Testimony before the Pennsylvania Senate Environmental Resources and Energy Committee

regarding

Philadelphia Energy Solutions (PES) Refinery Site and Cleanup Effort

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Good morning, Chairman Yaw, Minority Chair Comitta, and members of the Senate Environmental Resources and Energy Committee. Thank you for the opportunity to provide written testimony on Evergreen's role in the environmental remediation of the former Philadelphia Refinery site, now owned by Hilco Redevelopment Partners (HRP).

My name is Tiffani Doerr, and I am a Professional Geologist registered in the Commonwealth of Pennsylvania and Project Manager at Evergreen Resources Management Operations (Evergreen). Evergreen is a subsidiary of Energy Transfer, formed in November 2013 to manage Sunoco's legacy remediation obligations, including those at the former refinery site.

Sunoco is responsible for remediating contamination that existed up until it sold the property to Philadelphia Energy Solutions (PES) in 2012. This includes contamination that occurred during the more than 100 years that portions of the site operated as an oil refinery, prior to Sunoco acquiring portions the property beginning in the late 1980s. HRP is now responsible for remediation of contamination that occurred from the sale in 2012 through present day.

Sunoco and Evergreen have been remediating the site for decades and remediation will continue for decades more. However, it should be noted that after extensive assessment, there has been no indication of any health hazard in offsite residential populations resulting from air, soil or water impacts from historic subsurface environmental contamination at the site.

Remediation Status

Evergreen is in the process of completing the remedial investigation activities at the former refinery site to better understand the nature and extent of the chemicals in soil and groundwater, and to ultimately

develop Cleanup Plans for the site. Remedial progress is monitored closely by the Pennsylvania Department of Environmental Protection (DEP) and United States Environmental Protection Agency (EPA) under Pennsylvania's Land Recycling Program, commonly referred to as "Act 2" and the One Cleanup Program. At various steps throughout the process, Evergreen has prepared technical reports, held public meetings, posted information on a standalone website that was created for the public involvement process, and has repeatedly met directly with interested stakeholders.

The 1,300 acres of the former refinery site are broken up into 11 Areas of Interest (AOIs). To date, there have been 24 Act 2 reports submitted, mostly Remedial Investigation Reports (RIRs), which are housed on Evergreen's project website, phillyrefinerycleanup.info. Most recently, Evergreen submitted the Public Comment RIR in March of 2021, followed by the AOI-4 and AOI-9 RIR Addendums in September of 2021. Upon approval of those reports by the regulators, the site-wide groundwater Fate & Transport RIR will be prepared and submitted, which will provide projections of how and where contamination may move in groundwater.

After the Fate and Transport RIR is submitted, Evergreen can move forward to develop and submit Cleanup Plans, which will document how proposed remediation activities will meet the selected regulatory cleanup levels. Evergreen must complete Cleanup Plans for all areas of the site by the end of 2029. Lastly, Act 2 Final Report(s) will be prepared and submitted, which will include Post-Remediation Care Plan activities.

Prior to entry into the Act 2 program, remediation was conducted at the site in accordance with consent order and agreements with the DEP (original in 1993, updated in 2003). Those past and ongoing remediation activities are summarized in the RIRs posted to the website.

Sunoco and subsequently Evergreen have installed and operated numerous remediation systems at the site between 1995 and today. The current remediation systems extract oil, groundwater, and/or vapor from the subsurface with the goal of eliminating contaminant sources and/or protecting potential receptors. Some systems have operated for decades, and a total of over 600,000 gallons of oil and 1 billion gallons of groundwater have been removed and treated from the subsurface.

HRP is responsible for conducting its own, separate remediation activities for contamination that occurred since the 2012 sale. Evergreen has met and communicated with HRP since the sale of the site to exchange information and updates about respective remediation work. Additionally, Evergreen and HRP have participated together in public meetings and have worked to help stakeholders understand the specific roles of each entity in the remediation process.

Public Engagement

Evergreen is committed to working with members of the communities surrounding the former refinery site throughout the entire remediation process. Feedback from stakeholders has been routinely received and used to enhance the public engagement process. Evergreen continues to update the project website, phillyrefinerycleanup.info, to be more informational and more user-friendly. This includes the recent addition of five project fact sheets on the Resources page; a project overview on the Public Involvement page; and an educational video about Evergreen, the site and the remediation process. The stakeholder feedback received to date on the project website has been positive. The fact sheets and project update are included as Appendix A of this testimony.

