K	3.3	K	4.1	K
Selenium		0.8	K	0.9	J	0.7	U	0.7	U
Silver		1.7	K	0.58	K	1.4	U	1.3	U
Tetraethyl Lead		60.2	U	63.3	U	53.2	U	50.2	U
VOCs (mg/kg)									
Benzene		0.0011	U	0.001	U	0.0009	R	0.0008	R
Ethylbenzene		0.0011	U	0.001	U	0.0015		0.0008	R
Toluene		0.0011	U	0.001	U	0.0009	R	0.0008	R
m&p Xylene		0.0021	U	0.002	U	0.003		0.0016	R
o Xylene		0.0011	U	0.001	U	0.0009	R	0.0008	R

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
R - Value rejected, not included in screening
K - Result is estimated and potentially biased high due to a minor quality control anomaly.
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
J - detected below the method detection limit. Concentration is estimated.

TABLE
SOIL DATA - PHASE II RI
TEL EQUIPMENT LAYDOWN AREA - SWMU 26
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S26-SB19-SO-4-6 11/2/2007 10:00 4-6 ft	S26-SB20-SO-4-6 11/2/2007 9:40 4-6 ft	S26-SB21-SO-4-6 11/2/2007 9:30 4-6 ft
Metals (mg/kg)			
Lead	4.81	3.0	4.13
Wet Chemistry			
Percent Solids	88.4 %	92.7 %	90.3 %

Notes:
mg/kg - milligrams per kilogram.

TABLE A
SOIL DATA - VRS
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample Date Sample ID Sample Depth	31B-1 11/15/1994 31SS134653SO 0-0.5 ft	31B-1 11/15/1994 31B134653SO 1.5-2.0 ft	31B-2 11/15/1994 31SS234653SO 0-0.5 ft	31B-2 11/15/1994 31B234653SO 1.5-2.0 ft
Metals (mg/kg)						
7440-36-0	ANTIMONY		< 10 UL		< 10 UL	
7440-38-2	ARSENIC		< 2 UL		< 2 UL	
7440-39-3	BARIUM		23		20	
7440-43-9	CADMIUM		0.55		0.69	
7440-47-3	CHROMIUM, TOTAL		5.9		7.1	
7439-92-1	LEAD		4.4		4.6	
7439-97-6	MERCURY		< 0.05 UL		< 0.05 UL	
7440-02-0	NICKEL		4.3		4.1	
7782-49-2	SELENIUM		< 0.5 U		0.69	
7440-22-4	SILVER		< 1 UL		< 1 UL	
VOCs (mg/kg)						
71-55-6	1,1,1-TRICHLOROETHANE			< 0.01 U		< 0.01 U
106-93-4	ETHYLENE DIBROMIDE			< 0.01 U		< 0.01 U
107-06-2	1,2-DICHLOROETHANE			< 0.01 U		< 0.01 U
78-87-5	1,2-DICHLOROPROPANE			< 0.01 U		< 0.01 U
123-91-1	1,4-DIOXANE			< 1 U		< 1 U
71-43-2	BENZENE			0.002 J		< 0.01 U
75-15-0	CARBON DISULFIDE			< 0.05 U		< 0.05 U
108-90-7	CHLOROBENZENE			< 0.01 U		< 0.01 U
67-66-3	CHLOROFORM			< 0.01 U		< 0.01 U
100-41-4	ETHYLBENZENE			0.002 J		0.002 J
78-93-3	2-BUTANONE			< 0.1 U		< 0.1 U
100-42-5	STYRENE			< 0.01 U		< 0.01 U
127-18-4	TETRACHLOROETHENE			< 0.01 U		< 0.01 U
108-88-3	TOLUENE			0.014		0.015
1330-20-7	TOTAL XYLENES			0.018		0.018
SVOCs (mg/kg)						
95-50-1	1,2-DICHLOROBENZENE			< 0.33 U		< 0.33 U
541-73-1	1,3-DICHLOROBENZENE			< 0.33 U		< 0.33 U
106-46-7	1,4-DICHLOROBENZENE			< 0.33 U		< 0.33 U
105-67-9	2,4-DIMETHYLPHENOL			< 0.33 U		< 0.33 U
51-28-5	2,4-DINITROPHENOL			< 0.33 U		< 0.33 U
95-57-8	2-CHLOROPHENOL			< 0.33 U		< 0.33 U
108-39-4	3-METHYLPHENOL			< 0.33 U		< 0.33 U
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE			0.334 J		0.36 J
62-53-3	ANILINE			< 0.66 U		< 0.66 U
120-12-7	ANTHRACENE			0.43		0.996
56-55-3	BENZO(A)ANTHRACENE			0.206 J		0.334
50-32-8	BENZO(A)PYRENE			< 0.33 U		0.245 J
205-99-2	BENZO(B)FLUORANTHENE			< 0.33 U		< 0.33 U
207-08-9	BENZO(K)FLUORANTHENE			< 0.33 U		< 0.33 U
85-68-7	BENZYL BUTYL PHTHALATE			< 0.33 U		< 0.33 U
218-01-9	CHRYSENE			0.547		0.502
53-70-3	DIBENZ(A,H)ANTHRACENE			< 0.66 U		< 0.66 U
84-66-2	DIETHYL PHTHALATE			< 0.33 U		< 0.33 U
131-11-3	DIMETHYL PHTHALATE			< 0.33 U		< 0.33 U
84-74-2	DI-N-BUTYL PHTHALATE			0.217 B		0.193 B
117-84-0	DI-N-OCTYLPHTHALATE			< 0.33 U		< 0.33 U

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-28
SOIL DATA - PHASE I RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 31B-5 0-2 ft 05/18/1999		SWMU 31 B-5 SS 0 - 1 ft 5/28/1999	
Inorganics (mg/kg)					
Antimony		8.6	UL	9.04	UL
Arsenic		2.1		1.35	B
Barium		44.3		26.15	J
Cadmium		0.6	B	0.57	B
Chromium		14.1		12.34	L
Cyanide		0.3	U		
Lead		25.7	K	6.58	J
Mercury		0.02	U	0.013	U
Nickel		10.3	K	8.26	
Selenium		0.7	B	0.72	UJ
Silver		0.6	B	1.51	U
Vanadium				27.10	
VOCs (mg/kg)					
1,1,1 Trichloroethane		0.0009	UJ		
1,2 Dichloroethane		0.0009	UJ		
1,2 Dichloropropane		0.0009	UJ		
1,4 Dioxane		0.0885	R		
2 Butanone		0.0009	UJ		
Benzene		0.0028	J		
Carbon Disulfide		0.0009	UJ		
Chlorobenzene		0.0009	UJ		
Chloroform		0.0009	UJ		
Ethylbenzene		0.0296	J		
Ethylene dibromide		0.0009	UJ		
Methyl tert-butyl Ether		0.0009	UJ		
m&p Xylene		0.0797	J		
o Xylene		0.1314	J		
Styrene		0.0009	UJ		
Tetrachloroethene		0.0021	J		
Toluene		0.0191	J		
SVOCs (mg/kg)					
1,2 Dichlorobenzene		0.0603	U		
1,3 Dichlorobenzene		0.0603	U		
1,4 Dichlorobenzene		0.0603	U		
2 Chlorophenol		0.0603	U		
2-Methylnaphthalene		3.993	K		
2 Methylphenol		0.0603	U		
2,4 Dimethylphenol		0.0603	U		
2,4 Dinitrophenol		0.1507	U		
2,4 Dinitrotoluene		0.1507	U		
2,4,5 Trichlorophenol		0.0603	U		
2,4,6 Trichlorophenol		0.0603	U		
4 Nitrophenol		0.1507	U		
4,6 Dinitro 2 Methylphenol		0.1507	U		
4 Methylphenol		0.0603	U		
7,12 Dimethylbenz[a]anthracene		0.1809	U		
Aniline		0.1507	U		
Anthracene		0.167	K		

TABLE A-28
SOIL DATA - PHASE I RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 31B-5 0-2 ft 05/18/1999		SWMU 31 B-5 SS 0 - 1 ft 5/28/1999
Benzo(a)anthracene		0.1049	K	
Benzo(a)pyrene		0.1574	K	
Benzo(b)fluoranthene		0.1037	K	
Benzo(k)fluoranthene		0.0603	U	
Bis(2 ethylhexyl)phthalate		0.4353	B	
Butyl benzyl phthalate		0.0603	U	
Chrysene		0.1435	K	
Di n butyl phthalate		0.119	B	
Di n octyl phthalate		0.0603	U	
Dibenz(a,h)anthracene		0.0603	U	
Diethyl phthalate		0.0603	U	
Dimethyl phthalate		0.0603	U	
Fluoranthene		0.1031	K	
Indeno(1,2,3 cd)pyrene		0.0603	U	
Naphthalene		1.1288	K	
Nitrobenzene		0.0603	U	
Phenanthrene		1.1915	K	
Phenol		0.0603	U	
Pyrene		0.7211	K	
Pyridine		0.1507	U	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
K - Result is estimated and potentially biased high due to a minor quality control anomaly.
J - detected below the method detection limit. Concentration is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.
R - Value rejected, not included in screening
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
L - Result is estimated and potentially biased low due to a minor quality control anomaly.
Blank cells indicate constituent not analyzed.

