

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action **Environmental Indicator (EI) RCRIS code (CA750)** **Migration of Contaminated Groundwater Under Control**

Facility Name: Chevron Perth Amboy Refinery
Facility Address: 1200 State Street, Perth Amboy, New Jersey
Facility EPA ID #: NJD081982902

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of “Migration of Contaminated Groundwater Under Control” EI

A positive “Migration of Contaminated Groundwater Under Control” EI determination (“YE” status code) indicates that the migration of “contaminated” groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original “area of contaminated groundwater” (for all groundwater “contamination” subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The “Migration of Contaminated Groundwater Under Control” EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in the RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Background Information

The Chevron Refinery is an active, 339-acre facility located in a heavily industrial area on the east side the city of Perth Amboy, Middlesex County, New Jersey (Figure 1). The facility has been in operation since 1920. Barber Asphalt Company built and operated an asphalt Refinery in 1920. The California Oil Company (later became Chevron) purchased the property in 1946 and expanded the facility into a full-service Refinery in 1950. In 1983, Chevron shut down several process units and scaled back the refinery operation to asphalt production, which continues to this day.

The facility is bounded to the north and south by industrial properties and to the west by commercial and residential properties along Convery Boulevard (State Highway 35) (Figure 2). The base map, presented as Figure 2-2 of the Supplemental RCRA Facility Investigation Report (SRFI Report) is included in Attachment 1. Amboy Avenue runs north-south through the western portion of the Refinery and State Street runs north-south through the eastern portion of the Refinery. Maurer Road crosses east-west through the central portion of the Refinery and connects Amboy Avenue to State Street. The site is bordered to the east by the Arthur Kill, which provides the Refinery with docking berths for tanker ships and barges. Woodbridge Creek flows from the northwest to southeast through the northern portion of the Refinery and has been classified by the State of New Jersey as FW2-NT/SE3 surface water. Spa Spring Creek flows along the northern property boundary and discharges into Woodbridge Creek. Groundwater at the facility is not used as a drinking water source, and some areas are saline due to naturally-occurring salt water intrusion.

The Refinery has been divided into six major geographical areas referred to as Amboy Field, Central Yard, North Field/Main Yard, West Yard, East Yard, and North Field Extension (NFE). West Yard and Amboy Field were sold to the City of Perth Amboy, and now are no longer part of Chevron. Both West Yard and Amboy Filed is being developed for commercial warehouse purposes. The reduced Refinery now consists of only tank fields, an asphalt distribution terminal, process areas, offices, mechanical shops, wastewater treatment units, pipelines, and tanker docks. The NFE, a vacant tract of land separated from the Refinery by Woodbridge Creek, has never been developed or used by Chevron for any industrial or commercial purposes. The facility operates 24-hours a day, 365-days a year. The Refinery maintains a comprehensive site security system that includes perimeter fencing with warning signs, video surveillance, and controlled gate access and 24-hour security. The Refinery also has a security policy establishing locations and procedures for admittance to the site, including maritime security.

Site remediation activities are being conducted pursuant to the Resource Conservation and Recovery Act (RCRA). The RCRA Facility Investigation Report (RFI Report) was submitted on December 10, 2003 and the Supplemental RFI Report was submitted in February 2008. These reports address Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) in the North Field/Main Yard, East Yard, and Central Yard. The former West Yard was sold, has been redeveloped, and is no longer part of the Refinery. The Amboy Field property was also sold in November 2005 and is currently being re-developed. However, the remediation of West Yard and Amboy Field continues to be handled through Chevron under the HSWA permit. A separate remedial investigation of the NFE is currently being addressed by Chevron in conjunction with negotiations with the prior owners of the site.

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

X If yes - check here and continue with #2 below.

If no - re-evaluate existing data, or

If data are not available, skip to #8 and enter "IN" (more information needed) status code.

RATIONALE:

Chevron has conducted a RCRA Facility Investigation (RFI) at the Chevron Perth Amboy Refinery. The objectives of the RFI were to identify releases that resulted from accepted practices employed before the advent of modern waste management procedures and current regulations. The areas investigated included Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified in the permit as having a potential for a release, light non-aqueous phase liquid (LNAPL), and receiving surface water bodies and wetlands around the perimeter of the site. Where releases were identified, the nature and extent as well as whether groundwater at the facility was affected by the releases was evaluated. The RFI Report was submitted to the USEPA and NJDEP on December 10, 2003 and the Supplemental RFI Report (SRFI) was submitted in February 2008.

Since the NFE, a vacant tract of land separated from the Refinery by Woodbridge Creek, has never been developed or used by Chevron for any industrial or commercial purpose, a separate remedial investigation of the NFE has been conducted through a joint effort by Chevron and prior owners/potential purchasers of the property. The results of the investigation so far have been submitted to USEPA and NJDEP in the Remedial Investigation Report, Northfield Extension Site - March 2005, and the Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations - February, 2005.

Additional investigation and corrective measures for the West Yard and Amboy Field were performed under a Memorandum of Agreement (MOA) between Chevron and NJDEP. Under the MOA, Chevron prepared numerous workplans and reports documenting environmental conditions, corrective measures and regulatory compliance. These investigations and corrective measures were expedited to allow for the transfer of ownership of these two properties. For groundwater in the West Yard above the NJDEP Ground Water Quality Standards (GWQS), a Classification Exception Area (CEA) for ammonia, metals and sulfate (Attachment 2) has been submitted and is awaiting approval by the NJDEP. A CEA for Amboy Field for semi-volatile organic compounds (SVOCs), metals and ammonia has been submitted and is also awaiting NJDEP approval (Attachment 3).

The RFI Report, submitted in December 2003, addressed a total of thirty-five AOCs and sixty-two SWMUs throughout the Refinery. The supplemental RFI investigation was performed to address NJDEP and EPA comments on the RFI Report and 14 additional AOCs. During the SRFI, further delineation of contaminants of concern (COCs) was performed and additional hydrogeologic data was obtained, and an investigation of a chlorinated plume in the Central Yard (AOC 36) was also performed. Chevron submitted the AOC 36 Triad-Based Chlorinated Plume Investigation Report, and a supplemental report on March 6, 2006.

