EPA/ROD/R03-97/096
1997

EPA Superfund
Record of Decision:

TOBYHANNA ARMY DEPOT
EPA ID: PA5213820892
OU 01
TOBYHANNA, PA
09/30/1997

<IMG SRC 97096>
<IMG SRC 97096a>

FINAL

TOBYHANNA ARMY DEP0T
OPERABLE UNIT 1
(Areas A and B)
RECORD OF DECISION

Prepared by:
Environmental Science & Engineering, Inc.
Gainesville, Florida

September 1997

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Prepared for:

U.S. Army Environmental Center
Installation Restoration Division
Aberdeen Proving Ground, MD 21010-5401

Final

Tobyhanna Army Depot
Operable Unit 1
(Areas A and B)
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ESE Project No. 3922039G

Tobyhanna Army Depot Record of Decision

Declaration

Site Name and Location

Tobyhanna Army Depot
Tobyhanna, Pennsylvania
Operable Unit 1 (Areas A and B)

Statement of Basis and Purpose

This decision document presents the selected remedial action for Operable Unit 1 (OU1) at Tobyhanna Army Depot (TYAD), in Tobyhanna, Pennsylvania, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for OU1 and is based on the administrative record file for this site.

The Commonwealth of Pennsylvania concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from OU1 can be addressed by implementing the response action selected in this Record of Decision (ROD), thereby mitigating any possible imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The remedial action jointly selected by the Army and U.S. Environmental Protection Agency (EPA) is the final remedy for OU1. A previously conducted removal action removed a groundwater contamination source in OU1, and represented a source control measure that addressed principal threats posed by contaminated soil and significantly reduced the potential for contaminants to further degrade groundwater. The response action for groundwater, Natural Attenuation/Long-Term Monitoring/Institutional Controls, will minimize the threat of migration of contaminants in groundwater. Implementing the selected remedy will reduce risks to human health and the environment.

The major components of the selected remedy include periodic groundwater monitoring for the purpose of ensuring that the strength and size of the groundwater plume continues to decrease over time through the process of natural attenuation and institutional controls, to ensure contaminated groundwater above maximum contaminant levels (MCLs) is not used for potable purposes. A removal action, which removed a source of groundwater contamination within OU1, was completed in 1995. All soils in excess of soil cleanup levels developed for this site were excavated and transported offsite to a disposal facility. No further action, therefore, is required for soils.

This ROD for OU1 is the third ROD issued for TYAD. Two other RODs have been finalized at TYAD:

- OU2 addresses the former polychlorinated biphenyl (PCB) transformer substation site (AOC#63), and
- OU3 addresses buildings 10C and S90 (AOC #37 and AOC #38, respectively).

Three other operable units have been identified at TYAD:

- OU4 addresses AOC's associated with a metal finishing pre-treatment plant (AOC #9 through AOC #18, AOC #53, and AOC #54),
- OU5 addresses AOC's associated with the sewage treatment plant (AOC #19 through AOC #36, and AOC #56), and
- OU6 addresses AOC #42 and AOC #43 (waste motor oil/drum storage areas).

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy uses 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 may result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years after the commencement of remedial action, to ensure that the remedy continues to provide adequate protection of human health and the environment.

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Tobyhanna Army Depot Record of Decision

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List of Acronyms and Abbreviations

ARAR	applicable and relevant or appropriate requirement
BRA	Baseline Risk Assessment
C-E	communications-electronics
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	chemical of potential concern
CSF	cancer slope factor
1,2-DCE	1,2-dichloroethene
DDD	1,1-dichloro-2,2-bis-(p-chlorophenyl)ethane
DDE	1,1-dichloro-2,2-bis-(p-chlorophenyl)ethene
DDT	1,1-trichloro-2,2-bis-(p-chlorophenyl)ethane
DoD	U.S. Department of Defense
EA	Endangerment Assessment
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ESE	Environmental Science & Engineering, Inc.
FR	Federal Register
FS	Feasibility Study
ft	foot
gpm	gallons per minute
HI	hazard index
HRS	Hazard Ranking System
H5	Henry's law
IIA	Initial Installation Assessment
IRP	Installation Restoration Program
m	meter
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
mi -2	square mile
NA	not appropriate
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
nd	not determined
NE	not evaluated
NM	not modeled
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
OUl	Operable Unit 1
PAH	polynuclear aromatic hydrocarbon
PADEP	Pennsylvania Department of Environmental Protection
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
ppb	parts per billion
RA	Risk Assessment
RAB	Restoration Advisory Board
RAGS	Risk Assessment Guidance for Superfund
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act of 1986
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
TBC	to be considered
TCE	trichloroethene

TCLP	Toxicity Characteristic Leaching Procedure
TMV	toxicity, mobility, and volume
TYAD	Tobyhanna Army Depot
UCL 95	95 percent upper confidence limit
Ig/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
VOC	volatile organic compound
WoE	weight-of-evidence
WWI	World War I
WWII	World War 11
yd 3	cubic yard

1.0 Site Name, Location, and Description

The Tobyhanna Army Depot (TYAD) is located in the Pocono Mountains of northeastern Pennsylvania, approximately 20 miles southeast of Scranton, Pennsylvania, in Coolbaugh Township, Monroe County. Fig. 1-1 shows the location and current boundaries of TYAD. The installation encompasses approximately 2.2 square miles (mi). Operable Unit I (OU1) consists of Areas A and B. Fig. 1-2 shows the location of Areas A and B on TYAD.