TABLE A-29
SOIL DATA - PHASE II RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S31-SB8-SO-0-2 11/06/07 0-2 ft	S31-SB8-SO-8-10 11/06/07 8-10 ft	S31-SB8-SO-14-16 11/06/07 14-16 ft	S31-SB9-SO-0-2 11/06/07 0-2 ft	S31-SB9-SO-8-10 11/06/07 8-10 ft	S31-SB9-SO-14-16 11/06/07 14-16 ft	S31-SB10-SO-0-2 11/06/07 0-2 ft	S31-SB10-SO-8-10 11/06/07 8-10 ft	S31-SB10-SO-10-11 11/06/07 10-11 ft	S31-SB11-SO-0-2 11/06/07 0-2 ft	S31-SB11-SO-8-10 11/06/07 8-10 ft	S31-SB11-SO-14-16 11/06/07 14-16 ft	S31-SB13-SO-0-2 11/08/07 0-2 ft	S31-SB13-SO-8-10 11/08/07 8-10 ft
SVOCs (mg/kg)														
1,2-Dichlorobenzene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
1,3-Dichlorobenzene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
1,4-Dichlorobenzene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
2,4,5-Trichlorophenol	0.869 U	0.885 U	0.882 U	0.889 U	0.897 U	0.892 U	0.895 U	0.886 U	0.936 U	0.964 U	0.876 U	0.876 U	0.925 U	0.923 U
2,4,6-Trichlorophenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
2,4-Dimethylphenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
2,4-Dinitrophenol	0.869 U	0.885 U	0.882 U	0.889 U	0.897 U	0.892 U	0.895 U	0.886 U	0.936 U	0.964 U	0.876 U	0.876 U	0.925 U	0.923 U
2,4-Dinitrotoluene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
2-Chlorophenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
2-Methylphenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
3/4-Methylphenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
4,6-Dinitro-2-methylphenol	0.869 U	0.885 U	0.882 U	0.889 U	0.897 U	0.892 U	0.895 U	0.886 U	0.936 U	0.964 U	0.876 U	0.876 U	0.925 U	0.923 U
4-Nitrophenol	0.869 U	0.885 U	0.882 U	0.889 U	0.897 U	0.892 U	0.895 U	0.886 U	0.936 U	0.964 U	0.876 U	0.876 U	0.925 U	0.923 U
7,12-Dimethylbenz(a)anthracene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Aniline	1.74 U	1.77 U	1.77 U	1.78 U	1.8 U	1.79 U	1.8 U	1.78 U	1.88 U	1.93 U	1.76 U	1.76 U	1.85 U	1.85 U
Anthracene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Benzo(a)anthracene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Benzo(a)pyrene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Benzo(b)fluoranthene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Benzo(k)fluoranthene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Bis(2-ethylhexyl)phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Butyl benzyl phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Chrysene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Dibenz(a,h)anthracene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Diethyl phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 UJ	0.369 UJ
Dimethyl phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Di-n-butyl phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Di-n-octyl phthalate	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Fluoranthene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Indeno(1,2,3-cd)pyrene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Naphthalene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Nitrobenzene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Phenanthrene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Phenol	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Pyrene	0.347 U	0.354 U	0.353 U	0.355 U	0.359 U	0.356 U	0.358 U	0.354 U	0.374 U	0.385 U	0.35 U	0.35 U	0.37 U	0.369 U
Pyridine	0.696 U	0.709 U	0.707 U	0.712 U	0.719 U	0.714 U	0.717 U	0.709 U	0.75 U	0.772 U	0.701 U	0.702 U	0.74 U	0.739 U

TABLE A-29
SOIL DATA - PHASE II RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S31-SB13-SO-14-16 11/08/07 14-16 ft	S31-SB14-SO-0-2 11/12/07 0-2 ft	S31-SB14-SO-8-10 11/12/07 8-10 ft	S31-SB14-SO-14-16 11/12/07 14-16 ft	S31-SB15-SO-0-2 11/12/07 0-2 ft	S31-SB15-SO-8-10 11/12/07 8-10 ft	S31-SB15-SO-14-16 11/12/07 14-16 ft	S31-SB16-SO-13-15 11/12/07 13-15 ft	S31-SB16-SO-19-21 11/12/07 19-21 ft	S31-SB16-SO-5-7 11/12/07 5-7 ft	S31-SB17-SO-13-15 11/12/07 13-15 ft	S31-SB17-SO-19-21 11/12/07 19-21 ft	S31-SB17-SO-5-7 11/12/07 5-7 ft
SVOCs (mg/kg)													
1,2-Dichlorobenzene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
1,3-Dichlorobenzene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
1,4-Dichlorobenzene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
2,4,5-Trichlorophenol	0.882 U	0.911 U	0.888 U	0.889 U	0.894 U	0.873 U	0.863 U	0.866 U	0.859 U	0.942 U	0.87 U	0.906 U	0.856 U
2,4,6-Trichlorophenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
2,4-Dimethylphenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
2,4-Dinitrophenol	0.882 U	0.911 U	0.888 U	0.889 U	0.894 U	0.873 U	0.863 U	0.866 U	0.859 U	0.942 U	0.87 U	0.906 U	0.856 U
2,4-Dinitrotoluene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
2-Chlorophenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
2-Methylphenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
3/4-Methylphenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
4,6-Dinitro-2-methylphenol	0.882 U	0.911 U	0.888 U	0.889 U	0.894 U	0.873 U	0.863 U	0.866 U	0.859 U	0.942 U	0.87 U	0.906 U	0.856 U
4-Nitrophenol	0.882 U	0.911 U	0.888 U	0.889 U	0.894 U	0.873 U	0.863 U	0.866 U	0.859 U	0.942 U	0.87 U	0.906 U	0.856 U
7,12-Dimethylbenz(a)anthracene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Aniline	1.77 U	1.83 U	1.78 U	1.78 U	1.79 U	1.75 U	1.73 U	1.74 U	1.72 U	1.89 U	1.74 U	1.82 U	1.72 U
Anthracene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Benzo(a)anthracene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Benzo(a)pyrene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Benzo(b)fluoranthene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Benzo(k)fluoranthene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Bis(2-ethylhexyl)phthalate	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.262 J	0.376 U	0.348 U	0.362 U	0.342 U
Butyl benzyl phthalate	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Chrysene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Dibenz(a,h)anthracene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Diethyl phthalate	0.352 UJ	0.364 UJ	0.355 UJ	0.355 UJ	0.357 UJ	0.349 UJ	0.345 UJ	0.346 UJ	0.343 UJ	0.376 UJ	0.348 UJ	0.362 UJ	0.342 UJ
Dimethyl phthalate	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Di-n-butyl phthalate	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Di-n-octyl phthalate	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Fluoranthene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Indeno(1,2,3-cd)pyrene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Naphthalene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Nitrobenzene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Phenanthrene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Phenol	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Pyrene	0.352 U	0.364 U	0.355 U	0.355 U	0.357 U	0.349 U	0.345 U	0.346 U	0.343 U	0.376 U	0.348 U	0.362 U	0.342 U
Pyridine	0.706 U	0.729 U	0.711 U	0.712 U	0.716 U	0.699 U	0.691 U	0.693 U	0.688 U	0.754 U	0.697 U	0.725 U	0.686 U