The assessment of site-wide groundwater conditions at the Refinery during the RFI and SRFI was made primarily based data collected from 176 shallow wells and 25 deep monitoring wells, 524 temporary wells, and 13 piezometers. Currently, a site-wide groundwater sampling program has been implemented. The data includes laboratory analytical results for the presence of VOCs, SVOCs, and metals. Monitored Natural Attenuation (MNA) parameters are also analyzed including NO₂, NO₃, alkalinity, SO₄, total and dissolved iron, chloride, TDS and NH₃. The data also includes groundwater elevations and the results of analyses conducted on groundwater samples collected from temporary wells during previous investigations. The results of these investigations have provided sufficient

information to develop a comprehensive model of the shallow and deep groundwater conditions at the Refinery, including hydrogeologic setting and distribution of COCs. Areas of groundwater impacted by dissolved phase constituents have been identified and delineated within the Refinery. Data from the sentinel well system indicates that the contaminated groundwater plumes for the most part have not migrated off-site from Chevron property. One exception is the Central Yard chlorinated hydrocarbon plume, which has been concluded to be stable and reduced in size. The Light Non-Aqueous Phase Liquid (LNAPL) contaminated areas have been delineated and do not extend off-site. Interim Remedial Measures (IRMs) have been implemented at the LNAPL areas and are shown on Figure 37 of the SRFI Report included in Attachment 4. There are no current known continuing releases at the site.

References

- Chevron U.S.A., West Yard Site Investigation Report - January 1999.
- Chevron U.S.A., West Yard Remedial Investigation Report - December 2000.
- Chevron U.S.A., West Yard Groundwater Remedial Action Workplan - March 2001.
- Chevron U.S.A., West Yard Baseline Ecological Evaluation - April 2001.
- Chevron U.S.A., West Yard Remedial Action Report - June 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Report - July 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Addendum - November 2001.
- Chevron U.S.A., West Yard RI/RA/RAWP Addendum - May 2002.
- Chevron U.S.A., Response to NJDEP Letter Dated September 17, 2002 and Revised RAWP for the West Yard Groundwater - April 2003.
- Chevron U.S.A., West Yard Final Remedial Action Workplan for Soil and Revised Draft Deed Notice - June 2003.
- Chevron U.S.A., West Yard Northern Pipeway Remedial Action Report - August 2003.
- Chevron U.S.A., Amboy Field SI/RI Report - October 2003.
- Chevron U.S.A., Inc., Full RCRA Facility Investigation Report, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - November 2003.
- Chevron U.S.A., Inc., Remedial Action Selection Report Ammonia in West Yard Groundwater - January 2004.
- TRC Raviv Associates, Inc., North Field Extension, Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - February 2005.
- Roux Associates Inc., Remedial Investigation Report, North Field Extension Site, Woodbridge, New Jersey - March 2005.
- Chevron U.S.A., Inc., West Yard Final Sewer System Investigation - March 2005.
- Chevron U.S.A., Amboy Field Remedial Action Report - April 2005.
- Chevron U.S.A., West Yard Off-Site Ditch Supplemental Remedial Investigation Report - June 2005.
- Science Applications International Corporation (SAIC), Central Yard Area of Concern (AOC) 36, Triad Based Approach Chlorinated Plume Investigation, Chevron Perth Amboy Facility, NJ - August 25, 2005.
- SAIC, Status of Supplemental Investigation and Response to Comments for Area of Concern 36 - March 6, 2006.
- Science Applications International Corporation, Supplemental RFI Report, Chevron Perth Amboy Facility, New Jersey - February 2008.

2. Is **groundwater** known or reasonably suspected to be “**contaminated**”¹ above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

 X If yes - continue after identifying key contaminants, citing appropriate “levels,” and referencing supporting documentation.

_____ If no - skip to #8 and enter “YE” status code, after citing appropriate “levels,” and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”

_____ If unknown - skip to #8 and enter “IN” status code.

RATIONALE:

A. Overview of groundwater contamination

Groundwater is known to be impacted from various SWMUs and AOCs at the site. Groundwater contamination associated with the site has been extensively studied by Chevron based on the data collected from over 200 monitoring wells, and many more temporary wells. The primary contaminant of concern (COC) in groundwater is benzene. Benzene is a constituent of various petroleum products produced at the Refinery by Chevron. Benzene groundwater concentrations range from a high of approximately 31,000 parts per billion (ppb) in one location with free product present, to non-detect levels. Most of the groundwater impacted areas of the Refinery have benzene groundwater concentrations between 1 and 100 ppb. The applicable federal and state criterion for benzene is 5 ppb and 1 ppb, respectively. Other groundwater contaminants, found less frequently, include toluene, xylene, ethylbenzene, polycyclic aromatic hydrocarbons, several metals and chlorinated hydrocarbons. The list of COCs is attached as Table 1. Additionally, 13 on-site areas have been identified to be have separate phase petroleum product which exist as a light non-aqueous phase liquid (LNAPL) and is typically coincident with the benzene groundwater contamination, as shown on Figure 37 of the SRFI Report. The extent of site-wide groundwater contamination has been delineated and is documented in the various reports cited in the References. The contaminated groundwater is found in the shallow water bearing zone contained generally within the property boundary, with exception of AOC-36, which is described in detail in the section below.

B. Summary of Hydrogeologic Conditions

The Chevron Perth Amboy Refinery is situated in the Coastal Plain physiographic province. In general, 2 to 20 feet of fill material is present throughout the Refinery. The fill material consists of reworked clays and silts with varying amounts of sand, gravel and debris. Near Woodbridge Creek and the Arthur Kill, the fill is underlain by peat and gray clay. The clay is variable in thickness, up to 30 feet in some areas. Glacial till underlies the clay or fill and consists of up to 35 feet of reddish brown gravelly sand and silt. The gray clay and glacial till act as confining layers. Beneath the glacial till are the Woodbridge Clay and Farrington Sand (Raritan Formation) which are not continuous throughout the Refinery. Diabase bedrock is encountered at depths ranging from 60 to 140 feet. Shallow groundwater exists within the fill layer and has been found to be perched on top of the fill/native interface over much of the Refinery. The depth to groundwater is relatively shallow, typically within 10 feet of the ground surface. In general, the shallow groundwater flows to the northeast, discharging to adjacent saline and tidally flowed surface water bodies (the Arthur Kill and Woodbridge Creek). The hydraulic gradients range from 0.001 to 0.03 with the average gradient being approximately 0.01. The low permeability of the fill material along with the low hydraulic gradients results in a fairly low seepage velocity for the shallow groundwater.

