U. S. EPA Superfund Program

Proposed Plan

Ravenswood PCE Superfund Site
Operable Unit 1
Ravenswood, West Virginia

EPA ANNOUNCES PROPOSED PLAN January 2011

January 10, 2011 to February 9, 2011
Public Comment Period on EPA's Proposed Plan

Public Meeting
January 20, 2011
Ravenswood Fire Hall
333 Virginia Street
Ravenswood, WV 26164
TIME 6:30 p.m to 8:30 p.m.

The United States Environmental Protection Agency (EPA) is issuing this Proposed Remedial Action Plan (Proposed Plan) to present EPA's Preferred Alternative for remediating contaminated groundwater, Operable Unit 1 (OU1), at the Ravenswood PCE Superfund Site (Site). EPA is the lead agency for the Site, and the West Virginia Department of Environmental Protection (WVDEP) is the support agency. This Proposed Plan summarizes information from the Remedial Investigation (RI), completed in October 2010, and the Feasibility Study (FS) report, which was completed in October 2010. The RI/FS, prepared by EPA, is contained in the Administrative Record for the Site.

The Ravenswood PCE Superfund Site (Site) is located in the City of Ravenswood, Jackson County, West Virginia. The National Superfund Database Identification Number is WVSFN0305428. The Site consists of a groundwater plume which extends for approximately 1,400 feet under the downtown area of Ravenswood.

The location of the Site is shown in Figure 1.

EPA is issuing this Proposed Plan to solicit public comments on the remedy EPA is proposing for restoring the contaminated groundwater at the Site. This Proposed Plan is being issued as part of EPA's public participation requirements under Section 117 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 U.S.C. § 9617, commonly know as Superfund, and Section 300.430(f)(ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. § 300.430(f)(ii). After the close of the public comment period EPA will announce its selection of the final remedy for groundwater remediation at the Site in a document called the Record of Decision (ROD). The public's comments will be considered and presented with discussion incorporated in the Responsiveness Summary of the ROD. EPA encourages the public to review the documents that make up the Administrative Record to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site.

The Administrative Record for the Site can be accessed at www.epa.gov/arweb, or at the following locations:

Jackson County Library
323 Virginia Street
Ravenswood, WV
Hours: Call (304) 273-5343
for current hours

EPA Administrative Records Room
Administrative Coordinator
1650 Arch Street
Philadelphia, PA 19103
Phone: 215-814-3157
Hours: Monday- Friday 8:30 am to 4:30 pm
By appointment only

The Preferred Alternative discussed in the Proposed Plan will address contaminated groundwater. The goal of the preferred remedy is to restore the entire area of contaminated groundwater to its beneficial use. EPA's Preferred Alternative to meet these goals is identified in the Proposed Plan as Alternative 4, In-Situ Air Sparging with Soil Vapor Extraction, and includes these components:

- The In-Situ Air Sparging with Soil Vapor Extraction (AS/SVE) will include the continued operation of the AS/SVE system in place for the Treatability Study, monitoring of vapors and an expansion of AS and SVE wells in the central portion of the plume;

- Groundwater monitoring throughout the contaminated groundwater plume; which may require the installation and monitoring of additional wells;

- Continued well-head treatment on the City's contaminated production wells prior to distribution;

- A Pre-Remedial Design Investigation (PRDI) to ensure the proper placement of the air sparging and soil vapor extraction wells; and

- Institutional Controls to prevent the installation of new production wells in the contaminated portion of the aquifer.

The other Alternatives that EPA evaluated include the following:

Alternative 1- No Action
Alternative 2- Groundwater Extraction and Granular Activated Carbon (GAC) Treatment using a New Extraction Well
Alternative 3- Venturi Air Stripping Using a New Extraction Well

The proposed alternative is the final remedy for OU1, groundwater at the Site. OU2, vapor intrusion, will be addressed separately. A past removal action at the Site supplied the City with two new production wells in uncontaminated portions of the aquifer. EPA is proposing the preferred alternative to address the long term threat due to the contaminated groundwater. EPA has determined that the Preferred Alternative will effectively treat the contaminated groundwater when compared to the other alternatives.

EPA is issuing this Proposed Plan to solicit comments on the Preferred Alternative for the remediation of contaminated groundwater at the Site. EPA will select the final remedy for OU1 of the Site only after the public comment period has ended and the comments received during the comment period have been reviewed and considered. Comments should be submitted in writing or emailed to:

Laura Johnson (3HS23)
Remedial Project Manager
Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3295
Johnson.laura@epa.gov

Or

Trish Taylor (3HS52)
Community Involvement Coordinator
Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-5539
taylor.trish@epa.gov

The Proposed Plan includes the following sections:

- **Site Background-** Provides facts about the Site which provide the context for the subsequent sections of the Proposed Plan;
- **Site Characteristics**- Describes the nature and extent of contamination at the Site;
- **Scope and Role**- Describes how the response action fits into the overall Site strategy;
- **Summary of Site Risks**-Summarizes the results of the baseline risk assessment, and the land use and groundwater use assumptions used in the analysis;
- **Remedial Action Objectives**- Describes what the proposed Site cleanup is expected to accomplish;
- **Summary of Alternatives**- Describes the options for attaining the identified remedial action objectives;
- **Evaluation of Alternatives**- Explains the rationale for selecting the Preferred Alternative;
- **Preferred Alternative**- Describes the Preferred Alternative and affirms that it is expected to fulfill statutory and regulatory requirements, and

- **Community Participation-** Provides information on how the public can provide input to the remedy selection process.

I. SITE BACKGROUND

Site Location and Description

The Site is located in the City of Ravenswood in Jackson County, West Virginia. The City is approximately three miles long by one mile wide (Figure 1). It is bounded on its western edge by the Ohio River. Sandy Creek, which flows into the Ohio River, bounds the City to the south. The Ravenswood PCE Superfund Site (Site) generally compromises the downtown area of Ravenswood, which is underlain by groundwater contaminated with tetrachloroethene, also known as perchloroethylene or (PCE). The plume extends from the intersection of Broadway Street and Walnut Street approximately 1,400 feet northeast to the City of Ravenswood water supply well field which is off of Virginia Street (Figure 2). The City of Ravenswood water supply well field currently includes seven production wells (PW-1 to PW-7) that supply water to approximately 6,000 people.

Site Hydrology

The PCE contaminated groundwater at the Ravenswood PCE Site is located between 55 and 90 feet below ground surface in the alluvial aquifer. The City's productions wells are screened right above bedrock in the 'deep' portion of the alluvial aquifer. The monitoring wells are screened in both the 'shallow' and 'deep' portions of the alluvial aquifer. The majority of the PCE contamination is found in the 'shallow' (upper) portion of the alluvial aquifer. Bedrock is from the Dunkard Group which consists of interbedded sandstones, shales, limestones, clays and coal. During the Pre-Remedial Design Investigation additional geophysical information will be acquired about the bedrock to confirm that no PCE is located in the bedrock aquifer. The air sparging wells, installed as part of the Treatability Study, were installed at the bedrock surface. This allows the wells to influence the entire alluvial aquifer and allows for maximum PCE removal.

History of Previous Environmental Investigations and Removal Actions

In September 1989, during routine health department water analysis, PCE contamination was detected in PW-2, PW-3 and PW-5 at levels that exceeded the Maximum Contaminant Level (MCL) for PCE in drinking water which is 5 micrograms per liter (5μg/L) as set forth at 40 CFR Section 141.61. MCLs are standards for drinking water established by the Safe Drinking Water Act, 42 U.S.C. § 300g-l.