1.1 Site Topography

TYAD lies in the southern New York section (locally termed the Pocono section) of the Appalachian Plateau Physiographic Province. The section is characterized by mature glaciated plateaus of moderate relief with broad intervening lowlands. Within TYAD, the relief varies over a range of approximately 220 feet (ft); the lowest elevation (1,930 ft) occurs south of Barney's Lake; the highest elevation (2,150 ft) occurs on Powder Smoke Ridge. Fig. 1-3 shows a topographic relief map of TYAD.

1.2 Adjacent Land Use

TYAD is bordered to the north, east, and west by the Tobyhanna State Park Reserve (Fig. 1-1). The area south of TYAD is owned by various residential property owners within the Village of Tobyhanna.

1.3 Surface Water Hydrology

Fig. 14 shows the surface drainage features at TYAD. No through-flowing drainageways exist on TYAD. Surface drainage, originating within TYAD, flows principally into Cross Keys Run, Barney's Lake, and Hummler Run. Oakes Swamp receives drainage from the western and northern portions of TYAD and discharges to the north-northwest.

1.4 Site Soils

The Monroe County Soil Survey (Lipscomb, 1981) identifies six soil series within the study area. Fig. 1-5 depicts the soil series at TYAD. The site consists mostly of cut and fill land. The Empeyville soils are present on the higher areas and particularly on the topographic rise that divides the eastern and western wetland systems. Volusia soils are present toward the bottom of gentle slopes and Chippewa, Norwich, and Mucky Peat soils are associated with topographically low areas. Three of the six soil types within the study area (Chippewa, Norwich, and Mucky Peat) are hydric. Two other units (Volusia and Empeyville) may have inclusions of hydric soils. Descriptions of these soil types are presented in App. E of the Remedial Investigation/Feasibility Study at Tobyhanna Army Depot, Draft Final Remedial Investigation Addendum (RI Addendum) [Environmental Science & Engineering, Inc. (ESE), 1992c].

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1.5 Geohydrologic Setting

1.5.1 Shallow Unconsolidated Deposits

The shallow, unconsolidated geologic deposits present at TYAD consist primarily of materials derived from glaciation. Fig. 1-6 shows the shallow unconsolidated deposits at TYAD. Glacial advance and retreat cycles caused extensive bedrock surface scouring; consequently, the depth to bedrock at TYAD is highly variable. Due to the extremely large quantities of surface water runoff associated with the end of the most recent glacial period, numerous cobbles and boulders were deposited in the region now occupied by TYAD. These cobbles and boulders are interspersed with varying amounts of sand and clay and comprise the unconsolidated material beneath TYAD, which is knowp as glacial till. Although the till depth varies considerably throughout TYAD, the average deposit thickness around Areas A and B is about 20 to 30 ft. Bedrock underlying TYAD consists of fractured sandstone.

1.5.2 Consolidated Bedrock

Fig. 1-7 shows a geologic map of consolidated bedrock on TYAD. The bedrock underlying TYAD is dominated by the sandstones of the Catskill Formation of Upper Devonian age. Two members of this formation, the Duncannon Member and the Poplar Gap Member, are represented at TYAD; only the latter is found in Areas A and B. The Poplar Gap Member consists of fine to medium-grained gray sandstones. The rock is well indurated and quartzitic, with abundant trough crossbedding. The sandstones grade upward into grayish-red siltstones and shales, which comprise up to 25 percent of the unit. The total thickness of the unit is approximately 320 meters (m).

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1.6 Groundwater

1.6.1 Shallow Unconsolidated Deposits

Groundwater is present in both the glacial till and fractured bedrock aquifers. Water in the glacial till is not used as a potable water source. Groundwater in the glacial till aquifer generally flows from Areas A and B toward the west. Fig. 1-8 presents groundwater contours based on data collected during March 1996. Since the glacial till and fractured bedrock aquifers are hydraulically linked, volatile organic compounds (VOCs) in glacial till groundwater can move downward into the bedrock. The presence of fractures is expected to influence strongly the groundwater flow and VOC migration through the bedrock aquifer.

1.6.2 Consolidated Bedrock Aquifer

The Poplar Gap Member of the Catskill Formation, which underlies all of the study area, is the major source of domestic water supply. This aquifer has the potential for large yields from wells located on fracture traces and is suitable for industrial purposes. The water quality is considered good, with an average yield of about 2.3 gallons per minute (gpm). Historic chemical analyses of water from wells in the Catskill Formation indicate that dissolved solids concentrations average about 100 milligrams per liter (mg/L). Considerable variation in well depth within the Catskill Formation is typical and is related to thickness of surficial cover, with an average depth to bedrock of 50 ft. Depth to the groundwater surface also averages 50 ft. Water in the fractured bedrock represents a water supply source for nearby residents. Groundwater in the fractured bedrock aquifer flows from Areas A and B in a south-southeast direction toward the Village of Tobyhanna. Fig. 1-9 presents groundwater contours of the bedrock aquifer based on groundwater elevation data collected in March 1996.

1.7 Wetlands

Most wetland areas are considered environmentally sensitive because of their functional values, which provide habitat for wildlife, serve as potential groundwater recharge areas, and improve water quality. Barney's Lake and Hummler Run comprise wetlands that could potentially be affected adversely by contaminant runoff from Areas A and/or B at TYAD. Materials could flow directly from Area B into Hummler Run, or materials reaching the Barney's Lake system could ultimately flow into Hummiler Run and impact nearby wetlands and organisms. Field surveys were conducted to verify the nature and extent of existing wetlands identified by aerial photography and

National Wetland Inventory maps, as well as additional wetlands. Wetlands in the area are identified on the National Wetlands Inventory Map, FICWD, 1989. The area of wetlands delineation on TYAD is shown on Fig. 1-10. No remedial activities are expected to occur in wetlands. Additional wetlands information is presented in Sec. 6.0 and App. E of the RI Addendum (ESE, 1992c).

