COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
Hazardous Sites Cleanup Program
Intercourse TCE Site
Leacock Township, Lancaster County, Pennsylvania

ANALYSIS OF ALTERNATIVES AND PROPOSED RESPONSE

The purpose of this Analysis of Alternatives and Proposed Response document is to outline the decision-making process involved in the selection of the proposed response and to provide a description of the proposed remedial response. This document will be included in the Administrative Record that will be compiled for this response, pursuant to Section 506 of the Pennsylvania Hazardous Sites Cleanup Act, Act of October 18, 1988, P.L. 756 No. 108 (HSCA), 35 P.S. Section 6020.506.

The proposed response for the Intercourse TCE site (Site) will consist of a remedial response to reduce or eliminate the exposure of residents to individual water supplies contaminated with trichloroethylene (TCE). This action is taken to protect the public health and safety and the environment.

I. SITE INFORMATION

A. Site Location and Description

The Site is located in Leacock Township, Lancaster County, Pennsylvania. The Site is found on the USGS 7.5 minute topographic map for the New Holland, Pennsylvania, quadrangle. The site coordinates are approximately 40° 02′ north latitude and -76° 06′ west longitude. Groundwater in at least 150 residential wells has been found to be contaminated with trichloroethylene, also referred to as TCE. The total area encompassed by the groundwater contamination has been determined to be roughly a mile radius from center of town projecting east, south and west. The village of Intercourse located in an agricultural area has commercial and residential land use. Tourism accounts for a large percentage of revenue. Except for the Watson Run housing development that has installed a community water supply with carbon treatment, residents in the area rely on private wells for their water supplies.

B. Site History

The Pennsylvania Department of Environmental Protection (DEP) was contacted in August 2003 regarding the Watson Run Subdivision which was being developed for residential and commercial purposes. Since there is no public water supply in the area, the developer proposed the creation of a new public water supply. In the summer of 2004, two public water supply wells were drilled southeast of the town for the proposed subdivision. Analysis of samples from the wells found 1.5 ppb and 6 ppb of TCE. The Maximum Contamination Level (MCL) for public water supplies and the Statewide Health Standard for groundwater cleanup for TCE is 5 parts per billion (ppb.) MCLs are federal standards, incorporated by the PA Safe Drinking Water Act (P.L. 206, 35 P.S. Sections 721.1 et. seq.), that establish the maximum permissible levels of contaminants in finished water produced by public water supplies. MCLs are also applicable to the Statewide Health Standard for groundwater cleanup under the Pennsylvania Land Recycling and Remediation Standards Act.

In September 2004, the DEP Water Supply program sampled ten homes. Seven had some level of TCE contamination, and three were over the 5 ppb MCL. In January 2005, the DEP HSCA program sampled twenty-five more residential wells. Seventeen had some level of TCE contamination and nine of those were over the 5 ppb MCL. In June 2005, the U.S, Environmental Protection Agency (EPA) sampled twenty-eight wells. Seventeen showed some level of TCE contamination, and six were over the 5 ppb MCL. In November

2005, the DEP HSCA program sampled one hundred thirty five residential wells. Seventy-eight had some level of TCE contamination, and twenty seven of those wells were over the 5ppb MCL. One well, sampled in January 2005, had tetrachloroethene, (PCE) in excess of the 5 ppb MCL for PCE. In May 2008, 207 properties were sampled. TCE was detected at 122 properties. Forty properties returned concentrations greater than 5 ppb, with seven properties exceeding 25 ppb. Twenty five ppb is the inhalation exposure limit for TCE for the site

DEP initiated an interim response in April 2006, offering bottled water to residents with TCE concentrations between 5 and 25 ppb and point-of-entry treatment (POET) systems where the TCE concentration exceeded 25 ppb. To date, DEP has installed carbon treatment systems on eleven residences and is supplying bottled water to 47 residences. Two POET systems were installed on commercial facilities that are maintained by the facilities. Twenty seven residents have declined bottled water and one has declined the installation of a POET.

Groundwater & Environmental Services, Inc. (GES) was contracted by DEP to complete a remedial investigation (RI) and feasibility analysis (FA) of the contaminated area. The RI was initiated in January 2006 and was completed in a phased approach to determine the direction and flow characteristics of the contaminant plume, the areal and vertical extent of the contaminant plume, and the source or sources of contamination. The RI included installation of single and coupled shallow/deep monitor wells; a membrane interface probe and soil boring investigation; geophysical borehole logging; electrical resistivity survey; soil, groundwater and surface water sampling. Results of these activities are summarized in the Remedial Investigation Report.

