RECORD OF DECISION

SITE NAME AND LOCATION

Zanesville Well Field Site
Zanesville, Ohio

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Zanesville Well Field Site in Zanesville, Ohio, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for this site.

The State of Ohio has been consulted and concurs with the selected remedial action.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health or the environment.

DESCRIPTION OF SELECTED REMEDY

The selected remedial action for the Zanesville Well Field Site addresses the principal threats posed by the conditions at the site. The major components of the selected remedial action include:

- Containment/capture of contaminated groundwater and restoration of the aquifer to clean up levels through groundwater pumping;
- Treatment of contaminated groundwater by air stripping;
- Treatment of soil and source areas contaminated with volatile organic compounds (VOCs) by in-situ vapor extraction (ISVE);
- Treatment of soil contaminated with inorganic compounds by soil washing; and

- Fencing of the United Technologies Automotive Inc.(UTA) property and of the interceptor wells, discharge pipes and treatment facilities located in the Zanesville City Well Field.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will not result in hazardous substances on-site above health-based levels, the five-year review will not apply to this action.

Valdas V. Adamkus
Regional Administrator

Date

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
ZANESVILLE WELL FIELD SITE
ZANESVILLE, OHIO

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I. SITE NAME, LOCATION AND DESCRIPTION

The Zanesville Well Field Site includes the United Technologies Automotive, Inc. (UTA) facility and the City of Zanesville, Ohio Well Field (Figure 1). The 28 acre UTA facility is located between Linden Avenue and the Muskingum River within the City of Zanesville. There is residential housing on the west side of Linden Avenue and industrial use to the south of the UTA facility. The 72-acre well field lies across the River from the UTA facility, and the City currently pumps 5.5 to 6.0 million gallons per day (mgd) of groundwater from ten unaffected supply wells in the field. Three of the City's wells no longer supply water to the system because they have become contaminated. Two of these wells (W-6,W-12) are currently being used as part of the groundwater interceptor system. These wells directly discharge the contaminated water to the Muskingum River. A groundwater interceptor well system on the west side of the Muskingum River (UTA's property) currently pumps about 870 gallons per minute (gpm) and discharges treated water to the Muskingum River.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

There is a long history of manufacturing at the UTA site. Prior to 1929, a hand dug well ten feet in diameter and forty feet deep was installed on the property. The well was extended an additional 35 feet. The well was located approximately 150 feet west of the bank of the Muskingum River.

The well was filled in the early 1970s. Rubble from the demolition of the well pump house and an estimated 121 steel drums were used to fill in the well. Some of these drums contained trichloroethylene (TCE) based solvents. TCE is a chemical commonly used as a solvent and as feed stock in pharmaceuticals. It is a possible carcinogen. Approximately 145 tons of waste from the well including drums, drum fragments, soil and bricks were removed by UTA when the well was properly abandoned (sealed) and closed in 1983.

In addition to the abandoned well, other suspected sources of contamination at the facility include a former bulk solvent storage tank located adjacent to the well and two large storm sewer basins. The basins are referred to as the North and South Basins. An open area that was used to store drums containing waste solvents may also have contributed to contamination at the UTA facility. This storage area is located northwest of the storm sewer basins (see Figure 1 A).

In 1981, U.S. EPA detected contamination at the Zanesville Municipal Well Field. During 1981-1982, the U.S. EPA and OEPA conducted additional sampling in the southern portion of the well field. Three wells were found to be contaminated with TCE and dichloroethylene (DCE), both of which are volatile organic compounds (VOCs). VOCs have a tendency to evaporate when exposed to air. Due to this tendency, VOCs evaporate more readily in surface water than in groundwater. When present in drinking water, VOCs may pose a potential threat to human health. Since 1983 the city has been performing sampling and analysis of the contaminated wells and plant tap. No additional wells have been found to be contaminated, and the plant tap has never shown detectable levels of VOCs since 1981.

The City of Zanesville conducted an investigation of the UTA facility and the municipal well field to determine the extent and source of contamination. In 1983, based on the information gathered about contamination present at its property, UTA constructed a pump and treat system to deal with contaminated groundwater. Pumping the groundwater removes contaminants from the aquifer and contains or delays further spreading of the contaminants into the well field. The pump and treat system works by pumping groundwater from groundwater wells to the surface and treating it by forcing air into the water thus allowing the contaminants to evaporate. VOC contaminants like TCE and DCE evaporate readily when exposed to air. This form of treatment is called air stripping. Once the water has been treated with this system, it is discharged into the river in compliance with the State of Ohio discharge standards, which meet the substantive requirements for an NPDES wastewater discharge permit.

On September 8, 1983, the Zanesville Municipal Well Field Site was listed on the National Priorities List (NPL). The NPL is a list of top priority hazardous waste sites in the country that are eligible for investigation and clean up under the Superfund program. U.S. EPA has that determined UTA is a potentially responsible party (PRP) at the Zanesville Site. On August 3, 1988, a Consent Agreement was signed between UTA, OEPA and U.S. EPA whereby UTA agreed to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the site. Prior to the Consent Agreement, environmental investigation activities at the UTA facility were supervised by OEPA.

In January 1989, UTA submitted a summary of the firm's previous environmental investigations at the site to U.S. EPA and OEPA. This report was called the Phase I Remedial Investigation (RI). Findings of these investigations indicated that concentrations of groundwater contamination appeared on the average to be decreasing. On January 15, 1990, UTA submitted the Phase II RI Report. U.S. EPA and OEPA approved the report on September 24, 1990. The Final FS was placed in the public information repository for public viewing on July 29, 1991.

III. COMMUNITY RELATIONS HISTORY

Environmental issues and concerns were identified based upon information from EPA files, interviews and public hearings conducted in Zanesville.

On June 26 and 27, 1990, U.S. EPA interviewed four individuals, six local officials, three civic leaders and two environmental organization leaders, who were residents of Zanesville.

On February 28, 1991, a public availability session was held to answer questions regarding the RI study. Following completion of the FS, the U.S. EPA published a notice of the Proposed Plan for remedial action in a local newspaper on August 9. 1991. The RI/FS Report, the Proposed Plan for remedial action and the Administrative Record have been placed in an Information Repository located at the Muskingum County Public Library. Consistent with Section 113 of CERCLA, the Administrative Record includes all documents such as the work plan, data analysis, public comments, transcripts, and other relevant information used in developing remedial alternatives for the site.

To encourage public participation in the remedy selection process consistent with Section 117 of CERCLA, the U.S. EPA set a 30 day public comment period from August 10, 1991 through September 9, 1991 for the Proposed Plan. The comment period was later extended until September 16, 1991. A formal public hearing was held on August 15, 1991 to accept public comments. Interested parties provided comments on the alternatives presented in the Proposed Plan and elaborated upon the FS. The remedy for the Zanesville Well Field Site described herein was selected after a detailed review of the public comments received. The attached Responsiveness Summary addresses those public comments received.

IV. SCOPE AND ROLE OF THE RESPONSE ACTION

The scope of the final response action addresses: contaminated groundwater under and around the Zanesville Well Field and the UTA facility, the sources of the groundwater contamination and contaminated soils on and around the UTA facility.

The role of this final response action will be to permanently reduce the risk to human health and the environment posed by contamination at the site. This would be performed by extracting and treating groundwater, remediating soils and any sources to prevent further contaminant migration to groundwater and to prevent exposure of humans to soil contaminants.

V. SUMMARY OF SITE CHARACTERISTICS

The quantitative extent and magnitude of contamination was determined as a result of the Phase II Remedial Investigation (RI) conducted at the site during the summer of 1989. The Phase II RI and the FS were performed by Geraghty & Miller on behalf of United Technologies Automotive, Inc. (UTA), a Potentially Responsible Party (PRP). Several environmental matrices (groundwater, soils, sediments) were sampled and analyzed for a wide variety of parameters. The results of these investigations are presented in the Phase II RI, which was approved by U.S. EPA and OEPA on September 24, 1990. UTA has also submitted a Phase I RI. The Phase I RI is a compilation of previous studies and reports UTA had performed prior to the Consent Agreement. There was a lack of quality assurance and quality control documentation for the Phase I data, thus a Phase II RI was required. The data in the Phase I RI can be used to show general trends of changes in concentrations of contaminants in the groundwater. The data in the Phase I RI is also useful in giving an historical perspective to the site.

Groundwater Analytical Results

Groundwater samples were collected from monitoring wells on the UTA property and from monitoring wells and selected production wells in the municipal well field. TCE concentrations in samples from the shallow portion of the aquifer ranged from below the detection limit up to 3,100 parts per billion (ppb) (Figure 2). DCE concentrations were as high as 770 ppb (Figure 3). The highest concentrations of TCE and DCE were detected in monitoring wells located in the vicinity of the former dug well and the former bulk storage tank. Lower levels of TCE and DCE were detected in the vicinity of the former drum storage area. In the intermediate zone of the aquifer the highest concentrations of TCE and DCE (1,300 ppb and 340 ppb respectively) were also in the vicinity of the former dug well. In the deep portion of the aquifer, no TCE or DCE was detected. In addition, no VOCs were detected in the groundwater from the bedrock. The dimensions of the plume of TCE was approximately 1600 by 1200 feet where as the plume of DCE was approximately 1600 by 400 feet.

Groundwater monitoring wells and production wells within the Zanesville well field were also sampled. Concentrations of TCE ranged from 5 ppb to 1400 ppb, and concentrations of DCE ranged from below the detection limit to 65 ppb. Groundwater samples at the site were also analyzed for metals and cyanide. Although there were metals present in the groundwater, the concentrations and sporadic locations indicated that there was not a definable plume of contamination. Many metals naturally occur in groundwater and their presence may not be indicators of site related groundwater contamination.

Although it appears that the plume of contamination is contained, the plume of contamination could potentially migrate to the northern portion of the City of Zanesville Well Field. The population that could be affected are the residents living in and around Zanesville currently using municipal water and/or a resident drinking water from a future well within the plume of contamination.

In addition, although the VOCs have never been detected in the Muskingum River, the contamination plume could potentially migrate to the Muskingum River.

Soil Boring Analytical Results

There was no TCE, DCE or inorganic (metal) contamination detected in the soil samples from within the Zanesville Well Field area.

On UTA property, only those borings which were located near the former dug well, the former bulk solvent storage tank and the former drum storage area, exhibited significant levels of VOCs. The soil gas survey also showed areas of high TCE and DCE concentrations near the Southeast side of the main manufacturing building, which is likely associated with the clay tile system. The TCE concentration was as high as 170,000 ppb and the DCE level was 16,000 ppb. The highest concentrations were encountered between 0 and 6 feet below the land surface, which were located in the area of the former dug well, bulk storage tank and north catch basin. Only a few samples were collected between 6 and 24 feet in depth which resulted in data gaps. In deeper borings subsequent samples were only taken at depths of approximately 24 to 26 feet below the land surface. Therefore, the lowest depth of elevated concentrations are not known. In the vicinity of the former drum storage area the highest levels of TCE and DCE were 4,500 ppb and 1,900 ppb respectively. The highest levels were found within the upper 8 feet, however this area also has some data gaps. The total estimated volume of VOC contaminated soils is 36,000 cubic yards. VOCs are very mobile in soils and the soils could be a source of VOCs for groundwater. The FS also concluded that a currently undetermined source of VOCs may be contributing VOC contamination to the groundwater.

Results of analyses of soil samples for inorganic parameters indicate that aluminum, antimony, barium, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, vanadium and zinc were found significantly above background samples in at least one soil sample from the UTA property. The inorganic parameters substantively above background were generally found at a depth of up to 12 feet, however many data gaps exist. The former drum storage area, the vicinity of the former dug well and the north catch basin showed elevated levels of inorganic parameters. The total estimated volume of inorganic contaminated soil is 1800 cubic yards.

The population that could be exposed to soils contaminated with VOC or inorganic contamination include the workers of the UTA facility and any future residents that live on the site.

Muskingum River Water and Sediment Sampling

Surface water and sediment samples were collected and analyzed.

No trends in the data were detected and neither TCE or DCE were detected in any of the water or sediment samples. As a consequence of computer modeling of groundwater flow conditions, desorption of VOCs from riverbed sediments to groundwater was assumed to occur at the site in order for the model to approximately simulate observed site conditions. Additional information will be collected during the pre-design phase of this remedial action to determine if river bed sediments are adding VOCs to the groundwater. This additional information may include additional monitoring wells in the well field, determination of actual pumping rates of the municipal wells and/or re-sampling of riverbed sediments.

VI. SUMMARY OF SITE RISKS

A quantitative risk assessment that examined present and future potential human health and environmental risk posed by current site conditions was presented in chapter 5.0 of the Phase II RI report.

HUMAN HEALTH RISK

Two organic compounds and twelve inorganic compounds were identified as potential chemicals of concern in various contaminated media. They are:

Organic Chemicals of Concern

- Trichloroethylene
- 1,2 - Dichloroethylene (cis- and trans- isomers)

Inorganic Chemicals of Concern

. Arsenic	. Iron
. Barium	. Lead
. Cadmium	. Manganese
. Chromium	. Mercury
. Copper	. Silver
. Cyanide	. Zinc

In order for a risk to exist, a pathway from the chemicals of concern to a potential receptor must be present.

Two Human Health Risk exposure scenarios were developed: 1) worker exposure scenario to air releases from groundwater treatment, soil and non-potable groundwater; and 2) residential exposure scenario to drinking water, showering, soil, fish ingestion and swimming. Non-carcinogenic and carcinogenic risks were evaluated from calculated exposures to the chemicals of concern in various media. Standard exposure assumptions were used, as specified in the U.S. EPA Risk Assessment Guidance for Superfund(1989).

Currently, the site land use is industrial with workers being the population at risk due to potential exposure to contaminated soil, and workers and local residents at risk due to potential exposure to VOC vapors. The residents currently using Zanesville municipal water are also at risk due to potential exposure to contaminated groundwater, if the plume of contamination migrates northward and contaminates the municipal water supply.

The goal of the risk assessment was to assess the risks to human health and the environment posed by the site. Cancer potency factors (CPFs) are used to quantify the carcinogenic risks to humans. Reference Doses (RfDs) are used to quantify the noncarcinogenic risks to humans.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects upon humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

The residential exposure scenario was considered appropriate because of the close proximity of the residential land use to the UTA facility and the desirability of potential future residential building on the UTA bluff setting. Residential housing in this area commonly have basements. During construction, soil from depth could be brought to the surface resulting in an exposure to residents. It would be unlikely, however, that residents would be exposed to soil deeper than 15 feet under normal circumstances.

The results of the baseline risk assessment (i.e., risk that will remain if no action was taken at the site) determined that there is an unacceptable risk at the Zanesville Well Field Site. U.S. EPA has determined an acceptable range of risk for carcinogens to be 10^{-4} to 10^{-6} excess lifetime cancer risk (ELCR) and a Hazard Index less than 1 for non-carcinogens. U.S. EPA guidance risk criteria were exceeded at the site when a residential exposure was considered. The risk criteria were exceeded for carcinogens using the mean and maximum site concentrations, and for non-carcinogens, using the maximum detected site concentrations (i.e., the soil hot spots). The maximum contaminant concentrations for soils and groundwater were determined to be the reasonable exposure scenario.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

The total non-carcinogenic and carcinogenic site risk under these different scenarios are as follows:

Risk Scenario	Hazard Index		Excess Cancer	
	Max	Mean	Max	Mean
Worker Exposure	10	0.04	$2X10^{-5}$	$1X10^{-6}$
Residential Exposure 30 years	50	0.3	$1X10^{-3}$	$2X10^{-5}$
Residential Exposure 70 years	50	0.3	$3X10^{-3}$	$4X10^{-5}$

ENVIRONMENTAL RISKS

A preliminary ecological assessment was performed at the site. The only identified potential environmental exposure pathway to contamination at the site is through groundwater discharge to the Muskingum River with aquatic life being the receptors. TCE and DCE concentrations in the River were calculated in the risk assessment. The estimated concentrations to which aquatic life could be exposed were well below both Federal and State of Ohio standards for protection of aquatic life. Therefore, the risk assessment concluded that TCE and DCE pose a minimal potential hazard to aquatic life in the River.