PCE concentrations that exceeded the MCL were detected five times from 1989 to 1998 in the finished water that is distributed to the public. Following the identification of PCE in the drinking water supply, various Site investigations took place during the period between 1998 and 2004.

In 1998, the West Virginia Rural Water Authority requested EPA's assistance to address the PCE contamination in the municipal water supply. Under EPA's direction a contractor conducted two soil gas surveys covering an area of 75 acres. The surveys focused on areas in which there were potential sources for PCE contamination. During the study PCE was detected in moderate concentrations at 3 locations but no significant source area was found.

In 1999, based on the results of the soil gas survey, EPA utilized another contractor to attempt to locate the source of the groundwater contamination. EPA's contractor installed four monitoring wells, EPA-01 to EPA-04. While the wells were being installed EPA collected soil samples to be analyzed for the presence of PCE; none of the soil samples analyzed detected any PCE.

In addition to sampling the four newly installed monitoring wells, EPA also sampled the five City production wells then in operation. PCE was detected in all production wells sampled except for PW-4 which showed no PCE contamination. The highest detection of PCE in this sampling event came from PW-3 which had PCE detected at 29.8µg/L.

In 2000, EPA's contractor prepared a Site Inspection Narrative Report to assess the possible threat to human health and the environmental from the PCE contamination in groundwater. The report concluded that PCE was present in municipal well samples and that the PCE plume posed a threat to human health and the environment.

In 2000, the City added a Venturi air stripper to its treatment process to remove PCE from the drinking water and to eliminate the health threat from using contaminated groundwater as a water supply. City production wells PW-3 and PW-5, which historically had been the most contaminated, were treated with the air stripper before being blended with water from non-contaminated wells.

During this time the West Virginia Department of Environmental Protection (WVDEP) obtained an EPA Site Assessment grant and directed a contractor to further delineate the PCE plume. In 2000, there were 37 direct push points (a direct push drill rig drills to the groundwater and allows for a sample to be taken without having to install a permanent well) were advanced near suspected source areas. The four EPA installed monitoring wells and the City production wells were also sampled during this time. All the data collected at this time was presented in the Interim Investigation Report which is part of the Administrative Record (AR) for the Site. PCE sample results from the direct push sampling ranged from non-detect to 152µg/L.

In 2001, the WVDEP took an additional 18 direct push samples and installed seven permanent monitoring wells. One well, DEP-05S, was installed in shallow groundwater. The remainder, DEP-05D through DEP-10, were installed in deeper groundwater. The previously installed monitoring wells were sampled along with 55 samples taken from temporary soil borings. These results were presented in the 2001 Investigation Summary Addendum #1, which is also available in the AR for the Site. PCE concentration found in groundwater during this sampling event ranged from non-detect to 325µg/l in DEP-05S.

In 2002, WVDEP obtained a contractor to sample the existing groundwater wells during two sampling events. From March to April 2002, 11 monitoring wells and five City production wells were sampled. PCE detections ranged from non-detect to 410µg/L in DEP-05S. The second round of sampling took place in September 2002. This time, samples were collected from six monitoring wells and three City production wells. Again PCE concentrations ranged from non-detect to 200µg/L in DEP-05S.

In 2004, the Site was added to the National Priorities List (NPL).

EPA's Removal Program installed two new production wells that went online in August 2004. The wells (PW-6 and PW-7) were installed in an upgradient location that is not contaminated with PCE. These wells serve as uncontaminated water sources that are blended with water from the City's other five production wells. Sampling was conducted quarterly from 2003 to 2007 by EPA's Removal Program; this data is available in the Administrative Record.

In 2007, EPA directed their contractor to take an additional round of samples from 11 monitoring wells and 5 City production wells; this information was used to support a conceptual site model (CSM) which better detailed the characteristics of the plume. The highest concentration of PCE found during this sampling event was 1,200µg/L in DEP-05S.

All of the information gathered in previous sampling events was used to support the RI.

Treatability Study Installation and Sampling

In November 2008, as part of the RI, EPA initiated a Treatability Study (TS) at the Site to provide engineering data to support a final remedy decision for OU1 at the Site. Air sparging with soil vapor extraction (AS/SVE) was chosen due to its operational success at the similar Vienna PCE Superfund Site in Vienna, West Virginia. In November 2008, 15 wells were installed as part of the AS/SVE system. The system included: nine air sparging wells, three soil vapor extraction wells, two groundwater monitoring wells and one vapor monitoring well. A portable AS/SVE system was moved from the Vienna PCE Site and was installed at the Ravenswood PCE Site in June 2009.

The air sparging wells inject air into the water table which volatilizes (changes from an aqueous phase to a vapor phase) the PCE. The volatilized PCE then moves upward into the vadose zone (the area extending from the top of the groundwater to the land surface). The PCE is then captured by the soil vapor extraction wells; the SVE wells work by creating a vacuum in the vadose zone. The PCE vapors captured by these wells are transported via piping to a vapor-phase granular activated carbon (VPGAC) unit which is located in the TS building. The VPGAC works as a filter to remove the PCE from the air. The treated clean air is then discharged to the atmosphere.

Operation of the TS system began in phases, this allowed EPA to gather enough sampling data to ensure that the vapor extraction system captured all PCE vapors and no risk from PCE vapors was created from operating the system. In June 2009, the soil vapor extraction system was activated which resulted in the removal of PCE vapors from the subsurface. Sampling was conducted of the SVE system frequently during the first month of the SVE system operation. Once the vapor data confirmed that there were not high levels of PCE in the subsurface, the AS system was phased into operation. The AS system was activated at half capacity in August 2009, after two months of vapor monitoring; this ensured the system did not rapidly mobilize high concentrations of PCE into the subsurface that could not be captured by the SVE wells. Once additional vapor monitoring data confirmed that there were not elevated PCE concentrations in the subsurface, the AS system was activated at full capacity in September 2009.

Groundwater and vapor sampling of the Treatability Study system is conducted on a regular basis. Vapor samples were collected during the start up of the SVE system on day 1, day 2, day 3, day 7 and day 13 of SVE operation. After the AS system was started, vapor samples were collected on day 1 and day 2, and were then taken monthly to June 2010. Vapor samples are scheduled to be taken during two more sampling events in 2011 to confirm system effectiveness. Data from the vapor samples confirm that PCE is being volatilized with the air sparging and PCE mass is being removed from the aquifer. To date, over five pounds of PCE have been removed from the aquifer.

Groundwater sampling began with a baseline sampling event during the AS/ SVE installation in November and December 2008. Samples were collected from thirteen monitoring wells and the seven City production wells, along with screening level samples taken during the well installations for the AS/SVE system. The highest PCE concentration identified during this sampling effort came from a sample taken from an air sparging well where PCE was detected at 210µg/L. The highest detection from a monitoring well, 180µg/L, came from MW06. Samples from the monitoring wells were collected again in September 2009, February 2010, and May 2010 as part of the TS system operation. Results from those sampling events are available in the Administrative Record and show that the air sparging/ soil vapor extraction system is effective in removing PCE from the groundwater. The air sparging/ soil vapor extraction system continues to operate in order to gather more data of its effectiveness and to help control the PCE plume. A map of the air sparging and soil vapor extraction wells is included as Figure 3.