C. Summary of Groundwater Investigations

The assessment of site-wide groundwater conditions at the Refinery during the RFI and SRFI was based on more than 10 years of data collected from 200 monitoring wells, 524 temporary wells, and 13

piezometers. In addition, a site wide groundwater sampling program has been implemented. The data includes laboratory analytical results for the presence of VOCs, SVOCs, metals and MNA parameters. Groundwater samples were also collected from temporary wells during previous investigations. In addition to the RFI and SRFI wells, 25 monitoring wells were installed for the investigation at the NFE. Contaminants of Concern (COCs) identified in groundwater are listed in Table 1. To determine if groundwater at the facility is contaminated, groundwater data were evaluated to identify exceedances of applicable criteria, the NJDEP Class II-A GWQS.

While areas of groundwater impacted by LNAPL and dissolved phase constituents have been identified within the Refinery, data from the sentinel well system indicates that the perimeter of the site is for the most part not impacted by these constituents. One exception is where limited dissolved chlorinated VOCs are present at AOC-36 located in the southern portion of the Central Yard. Vertical migration of constituents is limited by the presence of low permeability gray clay and glacial till underlying the fill.

There are no current or planned uses of the groundwater in the Refinery area. The Refinery does not use any production wells and all surrounding residents are on a municipal water supply system. In addition, groundwater in the portions of the Refinery near Woodbridge Creek and the Arthur Kill has characteristics typical of the NJDEP Class III-B (non-potable) designation – brackish with naturally occurring iron, sodium, manganese, and aluminum concentrations in excess of Class II-A GWQS.

Groundwater plumes include areas of contiguous exceedances in groundwater of chemicals that are related to historic or current operations in a SWMU or AOC. Benzene is the most widely distributed compound at the Refinery. The extent of benzene plumes, for the most part, represents the extent of groundwater contamination in the North Field/Main Yard and the East Yard. The location and extent of the dissolved benzene plumes in the North Field/Main Yard and the East Yard are shown on Figure 37 of the SRFI Report (Attachment 4). The location and extent of the dissolved benzene plumes in the Central Yard are shown on Figure 56 of the SRFI Report (Attachment 5). These figures also include groundwater elevation contours indicating the groundwater flow direction. Additional figures showing the extent of other COCs in groundwater are presented in the SRFI Report. Specific plumes at AOC-36, North Field Extension, and West Yard and Amboy field are provided below:

AOC-36: A dissolved chlorinated hydrocarbon plume has been identified in the southeast portion of the Central Yard. The chlorinated hydrocarbon groundwater plume extends off-site towards State Street (Attachment 6). The source of this chlorinated hydrocarbon plume is believed to be the result of historic releases from the Shops Building area. No activities are currently being conducted in the Shops Building and no continuing sources of free product have been identified. The results of investigations conducted to delineate this plume are presented in the document entitled Central Yard AOC 36, Triad Based Approach Chlorinated Plume Investigation - August 25, 2005). In response to NJDEP and EPA comments on this report, Chevron performed additional investigations off-site on the State Street properties during December 2005 and January 2006. The results of the off-site investigation indicated that the chlorinated plume originating from the Refinery has been delineated and that an off-site source of chlorinated hydrocarbon contamination unrelated to the Chevron groundwater plume exists on the Sylvan property located along State Street. The extent of the chlorinated hydrocarbon plumes from the Central Yard is shown on Figures 48 through 55 of the SRFI Report (Attachment 6). The results of detailed off-site investigations have shown that the plume which originated from the Refinery extends a short distance off-site but not beyond State Street and does not appear to pose a vapor intrusion risk to any off-site properties. NJDEP has concurred with this assessment.

North Field Extension: The investigation of the North Field Extension (NFE) showed low levels of chlorinated VOCs in wells NFE-MW06D, NFE-MW11D and NFE-MW13D at concentrations slightly above the NJ Class II-A GWQS (Figure 3). These wells are screened within the deep overburden

(Farrington Sand) at depths ranging from 51 to 69 feet below ground surface. Higher concentrations of chlorinated VOCs were detected in NFE shallow monitoring well MW-26 (Figure 3). Well MW-26 is screened within the fill material above the peat and gray clay layer and is located along the northern boundary of the site. Shallow groundwater in this area is perched on top of the peat and gray clay. The results of this investigation were submitted in February 2005 in the document entitled North Field Extension, Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations. The chlorinated VOCs detected in these wells are believed to originate from an off-site source based on the historic uses of the NFE and the results of extensive soil sampling.

The metals antimony, arsenic, beryllium, lead and vanadium have been detected in groundwater above the NJ Class II-A GWQS in some NFE wells. The metals data is presented in the Remedial Investigation Report, North Field Extension Site (Roux, March 2005). The presence of these metals in groundwater was based on one round of sampling performed in 2002. The field data summary contained within Appendix B of the Roux report show that the groundwater samples collected in 2002 exhibited high turbidity. Therefore, an additional round of groundwater samples was collected on April 23, 2008 from the same wells that showed metal exceedances in 2002. Groundwater samples were collected from NFE wells MW-10S, MW-11S, MW-11D and MW-12 using low flow purging to obtain turbid free samples. The results of this analysis are presented in Figure 4. The results show that no metal exceedances were detected in the April 23, 2008 sampling round. This data supports the position that the 2002 metal exceedances were likely due to suspended sediments.

West Yard and Amboy Field: The investigation and corrective measures for the West Yard and Amboy Field were performed under a Memorandum Of Agreement (MOA) between NJDEP and Chevron. Groundwater contamination in the West Yard and Amboy Field includes ammonia, metals and sulfates. Under the MOA, Chevron has prepared numerous workplans and reports documenting environmental conditions, corrective measures and regulatory compliance. These investigations and corrective measures were expedited to allow for the transfer of ownership of these two properties. The West Yard and Amboy Field have been sold and are no longer part of the Refinery. The Remedial Action Workplan and Remedial Action Report have been approved by NJDEP for the West Yard. For groundwater in the West Yard above the NJDEP GWQS, a Classification Exception Area (CEA) for ammonia, metals and sulfate (Attachment 2) has been submitted and is awaiting NJDEP approval. The complete CEA submission for the West Yard is included in the Response to NJDEP Letter dated September 17, 2002 and Revised Remedial Action Workplan for the West Yard Groundwater, April 9, 2003. A CEA has also been submitted for Amboy Field for SVOCs, metals and ammonia (Attachment 3) and is also awaiting NJDEP approval. The CEA submission for Amboy Field is included in the Remedial Action Workplan and CEA Application for Amboy Field, September 2005.