A literature review identified several potential source areas for the TCE plume, including a former grain elevator company, equipment maintenance facility, former retail petroleum and/or engine repair facilities, bus garage and a former quarry/dump. The Membrane Interface Probe investigation and soil boring investigation completed in potential source areas did not conclusively identify a source. The lack of identification of a source means that response actions associated with containment, source area removal or source area treatment cannot be implemented to reduce plume concentrations or retard plume migration.

Groundwater flow is controlled by a karst network of vertical and horizontal solution channels and structural fractures. The natural karst system is artificially enhanced by the residential supply wells that are open-borehole wells advanced to various depths in the aquifer. Geophysical borehole logging identified major fractures/solution features at approximately 70-90 feet and 150-200 feet below ground surface (bgs). The electrical resistivity survey mapped saturated fractures trending generally northwest/southeast and northeast/southwest. An east/west fracture was also identified. The groundwater contamination plume is generally restricted to the area south of Old Philadelphia Pike, east of Clearview and Belmont Roads, north of Pequea Lane and west of Carriage Drive. In general, the plume is mapped as three disconnected plumes, which is typical of fracture-controlled flow in a karst aquifer. Two plumes are mapped south of East Newport Road that extend in an east/west direction. A third plume is mapped near Carriage Drive that also extends in a general east/west direction. The plumes may result from a single source area or multiple source areas with migration controlled by the fracture network.

The FA identified and evaluated remedial alternatives for addressing exposure of residents to water supplies impacted by TCE contaminated groundwater. The report summarizes the nature and extent of the release, exposure pathways, and the fate and transport mechanisms of the contamination. Remedial action objectives as well as applicable, relevant and appropriate requirements (ARARs) are provided. Remedial alternatives are identified and evaluated against screening criteria.

C. Threat of Release of Hazardous Substances

From 2005 through 2008, residential well sampling was completed at 360 properties. Of these 360 properties, TCE has been detected at 150 properties, with 74 properties returning TCE concentrations greater than 5 ppb. Twelve properties exceeded 25 ppb for TCE. Residential well concentrations are fairly stable with most properties maintaining a steady concentration. Minimal degradation products have been detected in the groundwater samples indicating that the aquifer is not inherently conducive to natural attenuation. Maximum concentrations in residential wells occur along Poplar Street. TCE was reported at 210 ppb and 97 ppb in the sample collected at 26 Poplar Street during the October 2007 and May 2008 sampling events, respectively. TCE is also reported at an average concentration of 75 ppb at 49 Poplar Street. TCE is a hazardous waste as defined under the Solid Waste Management Act, July 7, 1980 (P.L. 380, No. 97, *as amended*), 35 P.S. §§ 6018.101 *et. seq.*, and hazardous substance as defined under Section 103 of the Hazardous Sites Cleanup Act, Act of 1988, (P.L. 756, No. 108), 35 P.S. § 6020.101 *et. seq.* The residents are exposed to TCE through ingestion, inhalation, and dermal contact.

Trichloroethylene (TCE) is a colorless, nonflammable liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. TCE is listed as a probable human carcinogen by the U.S. Environmental Protection Agency. Chronic effects s to the liver, kidneys, and immune and endocrine systems have been seen in humans exposed to trichloroethylene occupationally or from contaminanted drinking water. The Agency for Toxic Substances and Disease Registry in their Toxicological Profile for Trichloroethylene, prepared in 1997, cites studies that demonstrate that trichloroethylene has a high propensity to volatilize from water, therefore inhalation may be a major route of exposure in homes supplied with contaminated water. As a result of volatilization, significantly elevated indoor air levels of TCE can occur.

II. RESPONSE CATEGORY

The DEP proposes a remedial response action at this site to protect public health and safety or the environment. This determination is based upon the following conditions which exist at the Site: (1) The continued release and/or presence of TCE in the groundwater, and (2) The actual human exposure to hazardous substances via inhalation, ingestion and dermal contact. A remedial response action is justified in order to remove the exposure risks posed by a hazardous substance in the groundwater serving residential well supplies. This plan does not address active remediation of the groundwater contamination for several reasons: pumping and treating such a widely distributed plume in karst geology would likely take decades before meeting drinking water standards; in-situ treatment of the TCE would likely result in vinyl chloride (VC) as an intermediated degradation bi-product. VC is more toxic than TCE and is not controlled by carbon treatment. Neither of these situations is acceptable for an area which relies exclusively on groundwater for drinking. After implementation of this response action further evaluation will be required to assess the possibility of groundwater remediation and vapor intrusion potential in yet to be determined areas at the Site where shallow groundwater may occur.