<u>2010 DPT Plume Delineation</u>

In February 2010, EPA's contractor mobilized to Ravenswood to begin a Direct Push Technology (DPT) sampling effort. The sampling focused on further delineating the boundaries of the plume. This information was gathered in support of this RI and to support the RI for OU2. OU2 will focus on vapor intrusion into buildings above the plume. Sampling efforts were focused on delineating the plume in areas where PCE concentration exceeded 5µg/L. During the sampling effort a total of 33 locations were sampled. Sampling proceeded in a step-out fashion. The first set of samples taken were

MCL delineation points. These samples were taken in areas assumed to contain PCE levels near 5µg/L and in areas with the greatest plume boundary uncertainty. While the results of the first set of samples were being analyzed there were five source identification point samples collected in areas of higher PCE concentration in the interior of the plume. These points were sampled to determine if a more definitive source area could be found. Once the analytical results from the first round of samples were received additional step out point samples were collected in areas where PCE levels were still above the MCL concentrations. The highest PCE concentration, 220 µg/L, found during this mobilization was located near the intersection of Mulberry Street and Washington Street. This is an area that has historically had higher levels of PCE. No definitive source areas were found during this sampling effort, but a complete model of the plume was obtained. Locations of the DPT sampling and results are included as Figure 4.

Sampling of City Supply Wells

In January 2010, the City production well, PW-3 had an increased level of PCE of 44µg/L, up from an annual average of 24µg/L. In February 2010 PW-3 was taken offline by the City due to the increased PCE levels. PW-3 was historically pumped at approximately 200,000 gallons per day (gpd). This high pumping rate controlled the spread of the PCE plume into the other City production wells. When PW-3 was taken offline by the City, PW-5 and PW-2 showed increased levels of PCE.

In May 2010, in order to maintain control of the plume, the City obtained a temporary National Pollutant Discharge Elimination System (NPDES) permit, as mandated by the Clean Water Act, 33 U.S.C. § 303, to pump PW-3 through the air stripper and then discharge the water to the Ohio River. It is now pumped at around 100,000 gpd. The increase of PCE in PW-3 is thought to be caused by a pocket of high PCE concentrations in the plume (identified in the DEP-05S sample collected in May 2007) which was drawn into PW-3. Since January 2010, PCE levels in PW-3 have decreased. In September 2010, the City's sampling results showed that PCE levels had decreased to 14.6µg/L.

II. SITE CHARACTERISTICS

Remedial Investigation and Feasibility Study

The Remedial Investigation/ Feasibility Study (RI/FS) used all available sampling data for the Site and was completed in October 2010. The RI/FS identified the types, quantities and locations of contaminants at the Ravenswood PCE Site and developed ways to address the contamination problems. The RI concluded that:

- A groundwater plume which is contaminated with PCE extends 1,400 feet northeast from the intersection of Broadway and Walnut Streets to the municipal well field.

- The pumping of the City production wells controls the flow in the majority of the contaminated aquifer. This pumping has drawn the contaminated groundwater into the City well field.

- Current data show that PCE has not reached the nearby surface water bodies. Modeling of the groundwater does indicate that some of the plume may migrate towards the Ohio River. However, samples taken closest to the River show that Cis-1,2-dichlorothene, which is a breakdown product of PCE is present (levels were below MCLs and RSLs and showed no risk). This means that PCE is naturally breaking down near the Ohio River which may preclude it from reaching the River.

- The primary Contaminant of Concern (COC) identified in the human health risk assessment (HHRA) is PCE. Other Contaminants of Potential Concern (COPCs) identified were metals including; arsenic, chromium, cobalt, iron, manganese, and total nickel, these did not exceed cancer risk or HI and were not retained as COCs. The only COC that is a cancer risk driver is PCE.

- The screening level ecological risk assessment (SLERA) indicates that there are currently no risks to ecological receptors because contaminants have not reached a point where exposure is expected.

- The RI did not find any indications of residual dense non-aqueous phase liquid (DNAPL) in either the vadose zone or saturated aquifer.

- The highest measured concentration of PCE (1,200µg/L) was found in DEP-05S in May 2007. This part of the plume is within the capture zone of the City production wells. Concentration of contaminants in DEP-05S decreased to 370µg/L in December 2008, potentially indicating that a pocket of relatively higher concentration groundwater had moved through that location and towards the City well field.

- Concentrations of PCE are much higher in the shallow part of the alluvial aquifer than in the deeper part of the alluvial aquifer.

- The interim results of the Treatability Study indicate that the AS/SVE system is effective in removing the PCE from the groundwater. This is supported by the decreased levels of PCE in the monitoring wells located within the radius of influence of the AS/SVE system, and the presence of PCE in the SVE system.

Based on the results of the RI, EPA proposes the following:

- The AS/SVE TS system should continue to operate and remove PCE from the groundwater.

- Prior to the Remedial Design (RD), a supplemental investigation should be performed to further delineate the plume so that all areas with PCE in groundwater can be treated by the remedy selected in the ROD.

III. SCOPE AND ROLE OF THIS ACTION

This response action referred to as Operable Unit 1 (OU1) covers contaminated groundwater at the Site. OU2, which will address the potential for vapor intrusion, will be addressed separately. The objective of this action is to prevent current and future exposure to contaminated groundwater through treatment of groundwater at the Ravenswood PCE Site. Through the use of treatment technologies this response will permanently reduce the toxicity, mobility, and volume of contaminants in the groundwater.

IV. SUMMARY OF SITE RISKS

During the RI/FS, EPA conducted a Human Health Risk Assessment (HHRA) and Screening Level Ecological Risk Assessment (SLERA) to determine the current and future effects of contaminants on human health and the environment. The results of those studies are discussed below. The objective of this action is to prevent current and future exposure to contaminated groundwater through the treatment of groundwater.

Human Health Risks-Groundwater

The HHRA was conducted to characterize and quantify the current and potential human health risks that would occur if no remedial action were taken to address the groundwater at the Site. The HHRA identifies the potential exposure pathways in which people may be exposed to Site contaminants, the toxicity of the contaminants present, and the potential for cancer and non-cancer effects to occur from exposure to the contaminants. EPA has set a target risk range of 10^{-4} to 10^{-6} for a lifetime cancer risk. For non-carcinogenic contaminants, EPA sets a target of a Hazard Index (HI) of no greater than 1.

The groundwater plume currently underlies the downtown area of Ravenswood, which is a mixed residential and commercial area. Ravenswood currently uses treated groundwater contaminated with PCE provided by the public supplier as a potable water source. The HHRA evaluated the current use of groundwater exposure pathways for dermal exposure and ingestion routes for residential children and adults as well as inhalation by adults while showering. Since the future land use of the City will most likely remain commercial and residential the potentially exposed future populations evaluated are the same as current populations; however future populations were assumed to contact untreated groundwater from the most contaminated wells in the plume. Vapors from groundwater potentially entering buildings will be evaluated separately as OU2.

The HHRA calculated risk for all of the complete and potentially complete exposure pathways found at the Site. The current/future cancer risk for adult residents ingesting and showering with the contaminated groundwater was 2.3×10^{-3} which exceeds EPA's target risk range. PCE was found to be the predominant cancer risk driver, contributing over 99% of the total cumulative cancer risk.

The non-cancer health hazard for adult residents was found to be a HI of 2 which exceeds EPA's threshold of 1. This indicates that non-cancer health effects may occur, the non-cancer risk driver is PCE.

The cancer and noncarcinogenic effects of contaminants on children were also assessed in the HHRA. The current and future risk for child residents ingesting and bathing with contaminated groundwater is 2.4×10^{-3} which exceeds EPA threshold. As with adults PCE is the predominant cancer risk driver. The noncancer risk was also evaluated for the current and future child receptor. The non-cancer risk was found to be a HI of 4, which exceeds EPA's threshold of 1. The non-cancer risk driver is PCE.