References

- Chevron U.S.A., West Yard Site Investigation Report - January 1999.
- Chevron U.S.A., West Yard Remedial Investigation Report - December 2000.
- Chevron U.S.A., West Yard Groundwater Remedial Action Workplan - March 2001.
- Chevron U.S.A., West Yard Baseline Ecological Evaluation - April 2001.
- Chevron U.S.A., West Yard Remedial Action Report - June 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Report - July 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Addendum - November 2001.
- Chevron U.S.A., West Yard RI/RA/RAWP Addendum - May 2002.
- Chevron U.S.A., Response to NJDEP Letter Dated September 17, 2002 and Revised RAWP for the West Yard Groundwater - April 2003.
- Chevron U.S.A., West Yard Final Remedial Action Workplan for Soil and Revised Draft Deed Notice - June 2003.
- Chevron U.S.A., West Yard Northern Pipeway Remedial Action Report - August 2003.

- Chevron U.S.A., Amboy Field SI/RI Report - October 2003.
- Chevron U.S.A., Inc., Full RCRA Facility Investigation Report, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - November 2003.
- Chevron U.S.A., Inc., Remedial Action Selection Report Ammonia in West Yard Groundwater - January 2004.

TRC Raviv Associates, Inc., North Field Extension, Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - February 2005.

Roux Associates Inc., Remedial Investigation Report, North Field Extension Site, Woodbridge, New Jersey - March 2005.

Chevron U.S.A., Inc., West Yard Final Sewer System Investigation - March 2005.

Chevron U.S.A., Amboy Field Remedial Action Report - April 2005.

Chevron U.S.A., West Yard Off-Site Ditch Supplemental Remedial Investigation Report - June 2005.

Science Applications International Corporation (SAIC), Central Yard Area of Concern (AOC) 36, Triad Based Approach Chlorinated Plume Investigation, Chevron Perth Amboy Facility, NJ - August 25, 2005.

Remedial Action Workplan and CEA Application for Amboy Field, September 2005.

SAIC, Status of Supplemental Investigation and Response to Comments for Area of Concern 36 - March 6, 2006.

Science Applications International Corporation, Supplemental RFI Report, Chevron Perth Amboy Facility, New Jersey - February 2008.

Footnotes:

1 "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"² as defined by the monitoring locations designated at the time of this determination)?

If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"².

If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"²) – skip to #8 and enter "NO" status code, after providing an explanation.

If unknown - skip to #8 and enter "IN" status code.

RATIONALE:

Delineation and Evaluation of the Stability of Groundwater Contamination

Groundwater contamination was identified, delineated and characterized in accordance with the requirements of the facility's RCRA/HSWA Corrective Action Permit. The assessment of site-wide groundwater conditions at the Refinery during the RFI and SRFI was based on data collected from 200 monitoring wells, 524 temporary wells, and 13 piezometers. A primary objective of the RFI and SRFI conducted at the Refinery (see Question 1 for more information) was to identify, delineate and characterize groundwater contamination exceeding applicable criteria. The RFI and SRFI were also performed to characterize the subsurface conditions (geologic and hydrogeologic) at the site.

The contamination is associated with historic operations which have been identified as SWMUs or AOCs and investigated as part of the facility's RCRA Facility Investigation. No continuing active releases are occurring. The migration of contaminated groundwater has stabilized, such that existing plumes are not continuing to expand above levels of concern. Data collected over 10 years of quarterly and semi-annual groundwater sampling has demonstrated that groundwater contaminated plumes are stable. The following discussion presents the rationale and physical evidence (e.g., groundwater sampling data) for this conclusion.

Benzene and LNAPL Plume: As discussed in response to Question 2, the benzene plumes represent the extent of groundwater contamination in the North Field/Main Yard and the East Yard. The location and extent of the dissolved benzene plumes in the North Field/Main Yard and the East Yard are shown on Figure 37 of the SRFI Report. Additional figures showing the extent of other COCs in groundwater are presented in the SRFI Report. These figures also present the groundwater sampling data used to delineate the various COCs.

Throughout the various investigations conducted at the Refinery, Chevron has identified LNAPL in 13 areas at the Refinery and is shown on Figure 37 of the SRFI Report (included as Attachment 4). The LNAPL areas have been delineated and do not extend off-site. Chevron has implemented Interim Remedial Measures (IRMs) at the LNAPL areas. Delineation was accomplished through the installation of monitoring wells and soil borings at each of the 13 LNAPL areas. Groundwater at all of the 13 LNAPL areas is monitored quarterly. The groundwater monitoring data shows that all of the LNAPL areas are either stable or are being reduced in size (both horizontal and vertical extent) as a result of the IRMs.

SWMU-8: In the northeast corner of the East Yard, LNAPL was found in 2005 to have accumulated in the groundwater at wells MW-132, MW-214, and MW-215. Product thickness ranged from sheen in well MW-132 to over two feet in well MW-215. Samples of this product were tested and found to have characteristics consistent with No. 2 fuel oil. This area of the Refinery has never been associated with the production, storage, or handling of No. 2 fuel oil, and its presence in the groundwater in these wells was concluded to come from the adjacent Amerada Hess Corporation (AHC) property, based upon on-site and off-site sampling investigation. AHC has been actively performing its own monitoring program of the groundwater immediately north of Chevron's SWMU-8. The same substance that resembles No. 2 fuel was found in AHC's well MW-5 in 1997 and 1999, and MW-7 in 1999, 2000 and 2001, located just to the north of SWMU-8 near the Chevron and AHC property boundary. The extent of LNAPL and dissolved groundwater contamination on the AHC property has been delineated by AHC through the installation and sampling of fourteen monitoring wells (MW-1 through MW-14). The AHC Remedial Investigation and Groundwater Sampling Progress Report is included in Attachment 7. Despite the fact that this area of the Chevron Refinery has never been associated with the production, storage, or

handling of No. 2 fuel oil, Chevron has been performing periodic LNAPL removal from its wells which has resulted in a decrease in product thickness levels to 0.05 feet in 2008 at MW-215.