Aside from the Watson Run housing development that installed a treated community water supply, all residents in the Village, all commercial establishments and all farms rely on groundwater for potable and agricultural use. Residents may be exposed to TCE through ingestion of impacted groundwater, inhalation of vapors and dermal contact from groundwater usage.

This action will be conducted under the Hazardous Sites Cleanup Act utilizing the Hazardous Sites Cleanup Fund. Remedial response actions are defined under the Pennsylvania Hazardous Sites Cleanup Act as a response which will exceed 12 months in duration and/or $2,000,000 in cost. It is estimated that the remedial response to address exposure to hazardous substances via inhalation, ingestion and dermal contact from use of contaminated groundwater will take several years to complete and exceed $2,000,000 in cost.

III. CLEANUP STANDARDS

Section 504 of HSCA requires that final remedial responses must meet (or waive or modify) all applicable or relevant and appropriate requirements ("ARARs"), and be cost effective. The primary, applicable ARARs for final remedial responses conducted under HSCA are the Land Recycling and Environmental Remediation Standards Act (P.L 4, 1995.2, 35 P.S. Section 6026.101 et. seq.), and the regulations found at 25 PA Code Chapter 250, Administration of Land Recycling Program. The proposed response is a remedial response pursuant to Section 504 of HSCA to address exposure to hazardous substances in the groundwater serving residential well supplies via inhalation, ingestion and dermal contact. A Statewide Health Standard medium-specific concentration (MSC) for TCE in groundwater has been established under the Land Recycling and Remediation Standards Act (Act 2) and 25 PA Code Chapter 250. This is the standard for the remediation of groundwater in a drinking water use aquifer. The groundwater MSC is consistent with the drinking water maximum contaminant level (MCL) for TCE as established by the U.S. Environmental Protection Agency and the Pennsylvania Safe Drinking Water Act for the protection of public water supplies. The Site-Specific Standard under § 250.403 requires that drinking water use of groundwater shall be made suitable by at least meeting the primary and secondary MCLs at all points of exposure. The standard not only provides for current use but also applies to the probable future use of groundwater. The Site-Specific Standard under § 250.404 Pathway identification and elimination, identifies any potential current and future exposure pathways for human receptors, and by use of engineering and institutional controls eliminates the pathways identified.

IV. APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The following standards, requirements, criteria, or limitations are legally applicable or relevant and appropriate under the circumstances presented by the site: They will be considered for response actions at this site.

The Pennsylvania Constitution, Article 1, Section 27.

Land Recycling and Environmental Remediation Standards Act, Act of May 19, 1995, P.L. 4, No. 1995.2, 35 P.S. Section 6026.101 et. seq. (Act 2).

Administration of the Land Recycling Program, 25 Pa. Code Chapter 250, Subchapter C (Statewide Health Standards).

Subchapter C - Statewide Health Standards

- Section 250.304 - MSCs for groundwater
- Appendix A - Table 1 - Medium-Specific Concentrations for Organic Regulated Substances in Groundwater

Subchapter D - Site-specific Standard

- Section 250.402 - Human health and environmental protection goals
- Section 250.403 - Use of groundwater
- Section 250.404 - Pathway identification and elimination

The Pennsylvania Solid Waste Management Act, Act of July 7, 1980, P.L. 380, No. 97, as amended, 35 P.S. Sections 6018.101 et. seq.

Hazardous Waste Management Regulations, Article VII, Chapters 260 - 270 (25 Pa. Code 260.1 - 270.1 et. seq.) - 25 PA Code Chapters 260a-266a, 266b and 268a-270a remain as PA ARARs. The former PA Hazardous Waste Regulations Chapters 260-270 are incorporated into the federal regulations by reference. Refer to the Resource Conservation and Recovery Act (RCRA) (42 U.S.C.A., §§ 6901-6992) and the federal regulations in 40 CFR Parts 124, 260-270, 273, and 279.

Residual Waste Management Regulations (Article IX, Chapters 287 - 299).