TABLE A-29
SOIL DATA - PHASE II RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S31-SB8-SO-0-2 11/06/07 0-2 ft	S31-SB8-SO-8-10 11/06/07 8-10 ft	S31-SB8-SO-14-16 11/06/07 14-16 ft	S31-SB9-SO-0-2 11/06/07 0-2 ft	S31-SB9-SO-8-10 11/06/07 8-10 ft	S31-SB9-SO-14-16 11/06/07 14-16 ft	S31-SB10-SO-0-2 11/06/07 0-2 ft	S31-SB10-SO-8-10 11/06/07 8-10 ft	S31-SB10-SO-10-11 11/06/07 10-11 ft	S31-SB11-SO-0-2 11/06/07 0-2 ft	S31-SB11-SO-8-10 11/06/07 8-10 ft	S31-SB11-SO-14-16 11/06/07 14-16 ft	S31-SB13-SO-0-2 11/08/07 0-2 ft	S31-SB13-SO-8-10 11/08/07 8-10 ft
VOCs (mg/kg)														
1,1,1-Trichloroethane	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
1,2-Dibromoethane (EDB)	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
1,2-Dichloroethane	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
1,2-Dichloropropane	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
1,4-Dioxane	0.231 U	0.212 U	0.201 U	0.211 U	0.239 U	0.198 U	9.56 U	0.214 U	0.221 U	0.216 U	0.226 U	0.22 U	0.23 U	0.211 U
2-Butanone	0.0577 U	0.053 U	0.0502 U	0.0528 U	0.0598 U	0.0494 U	2.39 U	0.0536 U	0.0553 U	0.0541 U	0.0565 U	0.055 U	0.0575 U	0.0528 U
Benzene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Carbon disulfide	0.00577 U	0.0053 U	0.00502 U	0.00528 U	0.00598 U	0.00494 U	0.239 U	0.00536 U	0.00553 U	0.00541 U	0.00565 U	0.0055 U	0.00575 U	0.00528 U
Chlorobenzene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Chloroform	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Ethylbenzene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
m,p-Xylene	0.00346 U	0.00318 U	0.00301 U	0.00317 U	0.00359 U	0.00297 U	0.143 U	0.00321 U	0.00332 U	0.00325 U	0.00339 U	0.0033 U	0.00133 J	0.00317 U
o-Xylene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Styrene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Tetrachloroethene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00129 J	0.00216 U	0.00226 U	0.0022 U	0.0023 U	0.00211 U
Toluene	0.00231 U	0.00212 U	0.00201 U	0.00211 U	0.00239 U	0.00198 U	0.0956 U	0.00214 U	0.00221 U	0.00216 U	0.00226 U	0.0022 U	0.0652	0.00101 J
Wet Chemistry														
Percent Solids	95.8 %	91.8 %	92.3 %	92.7 %	91.9 %	92.8 %	92.6 %	91.7 %	88.8 %	86.4 %	93.2 %	93.5 %	88.5 %	89.3 %

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit.
Concentration is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

TABLE A-29
SOIL DATA - PHASE II RI
FORMER SLURRY OIL DUMPSTER - SWMU 31
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S31-SB13-SO-14-16 11/08/07 14-16 ft	S31-SB14-SO-0-2 11/12/07 0-2 ft	S31-SB14-SO-8-10 11/12/07 8-10 ft	S31-SB14-SO-14-16 11/12/07 14-16 ft	S31-SB15-SO-0-2 11/12/07 0-2 ft	S31-SB15-SO-8-10 11/12/07 8-10 ft	S31-SB15-SO-14-16 11/12/07 14-16 ft	S31-SB16-SO-13-15 11/12/07 13-15 ft	S31-SB16-SO-19-21 11/12/07 19-21 ft	S31-SB16-SO-5-7 11/12/07 5-7 ft	S31-SB17-SO-13-15 11/12/07 13-15 ft	S31-SB17-SO-19-21 11/12/07 19-21 ft	S31-SB17-SO-5-7 11/12/07 5-7 ft
VOCs (mg/kg)													
1,1,1-Trichloroethane	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
1,2-Dibromoethane (EDB)	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
1,2-Dichloroethane	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
1,2-Dichloropropane	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
1,4-Dioxane	0.209 U	0.22 U	0.216 U	0.216 U	0.215 U	0.214 U	0.211 U	0.222 U	0.213 U	0.22 U	0.218 U	0.233 U	0.24 U
2-Butanone	0.0522 U	0.0551 U	0.054 U	0.0541 U	0.0538 U	0.0536 U	0.0526 U	0.0555 U	0.0532 U	0.0551 U	0.0544 U	0.0583 U	0.0601 U
Benzene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Carbon disulfide	0.00522 U	0.00551 U	0.0054 U	0.00541 U	0.00538 U	0.00536 U	0.00526 U	0.00555 U	0.00532 U	0.00551 U	0.00544 U	0.00583 U	0.00601 U
Chlorobenzene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Chloroform	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Ethylbenzene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
m,p-Xylene	0.00313 U	0.0033 U	0.00324 U	0.00324 U	0.00323 U	0.00322 U	0.00316 U	0.00333 U	0.00319 U	0.0033 U	0.00326 U	0.0035 U	0.00361 U
o-Xylene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Styrene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Tetrachloroethene	0.00209 U	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Toluene	0.000929 J	0.0022 U	0.00216 U	0.00216 U	0.00215 U	0.00214 U	0.00211 U	0.00222 U	0.00213 U	0.0022 U	0.00218 U	0.00233 U	0.0024 U
Wet Chemistry													
Percent Solids	92.5 %	90.8 %	92.6 %	92.5 %	93 %	93.3 %	95 %	94.7 %	94.8 %	87.5 %	94.4 %	91.1 %	94.3 %

Notes:

mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit. Concentration is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

TABLE A
SOIL DATA - VMS
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample Date Sample ID Sample Depth	32B-1 10/24/1994 32B134631SO 1-2 ft		32B-2 11/8/1994 32B234646SO 4-6 ft		32B-3 11/8/1994 32B334646SO 2-4 ft		32B-4 10/28/1994 32B434635SO 1-2 ft	
Metals (mg/kg)										
7440-36-0	ANTIMONY		< 10	UL	< 10	R	< 10	R	< 10	R
7440-38-2	ARSENIC		< 0.5	U	< 2	UJ	2.1	J	< 2	U
7440-39-3	BARIUM		14		20		25		13	
7440-41-7	BERYLLIUM		< 0.3	U	0.36		0.49		0.5	
7440-43-9	CADMIUM		< 0.5	U	< 0.5	U	0.56		2.2	
7440-47-3	CHROMIUM, TOTAL		4.8		5.5	L	6.3	L	37	
7440-48-4	COBALT		2.1		< 2	U	3.7		2.9	
57-12-5	CYANIDE		< 0.3	U	< 0.3	UL	< 0.3	UL	< 0.3	U
7439-92-1	LEAD		2.2	J	3.4		6.5		21	
7439-97-6	MERCURY		< 0.05	U	< 0.05	U	< 0.05	U	< 0.05	U
7440-02-0	NICKEL		< 2	U	2.4		3.9		1.4	
7782-49-2	SELENIUM		< 0.5	U	< 0.5	UL	< 0.5	UL	0.5	
7440-22-4	SILVER		< 1	U	< 1	U	< 1	U	< 1	U
7440-62-2	VANADIUM		4.8		8.8	L	13	L	102	
7440-66-6	ZINC		6.2		7.6		24		14	
VOCs (mg/kg)										
71-55-6	1,1,1-TRICHLOROETHANE		< 0.01	U	0.0032	J	0.0026	J	< 0.01	U
79-34-5	1,1,2,2-TETRACHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
106-93-4	ETHYLENE DIBROMIDE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
107-06-2	1,2-DICHLOROETHANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
78-87-5	1,2-DICHLOROPROPANE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
123-91-1	1,4-DIOXANE		< 1	U	< 1	U	< 1	U	< 1	U
67-64-1	ACETONE		0.108	B	0.041	JB	0.05	JB	0.059	B
71-43-2	BENZENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
75-15-0	CARBON DISULFIDE		< 0.05	U	< 0.05	U	< 0.05	U	< 0.05	U
108-90-7	CHLOROBENZENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
67-66-3	CHLOROFORM		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
100-41-4	ETHYLBENZENE		< 0.01	U	0.0029	J	0.0087	J	< 0.01	U
78-93-3	2-BUTANONE		< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
100-42-5	STYRENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
127-18-4	TETRACHLOROETHENE		< 0.01	U	< 0.01	U	< 0.01	U	< 0.01	U
108-88-3	TOLUENE		< 0.01	U	0.05		0.083		< 0.01	U
1330-20-7	TOTAL XYLENES		< 0.01	U	0.021		0.026		< 0.01	U
108-05-4	VINYL ACETATE		< 0.1	U	< 0.1	U	< 0.1	U	< 0.1	U
SVOCs (mg/kg)										
95-50-1	1,2-DICHLOROBENZENE		< 0.33	U	< 0.33	U	< 0.33	U	< 0.33	U
541-73-1	1,3-DICHLOROBENZENE		< 0.33	U	< 0.33	U	< 0.33	U	< 0.33	U
106-46-7	1,4-DICHLOROBENZENE		< 0.33	U	< 0.33	U	< 0.33	U	< 0.33	U
95-95-4	2,4,5 TRICHLOROPHENOL		< 0.33	U	< 0.33	U	< 0.33	U	< 0.33	U