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2.0 Site History and Enforcement Activities

2.1 Site History

TYAD was initially established as Camp Summerall when the government purchased 33 mi 2 of land in northeastern Pennsylvania in 1909. In 1913, the area was used by the Army and National Guard for machine gun and field artillery training, and later was renamed Tobyhanna Military Reservation. The reservation became an ambulance and tank regiment training center and an ordnance storage depot during World War I (WWI).

The installation was deactivated after WWI and remained inactive until 1932. From 1932 to 1938, the area was used as a camp by the Civilian Conservation Corps. From 1938 to 1941, the area was used by cadets from West Point for field artillery training.

In 1942, the installation was reactivated as an Army/Air Force Service Unit Training Center. The area was also converted to a storage and supply area for gliders and other equipment of the Air Service Command in 1944. The installation was deactivated after World War II (WWII).

The Commonwealth of Pennsylvania purchased the Tobyhanna site from the War Assets Administration in 1949. The Department of Forests and Waters and the Pennsylvania State Game Commission maintained the property from 1949 to 1951. During January 1951, 2.2 mi # was obtained by the Signal Corps for depot construction. Depot construction was performed by a civilian contractor; this contractor used the southeastern comer of TYAD as a base of operations and an equipment staging area. The balance of the tract remained as state-owned land with the federal government exercising recovery rights. In the following years, up to and including the present, much of this tract has been designated as state game lands and parks.

Tobyhanna Signal Depot was established as a Class II installation during February 1953, with an assigned supply mission. In August 1962, the depot was redesignated as TOAD (In 1994, the call letters for Tobyhanna Army Depot were changed from "TOAD" to "TYAD") and transferred to the U.S. Army Materiel Command. Since 1962, TYAD has assumed a variety of missions ranging from the U.S. Department of Defense (DoD) household goods movement and storage, to maintaining the Army's central file of motion pictures and distribution of audio-visual materials,

Currently, TYAD is a communications-electronics (C-E) maintenance and supply depot assigned to the U.S. Army Industrial Operations Command. The primary mission is logistics support for C-E equipment throughout the Army. TYAD is the largest C-E overhaul facility in the Army and is responsible for overhauling, rebuilding, repairing, converting, inspecting, testing, and assembling items including Tactical Fire Direction Systems and Satellite Communication Systems. Since its activation, TYAD has been a Govermnent-Owned/Govermnent-Operated installation. No industrial leases have existed at TYAD.

The locations of known contamination at OU1 may be separated into two distinct areas. The first of these two areas is centered around a site that was used in the past as a burning ground; designated in the Remedial Investigation/Feasibility Study at Tobyhanna Army Depot, Final Remedial Investigation Report A011 (RI) (ESE, 1988a) as Area A (Fig. 1-2). This area consists of trenches and pits that were excavated and used during the late 1950s and early 1960s for burning waste generated by TYAD. No records are available concerning the specific identity or quantities of materials deposited at this site; however, in addition to construction debris and similar types of waste material, flammable liquids may have been disposed in the pits to act as a fuel source for ignition of debris.

A second area of potential contamination was identified after the investigation at Area A had begun. At the suggestion of a long-term resident, an area near the southeastern corner of TYAD was examined for possible contamination. On inspection, three potential areas of contamination were identified: a large clearing near the middle of the site, a trench containing fragments of rusted drums near the western edge of the site, and a pile of debris with additional drum fragments on the ground surface near the southwestern edge of the site. This area was subsequently termed Area B (Fig. 1-2).

2.2 Enforcement Activities

The initial stage of the TYAD Installation Restoration Program (IRP), the Discovery Phase, consisted of an Initial Installation Assessment (IIA) (records search), which was conducted in 1979 and published in January 1980. Based on the results of this assessment and active efforts by TYAD personnel to address several of the problem areas, the U.S. Army Environmental Center (USAEC) concluded that additional investigative efforts were not warranted. Subsequently, USAEC determined that some of the original record searches conducted nationwide during the late 1970s and early 1980s should be reevaluated due to changes in the environmental laws. As a result of environmental problems discovered subsequent to the original onsite visit and changes in the mission of the installation, TYAD was included in this relook program. During October 1986, a reevaluation of TYAD was conducted; the final report became available in February 1988 (ESE, 1988b). USAEC requested aerial imagery analysis support from the U.S. Environmental Protection Agency's (EPA's) Environmental Photographic Interpretation Center (EPIC), along with the relook program. EPIC provided a summary of any possible Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related problem areas at TYAD identifiable through evaluation of historical aerial imagery. Based on information gathered during this reevaluation phase, conditions that merited initiation of the next phase of the IRP (i.e., RI/FS) were observed.

VOCs were first discovered at TYAD in 1981 in one of the onsite drinking water supply wells (well ON-3, see location on Fig. 1-2). An activated carbon groundwater treatment system was subsequently installed to remove VOCs prior to use. Later that same year, sampling conducted by Pennsylvania Department of Environmental Protection (PADEP) revealed the presence of trichloroethene (TCE) and tetrachloroethene (PCE) (collectively referred to as VOCs) in nearby residential wells. Although residents were subsequently notified of elevated VOC levels, TCE concentrations did not exceed PADEP's 1981 drinking water standard of 45 parts per billion (ppb).

In August 1986, the Monroe County Planning Commission collected groundwater samples from residential wells near TYAD, which also showed elevated levels of VOCs were in several wells. Follow-up sampling by PADEP confirmed these findings, as well as the fact that certain wells contained TCE levels exceeding the new federal drinking water maximum containinant level (MCL) of 5 ppb. Based on these new findings, the Army began supplying bottled water in March 1987 to affected residences.

