



pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOUTHEAST REGIONAL OFFICE

MEMO

TO Sachin Shankar, P.E. *SS*
Assistant Regional Director

FROM C. David Brown, P.G. *CDB*
Licensed Professional Geologist

THROUGH Walter Payne, P.G. *WP*
Professional Geologist Manager

DATE October 31, 2016

RE ECB: Land Recycling Program
Act 2 Technical Memo Summary
Philadelphia Refinery AOI 1
Remedial Investigation Report
eFACTS PF No. 778374
3144 Passyunk Avenue
City of Philadelphia
Philadelphia County

Property Owner Name and Site Address:

Owner	Remediator	Site
Philadelphia Energy Solutions 3144 W. Passyunk Ave. Philadelphia, PA 19145	Evergreen Resources Management Operations 2 Righter Parkway, Suite 200 Wilmington, DE 19803	3144 Passyunk Ave. Philadelphia, PA 19145

Coordinates: 39.9164°N, 75.1933°W

Act 2 Standard(s) Sought:

Soil and groundwater—nonresidential site-specific standard

Property Size: 67 acres

Project Site History:

Petroleum refining began at the site circa 1870. The facility consisted of two refineries, Point Breeze operated by Atlantic Petroleum Corporation (formerly ARCO) and Girard Point by Chevron (formerly Gulf). Sunoco purchased these two refineries in 1988 and 1994 and consolidated them into a single facility. In 2012 Sunoco sold the refinery to the Carlyle Group and entered a joint venture to operate it as Philadelphia Energy Solutions (PES). Sunoco, Inc. is now a subsidiary of Energy Transfer Partners, L.P. Evergreen Resources Management Operations is a Sunoco subsidiary responsible for its legacy environmental liabilities.

The refinery can process up to 330,000 barrels a day of crude oil. It produces gasoline, diesel, jet fuel, kerosene, home heating oil, and other petroleum liquids. The facility includes multiple process units, above-ground storage tanks, pipelines, as well as truck, railcar, and barge transfer equipment. Adjacent to the refinery is the Belmont Terminal which is owned and operated by Sunoco Logistics Partners L.P.

Area of Interest 1 of the Philadelphia Refinery complex (AOI 1) includes the No. 1 and No. 2 Tank Farms. It is located in the northeast section of the Point Breeze South Yard. It is bordered by the Belmont Terminal to the north, 26th Street to the east, AOI 4 to the south, and AOI 2 to the west. There are approximately 35 aboveground storage tanks in AOI 1, and in the past there were several more. Most tanks were constructed in the 1950s, but the oldest installation date in DEP's records is 1931 and the most recent is 1982. The tank farms are utilized for storage of light-end petroleum products (e.g., gasoline) and product blending.

Petroleum contamination exists in AOI 1 from historical operations, including releases from above ground storage tanks and pipelines. There were also releases at the Belmont Terminal that migrated to AOI 1. Evergreen (Sunoco) is participating in the Act 2 program to address contamination predating the transfer of the property to PES on September 8, 2012. Corrective action responsibilities under the Storage Tank and Spill Prevention Act are being addressed simultaneously. There are presently seven open tank incidents associated with six regulated storage tanks in AOI 1 (51-19781). A site characterization report for these tanks was received on August 26, 2016 and is under review.

(A NIR was received for the Belmont Terminal in October 2014 (PF ID 780561). Evergreen will prepare and submit a separate RIR for that facility.)

Site Findings:

Unconsolidated materials at the facility, from surface to bedrock, consist of fill, alluvium (sand, silt, and clay), the Trenton Gravel (sand and gravel), and the Potomac-Raritan-Magothy (PRM) formations (sand and clay units). The depth to Wissahickon Formation bedrock is ~70–90'. Shallow groundwater depths range from ~16' to 28', generally within the Trenton Gravel.

Hundreds of borings have been advanced in AOI 1 since the 1980s. Data from roughly 300 soil samples collected in 2005–2016 were presented in the report. The samples were collected for general characterization, from monitoring well borings, at tanks for closure or release investigations, at tanks that were removed without closure assessments, in areas of non-tank releases, at potential source areas (associated with LNAPL), and to delineate previously

identified exceedences. Analytes generally included up to 10 VOCs, 10 SVOCs, and lead, based on DEP's petroleum short list.

Sample results showed numerous exceedences of soil-to-groundwater MSCs. As groundwater is being investigated and is known to be impacted, Evergreen has focused on direct contact MSC exceedences. Direct contact exceedences were identified at only five locations. They were broadly delineated by other sample points.

Substance	Boring	Depth (ft)	Concentration (mg/kg)	Area
1,2,4-TMB	BH-14-013	0-2	903	Tank PB 129 line
Lead	BH-15-002	0-2	6280	east-central
Lead	PH83-BG2	0.5-1.0	6720	east-central
Lead	S-389D	0-2	2590	east-central
Lead	S-392D	0-2	9630	southwest

(I reviewed the soil data for ethylbenzene, naphthalene, and chrysene exceedences. These substances now have significantly lower direct contact MSCs in the August 27, 2016 Ch. 250 revisions. There were no new exceedences for these three substances.)