A preliminary biological survey conducted at the UTA site concluded that it has little potential to support a terrestrial or semi-aquatic community. It was therefore concluded that the chemicals detected did not likely pose a hazard to the existing terrestrial environment.

VII. REMEDIAL ACTION OBJECTIVES

The remedial action objectives are the media-specific goals that must be achieved to protect human health and the environment. Principal threats are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably controlled and that present a significant risk to human health or the environment. They include liquids, highly mobile materials (e.g., solvents) or high concentrations of toxic compounds (inorganics). The principal threats to be addressed at this site are the sources of groundwater contamination, soils, and the clay tile system. The source of the contamination is a principle threat because it continues to contaminate the groundwater. The soils are principal threats at this site because of potential direct contact with the soils, and the soils' impact on the groundwater. The clay tile system is a principal threat because of the potential impact on the soils, the groundwater, and the potential for direct contact.

There are four response objectives that have been developed in order to remediate the principal threats. The four response objectives are:

1) Contain/capture contaminated groundwater and restore the aquifer by remediating contaminated groundwater to achieve groundwater clean up levels throughout the contamination plume.

Contain/Capture Contaminated Groundwater

U.S. EPA proposes to contain/capture the contaminated groundwater through a network of interceptor wells installed within the plume of contamination. They will be utilized to pump groundwater in order to force a hydraulic barrier. This hydraulic barrier, if designed correctly, will be able to prevent the further spread of the plume of contamination. These same interceptor wells can be used to capture the contaminated groundwater by pumping it from the aquifer to the surface for treatment.

Restoration of Aquifer

The National Oil and Hazardous Substance Contingency Plan (NCP) states that the U.S. EPA groundwater policy is to rapidly restore aquifers (when practicable), that are currently being used as a drinking water source. The NCP gives a range of 1 to 5 years for very rapid restoration, to relatively extended restoration of perhaps several decades. U.S. EPA's goal for the Zanesville Well Field Site is rapid aquifer restoration.

A limiting factor in clean up time is likely to be the additional contribution of VOCs from the source, in addition to the limitations of groundwater pumping. Source reduction will reduce loading of VOCs into the groundwater. It is believed reduced loading of VOCs will shorten the time frame for aquifer restoration.

There are many physical parameters, unknowns, and heterogeneities that may extend the clean up time frame. It is important to note that a failure to restore the aquifer within the NCP rapid restoration goal time frame is not a failure of the remedy. The FS states that source control, such as in-situ vapor extraction (ISVE), can be used to significantly shorten the aquifer restoration time frame. Additional techniques such as pulse pumping and additional interceptor wells and/or higher capacity pumps in the heart of the plume may also shorten the restoration time frame.

Groundwater Clean Up Levels

Maximum Concentration Limits (MCLs) are promulgated standards for chemical constituents in tap water that are considered protective of public drinking water. Health based cleanup standards take into account the adverse effect a chemical can have on human health. Carcinogenic (cancer-related) and non-carcinogenic effects from the chemicals of concern in groundwater were evaluated in the Phase II RI Risk Assessment. TCE and arsenic were the only carcinogens detected in the groundwater. TCE was detected at a concentration above the MCL of 5 ppb. Arsenic was only detected below the MCL of 50 ppb. Therefore it was not further considered. TCE has both carcinogenic and non-carcinogenic characteristics. The non-carcinogenic chemicals of concern found above MCLs are TCE, cis-DCE, trans-DCE, iron and manganese. The MCL for cis-DCE is 70 ppb and for trans-DCE it is 100 ppb. Iron and manganese exceeded secondary MCLs, which are standards for chemical constituents that affect taste, odor and the appearance of the water. A new MCL for lead of 5 ppb is being proposed. Two monitoring wells on the UTA property exhibited levels of lead in groundwater above the proposed MCL.

For the Zanesville Site, groundwater cleanup levels for TCE, cis-DCE and trans-DCE are 5 ppb, 70 ppb and 100 ppb respectively. After groundwater remediation is complete, all MCLs and health based cleanup standards will be met for all of the chemicals of concern in groundwater. The health criteria of a cumulative excess lifetime cancer risk (ELCR) for groundwater within the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$, and a cumulative Hazard Index for groundwater less than 1, will be met after remediation is complete.

2) Remediate source areas or prevent migration from source areas which cause groundwater to be contaminated in concentrations that exceed ARARS or risk-based levels.

Source Remediation

The groundwater being pumped by the four UTA interceptor wells has shown a general declining trend in the concentrations of VOCs. Concentrations of VOCs in interceptor well I-4 have not decreased as readily as in interceptor wells I-1, I-2 and I-3. Interceptor well I-4 was installed three years after the other three interceptor wells. Interceptor well I-4, which is located between the plant and the other three interceptor wells and furthest from the river, removes on the average 1.7 pounds per day of VOCs from groundwater. Also, the soil vapor extraction system located at I-4 has consistently removed between 0.3 to 1 pound per day of VOC vapors. The Feasibility Study concluded that a currently undetermined source of VOCs may be contributing to the concentrations observed in interceptor well I-4. It is suspected that the aquifer, or the saturated zone, and the unsaturated zone above the water table may be acting as a source for VOCs in this area. During Remedial Design additional studies will be performed to determine the location and extent of the source. The soil cleanup alternative will be adjusted as necessary to include this possible source.

3) Remediate soils to prevent contaminant migration to groundwater, or direct contact, ingestion, or inhalation with soils that contain contaminant concentrations in excess of MCLs, ARARs, or risk-based levels.

Soil Clean up Levels Based on Leaching

There is a potential for contaminated soils to leach constituents into groundwater in concentrations that exceed the groundwater clean up levels. Therefore, the clean up level for soils, based on leaching, will be the minimum soil concentration that will not leach constituents into groundwater above their respective MCLs. Given a known groundwater clean up level, the groundwater concentration of a given constituent which desorbs from the soil is used to back-calculate the allowable soil concentration. The VOCs are the constituents most likely to migrate through the soils and affect the groundwater. Using the conservative Summers model, the calculated values for soil clean up levels protective of groundwater for TCE, cis- DCE, and trans- DCE are 6.3 ppb, 34.3 ppb and 59.0 ppb respectively. These values were calculated using limited available site specific data and typical text book values for many of the required equation parameters. Additional site specific data will be collected during the pre-design to better determine the clean up values. The additional data will include: total organic carbon (TOC), Kd, soil moisture and other required soil parameters for all the soil types at the site. After soil values are determined, the Summers model or the more sophisticated Multi-Med model will be used to calculate the actual clean up concentrations.

Soil Clean up Levels Based on direct contact, ingestion, or inhalation.

The residential exposure scenario was considered appropriate because of site specific conditions, including the close proximity of the residential land use to the site, the desirability of the UTA bluff setting, and current U.S. EPA guidance. A future residential scenario was used to develop the clean up levels. Residential housing in this area commonly have basements. During construction, soil from depth could be brought to the surface resulting in an exposure to residents. Under this scenario, contaminated soil will be remediated to a maximum depth of approximately 15 feet. It would be unlikely that residents will be exposed to soil deeper than 15 feet under normal circumstances.

The soil clean up levels for the inorganic chemicals of concern represent concentrations which yield a cumulative hazard index less than 1, and the cumulative excess lifetime cancer risk (ELCR) less than $1x10^{-6}$. Table 1 summarizes the calculated soil concentrations that achieve the soil clean up levels. The actual soil concentrations of the chemicals of concern may vary during remedy implementation due to heterogeneity in the soil. If the calculated clean up concentrations for soils cannot be met, U.S. EPA may allow new clean up concentrations to be calculated for individual chemicals as long as the overall soil clean up level is met. For example, after soil remediation samples indicate that the soil concentration of the inorganic chemicals of concern yield a cumulative hazard index less than 1, a cumulative ELCR less than $1x10^{-6}$, and the VOC soil concentrations will not contribute additional VOCs to groundwater above MCLs, the soil remediation should be considered complete.

4) Prevent inhalation of air which contains contaminant concentrations in excess of ARARs or risk-based levels.

Air Response Objectives

The last objective is to prevent inhalation of air which contains contaminant concentrations in excess of ARARs or health based levels of concern. State of Ohio air emission standards will be met by the remedy.

VIII. DESCRIPTION OF ALTERNATIVES

During the FS, U.S. EPA and OEPA identified and evaluated a number of alternatives that could be used to address the threats and/or potential threats identified at the site. A range of potential technologies were examined to meet the response objectives. For convenience, soil and groundwater technologies were examined separately. Although the interaction between soil and groundwater is important when considering site-wide alternatives, the general response actions for soil and groundwater were established separately, leading to groups of Remedial Technologies, and finally Specific Process Options. After the process options, specific technologies were assembled. Each technology was evaluated with respect to its ability to meet the response objectives. Based on the retained process options applicable to the general response action, alternatives were developed which present a reasonable range of options for each of the environmental media considered (soil, groundwater, and air). It is convenient to consider soil alternatives as source control options for the chemicals of concern, while groundwater alternatives involve plume containment or active restoration of the aquifer.

Institutional Controls

All of the alternatives will include institutional controls to prevent residential exposure until the remedial action objectives have been met. The affected area is owned by three entities (UTA, the adjacent railroad, and the City of Zanesville). UTA site access will be minimized by maintaining the fence around the UTA facility. Warning signs will also be posted. Access will be restricted at the city well field for specific areas encompassing the interceptor well system. A fence or similar device with warning signs will be used to minimize access to the interceptor wells, the discharge pipes, and any treatment system.

Restrictions will be sought on the UTA property deed to control future use of the site until soil clean up levels have been met and to control the use and placement of wells in the affected area until groundwater cleanup levels have been met. The local permit process may also be used to limit future installation of groundwater wells in the area of contamination.

Groundwater Containment Alternatives

A series of interceptor wells are installed in or down gradient of the contaminated area in typical groundwater containment networks. They are utilized in order to pump contaminated groundwater from the aquifer to the surface for treatment and subsequent discharge to a surface water body or a Publicly Owned Treatment Works (POTW).

Four different groundwater containment alternatives have been evaluated. One alternative is the no action alternative that is required by the NCP. The three remaining alternatives consider various numbers of interceptor wells. A Pre-Design Study will be conducted to determine the exact number and location of interceptor wells.

The response objectives for the three active containment alternatives are to contain/capture the contaminated groundwater plume utilizing interceptor wells. Continued groundwater extraction will be utilized for aquifer remediation to achieve clean up levels throughout the contamination plume. Since there are some data gaps, the exact number of interceptor wells and their location cannot be determined until the pre-design study is completed. For cost purposes, three different alternatives were developed for achieving containment/capture and rapid aquifer restoration. Alternative GWC-2 used the existing four UTA interceptor wells, and two city wells W-6, W-12, and possibly W-7 to capture/contain the plume. Alternative GWC-3 uses all wells described in GWC-2 plus two additional interceptor wells. Alternative GWC-4 uses all wells described in GWC-2 plus 5 additional interceptor wells.

Pre-Design Study

A computer groundwater model was developed by the Geraghty and Miller modeling group and presented in the FS to evaluate the existing groundwater flow conditions and to predict future TCE and DCE concentrations in groundwater. During the comparison of the groundwater data generated during the RI and the groundwater data produced by modeling, several data gaps became apparent. The model predicted the contamination may be flowing toward one of the city wells and was not being completely contained. None of the city wells currently show any evidence of contamination. Several monitoring wells will be added in and between the known area of contamination and the city drinking water wells in order to confirm that no contamination is moving toward the city drinking water wells. Data on the direction of groundwater flow can also be obtained from these wells.

Another important data gap is the rate (gallon per minute) that each city well is pumping. The model estimated the rate based on the overall pumping from the whole city well field. There is also a public concern that additional contamination is entering the city well field from an old closed landfill. Additional monitoring wells will be installed on the east side of the well field to confirm or deny this possibility.

This additional data will be used to determine if containment of the plume is being achieved. If containment is not being achieved the data will help determine the number of additional interceptor wells and their location in order to achieve containment of the plume. The additional data will also help determine the number of additional interceptor wells that best achieves the U.S. EPA goal of rapid aquifer restoration for this site. The current groundwater model indicates a range of clean up time from 10 years to less than 10 years. This range is based on no additional interceptor wells affecting the sources and no additional ISVE wells affecting the sources. The FS states that source control, such as in-situ vapor extraction (ISVE), along with pulse pumping and additional interceptor wells in the heart of the plume can significantly shorten the aquifer restoration time frame.

The field work will include additional groundwater monitoring wells, additional sampling and analyses of the groundwater monitoring wells and contaminated or potentially contaminated city wells at the well head and at the final point of discharge of W-6 and W-12, installation of flow meters on the City of Zanesville water wells to determine the rate of flow, the Muskingum River sediments may also be required to sampled and analyzed, and the addition of monitoring wells east of the city interceptor wells.

This data will be used to determine removal efficiency of the City's present treatment process, its mass loading of VOCs to the air, and its mass loading of VOCs to the Muskingum River to determine if further treatment is necessary and if air emission controls are necessary. Also this data will be used to determine if the Muskingum River is a significant source of VOCs.

Based on the results of the additional field data and groundwater model runs, it will be determined which groundwater containment alternative effectively captures/contains the contaminant plume and if system modifications are necessary to rapidly achieve clean up levels. Modifications may include different pumping rates or additional interceptor wells. This evaluation of the system effectiveness will continue on a yearly basis until clean up is achieved. After the groundwater clean up levels have been met and the U.S. EPA allows the containment system to be shut off, groundwater will be monitored to ensure the clean up levels are maintained.

In order to evaluate a pump and treat system, groundwater quality data from monitoring wells is essential. The frequency of sampling, the chemical parameters to be analyzed and the number of monitoring wells to be sampled could be modified as cleanup progresses. Initially, monitoring wells will be sampled on a quarterly basis to establish a data base. The effectiveness of the remedy will be evaluated on the data base and not solely on simulated modeling results.

Alternative GWC-1: No Action

Under this alternative, no response action would be taken and the interceptor wells at the UTA facility and the city well field would be turned off. The purpose of this alternative is to examine the consequences of no action from a public health and environmental standpoint. Groundwater beneath the UTA facility exceeds MCLs and with no interceptor wells in operation the plume of TCE and DCE would move northward and contaminate Zanesville wells currently being used for drinking water. This could result in contamination of a major portion of the aquifer currently used by the City of Zanesville. There is no direct cost associated with the No Action alternative.

Alternative GWC-2: Utilize Existing Interceptor Wells

Operation of the four interceptor wells at the UTA facility and Municipal wells W-6, W-12 and possibly W-7 would be continued under this alternative. Regular operation and maintenance (O&M) would continue in order to ensure the effectiveness of the system until clean up levels are met. O&M activities would include well and pump maintenance, repair, monthly sampling and flow measurements, and quarterly inspection and evaluation of the entire system.

As with all of the containment alternatives, the Pre Design Study discussed above will be performed.

The yearly evaluation of the system effectiveness will continue until clean up is achieved. After the groundwater clean up levels have been met and the U.S. EPA allows the containment system to be shut off, groundwater would be monitored to ensure the clean up levels are maintained.