In September 1987, the Army initiated a RI/FS at TYAD to determine the source of the VOCs in groundwater and to characterize its nature and extent. Results from the RI/FS confirmed that Area B was the source of VOCs in groundwater underlying TYAD and a portion of the Village of Tobyhanna. Although Area A was also identified as a source of VOCs, groundwater from this area has not migrated beyond the installation boundary.

In 1989, the Army replaced the previously mentioned activated carbon groundwater treatment system with a permanent air stripper device to remove VOCs from drinking water supply well ON-3.

EPA completed a Hazard Ranking System (HRS) evaluation of TYAD in July 1989. TYAD was proposed for inclusion on the National Priorities List (NPL) on July 14, 1989, and subsequently added to the final NPL on August 30, 1990. As a result of TYAD's NPL listing, the Army and EPA negotiated a comprehensive Federal Facility Agreement, which was signed by EPA on November 19, 1990, and became effective on January 31, 1991.

In June and July 1990, a treatment study was performed to assess the effectiveness of removing TCE from soils with the passive volatilization technology. This pilot study involved excavating 32 cubic yards (yd 3) of TCE-contaminated soil from Area B. The pilot study concluded that passive volatilization would be an effective technology for removing TCE from soil.

In September 1990, the Army conducted the second phase of field investigations to more clearly determine the extent of groundwater containing VOCs in Areas A and B, supplement existing hydrogeology information in the southeast portion of TYAD, confirm results from previous surface water and sediment sampling, and examine potential impacts to environmental receptors and critical habitats. Results are included in the RI Addendum report.

In June 1991, the Army installed a waterline from TYAD to 23 affected residences/businesses to provide a more continuous potable water source. One additional resident was connected to this supply in June 1995. In 1991, TYAD implemented a waterline agreement with the affected residents which provides that they will stop using their wells, and in return TYAD will continually supply water to the 24 residences/businesses until groundwater at the affected private wells is safe for potable purposes. Although these residences/businesses no longer use their wells, the waterline agreement stipulates that the wells shall continue to be made available to the Army for monitoring purposes. Additionally, other residents/businesses will be connected to the TYAD water supply if VOC contaminant concentrations in their wells exceed MCLs, and this exceedance is a result of groundwater contaminated at TYAD. Since 1988, offsite residential wells have been sampled semi-annually.

During the RI/FS, coal ash was discovered in soil samples collected at Area A. Coal ash is residue generated from the burning of anthracite coal. To determine the extent of coal ash in Area A and assess potential impacts to human health and the environment, the Army conducted supplemental sampling in April 1992. Although discrete areas of coal ash were not observed, several samples contained a mixture of soil and coal ash. Results from supplemental sampling have also been included in the RI Addendum report. A final RI report was accepted by EPA in 1988. EPA approved the RI Addendum; Remedial Investigation/Feasibility Study at Tobyhanna Army Depot, Endangerment Assessment (EA); and Remedial Investigation/Feasibility Study at Tobyhanna Army Depot, Draft Final Feasibility Study Report for the Areas A and B Operable Unit (FS) in 1993.

In September 1993, the Army issued the proposed Remedial Action Plan for Operable Unit 1 at Tobyhanna Army Depot (Remedial Action Plan). This document presented five alternatives for remediating contaminated soil and groundwater at TYAD. A public meeting was held on November 4, 1993, to discuss the alternatives presented in the Proposed Plan and explain the reasons for the recommendation of the preferred alternative. There was no significant comment to the recommended alternative from the public during the public comment period.

The preferred alternative presented at the November 1993 public meeting was Alternative 4P, which involved soil and groundwater treatment. (The "P" denotes that this alternative was previously considered. However, since the collection of predesign field data, this alternative is no longer considered applicable.) Soil treatment was to involve excavating soil in excess of soil cleanup levels at Areas A and B and reducing VOC concentrations using a technology called passive volatilization. This approach would have involved placing soil within a lined treatment cell, which is referred to as a bubble, and forcibly drawing air through the soils to remove VOCs.

Soil cleanup levels were developed by the Summer's Model, a fate and transport model used to determine levels to which the VOCs in soils should be reduced in order to ensure that leaching of any contaminants from soil to groundwater would not cause the groundwater to exceed the federal MCLs. The cleanup levels developed for soils by the Summer's Model are as follows:

	Area A	Area B
D Trichloroethene (TCE) - milligrams per kilogram (mg/kg)	0.067	1.67
D Tetrachloroethene (PCE) - mg/kg	0.180	4.66

The Pennsylvania Land Recycling Act of 1995, Act 2, also establishes cleanup levels for soil. The Act 2 standard for both TCE and PCE in soil is 2 mg/kg. Since the modeled soil cleanup level for Area B is greater than 2 mg/kg (4.66 mg/kg), the Act 2 standard of 2 mg/kg was used as the established cleanup level for PCE in soils at Area B. Hereinafter, the Summer's model and Act 2 cleanup levels which were used as the basis for remediation of soils at OU1 will be referred to collectively as "soil cleanup levels".

Groundwater treatment was to involve an extraction and treatment system consisting of four onpost extraction wells and one offpost extraction well. Groundwater would be processed through an onpost treatment system, which would consist of an air stripper to remove VOCs from the groundwater. If necessary, VOC emissions from the air stripping tower would be treated, using vapor phase carbon, prior to discharging air to the atmosphere. After treatment, groundwater would be discharged to one of several locations; the specific location was to be defined in a later phase of work.