Approximately 120 Evergreen monitoring wells are present in or near AOI 1. This number includes about 16 wells located east of 26th Street, four of which are on a former Arco gas station property north of Hartranft Street. In addition, over a hundred monitoring wells are present to the east of AOI 1 on the CSX-owned railroad right-of-way, on the Steen property, at the former Defense Support Center Philadelphia property, at the Philadelphia Housing Authority property, and around the Siena Place Homes development. These wells were installed by the Defense Logistics Agency for the DSCP investigation.

Most of the Evergreen monitoring wells are screened to a depth of ~30-40' in the shallow, unconfined groundwater, generally within the Trenton Gravel. Most cross the water table. Several wells are screened in the PRM Lower Sand aquifer to a depth of ~70-90'. The wells have been gauged quarterly for over 10 yr, with the results submitted in progress reports. Many wells were sampled at least four times between 2004/2005 and 2014/2015. A few wells had older data, and some were sampled more frequently (e.g., annually). Analytes included up to 10 VOCs, 10 SVOCs, and lead, based on DEP's petroleum short list.

Areas of groundwater mounding may be attributable to thicker fill within pre-industrial valleys. In the northern part of AOI 1 shallow groundwater flow is inferred to the southeast. In the southern portion of AOI 1 flow is interpreted to be influenced by infiltration into the 26th Street sewer main. Flow is indicated to the southeast in the lower aquifer. The hydraulic heads in nearby wells screened at different depths show a downward gradient in most areas but localized upward gradients near 26th Street.

LNAPL has been observed in numerous wells in AOI 1. The primary LNAPL plumes occur along the northern boundary with the Belmont Terminal and the eastern property line. Maximum recent in-well thicknesses are ~2'. Some offsite wells east of 26th Street have also exhibited

measurable LNAPL, on the northeast side of AOI 1. Plumes have been broadly delineated. LNAPL samples were identified as light and/or middle distillate for most areas.

Stantec evaluated the stability of LNAPL in AOI 1. The number of wells containing LNAPL, the extent of LNAPL, and LNAPL thicknesses have generally decreased since ~2000. To some extent this trend may be influenced by rising groundwater elevations, but it presumably also reflects petroleum degradation and recovery. Several wells have shown increasing trends, notably S-100 which is offsite. Stantec analyzed historic baildown data, recovery system data, critical pore entry pressures, plume velocities, and potential recoverability. Estimates of LNAPL transmissivity were generally $> 0.8 \text{ ft}^2/\text{day}$. Pore entry pressures and velocities also indicated a potential for mobility and further migration.

The groundwater sample results reflect exceedences of most of the analyzed VOCs, SVOCs, and lead in shallow groundwater at AOI 1. However, the most consistent, widespread, and significant exceedences were of benzene and MTBE. Exceedences of EDB, 1,2-DCA, and lead tended to be irregular and not persistent. In deeper groundwater, exceedences of benzene, MTBE, and lead were found; lead had only brief, low exceedences in two wells.

Benzene exceeds the MSC of $5 \text{ } \mu\text{g/L}$ throughout almost the entire area of AOI 1. The most recently elevated concentrations ($> 1000 \text{ } \mu\text{g/L}$) occur by the northern boundary with the Belmont Terminal, north of Tank 129, south of Tank 121 (maximum $88,000 \text{ } \mu\text{g/L}$), and distributed throughout the No. 2 Tank Farm. In addition, benzene is elevated offsite east of 26th Street in the north (S-98 and S-193, $\sim 1400 \text{ } \mu\text{g/L}$) and on the former Arco gas station parcel ($\sim 2400 \text{ } \mu\text{g/L}$). The magnitude and extent of the benzene plume have decreased in the northern No. 1 Tank Farm since 2004. The plume in the No. 2 Tank Farm has decreased comparatively less, and maximum benzene concentrations near the eastern property line (Tank 121) have changed little in 10 yr.

Benzene in the lower aquifer is significantly elevated at the Belmont Terminal (S-194D, up to $22,000 \text{ } \mu\text{g/L}$). Elsewhere at AOI 1 benzene is $< 100 \text{ } \mu\text{g/L}$. A deep well at the offsite Arco property exhibits concentrations of $250\text{--}1500 \text{ } \mu\text{g/L}$.

MTBE exceeds the MSC of $20 \text{ } \mu\text{g/L}$ in shallow groundwater throughout a large portion of AOI 1. Recent maximum concentrations, $\sim 7000 \text{ } \mu\text{g/L}$, reflect a substantial decrease from 2004/2005, and the overall magnitude has decreased throughout. However, the MTBE plume has apparently migrated offsite in the northeast (e.g., S-98). In addition, MTBE has exceeded in DSCP well sampling to the east of the No. 2 Tank Farm, on the CSX and Steen properties east of 26th Street and immediately to the east of the CSX railroad tracks and I-95. In the lower aquifer MTBE has been $< 100 \text{ } \mu\text{g/L}$ except at one well east of Tank 129, near 26th Street ($\sim 1000 \text{ } \mu\text{g/L}$). Offsite exceedences to the east have been more prominent than in shallow groundwater, but have been $< 100 \text{ } \mu\text{g/L}$.