The calculation of lifetime risk to residents, which totals the adult and child carcinogenic risk for ingesting, showering and bathing with contaminated groundwater the carcinogenic risk was found to be 4.7×10^{-3}, which exceeds EPA's threshold. The predominant cancer risk driver is again PCE accounting for more that 99% of the cumulative risk.

While risk to exposure of contaminated groundwater exists, at this time the City is treating the contaminated groundwater with an air stripper prior to distribution and no PCE exposure is expected. EPA's Preferred Alternative will restore the groundwater to the MCL, mitigating the risk in the future.

Ecological Risk Assessment

A SLERA was completed for the Site as part of the RI. The objective of the SLERA was to evaluate the future potential ecological impacts of contaminants from the Site on the Ohio River and Sandy Creek. Sandy Creek borders Ravenswood to the south and flows into the Ohio River which borders Ravenswood on the west.   The Conceptual Site Model, discussed in the RI illustrates that while there is a portion of the plume that may eventually reach the Ohio River, the City's production wells' influence on the groundwater gradient have so far prevented this from happening.

The SLERA was conducted in a manner consistent with *EPA's Ecological Risk Assessment Guidance for Superfund (ERAGS)* guidance document. The SLERA examined all sampling data collected for the Site to date and used the highest concentrations found in those samples. This examination included Volatile Organic Compounds (VOCs), Semi-Volatile Compounds (SVOCs), inorganics such as metals, and pesticides. The SLERA then examined potential exposure pathways and receptors for exposure such as fish and birds. The SLERA identified several Contaminants of Potential Concern (COPCs) using conservative assumptions. Any contaminants found above the Ecological Screening Level (ESL) were included as COPCs. The full list of COPCs can be found in the AR for the Site. The SLERA found that potential future risk exists where groundwater discharges into the surface water.

The risk assessment concluded that while there could be future potential risks to ecological receptors exposed to contaminated groundwater discharging to the Ohio River and Sandy Creek; the current data indicates that the plume has not reached the Ohio River or Sandy Creek and no risk currently exists.

Summary

In summary, the baseline human health risk assessment conducted for the Site demonstrated that unacceptable risks are present because of the contaminated groundwater. These risks are currently mitigated by the City's treatment of groundwater before distribution to the public. However, it is EPA's objective, as stated in the NCP, to return groundwater to its beneficial use. Therefore, it is EPA's determination that the Preferred Alternative identified in this Proposed Plan is necessary to protect human health and the environment from actual or threatened risk from the contaminated groundwater.

V. REMEDIAL ACTION OBJECTIVES

To protect the public and the environment from potential current and future health risks, the following Remedial Action Objectives (RAOs) have been developed to address the contaminated groundwater at the Site:

- Prevent human exposure, including ingestion, inhalation, and dermal contact by current and future residents and industrial workers to contaminated groundwater that exceeds EPA's acceptable level of risk;

- Prevent down-gradient and offsite migration of contaminants in the groundwater to the Ohio River and Sandy Creek; and

- Restore contaminated groundwater to meet the regulatory requirements of groundwater, which EPA has identified for the COC as the Maximum Contaminant Levels (MCLs).

This proposed action will reduce the excess cancer risk from exposure to contaminated groundwater to less than one in ten thousand. This will be achieved by reducing the concentrations of PCE to the MCL for drinking water, which is currently 5µg/L.

VI. SUMMARY OF REMEDIAL ALTERNATIVES

Remedial Alternatives for the Site are presented below. The alternatives are numbered to correspond with the alternatives presented in the FS.

Common Elements

Three of the four remedial alternatives have common elements. With the exception of Alternative 1- No Action, all of the alternatives would require groundwater monitoring to monitor contaminant levels throughout the Site. The other common element in the three alternatives is the requirement for institutional controls to prevent the installation of any new production wells within the contaminated area of the groundwater plume.

All of the alternatives would require five-year reviews. Five year reviews are required at all Superfund sites when there is contamination that is left in place. In the case of Ravenswood PCE Site, a review would be conducted every five years until the performance standards for groundwater are achieved.

- Alternative 1: No Action
- Alternative 2: Groundwater Extraction and Granular Activated Carbon (GAC) Treatment using a New Extraction Well
- Alternative 3: Venturi Air Stripping Using a New Extraction Well
- Alternative 4: In-Situ Air Sparging with Soil Vapor Extraction

Alternative 1: No Action

Estimated Cost: $0
Estimated Annual Cost: $0
Estimated Present Worth Cost: $0
Estimated Time to Completion: hundreds of years

This alternative is developed and retained as a baseline scenario to which the other alternatives may be compared. Under this alternative EPA would take no action at the Site to prevent exposure to the groundwater contamination.

Alternative 2: Groundwater Extraction and Granular Activated Carbon (GAC) Treatment using a New Extraction Well

Estimated Capital Cost:
Alternative 2a: $578,500
Alternative 2b: $513,800
Estimated Annual Cost: $35,650
Estimated Present Worth:
Alternative 2a: $1,675,000
Alternative 2b: $1,610,000
Estimated Time to Completion: 30 years

This alternative would involve extracting groundwater and treating it using a granular activated carbon (GAC) treatment system. A new extraction well would be installed to capture and pump contaminated groundwater to the surface for treatment. The most likely location for the installation of the new extraction well would be in the area near

PW-3, which would allow the extraction well to capture the contaminated groundwater before it reaches the City water supply. Once the groundwater was pumped to the surface, the GAC treatment system would remove the PCE through adsorption to the surface of the carbon particles. A pre-filter would be placed in the system before the GAC to remove any suspended particles. Once the carbon becomes exhausted it will be replaced.

Two potential discharge options have been considered:

- Alternative 2a assumes the treated groundwater would be discharged to the Ohio River.
- Alternative 2b assumes the treated groundwater would be blended with the water from the City production wells and connected to the City water supply.

A groundwater monitoring program, including the installation of additional monitoring wells and routine sampling, would be needed to monitor the migration and concentration of the plume. Institutional controls would be put in place to prohibit the installation of any additional productions wells in the plume area. It would also be necessary to continue treatment of the contaminated City production wells until PCE levels are reduced to MCLs.

This option could take 25-50 years to achieve the clean-up standards.

Alternative 3: Venturi Air Stripping Using a New Extraction Well

Estimated Capital Cost: $325,900
Estimated Annual Cost: $874,800
Estimated Present Worth: $1,201,000
Estimated Time to Completion: 30 years

This alternative would involve installing a new Venturi air stripper on a newly installed extraction well to increase the City's capacity to treat contaminated groundwater compared to its current capacity. The extracted groundwater would pass through the new Venturi air stripper to remove PCE prior to the treated water being blended from the water from the City's other wells. The new extraction well would be placed in the vicinity of PW-3. The number of wells needed to control the contaminated groundwater would be determined by groundwater modeling performed as part of the remedial design.

Treatment using the Venturi air stripper would increase the amount of uncontaminated groundwater being blended in the City water supply. It would be necessary to continue treatment of the City's production wells until PCE levels are reduced to MCLs.

A groundwater monitoring program, including the installation of additional monitoring wells and routine sampling, would be needed to monitor the migration and concentration of the plume. Institutional controls would be put in place to prohibit the installation of any additional productions wells in the plume area.

This option could take 25-50 years to achieve the clean-up standards.

Alternative 4: In-Situ Air Sparging with Soil Vapor Extraction

Estimated Capital Cost: $282,400
Estimated Annual Cost: $23,186.67
Estimated Present Worth: $978,000
Estimated Time to Completion: 10 years

This alternative would involve in-situ air sparging and soil vapor extraction to remove PCE from the groundwater. In-situ air sparging is a technique in which air is injected into the groundwater to transfer aqueous phase volatile organic contaminants to the vapor phase. Typically, it is used in conjunction with soil vapor extraction which eliminates the migration of vapors.

