Overview of Former Sunoco Philadelphia Refinery Environmental Investigations

June 23, 2020

This document provides background information about contamination at the Philadelphia Refinery and how the site will be cleaned up under the Pennsylvania Department of Environmental Protection (PADEP) Act 2 Program. Evergreen has prepared plain language summaries of each of the Remedial Investigation Reports (RIRs) to help people understand the content, even if they do not have technical training. This overview is a guide for reviewing those reports and provides some basic background information, explanation of the regulations that apply to Evergreen's work, and some basic technical concepts that will be discussed in the RIR summaries. Additional information can be found on the Evergreen website: https://phillyrefinerycleanup.info/. Detailed information on each of the subjects below can be found in any of the RIRs that are available on the website.

Site Background

The former Sunoco Philadelphia Refinery, now known as the Philadelphia Energy Solutions Refining and Marketing (PES) LLC Complex (Site), consists of approximately 1400 acres in Philadelphia. The Site has a long history of petroleum transportation, storage and processing. Evergreen is addressing environmental impacts to soil and groundwater that happened before the sale of the property to PES 2012 through the PADEP Act 2 cleanup program under a Buyer/Seller Agreement.

In 2013, Evergreen was registered in the State of Delaware to manage Sunoco's legacy (pre-2012) environmental cleanup at the Philadelphia Refinery. Releases that occur at the Site after 2012 are managed by the current owner/operator.

Figure 1: Areas of Interest

Areas of Interest

The entire Site has been divided into 11 areas that are called Areas of Interest (AOI). AOIs 1 through 10, shown above in **Figure 1**, divide up the land. AOI 11, also called the lower aquifer, includes groundwater underneath the Site. Evergreen has conducted environmental investigations for each of the AOIs. Status of the reports and next steps are included later in the document.

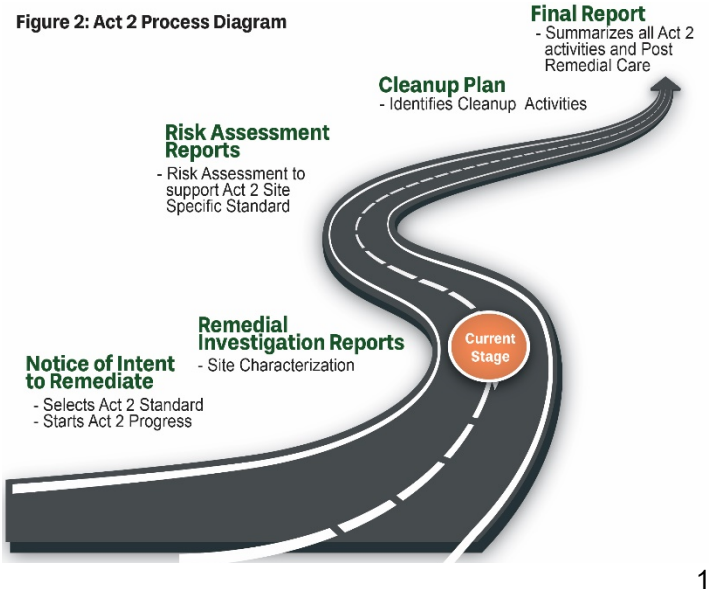
Regulations and Agreements

Act 2 Program – PADEP's Act 2 Program allows for the cleanup and reuse of properties. Sunoco entered the Site into the Act 2 Program with a Notice of Intent to Remediate in 2006.

Storage Tank Corrective Action Program – This PADEP program applies to releases from regulated storage tanks into the environment. The Program uses Act 2 standards and reporting.

Resource Conservation and Recovery Act – The RCRA program under the Environmental Protection Agency (EPA) regulates Sites that handled waste. The

Figure 2: Act 2 Process Diagram



One Cleanup Program allows Act 2 to satisfy a Site's RCRA corrective action requirements at the same time. In 2011, the Site entered into the One Cleanup Program.

Consent Order and Agreement - In 1993, a PADEP Consent Order and Agreement required environmental investigations and remediation for the Point Breeze Philadelphia Refinery portion of the Site. In 2003, a new PADEP Consent Order and Agreement required environmental investigations of the entire Site.

Buyer-Seller Agreement - In 2012, when the Site was transferred from Sunoco to PES, a Buyer-Seller Agreement between the PADEP, PES and Sunoco replaced the 2003 Consent Order and Agreement.

Current Site Status: Remedial Investigation Reports

The Site is currently at the stage of the Act 2 process where RIRs are being or have been prepared for each of the 11 areas of interest. An RIR is a report that describes all of the data collected at a Site and shows that the data is sufficient to assure that the environmental conditions at the property are known; this process is called "characterization".