Sunoco initiated a Public Involvement Plan in 2007, at the request of the City of Philadelphia. Evergreen updated and expanded this plan in June 2019, making Act 2 documents available on the website, as well as at two branches of the Free Library of Philadelphia. As noted in the plans and as required by Act 2, public and City notices have been submitted with each Act 2 report submitted to date.

In 2020, Evergreen worked with members of the public and regulatory agencies to develop a Community Outreach Plan, prompting more information about the remediation process to be published to the website, including plain-language summaries of Act 2 reports; additional public meetings; email blasts about upcoming meetings and other developments; hard-copy mailers; newspaper notifications; and notifications to the City and agencies ahead of report submittals.

Earlier this year, Evergreen hired a community engagement consulting firm specializing in environmental projects, Hummingbird Firm, to help create a more robust and inclusive public engagement plan. This week, a new Public Engagement Plan was finalized, which builds on previous efforts and serves as a more robust community engagement strategy. The plan is the result of a situational analysis performed by Hummingbird, created by feedback gathered during interviews throughout the surrounding communities.

With this plan, Evergreen will continue to expand outreach efforts and community access to updated information. This will include sharing information with community organizations to disseminate using their existing channels.

Evergreen began this year holding quarterly public meetings, increasing the previous frequency to provide more regular updates on the remediation process. To date, Evergreen has held five public meetings since 2019.

The cleanup activities Evergreen is engaged in will support HRP in its site redevelopment, which has the potential to create tens of thousands of jobs and provide for beneficial reuse of the property. The public involvement process for the project continues to evolve, and Evergreen continues to seek and consider feedback from the public, regulatory agencies, local legislators and all interested parties.

Evergreen shares the common goal of cleaning up the site and ensuring that human health and the environment of the surrounding communities are protected. Through Act 2, all interested stakeholders have a role in the cleanup, promoting transparency at every step in the process.

Thank you for the opportunity to submit written testimony today.

APPENDIX A

Overview of the Former Sunoco Philadelphia Refinery Cleanup Program

Introduction and Current Status of the Site

The former Sunoco Philadelphia Refinery, now known as the Philadelphia Energy Solutions Refining and Marketing (PES) LLC Complex, consists of approximately 1400 acres located on the Schuylkill River's eastern and western banks in Philadelphia. The Site has a long history of petroleum transportation, storage, and processing with activities that extend back to the 1860s. Since December 30, 2013, Philadelphia Refinery Operations, a series of Evergreen Resources Group LLC (Evergreen), which is an affiliate of Sunoco, Inc., now known as ETC Sunoco Holdings LLC, has managed the legacy environmental investigation and remediation (cleanup) at the refinery.

Under the Pennsylvania Department of Environmental Protection's (PADEP) Land Recycling Program (Act 2), Evergreen is addressing the environmental impacts to soil and groundwater prior to the 2012 sale of the property to PES. Evergreen has conducted a wide variety of site investigation and cleanup activities at the refinery site as a continuation of the work carried out by Sunoco since the early 1990s. Ongoing cleanup activities at the Site include: remediation of soil and groundwater, removal of oil, and mitigation of sewer vapors. For a more complete review of the reports that detail the site investigation and cleanup activities currently underway at the Refinery Site, please go to www.phillyrefinerycleanup.info.

After the explosion that happened in the PES refinery in June 2019, the refinery was permanently shut down and later sold to Hilco Redevelopment Partners in 2020. Currently, Hilco is in the process of developing the Site into a multi-modal logistics hub.

Regulatory Programs

Currently, Evergreen is working to clean up the former Sunoco Philadelphia Refinery under the oversight of the Pennsylvania Department of Environmental Protection (PADEP) and the U.S. Environmental Protection Agency (EPA), in cooperation with the City of Philadelphia. The regulatory programs concerning environmental investigations and cleanup activities that apply to the Site are listed below. The Act 2 Program is used to complete the reporting requirements for these programs.

- **Act 2 Program** – The Act 2 Program, for which the PADEP is the regulating agency, allows for the cleanup and reuse of properties. In 2006, the Site was entered into the Act 2 Program.
- **Resource Conservation and Recovery Act (RCRA)** – The RCRA program, regulated by EPA, regulates facilities that handle waste. In 2011, the Site was entered into EPA's One Cleanup Program which allows PADEP and EPA to coordinate so that Act 2 can also satisfy the Site's RCRA requirements.
- **Storage Tank Corrective Action Program** – This PADEP regulated program, which uses Act 2 standards, requires owners and operators of regulated storage tanks to provide information about releases of regulated substances and take necessary actions to address related health and environmental impacts.