TABLE A
SOIL DATA - [illegible]S
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

CAS	Analyte	Location ID Sample Date Sample ID Sample Depth	32B-1 10/24/1994 32B134631SO 1-2 ft	32B-2 11/8/1994 32B234646SO 4-6 ft	32B-3 11/8/1994 32B334646SO 2-4 ft	32B-4 10/28/1994 32B434635SO 1-2 ft
88-06-2	2,4,6 TRICHLOROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
105-67-9	2,4-DIMETHYLPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
51-28-5	2,4-DINITROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
121-14-2	2,4 DINITROTOLUENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
95-57-8	2-CHLOROPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
91-57-6	2-METHYLNAPHTHALENE		< 0.33 U	< 0.33 U	0.709	< 0.33 U
95-48-7	2-METHYLPHENOL (O-CRESOL)		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
108-39-4	3-METHYLPHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
106-47-8	4-CHLOROANILINE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
106-44-5	4-METHYLPHENOL (P-CRESOL)		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
100-02-7	4-NITROPHENOL		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
57-97-6	7,12-DIMETHYLBENZ(A)ANTHRACENE		< 1 U	< 1 U	< 1 U	< 1 U
208-96-8	ACENAPHTHYLENE		< 0.33 U	0.185 J	1.02	< 0.33 U
62-53-3	ANILINE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
120-12-7	ANTHRACENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
56-55-3	BENZO(A)ANTHRACENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
50-32-8	BENZO(A)PYRENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
205-99-2	BENZO(B)FLUORANTHENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
207-08-9	BENZO(K)FLUORANTHENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
85-68-7	BENZYL BUTYL PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
218-01-9	CHRYSENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
53-70-3	DIBENZ(A,H)ANTHRACENE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
84-66-2	DIETHYL PHTHALATE		0.654	< 0.33 U	< 0.33 U	< 0.33 U
131-11-3	DIMETHYL PHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
84-74-2	DI-N-BUTYL PHTHALATE		< 0.33 U	2.08 B	1.32 B	0.504 B
117-84-0	DI-N-OCTYLPHTHALATE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
206-44-0	FLUORANTHENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
86-73-7	FLUORENE		< 0.33 U	< 0.33 U	1.85	< 0.33 U
193-39-5	INDENO(1,2,3-C,D)PYRENE		< 0.66 U	< 0.66 U	< 0.66 U	< 0.66 U
91-20-3	NAPHTHALENE		< 0.33 U	< 0.33 U	0.215 J	< 0.33 U
98-95-3	NITROBENZENE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
85-01-8	PHENANTHRENE		< 0.33 U	< 0.33 U	4.35	< 0.33 U
108-95-2	PHENOL		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U
129-00-0	PYRENE		< 0.33 U	< 0.33 U	1.15	< 0.33 U
110-86-1	PYRIDINE		< 0.33 U	< 0.33 U	< 0.33 U	< 0.33 U

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
B - Result is potentially biased high due to blank contamination.
J - detected below the method detection limit. Concentration is estimated.
R - Value rejected, not included in screening.
UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.
L - Result is estimated and potentially biased low due to a minor quality control anomaly.
JB - Result is potentially biased high due to blank contamination; result is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

TABLE A-31
SOIL DATA - PHASE I RI
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth in feet Sample Date	SWMU 32B-8 2-4 ft 05/17/99		SWMU 32B-8 SS 0 - 0.5 ft 05/28/99	
Inorganics (mg/kg)					
Antimony		9.1	U	8.71	U
Arsenic		1.5	U	1.64	
Barium		18.8	B	28.6	B
Beryllium				0.29	B
Cadmium		0.8	U	0.73	U
Chromium		9.6		9.46	
Cobalt		2.8	B	1.96	B
Cyanide		0.4			
Lead		2.4		9.33	
Mercury		0.014	U	0.014	U
Nickel		6.5		6.97	
Selenium		0.8	U	0.73	U
Silver		0.8	B	1.45	U
Vanadium		15.4		25.24	
Zinc		15.0		18.66	
VOCs (mg/kg)					
1,1,2,2 Tetrachloroethane		0.0009	U		
1,1,1 Trichloroethane		0.0009	U		
1,2 Dichloroethane		0.0009	U		
1,2 Dichloropropane		0.0009	U		
1,4 Dioxane		0.0859	U		
2 Butanone		0.0944			
Acetone		0.3195			
Benzene		0.0009	U		
Carbon Disulfide		0.0009	U		
Chlorobenzene		0.0009	U		
Chloroform		0.0009	U		
Ethylbenzene		0.3559	J		
Ethylene dibromide		0.0009	U		
m&p Xylene		2.6	J		
o Xylene		3.8	J		
Styrene		0.0009	U		
Methyl tert-butyl ether		0.0009	U		
Tetrachloroethene		0.0009	U		
Toluene		0.0439			
Vinyl Acetate		0.0009	U		
SVOCs (mg/kg)					
1,2 Dichlorobenzene		0.0569	U		
1,3 Dichlorobenzene		0.0569	U		
1,4 Dichlorobenzene		0.0569	U		
2 Chlorophenol		0.0569	U		
2 Methylnapthalene		132.46			
2 Methylphenol		0.0569	U		
2,4 Dimethylphenol		0.0569	U		
2,4 Dinitrophenol		0.1421	U		
2,4 Dinitrotoluene		0.1421	U		
2,4,5 Trichlorophenol		0.0569	U		
2,4,6 Trichlorophenol		0.0569	U		
4 Chloroanaline		0.0569	U		
4 Nitrophenol		0.1421			
4 Methylphenol		0.0569	U		
4,6 Dinitro 2 Methylphenol		0.1421	U		
7,12 Dimethylbenz[a]anthracene		0.1706	U		
Acenapthalene		0.0569	U		
Aniline		0.1421	U		

TABLE A-31
SOIL DATA - PHASE I RI
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth in feet Sample Date	SWMU 32B-8 2-4 ft 05/17/99		SWMU 32B-8 SS 0 - 0.5 ft 05/28/99
Anthracene		3.3		
Benzo(a)anthracene		0.1683		
Benzo(a)pyrene		0.2456		
Benzo(b)fluoranthene		0.17		
Benzo(k)fluoranthene		0.0569	U	
Bis(2 ethylhexyl)phthalate		0.8073		
Butyl benzyl phthalate		0.0569	U	
Chrysene		0.2263		
Di n butyl phthalate		0.0569	U	
Di n octyl phthalate		0.0569	U	
Dibenz(a,h)anthracene		0.0569	U	
Diethyl phthalate		0.0569	U	
Dimethyl phthalate		0.0569	U	
Fluorene		7.3		
Fluoranthene		0.3559		
Indeno(1,2,3 cd)pyrene		0.0569	U	
Naphthalene		27.1		
Nitrobenzene		0.0569	U	
Phenanthrene		23.9		
Phenol		0.0569	U	
Pyrene		5.6	J	
Pyridine		0.1421	U	

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit. Concentration is estimated.
B - constituent detected below contract required detection limit, but above
Blank cells indicate constituent not analyzed.