After the public comment period, the Army collected site data to evaluate the feasibility of implementing the preferred alternative at TYAD (i.e., first two data columns of Table 2-1). For soils, the results of the 1994 data collection effort showed that the actual extent of soil contamination was less than that originally estimated. In fact, the levels of constituents detected in soils in Area A were less than soil cleanup levels, and therefore, no treatment was required at this site. Due to the limited soil contamination found onsite in Area B, the Army conducted a Removal Action in July 1995 and removed approximately 2,100 yd 3 of VOC-contaminated soils. The removal action, which entailed excavation and offsite disposal of contaminated soil, was conducted instead of using the passive volatilization technology because it was more cost effective. Sampling of remaining site soils, conducted after the removal action was complete, showed concentrations of VOCs (last column of Table 2-1) in soils were less than soil cleanup levels.

Because a removal action was completed in Area B, and remaining soil concentrations in Areas A and B are less than soil cleanup levels, no further action is warranted for VOCs in soil.

Table 2-1. Maximum Contaminant Concentrations in Soil-Areas A and B in 1994, and Area B Maximum Concentrations following the 1995 Removal Action

	Concentration (mg/kg)		
Contaminant	Area A 1	Area B (prior to removal action 2)	Area B (following removal action)
PCE*	0.110	14.0	0.88
TCE*	0.043	7.80	0.56

Note: mg/kg = milligrams per kilogram.
PCE = tetrachloroethene.
TCE = trichloroethene.

1 Maximum concentrations reported during original RI effort (1987): TCE = 0.449 mg/kg, PCE = ND.

2 Maximum concentrations reported during original RI effort (1987): TCE = 5.05 mg/kg. PCE = 5.48 mg/kg.

*Pennsylvania's Land Recycling Act of 1995, Act 2, cleanup level is 2 mg/kg for both contaminants. Site-specific cleanup levels are 0.067 mg/kg for TCE and 0.180 mg\kg for PCE at Area A, and 1.67 mg/kg for TCE and 4.66 mg/kg for PCE at Area B, and are based on the Summer's Model.

In December 1996, TYAD sampled additional onpost areas where coal ash material was deposited for comparison to Area A samples collected in 1992. EPA performed a statistical comparison of 1992 and 1996 data and determined that, with the exception of one sample in Area A taken at a depth of 4 ft, only aluminum and manganese were above background range for similar types of soil. However, the concentrations of aluminum and manganese were below EPA's risk-based concentration levels for industrial soil. Therefore, as long as future use remains industrial at TYAD, no further action is necessary for soils.

For groundwater, site data showed extraction of contaminated groundwater was impractical due to the inability of extraction wells to efficiently recover contaminated groundwater. EPA and PADEP agreed with the Army's conclusions and recommended that the Army revise the original Proposed Plan to delete four of the original alternatives and address two new alternatives: (1) natural attenuation (the current preferred alternative), and (2) limited groundwater treatment. The two new alternatives, in addition to a revised no-action alternative, were presented to the public at a meeting held on March 26, 1997.

3.0 Highlights of Community Participation

The RI Addendum, EA, and FS and the first proposed Remedial Action Plan (Areas A and B) (ESE, 1993a) at TYAD were released to the public in September 1993. These documents were made available to the public through information repositories maintained at the Coolbaugh Township Municipal Building in Tobyhanna, Pennsylvania, and the Public Affairs Office at TYAD. The notice of availability of the RI, RI Addendum, EA, FS, and proposed Remedial Action Plan was published in The Pocono Record on September 30, 1993. A formal public comment period was held from September 30 through November 13, 1993. A public availability/ public meeting was also held on November 4, 1993, at the Coolbaugh Township Volunteer Fire Company Hall. The Proposed Remedial Action Plan (Revised) for Operable Unit 1 at Tobyhanna Army Depot (Revised Remedial Action Plan) was released to the public in March 1997. A new availability/public meeting announcement for the RI; RI Addendum; EA; FS; proposed Remedial Action Plan, as well as new documents which include the Preliminary Remedial Design (Weston, 1996) and the Contaminated Soil Removal from Area B report (OHM, 1996) was published in The Pocono Record on March 19, 1997. A second public meeting for the new Revised Remedial Action Plan was held on March 26, 1997, at the Coolbaugh Township Municipal Bldg.

At each of the two Proposed Remedial Action Plan meetings, representatives from the Army, EPA, and PADEP were available to summarize the remedial alternatives presented in the proposed Remedial Action Plan (ESE, 1993a) and Revised Remedial Action Plan (ESE, 1997), discuss the rationale for selecting the preferred alternative, and discuss site-related issues raised by the public and the remedial alternatives under consideration. In addition, during the second public meeting, representatives from the Army, EPA, and PADEP discussed the rationale for revising the 1993 proposed Remedial Action Plan.

A response to the comments received for the proposed Remedial Action Plan (1997) during the public comment period is included in the Responsiveness Summary (Attachment A) of this Record of Decision (ROD). No written comments were received during the 30-day public comment period. In addition, no verbal comments were presented during the March 26, 1997 public meeting regarding OU1. This decision document presents the selected remedial action for the OUI at TYAD, chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for this operable unit (OU) is based on the administrative record.

In addition to the community being involved in the planning phase of activities at TYAD, a Restoration Advisory Board (RAB) was established in June 1994 and meets quarterly at the Coolbaugh Township Municipal Bldg. The RAB was kept informed of information developed for OU1 and had the opportunity to comment on any issues at the quarterly RAB meetings.

4.0 Scope and Role of OU1

Discrete portions of an NPL site are often managed more effectively as OUs. This ROD for OU1 [Area A (AOC#4) and Area B (AOC#7)] addresses VOC-contaminated groundwater underlying the southeastern portion of TYAD and the Village of Tobyhanna, Pennsylvania (Fig. 1-2). Two other RODs have been finalized at TYAD:

- OU2 addresses the former polychlorinated biphenyl (PCB) transformer substation site (AOC # 63), and
- OU3 addresses Bldgs. 10C and S90 (AOC # 37 and AOC # 38, respectively).