Outreach and Engagement

Under the PADEP **Act 2 Program**, Evergreen's primary requirements for public participation are to provide a public notification and comment period to the public for all Act 2 reports and documents they are required to submit to PADEP. Over the past several years, Evergreen also developed a community outreach plan and has conducted outreach and community engagement initiatives to include community members, organizations, and other stakeholders in the remediation process.

Moving forward, Evergreen aims to cultivate and enhance new and existing relationships with community residents, key thought leaders, and other interested and affected stakeholders through an updated public outreach and engagement program. To assist in the development of this new and updated public outreach and engagement program, Evergreen hired a community engagement consulting firm, the Hummingbird Firm, in June 2021. Hummingbird's first step in this planning process is to conduct an assessment to determine the current needs of the community as this relates to public outreach and engagement. This assessment will occur in the early summer of 2021 and will include gathering information from a representative sample of residents and key stakeholders interested in and affected by the Legacy Environmental Investigation and Remediation of the former Philadelphia Refinery.

AIR QUALITY

Philadelphia Refinery
LEGACY REMEDIATION

WHAT IS AIR QUALITY?

- Air quality is a measure of how much pollution is present in the air.
- Air quality discussed in this fact sheet focuses on constituents that have the potential to result from activities related to investigating and addressing former refinery operations.

How is air quality evaluated?

- Real-time monitoring equipment can detect airborne particulate matter and other contaminants
- Air samples can be collected in containers and sent to a laboratory for testing
- Computer modeling can be performed to simulate physical conditions and understand anticipated impacts from a source with the potential to cause impacts to indoor or outdoor air

Types of "sources" of air quality impacts and the permits they require:

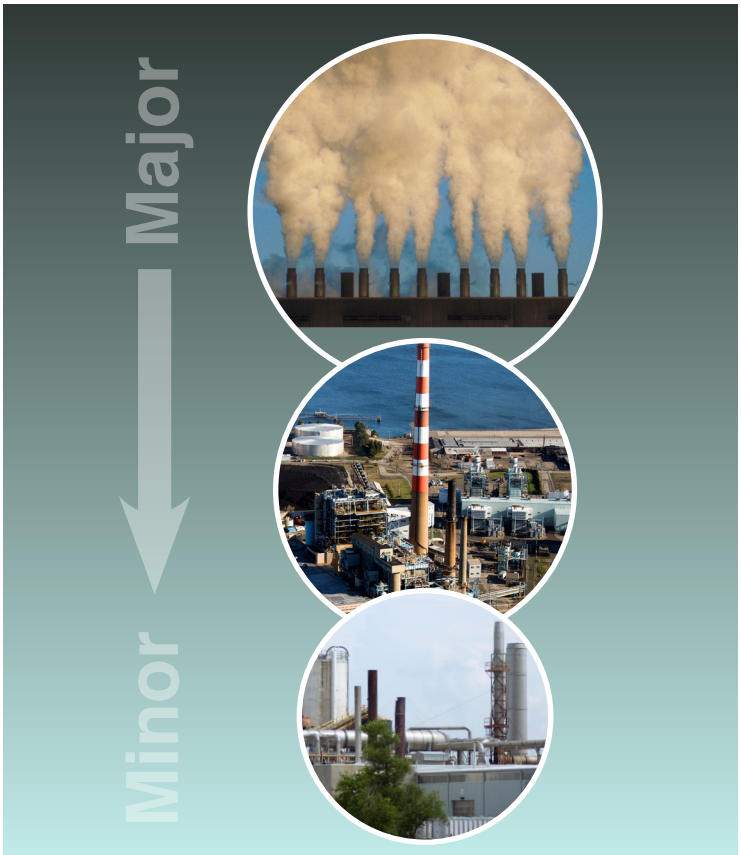
- Stationary sources can include factories, refineries, boilers, landfills, power plants, and other types of facilities that emit air pollutants and are not mobile. These are classified as major or minor sources.
  - **Major source** - must hold a Title V Permit required by Title V of the Clean Air Act that identifies what the responsible party must do to control air pollution.
  - **Minor source** – also know as a "natural minor source" or "synthetic minor source" depending on operating conditions. These require air permits from the Pennsylvania Department of Environmental Protection or the City of Philadelphia.
- Other sources that can impact air quality include mobile sources (such as cars, buses, construction vehicles, airplanes, ships, etc). These are regulated in a different manner from stationary sources.