TABLE A-32
SOIL DATA - PHASE II RI
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S32-SB20-SO-0-2 11/28/07 0-2 ft		S32-SB20-SO-14-16 11/28/07 14-16 ft		S32-SB18-SO-0-2 11/28/07 0-2 ft		S32-SB18-SO-14-16 11/28/07 14-16 ft		S32-SB16-SO-0-2 11/28/07 0-2 ft		S32-SB16-SO-14-16 11/28/07 14-16 ft		S32-SB17-SO-0-2 11/28/07 0-2 ft		S32-SB17-SO-14-16 11/28/07 14-16 ft		S32-SB19-SO-0-2 11/28/07 0-2 ft		S32-SB19-SO-14-16 11/28/07 14-16 ft		S32-SB21-SO-0-2 11/28/07 0-2 ft		S32-SB21-SO-14-16 11/28/07 14-16 ft		S32-SB15-SO-0-2 11/29/07 0-2 ft		S32-SB15-SO-14-16 11/29/07 14-16 ft	
SVOCs (mg/kg)																												
1,2,4-Trichlorobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
1,2-Dichlorobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
1,3-Dichlorobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
1,4-Dichlorobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
2,4-Dinitrotoluene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
2,6-Dinitrotoluene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
2-Chloronaphthalene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
2-Methylnaphthalene	0.347	U	0.087	J	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
2-Nitroaniline	0.867	U	0.949	U	0.911	U	0.869	U	0.951	U	0.877	U	0.897	U	0.889	U	0.995	U	0.878	U	0.916	U	0.862	U	23.7	U	0.854	U
3,3-Dichlorobenzidine	0.694	U	0.76	U	0.73	U	0.696	U	0.761	U	0.702	U	0.718	U	0.712	U	0.797	U	0.703	U	0.734	U	0.69	U	18.9	U	0.683	U
3-Nitroaniline	0.867	U	0.949	U	0.911	U	0.869	U	0.951	U	0.877	U	0.897	U	0.889	U	0.995	U	0.878	U	0.916	U	0.862	U	23.7	U	0.854	U
4-Bromophenyl phenyl ether	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
4-Chloroaniline	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
4-Chlorophenyl phenyl ether	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
4-Nitroaniline	0.867	U	0.949	U	0.911	U	0.869	U	0.951	U	0.877	U	0.897	U	0.889	U	0.995	U	0.878	U	0.916	U	0.862	U	23.7	U	0.854	U
Acenaphthene	0.347	U	0.0399	J	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Acenaphthylene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Anthracene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Benzo (a) anthracene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Benzo (a) pyrene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Benzo (b) fluoranthene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Benzo (g,h,i) perylene	0.347	U	0.0577	J	0.364	U	0.347	U	0.461		0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Benzo (k) fluoranthene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Bis(2-chloroethoxy)methane	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Bis(2-chloroethyl)ether	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Bis(2-chloroisopropyl)ether	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Bis(2-ethylhexyl)phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Butyl benzyl phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Carbazole	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Chrysene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Dibenz (a,h) anthracene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Dibenzofuran	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Diethyl phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Dimethyl phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Di-n-butyl phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Di-n-octyl phthalate	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Fluoranthene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Fluorene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Hexachlorobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Hexachlorobutadiene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Hexachlorocyclopentadiene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Hexachloroethane	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Indeno (1,2,3-cd) pyrene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Isophorone	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Naphthalene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Nitrobenzene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
N-Nitrosodi-n-propylamine	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
N-Nitrosodiphenylamine	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Phenanthrene	0.347	U	0.359	J	0.976		0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Pyrene	0.347	U	0.379	U	0.364	U	0.347	U	0.38	U	0.35	U	0.359	U	0.356	U	0.398	U	0.351	U	0.366	U	0.345	U	9.46	U	0.341	U
Pyridine	0.694	R	0.76	U	0.73	U	0.696	U	0.761	U	0.702	U	0.718	U	0.712	U	0.797	U	0.703	U	0.734	U	0.69	U	18.9	U	0.683	U

TABLE A-32
SOIL DATA - PHASE II RI
OIL SEWER BACKUP AREA - SWMU 32
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S32-SB20-SO-0-2 11/28/07 0-2 ft	S32-SB20-SO-14-16 11/28/07 14-16 ft	S32-SB18-SO-0-2 11/28/07 0-2 ft	S32-SB18-SO-14-16 11/28/07 14-16 ft	S32-SB16-SO-0-2 11/28/07 0-2 ft	S32-SB16-SO-14-16 11/28/07 14-16 ft	S32-SB17-SO-0-2 11/28/07 0-2 ft	S32-SB17-SO-14-16 11/28/07 14-16 ft	S32-SB19-SO-0-2 11/28/07 0-2 ft	S32-SB19-SO-14-16 11/28/07 14-16 ft	S32-SB21-SO-0-2 11/28/07 0-2 ft	S32-SB21-SO-14-16 11/28/07 14-16 ft	S32-SB15-SO-0-2 11/29/07 0-2 ft	S32-SB15-SO-14-16 11/29/07 14-16 ft
VOCs (mg/kg)														
1,1,1-Trichloroethane	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
1,2-Dibromoethane (EDB)	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
1,2-Dichloroethane	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
1,2-Dichloropropane	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
1,4-Dioxane	0.21 U	0.258 U	0.23 U	0.216 U	0.217 U	0.223 U	0.253 U	0.206 U	0.219 U	0.22 U	0.186 U	0.21 U	0.217 U	0.228 U
2-Butanone	0.00688 J	0.0645 U	0.0575 U	0.0539 U	0.0542 U	0.0557 U	0.0632 U	0.0514 U	0.0547 U	0.0549 U	0.0464 U	0.0524 U	0.0543 U	0.0571 U
Benzene	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
Carbon disulfide	0.00524 U	0.00645 U	0.00575 U	0.00539 U	0.00542 U	0.00557 U	0.00632 U	0.00514 U	0.00093 J	0.00549 U	0.00464 U	0.00524 U	0.00543 U	0.00571 U
Chlorobenzene	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
Chloroform	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00103 J
Ethylbenzene	0.00322	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.0029	0.00219 U	0.0022 U	0.00186 U	0.00109 J	0.00217 U	0.00209 J
m,p-Xylene	0.012	0.00387 U	0.00345 U	0.00324 U	0.00325 U	0.00334 U	0.00379 U	0.011	0.00328 U	0.0033 U	0.00279 U	0.0013 J	0.00326 U	0.00469
Methyl tert-Butyl ether														
o-Xylene	0.0032	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00257	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
Styrene	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
Tetrachloroethene	0.0021 U	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00206 U	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00228 U
Toluene	0.0117	0.00258 U	0.0023 U	0.00216 U	0.00217 U	0.00223 U	0.00253 U	0.00752	0.00219 U	0.0022 U	0.00186 U	0.0021 U	0.00217 U	0.00502
Wet Chemistry														
Percent Solids	94.4	85.7	90.4	94.2	85.8	92.4	88.1	93.2	82.5	94.4	88.4	94.6	84.6	92.8

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
R - Value rejected, not included in screening.
J - detected below the method detection limit. Concentration is estimated.