The level of benzene as sampled from MW-132 at SWMU-8 has been found to be generally stable for the past 6 years, from 700 ppb in 2002, 1300 ppb in 2003, 720 ppb in 2004, 920 ppb in 2005, 640 ppb in 2006, 570 ppb in 2007, and 590 ppb in 2008. Furthermore, the SWMU-8 plume has been contained on-site, since no benzene was detected in four sampling events over the past two years in sentinel wells SB-14, SB-15, and SB-17 located to the east and northeast side of the SWMU-8 on edge of the Arthur Kill. Although slightly elevated levels of lead (7 ppb) were found sporadically in one out of 8 sampling events in both SB-14 and SB-17 in 2007, it is still less than 10 times of the allowable NJDEP groundwater criteria (5 ppb). See further discussion in response to Question 5. There is no evidence of vertical migration of benzene, as benzene was not detected at well MW-252 in four sampling events in 2007 and 2008.

Based on the groundwater investigation by both Chevron and Hess, it is concluded that the VOC plume at SWMU 8 is attributable to an off-site source. Therefore, the VOC contamination in groundwater at SWMU 8 will not be considered further in this EI determination.

AOC 31: The Refinery is underlain by two to 20 feet of fill material. Glacial till and/or gray clay underlies the Refinery below the fill material. The gray clay and glacial till act as confining layers, and generally define the vertical limits of existing groundwater contamination at the facility. Through the analysis of the 25 deep monitoring wells and three deep piezometers, the vertical limit of groundwater contamination has been delineated. As presented in the SRFI Report, the results of analysis of the deep wells showed that they did not contain VOCs or SVOCs above the Class IIA GWQS with the exception of AOC 31 in the East Yard. Deep monitoring well MW-250, located in AOC 31 showed exceedances for benzene (up to 5,800 ppb), cyclohexane (up to 340 ppb) and methylcyclohexane (140 ppb). Deep monitoring well MW-250 is screened from 29 to 34 feet below ground surface in the glacial till within red-brown sand.

In response to the exceedances detected in deep well MW-250, Chevron installed three additional deeper wells (MW-275, MW-276 and MW-277) in AOC 31. The boring logs for monitoring wells MW-275, MW-276 and MW-277 indicate that the red-brown sand in which well MW-250 is screened is underlain by red-brown clay below depths ranging from 34 to 42 feet. The clay extends to a depth of 64 feet at which depth bedrock was most likely encountered based on the boring log. Deep well MW-275 was paired with MW-250 and screened from 37 to 42 feet below ground surface to complete the vertical delineation in this area. Monitoring wells MW-275, MW-276 and MW-277 were sampled during November 2007 and the results are shown in Table II and Attachment 8. The results for well MW-275 show benzene and bromodichloromethane above the Class IIA GWQS at 12 ppb and 8 ppb, respectively. The concentration of benzene detected in well MW-275, although slightly above the NJ Class II-A GWQS is two orders of magnitude lower than in the shallower paired well MW-250. Bromodichloromethane, although present at low levels slightly above the GWQS in well MW-275, was not detected in monitoring well MW-250 and appears to be an isolated detection. Bromodichloromethane is typically a byproduct of adding chlorine to water supply systems and may have been introduced into the well during the drilling process from potable water used to make the drilling mud. Benzene and bromodichloromethane were not detected in deep monitoring wells MW-276 and MW-277.

Dissolved cyclohexane and methylcyclohexane were detected in deep monitoring well MW-250 but were not detected in significant concentrations in well MW-275. This data, coupled with the benzene data provides evidence that the glacial clay encountered in monitoring wells MW-275, MW-276 and MW-277 significantly retards the migration of dissolved contaminants in AOC 31. The horizontal and the vertical extent of the dissolved contamination detected in deep well MW-250 is delineated by these three wells.

The results of historic rounds of groundwater sampling together with current quarterly and semi-annual sampling indicate that the dimensions of the existing areas of groundwater contamination at AOC 31 remain essentially unchanged. Therefore, the migration of contaminated groundwater has stabilized, and is expected to remain within the existing areas of contaminated groundwater.

SWMU 36: A dissolved chlorinated hydrocarbon plume has been identified in the southeast portion of the Central Yard. The extent of the plumes is shown on Figures 48 through 55 of the SRFI Report (Attachment 6). The source of this chlorinated hydrocarbon plume is believed to be the Shops Building. No activities are currently being conducted in the Shops Building and no continuing sources or free product has been identified. As stated in response to Question 2, investigations of this plume were performed. On August 25, 2005, Chevron submitted the AOC 36 Triad-Based Chlorinated Plume Investigation Report to EPA and NJDEP for review. On March 6, 2006 Chevron submitted a supplemental report to EPA and NJDEP that focused on an additional field investigation to the east on the Sylvan property to provide better delineation of the chlorinated compounds found previously in that area downgradient of the Chevron property. The results of these investigations indicated that the chlorinated plume originating from the Refinery has been delineated and that an off-site source of chlorinated hydrocarbon contamination unrelated to the Chevron groundwater plume also exists on the Sylvan property located along State Street. The results of detailed off-site investigations have shown that the plume which originated from the Refinery extends a short distance off-site but not beyond State Street and does not appear to pose a vapor intrusion risk to any off-site properties. Groundwater sampling results indicate, which is supported by transport and contaminant modeling, that the plume is naturally attenuating based on the presence of breakdown products, and that the plume is stable and is reduced in size. NJDEP concurs with this assessment.

North Field Extension: Since the NFE, a vacant tract of land separated from the Refinery by Woodbridge Creek, has never been developed or used by Chevron for any industrial or commercial purposes; a separate remedial investigation of the NFE has been conducted through a joint effort by Chevron and prior owners/potential purchasers of the property. The investigation of the NFE showed low levels of chlorinated VOCs in wells NFE-MW06D, NFE-MW11D and NFE-MW13D at concentrations slightly above the NJ Class II-A GWQS (Figure 3). These wells are screened within the deep overburden (Farrington Sand) at depths ranging from 51 to 69 feet below ground surface. The chlorinated VOCs detected in these wells are believed to originate from an off-site source based on the historic uses of the NFE and the results of extensive soil sampling. Higher concentrations of chlorinated VOCs were detected in NFE shallow monitoring well MW-26 (Figure 3). Well MW-26 is screened within the fill material above the peat and gray clay layer and is located along the northern boundary of the site. Shallow groundwater in this area is perched on top of the peat and gray clay. The results of this investigation were submitted to NJDEP and EPA in the document entitled North Field Extension, Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations prepared by TRC Raviv Associates, Inc., February 2005.