Contaminated soils within OU1 were previously addressed by a removal action completed in 1995. The general objectives of response actions at OU1 are to: (1) minimize the potential for future migration of VOCs in groundwater, and (2) restore groundwater in the glacial till and bedrock aquifers to beneficial use and to levels protective of human health and the environment, as soon as practicable, through natural attenuation. An interim objective of the response actions is to continue to prevent exposure of groundwater until it has been restored to federal MCLs. With the completion of the removal action at OU1, contaminated soil was removed and resulted in a permanent reduction in the toxicity and volume of contaminated soil, and minimized future releases of VOCs to groundwater.

The selected alternative for OU1, Natural Attenuation/Long-Term Monitoring/Institutional Controls for groundwater and no further action for soils, involves collecting groundwater samples twice per year. These data will be evaluated to determine if the size and strength of the groundwater plume is decreasing over time. If future data collection shows that the plume size and strength is not decreasing over time, the implementation of a different alternative, Limited Groundwater Treatment/Institutional Controls/Monitoring, may be necessary to remove groundwater in areas of highest contaminant concentrations. As presented in Sec. 2.0, a removal action was conducted in Area B in 1995. The removal action removed all soils that exceeded soil cleanup levels (see Page 2-5). Sampling in Area A showed that no remediation was required in this area. EPA and PADEP agreed that no further action is required to address VOC contaminated soils in OU1.

5.0 Summary of Site Characteristics

5.1 Overview and Extent of Site Contamination

The primary environmental concerns at TYAD OU1 are represented by VOC-contaminated groundwater. Contaminated soil was also a concern at TYAD OU1; however, the removal action completed in 1995 remediated contaminated soils to soil cleanup levels (see page 2-5).

Analytical results indicate that the groundwater in the southeastern portion of TYAD, and in a semicircular area southeast (offpost) of TYAD, has become contaminated with VOCs that originate from a source area located in the southeastern corner of TYAD. The offPost area, encompassing a portion of the Village of Tobyhanna, has been affected. A well (also referred to as R2-28) located in Tobyhanna, operated by the Tobyhanna Water Company, has also been found to contain detectable quantities of VOCs. To date, a total of 26 different offsite residential wells were reported with detectable levels of VOCs, of which 24 receive a potable water supply from TYAD. Fifteen of the 26 residential wells have reported VOC detections in excess of MCLs.

The locations of known contamination may be separated into two distinct areas. The first of these two areas is centered around a site that was used in the past as a burning ground; this is designated in the RI (ESE, 1988a) as Area A (Fig. 1-2). This area consists of trenches and pits that were excavated and used during the late 1950s and early 1960s for the burning of waste generated by TYAD. No records are available concerning the specific identity or quantities of materials deposited at this site; however, it is believed that, in addition to construction debris and similar types of waste material, flammable liquids may have been disposed in the pits to act as a fuel source for ignition of the debris.

A second area of potential contamination was identified after the investigation at Area A had begun. At the suggestion of a long-term resident, an area near the southeastern corner of TYAD was examined for possible contamination, On inspection, three potential areas of contamination were identified: a large clearing near the middle of the site, a trench containing fragments of rusted drums near the western edge of the site, and a pile of debris with additional drum fragments on the ground surface near the southwestern edge of the site. This area was subsequently termed Area B (Fig. 1-2).

The results of field sampling investigations (e.g., soil, surface water, sediment, and groundwater) are briefly summarized in Secs. 5.1.1 through 5.1.3. Additional information regarding sampling locations and methodology is presented in the RI (ESE, 1988a) and RI Addendum (ESE, 1992c).

5.1.1 Soil

Soil sampling conducted during the RI showed the presence of VOCs at Areas A and B (see Table 2-1). The column denoting "Area A" in Table 2-1 shows TCE and PCE concentrations as they were reported during the RI (1988a), and are the highest historical concentrations reported at Area A. These detected levels are below soil cleanup levels. The locations from where the RI samples were collected were sampled again during the predesign investigations conducted in 1994.

The results of the predesign investigation showed that the maximum reported concentration of any VOC was less than one-tenth of the maximum level reported in the RI. Based on these data, and since contaminant levels were less than soil cleanup levels at Area A, it was determined that soil remediation in Area A was not necessary. Therefore, response action for Area A is deemed unnecessary to protect human health and the environment.

The column denoting "Area B (prior to removal action)" in Table 2-1 shows TCE and PCE concentrations as they were reported during the predesign investigation (1994). These concentrations were the maximum historical concentrations reported at Area B. All soils exceeding soil cleanup levels were removed during the removal action conducted in 1995. The last column in Table 2-1, "Area B (following the removal action)" shows the highest concentrations of TCE and PCE that remain at Area B following the removal action. These levels are below soil cleanup levels. Therefore, further response action for Area B is deemed unnecessary to protect human health and the environment.

Sample results from the RI showed detectable levels of the pesticides 1,1-dichloro-2,2-bis-(p-chlorophenyl)ethane (DDD); 1,1-dichloro-2,2-bis-(p-chlorophenyl)ethene (DDE); and 1,1-trichloro-2,2-bis-(p-chlorophenyl)ethane (DDT) in soil samples from Area A. These levels are below EPA's risk-based concentrations for soil. Also, in December 1995, TYAD conducted a basewide ecological risk assessment. Low levels of DDT, DDD, and DDE were found in several upland soil samples both on and offpost. A likely explanation for the presence of DDT and its related compounds is that the pesticide was widely used at TYAD and surrounding private and state lands in the past for insect control. There is no evidence that these compounds were disposed at Area A.