Each report submitted under the Act 2 program is reviewed by the PADEP and EPA. PADEP will issue an approval or rejection letter based on their review of each RIR to determine if the report meets the requirements of the Act 2 program. If approved, then the next steps in the process can be completed. If rejected, then the comments need to be addressed and another report needs to be submitted which shows that those comments were adequately addressed.

There is common information in each of the RIRs based on Act 2 requirements for investigations and reporting. However, details in each specific AOI report may be different based on the conditions of each AOI which are discussed in the individual AOI Plain Language Summaries. Some of the common elements presented in RIRs are described below.

Introduction and Site Background

The following items are included in the beginning of all reports and are generally the same across the facility.

- A description of the historical operations and current Site operations.
- A summary of the PADEP and EPA regulations that apply to that AOI.
- A summary of the Act 2 standards (which are chemical concentrations) to which onsite data are compared. The selected standards for most areas of the Site include the non-residential Statewide health and site-specific standards for soil and groundwater. Lead has an approved site-specific standard for surface soils that is also commonly mentioned in this section. All data is compared to the statewide health standards in the RIR. The standards are based on Site use being non-residential and encountered conditions.
- A summary of the chemicals that were investigated as part of the Remedial Investigation. Table 1 includes the chemicals that were investigated in each RIR. Additional chemicals may have been added for each AOI investigation based on past operations in those areas.

Table 1 Chemicals analyzed during Remedial Investigations

Volatile Organic Compounds	Semi-Volatile Organic Compounds	Metals
Benzene	Anthracene	Lead
Cumene	Benzo(a)anthracene	
1,2-dibromoethane	Benzo(a)pyrene	
1,2-dichloroethane	Benzo(b)fluoranthene	
Ethylbenzene	Benzo(g,h,i)perylene	
Methyl tert-butyl ether (MTBE)	Chrysene	
Toluene	Fluorene	
1,2,4-trimethylbenzene	Naphthalene	
1,3,5-trimethylbenzene	Phenanthrene	
Xylenes	Pyrene	

Environmental Setting

The environmental setting describes the general environment of the area, including what's beneath the surface that can control how contamination moves over time.

- **Surface Water** – Surface water that is investigated as part of the process includes both surface water features that are on the property (like ponds) and surface water that may be near the property (like the Schuylkill River) that could potentially be affected by chemicals found on Site.
- **Geology** – The soils and rock (referred to as bedrock) beneath the Site. The soils were deposited over long periods of time. Soils are described by geologic units (or groupings of soils), which represent similar soils. Soils placed by humans rather than natural processes are called "fill". Fill was used to make the land higher in order to build the Site. Understanding the geology is important because it can influence how the chemicals in the ground will be found or move in the ground and in groundwater.
- **Groundwater** – Water that is present in the spaces between grains of soil or rock. Groundwater is not an underground lake or stream, but it does flow from one location to another. Different groundwater units can be found to be separated from one another where soils are packed very closely together, like a clay, between two groundwater units. At the Site, there are two groundwater units, which we call the shallow and the deep groundwater. Similar to the geology, understanding groundwater is important because it can influence where the chemicals will be found and how they may move. If chemicals are present in an area of groundwater it is referred to as a "groundwater plume."

Site Characterization

The Site Characterization describes how each AOI was investigated and the results of the investigations. Some important concepts to understand when reading about site characterization activities are described below:

- **Light Non-Aqueous Phase Liquid (LNAPL)** – LNAPL is a petroleum hydrocarbon, oil for example, that floats on water. When LNAPL is found in an area of the soil or groundwater it is referred to as an LNAPL plume. LNAPL can be a source for soil and groundwater contamination. Each of the RIRs describe where LNAPL is present, how it got there, if it is moving, and if it is being remediated (meaning removed or treated in some way). **Figure 3** is an example of how LNAPL gets into the ground. Future Act 2 reports will present Cleanup Plans for LNAPL.