DEFINITIONS

Ambient air
the portion of the atmosphere that is external to buildings and is breathed by the general public

Indoor air
air within a building which has the potential to impact the health of building occupants

Vapor intrusion
migration of vapor-forming chemicals from subsurface contaminated groundwater or soil into an overlying building



AIR QUALITY

Stages of the Former Philadelphia Refinery's historic operations, cleanup, and redevelopment lifecycle with the potential to impact air quality:

Former Site Use: Refinery operations (up until 2019)

- Historical air emissions from Philadelphia Refinery in operation producing fuels and basic petrochemicals, both prior to the passage of the Clean Air Act and later while operating under a Title V major source air permit to control air pollution emissions

Historic (pre-2012) Contamination, Site Investigation, and Remediation

- Residual soil contamination, dissolved groundwater contamination, or underground oil plumes – has the potential to impact indoor or outdoor air quality onsite at the Former Philadelphia Refinery or offsite depending on the contamination location. Typically, the most likely source of air quality impacts from soil and groundwater contamination would be through volatilization of contaminants from groundwater or LNAPL/oil (such as benzene or other volatile organic compounds) which can potentially lead to vapor intrusion. **Based on the known soil and groundwater conditions and initial air quality investigations at the Former Philadelphia Refinery, the environmental impacts to soil and groundwater have not shown to cause impact to indoor or outdoor air in residential areas offsite.**
- Investigation activities and remediation system construction – has the potential to impact outdoor air quality. An example is emissions from construction vehicles such as drilling rigs used for sampling activities and temporary vapors emitted from the ground during drilling or excavation.
- Remediation system operation – has the potential to impact outdoor air quality. An example of a potential impact to air quality is the discharge of vapors from a soil vapor extraction system (see graphic). As shown in the graphic, vapors that are pulled from the ground are captured and treated before discharge into the atmosphere in accordance with an air permit. Evergreen does not currently operate any soil vapor extraction systems onsite. There are other remediation systems onsite that do have air permits for treated vapor emissions. However, the air treatment is preventative and treats the potentially impacted vapors that come off of the equipment itself, such as holding tanks, oil-water separators, and piping.

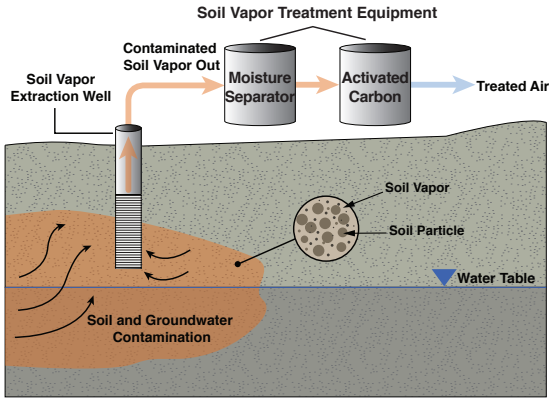
Future Site Use: Redevelopment construction and future non-residential use

- May include dust generation or emissions from construction vehicles during redevelopment construction activities. Note that all future development and construction, except for Evergreen remediation systems, will be managed by the current owner/operator.

How is air quality addressed if it is identified to be harmful to human health or the environment?

- When a facility's operations generate air pollution, air pollution control equipment can capture and treat air prior to discharge to the atmosphere in accordance with a Title V or Minor Source air permit
- Groundwater and/or soil contamination that is impacting air quality can be remediated, such as through operation of an air sparging system that treats groundwater and reduces future impacts from the contamination. If a remediation system involves impacted vapors, it will be treated before it is released to the atmosphere in accordance with a Minor Source permit. A vapor mitigation system can also be installed when vapor intrusion occurs.
- Impacts from construction (dust generation, emissions from construction vehicles) can be managed by measures such as dust suppression, selection of vehicles, and procedures to minimize construction traffic or use local resources
- There are currently three remediation system at the Former Philadelphia Refinery that either remove air from sewers in case of vapor migration from the ground into the sewers or block air movement to prevent migration of vapors offsite.