The estimated cost of this alternative is:

Capital Cost	$ 0
Present Worth of Annualized O&M	$487,200
Total Present Worth 10 Years @ 5%	$487,200

Alternative GWC-3: Install Two Additional Interceptor Wells

This alternative is similar to Alternative GWC-2, but includes two additional interceptor wells located north and south of the existing system in order to enhance plume capture based on groundwater modeling results. The actual locations would be determined in pre-design. The groundwater model predicted that GWC-3 appears to capture/contain more of the TCE, DCE plume than GWC-2 would, however it may not completely capture/contain the plume. The model also predicted that it would take less than 10 years to remediate the aquifer and achieve groundwater clean up levels, however, an accurate number of years could not be determined due to limitations with the current model.

The pre-design study will have to be performed in order to determine if this alternative achieves all clean up objectives.

The yearly evaluation of the system effectiveness will continue until clean up is achieved. After the groundwater clean up levels have been met and the U.S. EPA allows the containment system to be shut off, groundwater would be monitored to ensure the clean up levels are maintained.

The estimated capital and O&M costs for the alternative is:

Capital Cost	$ 75,000
Present Worth of Annualized O&M	$602,000
Total Present Worth 9 Years @ 5%	$677,000

Alternative GWC-4: Install Five Additional Interceptor Wells

This alternative is similar to alternative GWC-2, but includes five additional interceptor wells located around the UTA facility. Two of the wells would be in the same location as in alternative GWC-3 in order to enhance plume containment. The three additional wells serve to accelerate the rate of removal of affected groundwater. Based on groundwater modeling results, GWC-4 appears to capture/contain more of the TCE and DCE plume than GWC-2 or GWC-3, however, it may not completely contain the plume. Alternative GWC-4 has the fastest rate of groundwater remediation of the alternatives.

The pre-design study will have to be performed in order to determine if this alternative achieves all of the clean up objectives.

The yearly evaluation of the system effectiveness will continue until clean up is achieved. After the groundwater clean up levels have been met and the U.S. EPA allows the containment system to be shut off, groundwater would be monitored to ensure the clean up levels are maintained.

The estimated capital and O&M costs for the alternative is:

Capital Cost	$ 168,600
Present Worth of Annualized O&M	$ 950,300
Total Present Worth 9 Years @ 5%	$1,118,900

Groundwater Treatment Alternatives

UTA has operated an interceptor well and treatment system at its facility since 1983. All of the containment alternatives assume the four UTA interceptor wells and the city wells W-6, W-12 and possibility W-7 would continue pumping and discharging to the Muskingum River. Discharges to the Muskingum River would meet the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit.

Four process options for ground-water treatment are examined in detail: 1) air stripping (with and without air emission controls); 2) UV/oxidation; 3) biological treatment; and 4) liquid phase activated carbon. Each alternative assumes that the existing air stripper would continue to operate under existing flow and discharge conditions.

In order to adequately determine preliminary sizing for the treatment systems that are being assessed, appropriate ground-water treatment parameters have to be established. Since a new treatment system would be used in combination with either ground-water collection Alternative GWC-3 or Alternative GWC-4, the flow rate into the system would be dictated by the amount of flow produced by the respective interceptor wells. The expected flow rates are estimated to be 400 gpm for Alternative GWC-3 and 1,000 gpm for Alternative GWC-4. Thus, for each new treatment system being assessed these two design cases need to be considered.

A contingent alternative was developed to treat excess flow from the existing interceptor well I-1. In the event that VOCs in the direct discharge of groundwater from I-1 to the Muskingum River exceed State of Ohio discharge standards, then available capacity of the existing air stripper system will be exceeded and an additional treatment system will be required. The direct discharge of well I-1 would not be allowed if it failed to meet the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. The preliminary hydraulic capacity of the new system will need to be about 270 gpm. Therefore, the contingent treatment system has been preliminarily sized to treat a flow rate of 300 gpm.

A second contingent alternative was developed in the event that the direct discharge from the city interceptor wells requires treatment because it exceeds the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. An air stripper was considered for this treatment.

Alternative GWT-1A: Air Stripper Without Emission Controls

Under this alternative, an additional air stripper would be constructed to treat additional flow as a result of the implementation of Alternative GWC-3 or GWC-4, at the design flow rates of 400 gpm and 1000 gpm respectively. The air stripper would be a counter-current type, and constructed of fiberglass reinforced plastic or epoxy coated steel. Randomly dumped packing material (plastic or ceramic) would be used as the stripping media inside of the tower. Groundwater from the interceptor wells would be pumped to the top of the tower and allowed to flow by gravity against an air stream supplied by a blower mounted near the bottom of the air stripper. The air stripper would be designed to remove TCE and DCE so that its discharge will meet State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. The air stripper would be built on a concrete slab, but no building would be constructed for weatherization. Galvanized discharge piping would be used, and piping would be insulated or heat traced as required to prevent freezing. Iron fouling of the packing media in the existing air stripper is a known problem, because ferrous iron (Fe^{+2}) is present in extracted groundwater. Fouling problems lead to increased operating costs due to an excessive pressure drop in the tower, and reduced removal efficiency due to reduced air water contact area, and channeling effect. Therefore, an integrated acid wash/chlorination system would be designed into the tower in order to clean the packing material without the need for disassembly.

No treatment of the discharge air stream would occur under this alternative. Assuming a 99% removal efficiency and the average concentrations to the air stripper over the past year, the estimated VOC mass emission rate is 2.7 lb/day to 6.6 lb/day, for a groundwater flow rate of 400 gpm to 1000 gpm respectively. In order to ensure that the air stripper efficiency is optimized, regular operation and maintenance activities would be required. These activities include continued sampling of influent, and effluent, maintenance of pumps, blowers, and other mechanical equipment, and a regular schedule of air stripper packing cleaning and replacement, as necessary.
The estimated capital and O&M cost for Alternative GWT-1A are shown below:

Design Case 1: In combination with Alternative GWC-3 (400 gpm)

Capital Cost	$ 88,900
Present Worth of Annualized O&M	$256,600
Total Present Worth 9 years @ 5%	$345,500

Design Case 2: In combination with Alternative GWC-4 (1000 gpm)

Capital Cost	$149,700
Present Worth of Annualized O&M	$302,800
Total Present Worth 9 years @ 5%	$452,500

Alternative GWT-1 B: Air Stripper with Emission Controls

Alternative GWT-1B is identical to Alternative GWT-1A except that the air stripper vapor emissions would be treated with granular activated carbon (GAC) prior to discharge to the atmosphere. One GAC absorber with an 8000 lb carbon capacity would be used for the 400 gpm design case, and two absorbers in parallel would be used for the 1000 gpm design case. A preheater would be used to raise the temperature and lower the relative humidity of the air stream prior to vapor phase treatment. The heater would increase the efficiency of the activated carbon. The estimated capital and O&M costs for Alternative GWT-1 B are shown below:

Design Case 1: In combination with Alternative GWC-3 (400 gpm)

Capital Cost	$126,400
Present Worth of Annualized O&M	$764,800
Total Present Worth 9 years @ 5%	$891,200

Design Case 2: In combination with Alternative GWC-4 (1000 gpm)

Capital Cost	$ 225,900
Present Worth of Annualized O&M	$1,239,600
Total Present Worth 9 years @ 5%	$1,465,500

Alternative GWT-1 B1

Groundwater extracted from interceptor well I-1 may need to be treated, instead of the current practice of being directly discharged to the river, in order to meet the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. If treatment is required an air stripper or an equal or superior technology would be implemented. Therefore a contingent air stripper alternative has been developed to handle excess flow from the existing interceptor well. If additional interceptor wells are added, this contingent alternative would not be implemented since the treatment for the new wells would be designed to accommodate any excess flow from the existing system. For cost estimating purposes, the assumed design flow rate of this system is 300 gpm, which is approximately the flow rate currently being bypassed to the river. The estimated capital and O&M cost for Alternative GWT-1 B1 is:

Capital Cost	$108,300
Present Worth of Annualized O&M	$751,300
Total Present Worth 9 years @ 5%	$859,600

Alternative GWT-1 C: Utilize Existing Air Stripper

Under this alternative, the existing air stripper system would continue to operate without increased or decreased flow. It would be implemented with the existing containment Alternative GWC-2. No additional equipment would be installed, although operation and maintenance activities would continue in order to maintain the system effectiveness. Alternative GWT-1B1 may also be required to be implemented to treat interceptor well 1. There are no Capital Costs associated with Alternative GWT-1 C. The estimated O&M costs are shown below:

Capital Cost	$ 0
Present Worth of Annualized O&M	$256,600
Total Present Worth 9 years @ 5%	$256,600

Alternative GWT-2: UV/Oxidation

Alternative GWT-2 would utilize ultraviolet light in combination with chemical oxidation (UV/oxidation) for groundwater treatment. The particular process equipment evaluated is manufactured by Ultrox International, Santa Ana, California. A typical Ultrox[R] system consists of an oxygen or air source, an Ozone (O_3) generator, a hydrogen peroxide (H_2O_2) feed system, a UV/oxidation reactor, an Ozone (O_3) decomposition unit. Influent from the interceptor wells would first enter a tank and be mixed with H_2O_2 then pumped into the reactor, sparged with O_3 gas, and simultaneously exposed to UV light. Unreacted O_3 would be decomposed by a catalytic unit downstream of the UV/oxidation reactor. Treated water would be discharged to the Muskingum River via the North Catch Basin.

Groundwater at the UTA site is classified as very hard because of the high concentrations of divalent cations. H_2O_2 and O_3 are strong oxidants which can oxidize the dissolved iron in the groundwater to a relatively insoluble precipitate. This precipitate can coat the UV lamps, decreasing their intensity, and thus decreasing the overall treatment system efficiency. Pretreatment of the extracted groundwater (such as lime softening) would be necessary in order to prevent excessive maintenance shut downs due to poor treatment efficiency from

scaling and oxidation of iron and manganese in the extracted ground-water.

Another approach to prevent iron fouling involves the addition of a sequestering agent in order to keep the iron in solution as the groundwater undergoes treatment.

UV/oxidation is an attractive technology because it destroys oxidizable chemicals. Therefore, the risk of exposure to these chemicals would be permanently eliminated. During operation there would be no treatment residuals or atmospheric discharges of chemicals of concern from the reactor. However a pretreatment system for hardness would be required. This may generate an estimated 1000 yd^3/yr to 2500 yd^3/yr of non hazardous waste that would have to be disposed. The estimated capital and O&M costs for Alternative GWT-2 are:

Design Case 1: In combination with Alternative GWT-2 (400 gpm)

Capital Cost	$1,017,500
Present Worth of Annualized O&M	$ 957,400
Total Present Worth 9 years @ 5%	$1,974,400

Design Case 2: In combination with Alternative GWC-4 (1,000 gpm for 9 years)

Capital Cost	$2,033,900
Present Worth of Annualized O&M	$1,417,300
Total Present Worth 9 years @ 5%	$3,451,200

Alternative GWT-3: Biological Treatment

Biological treatment of groundwater at the UTA site can potentially be accomplished through treatment in an above ground biological reactor containing bacteria and nutrients. The bioreactor evaluated for this application is a fixed-film reactor. This technology utilizes the growth of organisms on a biofilm. A healthy biofilm is grown within the bioreactor using a supplemental feed of organic carbon. When the biofilm has sufficiently matured, the waste stream to be treated is fed into the reactor. With typical total organic chemical concentrations in the groundwater at around 600 ug/L, the bioreactor's effluent can potentially achieve the State of Ohio substantive requirements of an NPDES permit. A pilot test will be required to confirm the effluent concentrations. The estimated capital and O&M costs for Alternative GWT-3 are:

Design Case 1: In combination with Alternative GWC-3 400 gpm

Capital Cost	$ 930,000
Present Worth of Annualized O&M	$1,254,500
Total Present Worth 9 years @ 5%	$2,184,500

Design Case 2: In combination with Alternative GWC-4 1000 gpm

Capital Cost	$1,802,500
Present Worth of Annualized O&M	$2,836,000
Total Present Worth (9 years, 5%)	$4,638,500

Alternative GWT-4: Activated Carbon

Alternative GWT-4 would use granular activated carbon for the removal of TCE and DCE from the recovered groundwater. Activated carbon functions to remove organic compounds from solution through an adsorption process in which compounds enter molecular size pores in the carbon and remain there due to molecular attraction. Activated carbon is a proven treatment technology that is used extensively for removing soluble organic compounds, as well as some inorganic compounds, from solution. The carbon in the system would need to be replaced approximately three to four times per year. Once the adsorption capacity of the activated carbon is exhausted, the spent carbon would be reactivated, and the TCE and DCE would undergo complete thermal destruction. The carbon can then be reused. Treated groundwater would be discharged to the Muskingum River in compliance with the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. The estimated capital cost and O&M costs for Alterative GWT-4 are:

Design Case 1: In combination with Alternative GWC-3 (400gpm)

Capital Cost	$ 284,000
Present Worth of Annualized O&M	$1,066,900
Total Present Worth 9 years @ 5%	$1,350,900

Design Case 2: In combination with Alterative GWC-4 (1000gpm)

Capital Cost	$ 511,000
Present Worth of Annualized O&M	$2,339,200
Total Present Worth 9 years @ 5%	$2,850,200

Alternative GWT-5: Air Stripper Treatment in the Zanesville Well Field

Under this alternative, an air stripping system would be constructed at the Zanesville Well Field, if the extracted groundwater from the existing well system (W-6 and W-12 or possibly W-7) exceed the State of Ohio discharge standards, which meet the substantive requirements of an NPDES discharge permit. These wells currently discharge using a simple aeration device directly to the Muskingum River. Prior to implementing this remedy, a sampling effort would be undertaken in order to determine contaminant concentration in the groundwater being discharged to the Muskingum River using the existing system. If the discharge is below the State of Ohio discharge standards, which meet the substantive requirements of an NPDES discharge permit, no treatment would be required. If a new treatment system is necessary, each extraction well would be piped to a central location, and groundwater would be pumped to the top of an air stripping tower. The air stripper must be evaluated pursuant to the BAT requirements outlined in OAC 3745-31-05 prior to the determination that air emission controls are required. Air emissions from the air stripper would be treated using activated carbon vessels. Treated groundwater would be discharged to the Muskingum River below the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit.

The estimated capital cost and O&M cost for Alterative GWT-5 are:

Capital Cost	$265,700
Present Worth of Annualized O&M	$282,600
Total Present Worth 4 years @ 5%	$548,300

SOIL REMEDIATION ALTERNATIVES

There are a limited number of areas which currently exceed soil clean up levels. All of the areas requiring soil remediation are on the UTA facility. Isolated "Hot Spots" of soil affected by inorganic constituents were identified during the Phase II RI. TCE was detected above the clean up level in several soil borings and one soil sample contained DCE above the clean up level. The areas where contaminants above cleanup levels were detected are around the former drum storage area, the north catch basin area (including the northeast corner of the building), and the former above ground bulk storage tank. However, additional remediation may be required around the areas associated with the clay tile system.

The groundwater being pumped by the four UTA interceptor wells has shown a general declining trend in the concentrations of VOCs. Concentrations of VOCs in interceptor well I-4 have not decreased as readily as in interceptor wells I-1, I-2 and I-3. Interceptor well I-4 was installed three years after the other three interceptor wells. Interceptor well I-4, which is located between the plant and the other three interceptor wells and furthest from the river, removes on the average 1.7 pounds per day of VOCs from groundwater. Also the soil vapor extraction system located at I-4 has consistently removed between 0.3 to 1 pound per day of VOC vapors. The Feasibility Study concluded that a currently undetermined source of VOCs may be contributing to the concentrations observed in interceptor well I-4. It is suspected that the aquifer, or the saturated zone, and the unsaturated zone above the water table may be acting as a source for VOCs. During Remedial Design, additional studies will be performed to determine the location and extent of the source. The soil cleanup alternative will be adjusted as necessary to include this possible source.