TABLE A-33
SOIL DATA - PHASE I RI
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID	SWMU 33 b2		SWMU 33 MW-2		SWMU 33 MW-1		SWMU 33 MW-1		SWMU 33 b1	SWMU 33 b2	SWMU 33 b3	SWMU 33 b3	SWMU 33 b4	SWMU 33 b4	SWMU 33 b5	SWMU 33 b5	SWMU 33 b6	SWMU 33 b6
	Sample Depth	0-2 ft		10-12 ft		2-4 ft		8-10 ft		8-10 ft	8-10 ft	4-6 ft	8-10 ft	6-8 ft	8-10 ft	0-2 ft	8-10 ft	4-6 ft	8-10 ft
	Sample Date	03/16/99		02/24/99		02/24/99		02/24/99		03/16/99	03/16/99	03/16/99	03/16/99	03/16/99	03/16/99	02/25/99	02/25/99	03/16/99	03/16/99
Inorganics (mg/kg)																			
Antimony		9.1	R	8.1	UL														
Arsenic		23.1		4.8															
Barium		40.8		23	B														
Cadmium		2.3	L	0.4	UL														
Chromium		18.5		13.1	K														
Lead		11.6	K	3	K														
Mercury		0.02	U	0.02	U														
Nickel		55.8	J	5.9	L														
Selenium		0.8	U	0.7	U														
Silver		1.5	U	0.4	UL														
Tetraethyl Lead		0.35	U	1.3	U														
VOCs (mg/kg)																			
1,1,1 Trichloroethane		0.002	U	0.055	U	0.057	U												
1,2 Dichloroethane		0.002	U	0.055	U	0.057	U												
1,2 Dichloropropane		0.002	U	0.055	U	0.057	U												
1,4 Dioxane		0.16	R	5.5	R	5.7	R												
2 Butanone		0.002	U	0.36	B	0.36	B												
Benzene		0.002	U	0.055	U	0.057	U	0.001	U										
Carbon Disulfide		0.002	U	0.055	U	0.057	U												
Chlorobenzene		0.002	U	0.055	U	0.057	U												
Chloroform		0.002	U	0.055	U	0.057	U												
Ethylbenzene		0.002	U	0.055	U	0.057	U	0.001	U										
Ethylene dibromide		0.002	U	0.055	U	0.057	U												
m&p Xylene		0.003	U	0.11	U	0.057	U	0.001	U										
o Xylene		0.002	U	0.055	U	0.057	U	0.001	U										
Styrene		0.002	U	0.055	U	0.057	U												
Methyl tert-butyl ether		0.002	U	7.9		0.057	U												
Tetrachloroethene		0.002	U	0.055	U	0.057	U												
Toluene		0.002	U	0.055	U	0.057	U	0.001	U										
SVOCs (mg/kg)																			
1,2 Dichlorobenzene		0.35	U	0.43	U	0.41	U												
1,3 Dichlorobenzene		0.35	U	0.43	U	0.41	U												
1,4 Dichlorobenzene		0.35	U	0.43	U	0.41	U												
2,4,5 Trichlorophenol		0.89	U	0.43	U	0.41	U												
2,4,6 Trichlorophenol		0.35	U	1.1	U	1	U												
2,4 Dimethylphenol		0.35	U	0.43	U	0.41	U												
2,4 Dinitrophenol		0.89	U	1.1	U	1	U												
2,4 Dinitrotoluene		0.35	U	0.43	U	0.41	U												
2 Chlorophenol		0.35	U	0.43	U	0.41	U												
2 Methylphenol		0.35	U	0.43	U	0.41	U												
4,6 Dinitro 2 Methylphenol		0.89	U	1.1	U	1	U												
4 Methylphenol		0.35	U	0.43	U	0.41	U												
4 Nitrophenol		0.89	U	1.1	U	1	U												
7,12 Dimethyibenz[a]anthracene		1.1	U	0.43	U	0.41	U												
Aniline		0.89	U	1.1	U	1	U												
Anthracene		0.35	U	0.43	U	0.41	U												
Benzo(a)anthracene		0.35	U	0.43	U	0.41	U												
Benzo(a)pyrene		0.35	U	0.43	U	0.41	U												
Benzo(b)fluoranthene		0.35	U	0.43	U	0.41	U												
Benzo(k)fluoranthene		0.35	U	0.43	U	0.41	U												
Bis(2 ethylhexyl)phthalate		0.17	B	2.1	B	1.7	B												

TABLE A-33
SOIL DATA - PHASE I RI
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analyte	URS Sample ID Sample Depth Sample Date	SWMU 33 b2 0-2 ft 03/16/99	SWMU 33 MW-2 10-12 ft 02/24/99	SWMU 33 MW-1 2-4 ft 02/24/99	SWMU 33 MW-1 8-10 ft 02/24/99	SWMU 33 b1 8-10 ft 03/16/99	SWMU 33 b2 8-10 ft 03/16/99	SWMU 33 b3 4-6 ft 03/16/99	SWMU 33 b3 8-10 ft 03/16/99	SWMU 33 b4 6-8 ft 03/16/99	SWMU 33 b4 8-10 ft 03/16/99	SWMU 33 b5 0-2 ft 02/25/99	SWMU 33 b5 8-10 ft 02/25/99	SWMU 33 b6 4-6 ft 03/16/99	SWMU 33 b6 8-10 ft 03/16/99
Butyl benzyl phthalate		0.35 U	0.43 U	0.41 U											
Chrysene		0.35 U	0.43 U	0.41 U											
Di n butyl phthalate		0.35 U	4.2 B	0.84 B											
Di n octyl phthalate		0.35 U	0.43 U	0.41 U											
Dibenz(a,h)anthracene		0.35 U	0.43 U	0.41 U											
Diethyl phthalate		0.35 U	0.43 U	0.41 U											
Dimethyl phthalate		0.35 U	0.43 U	0.41 U											
Fluoranthene		0.35 U	0.43 U	0.41 U											
Indeno(1,2,3 cd)pyrene		0.35 U	0.43 U	0.41 U											
Naphthalene		0.35 U	0.43 U	0.56											
Nitrobenzene		0.35 U	0.43 U	0.41 U											
Phenanthrene		0.35 U	0.43 U	0.41											
Phenol		0.35 U	0.43 U	0.41 U											
Pyrene		0.35 U	0.43 U	0.41 U											
Pyridine		0.89 U	1.1 U	1 U											
BTEX Constituent															
Benzene						0.14 U	0.002 U	0.13 U	0.054 U	0.001 U	0.002 UJ	0.001 U	0.001 U	0.05 U	0.001 UJ
Ethylbenzene						3.80	0.002 U	0.13 U	0.054 U	0.008	0.025 J	0.001 U	0.001 U	0.05 U	0.001 UJ
Toluene						0.20	0.002 U	0.13 U	0.054 U	0.001 U	0.002 UJ	0.005	0.001 U	0.05 U	0.001 UJ
m&p Xylene						3.20	0.003 U	0.27 U	0.11 U	0.001 J	0.003 J	0.001	0.001 U	0.1 U	0.002 UJ
o Xylene						0.34	0.002 U	0.13 U	0.054 U	0.001 U	0.002 UJ	0.001	0.001 U	0.05 U	0.001 UJ

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

B - Result is potentially biased high due to blank contamination.

J - detected below the method detection limit. Concentration is estimated.

R - Value rejected, not included in screening.

UL - Non-detect result (reporting limit) is estimated and potentially biased low due to a minor quality control anomaly.

L - Result is estimated and potentially biased low due to a minor quality control anomaly.

UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

K - Result is estimated and potentially biased high due to a minor quality control anomaly.

Blank cells indicate constituent not analyzed.