SOIL VAPOR EXTRACTION AND TREATMENT EXAMPLE



CONTAMINANT FATE AND TRANSPORT

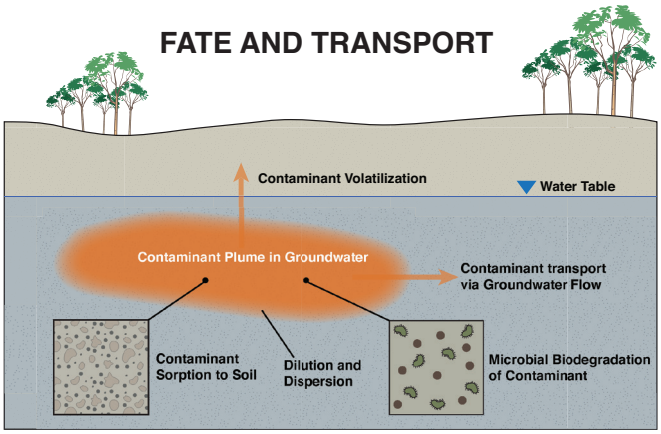
Philadelphia Refinery
LEGACY REMEDIATION

WHAT IS CONTAMINANT FATE AND TRANSPORT?

Fate and transport analysis is the study of how chemicals degrade, transform, and travel through soil, water, and air. Knowledge of the fate and transport of contaminants is key to making decisions regarding investigation and remediation.

Examples of factors that affect a chemical's fate and transport in the environment include:

- Physical properties of the contaminant such as how readily it dissolves into water and how readily it evaporates into the air.
- Characteristics of the site that can affect how a chemical can move in that environment, such as soil properties or the depth of the water table below ground.
- Natural processes that may be occurring and decreasing contaminant concentrations over time, such as microorganisms breaking down contamination



How are fate and transport studied and incorporated into remediation planning?

- Remedial investigations (testing and field sampling) are performed to understand site-specific conditions such as what contaminants are present and where they are located, the site geology, the groundwater flow direction, and other conditions.
- Published data on contaminant properties are used to understand how contaminants are likely to behave in the environment
- A groundwater flow model and fate and transport model can be developed and used to estimate and predict both existing conditions as well as potential remediation scenarios. This can be used to evaluate how effective different remediation methods may be prior to selecting which remediation method to use.
- An example of how a fate and transport model can be used is predicting how the concentration of multiple contaminant in groundwater are anticipated to be reduced over time if groundwater is pumped out of the ground and treated at a treatment system.
- Modeling can include climate change considerations such as higher average river stage due to sea level rise or an increased groundwater recharge rate due to increased annual precipitation.

DEFINITIONS

Conceptual site model
an understanding of the physical, chemical, and biological processes and site conditions that control the transport, migration, and impacts of contamination to human health and/or the environment

Volatilization
transfer of contamination from groundwater or soil into the air

Sorption
attachment of contamination to soil and sediment

Biodegradation
the biological process of microorganisms breaking down contamination

Dilution and dispersion
the process of groundwater contamination spreading out and mixing with other groundwater

WHAT STAGE OF THE ACT 2 PROCESS IS THIS?

- Fate and transport analysis helps build the conceptual site model (CSM) initially developed during Remedial Investigation. The CSM is refined throughout the project lifecycle as additional information is gathered.
- The CSM is used to make decisions regarding additional investigation that may be needed and is used during remediation planning and execution.

EVERGREEN'S REMEDIATION PROGRAM - REGULATORY REQUIREMENTS

Philadelphia Refinery
LEGACY REMEDIATION

WHAT REGULATIONS APPLY TO REMEDIATION AT THE FORMER PHILADELPHIA REFINERY?

- Environmental activities have occurred at the site pursuant to consent orders with the Pennsylvania Department of Environmental Protection (PA DEP) since 1993. In 2012, Sunoco, Philadelphia Energy Solutions, and the PA DEP entered into the most recent Consent Order & Agreement (CO&A) setting forth individual obligations for site cleanup. The consent order was amended in 2020.
- The investigation and remediation of legacy impacts (pre-2012) at the Former Philadelphia Refinery are managed by Evergreen under the **Pennsylvania Land Recycling Program**, also called "**Act 2**."
- The Former Philadelphia Refinery is also part of the **One Cleanup Program** which unifies the cleanup process to address both state and federal requirements. For this Site, federal requirements under the Resource Conservation and Recovery Act (RCRA) are being addressed through a coordinated cleanup under Act 2. Therefore, EPA also reviews and makes decisions on submitted reports.
- Releases from regulated storage tanks are managed through PA's **Storage Tank and Spill Prevention Program.** For this project, the Tank Reports were often submitted along with Act 2 Reports and may be incorporated into future Act 2 deliverables.

What is the Act 2 (Land Recycling) Program?