From a joint groundwater monitoring program by Chevron and CP Chemical which is located immediately to the north of the NFE, it was discovered that the same VOC plume found at Chevron's NFE is also found in CP Chemical's property. Based on review of groundwater data, NJDEP has concluded that the "organic groundwater contamination in the deeper aquifer that is impacting the former CP Chemical property is migrating from the adjacent Shell Oil property". Consequently, NJDEP intends to require Shell Oil to further investigate and implement any remedial activities necessary to address this contamination. Since the NFE has never been developed or used by Chevron for any industrial or commercial purposes, it is concluded based on groundwater investigation and historical knowledge that the chlorinated VOC plume at the NFE is attributable to off-site sources, the VOC contamination in groundwater at NFE will not be considered further in this EI determination

The metals antimony, arsenic, beryllium, lead and vanadium have also been detected in groundwater above the NJ Class II-A GWQS in the NFE. The metals data is presented in the Remedial Investigation Report, North Field Extension Site (Roux, March 2005). The presence of these metals in groundwater was based on one round of sampling performed in 2002. The field data summary contained within Appendix B of the Roux report show that the groundwater samples collected in 2002 exhibited high turbidity. Therefore, an additional round of groundwater samples was collected on April 23, 2008 from select NFE wells that showed metal exceedances in 2002. Groundwater samples were collected from NFE wells MW-10S, MW-11S, MW-11D and MW-12 using low flow purging to obtain turbid free samples. The results of this analysis are presented in Figure 4. The results show that no metal exceedances were detected in the April 23, 2008 sampling round. This data indicates that the 2002 metal exceedances were likely due to suspended sediments.

West Yard and Amboy Field: All process areas and former SWMUs and AOCs have been excavated and removed from both the West Yard and Amboy Field. The demolition of process areas and remediation of potential sources of groundwater contamination were conducted prior to Chevron's recent sale of these two areas. An extensive groundwater monitoring investigation was conducted and conditions documented in the various reports identified in the References cited below. These investigations revealed that groundwater in the West Yard and Amboy Field above the NJDEP GWQS existed. Groundwater contamination has been delineated and characterized. NJDEP required that Chevron submit a Classification Exception Area (CEA) for the groundwater contamination which records the nature and extent of the contamination. Chevron has completed the CEA documents and they are under review by the NJDEP.

For the West Yard, the proposed CEA area for ammonia, metals and sulfate along with the analytical data are presented in Attachment 2. NJDEP stated in a September 14, 2006 letter commenting that the area of samples H0691, H0687, H0688 and H0690 should be re-sampled for ammonia to fully delineate the extent of ammonia contamination. The CEA submission for the West Yard is included in the Response to NJDEP Letter dated September 17, 2002 and Revised Remedial Action Workplan for the West Yard Groundwater, dated April 9, 2003. For Amboy Field, the proposed CEA area for SVOCs, metals and ammonia along with the analytical data is shown in Attachment 3. The CEA submission for Amboy Field is included in the Remedial Action Workplan and CEA Application for Amboy Field, September 2005.

The documentation provided by Chevron in the Remedial Action Reports for the West Yard and Amboy Field, referenced below, show that the sources of groundwater contamination have been removed through excavation and off-site disposal. Most down-gradient monitoring wells, including MW-86, MW-91, MW-92, and temporary wells HO-716 and HO-721 indicated a drastic downward trend of ammonia levels in the groundwater after the excavation of contaminated soils. Post-excavation soil and groundwater samples have been evaluated and it has been confirmed that the plume is stabilized and shrinking.

References

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Chevron U.S.A., West Yard Remedial Investigation Report - December 2000.

Chevron U.S.A., West Yard Groundwater Remedial Action Workplan - March 2001.

Chevron U.S.A., West Yard Baseline Ecological Evaluation - April 2001.

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Chevron U.S.A., West Yard RI/RA/RAWP Addendum - May 2002.

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Roux Associates Inc., Remedial Investigation Report, North Field Extension Site, Woodbridge, New Jersey - March 2005.

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Chevron U.S.A., Amboy Field Remedial Action Report - April 2005.

Chevron U.S.A., West Yard Off-Site Ditch Supplemental Remedial Investigation Report - June 2005.

Science Applications International Corporation (SAIC), Central Yard Area of Concern (AOC) 36, Triad Based Approach Chlorinated Plume Investigation, Chevron Perth Amboy Facility, NJ - August 25, 2005.

SAIC, Status of Supplemental Investigation and Response to Comments for Area of Concern 36 - March 6, 2006.

Science Applications International Corporation, Supplemental RFI Report, Chevron Perth Amboy Facility, New Jersey - February 2008.

Chevron Corporation, Supplemental RFI - Amendment #1, Perth Amboy, New Jersey - April 16, 2008.

- 2 “Existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

 X If yes - continue after identifying potentially affected surface water bodies.

 If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.

 If unknown - skip to #8 and enter “IN” status code.

RATIONALE:

Three surface water bodies exist adjacent to the Refinery (Figures 5 and 6). Spa Spring Creek runs along the north border of the North Field/Main Yard and flows to the east into Woodbridge Creek. Woodbridge Creek is located along the northeast border of the North Field/Main Yard and flows southeast into the Arthur Kill. The Arthur Kill borders the East Yard to the east.

A sentinel groundwater monitoring network has been in place at the Refinery along the downgradient surface water bodies to evaluate the potential impact of groundwater contamination on surface water. The sentinel monitoring well system consists of 28 wells located immediately adjacent to the downgradient surface water bodies. The sentinel wells are monitored on a semi-annual basis. The results of the sentinel well monitoring program are submitted annually to EPA and NJDEP as part of Chevron’s RCRA/HSWA Corrective Action Permit progress reporting requirements. The results of the monitoring so far show a pattern of low level sporadic exceedances of metals, ammonia, PAHs, BEHP and benzene in wells located along Spa Spring Creek, Woodbridge Creek and the Arthur Kill. These exceedances are generally low levels and not repeatable. The presence of contamination in these wells indicates that contaminated groundwater is likely discharging to surface water.