Air is injected into the groundwater through air sparging wells which disturbs the PCE and causes it to go into a vapor state. The PCE vapors then travel up into the unsaturated zone of soil where the soil vapor extraction wells capture the vapors and send them via underground piping into the treatment building. In the building, the vapors are filtered in a carbon adsorption unit, which removes the PCE from the air and discharges clean air into the atmosphere. Vapors would be monitored and as in the Treatability Study the system would be initiated in a way that prevented exposure to the vapors produced from the remediation by ensuring all vapors were extracted using the vapor extraction wells.

The TS which is operating on-Site was installed so that, if needed, additional air sparging wells and soil vapor extraction wells could be added to the system. The results of the ongoing TS would be used to confirm the air flow rates needed and the radius of influence of the air sparge wells before the design is finalized. Additional sampling prior to the Remedial Design may be needed to determine PCE concentrations and placement of additional air sparging and soil vapor extraction wells.

A groundwater monitoring program, including the installation of additional monitoring wells and routine sampling, would be needed to monitor the migration and concentration of the plume. Institutional controls would be put in place to prohibit the installation of any additional productions wells in the plume area.

Based on the results of a nearby system treating PCE in similar conditions, EPA estimates it will take ten years to reach MCLs in groundwater. This option should take a considerable less amount of time then the other options considered.

VII. EVAUATION OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. The section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine criteria are discussed below. The "Detailed Analysis of Alternatives" can be found in the FS.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
1. Overall Protection of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
2. Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
3. Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principle contaminants, their ability to move in the environment, and the amount of contamination present.
5. Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
6. Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total of an alternative over time in today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
8. State/ Support Agency Acceptance considers whether the State agrees with EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
9. Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

DETAILED ANALYSIS OF THE PROPOSED REMEDIAL ALTERNATIVES

1. Overall Protection of Human Health and the Environment

Alternative 1 would not provide any protection of human health and the environment. No risk reduction is anticipated under the "no action" alternative.

Alternative 2a, 2b and 3 would be protective of human health and the environment. Since extraction would be used in 2a, 2b and 3 and only the extracted water would be treated, the contaminated groundwater would remain in the aquifer until remediated; this would take a significantly longer period of time than Alternative 4 and could potentially impact Sandy Creek and the Ohio River. Alternative 2a, 2b and 3 would minimize the potential for contaminated groundwater to impact the City's production wells since the movement of groundwater would be controlled by the extraction wells. However, since these alternatives provide wellhead treatment only, these alternatives would take significantly more time to reduce overall concentrations of PCE in the aquifer.

Alternative 4 would also be protective of human health and the environment through in-situ treatment of the contamination in the aquifer. The air sparge system would be designed to intercept the center of the plume before it is drawn into the City's production wells. EPA anticipates that it will take 10 years for the MCLs to be reached in the aquifer. Continued treatment of the contaminated City production wells would be necessary, until PCE levels are reduced to the MCL in the aquifer.

2. Compliance with ARARs

Alternative 1- No Action provides no protection to human health and the environment and would not achieve compliance with ARARs. Alternatives 2a, 2b, 3 and 4 would all be expected to comply with chemical, location, and action specific ARARs set forth in Table 1-1. The ARARs would include drinking water standards required by the Safe Drinking Water Act, 42 U.S.C. § 300g-l, and set forth at 40 CFR Section 141.61, and emission standards for process vents required by RCRA and set forth at 40 C.F.R. Part 264., during remedial activities. Alternatives 2a, 2b, and 3 would meet MCLs in drinking water by extracting and treating the groundwater prior to distribution to the public. Alternatives 2a, 2b, and 3 are expected to achieve MCLs in groundwater, but could take a significant amount of time. Alternative 4 is the only alternative that would meet MCLs in the aquifer within a reasonable time frame.

3. Long Term Effectiveness and Permanence

Alternative 1 would have no long term effectiveness and permanence since there would be no treatment of groundwater.

Alternatives 2a, 2b, 3 and 4 would all provide long-term protection for the Ravenswood Municipal Water Supply. Alternative 4 would be the most effective in preventing high concentrations of PCE from migrating to the Ohio River, since it will remove PCE from the aquifer in the lease amount of time.

EPA estimates that Alternative 4 will meet MCLs in the aquifer in approximately ten years. Alternatives 2a, 2b and 3 are assumed to need to operate for at least 30 years with the possibility that it could take longer than 50 years to treat the groundwater within the capture zone of the extraction well. Alternative 4 provides the greatest amount of permanence since it will meet MCLs in the aquifer in a much shorter time frame than the other alternatives.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 would not reduce the toxicity, mobility, or volume since no treatment will occur. Additionally, Alternative 1 would not meet the statutory preference for treatment since remedial activities would not be performed.

Alternatives 2a, 2b, 3 and 4 would all utilize various treatment technologies to reduce the mobility and volume of PCE in the groundwater. Alternatives 2a, 2b, and 3 would all slightly reduce the volume of PCE by extracting and treating the groundwater prior to distribution to the public, and the toxicity of the extracted groundwater would be reduced through the treatment. Alternatives 2a and 2b would contain the extracted PCE in an aqueous phase carbon system. Alternative 3 would remove the PCE as vapors, which would be discharged in accordance with ARARs. Alternatives 2a, 2b and 3 would not reduce the mobility of PCE in the aquifer beyond the area of influence of the groundwater extraction well.

Alternative 4 would reduce the mobility of contaminants in the aquifer by the in-situ treatment of PCE. The reduction of the higher concentration of contaminants in portions of the plume would reduce dispersion and further movement of the PCE. The volume of the PCE in the aquifer would be reduced by the volatilization of and capture of the PCE vapors by the SVE wells. The toxicity of the groundwater in the aquifer would be reduced as contaminants were removed from the aqueous phase. Because Alternative 4 will directly treat a large portion of the plume it is expected to be the most effective at reducing toxicity throughout the entire plume. The carbon filter will capture the PCE vapors eliminating almost all PCE vapors from reaching the atmosphere.

5. Short-term Effectiveness

Alternative 1 would have no short-term impacts since no remedial actions would be performed.

Alternatives 2a, 2b, 3 and 4 would all have limited short-term impacts on Site workers conducting the construction activities related to the remedial action. Because PCE is only found in groundwater the risks would be considered very low and could be controlled by standard health and safety practices.

It would be necessary to continue treatment of the City’s production wells prior to distribution to the public until PCE levels are reduced to MCLs with all of the alternatives.

Alternatives 2a, 2b and 3 are expected to take 25-50 years to capture all of the PCE in the contaminated aquifer.

Alternative 4 is expected to meet MCLs in the aquifer in approximately ten years giving it the greatest short-term effectiveness.

6. Implementability

There are no implementation issues related to Alternative 1 since no actions would be taken.

Alternatives 2a, 2b, 3 and 4 are all relatively easy to implement since they use standard construction equipment and services. Due to the location of the plume, the placement of the treatment equipment associated with all the alternatives would need to be evaluated to ensure no interruptions to the current land uses.

Construction of Alternatives 2a, 2b and 3 might cause some disruptions to streets depending on the locations of the wells, treatment systems and discharge pipes. Alternatives 2a and 2b could be harder to implement depending on the size of the carbon unit required. Alternative 3 may also be more difficult to implement due to the difficulty in obtaining replacement parts for the air stripper. Access may be needed for public and private property (public streets, land and/or private residence yards) for the placement of the wells, piping and remedial components for all these alternatives which may cause delays or issues.