It is believed that remediation of this possible source area would significantly decrease the time frame to achieve the remediation of the groundwater.

Alternative S-1: No Action

Under Alternative S-1, no further action would be undertaken to remediate soils at the site and minimal actions such as additional monitoring may be undertaken. Only natural attenuation mechanisms would be responsible for changes in concentrations of VOCs. There are no direct costs associated with the No Action alternative.

Alternative S-2: Multi-Media Cap

Under Alternative S-2, a multi-media cap will be placed over the area affected by both inorganic and organic constituents. The purpose of such a cap is to eliminate the potential for direct contact with affected soils and minimize surface water infiltration which may leach constituents into groundwater. The multi-media cap would be designed and constructed to meet the technical requirements described in 40 CFR Part 264. These requirements include a minimum 2-foot thick vegetative layer, a minimum 12-inch thick drainage layer, and a low permeability layer of compacted clay with a synthetic liner. The estimated capital and O&M costs for Alternative S-2 are:

Capital Cost	$133,300
Present Worth of Annualized O&M	$ 76,900
Total Present Worth 30 years @ 5%	$210,200

Alternative S-3: Excavation and Off-site Landfill Disposal

Alternative S-3 is directed at eliminating potential sources which may affect groundwater quality. Soil exceeding the clean up levels will be excavated and transported off-site, to an off-site RCRA/CERCLA compliant Subtitle C (hazardous waste) landfill. Clean soil would be brought from outside sources and used as

backfill to restore the excavated area to original grade. The estimated capital and O&M costs of Alternative S-3 are shown:

Capital Cost	$8,325,000
Present Worth of Annualized O&M	$ 0
Total Present Worth	$8,325,000

Alternative S-4(A): Vapor Extraction Organic Contaminant Treatment

Alternative S-4(A) is a source control alternative consisting of active remediation of VOCs in the unsaturated soils using in-situ vapor extraction (ISVE). Inorganic constituents of concern will have to be treated by another soil Alternative such as S-4(B) limited excavation and disposal, or S-6 soil washing. Several areas were identified for vapor extraction: south of the former drum storage area (near the north east corner of the main facility building); North Catch Basin area; and portions of the clay tile system. These areas were selected by comparing analytical results from soil and soil gas samples with calculated clean up levels. Based on this comparison, the constituents of concern are TCE and DCE. Although the exact depth limit of soil contamination is not known it is believed to be within the upper half of the 40 foot unsaturated zone. The extracted VOCs will be adsorbed onto activated carbon. The activated carbon will be reactivated and reused by thermally destroying the VOCs.

A major area also requiring ISVE is believed to be the source area. The source area will be further defined and located through the pre-design studies. It is believed that rapid remediation of this source area would significantly reduce the time frame to reach the groundwater clean up levels. Rapid source area remediation will be an ISVE design requirement.

The application of ISVE is appropriate for these areas based on the following considerations: 1) TCE has a Henry's Law constant that favors partitioning into air-filled soil pore spaces; 2) The sand-silt soils are anticipated to be permeable enough to accommodate typical air flow rates and applied vacuum conditions; and 3) ISVE influences a broad area, and its effectiveness is not affected by local concentration variations within the area.

Prior to design and construction of a ISVE system, a pilot study will be conducted to develop site specific information as a basis for the establishment of system design criteria. The pilot study will develop information based on specific site variables, such as depth to ground-water, soil permeability, moisture content, stratigraphy, porosity, and the vertical and horizontal concentration of VOC vapors in the soils. This information will be used to design the system and specify the number of wells, their locations, depths, zone of influence, and rate of vapor extraction. During the pilot study, the need for a temporary cap to enhance the rate of VOC extraction would be evaluated. The length of time to achieve clean up levels would be from 7 to 29 years. For cost estimating purposes, an estimate of 10 years was used.

The estimated capital and O&M costs of Alternative S-4(A) is

Total Capital Cost	$193,750
Present Worth of Annualized O&M	$286,500
Total Present Worth 10 Years @ 5%	$480,250

Alternative S-4(B): Limited Excavation and Disposal Inorganic Treatment

There are several areas preliminarily identified as potentially requiring excavation and disposal due to inorganic constituents of concern above the calculated clean up levels. These areas are north and south of the former drum storage area, around the former bulk storage tank, and around the former dug well. This would be implemented after ISVE has been completed. For cost estimating purposes, the total volume of soil to be excavated was estimated based on an assumed 15 foot radius of excavation and the maximum depth at which constituents of concern greater than the clean up levels were detected. Based on these calculations, the estimated volume of soil for excavation and disposal is 1800 cubic yards. Additional soil borings will be completed in these areas in order to better define the horizontal and vertical extent of affected soil. All soil taken off site will meet the State of Ohio requirements for solid or hazardous waste.

The estimated capital and O&M costs for Alternative S-4-B are:

Capital Cost	$416,250
Present Worth of Annualized O&M	$ 0
Total Present Worth	$416,250

Alternative S-5: Excavation and Off-Site Incineration

Alternative S-5 is similar to Alternative S-3 (excavation and landfilling) with substitution of incineration for landfilling. Affected soils will be excavated and transported to a RCRA/CERCLA compliant off site commercial incinerator. Clean soil would be utilized for backfill to restore the excavated area. The volume of soil to be excavated and incinerated is 36,000 cubic yards.

The estimated capital and O&M costs of Alternative S-5 are:

Capital Cost	$10,575,000
Present Worth of Annualized O&M	$ 0
Total Present Worth	$10,575,000

Alternative S-6: Soil Washing
Inorganic Treatment

Under this alternative, soils which exceed the inorganic constituent soil clean up levels, (the same areas as Alternative S-4(B) Limited Excavation and Landfilling) will be excavated and treated in an above ground washing system. The areas to be treated are north and south of the former drum storage area, the former bulk storage area, and the abandoned dug well. Please refer to Section VII, REMEDIAL ACTION OBJECTIVES of this ROD, for more information on the cleanup levels. Soils contaminated with VOCs would be treated using the Organic Treatment Alternative S-4(A) ISVE. Soil washing of soils containing inorganics (e.g. lead & mercury,etc.) would occur after completion of the ISVE portion of the remedy in order to limit VOC emissions during the required excavation activities.

Typical soil washing techniques operate by excavating all soils exceeding the clean up levels and staging the soils in working piles for processing. Each pile may be placed on mechanical vibrating screens in order to remove any oversized materials. Hydraulic separation may then be performed in hydrocyclones, followed by gravity separation in order to produce coarse and fine grained materials. Actual soil washing may be accomplished in floatation cells, the end products of which are concentrated waste and filter cake from generated sludge which requires further processing (i.e. off-site disposal or further off-site treatment).

Soil testing will be performed prior to excavation to determine if site soils are a RCRA characteristic hazardous waste. If the soils are a characteristic hazardous waste, they will be treated to meet land disposal restriction standards, as well as the hazardous waste requirements listed below prior to replacement. If the soils are a hazardous waste, any interim waste pile will comply with Ohio Administrative Code (OAC) Section 3745-56-50 through 3745-56-60. If the soils are not a hazardous waste, the working piles will be made to minimize wind dispersal and run-on /run-off of liquids. The concentrated waste and filter cake will be tested per 40 CFR 261.20 to determine if it is hazardous waste. If it is a hazardous waste or a solid waste, it will be handled according to all applicable OAC and CFR requirements. All waste water will be managed in compliance with all applicable State and Federal requirements.

Clean soil material may be replaced in the ground if it is not considered a solid waste pursuant to ORC 3734.01(E) or if it qualifies for an exemption pursuant to ORC 3734.02(G). Process water would be recycled through the soil washing system. A pilot test will be necessary to ensure that soil washing would be effective for the soil and chemical constituents found at the site. If during pilot studies, it is determined that the soils are considered a solid waste and do not qualify for a solid waste exemption, other treatment and disposal options will be evaluated.

The estimated capital and O&M costs of Alternative S-6 are:

Capital Cost	$625,000
Present Worth of Annualized O&M	$ 42,000
Total Present Worth 5 years @ 5%	$667,400

Alternative S-7: In-Situ Vitrification

Alternative S-7 would eliminate potential source areas by utilizing In-Situ Vitrification technology (ISV). The ISV process uses high temperature electric melting to treat the soil matrix. Organic constituents are destroyed and inorganics, with the exception of mercury, are immobilized into a glassified residual product. Mercury vapor and other off gasses would be treated by a surface system. An array of electrodes would be placed around the area to be treated, and driven to the target depth. An electric potential would be applied to the electrodes in order to heat the soil to about 2,000°C. At these temperatures organic constituents would be pyrolyzed and rise to the surface of the vitrified zone where they would combust at the surface in the presence of oxygen. An off-gas hood would be placed over the vitrified zone during operation.

The same location considered for treatment in Alternative S-3 is included in this alternative using the same assumptions. The volume of soil to be treated is 36,000 cubic yards. In addition, the cost of treating only the inorganic constituents of concern such as alternative S-4-B and S-6 (approximately 1800 cubic yards) was evaluated in the event that ISV is combined with alternative S-4(A) ISVE.

The estimated capital and O&M costs for Alternative S-7 are:

Case 1: 36,000 cubic yards of soil

Capital Cost	$29,243,800
Present Worth of Annualized O&M	$ 42,400
Total Present Worth 5 years @ 5%	$29,286,200

Case 2: 1,800 cubic yards of soil

Capital Cost	$1,670,000
Present Worth of Annualized O&M	$ 42,400
Total Present Worth 5 years @ 5%	$1,712,400

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives were evaluated according to the following nine criteria which are used by the U.S. EPA to provide the rational for the selection of the final remedial action at a site.

A. The Nine Evaluation Criteria

THRESHOLD CRITERIA

* **Overall Protection of Human Health and the Environment** addresses whether or not the remedy provides adequate protection and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

* **Compliance with ARARs** address whether or not the remedy will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and/or provide grounds for invoking a waiver.

PRIMARY BALANCING CRITERIA

* **Long-Term Effectiveness and Permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once clean up goals have been met.

* **Reduction of Toxicity, Mobility, or Volume through treatment** assesses to what degree the remedial alternatives, by utilizing treatment technologies, will permanently and significantly reduce the toxicity, mobility or volume of the hazardous substances at the site.

* **Short-Term Effectiveness** involves the period of time needed to achieve protection and any adverse impact on human health and the environment that may be posed during the construction and implementation period until clean up goals are achieved.

* **Implementability** is the technical and administrative feasibility of a remedy including the availability of goods and services needed to implement the chosen solution.

* **Cost** includes capital and operation and maintenance costs.

MODIFYING CRITERIA

* **Support Agency Acceptance** indicates whether, based on its review of the RI/FS and Proposed Plan, the support agency concurs, opposes, or has no comment on the preferred alternative.

* **Community Acceptance** will be assessed in the Record of Decision following a review of the public comment received on the RI/FS Report and the Proposed Plan.

B. Comparative Analyses of Alternatives

Threshold criteria must be met in order for an alternative to be eligible for selection. Primary balancing criteria are used to assess the technical and administrative trade-offs between alternatives. As a result of the assessment of primary balancing criteria, U.S. EPA determines which alternatives satisfy the statutory requirement for cost-effective and permanent solutions which utilize treatment to the maximum extent practicable. Comments received during the public comment period will form the basis for evaluating the alternatives relative to the modifying criteria described above.

Overall Protection of Human Health and the Environment:

Groundwater Containment Alternatives
All of the groundwater containment alternatives, except for the no action alternative, will provide some degree of protection of human health and the environment because the contaminated groundwater plume will be captured/contained and will not impact the city drinking water wells. GWC-4 and GWC-3 provide slightly more containment than GWC-2. The pre-design will determine the exact number and location of wells needed to capture/contain the plume of TCE and DCE.

Groundwater Treatment Alternatives
All of the groundwater treatment alternatives provide some degree of protection of public health and the environment. The primary site risk of ingestion of groundwater is eliminated by implementing the groundwater containment alternative. Each treatment alternative will discharge to the Muskingum River and will be able to reduce the constituents of concern to concentrations at or below State of Ohio discharge standards,

which meet the substantive requirements of an NPDES water discharge permit.

Soil Treatment Alternatives
Alternative S-6, remediation of inorganic constituents, provides a high degree of protection by removing the inorganic constituents from the soils and further treating or disposing the treatment sludge. Alternative S-3 and S-4(B) will eliminate the potential for exposure at the site but will transfer the excavated material to a land disposal facility, where cross-media impacts may occur.

Alternatives S-3 and S-5 will increase worker and residential exposure due to the generation of dust and volatile emissions during excavation. Alternative S-4(B) and Alternative S-6 may also increase worker and residential exposure due to the generation of dust, but to a lesser degree since the volume of soil removed is considerably less. No volatile emissions will occur because Alternative S-4(A) will first remove the VOCs before S-4(B) or S-6 is implemented.

Compliance with ARARs: SARA requires that all remedial actions meet legally applicable or relevant and appropriate requirements of other environmental laws.

Groundwater Containment Alternatives

Maximum Contaminant Levels (MCLs), and to a certain extent, Maximum Contaminant Level Goals (MCLGs), drinking water standards promulgated under the Safe Drinking Water Act (SDWA), apply at the tap to public water supplies servicing 25 or more people. At the Zanesville Site, MCLs and MCLGs are not applicable, but are relevant and appropriate, since the aquifer is used as a drinking water supply by the City of Zanesville. MCLGs are relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens), otherwise, MCLs are relevant and appropriate. The Groundwater Containment Alternatives will achieve these ARARs by pumping and subsequently treating the affected groundwater until the ARARs are achieved.

The NCP, 55 Federal Register 8753, provides that groundwater cleanup standards should generally be attained throughout the contaminant plume or at and beyond the edge of the waste management area when waste is left in place. The pre-design will determine the exact number and location of wells needed to capture/contain the plume of TCE and cis- and trans- DCE such that MCLs (and MCLGs) are met throughout the plume.

Groundwater Treatment Alternatives

The Clean Water Act requires the State to promulgate state water quality standards for surface water bodies, based on the designated uses of the surface water bodies. CERCLA remedial actions involving surface water bodies must ensure that applicable or relevant and appropriate state water quality standards are met. ORC Chapter 6111 establishes Ohio EPA's authority to set water quality standards (Section 6111.041) and to regulate water pollution sources. Regulations developed and implemented by Ohio EPA under the authority contained in ORC Chapter 6111 are in part, found at OAC Sections 3745-1-03 through 3745-1-07, inclusive, 3745-1-24, 3745-31-05, 3745-32-05 and 3745-33-05.

At the Zanesville Site, the Groundwater Treatment Alternatives involve treatment and discharge of groundwater to the Muskingum River. The alternatives will meet the substantive requirements of ORC Chapter 6111 and OAC Sections 3745-1-03 through 3745-1-07, inclusive, 3745-1-24, 3745-31-05, 3745-32-05 and 3745-33-05. Attachment 1 contains the State of Ohio effluent limitations for the Zanesville Well Field Site. Additional effluent monitoring requirements will be developed to meet the substantive requirements of these Ohio regulations.

GWT-1B will comply with OAC 3745-31-05 because any new air stripper constructed at the site will be evaluated pursuant to the BAT requirements outlined in OAC 3745-31-05 to determine whether air emission controls are required.