As discussed in response to question 2, fill material is present throughout the Refinery. The fill material consists primarily of reworked clays and silts, as well as heterogeneous mixtures of gravel and sand, with lesser amounts of historic fill type materials such as cinders and construction debris. Shallow groundwater is present within this fill material, and flows towards surface water bodies as shown on Figure 37 of the SRFI Report (Attachment 4). In the East Yard, groundwater predominately flows toward the Arthur Kill. In the North Field/Main Yard, groundwater generally flows towards Woodbridge Creek. Glacial till and/or gray clay underlies the site below the fill material. The gray clay and glacial till generally define the vertical limits of groundwater contamination at the facility. As described in previous questions, dissolved benzene plumes have been identified and delineated at the Refinery (Attachments 4 and 5).

As already discussed in detail in response to the previous Question 3, groundwater sampling data results from the RFI, the SRFI and subsequent sampling events indicate that the dimensions of the existing areas of groundwater contamination remain essentially unchanged. Therefore, the migration of contaminated groundwater has stabilized, and is expected to remain within the existing areas of contaminated groundwater. In order to determine if contaminated groundwater has the potential to discharge into surface water, groundwater sample results from locations adjacent to surface water were

evaluated. The recent data collected during 2006 and 2007 from these sample locations were then compared to the NJ Class II-A GWQS. The results of this comparison are presented in Figures 5 and 6.

Throughout the various investigations conducted at the Refinery, Chevron has identified LNAPL in the areas of the Refinery that are shown on Figure 37 of the SRFI Report (Attachment 4). The LNAPL areas have been delineated and do not extend off-site or to surface water bodies. IRMs have been implemented at the LNAPL areas, ranging from routine monitoring to active NAPL recovery systems. The LNAPL areas do not extend into any surface waters as shown on Attachment 4.

Potential for contaminated groundwater discharged into surface water bodies

The primary COC in groundwater at the Refinery is benzene. The extent of the benzene plumes identified within the Refinery along with the groundwater elevation contours are presented in Attachment 4. The benzene plume maps show that benzene has been delineated as not extending to surface water bodies. Sporadic low level benzene exceedances to the NJ Class II-A GWQS have been detected in well MW-156 located along the Arthur Kill (Figure 6). Recent data from well MW-156 showed that benzene was not detected in March and September 2007.

Occasional metal exceedances to the NJDEP Class II-A GWQS were detected in several monitoring wells along the Arthur Kill, Spa Spring Creek and Woodbridge Creek. The metal exceedances were sporadic and not repeatable in later sample rounds. The exceedances are believed to be sampling artifacts, or the result of suspended sediments in well samples, based on the sporadic nature of the detections and there is no indication that dissolved metal groundwater plumes are present and discharging to surface water.

Ammonia (as N) was also found above the NJDEP Class II-A GWQS in some monitoring wells along the Arthur Kill, Spa Spring Creek and Woodbridge Creek. However, ammonia was not detected above the NJDEP Surface Water Quality Standards (SWQS) in any of the surface water samples from these water bodies. Ammonia is naturally occurring and readily degradable as a nutrient source.

References

- Chevron U.S.A., West Yard Site Investigation Report - January 1999.
- Chevron U.S.A., West Yard Remedial Investigation Report - December 2000.
- Chevron U.S.A., West Yard Groundwater Remedial Action Workplan - March 2001.
- Chevron U.S.A., West Yard Baseline Ecological Evaluation - April 2001.
- Chevron U.S.A., West Yard Remedial Action Report - June 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Report - July 2001.
- Chevron U.S.A., West Yard Sewer System Investigation Addendum - November 2001.
- Chevron U.S.A., West Yard RI/RA/RAWP Addendum - May 2002.

Chevron U.S.A., Response to NJDEP Letter Dated September 17, 2002 and Revised RAWP for the West Yard Groundwater - April 2003.

Chevron U.S.A., West Yard Final Remedial Action Workplan for Soil and Revised Draft Deed Notice - June 2003.

Chevron U.S.A., West Yard Northern Pipeway Remedial Action Report - August 2003.

Chevron U.S.A., Amboy Field SI/RI Report - October 2003.

Chevron U.S.A., Inc., Full RCRA Facility Investigation Report, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - November 2003.

Chevron U.S.A., Inc., Remedial Action Selection Report Ammonia in West Yard Groundwater - January 2004.

TRC Raviv Associates, Inc., North Field Extension, Results of Total Petroleum Hydrocarbon Soil and Chlorinated Groundwater Investigations, Chevron Perth Amboy Refinery, Perth Amboy, New Jersey - February 2005.

Roux Associates Inc., Remedial Investigation Report, North Field Extension Site, Woodbridge, New Jersey - March 2005.

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Science Applications International Corporation (SAIC), Central Yard Area of Concern (AOC) 36, Triad Based Approach Chlorinated Plume Investigation, Chevron Perth Amboy Facility, NJ - August 25, 2005.

SAIC, Status of Supplemental Investigation and Response to Comments for Area of Concern 36 - March 6, 2006.

Science Applications International Corporation, Supplemental RFI Report, Chevron Perth Amboy Facility, New Jersey - February 2008.

5. Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

 X If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting:
1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or

reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system. (See discussion above).

_____ If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter “IN” status code in #8.

RATIONALE:

To determine if potential discharge of contaminated groundwater into surface water is likely to be “insignificant” (i.e., the maximum concentration of key contaminants discharging into surface water is less than 10 times their appropriate groundwater level), groundwater samples collected from sentinel well locations along Spa Spring Creek, Woodbridge Creek and the Arthur Kill were compared to the NJ Class II-A GWQS. Exceedances detected in these wells during the past year are presented in Figures 5 and 6.