The Air Pollution Control Act, Act of January 8, 1960, P.L. 2119, 35 P.S. Sections 4001, et. seq.

Chapter 123 - Standards for Contaminants
- Section 123.1 - Prohibition of certain fugitive emissions
- Section 123.2 - Fugitive particulate matter

Chapter 127 - Construction, Modification, Reactivation and Operation of Sources
- Sections 127.1 - Purpose (New source emission control)
- Section 127.12(a)(5) - Best Available Technology (BAT)
- Section 127.71 - New or modified volatile organic compound sources

Chapter 131 - Ambient Air Quality Standards
- Section 131.1 - Purpose
- Section 131.2 - National Ambient Air Quality Standards
- Section 131.3 - Ambient air quality standards
- Section 131.4 - application of ambient air quality standards

Pennsylvania Safe Drinking Water Act, Act of May 1, 1984, P.L. 206, 35 P.S. Sections 721.1 et. seq.

Chapter 109 - Safe Drinking Water
- Section 109.201 - Authority
- Section 109.202 - State MCLs and treatment technique requirements
- Section 109.301 - General monitoring requirements.
- Section 109.503 - Public water system construction permits
- Section 109.612 - POE devices.

Pennsylvania Hazardous Substance Transportation Regulations, Pa. Code Titles 13 & 15.

Pennsylvania Hazardous Sites Cleanup Act, Act of October 18, 1988, 35 P.S. 6020-101et. seq.

Pennsylvania Uniform Environmental Covenant Act, Act of December 18, 2007

V. ANALYSIS OF ALTERNATIVES

Alternative 1. Institutional Controls and Monitoring only

Under this alternative, the DEP would use institutional controls to limit the use of groundwater. Individuals would be notified of the health risks for continued use of contaminated private water supplies. Institutional controls such as deed notices would be placed on record that would alert new property owners, during property transactions, of the contaminated groundwater. Deed notices are attached to the deed to inform prospective property purchasers of the contamination present at the property. Deed restrictions placed on property deeds would restrict or limit future site activities to prevent human contact with contaminated groundwater and place limitations on the use of groundwater without adequate treatment. Local ordinances, which are administrative actions enacted by municipalities to limit property use or activities, would be used to reduce exposure to contaminated media by enacting and enforcing zoning by-laws and regulations that require connection to a public water supply and/or limit private well installation or use of groundwater without treatment.

This alternative would not remove the actual exposure of the residents to the hazardous substances in the groundwater and would not be protective of human health and the environment unless the individual property owners initiated measures to limit their exposure. Contamination would remain in the underlying aquifer and would continue to pose threats to groundwater users. Existing private well supplies and selected monitoring wells would be incorporated into a long-term monitoring network. Groundwater would be monitored annually for TCE and other VOCs to assess the contaminant plume status and to assess whether additional homes may be at risk from contaminated water supplies.

This alternative would not comply with all ARARs for the site. Once the deed restrictions and ordinances are finalized, this alternative can essentially be implemented immediately. The cost of implementing these measures associated with implementing this Alterative is estimated at $24,000. The annual analytical cost for the groundwater monitoring in this alternative is $59,544 for a thirty year total cost of $1,810,320.

Alternatives 2A and 2B. Bottled Water and Point of Entry Treatment (POET) Systems, Land Use Controls and Monitoring

Alternative 2A provides for the DEP to furnish commercial bottled water to the impacted residences that have water supplies containing TCE at concentrations exceeding 5 ppb and less than 25 ppb. POET systems will be installed at properties that have water supplies containing TCE at concentrations above 25 ppb. At this time 11 residences have treatment systems and one residence has not granted the DEP access to install a system.

This would effectively mitigate the risk posed by ingestion, inhalation and dermal contact from use of the contaminated groundwater within the home. This alternative would reduce the negative health impact of using the contaminated groundwater for private water supplies and thus provide an increase in protection of human health and the environment. A Long Term Groundwater Monitoring Plan would need to be developed. Groundwater would be monitored annually for TCE and other VOCs to assess the contaminant plume status and to assess whether additional homes may be at risk from contaminated water supplies. Contamination would remain in the underlying aquifer and would continue to pose threats to groundwater users. Low level ingestion and inhalation exposure would occur for residents with water supply contamination below 5ppb and low level inhalation exposure would occur for residents with contamination below 25 ppb. The remedy would need to be continued until the contamination is no longer present in the influent water.