TABLE A-34
SOIL DATA - PHASE II RI
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S33-SB9-SO-0-2	S33-SB9-SO-5-6	S33-SB9-SO-8-9	S33-SB9-SO-9-10	S33-SB7-SO-0-2	S33-SB7-SO-4-5	S33-SB7-SO-7-9	S33-SB8-SO-0-2	S33-SB8-SO-4-5	S33-SB8-SO-8-9	S33-SB14-SO-0-2
	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	11/30/07	12/03/07
	0-2 ft	5-6 ft	8-9 ft	9-10 ft	0-2 ft	4-5 ft	7-9 ft	0-2 ft	4-5 ft	8-9 ft	0-2 ft
Metals (mg/kg)											
Arsenic	1.29	7.16	10.7	14.2	1.03 U	14.1	14.1	28.7	20.4	9.62	10.5
Vanadium	10.1	24	22.2	43.5	19.1	34.2	42.1	53.3	33.4	30.2	21.1 J
SVOCs (mg/kg)											
1,2-Dichlorobenzene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
1,3-Dichlorobenzene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
1,4-Dichlorobenzene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
2,4,5-Trichlorophenol	0.851 U	0.977 U	1.08 U	1.09 U	0.882 U	1.05 U	1.07 U	1.05 U	1.03 U	1.05 U	0.999 U
2,4,6-Trichlorophenol	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
2,4-Dimethylphenol	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
2,4-Dinitrophenol	0.851 U	0.977 U	1.08 U	1.09 U	0.882 U	1.05 U	1.07 U	1.05 U	1.03 U	1.05 U	0.999 U
2,4-Dinitrotoluene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
2-Chlorophenol	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
2-Methylphenol	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
3/4-Methylphenol	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
4,6-Dinitro-2-methylphenol	0.851 U	0.977 U	1.08 U	1.09 U	0.882 U	1.05 U	1.07 U	1.05 U	1.03 U	1.05 U	0.999 UJ
4-Nitrophenol	0.851 U	0.977 U	1.08 U	1.09 U	0.882 U	1.05 U	1.07 U	1.05 U	1.03 U	1.05 U	0.999 U
7,12-Dimethylbenz(a)anthracene	0.34 UJ	0.39 UJ	0.43 UJ	0.434 UJ	0.353 UJ	0.418 UJ	0.426 UJ	0.421 UJ	0.41 UJ	0.42 UJ	0.399 U
Aniline	1.71 U	1.96 U	2.16 U	2.18 U	1.77 U	2.1 U	2.14 U	2.11 U	2.06 U	2.1 U	2 U
Anthracene	0.34 U	0.39 U	1.53	0.276 J	0.061 J	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Benzo(a)anthracene	0.34 U	0.39 U	0.964	0.201 J	0.0709 J	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Benzo(a)pyrene	0.34 U	0.39 U	0.56	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Benzo(b)fluoranthene	0.34 U	0.39 U	0.558	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Benzo(k)fluoranthene	0.34 U	0.39 U	0.461	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Bis(2-ethylhexyl)phthalate	0.34 U	0.178 J	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Butyl benzyl phthalate	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Chrysene	0.34 U	0.39 U	0.87	0.18 J	0.107 J	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Dibenz(a,h)anthracene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Diethyl phthalate	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Dimethyl phthalate	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Di-n-butyl phthalate	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Di-n-octyl phthalate	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Fluoranthene	0.34 U	0.39 U	2.67	0.585	0.0787 J	0.418 U	0.426 U	0.421 U	0.41 U	0.0542 J	0.399 U
Indeno(1,2,3-cd)pyrene	0.34 U	0.39 U	0.199 J	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Naphthalene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.203 J	0.42 U	0.399 U
Nitrobenzene	0.34 U	0.39 U	0.43 U	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Phenanthrene	0.34 U	0.39 U	7.53 J	1.28	0.301 J	0.418 U	0.426 U	0.421 U	0.0767 J	0.0542 J	0.399 U
Phenol	0.34 U	0.39 U	2.48	0.434 U	0.353 U	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Pyrene	0.34 U	0.39 U	0.861 U	0.49	0.291 J	0.418 U	0.426 U	0.421 U	0.41 U	0.42 U	0.399 U
Pyridine	0.681 U	0.782 U	0.121 U	0.87 U	0.706 U	0.837 U	0.853 U	0.844 U	0.821 U	0.841 U	0.8 U
VOCs (mg/kg)											
1,1,1-Trichloroethane	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
1,2-Dibromoethane (EDB)	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
1,2-Dichloroethane	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
1,2-Dichloropropane	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
1,4-Dioxane	0.215 U	0.204 U	12.4 U	0.24 U	0.181 U	12 U	0.235 U	0.235 U	0.252 U	0.26 U	0.207 U
2-Butanone	0.0539 U	0.0511 U	3.09 U	0.0601 U	0.0142 J	3.01 U	0.0589 U	0.0589 U	0.0629 U	0.0649 U	0.0516 U
Benzene	0.0198 J	0.0157	0.77	0.0245	0.00181 U	0.12 U	0.00224 J	0.00235 U	0.00175 J	0.0026 U	0.00207 U
Carbon disulfide	0.00262 J	0.00118 J	0.309 U	0.00601 U	0.00219 J	0.301 U	0.00246 J	0.00589 U	0.00654	0.00649 U	0.00516 U
Chlorobenzene	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
Chloroform	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
Ethylbenzene	0.0104 J	0.00549	0.432	0.00336	0.0101	0.12 U	0.00235 U	0.00235 U	0.00187 J	0.0026 U	0.00207 U
m,p-Xylene	0.0191 J	0.0104	0.149 J	0.0101	0.0434	0.181 U	0.00161 J	0.00353 U	0.00377 U	0.00389 U	0.0031 U
Methyl tert-Butyl ether	0.00137 J	0.00395	0.124 U	0.00782	0.00128 J	0.12 U	0.00171 J	0.00235 U	0.00252 U	0.0026 U	0.00207 U
o-Xylene	0.00449 J	0.00279	0.18	0.00288	0.0491	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
Styrene	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
Tetrachloroethene	0.00215 U	0.00204 U	0.124 U	0.0024 U	0.00181 U	0.12 U	0.00235 U	0.00235 U	0.00252 U	0.0026 U	0.00207 U
Toluene	0.00967 J	0.00746	0.211	0.0089	0.00219	0.12 U	0.00235 U	0.00235 U	0.00117 J	0.0026 U	0.00207 U
Wet Chemistry											
Percent Solids	97.3 %	83.7 %	76.6 %	75 %	93.4 %	78.6 %	76.8 %	76.8 %	80.3 %	76.9 %	82.9 %

Notes:

mg/kg - milligrams per kilogram.

U - not detected above method detection limit.

J - detected below the method detection limit. Concentration is estimated.

UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

TABLE A-34
SOIL DATA - PHASE II RI
PIERS 1, 2, AND 3 - SWMU 33
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S33-SB15-SO-0-2		S33-SB17-SO-0-2		S33-SB16-SO-0-2		S33-SB18-SO-0-2		S33-SB11-SO-2-4		S33-SB10-SO-2-4		S33-SB12-SO-2-4		S33-SB13-SO-2-4	
	12/03/07		12/03/07		12/03/07		12/03/07		12/03/07		12/04/07		12/04/07		12/04/07	
	0-2 ft		0-2 ft		0-2 ft		0-2 ft		2-4 ft		2-4 ft		2-4 ft		2-4 ft	
Metals (mg/kg)																
Arsenic	5.47		7.38		6.08		4.51		22.1		11.4		12.9		11.2	
Vanadium	22.8	J	44.9	J	30.6	J	13.4	J	33.9	J	52.9		65.3		49.9	
SVOCs (mg/kg)																
1,2-Dichlorobenzene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
1,3-Dichlorobenzene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
1,4-Dichlorobenzene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
2,4,5-Trichlorophenol	1.09	U	2.07	U	0.996	U	0.894	U	1.11	U	1.08	U	1.07	U	1.12	U
2,4,6-Trichlorophenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
2,4-Dimethylphenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
2,4-Dinitrophenol	1.09	UJ	2.07	UJ	0.996	UJ	0.894	UJ	1.11	UJ	1.08	U	1.07	U	1.12	U
2,4-Dinitrotoluene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
2-Chlorophenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
2-Methylphenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
3/4-Methylphenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
4,6-Dinitro-2-methylphenol	1.09	UJ	2.07	UJ	0.996	UJ	0.894	UJ	1.11	UJ	1.08	UJ	1.07	UJ	1.12	UJ
4-Nitrophenol	1.09	U	2.07	U	0.996	U	0.894	U	1.11	U	1.08	U	1.07	U	1.12	U
7,12-Dimethylbenz(a)anthracene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Aniline	2.19	U	4.15	U	2	U	1.79	U	2.22	U	2.16	U	2.15	U	2.25	U
Anthracene	0.436	U	0.828	U	0.398	U	0.357	U	0.165	J	0.43	U	0.429	U	0.0462	J
Benzo(a)anthracene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Benzo(a)pyrene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Benzo(b)fluoranthene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Benzo(k)fluoranthene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Bis(2-ethylhexyl)phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Butyl benzyl phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Chrysene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Dibenz(a,h)anthracene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Diethyl phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Dimethyl phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Di-n-butyl phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Di-n-octyl phthalate	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Fluoranthene	0.436	U	0.828	U	0.398	U	0.357	U	0.367	J	0.43	U	0.429	U	0.448	U
Indeno(1,2,3-cd)pyrene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Naphthalene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	1.63		0.429	U	0.0772	J
Nitrobenzene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Phenanthrene	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.0775	J	0.429	U	0.448	U
Phenol	0.436	U	0.828	U	0.398	U	0.357	U	0.442	U	0.43	U	0.429	U	0.448	U
Pyrene	0.436	U	0.828	U	0.398	U	0.357	U	0.317	J	0.43	U	0.429	U	0.448	U
Pyridine	0.873	U	1.66	U	0.797	U	0.716	U	0.886	U	0.862	U	0.86	U	0.898	U
VOCs (mg/kg)																
1,1,1-Trichloroethane	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
1,2-Dibromoethane (EDB)	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
1,2-Dichloroethane	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
1,2-Dichloropropane	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
1,4-Dioxane	0.263	U	0.28	U	17.9	U	0.221	U	0.282	U	23.6	U	0.25	U	0.251	U
2-Butanone	0.0658	U	0.07	U	4.47	U	0.0553	U	0.0705	U	5.89	U	0.0624	U	0.0627	U
Benzene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.005		1.59		0.0025	U	0.0264	J
Carbon disulfide	0.00658	U	0.007	U	0.447	U	0.00553	U	0.00536	J	0.589	U	0.00624	U	0.0092	J
Chlorobenzene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
Chloroform	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
Ethylbenzene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	530		0.00131	J	115	
m,p-Xylene	0.00395	U	0.0042	U	0.268	U	0.00332	U	0.00423	U	1610		0.00419		129	
Methyl tert-Butyl ether	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
o-Xylene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00125	J	148		0.0025	U	0.0272	J
Styrene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
Tetrachloroethene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	0.236	U	0.0025	U	0.00251	U
Toluene	0.00263	U	0.0028	U	0.179	U	0.00221	U	0.00282	U	7.58		0.0025	U	0.0103	J
Wet Chemistry																
Percent Solids	76.3	%	80.1	%	82.7	%	89.8	%	74.2	%	77	%	75.3	%	73.4	%

Notes:

mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit. Concentration is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.

TABLE A-35
SOIL DATA - PHASE II RI
NAPTHALENE TANK FARM - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S34-SB1C-SO-33-35		S34-SB1E-SO-32-34		S34-SB1K-SO-31-33		S34-SB1O-SO-32-34		S34-SB1G-SO-30-32		S34-SB1Z-SO 31-33		S34-SB1J-SO-31-33	
	11/01/07		11/01/07		10/31/07		10/31/07		12/04/07		12/06/07		12/18/07	
	33-35 ft		32-34 ft		31-33 ft		32-34 ft		30-32 ft		31-33 ft		31-33 ft	
Metals (mg/kg)														
Antimony	11	U	11.2	U	11	U	10.8	U	11.2	UJ	10.7	UJ	10.9	UJ
Arsenic	1.1	U	1.12	U	4.45		1.41		1.12	UJ	1.07	U	1.09	U
Barium	19.8	J	26.7	J	46.4		28.1		31	J	31.9		34.8	
Cadmium	1.1	U	1.12	U	0.701	J	0.325	J	1.12	U	1.07	U	1.09	U
Chromium	3.47	J	3.93	J	21.6	J	54.4	J	3.59	J	8.61		16.8	J
Lead	3.31	J	4.73	J	6.68	J	2.84	J	2.13	J	3.03		3.13	
Mercury	0.107	U	0.109	U	0.113	U	0.109	U	0.109	U	0.108	U	0.108	U
Nickel	3.38		3.64		9.2	J	6.96	J	4.29	J	5.84		7.55	
Selenium	2.19	U	2.23	U	2.19	U	2.17	U	2.24	U	3.37		2.17	U
Silver	1.1	U	1.12	U	1.1	U	1.08	U	1.12	U	1.07	U	1.09	U
SVOCs (mg/kg)														
1,2-Dichlorobenzene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
1,3-Dichlorobenzene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
1,4-Dichlorobenzene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
2,4,5-Trichlorophenol	0.893	U	0.927	U	0.936	U	0.921	U	0.937	U	0.874	U	0.909	U
2,4,6-Trichlorophenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
2,4-Dimethylphenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
2,4-Dinitrophenol	0.893	U	0.927	U	0.936	U	0.921	U	0.937	U	0.874	U	0.909	U
2,4-Dinitrotoluene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
2-Chlorophenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
2-Methylphenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
3/4-Methylphenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
4,6-Dinitro-2-methylphenol	0.893	U	0.927	U	0.936	U	0.921	U	0.937	UJ	0.874	U	0.909	UJ
4-Nitrophenol	0.893	U	0.927	U	0.936	U	0.921	U	0.937	U	0.874	U	0.909	U
7,12-Dimethylbenz(a)anthracene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Aniline	1.79	U	1.86	U	1.88	U	1.85	U	1.88	U	1.75	U	1.82	U
Anthracene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.243	
Benzo(a)anthracene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.191	
Benzo(a)pyrene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Benzo(b)fluoranthene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Benzo(k)fluoranthene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Bis(2-ethylhexyl)phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.242	J	0.141	
Butyl benzyl phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Chrysene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Dibenz(a,h)anthracene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Diethyl phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Dimethyl phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Di-n-butyl phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Di-n-octyl phthalate	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Fluoranthene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.246	
Indeno(1,2,3-cd)pyrene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Naphthalene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Nitrobenzene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Phenanthrene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.443	
Phenol	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.363	U
Pyrene	0.357	U	0.371	U	0.374	U	0.368	U	0.375	U	0.349	U	0.207	
Pyridine	0.715	U	0.742	U	0.75	U	0.738	U	0.751	U	0.7	U	0.727	U

TABLE A-35
SOIL DATA - PHASE II RI
NAPTHALENE TANK FARM - SWMU 34
DELAWARE CITY REFINERY
DELAWARE CITY, DELAWARE

Analytes	S34-SB1C-SO-33-35	S34-SB1E-SO-32-34	S34-SB1K-SO-31-33	S34-SB1O-SO-32-34	S34-SB1G-SO-30-32	S34-SB1Z-SO 31-33	S34-SB1J-SO-31-33
	11/01/07	11/01/07	10/31/07	10/31/07	12/04/07	12/06/07	12/18/07
	33-35 ft	32-34 ft	31-33 ft	32-34 ft	30-32 ft	31-33 ft	31-33 ft
VOCs (mg/kg)							
1,1,1-Trichloroethane	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
1,2-Dibromoethane (EDB)	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
1,2-Dichloroethane	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
1,2-Dichloropropane	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
1,4-Dioxane	0.199 UJ	0.189 UJ	0.239 U	0.208 U	0.249 U	0.209 U	0.205 U
2-Butanone	0.0111 J	0.0472 U	0.0206 J	0.333 J	1.15	0.0523 U	0.776 J
Benzene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Carbon disulfide	0.00498 U	0.00472 U	0.00597 U	0.00519 U	0.00622 U	0.00523 U	0.00514 U
Chlorobenzene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Chloroform	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Ethylbenzene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
m,p-Xylene	0.00299 U	0.00283 U	0.00358 U	0.00312 U	0.00389	0.00228 J	0.00308 U
Methyl tert-Butyl ether	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
o-Xylene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Styrene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Tetrachloroethene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Toluene	0.00199 U	0.00189 U	0.00239 U	0.00208 U	0.00249 U	0.00209 U	0.00205 U
Wet Chemistry							
Percent Solids	91 %	88.6 %	87.3 %	90.3 %	88.6 %	92.6 %	89.8 %

Notes:
mg/kg - milligrams per kilogram.
U - not detected above method detection limit.
J - detected below the method detection limit. Concentration is estimated.
UJ - Non-detect result (reporting limit) is estimated due to a minor quality control anomaly.