1. As discussed previously, the primary COC in groundwater is benzene. From four recent semi-annual groundwater results obtained from the downgradient sentinel monitoring well network adjacent to surface water bodies, it indicates that benzene is not significantly impacting surface water quality. All results were non-detect with the exception of two data points (MW-156 and MW-156) which showed estimated concentrations respectively of 1 pbb and 3 ppb in the 1996 sampling episodes and non-detect in the three subsequent episodes.
2. The metals antimony, arsenic, cadmium, chromium, cobalt, lead, nickel, and zinc have sporadically been detected in sentinel wells along Spa Spring Creek, Woodbridge Creek and the Arthur Kill above the GWQS. Due to the sporadic nature of the detection of these metals, their presence is believed to be the result of suspended sediments.
3. PAHs were detected sporadically above the GWQS in wells along Woodbridge Creek and the Arthur Kill. The presence of the PAHs is believed to be due to suspended sediments due to the sporadic nature of the detections.
4. Ammonia nitrogen was detected in monitoring wells located adjacent to Spa Spring Creek and Woodbridge Creek. The concentrations of ammonia are generally less than 10 times the GWQS with the exception of well MW-158 located along Woodbridge Creek near State Street. Ammonia has not been detected in surface water samples above the SWQS. Ammonia is naturally occurring and readily degradable in typical sediment environments. Given the concentration in the groundwater, ammonia will have no significant impact to surface water quality.
5. Sulfate was detected in sentinel wells NF-13, MW-126 and MW-34 along Woodbridge Creek at concentrations above the GWQS but below 10 times the GWQS. Sulfate was detected at one location along the Arthur Kill greater than 10 times the GWQS in recently installed well MW-253.

Surface water samples were collected from the Arthur Kill, Spa Spring Creek and Woodbridge Creek and the results are presented in Section 9.0 of the RFI Report. Three metals (mercury, zinc and nickel) were detected above the NJDEP Surface Water Quality Standards (SWQS) and the EPA surface water quality criteria for saltwater. Mercury was detected at one location in the Arthur Kill but was not detected in a duplicate sample at the same location. Zinc was detected above the SWQS in two of 17 surface water samples. Mercury and zinc have not been identified as site specific contaminants in groundwater. Nickel was detected in nine of 17 surface water samples above the SWQS. Although nickel has sporadically been detected in groundwater at the Refinery, the highest concentration of nickel in surface water was however detected in a background sample located in Woodbridge Creek upstream of the Refinery. The other metals detected in groundwater did not exceed their applicable NJDEP Surface Water Quality Standard. Based on the surface water as well as groundwater sampling data discussed above, the reports cited in the References (below), and the absence of site related groundwater contaminants in surface water, the potential discharge of contaminated groundwater into surface water is not considered to be significant.

References

Chevron U.S.A., West Yard Site Investigation Report - January 1999.

Chevron U.S.A., West Yard Remedial Investigation Report - December 2000.

Chevron U.S.A., West Yard Groundwater Remedial Action Workplan - March 2001.

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Roux Associates Inc., Remedial Investigation Report, North Field Extension Site, Woodbridge, New Jersey - March 2005.

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Science Applications International Corporation (SAIC), Central Yard Area of Concern (AOC) 36, Triad Based Approach Chlorinated Plume Investigation, Chevron Perth Amboy Facility, NJ - August 25, 2005.

SAIC, Status of Supplemental Investigation and Response to Comments for Area of Concern 36 - March 6, 2006.

Science Applications International Corporation, Supplemental RFI Report, Chevron Perth Amboy Facility, New Jersey - February 2008.

Footnotes:

- 3 Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

6. Can the **discharge** of “contaminated” groundwater into surface water be shown to be “**currently acceptable**” (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

___ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site’s surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,⁵ appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment “levels,” as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

___ If no - (the discharge of “contaminated” groundwater can not be shown to be “currently acceptable”) - skip to #8 and enter “NO” status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

___ If unknown - skip to 8 and enter “IN” status code.

Not Applicable, skip to Question 7.

Footnotes:

- 4 Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.
- 5 The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”

___**X**___ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”

___ If no - enter “NO” status code in #8.

___ If unknown - enter “IN” status code in #8.

RATIONALE:

A site-wide semi-annual and quarterly groundwater monitoring program involving semi-annual monitoring at over 100 wells and the quarterly monitoring over 20 wells has been implemented. This semi-annual and quarterly sampling is used to determine whether or not the groundwater plume remain within the horizontal dimensions of the “existing area of contaminated groundwater”.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

YES - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the facility, **EPA ID # NJD081982902, 1200 State Street, Perth Amboy, New Jersey**. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

NO - Unacceptable migration of contaminated groundwater is observed or expected.

IN - More information is needed to make a determination.

Completed by: _____ Date _____
Ken Siet
Environmental Consultant
TRC Companies

Reviewed by: _____ Date _____
Sin-Kie Tjho, Project Manager
New Jersey Section
RCRA Program Branch
EPA Region 2

Barry Tornick, Chief
New Jersey Section
RCRA Program Branch
EPA Region 2

Date _____

Approved by original signed by: _____ Date: September 25, 2008
Adolph Everett, Chief
RCRA Program Branch
EPA Region 2

Locations where References may be found:

U.S. Environmental Protection Agency - Region 2
RCRA File Room

290 Broadway - 15th Floor
New York, New York 10007

New Jersey Department of Environmental Protection
401 East State Street, Records Center, 6th Floor,
Trenton, New Jersey.

Contact telephone number and e-mail address

Sin-Kie Tjho, Project Manager
U.S. Environmental Protection Agency - Region 2
RCRA Program Branch
Telephone: (212) 637-4115
E-mail: tjho.sin-kie@epa.gov

Figures, Tables and Attachments

The following figures, tables and attachments have been provided to support this EI determination:

Figure 1 – Site Location Map
Figure 2 – Aerial Photograph (2003)
Figure 3 – Groundwater Sampling Results, September and October 2004, North Field Extension
Figure 4 – Summary of Metals in Groundwater, North Field Extension
Figure 5 – Sentinel Well Data - North Field / Main Yard
Figure 6 – Sentinel Well Data - East Yard

Table 1 - Site Wide List of Contaminants of Concern in Groundwater
Table 2 - AOC 31 Groundwater Data

Attachment 1 - Refinery Base Map
Attachment 2 - Classification Exception Areas and Analytical Results – West Yard
Attachment 3 - Proposed Classification Exception Area – Amboy Field
Attachment 4 - Site Wide Groundwater Benzene Isoconcentration Map
Attachment 5 - 2006 Central Yard Benzene Isoconcentration Map
Attachment 6 - 2006 Central Yard Chlorinated Hydrocarbon Isoconcentration Maps
Attachment 7 - Amerada Hess Remedial Investigation and Groundwater Progress Report
Attachment 8 - AOC 31 Deep Groundwater Exceedances - 4th Quarter 2007

Note: The above attachments are available upon request.