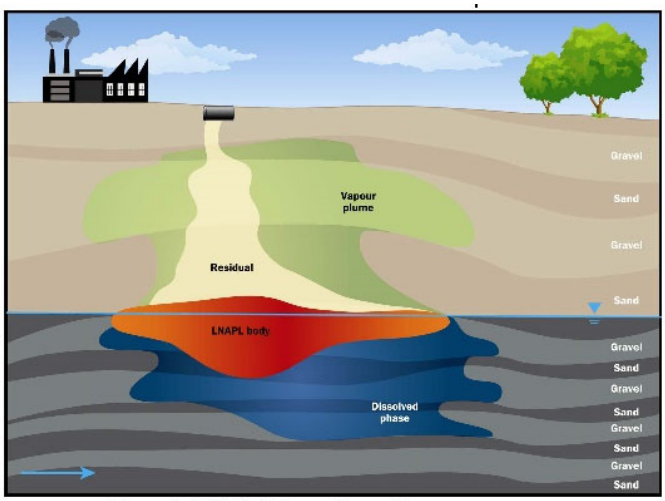


Figure 3: LNAPL Release Example (CL:AIRE, 2014)

- **Soils** - Soil samples are collected throughout the Site and at many different depths to investigate chemicals in the soil. The soil samples are tested, and the results are compared to the non-residential Statewide Health Standards (SHS) established by the PADEP under Act 2. The PADEP has approved a site-specific standard (SSS) for lead of 2,240 milligrams per kilogram (mg/kg) in surface soils (top two feet). Act 2 has different non-residential standards for the 0-2 feet interval below ground surface and greater than 2 feet interval below ground surface. The statewide health standard is used for the soils greater than two feet in the RIRs. The calculation of the SSS was based on updated procedures by the EPA and PADEP and are not due to conditions at the Site. The procedures to calculate a site specific standard for lead follow the PADEP Act 2 described in Chapter 250.306(e). The RIRs describe how the chemical concentrations in soil that are above Act 2 standards are delineated, meaning where their boundaries are located. Delineation is accomplished by taking additional samples to identify where chemical concentrations are above and below the Act 2 standards.

- **Groundwater** – Groundwater samples are collected from monitoring wells and tested to identify chemicals present in the groundwater. The groundwater data are compared to the Act 2 standards. When reading the RIRs, you will see how the locations of chemical concentrations in groundwater that are above the Act 2 standards have been delineated, if possible, by collecting and testing samples from other nearby wells where chemical concentrations were below the Act 2 standards. Additional evaluation of how the chemicals will move in groundwater will be submitted in future Act 2 submittals.

- **Vapor Intrusion -** Vapors from chemicals in soil or groundwater can move upwards and enter indoor air in buildings. Indoor air samples from occupied buildings, outdoor air samples collected directly above LNAPL plumes, and ambient (background) outside air samples are used to evaluate existing vapor pathways. These samples are different than the air samples that were collected by the refinery to look at impacts from emissions from operations. The air sample results are compared to the Act 2 standards, EPA Regional Screening Levels (EPA RSL), Occupational Safety and Health Administration (OSHA) standards, and National Institute for Occupational Safety and Health (NIOSH) standards.

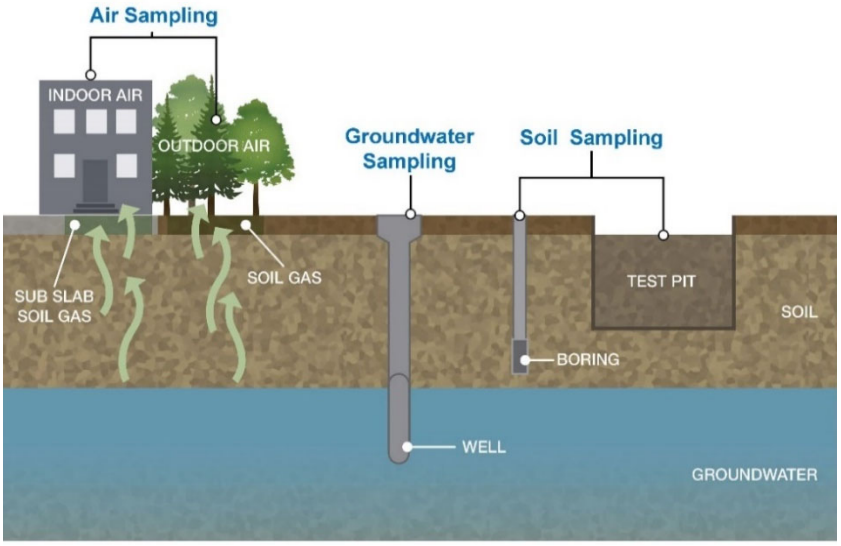


Figure 4: This figure illustrates some of the concepts described above. It shows 1) a monitoring well that goes below the water table for collection of groundwater samples, 2) a soil boring (installed by hand or with a drill rig) and test pit (installed by hand or with a backhoe) from which soil samples can be collected and 3) and how vapors can move upward from soil and groundwater.