Alternative 4 may create a short-term disruption to the surrounding area and streets as more wells are installed. As described above, access may also be an issue. The original Treatability Study system was installed in a way that allows for more wells to be hooked up to it, making the system easy to expand. All additional wells and piping would use common drilling and construction techniques.

7. Cost

The retained alternatives are ranked from least to most expensive using the present worth. Alternative 1 is not included in the table since no actions would be taken and there would be no associated costs.

Alternative 4 would be the least expensive alternative with a capital cost of $282,400 and a long-term present worth Operation and Maintenance (O&M) cost of $695,600. Alternative 3 would be in the middle of the cost range with a capital cost of $325,900 and a long-term present worth O&M cost of $874,800. Alternative 2 would be the most expensive alternative with a capital cost of $578,500 for discharge to the Ohio River (2a) and $513,800 for discharge to the City water supply (2b). The long-term present worth O&M cost for both 2a and 2b would be $1,096,500. All O&M costs are based on a standard 30-year O&M period. However Alternatives 2a, 2b, and 3 could take 25-50 years to capture all of the contaminated groundwater. Alternative 4 is expected to take ten years for groundwater in the aquifer to meet MCLs; ten years of biannual O&M and sampling were assumed with a decrease to annual sampling after 20 years.

Alternative	Capital Cost	Present Worth of O&M Costs	Present Worth
Alternative 2	a- $578,500 b- $513,800	a- $1,096,500 b- $1,096,500	a- $1,675,000 b- $1,610,000
Alternative 3	$325,900	$874,800	$1,201,000
Alternative 4	$282,400	$695,600	$978,000

8. State Acceptance

The State acceptance of the Preferred Alternative will be evaluated after the public comment period ends. Community comments and EPA's response to comments will be available in the Responsiveness Summary of the ROD.

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be available in the Responsiveness Summary of the ROD.

VIII. EPA'S PREFERED ALTERNATIVE

EPA's Preferred Alternative is Alternative 4, Air Sparging with Soil Vapor Extraction, as further described below.

1. The In-Situ Air Sparging with Soil Vapor Extraction will include the continued operation of the AS/SVE system used for the Treatability Study with an expansion of AS and SVE wells in the central portion of the plume. Air sparging will be used to inject air into the groundwater contaminated with PCE, which will volatilize PCE into a vapor state. The PCE vapors will then be captured by the Soil Vapor Extraction wells and transported via underground piping into the treatment building. The PCE vapors will then be filtered using a granular activated carbon unit (GAC) and the treated air will be discharged into the atmosphere. Vapors sampling will be conducted to ensure the soil vapor extraction unit captures all PCE. The system will remain operational until MCLs in groundwater are met. This will result in a reduction of the concentration of the Contaminant of Concern (COC), PCE, in groundwater to levels below the MCL of 5µg/L or 5 parts per billion; which result in less than or equal to a 1×10^{-4} to 1×10^{-6} cumulative excess cancer risk and a Hazard Index of less than 1. It will also achieve drinking water standards (MCLs) established by the Safe Drinking Water Act, 42 U.S.C. § 300g-l.

2. A groundwater monitoring program, which may include the installation and monitoring of additional wells, will be implemented.

3. A Pre-Remedial Design Investigation (PRDI) should take place to ensure the proper placement of the air sparging and soil vapor extraction wells.

4. To ensure there is no human consumption of contaminated groundwater during the remedy implementation, wellhead treatment should still occur on the City's contaminated production wells prior to distribution to the public.

5. Institutional controls should be put in place to ensure no new production wells are installed in the contaminated portion of the aquifer.

The Preferred Alternative is proposed over the other alternatives because it is expected to achieve substantial and long-term risk reduction through treatment of contaminants in the aquifer and it provides measures to ensure that future exposure to contaminated groundwater does not occur. The Preferred Alternative reduces risks within a reasonable time frame and at less cost than the other alternatives. The Preferred Alternative also meets the statutory preference for the selection of a remedy that involves treatment as the principle element.

Based on the information presently available, EPA has determined that the Preferred Alternative would be protective of human health and the environment, would comply with ARARs, would be cost effective, and would utilize permanent solutions for the treatment of groundwater. The remedy selected by EPA for OU1 may differ from the Preferred Alternative described in this Proposed Plan based on public comments or new information.

IX. COMMUNITY PARTICIPATION

EPA relies on public input so that the remedy selected for each Superfund site meets the needs and concerns of the local community.

Public Comment Period- To ensure that the community's concerns are being addressed, a public comment period will open January 10, 2011 and close February 9, 2011. During this time the public is encouraged to submit to EPA any comments on the Proposed Plan.

Public Meeting- A public meeting will be held to discuss the Proposed Plan on January 20, 2011 from 6:30 p.m. to 8:30 p.m. The public meeting will be held at the Ravenswood Fire Hall, 333 Virginia Street Ravenswood, WV.

It is important to note that although EPA has proposed a Preferred Alternative, the final remedy has not yet been selected for the Site. All relevant comments received will be considered and addressed by EPA before the final remedy is selected for OU1.

Detailed information on the material discussed herein may be found in the Administrative Record for the Site, which includes the RI, Risk Assessment, FS and other information used by EPA in the decision making process. EPA encourages the public to review the Administrative Record in order to gain a more comprehensive understanding of the Site and the Superfund activities that have taken place there. Copies of the Administrative Record are available for review at www.epa.gov/arweb, or at the following locations:

Jackson County Library
323 Virginia Street
Ravenswood, WV
Hours: Call (304) 273-5343

EPA Administrative Records Room
Attention: Administrative Coordinator
1650 Arch Street
Philadelphia, PA
(215) 814-3157
Hours: Monday through Friday, 8:00am to 4:30pm; by appointment only