Soil Treatment Alternatives

RCRA requirements are not applicable unless RCRA-listed or characteristic hazardous wastes are excavated and managed (treated, disposed or stored).

Alternative S-6 (soil washing) involves excavation, treatment and replacement of the soils at the Site. The contaminated soils will be tested prior to excavation to determine if the soils are a characteristic hazardous waste. If the soils are determined to be a characteristic hazardous waste, certain RCRA requirements, including RCRA Land Disposal Restrictions, would be applicable. If the soils are determined to be a characteristic hazardous waste, Alternative S-6 would meet OAC 3745-56-50 through 3745-56-59 for any waste piles created during interim handling procedures. In addition, treated soils would meet LDR treatment requirements prior to replacement and any concentrated waste and filter cake generated by this alternative would be tested by the TCLP test to determine if they are hazardous and treated or disposed of off-site in compliance with RCRA.

Alternative S-6 may also invoke State of Ohio Solid Waste regulations. Under alternative S-6, treated soil will be replaced in the ground only if it is not considered a solid waste pursuant to ORC 3734.01(E) or if it qualifies for an exemption pursuant to ORC 3734.02(G).

The Alternative S-4(A) air emission control device would meet applicable State of Ohio regulation OAC 3745-15-07 and OAC 3745-16-02. The carbon adsorption filters will be re-cycled according to the applicable federal regulations of 40 CFR 264.600 sub part X. The Alternative S-7 air emission control off-gas hood device will meet applicable State of Ohio regulation OAC 3745-15-07, OAC 3745-16-02. Any carbon adsorption filters will be re-cycled according to the applicable federal regulations of 40 CFR 264.600 sub part X.

Long-Term Effectiveness and Permanence:

Groundwater Containment Alternatives
All of the alternatives, except for no action, achieves a high degree of long-term effectiveness and permanence by extracting groundwater affected by chemicals of concern to a treatment system (Alternative GWT 1 through GWT-4).

Groundwater Treatment Alternatives
Alternative GWT-1-B, GWT-2, GWT-3, GWT-4 and GWT-5 achieve the highest level of long term effectiveness because the groundwater constituents of concern are ultimately destroyed. Alternatives GWT-1-A and GWT-1-C will transfer the bulk of volatile groundwater constituents into the atmosphere. It is anticipated that none of the alternatives will require long term operation or monitoring after ARARs are achieved in order to maintain their effectiveness.

Soil Treatment Alternatives
Each alternative, with the exception of Alternative S-1 (No Action), provides some degree of long-term effectiveness and permanence. Alternative S-1 will allow continued leaching of constituents to groundwater and potential exposure of residents to contaminated soils.

The effectiveness and permanence of Alternative S-2 assumes the multi-media cap is not disturbed in the long-term. Alternative S-3, S-4(B), S-5 and Alternative S-6 provide the greatest degree of long-term effectiveness and permanence because the affected soils are removed from the site or treated. Alternative S-4(A) provides a moderate to high degree of permanence through the in-situ removal of VOCs in the soil. Alternative S-4(A) also provides the most effective treatment of the source areas. Alternative S-7 also provides a high degree of long-term effectiveness and permanence by destroying organic constituents and transforming the metals and soils into a vitrified mass.

Reduction of Toxicity, Mobility, or Volume:

Groundwater Containment Alternatives
This criterion relates to treatment aspects of an alternative and is therefore not applicable to the containment alternatives.

Groundwater Treatment Alternatives
Alternative GWT-1B, GWT-2, GWT-3, GWT-4, and GWT-5 will provide the highest degree of reduction of chemical toxicity, mobility, or volume by destroying extracted organic chemicals in the identified groundwater plume. Alternatives GWT-1-A and GWT-1-C do not provide any reduction of the mobility, toxicity, or volume of the contaminants because it transfers volatile constituents into the atmosphere. However GWT-1-A and GWT-1-C will provide significant reduction of contaminant loading to groundwater and subsequently the groundwater toxicity, mobility, and volume.

Soil Treatment Alternatives
Alternative S-5 and S-7 provide the greatest degree of reduction in toxicity, mobility, or volume through treatment, followed closely by Alternative S-6. Alternative S-5 will thermally destroy volatile constituents and slightly reduce the volume, but inorganic constituents (metals) will concentrate in an ash. Alternative S-7 will also thermally destroy organic constituents (in-situ) and will immobilize inorganic chemicals in the soil by creating a vitrified mass. Alternative S-4(A) will contain VOC vapors on carbon, then thermally destroy the organic constituents achieving a major reduction of toxicity, mobility or volume through treatment.

Alternative S-1, S-2, S-3, and S-4(B) do not provide any treatment of the affected soil, nor do they provide any reduction in toxicity, mobility, or volume.

Short-Term Effectiveness:

Groundwater Containment Alternatives
Construction related adverse impacts will be minor for all of the containment alternatives since a relatively small amount of subsurface material containing chemicals of concern require handling.

The U.S. EPA groundwater policy as described in the NCP states that the EPA's preference is for rapid restoration, when practicable, of contaminated groundwater that is currently a drinking water source. It also states that reasonable restoration time periods may range from very rapid, 1 to 5 years, to relatively extended, perhaps several decades. The U.S. EPA proposes aggressive source control through ISVE in combination with aggressive containment and achievement of clean up levels. This will, therefore satisfy both the NCP preference for rapid restoration and overall site objectives.

Alternative GWC-4 offers the greatest degree of short-term effectiveness with the addition of five interceptor wells. Alternatives GWC-3 and GWC-2 offer short-term effectiveness in descending order, respectively. GWC-3 provides for two additional interceptor wells and GWC-2 provides continued operation of the existing interceptor system.

The exact number of years to achieve ARARs could not be determined at this time based on limitations within the groundwater model. Also, the model did not adjust the source for additional interceptor wells or aggressive source control using ISVE.

Groundwater Treatment Alternatives
All of the treatment alternatives have approximately the same degree of short-term effectiveness since this factor is controlled by the groundwater containment alternative. Construction related adverse impacts will be minor for each alternative.

Soil Treatment Alternatives
Alternatives S-3, S-4(B), S-5, and S-6 will cause slight to moderate adverse impacts to on site personnel and the surrounding residents due to air emissions during excavation. Alternative S-4(A) will present only a slight adverse impact during construction and implementation. Alternative S-6 and S-7 will cause slight adverse impacts during construction and may inconvenience employees at the UTA facility because of space requirements during construction implementation. Estimated time for construction, and time to reach clean up levels and ARARs for each alternative are shown below:

Alternative	Time to Construct	Time to Meet ARARS/Clean Up
S-1	NA	
S-2	1 week	NA
S-2	1 week	NA
S-3	1 week	1 week
S-4a	4 weeks	10 years
S-4b	1 week	NA
S-5	1 week	1 week
S-6	4 weeks	4 weeks
S-7	4 weeks	4 weeks

Implementability:

Groundwater Containment Alternatives
All of the containment alternatives are readily implementable because they use standard construction techniques and commonly available material and labor.

Groundwater Treatment Alternatives
All of the alternatives are implementable, although GWT-1-A, GWT-1-B, GWT-1-C, GWT-4, and GWT-5 are most readily constructed and operated because they utilize conventional, proven methods. The implementability of GWT-2 and GWT-3 is fair because of the requirement for trained operators and significant maintenance activity in order to maintain their effectiveness.

Soil Treatment Alternatives
The technical feasibility of each soil alternative is very good, with the possible exception of Alternative S-6 and Alternative S-7. Soil washing and vitrification are relatively new innovative technologies for waste treatment. Although these alternatives will require pilot testing to assess their effectiveness, the NCP states a preference to consider innovative technologies when they offer comparable or superior treatment performance. Any delays due to pilot testing of the Inorganic Alternative will have little effect since the alternative will not be implemented until Alternative S-4(A) nears completion.

Alternatives S-2, S-6 and S-4(A) can be easily modified in the event of remedy failure. If Alternative S-7 were to fail, implementation of additional remedial actions may be difficult due to the nature of the vitrified mass. If it is determined after the ISVE pilot study and the pre-design study that S-6 will not be effective or able to meet ARARs, other treatment alternatives will be evaluated.

Cost:

Groundwater Containment Alternatives
The present worth cost of each alternative is shown below:

Alternative	Capital Cost	O&M (PW)	Present Worth
GWC-1	$ 0	$ 0	$ 0
GWC-2	$ 0	$ 487,200	$ 487,200
GWC-3	$ 75,000	$ 602,000	$ 677,000
GWC-4	$ 168,600	$ 950,300	$1,118,900

The no action alternative will have the lowest cost, however, the remedial action objectives will not be met. The existing interceptor wells system has a cost of $487,200 however, it is uncertain based on the model if the remedial action objectives, and goal of rapid restoration will be met. The addition of two interceptor wells have a cost of $ 677,000 and the addition of five interceptor wells have a cost $1,118,900. These two alternatives have a higher degree of certainty of achieving the remedial action objectives and rapid restoration.

Groundwater Treatment Alternatives
The Present Worth Cost of each alternative is presented below:

Alternative	Capital	O&M (PW)	Present Worth
GWT-1A(400 gpm)	$ 88,900	$ 256,600	$ 345,500
GWT-1A(1,000 gpm)	$ 149,700	$ 302,800	$ 452,500
GWT-1B(400 gpm)	$ 126,400	$ 764,800	$ 891,200
GWT-1B(1,00 gpm)	$ 225,900	$1,239,600	$1,465,500
GWT-1B1(300 gpm)	$ 108,300	$ 751,300	$ 859,600
GWT-1C(400 gpm)	$ 0	$ 256,600	$ 256,600
GWT-2(400 gpm)	$1,017,500	$ 957,400	$1,974,400
GWT-2(1,000 gpm)	$2,033,900	$1,417,300	$3,451,200
GWT-3(400 gpm)	$ 930,000	$1,254,500	$2,184,500
GWT-3(1,000 gpm)	$1,802,500	$2,836,000	$4,638,500
GWT-4(400 gpm)	$ 284,000	$1,066,900	$1,350,900
GWT-4(1,000 gpm)	$ 511,000	$2,339,200	$2,850,200
GWT-5(1,000 gpm)	$ 265,700	$ 282,600	$ 548,300

Soil Treatment Alternatives
The estimated present worth of the soil alternatives are shown below.

Alternative	Capital	O&M	Present Worth
S-1	$ 0	$ 0	$ 0
S-2	$ 133,000	$ 76,900	$ 210,200
S-3	$ 8,325,000	$ 0	$ 8,235,000
S-4(A)	$ 193,750	$286,500	$ 480,250
S-4(B)	$ 416,250	$ 0	$ 416,250
S-5	$10,575,000	$ 0	$10,575,000
S-6	$ 625,000	$ 42,400	$ 667,400
S-7	$29,243,800	$ 42,400	$29,286,200

State Acceptance: The State of Ohio concurs with the selected remedial alternative. A letter from the OEPA indicates this support.

Community Acceptance: U.S. EPA solicited input from the community on the Proposed Plan for the Zanesville Well Field Site. Verbal comments received during the public meeting indicated full support of the selected remedial alternative. Written comments received during the public comment period also indicated full support of the selected remedial alternative.

X. THE SELECTED REMEDY

U.S. EPA believes the preferred alternative as described in the Record Of Decision of GWC-3, GWT-1B, GWT-1C, S-4, and S-6 is the most appropriate solution for the remediation at the Zanesville Well Field Site because of its performance against the nine evaluation criteria previously discussed. The major components of the selected remedy include the following:

* Pre-Design Work;
* Groundwater Containment (Modified GWC-3 - installation of additional interceptor wells if required after further study);
* Groundwater Treatment Alternative GWT-1B (air stripper meeting BAT requirements of OAC 3745-31-05) only if additional wells are installed, with GWT-1C (existing stripper);
* Organic Soil Remediation Alternative S-4(A) (in-situ vapor extraction (ISVE)); and
* Inorganic Soil Remediation Alternative S-6 (soil washing).

The exact number of interceptor wells needed to completely capture/contain the plume of TCE and DCE and meet groundwater clean up objectives within a rapid time frame will be determined in pre-design. Following pre-design, it will be determined whether less or more than two additional interceptor wells will be needed. The U.S. EPA has identified the potential need for additional interceptor wells based on the results of the groundwater model. Since additional information is required to increase the accuracy of the model, it cannot be determined at this time if the existing four interceptor wells and the two city interceptor wells are completely containing the plume of TCE and DCE, and will meet the groundwater clean up objectives within a rapid time frame Therefor, U.S. EPA has chosen a modified GWC-3 Alternative, which requires that after the pre-design study is completed, the necessity, the number of interceptor wells and the location of the wells will be determined.

The capture/containment system will be evaluated yearly to determine the systems effectiveness. The U.S. EPA will determine based on the results of the evaluation if any modifications of the capture/containment system are required in order to ensure complete capture of the contaminate plume and if the system will meet the groundwater clean up objectives within a rapid time frame.

The groundwater capture/contain system will continue to operate until the MCLs and health based clean up standards of all the chemicals of concern have been met.

Institutional Controls such as fences will be used to restrict access to the UTA facility, the city interceptor wells and their discharge pipes. (Deed restrictions will be sought to control future use of the UTA facility until soil clean up levels have been met and to control the use and placement of wells in the affected area until groundwater cleanup levels have been met.)

Additional groundwater monitoring wells will be installed east of the city interceptor wells to determine if a source of contaminants other than those attributable to UTA's facility are entering the city well field. Available data indicates that the major source of VOCs is from the UTA facility. However, there are some data gaps on the east side of the well field. The additional wells will identify if there are other sources of contaminants entering the city well field.

The appropriate size air stripper was chosen to treat the total flow rate from GWC-3. Any new air stripper constructed at the site (i.e. on UTA's property or in the well field) must be evaluated pursuant to the BAT requirements in OAC 3745-31-05 to determine air emission controls requirements.

Discharge from Interceptor well I-1 will require additional treatment if it fails to meet the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit. Discharge from the city interceptor wells will require additional treatment if it fails to meet the State of Ohio discharge standards, which meet the substantive requirements of an NPDES permit.

The soils contaminated with VOCs will be treated with ISVE. The extracted vapors will be treated using carbon absorption. The soils contaminated with inorganics will be treated by soil washing. The clean soils may be replaced in the ground. The concentrated waste and filter cake will be taken off site for further treatment/disposal.

Cost of Selected Remedial Alternative:

Alternative	Capital Cost	O&M (PW)	Present Worth
GWC-3	$ 75,000	$ 602,000	$ 677,000
GWT-1B (400 gpm)	$ 126,400	$ 764,800	$ 891,200
GWT-1C	$ 0	$ 256,600	$ 256,600
S-4(A)	$ 193,750	$ 286,500	$ 480,250
S-6	$ 625,000	$ 42,400	$ 667,400
TOTAL	$1,020,150	$1,952,300	$2,972,450

XI. STATUTORY DETERMINATIONS SUMMARY

1. Protection of Human Health and the Environment

The selected remedy provides a sufficient degree of overall protection of human health and the environment, by containing/capturing the groundwater contamination plume, restoring the aquifer to MCL cleanup levels, treating the soils and any source to prevent additional groundwater contamination, treating the soils to prevent human exposure to contaminated soils, and minimizing contaminant air emissions. Institutional controls will be implemented during remediation to assure protection until confirmation sampling and analyses indicate that a health based clean-up has been achieved.

2. Attainment of ARARs

The selected remedy will attain all Federal and State applicable or relevant and appropriate requirements as described in Section IX of this Record of Decision. In addition, the selected remedy will attain all Federal and State "To Be Considered" requirements as described in Section IX of this Record of Decision.