Deed notices and/or deed restrictions would be attached to the property deeds to inform prospective property purchasers of the contamination and that bottled water or a treatment system is provided to mitigate the threat to human health from ingestion of the contaminated water supply. This would comply with the applicable

requirements of the site specific cleanup standard under the Land Recycling and Environmental Remediation Standards Act.

The present cost of bottled water for this alternative for the known 74 residential supplies that exceed the MCL for TCE and do not have a treatment system is approximately $233,810 per year. The annual analytical cost for the groundwater monitoring in this alternative is $59,544.

The Department has already installed eleven POET systems and performed initial verification of treatment effectiveness and is monitoring operation of the systems. The systems would become the responsibility of the homeowners who would be responsible for the variable costs for continued operation of the systems which include quarterly sediment filter and annual carbon change out, annual UV light replacement, and annual long term monitoring costs of $3,988 for each system. The Thirty-Year Cost for Alternative 2A is $10,007,334.

Alternative 2B provides for the DEP to install water treatment units on all 74 wells having concentrations of TCE over the 5 ppb. The water treatment systems consist of a sediment filter, two carbon units in series and an ultraviolet light on the supply line from the contaminated wells. Water pumped from the private wells would be passed through the treatment systems at the point of entry into the homes and the TCE would be removed to below the MCL. This alternative would further reduce the negative health impact of using the contaminated groundwater for private water supplies by mitigating the inhalation threat for the majority of homes. Contamination would remain in the underlying aquifer and would continue to pose threats to groundwater users. Low level ingestion and inhalation expose would occur for residents with water supply contamination below 5 ppb. The remedy would need to be continued until the contamination is no longer present in the influent water. Verification monitoring will be completed following installation to ensure TCE removal to below the MCL. This would effectively mitigate the risks posed by ingestion, inhalation and dermal contact.

Carbon adsorption is effective in removing the TCE present in the site groundwater. However, activated carbon has low sorptive capacities for vinyl chloride, which will not be effectively or efficiently removed. Vinyl chloride has not been detected in groundwater from the site but may eventually appear because it is an end product of the degradation process of TCE. Another potential impact to human health is the potential for bacterial growth on the carbon beds and resultant excess bacterial counts in the treated effluent. This condition will be addressed through periodic replacement of the carbon and the use of an ultraviolet light after the carbon treatment.

This alternative will be protective of human health and the environment except for those residences where the property owner refuses to allow the installation of a POET. This alternative will comply with the applicable requirement that drinking water use of groundwater meet the MCL. Because the POET units would be considered water treatment systems, an Operation and Maintenance (O&M) Plan would need to be prepared and implemented to ensure carbon units were replaced, as necessary. It is expected that the Township would be responsible for enforcing the O&M Plan. The exhausted or "spent" carbon will be removed for regeneration or disposal in accordance with applicable regulations.

Deed notices and/or deed restrictions would be attached to the property deeds to inform prospective property purchasers of the contamination, that treatment systems have been installed to mitigate the threat to human health and that the treatment systems are required to be maintained to prevent contact with contaminated groundwater. If property owners do not allow for treatment systems to be placed on contaminated water supplies then deed notices would be placed on property deeds to inform prospective property purchasers of the contamination and the threat to human health with use of the water supply. This would comply with the applicable requirements of the site specific cleanup standard under the Land Recycling and Environmental Remediation Standards Act. The Site-Specific Standard under § 250.403 requires that drinking water use of groundwater shall be made suitable by at least meeting the primary and secondary MCLs at all points of exposure.

Capital costs include initial installation of carbon treatment systems. The Department would install the systems; perform initial verification of treatment effectiveness and monitor operation of the systems for one year. The systems would then be the responsibility of the homeowners who would be responsible for the variable costs for continued operation of the systems which include quarterly sediment filter, annual carbon change out, annual UV light replacement, and annual long term monitoring costs of $4,696 for each system. Initial installation of a carbon treatment system is estimated to cost $3,988 per unit. Long term monitoring on an annual basis by DEP would be necessary to monitor the plume and identify affected properties. The annual analytical cost for the groundwater monitoring in this alternative is $59,544. The Thirty-year Cost for Alternative 2B is $10,727,250.