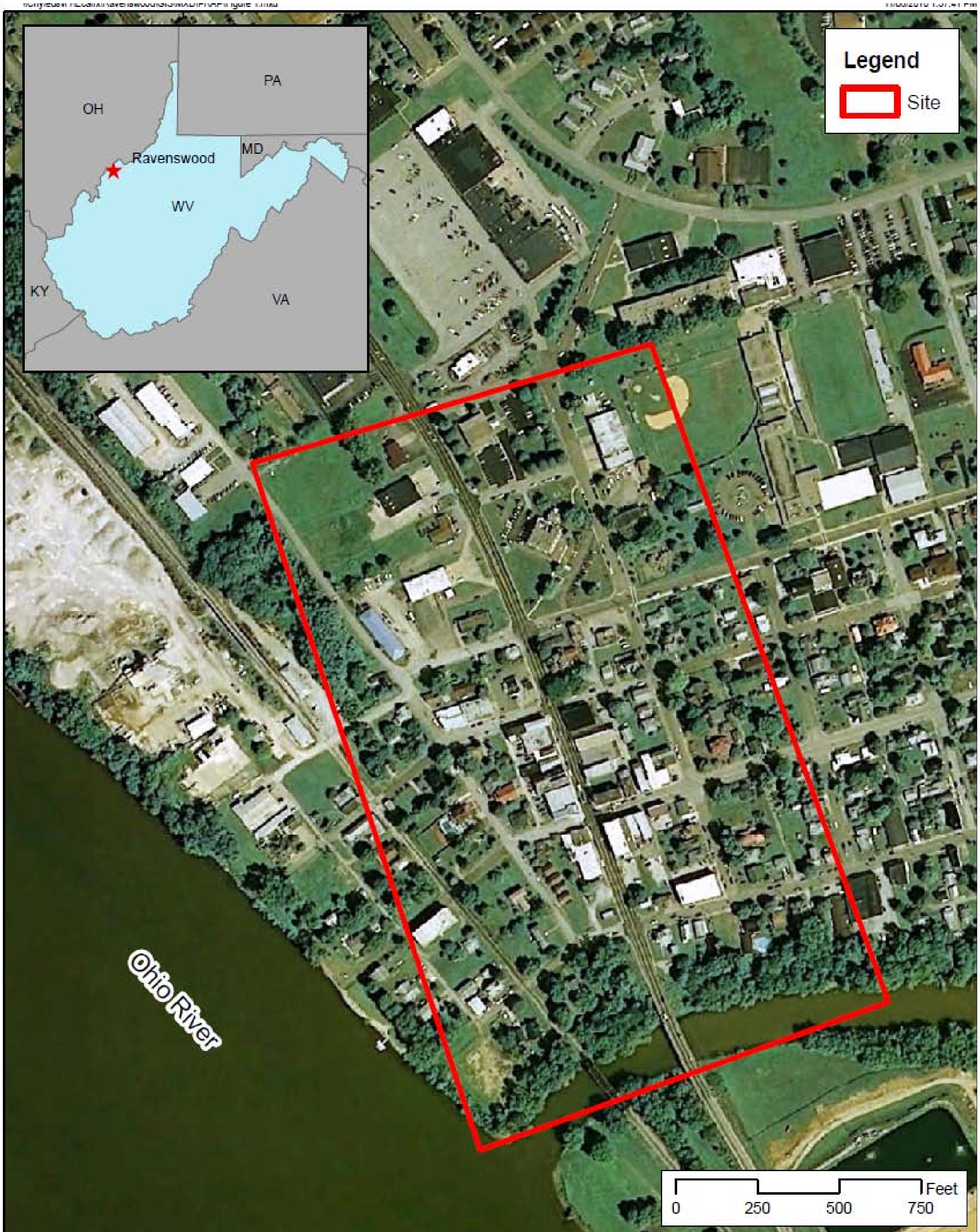
Written comments, questions about the Proposed Plan or public meeting, and requests for information can be sent to either representative below:

Laura Johnson (3HS23)
Remedial Project Manager
Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3295
Johnson.laura@epa.gov

Or

Trish Taylor (3HS52)
Community Involvement Coordinator
Remedial Project Manager
Environmental Protection Agency Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-5539
taylor.trish@epa.gov

Following the conclusion of the public comment period on this Proposed Plan, a Responsiveness Summary will be prepared. The Responsiveness Summary will summarize and respond to comments on EPA's Preferred Alternative for OU1. EPA will then prepare a formal decision document, the Record of Decision (ROD), that summarizes the decision process and the alternative selected for Operable Unit 1 of the Ravenswood PCE Site. The OU1 ROD will include the Responsiveness Summary. Copies of the ROD will be available for public review in the designated repositories, described above.

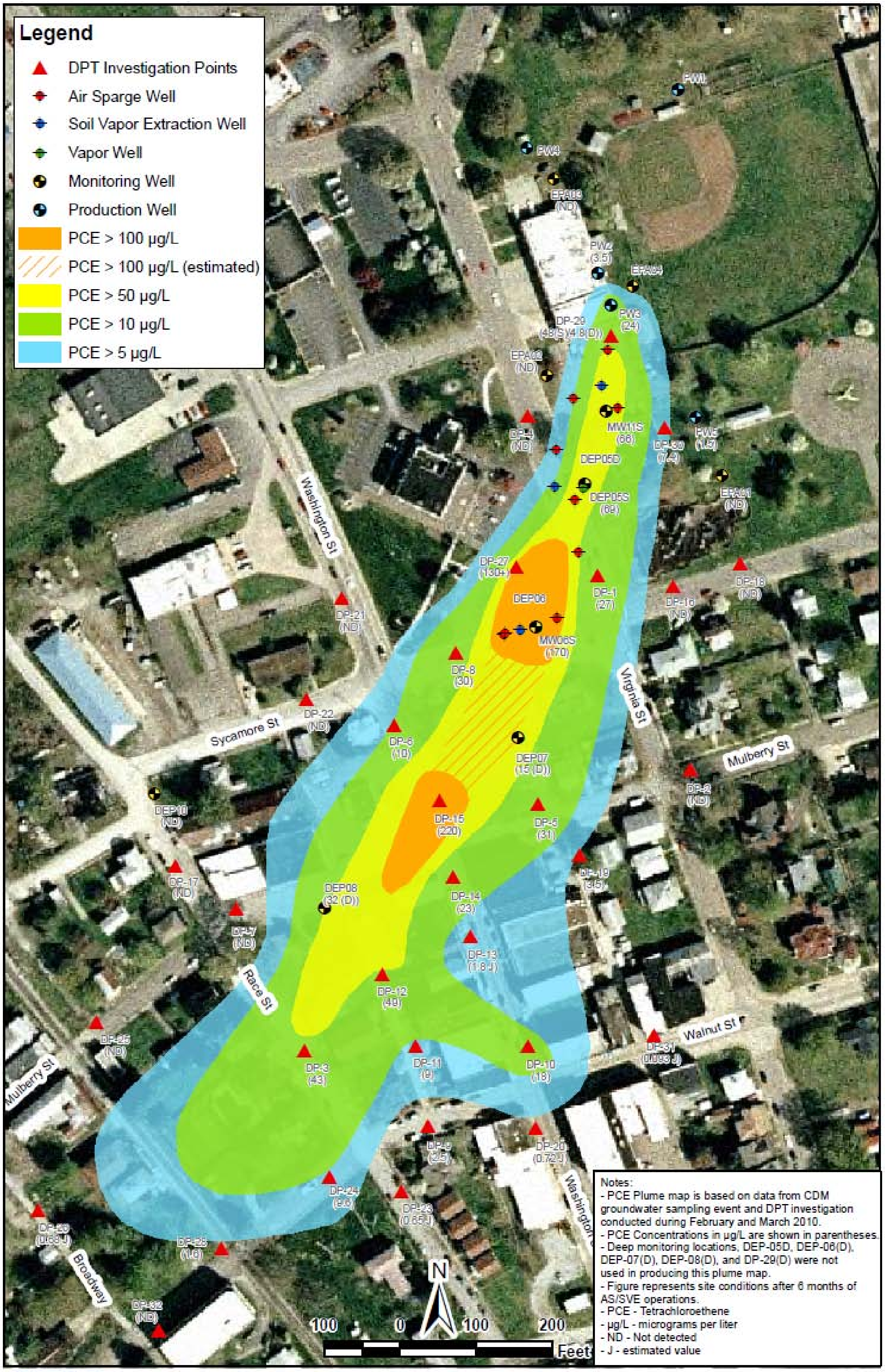


Notes:
Source of aerial photo: Google Earth Pro 3/31/2010.