The following specific ARARs will be met by the selected remedy:

Air

ORC Chapter 3704 provides statutory authority for the regulations of air pollution control in the State of Ohio. The Ohio EPA air pollution control regulations developed on the basis of Chapter 3704 of the ORC can be found in Chapters 3745-15 to 3745-26, 3745-31, 3745-35, 3745-71, 3745-73 and 3745-75.

Groundwater

Maximum Contaminant Levels (MCLs) and Non Zero Contaminant Level Goals (MCLGs) established under the Safe Drinking Water Act (SDWA) in 40 CFR 141 and 56 Fed. Reg. 3526.

Surface Water

National Pollutant Discharge Elimination System (NPDES) Requirements

ORC Chapter 6111 establishes Ohio EPA's authority to set water quality standards and to regulate water pollution sources. Regulations developed and implemented by Ohio EPA under the authority contained in ORC Chapter 6111 are in part, found at OAC Chapter 3745-1-03 through 3745-1-07, inclusive, 3745-1-24,3745-31-05, 3745-32-05 and 3745-33-05.

Soil

RCRA Land Disposal Restrictions (40 CFR 268)

ORC Chapter 3734 provides statutory authority for the regulations of solid and hazardous waste activities in the State of Ohio.

The Ohio EPA hazardous waste regulations developed on the basis of Chapter 3734 of the ORC can be found in ORC Chapters 3745-50 to 3745-59.

It may be noted that the selected alternative may involve sending materials excavated from the site to an off-site landfill. These activities will be conducted in compliance with the U.S. EPA Off-Site policy (OSWER Directive No. 9834.11) and Section 121 (d)(3) of SARA.

3. Cost-Effectiveness

The selected remedy provides overall cost-effectiveness because a high degree of permanence is achieved by treatment, via pumping and treating the groundwater, treating the soils and any sources, and treating the air emissions. The selected soil remedy can be implemented at a cost far less than complete off-site disposal, off-site incineration, or in-situ vitrification. Although soil washing is slightly more costly than limited off-site disposal for the treatment of the inorganic contaminated soils, soil washing provides for reduction of volume through treatment. Limited off-site disposal does not provide for any treatment.

4. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance with respect to the nine evaluation criteria as described in section IV of this Record of Decision. Permanent solutions are obtained through a combination of groundwater restoration using interceptor wells and complete treatment of all soil contaminants and any source (preventing additional groundwater contamination), using ISVE and soil washing. Treatment technologies are utilized to the maximum extent practicable by treating the air emissions of any newly required air strippers and air emissions of the ISVE, treating both the organic and inorganic soil contaminants using ISVE and soil washing.

5. Preference for Treatment as a Principal Element

The selected remedy eliminates the principal threats at this site by the use of treatment, via ISVE of the organic contaminated soils and soil washing of the inorganic contaminated soils. The selected remedy also treats any new air emission using activated carbon filters.

XII. DOCUMENTATION OF SIGNIFICANT CHANGE

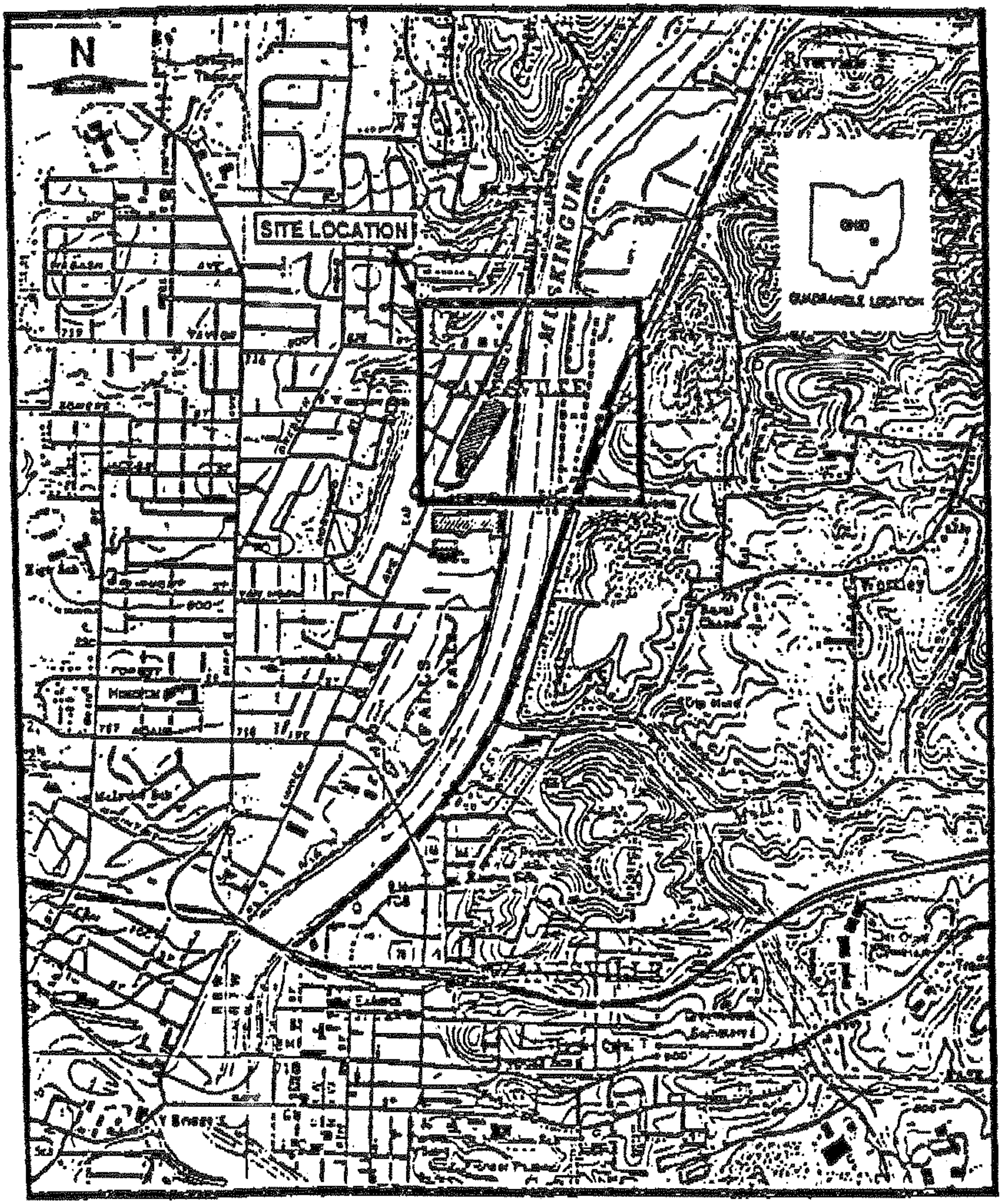
Section 117(b) of CERCLA requires that the final remedial action plan be accompanied by a discussion of any significant changes in the Proposed Plan. The selected remedy as described in this ROD is the U.S. EPA final remedial action plan for this site. The U.S. EPA has determined that there are no significant changes from the Proposed Plan.

The Responsiveness Summary attached hereto addresses the public comments received during the 40 day public comment period on the Proposed Plan.

Table 1.
Summary of Calculated Organic and Inorganic Soil Clean Up Levels

Organic Constituent	Clean Up Level ppb
TCE	6.3
cis-DCE	34.3
trans-DCE	59.0

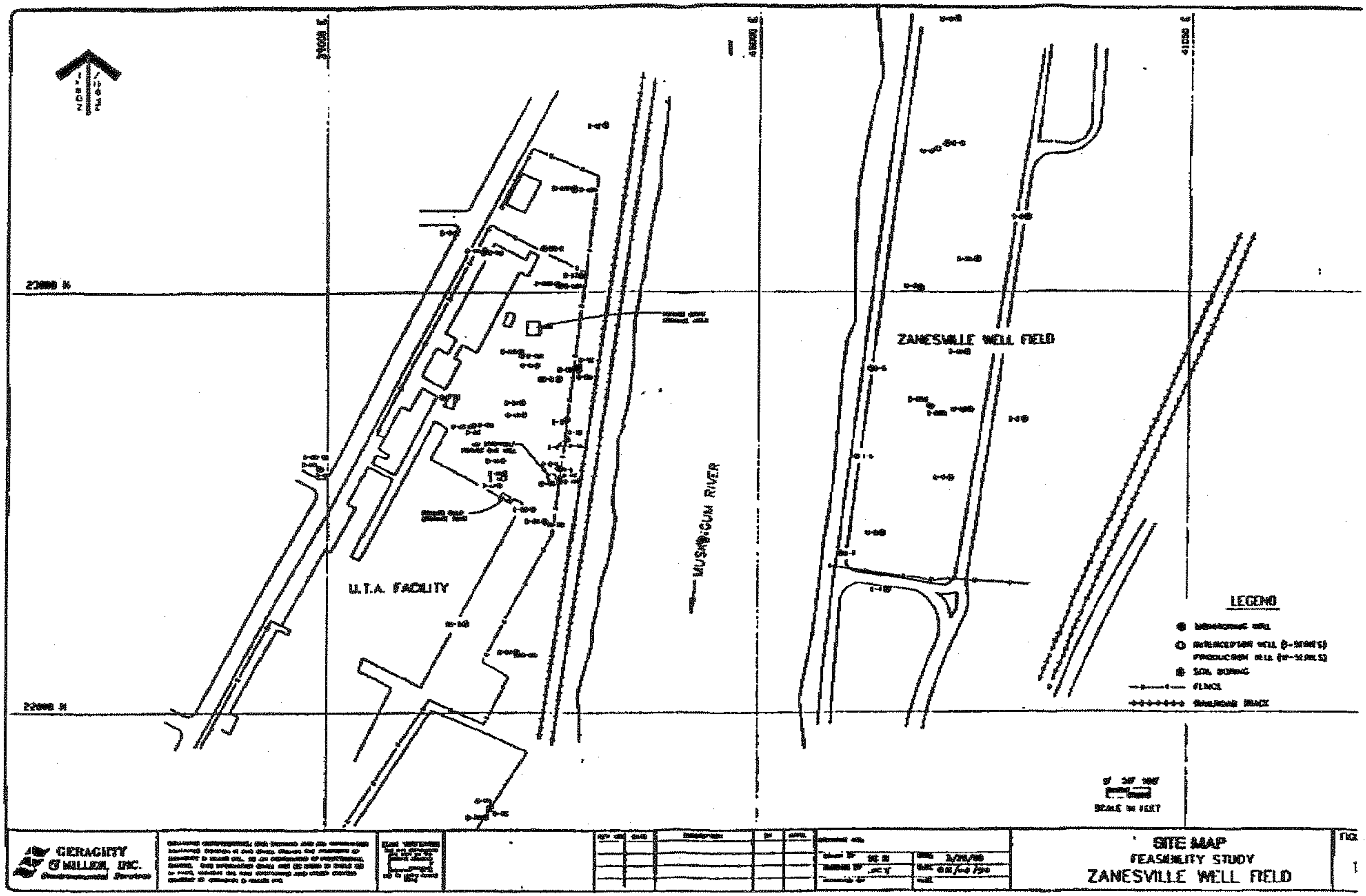
Inorganic Constituent	Clean Up Level mg/kg
Barium	77
Cadmium	4
Copper	315
Lead	12
Manganese	771
Mercury	3
Zinc	1,410

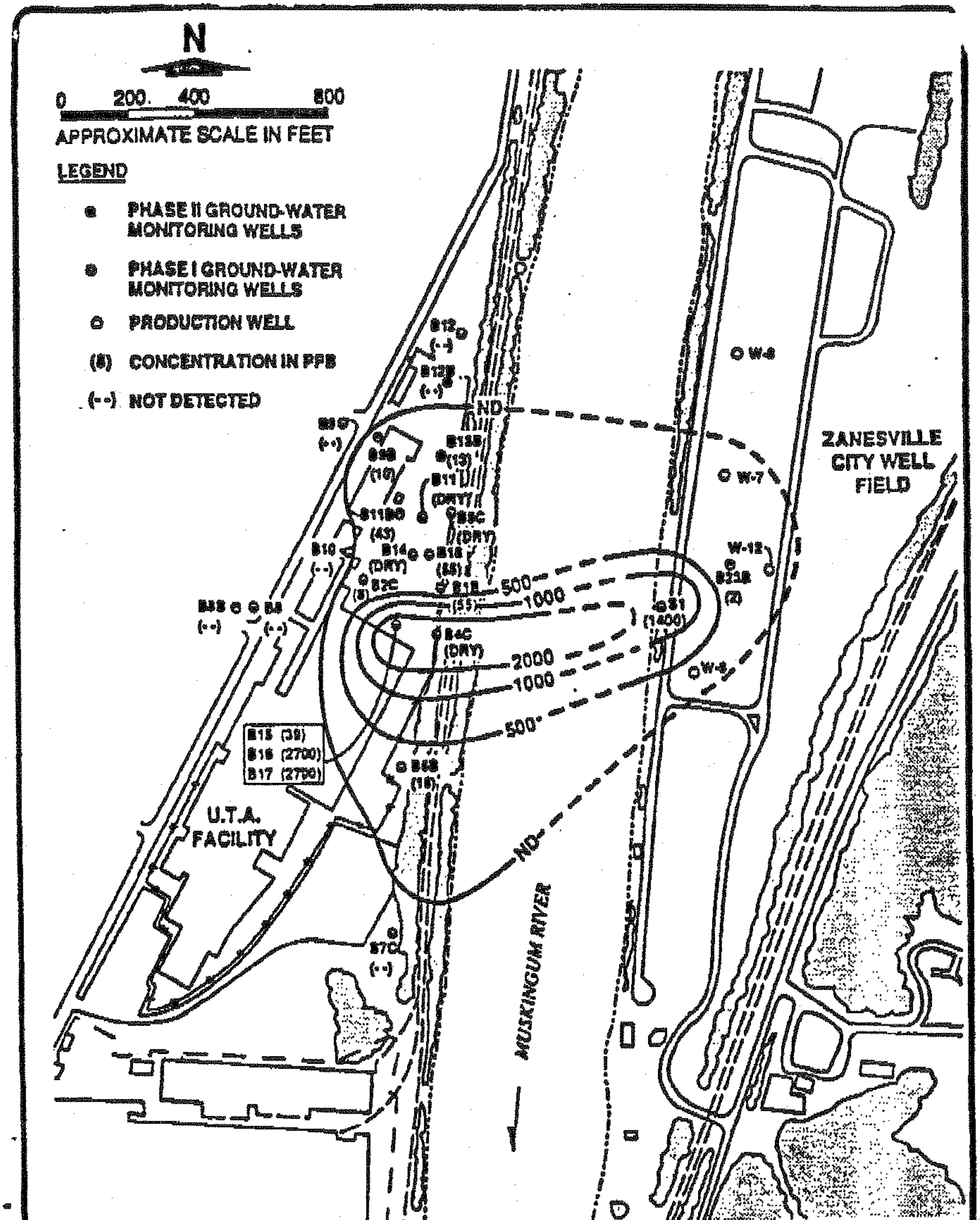


SOURCE: USGS 7.5 Minute Topographic Map, ZANESVILLE EAST, OHIO and ZANESVILLE WEST, OHIO Quadrangles.