Fate and Transport

Once the characterization of contamination in soil and groundwater is complete, a “fate” (how the chemicals decrease in concentrations over time) and “transport” (how the chemicals move through the ground over time) analysis must be conducted. The fate and transport section of the RIRs presents a discussion of where and how the chemicals in soil or groundwater may move. In addition to the information presented in the RIRs that have been submitted, Evergreen will submit one or more detailed Fate and Transport RIRs that will use a computer model to estimate chemical movement and how concentrations are expected to decrease over time.

Conceptual Site Model

The Conceptual Site Model brings together all of the data presented in the RIR. The Conceptual Site Model also presents a discussion of potential pathways and receptors. A potential exposure pathway is a way for a receptor (for example a worker) to be exposed to a chemical in soil, groundwater, surface water, or indoor air. A complete exposure pathway is when there is chemical present that can come into contact with a receptor and no barriers exist to prevent contact. An example of a complete exposure pathway would be if a worker would touch soils that have unacceptable levels of a chemical, without having a cap present to eliminate contact. Evergreen is planning to submit a detailed Human Health Risk Assessment Report(s) once all the RIRs are approved to provide a detailed assessment of pathways, receptors and potential risk.

Ecological receptors (for example endangered birds or plants) are also investigated at the Site. An ecological assessment includes the results from a biological expert’s visual inspection of each AOI, database searches and communication with state and federal agencies about the Site. Sitewide ecological risk assessment activities have also been completed and will be reported in a future Act 2 submittal.

Next Steps/Additional Information

Act 2 Program Status

As of the date of this summary, Evergreen has submitted an RIR for each of the AOIs to the PADEP. The PADEP has approved, conditionally, each of the RIRs except for AOIs 4 and 9. Additional investigation work is being conducted in AOIs 4 and 9 to address the PADEP's comments. All of the Act 2 reports submitted to date, along with PADEP's approval/rejection letters, memorandums, and comment letters which have been given to Evergreen are included on Evergreen's website at https://phillyrefinerycleanup.info/act-2-documents/. All future reports will include public notices as required by Act 2, which is part of the public involvement process discussed in the section below. Future reports will also have Plain Language Summaries submitted along with the reports to aid in the public's review of those documents.

Once the final RIRs are approved for all AOIs, then the project can move on to the next step in the Act 2 process illustrated in **Figure 2** of this document.

Public Participation

Act 2 has requirements for community participation. After submittal of the NIR in 2006, which entered the Site into the Act 2 program, the City of Philadelphia requested that Sunoco develop a Public Involvement Plan. The plan included holding a public information session to give an overview of the regulatory framework for the project and ongoing corrective action processes. A public information session was held on September 19, 2007.

Evergreen prepared an updated Public Involvement Plan in 2019 at the request of the PADEP, which again included public information sessions, the first of which was scheduled for November 7, 2019 but not held. The purpose of the meeting was to present results of environmental investigations and remediation activities relating to the cleanup program being conducted by Evergreen. Evergreen is currently working with the City of Philadelphia, PADEP, EPA and members of the public to amend the Public Involvement Plan to include a Community Outreach Plan, which will lay out how Evergreen will communicate with the public on future reports and site activities. As information becomes available, it will be posted on Evergreen's website and by clicking the following link: https://phillyrefinerycleanup.info/public-involvement/.

The public has the right to comment on Act 2 report submittals and the cleanup process at the Site. Currently, there are various ways to provide comment including: 1) via the website at https://phillyrefinerycleanup.info/report-comments/, 2) via email at phillyrefinerycleanup@ghd.com, and 3) in person during public meetings. Questions and comments that have been collected since the November 2019 public meeting attempt along with Evergreen's responses have been posted to the website on a Q&A page (https://phillyrefinerycleanup.info/q-a/). All questions, comments and responses will also be included in a Public Comment RIR.

Since December 30, 2013, Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC, which is an affiliate of Sunoco, Inc., now known as ETC Sunoco Holdings LLC (Evergreen), has managed the legacy investigation and remediation at the refinery. Evergreen is completing an environmental investigation and cleanup of the former Sunoco Philadelphia Refinery (Site) under the Pennsylvania Department of Environmental Protection's (PADEP) Act 2 Program.

ACRONYMS USED IN THIS SUMMARY

(A full listing of the acronyms found in the RIRs can be found on the Evergreen website)

AOI	Area of Interest
EPA	United States Department of Environmental Protection
LNAPL	Light Non-Aqueous Phase Liquid
NIR	Notice of Intent to Remediate
PADEP	Pennsylvania Department of Environmental Protection
PES	Philadelphia Energy Solutions
RCRA	Resource Conservation and Recovery Act
RIR	Remedial Investigation Report
RSL	Regional Screening Level
SCR	Site Characterization Report
SSS	Site-Specific Standard