Elevated levels of metals were reported in Area A during the RI, and coal ash was reported in samples collected from this area. TYAD concluded that the observed soil concentrations appear to be indicative of soils mixed with coal ash, a common occurrence in northeastern Pennsylvania.

Coal ash is sometimes used for construction and maintenance material in northeast Pennsylvania and is commonly used throughout northeast Pennsylvania as an anti-skid material. Coal ash was also applied to the TYAD running track as a finishing layer and was used to a great degree in the construction of the railroad spur running through the depot.

In December 1996, TYAD sampled additional onpost areas where coal ash material was deposited for comparison to Area A samples. The purpose of this analysis was to collect actual site data (coal ash) to confirm if elevated metals reported in the burn pits of Area A (as reported in 1992) are associated with coal ash. EPA performed a statistical comparison of 1992 and 1996 data and determined that, with the exception of one sample in Area A taken at a depth of 4 ft (i.e., within the burn pit), only aluminum and manganese were above background range for similar types of soil. However, the concentrations of aluminum and manganese were below EPA's risk-based concentration levels for industrial soil; therefore, as long as future use remains industrial, no further action is necessary with respect to inorganics in soils at Area A. The use (and related exposure) is an important determinant of risk from overall soil exposure to aluminum and manganese, and localized exposure (if any) to burn pit subsoil. The Army anticipates that TYAD will continue to function as an active military installation zoned for industrial use. In the event that TYAD is closed at some point in the future, and the land transferred/sold to private or other public interests, DoD policy would require a re-evaluation of the risks based on intended reuse.

PADEP has determined that soils at Areas A and B and underlying groundwater do not contain listed hazardous wastes, as defined under 25 Pa. Code 261.30, et. seq. Since a review of published literature indicated that elevated metal levels are commonly present in coal-ash residue, Toxicity Characteristic Leaching Procedure (TCLP) testing was performed on soil and ash soil samples collected during supplemental sampling conducted in April 1992. Neither VOCs nor metals were present in concentrations exceeding TCLP standards.

5.1.2 Groundwater

VOCs have been identified in groundwater underlying the southeast portion of TYAD and the Village of Tobyhanna. VOCs in excess of federal MCLs have been observed in onpost monitor wells and offpost residential wells.

Low levels of VOCs (less than the federal MCLs) have been consistently detected in a well operated by the Tobyhanna Water Company (identified as R2-28 in the lower central portion of Fig. 1-2), which supplies groundwater from the fractured bedrock to a number of homes in the area. Residents connected to the Tobyhanna Water Company, as well as those on private wells, will be supplied potable water if, in the future, monitoring confirms VOCs are present in excess of federal MCLs. All present and future private wells which have been confirmed to have VOCs in excess of federal MCLs will only be used for sampling, until such time that monitoring ensures that the private well is again safe for use as a domestic water supply.

Table 5-1 summarizes maximum levels of VOCs detected to date in onpost monitor wells, onpost drinking water supply wells, and offpost residential wells and a comparison to the respective MCLs for the period between January 1988 and March 1996. In general, all wells were sampled 2 times per year during this period.

Table 5-1. Maximum Contaminant Concentrations in Groundwater

Contaminant	Glacial Till 1	Fractured Bedrock 1	Water Supply 2	Residential 3	MCL
	Concentration (ug/L)				
PCE	190(06/88 and 08/93)	100 (08/88)	1.4(08/88)	12.0 (08/88)	5
TCE	1,000 (01/88)	700 (01/88)	14.0 (01/92)	41 (08/88)	5
Trans-1,2-DCE	3,000 (01/88)	5,000 (03/89)	9.7(08/92)	5.24 (08/92)	100
Vinyl Chloride	500(03/89)	1,000 (03/89)	ND	ND	2

Note: MCL = maximum contaminant level.
ND = not detected.
PCE = tetrachloroethene.
TCE = trichloroethene.
Trans-1,2-DCE = trans-1,2-dichloroethene.
Ig/L = micrograms per liter.

Values in parentheses represent month and year of maximum concentration.

1 Monitor well (MW-) series wells
2 Onsite (ON-) series wells
3 Residential (R-) series wells

Figs. 5-1 and 5-2 show the area of groundwater contaminated with TCE (the predominant contaminant in groundwater) at levels greater than the MCL, as it was reported in January 1988 and March 1996, respectively. The area of groundwater contaminated by TCE with levels in excess of the MCL has decreased by more than 77 percent over the referenced period. When the RI/FS began a total of six onpost bedrock monitor wells exceeded MCLs; while in 1996, a total of three wells exceeded MCLs. In 1988, 12 residential wells exceeded VOC MCLs, while only two wells were above MCLs for TCE and/or PCE in March 1996. The reasons for the decreasing plume size are believed to be direct removal of source contamination in the Area B, adsorption of TCE and PCE on aquifer media, degradation of VOCs, dispersion, dilution, and other natural processes. As of March 1996, concentrations exceeding MCLs were present in two residential wells and four onsite monitor wells.

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Certain metals such as lead and mercury were detected in onpost and offpost wells at levels exceeding applicable drinking water standards. Mercury has not been detected in an onsite monitor well, above drinking water standards, since 1989. Since 1989, mercury has been reported at levels above drinking water standards three times; all of these values correspond to only offsite residential wells. Lead was sporadically detected in onsite monitor wells and some offsite residential wells. However, several offsite residential wells consistently report levels of lead in excess of the drinking water standard. After evaluating several rounds of groundwater monitoring data, the RI Addendum reported that existing data suggest that the elevated metals levels are related to area wide variations in the metals content of the glacial till and bedrock, in combination with the natural acidity of the groundwater. An additional contributing factor may be the deteriorating condition of offpost residential well casings (metal) in response to continued exposure to low pH groundwater. Based on this information, the Army concluded that it was not possible to attribute the presence of metals to past disposal of coal ash or other waste at Areas A and B.