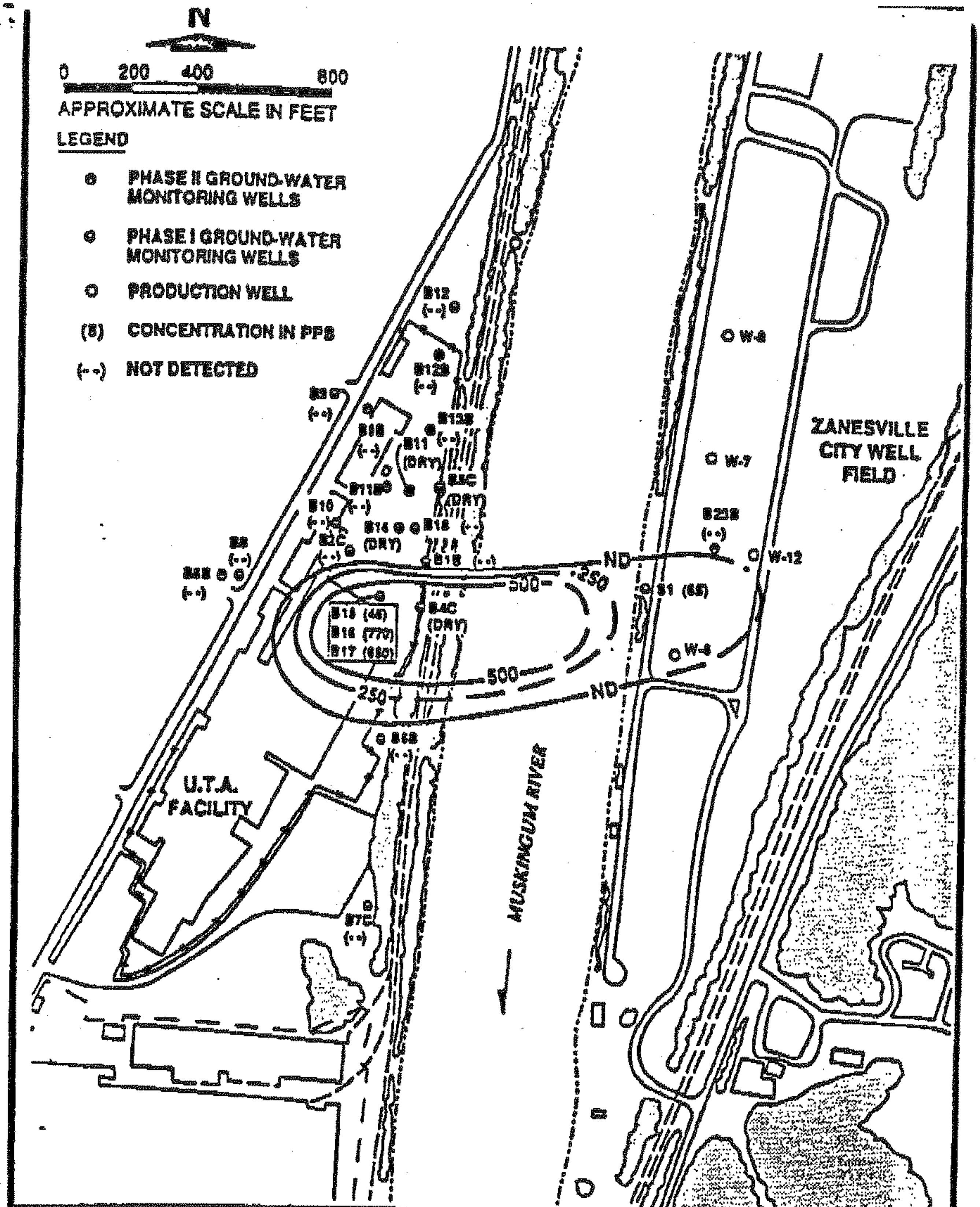
0 1000 2000 4000
SCALE IN FEET

SCALE AS SHOWN	DRAWING NO.	SITE LOCATION MAP FEASIBILITY STUDY ZANESVILLE WELL FIELD	FIGURE 1
GERAGHTY & MILLER, INC. Environmental Services	DRAWN BY SG III / DATE 4/8/90; CHECKED BY JCT / DATE 08/06/90; APPROVED BY / DATE		


U.T.A. FACILITY
MUSKINGUM RIVER
ZANESVILLE WELL FIELD
LEGEND
SOIL BORING
FENCE
RAILROAD TRACK
SCALE IN FEET
GERAGHTY & MILLER, INC.
SITE MAP
FEASIBILITY STUDY
ZANESVILLE WELL FIELD
FIG.
1



SCALE AS SHOWN	DRAWING NO.		TCE CONCENTRATIONS SHALLOW GROUND-WATER MONITORING WELLS FEASIBILITY STUDY ZANESVILLE WELL FIELD	FIGURE 2
GERAGHTY & MILLER, INC. Environmental Services	DRAWN BY: SC III	DATE: 7/24/90		
	CHECKED BY: JLT	DATE: 8/04/90		
	APPROVED BY:	DATE:		



SCALE AS SHOWN	DRAWING NO.		DCE CONCENTRATIONS SHALLOW GROUND-WATER MONITORING WELLS	FIGURE
GERAGHTY & MILLER, INC. Environmental Services	DRAWN BY: SG III	DATE: 7/24/90	FEASIBILITY STUDY ZANESVILLE WELL FIELD	3
	CHECKED BY: JCT	DATE: 08/09/90		
	APPROVED BY:	DATE:		

ATTACHMENT 1

EFFLUENT LIMITATIONS - ZANESVILLE SITE

A. 1 Effluent Limitations - Outfall - 001

EFFLUENT CHARACTERISTIC			DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
			Concentration Other Units (Specify)		Loading* kg/day			
Reporting Code	UNITS	PARAMETER	30 day	Daily Max.	30 day	Daily Max.	Meas. Freq.	Sample Type
00530	MG/L	Residue, Total Nonfilterable	30	45	136	204	1/Month	Grab
00550	MG/L	Oil and Grease, Total	15	20	68	91	1/Month	Grab
00719	MG/L	Cyanide, Free	—	—	—	—	1/Month	Grab
01042	UG/L	Copper, Total	—	—	—	—	1/Month	Grab
01045	UG/L	Iron, Total	—	—	—	—	1/Month	Grab
01077	UG/L	Silver, Total	—	—	—	—	1/Month	Grab
01092	UG/L	Zinc, Total	—	535	—	2.43	1/Month	Grab
34546	UG/L	1,2-Trans-Dichloroethylene Total	25	66	0.011	0.30	1/Month	Grab
39180	UG/L	Trichloroethylene, Total	26	69	0.012	0.31	1/Month	Grab
50050	MGD	Flow Rate	—	—	—	—	Daily	24 Hr. Total
71900	UG/L	Mercury	—	—	—	—	1/Month	Grab

* Effluent loading limitations have been established using a flow value of 1.2 MGD.

B.1. The pH (Reporting Code 00400) shall not be less than 6.5 S.U. nor greater than 9.0 S.U. and shall be monitored 1/month by grab sample.

A.2 Effluent Limitations - Outfall - 002

EFFLUENT CHARACTERISTIC			DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
			Concentration Other Units (Specify)		Loading* kg/day			
Reporting Code	UNITS	PARAMETER	30 day	Daily Max.	30 day	Daily Max.	Meas. Freq.	Sample Type
00530	MG/L	Residue, Total Nonfilterable	30	45	68	103	1/Month	Grab
00550	MG/L	Oil and Grease, Total	15	20	34	46	1/Month	Grab
00719	MG/L	Cyanide, Free	—	—	—	—	1/Month	Grab
01042	UG/L	Copper, Total	—	—	—	—	1/Month	Grab
01045	UG/L	Iron, Total	—	—	—	—	1/Month	Grab
01077	UG/L	Silver, Total	—	—	—	—	1/Month	Grab
01092	UG/L	Zinc, Total	—	535	—	1.22	1/Month	Grab
34546	UG/L	1,2-Trans-Dichloroethylene Total	25	66	0.057	0.15	1/Month	Grab
39180	UG/L	Trichloroethylene, Total	26	69	0.059	0.16	1/Month	Grab
50050	MGD	Flow Rate	—	—	—	—	Daily	24 Hr. Total
71900	UG/L	Mercury	—	—	—	—	1/Month	Grab

* Effluent loading limitations have been established using a flow value of 0.604 MGD.

B.2. The pH (Reporting Code 00400) shall not be less than 6.5 S.U. nor greater than 9.0 S.U. and shall be monitored 1/month by grab sample.

A.3 Effluent Limitations - Outfall 003

EFFLUENT CHARACTERISTIC			DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
			Concentration Other Units (Specify)		Loading* kg/day			
Reporting Code	UNITS	PARAMETER	30 day	Daily Max.	30 day	Daily Max.	Meas. Freq.	Sample Type
00530	MG/L	Residue, Total Nonfilterable	30	45	58	87	1/Month	Grab
00550	MG/L	Oil and Grease, Total	15	20	29	39	1/Month	Grab
00719	MG/L	Cyanide, Free	—	—	—	—	1/Month	Grab
01042	UG/L	Copper, Total	—	—	—	—	1/Month	Grab
01045	UG/L	Iron, Total	—	—	—	—	1/Month	Grab
01077	UG/L	Silver, Total	—	—	—	—	1/Month	Grab
01092	UG/L	Zinc, Total	—	535	—	1.03	1/Month	Grab
34546	UG/L	1,2-Trans-Dichloroethylene Total	25	66	0.048	0.15	1/Month	Grab
39180	UG/L	Trichloroethylene, Total	26	60	0.050	0.15	1/Month	Grab
50050	MGD	Flow Rate	—	—	—	—	Daily	24 Hr. Total
71900	UG/L	Mercury	—	—	—	—	1/Month	Grab

* Effluent limitations have been established using a flow value of 0.510 MGD.

B.3. The pH (Reporting Code 00400) shall not be less than 6.5 S.U. nor greater than 9.0 S.U. and shall be monitored 1/month by grab sample.

Outfall 001 samples shall be taken of groundwater from Interceptor Wells #1, #2, #3 and #4 (on the east side of United Technologies Automotive's property), after air stripping and before discharge into the Muskingum River.

Outfall 002 samples of city well W-6 contaminated groundwater shall be taken at final point of discharge to the Muskingum River.

Outfall 003 samples of city well W-12 contaminated groundwater shall be taken at final point of discharge to the Muskingum River.

Effluent limitations may be revised in order to meet water quality standards after a stream use determination and wasteload allocation are completed and approved. These limitations and discharge requirements may be modified to comply with any applicable water quality effluent limitations.

Special Conditions:

1. The effluent shall, at all times, be free of substances:

   A. In amounts that will settle to form putrescent, or otherwise objectionable, sludge deposits; or that will adversely affect aquatic life or water fowl;

   B. Of an oily, greasy, or surface-active nature, and of other floating debris, in amounts that will form noticeable accumulations of scum, foam or sheen;

   C. In amounts that will alter the natural color or odor of the receiving water to such degree as to create a nuisance;

   D. In amounts that either singly or in combination with other substances are toxic to human, animal, or aquatic life;

   E. In amounts that are conducive to the growth of aquatic weeds or algae to the extent that such growths become inimical to more desirable forms of aquatic life, or create conditions that are unsightly, or constitute a nuisance in any other fashion;

   F. In amounts that will impair designated instream or downstream water uses.

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored flow. Test procedures for the analysis of pollutants shall conform to regulation 40 CFR 136, "Test Procedures For the Analysis of Pollutants" unless other test procedures have been specified in this permit. Also periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to insure accuracy of measurements.

Definitions:

A. The "daily load limitation" is the total discharge by weight during any calendar day. If only one sample is taken during a day, the weight of pollutant discharge calculated from it is the daily load.

B. The "daily concentration limitation" means the arithmetic average of all the determinations of concentration made during the day. If only one sample is taken during the day, its concentration is the daily concentration.

C. The "30-day load limitation" is the total discharge by weight during any 30-day period divided by the number of days in the 30-day period that the facility was in operation. If only one sample is taken in a 30-day period, the weight of pollutant discharge calculated from it is the 30-day load. If more than one sample is taken during one 30-day period, the 30-day load is calculated by determining the daily load for each day sampled, totaling the daily loads for the 30-day period and dividing by the number of days sampled.

D. The "30-day concentration limitation" means the arithmetic average (weighted by flow) of all the determinations of daily concentration made during the 30-day period. If only one sample is taken during the 30-day period, its concentration is the 30-day concentration for that 30-day period.

E. Absolute limitations. Compliance with limitations having descriptions of "shall not be less than," "nor greater than," "shall not exceed," "minimum," or "maximum" shall be determined from any single value for effluent samples and/or measurements collected.

F. 1. "MGD" means million gallons per day.

2. "mg/l" means milligrams per liter.

3. "ug/l" means micrograms per liter.

G. "Bypass" means the intentional diversion of wastes from any portion of a treatment facility.

H. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

Zanesville Well Field Site
Zanesville, Ohio
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Responsiveness Summary

Introduction

The United States Environmental Protection Agency (U.S. EPA), the Ohio Environmental Protection Agency (OEPA), and United Technologies Automotive, Inc (UTA), entered into a Section 122 Administrative Consent Order whereby UTA agreed to undertake a Remedial Investigation and Feasibility Study (RI/FS) at the Zanesville Well Field Site. The RI/FS activities have been completed. Information was collected on the nature and extent of contamination at the Zanesville Site Well Field (RI) and alternatives for appropriate remedial action at the Zanesville Well Field Site were developed and evaluated (FS and Proposed Plan). Throughout this process, public meetings have been held near the site at which U.S. EPA and OEPA were available to discuss the RI/FS and exchange information with the public. At the conclusion of the FS, a Proposed Plan was finalized by U.S. EPA in consultation with OEPA, which recommended an alternative for remedial action at the Zanesville Well Field Site. U.S. EPA conducted a 37 day public comment period on U.S. EPA's Proposed Plan and FS from August 8, 1991 to September 16, 1991. On August 15, 1991 U.S. EPA presented its Proposed Plan for the Zanesville Well Field Site at a public meeting.

The purpose of this responsiveness summary is to document the comments received during the public comment period, and the U.S. EPA's responses to the comments. All of the comments summarized in this document were considered prior to U.S. EPA's final decision embodied in the Record of Decision for the Zanesville Well Field Site.

The responsiveness summary is divided into the following sections:

I. Responsiveness Summary Overview. This section briefly outlines the proposed remedial alternatives as presented in the Proposed Plan, including the recommended alternative.

II. Summary of Public Comments Received During the Public Comment and U.S. EPA Responses.

I. Responsiveness Summary Overview

On August 10, 1991, U.S. EPA made available to the public for review and comment the Feasibility Study (FS) report and U.S. EPA's Proposed Plan for the Zanesville Well Field Site. The alternatives for remedial action described methods for cleaning the contaminated groundwater, soils and any source areas. U.S. EPA's Proposed Plan described four groundwater containment alternatives, five groundwater treatment alternatives and seven soil remediation alternatives. The proposed remedial alternatives included the following:

Groundwater Containment - No action
Existing Interceptor Wells
Two Additional Interceptor Wells
Five Additional Interceptor Wells

Groundwater Treatment - No Action
Existing Air Stripper
Additional Air Striper No Emission Control
Additional Air Stripper Emission Controls
UV/Oxidation Treatment
Biological Treatment
Activated Carbon Treatment
Air Stripper in City Well Field

Soil Remediation - No Action
Multi-media Cap
Off-Site Landfill Disposal of Soils
In-Situ Vapor Extraction of Soils
Limited Excavation and Off-Site Disposal
Off-Site Incineration of Soils
Soil Washing
In-Situ Vitrification of Soils

After careful evaluation of the RI and FS the U.S. EPA recommended remedy of two additional interceptor wells if required, additional air stripper with emission controls if required, in-situ vapor extraction, and soil washing of contaminated soils for the Zanesville Well Field Site.

II. SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD AND U.S. EPA'S RESPONSE TO COMMENTS.

Comments raised during the Zanesville Well Field Site Proposed Plan public comment period are summarized below.

1) Comment Mike Wyatt - citizen
More groundwater monitoring wells should be installed and sampled on the eastern side of the well field in addition to the monitoring wells proposed by U.S. EPA. These wells will help to determine if any additional contamination is entering the well field from sources other than UTA's source of contamination. Prior to House Bill 592 the well field was completely surrounded by landfills. The additional wells are required to determine if there is an additional source of contamination to the well field.

1) Response
The exact number of groundwater monitoring wells required to assess any additional sources of contamination was not determined in the proposed plan. U.S. EPA determined that the most appropriate time

to determine the number of wells required is during the development of the work plan to perform the Remedial Action. U.S. EPA will require enough monitoring wells to adequately determine if there is an additional source of contamination to the well field.

2) Comment Philip Schutte - citizen
If three additional interceptor wells were added on the UTA side of the river it would lower the water table. This would force contaminated groundwater back to the UTA facility preventing it from crossing under the river into the well field. The three additional wells should be placed as close to the abandoned well as possible, or where ever the highest concentration of the contaminant is found.

2) Response The U.S. EPA recommended containment alternative allows for as many interceptor wells as is required to completely contain the plume of contamination and restore the aquifer in a rapid restoration time frame. After the completion of the pre-design study, U.S. EPA will be able to determine the exact number and location of interceptor wells required. The interceptor wells will prevent additional contamination from crossing under the river.

3) Comment Doyle Strain - citizen
I believe that the U.S. EPA recommended alternatives should be taken. Those suggested actions would appear to correct the contamination as well as possible.

The old Zanesville landfill should be surrounded with monitoring wells. The residents of Zanesville deserve to know what is leaching from the old Zanesville landfill to the groundwater and the direction of its migration.

3) Response
The U.S. EPA recommended alternative requires groundwater monitoring of the eastern side of the well field to determine if additional contaminants are entering the well field. If it is determined that there is another source of contamination to the well field, the location of the source will be investigated.

4) Comment - Frederick J. Grant III, PE. PS.
Public Service Director, City of Zanesville

Signs and Fencing. The City has maintained warning signs at each well discharge to the Muskingum River since 1981. In addition, the City has generally isolated the area by blocking off the access road, chain link fencing and gates, wooden guard posts and extending discharge piping well away from the river bank. The City has not fenced individual discharge points because they would collect debris during normal seasonal rise and fall of the river creating a maintenance problem.

The City has not experienced a problem with intrusion into these areas in the past, and feels additional fencing measures are unnecessary.

Additional Monitoring Wells. During the initial investigations by the City for the source of pollution, the City installed monitoring wells toward the old City owned landfill. These wells showed no evidence of contamination from the old landfill and were removed.

The old landfill was City owned and operated and dedicated to domestic municipal waste and industrial or commercial waste and was closed in the late 1960's. Any leachate discharge would be 1200 feet down stream from the polluted well #6. The leachate drains over land directly to the river and not into the aquifer because of the relative impervious overburden in this area. The City is not aware of any leachate problems from this old landfill either now or during the time it was active.

The City feels monitoring the old landfill as part of the remediation program would be a waste of funds.

Interception by 2 Municipal wells. Currently, the City plans to utilize only one municipal well for interception. Existing levels of pollution are such that operation of one well will prevent any migration of pollution northward. Levels of pollution have fallen dramatically since 1981 in the south end of the well field and modeling studies indicate one active well in this area will be adequate to prevent migration.

4) <u>Response</u>

Signs and Fencing. In a number of the public meetings citizens have expressed concern to U.S. EPA that the waste water discharge pipes are located within a public park and that there is nothing to restrict access to the pipes. Several citizens stated that they have seen children swimming directly below the outfall of the pipes. Therefore, U.S. EPA is still very concerned that the access to the pipes be restricted. U.S. EPA is aware of the maintenance problems of installing a fence on the banks of a river that floods. Therefore, the ROD may allow other devices, in lieu of a fence, that will restrict access to the outfall but not have the same maintenance problems. However, if other devices fail to prevent access, U.S. EPA will fencing and it's require periodic maintenance as a requirement of the remedial action

Additional Monitoring Wells. In every public meeting, citizens of Zanesville have expressed concern over the possibility that the old Zanesville landfill may be adding contaminants to the City Well Field. Currently, there are no groundwater monitoring wells in the area which could detect contamination coming from the direction of the old landfill. Because of a lack of laboratory quality assurance documentation of UTA's groundwater data collected before U.S. EPA's involvement, U.S. EPA was not able to use the data to make decisions on remediation. Likewise the data collected by the City of Zanesville does not have the laboratory quality assurance documentation required to make decisions on remediation. Therefore the additional monitoring wells will be required.

Interception by 2 Municipal Wells. U.S. EPA agrees with the City of Zanesville that the levels of pollution have fallen dramatically since 1981. There are still high concentrations of TCE of up to 1400 ppb within the well field. These high concentrations may present an imminent and substantial endangerment to public health. After extensive studies, U.S. EPA had determined that wells 6, 12, and possible well 7 will be required to be used as interceptor wells in order to completely contain the plume of TCE and DCE and remediate the aquifer in a rapid restoration time frame. The use of these wells as interceptor wells is considered a part of the Remedial Action selected by U.S. EPA.

U.S. EPA will allow identified potentially responsible parties(PRPs) the opportunity to enter in to an agreement with U.S. EPA to undertake the Remedial Design and Remedial Action (RD/RA). Should the PRP elect not enter into an RD/RA agreement with U.S. EPA, U.S. EPA may order the PRPs under section 106 of CERCLA to design and implement the RA, and/or use Superfund monies to design and implement the RD/RA and later seek to recover these monies from the PRP. Currently, UTA is the only party U.S. EPA has identified as a PRP.

5) <u>Comment</u> Julie M. Walawender, Senior Environmental Services Specialist, United Technologies Automotive, Inc. Potentially Responsible Party (PRP)

GROUNDWATER CONTAINMENT Alternative GWC-3 was recommended by U.S. EPA since, "it cannot be determined at this time if the existing four interceptor wells and the two city interceptor wells are completely containing the plume of TCE and DCE." (p. 29 of the Proposed Plan). This possibility was documented as requested by U.S. EPA throughout the FS, which led to the agreement for additional data collection to better define the existing ground-water capture zone. Therefore, selection of a particular number of interceptor wells is premature. U.S. EPA's containment alternative is termed "modified" (p. 29) based on the appropriate number of interceptor wells, and the selected remedy under this scenario could actually become Alternative GWC-2 (utilize existing interceptor wells) . The ROD should be explicit regarding the potential for pre-design data to alter the selected remedy.

GROUNDWATER TREATMENT Air stripping treatment for interceptor Well I-1 contingent upon revised NPDES limits was developed in the FS (p. 95). In the June 27, 1991 letter from Paul Novak of the Ohio Environmental Protection Agency to UTA, the proposed 30-day average NPDES limits for TCE and 1,2-DCE were 26 ug/L and 25 ug/L, respectively, based on an average flow rate of 1.15 million gallons per day (about 800 gallons per minute). Given the sample variability over time, it appears that the existing air stripper will not consistently meet the proposed limits. However, as a result of source control action (vapor extraction), the mass loading to the aquifer may be significantly reduced. Therefore, an evaluation should be conducted regarding the predicted mass loading to the air stripper while the vapor extraction system is operating. Such an evaluation should occur after completion of the vapor extraction design test to determine if the existing stripper tower (in combination with soil vapor extraction) can meet the revised discharge limits.

According to the Proposed Plan, air emission controls (activated carbon) are required for the proposed groundwater treatment system at UTA, "because of state emission limits" (page 29). Specific air discharge limits were not available (identified as ARARS) at the time the FS was prepared. The current permitted discharge rate is 20 lbs/day, which is being consistently met by the existing air stripper. Table 25 of the FS provides estimated mass emission rates to the atmosphere for various groundwater flow rates. Using average influent concentrations of trichloroethylene and dichloroethylene, these calculations indicate that the maximum mass loading to the atmosphere would be about 10 lbs/day (assuming a groundwater flow rate of 1,500 gallons per minute). It is not known whether the state emission limits referred to in the Proposed Plan relate to a revised numerical standard, a requirement for emission controls regardless of the nature of the source, an assumed discharge rate from a new source based on particular design assumptions, or some other factor. Regardless of the reason, U.S. EPA and/or Ohio EPA should explain this statement prior to issuance of the ROD, since it potentially represents an ARAR which was not identified during the FS process.

SOIL TREATMENT FOR INORGANIC CONSTITUENTS OF CONCERN Soil washing (alternative S-6) was recommended by U.S. EPA presumably due to the additional treatment afforded by this technology relative to off-site disposal in a landfill. Since the Agency determined that remediation of hot spots at depth was required (as a result of the residential exposure scenario), the FS included recommendations for additional soil borings and sampling (pps. 40, 130) in order to better define the actual volume of soil requiring remediation. This data may indicate that the volume is significantly less than 1,800 yd^3, as assumed in the FS. In addition, it is likely that most of the affected soil could be disposed of as non-hazardous waste. These two factors (reduced volume and lower disposal cost) could significantly reduce the cost excavation and off-site disposal. For example, the estimated cost for disposal of 1,800 yd^3 of non-hazardous waste is \$20-50/yd^3 compared to \$140-200/yd^3 for the same volume of hazardous waste. The ROD should contain language which acknowledges the need for the collection of additional soil samples for inorganic constituent analysis and should outline the general criteria for potential remedy changes. Such criteria should include the percent change in the assumed soil volume requiring disposal or treatment which would require revisiting the detailed analyses in the FS. Documenting decision criteria in the ROD is critical, to allow the flexibility necessary to make changes in the remedy as additional data warrants.

In addition, the FS and the Proposed plan both indicate concerns regarding the feasibility of soil washing. This is due, in part, to the very limited number of available vendors for this technology. Technical feasibility is further weakened due to the small amount of soil to be treated. Above-ground soil washing systems are normally feasible for a minimum 20,000 yd^3 of material. The average throughput of soil washing systems is 20 tons per hour. Therefore, if the technology were applied to the small volume of soil (approx. 1,800 tons) at UTA, very little time would be available to fine tune the system, which could lead to reprocessing and other system inefficiencies. It may also be difficult to locate a vendor interested in bidding on such a small scale job.

SOIL CLEAN-UP LEVELS
Table 1 of the Proposed Plan lists calculated cleanup levels for a residential exposure scenario. However, these numbers differ from the levels calculated in the FS (Tables 13 and 16). It is unclear how the cleanup levels in the Proposed Plan were calculated. Based on the levels indicated in the Proposed Plan, several inorganic chemicals assumed to be constituents of concern in the FS should no longer be considered for remediation (barium, cadmium, copper, manganese, and zinc), since the maximum detected concentrations of these constituents (Table 11 of the FS) are below U.S. EPA cleanup levels. The use of the proposed cleanup levels provides additional support for excavation and off-site disposal since the volume of soil requiring remediation will be substantially smaller than assumed in the FS.

ADDITIONAL MONITORING WELLS UTA agrees that the installation of additional groundwater monitoring wells east of the city interceptor wells may provide useful information about additional sources of contamination. However, since the purpose of these wells is to determine if a nearby landfill is affecting city wells (and to alleviate public concern). UTA cannot commit to bear the financial responsibility for their installation.

4) <u>Response</u>

Groundwater Containment. The Proposed Plan stated that <u>the exact number of interceptor wells</u> needed to completely capture/contain the plume of TCE and DCE and meet the groundwater clean up objectives within a rapid time frame will be <u>determined in pre-design</u> (emphasis added). For RA cost estimation, purposes U.S. EPA identified the expected number of wells. U.S. EPA identified the potential need for additional wells based on the results of the UTA developed groundwater model which predicted that the plume was not being completely contained and that the groundwater clean up objectives would not be met within a rapid time frame, and observed site conditions which suggested that the existing interceptor system may not meet the groundwater clean up objectives within a rapid time frame.

Groundwater Treatment. U.S. EPA in consultation with OEPA, would consider making a determination concerning the effects of the ISVE system on the loading of the air stripper. If it can be demonstrated that after the completion of the ISVE pilot test and one year of implementation of the full-scale ISVE system, the existing stripper tower in combination with ISVE can meet the discharge limits contained in the ROD; then the U.S. EPA in consultation with OEPA, may allow treatment of the water from well I-1 using an equal or superior technology (in place of air stripping) which would meet discharge limits contained in the ROD.

The air emissions of any new air stripper constructed on the site(i.e. on UTA's property or in the well field) must be evaluated pursuant to the BAT requirements outlined in OAC 3745-31-05 prior to the determination that air emission controls are required. This ARAR was identified in the FS process.

Soil Treatment For Inorganic Constituents of Concern. The FS included recommendations for additional soil borings and sampling because of an inadequate number of soil borings and sampling during the RI which resulted in data gaps. Although it may also be true that additional sampling will indicate that the volume is significantly less than 1,800 yd^3 as assumed in the FS it may also be true that additional sampling could indicate a significant increase in the volume of soils to be treated(over 1,800 yd^3). Neither the FS nor the comment from UTA suggest any scientific reason why the volume of soils could be less than 1,800 yd^3. During the review of the RI U.S. EPA presented UTA with a scientific set of calculations that can be used to estimate the depth to which soils should be cleaned up. This calculation demonstrates that the depth to which soils should be cleaned may be deeper than what the FS assumed. Therefore the total volume of soils required to be treated could be well above 1,800 yd^3. UTA also does not give any data to support the assumption that most of the affected soil could be disposed of as non-hazardous waste instead of hazardous waste as the FS determined. Therefore U.S. EPA has no bases to modify the recommended alternative of soil washing based on percent change of soil volume requiring treatment.

The feasibility of soil washing is considered fair not infeasible. It is considered fair because of a limited number of venders and the volume of soil to be treated. There is a limited number of venders due to fact that soil washing is a relatively new innovative technology. The number of venders will most likely increase in the future. Since soil washing may not be implemented for ten years, there should be a greater number of venders available at that time. A carefully conducted and controlled soil washing pilot test study, should be able to fine tune the soil washing system. This should prevent the reprocessing of the soils and limit other system inefficiencies.

Soil Clean Up Levels UTA's comment notified U.S. EPA that the Proposed Plan contained typographical errors concerning the calculated clean up levels based on residential child direct contact, ingestion, or inhalation. The errors were contained on Table 1. The text of the Proposed Plan on page 11 did contain the correct clean up level based on residential child direct contact, ingestion, or inhalation ("The soil clean up level for the inorganic chemicals of concern represent concentrations which yield a cumulative hazard index less than 1, and the cumulative excess lifetime cancer risk (ELCR) less than $1x10^{-6}$."). Table 1 only summarized calculated soil concentrations that achieve the soil clean up levels. In fact the actual clean up concentration for the soil contaminate may change after the soils remediation as long as the over all risk yield a cumulative hazard index less than 1, and the cumulative excess lifetime cancer risk (ELCR) less than $1x10^{-6}$.

ADDITIONAL MONITORING WELLS U.S. EPA has determined that the additional monitoring wells are necessary for the RA. The party that pays for the installation and sampling of the wells does not concern the selection of the remedy, therefore, there is no response to this comment.

provided comments on the alternatives presented in the Proposed Plan and elaborated upon the FS. The remedy for the Zanesville Well Field Site described in the ROD was selected after a detailed review of the public comments received. The attached comments are responded to in Section III of this Responsiveness Summary.