CDM

Ravenswood PCE Superfund Site
Ravenswood, West Virginia

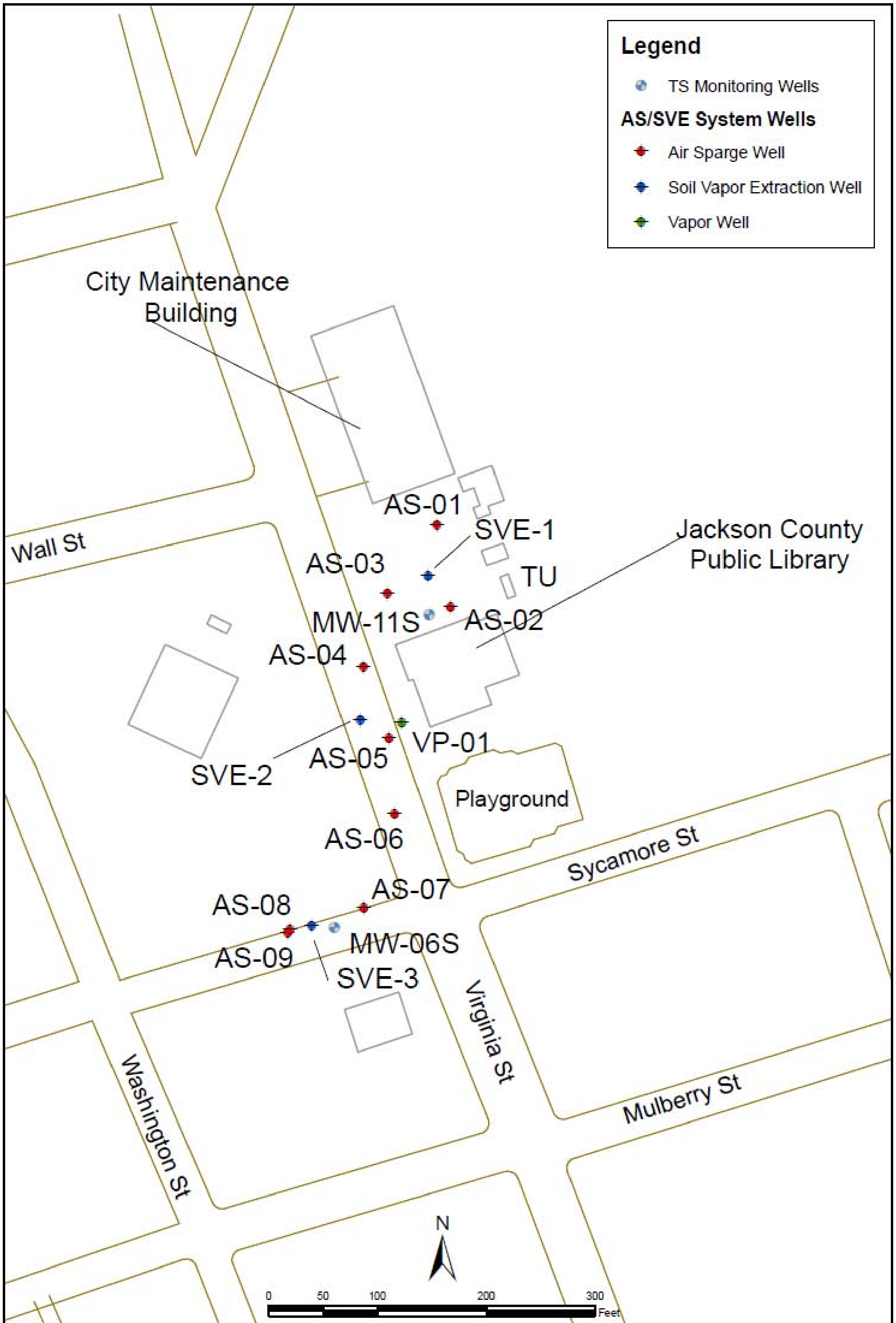
Figure 1
Site Location Map



CDM

Ravenswood PCE Site
Ravenswood, West Virginia

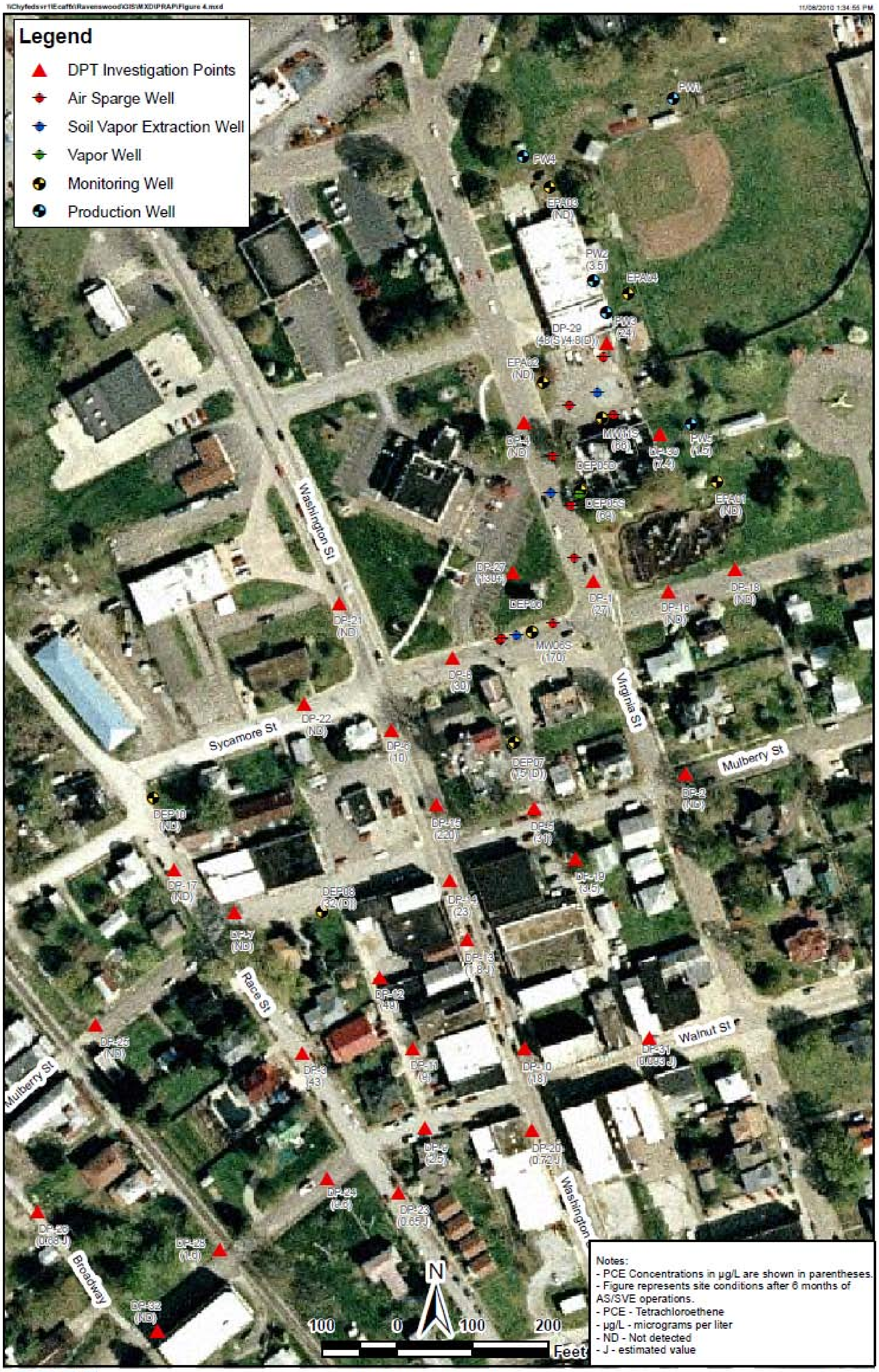
Figure 2
PCE in Groundwater, 2010



CDM

Ravenswood PCE Site
Ravenswood, West Virginia

Figure 3
Treatability Study Wells



CDM

Ravenswood PCE Site
Ravenswood, West Virginia

Figure 4
PCE in Groundwater, 2010