Alternatives 3A and 3B. Connection to a Public Water System

This alternative provides for properties within the plume to be connected to public water. There are no public water supplies within a reasonable distance to provide an extension to the site and adequate surface water sources are not available; therefore groundwater is proposed to be the water source. Two potential options exist for this alternative: 3A - designing and constructing a new water treatment plant, with a groundwater source located outside of the plume or 3B - expanding the existing Watson Run treatment system, which is located within the plume. These responses will include installing the water distribution infrastructure, the lateral water line from the curb into each residence and connecting this line into the home water distribution system. Any fees related to the initial connection to the system and all necessary restoration work would be included in the response.

These responses would require the Township to: 1) enact a mandatory tap-in ordinance for properties within the plume; 2) require existing private wells in residential areas to be abandoned; and 3) prohibit installation of new residential wells within the plume. A modified Long Term Groundwater Monitoring Plan would be developed and implemented by the Department to monitor plume migration and concentrations.

Of all the proposed alternatives, Alternatives 3A and 3B are the most protective of human health and the environment. These alternatives will comply with the applicable requirement that drinking water meet the MCL and the PA Safe Drinking Water Act requirements. These alternatives will provide a permanent supply of potable water. Although contamination would remain in the underlying aquifer, exposure to the contamination through the use as a groundwater supply would be eliminated. Deed notices and/or deed restrictions would not be required because the exposure pathway has been eliminated. This would comply with the applicable requirements of the pathway elimination site specific cleanup standard under the Land Recycling and Environmental Remediation Standards Act. The Site-Specific Standard under § 250.404 Pathway identification and elimination, identifies any potential current and future exposure pathways for human receptors, and by use of engineering and institutional controls eliminates the pathways identified. However, Alternative 3B would not meet the requirement of Section 109.603 of the Safe Drinking Water regulations which requires that "the water supplier shall make reasonable efforts to obtain the highest quality water source available."

Costs for these alternatives include construction of the water supply source wells, construction of a new water supply plant or the expansion of the Watson Run water plant. Additional costs include construction of the infrastructure to distribute the water, connection to the properties and abandonment of the contaminated wells. Once constructed, the variable costs of operating and maintaining the water treatment plant and distribution system would be paid through monthly usage fees assessed to each property owner connected to the system. Alternatives 3A and 3B will likely take three and two years, respectively, to implement. The total Cost for Alternative 3A is $13,259,754 and the total Cost for Alternative 3B is $11,517,557.

Criteria	**Description**	**Alternative 1**	**Alternative 2A**	**Alternative 2B**	**Alternative 3A**	**Alternative 3B**
		Institutional controls and Monitoring	**Bottled Water and Point-of-Entry Treatment Systems, Land Use Controls and Monitoring**	**Point-of-Entry Treatment Systems, Land Use Controls and Monitoring**	**Install New Municipal Water Supply System, Land Use Controls, Well Abandonment and Monitoring**	**Connect to Watson Run Municipal Water Supply System, Land Use Controls, Well Abandonment and Monitoring**
Protection of Public Health/Environment		No reduction in risk; long-term monitoring to identify any newly affected properties	Protective of human health; land use controls to notify prospective buyers of contamination on property; long-term monitoring to identify any newly affected properties	Protective of human health; land use controls to notify prospective buyers of contamination on property; long-term monitoring to identify any newly affected properties	Protective of human health; Municipal ordinance requiring hook-up and abandonment; well abandonment eliminates access to groundwater; long-term monitoring to identify any newly affected properties	Protective of human health; Municipal ordinance requiring hook-up and abandonment; well abandonment eliminates access to groundwater; long-term monitoring to identify any newly affected properties
Compliance with ARARs	Chemical	Will not meet ARARs since there will be no action	Use of bottled water and/or treated water via POET system will meet the MCL; use of treated water via POET system will meet inhalation standard	Use of treated water via POET system will meet the MCL; use of treated water via POET system will meet inhalation standard	Public water will meet MCL and inhalation standard Will meet the PA Safe Drinking Water Act	Will require treatment to meet MCLs Does not meet requirement to "make reasonable efforts to obtain the highest quality water source available."
	Action		Used carbon will be tested before being transported off-site for regeneration and/or disposal	Used carbon will be tested before being transported off-site for regeneration and/or disposal	Treatment system, if required, will need to meet applicable criteria.	Treatment system will need to meet applicable criteria
	Location		None	None	Siting for new well field will determine if treatment is required	Expanding existing well field will require added treatment capacity
Feasibility	Reduction of toxicity, mobility and volume through treatment	No reduction in risk	Carbon adsorption via POET systems will reduce toxicity of TCE in groundwater; no reduction in mobility and volume	Carbon adsorption via POET systems will reduce toxicity of TCE in groundwater; no reduction in mobility and volume	Public water will eliminate consumption of impacted groundwater; there will be no reduction of toxicity, mobility and volume in the aquifer	Public water will eliminate consumption of impacted groundwater; limited impact on reduction of toxicity, mobility and volume in the aquifer
Criteria	**Description**	**Alternative 1**	**Alternative 2A**	**Alternative 2B**	**Alternative 3A**	**Alternative 3B**