- Act 2 is a risk-based environmental cleanup program regulated by the Pennsylvania Department of Environmental Protection (PA DEP). This program was established by a series of regulations enacted in 1995 known as the "Land Recycling Program" or simply "Act 2."
- Act 2 encourages cleanup of contaminated vacant or underutilized former industrial properties, also referred to as brownfields, with the goal of returning them to productive use. This stimulates economic growth and maximizes the use of existing infrastructure, helping to preserve farmland and open spaces.
- Risk-based cleanup means that the cleanup standards and cleanup decisions under Act 2 are based on the actual risk that contamination at the site may pose to public health and the environment, considering the current and future property use. This also considers the degree to which contamination could potentially spread off-site.
- Cleanup standards are, by law, protective of human health and the environment. Remediators have the option to select background standards, state-wide health standards, or site-specific standards (also called cleanup levels).
- Per the 2020 First Amendment to the CO&A, the Former Philadelphia Refinery property will be used for non-residential use. The site will be remediated to non-residential use standards under Act 2.

DEFINITIONS

Contaminated property
a property with a chemical present in environmental media (e.g. soil or groundwater) that is regulated by PA DEP or EPA and is at a concentration above the selected PA DEP or EPA standard

Remediation
the process of addressing environmental contamination that is present above a cleanup standard

Consent order
a legal contract used to settle environmental liability and set forth obligations

Conceptual site model
an understanding of the physical, chemical, and biological processes and site conditions that control the transport, migration, and impacts of contamination to human health and/or the environment

REGULATIONS

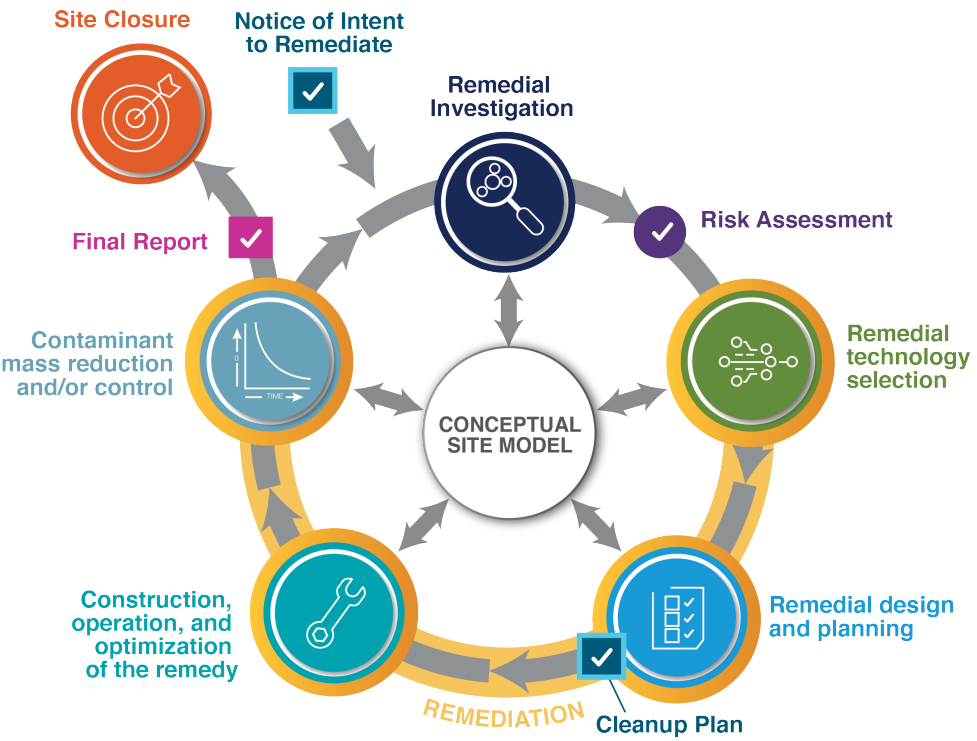
Major Steps of the Remediation Process and the Act 2 Program

- **Notice of Intent to Remediate** – submitting a Notice of Intent to Remediate to PA DEP formally enters the site into Act 2
- **Remedial Investigation** – also called site assessment or site characterization, this step consists of sampling environmental media (e.g. soil, groundwater) and evaluating site conditions to determine what contaminants exist, where, and at what concentrations. This information helps build what is called a "conceptual site model". The results of the investigation are included in a Remedial Investigation Report.
- **Risk Assessment** – if a site is being remediated to site-specific cleanup levels, a risk assessment is conducted to establish the cleanup levels based on evaluation of the level of risk contamination may pose to human health or the environment. PA DEP and EPA must approve site-specific cleanup levels.
- **Remediation** – remediation of contamination is conducted to meet selected cleanup levels. This process includes remedial technology selection, the design, planning and construction of the remediation system, operation and maintenance of the remedy, and the resultant reduction and/or control of contaminant mass. The recommended remediation is included in a Cleanup Plan.
- **Final Report** – after remediation is complete, the remediator submits a final report to PA DEP and EPA to demonstrate that cleanup levels have been met

There are public involvement opportunities throughout the Act 2 program. At the end of the Act 2 program, the property is available for reuse.