Groundwater is not used in the vicinity of the Philadelphia Refinery. However, the Lower Sand aquifer of the PRM is a water supply in New Jersey. Evergreen will be preparing a site-wide fate-and-transport model to further evaluate the extent and potential migration of contaminant plumes in shallow and deep groundwater.

The Schuylkill River is ~1500' west of AOI 1. Contaminated groundwater may enter the Pollack Street and 26th Street sewer lines. The Pollack Street sewer discharges to the Schuylkill River. The 26th Street sewer effluent is treated at the city's Southwest Wastewater Treatment Plant. Evergreen performed a PNDI review in December 2015. The review and follow-up information from DCNR indicated no potential ecological concerns.

There is only one occupied structure within AOI 1, the Inline Blender Building. Stantec collected an indoor air sample from the building in March 2015 as well as four outdoor air samples. A second indoor air sample was obtained in March 2016. The indoor and outdoor concentrations did not exceed OSHA PELs, ACGIH TLVs, or NIOSH RELs. One substance in indoor air, 1,2,4-TMB ($6.6 \mu\text{g}/\text{m}^3$), exceeded DEP's forthcoming site-specific standard screening value (hazard quotient 0.1). Benzene and other VOCs were below DEP and EPA RSL-based screening values.

Site Cleanup History:

NIR Received Date November 17, 2014

RIR Received Date August 16, 2016

An initial NIR was submitted October 16, 2006; it was revised with updated information on November 17, 2014. The facility entered into a consent order and agreement with DEP's Clean Water Program in December 1993; the agreement was succeeded by another in December 2003 which terminated in December 2013. The facility is currently subject to a DEP buyer-seller agreement which became effective September 8, 2012. A site characterization report was submitted for AOI 1 on June 30, 2005 under the Clean Water Program agreement. That report was revised on August 8, 2006 and October 4, 2007. The refinery site entered into the One Cleanup Program with DEP and EPA on November 8, 2011.

On May 6, 2015 DEP approved a nonresidential site-specific numerical standard of 2240 mg/kg for lead in soil at the Philadelphia Refinery. This standard was developed in a risk assessment report received February 26, 2015.

Discussion of Cleanup Involved and Demonstration of Attainment:

Sunoco and Evergreen have operated three remediation systems in AOI 1.

- The 26th Street North system began operation in 1995, and it remains active. It consists of 15 recovery wells arrayed along the eastern property line in the northeast corner of AOI 1. It controls LNAPL and dissolved plume migration offsite. Total fluids are extracted and discharged to the refinery process sewer. Historically the system has not operated in winter, but in 2015 lines and other components were upgraded and winterized. The cumulative LNAPL removal is ~58,000 gal.
- The 26th Street South system (S-50 area) operated in 2009–2014. It was an oxygen injection system consisting of 27 points along the eastern property line southeast of Tank 121 and just north of the Pollack Street sewer. Oxygen was injected to enhance the degradation of the dissolved phase plume and reduce offsite impacts. Operation was ceased because of persistent LNAPL in nearby wells.
- The Point Breeze sewer ventilation system and biofilter was installed in 1998, and it remains active. It collects vapors from the Pollack/Packer and 26th Street sewer lines with blowers; the

air is humidified and passed through biomass treatment beds. The system mitigates vapors from LNAPL and dissolved phase contamination that enters the sewers both at the refinery and DSCP site.

Evergreen will prepare a cleanup plan to address the direct contact exceedences of 1,2,4-TMB and lead in soil. Soil-to-groundwater exceedences will be addressed through groundwater attainment with a site-specific standard. Evergreen intends to attain a site-specific standard for groundwater by means of pathway elimination. A future report will analyze groundwater fate-and-transport to assess the extent of contamination and potential receptors. Mobile LNAPL plumes likely will require ongoing monitoring and, in some cases, hydraulic control. An environmental covenant will be required.

DEP Final Action Approval/Disapproval Letter:

I recommend approving the AOI 1 remedial investigation report. Soil and groundwater contamination have been adequately characterized and vapor intrusion was evaluated. This approval is contingent on Evergreen completing additional work prior to submittal of a final report.

- Evergreen must prepare a fate-and-transport analysis to define the present and future extent and fate of contamination [§250.408(a)]. DEP has agreed to permit a site-wide fate-and-transport study to be submitted for approval at a future date. The focus of this work should be on understanding the potential extent of offsite groundwater impacts. It may require the collection of additional data.
- As contaminated groundwater may enter the Pollack Street sewer in AOI 1, Evergreen must evaluate potential surface water impacts caused by discharge to the Schuylkill River [§250.406(c)]. DEP understands that Evergreen will be examining site-wide surface water compliance in future reporting.
- An inhalation risk assessment is needed for potential vapor intrusion at the Inline Blender Building [§250.405(a), §250.409].

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