		No Action	Bottled Water and Point-of-Entry Treatment Systems, Land Use Controls and Monitoring	Point-of-Entry Treatment Systems, Land Use Controls and Monitoring	Install New Municipal Water Supply System, Land Use Controls, Well Abandonment and Monitoring	Connect to Watson Run Municipal Water Supply System, Land Use Controls, Well Abandonment and Monitoring
Effectiveness	Short term	Ineffective in protecting humans from ingestion and inhalation of impacted groundwater	Effective in mitigating impacts associated with ingestion and inhalation	Effective in mitigating impacts associated with ingestion and inhalation	Very effective in eliminating ingestion and inhalation of impacted groundwater	Very effective in eliminating ingestion and inhalation of impacted groundwater
Implementability	Reliability, availability, ability	Not reliable; no construction	Technology readily available; documented performance provided system is maintained and checked for break through	Technology readily available; documented performance provided system is maintained and checked for break through	Reliable, safe and effective Regulated by PA Safe Drinking Water Act	Reliable, safe and effective Regulated by PA Safe Drinking Water Act
Permanence	Long Term Effectiveness and Permanence	No controls over impacts; not reliable	Operation & maintenance (including influent and midfluent monitoring) required to maintain effectiveness of POET system; long term GWM required to monitor plume concentrations and identify affected residents	Operation & maintenance (including influent and midfluent monitoring) required to maintain effectiveness of POET system; long term GWM required to monitor plume concentrations and identify affected residents	Permanent solution to impacted groundwater	Permanent solution to impacted groundwater
Cost	Capital Costs	$24,000	$4,458.00	$280,854	$10,232,159	$9,632,169
	Variable Costs - PADEP	$1,786,320	$8,530,632	$1,516,320	$996,617	$664,411
	Variable Costs - Township	$0	$1,435,536	$8,852,472	$-	$-
	Periodic Costs - PADEP	$0	$36,708	$77,604	$2,030,978	$1,220,978
	Total Cost - 30 Years	$1,810,320	$10,007,334	$10,727,250	$13,259,754	$11,517,557
	Present Worth Cost	$761,593	$4,163,505	$4,647,336	$11,949,258	$7,557,447

VI. PROPOSED RESPONSE

Based on the preceding discussion, the recommended response is Alternative 3A, construction of a new municipal water supply system. Although this alternative is more expensive than the other Alternatives the benefits outweigh the costs. Alternative 3A is superior to Alternatives 1 through 2B because all routes of exposure ingestion, inhalation and dermal contact with contaminated groundwater would be eliminated. Alternative 3A is superior to Alternative 3B because it is founded upon a source of the highest quality of water free of TCE and eliminates the need for carbon treatment. This alternative removes all exposure associated with private use of groundwater (ingestion, inhalation and dermal contact), eliminates the need for long term monitoring of individual's wells and eliminates the need for deed notices and/or restrictions. Installation of a public water supply would also eliminate the threat of the TCE breakdown product, vinyl chloride, passing through carbon treatment systems. Also, constant monitoring by the public water supplier ensures protection of public health through compliance with the PA Safe Drinking Water Act requirements. Residences, businesses and institutions connected to the public supply shall be responsible for customary continuing service payments.

This response is a final remedial response pursuant to Section 504 of the Hazardous Sites Cleanup Act (HSCA) for the exposure of residents to water supplies using contaminated groundwater.. Additional response action may be needed to achieve a complete, permanent and final cleanup for the site. Treatment technologies that address aquifer restoration and/or protection of the environment, such as *ex-situ* or *in-situ* treatment technologies, may be considered in the future provided a technically feasible and cost-effective approach can be developed.

VII. DEP APPROVALS

FOR THE COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Michael Sherman
Deputy Secretary for Field Operations