Where can I learn more?

- Learn more about Act 2 at www.dep.pa.gov/Business/Land/LandRecycling
- Deliverables for the completed steps of the Act 2 program for the Former Philadelphia Refinery can be found at phillyrefinerycleanup.info including plain language summaries



Philadelphia Refinery
LEGACY REMEDIATION

REMEDIATION

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WHAT IS REMEDIATION?

Remediation is the process of addressing environmental contamination that is present above a cleanup standard. This is accomplished by using one or more treatment methods until the contamination is either removed, concentrations are reduced to meet the site's cleanup levels, or the contamination has been isolated or immobilized such that it does not pose a risk to human health or the environment.

- Remediation does not always mean the site is restored to background (pre-development) conditions.
- Following successful remediation, the impacts of former site operations and residual contamination will have been addressed. Areas that have been cleaned up will be available for reuse.

Common types of remediation technologies:

- **LNAPL/groundwater extraction and treatment** – LNAPL and groundwater are pumped out of the ground and to an above-ground treatment plant to treat the contaminants in the liquid. This is a common method of addressing LNAPL/groundwater plumes.
- **Air sparging** – air is injected through injection wells below the water table. As the air moves upward through groundwater to return to land surface, contaminants in groundwater vaporize and are carried in the air stream. Transfer into the vapor phase (into what is called soil vapor) reduces contaminant concentrations in groundwater. Vapors are then captured and treated. Air sparging does not result in air emissions that would affect site workers or neighboring properties.
- **Soil vapor extraction (SVE)** – a vacuum is applied to extraction wells which are drilled into contaminated soil (above the water table). The vacuum removes contaminated soil vapor which is captured and treated. SVE may be used in combination with air sparging.
- **Natural attenuation monitoring** – relies on a combination of natural processes to reduce (attenuate) contamination levels over time, one of which is bioattenuation where microorganisms in the soil reduce contamination. Through routine sampling, concentrations are monitored over time to ensure concentrations are decreasing.
- **Capping** – a barrier such as clean soil or pavement installed on top of contaminated soil that prevents direct human exposure to the underlying soil and infiltration of rainwater. By preventing contact with the soil, this mitigates the risk of adverse effects that would occur if humans were to exposed to the soil.

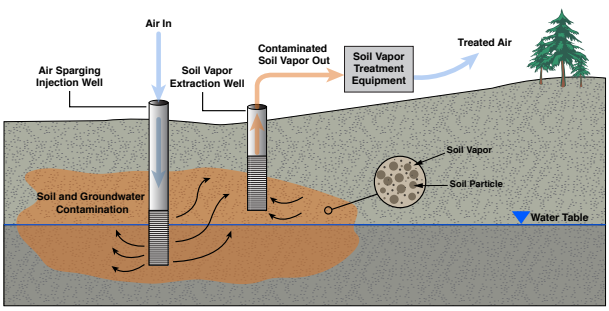
DEFINITIONS

Light Non-aqueous phase liquid (LNAPL)
chemicals that exist as liquids but do not dissolve easily in water, such as gasoline, diesel, and other petroleum products and that generally "float" on top of water

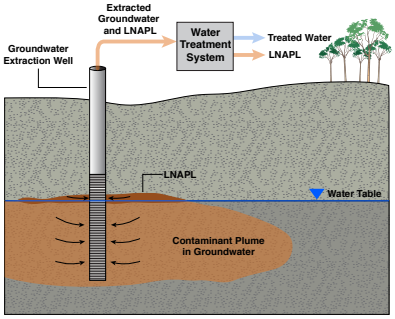
Contamination
a chemical present in environmental media (soil, groundwater, surface water, air) that is regulated by PA DEP or another regulatory body

Cleanup level
the concentration to which a regulated chemical must be cleaned up (remediated to levels that are shown to be protective of human health and the environment)

AIR SPARGING AND SOIL VAPOR EXTRACTION



LNAPL/GROUNDWATER EXTRACTION AND TREATMENT



REMEDIATION

Who decides what remediation method is used?

- For any remediation method selected, detailed plans for remediation will be prepared which consider many factors including site-specific conditions (e.g. geology, hydrogeology) that would affect the success of the remedy, anticipated longevity of different remedy options, climate change resiliency, routine maintenance requirements to maintain effectiveness, the estimated time to achieve cleanup levels, and other factors.
- The regulatory agency must approve the detailed remediation plans prior to implementation via a Cleanup Plan (in Act 2).

WHAT STAGE OF THE ACT 2 PROCESS IS THIS?

- Remediation occurs after the remedial investigation and after cleanup standards have been established and approved by PA DEP and EPA. However, “interim measures” may be put into place without a Cleanup Plan if deemed necessary to be protective of human health and the environment. At the Former Philadelphia Refinery, there were also remediation systems in place prior to joining Act 2.
- Remediation can occur according to different schedules in different areas of the Former Philadelphia Refinery
- Remediation can overlap with redevelopment activities

How is human health and the environment protected during remediation?

- During remediation, the contractor completing the work uses best management procedures to protect human health and the environment. Permits may also be required for certain types of work.
- Depending on the treatment technology used in various areas, this may include dust suppression measures and air monitoring to control off-site air impacts and stormwater control and erosion protection measures to control off-site impacts including impacts to surface water bodies.
- Remediation systems and equipment are routinely inspected and maintained to control their effectiveness and ensure the treatment method in place remains protective of human health and the environment.
- Residents do not need to take extra precautions during remediation. However, residents may notice increased truck traffic and periods of noise disturbances during work hours for certain treatment methods.

RISK ASSESSMENT

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WHAT IS RISK ASSESSMENT?

A human health risk assessment evaluates the potential risks to humans from environmental stressors (site contaminants). An ecological risk assessment evaluates the potential risks to the environment from environmental stressors.

There are four major steps of a human health risk assessment. These steps seek to answer the following questions:

Identification of hazards
what chemical is present that has the potential to cause harm to humans?

Dose-response assessment
at what level (dose) will the chemical cause harm (response) to humans?

Exposure assessment
how much chemical is the person or ecological receptor exposed to, and how? (e.g. via ingesting contaminated groundwater)

Risk characterization
what level of risk does the chemical cause to the person?

A similar process is followed to conduct an ecological risk assessment. In an ecological risk assessment, impacts to ecosystems and wildlife is assessed (e.g. river water quality, fish health, etc.).

How are these data used?

- Results of risk assessments tell us if the actual chemicals and concentrations present at a site pose a risk based on exposure pathways, which are the paths through which people or the environment come into contact with contaminants.
- Data are used in the risk management process to do the following:
  - Determine the cleanup levels for chemicals in soil and groundwater
  - Identify chemicals and media requiring cleanup
  - Support cleanup decisions, such as what treatment method is needed to mitigate the human health or ecological risk
- In some instances, site-specific cleanup levels are calculated to be higher than state-wide levels. This can happen even while the site-specific cleanup levels remain protective of human health and the environment under the planned site use. This is because state and federal default cleanup levels are intended to be used under a wide range of conditions that can be found at different sites. These default cleanup levels cannot account for differences between individual properties and receptors at each property.

Types of questions a risk assessment tries to answer:

- Is there potential risk to humans or the environment caused by environmental stressors such as chemicals?
- What are the potential pathways or routes of exposure?
- Is there a level below which some chemicals don't pose a risk?

DEFINITIONS

Environmental stressor – any physical, chemical, or biological entity that can cause an adverse effect in humans or ecosystems. An example is chemicals in the environment.

Receptor – any human, flora (plants), or fauna (animals) that may be exposed to an environmental stressor.

Exposure pathway – a path through which an environmental stressor contacts a receptor (e.g. via ingestion, dermal (skin) absorption, or inhalation).

WHAT STAGE OF THE ACT 2 PROCESS IS THIS?

- Exposure pathway identification is conducted during the remedial investigation stage
- Risk assessement and development of site-specific standards is generally conducted after the remedial investigation stage or the site can move directly to the cleanup stage.

Where can I learn more?

- EPA guidance on risk assessment can be found at: https://www.epa.gov/risk/conducting-human-health-risk-assessment
- PA DEP guidance on risk assessment is available in Section III(H) of the ACT 2 Technical Guidance Manual available from: https://www.dep.pa.gov/Business/Land/LandRecycling/Standards-Guidance-Procedures/Guidance-Technical-Tools/Pages/Technical-Guidance-Manual.aspx