5.1.3 Surface Water and Sediment

VOCs were not detected in any surface water samples collected during the RI and RI Addendum. Although a low level of PCE was observed in one sediment sample, this particular location receives stormwater runoff from many sources on TYAD and may not be attributable to Areas A and B. Based on the data obtained to date, VOCs at Areas A and B do not appear to be adversely impacting the surface water or sediment quality. Therefore, the Army does not plan to address surface water or sediment as part of this OU.

5.2 Routes of Exposure

As previously stated, due to the limited amount of contaminated soils identified, during the pre-design and remedial design investigations, the Army conducted a removal action in July 1995 and removed approximately 2,100 yd 3 of VOC-contaminated soils from Area B. Following the completion of the removal action, site sampling showed concentrations of VOCs in soils were less than soil cleanup levels (see page 2-5). With this information, the EPA and Army agreed that no further action was necessary for soils in Area B. Although soils were considered in the Risk Assessment (RA), this discussion of exposure pathways only addresses groundwater, since all soils with concentrations of VOCs greater than soil cleanup levels were removed during the 1995 removal action.

Based on EPA guidance, one or more exposure routes (i.e., ingestion, inhalation, and/or dermal contact) are associated with contaminated groundwater. Therefore, several routes of exposure exist, depending on the receptor and the land use scenario being considered. Each potential exposure pathway was evaluated in the exposure assessment and is briefly described in Secs. 5.2.1 through 5.2.3. Table 5-2 provides a list of the potential exposure pathways, including those that were selected and those that were not selected for quantification.

For the purposes of the RA for groundwater, the Army assumed unrestricted use of offsite contaminated groundwater. This scenario is conservative in that residences/businesses private wells which do have levels of VOCs in excess of MCLs have been provided an alternative water source. However, assuming offsite receptors that are currently connected to the waterline are exposed to groundwater, through these uses of groundwater, persons may be exposed to contaminants originating from the two identified source areas. Therefore, these pathways are included in the exposure analysis for TYAD.

For the exposure pathways discussed in the following sections, current use and future use exposure scenarios were developed to evaluate the risks to human health from exposure to groundwater. Current use at the offpost area considers only residential users (adults and children). Future use at onpost and offpost areas is represented by residential users. A current use onsite scenario is not presented herein because contaminated soils have been removed from the site and there is no current use of contaminated groundwater.

The RAs for Offpost Area 1, Offpost Area 2, and Offpost Area 3 consist of the effects to receptors through domestic uses of groundwater (inhalation, ingestion, and dermal contact), exposure associated with watering vegetables (inhalation), and consuming vegetables (ingestion).

The current use scenario included the use of groundwater as a source of drinking water. The Army has installed a waterline to provide a continuous source of potable water to nearby residents. Consequently, many individuals within Offpost Area 1 or Offpost Area 2 are not currently using groundwater.

Table 5-2. Summary of Exposure Pathways for TYAD

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Selected for Evaluation?	Reason for Selection
	Areas A and B		
Current Land Us			
Adult, Child	Ingestion of contaminated fish from Barney's Lake	No	The volatile COCs are not bioaccumulated
Hypothetical Future Land Use			
Resident Adult, Child	Ingestion of ground-water, inhalation of volatiles	Yes	Area could be developed in the future as a residential area
	Area B-Offpost Sites		
Current and Hypothetical Future Land Use			
Resident Adult, Child	Direct dermal contact, ingestion of ground-water, ingestion of contaminated vegetables, and inhalation from watering vegetables	Yes	Area is currently a residential area

Source: ESE, 1992a.

Future use at Areas A and B includes receptors who use groundwater for domestic purpose (inhalation, ingestion, and dermal contact). Exposure pathways for groundwater in Offpost Areas 1 and 2 include receptors who may use groundwater for domestic purposes (inhalation, ingestion, and dermal contact) and who might also become exposed while watering vegetables (inhalation) and consuming vegetables (ingestion). Offpost Area 3 includes receptors who may use groundwater for domestic purposes (inhalation, dermal contact, and ingestion).

The future residential use scenario is hypothetical and assumes that the source areas in Areas A and B can be used for unrestricted land use. An unrestricted land use would permit groundwater wells and residential areas to be constructed anywhere in Areas A and B. The future residential use scenario, which was evaluated for comparative purposes, is the most conservative choice for land use and will generate the greatest potential exposure. However, it is unlikely that TYAD's missions will be eliminated and the depot land be used for residential purposes. Since TYAD currently fulfills a critical mission that will be necessary as part of future Army operations, and it is Army practice to clean up to the current land use scenario, no soil cleanup levels were based on the onsite future residential use scenario (groundwater risks are based on potential residential use, as appropriate for this medium, particularly offsite). If, in the future, TYAD would be subject to base closure, site-related risk would be re-evaluated in accordance with DoD base closure policy (10 U.S.C. 2687 and NOTE).

5.2.1 Direct Contact Route

The greatest dermal exposure potential associated with exposure to groundwater was expected to occur to individuals taking baths, with showering representing a smaller potential exposure and the other activities mentioned (e.g., running through sprinklers and playing in small child pools) representing even lower potential exposures.

5.2.2 Ingestion Route

Residents with wells where VOC constituents exceeded the MCLs were initially supplied bottled water for all drinking and cooking purposes. These homes have now been connected to a waterline from TYAD that provides potable water. While the wells at these homes were to have been rendered unusable, it was considered possible that some of the contaminated wells may still be accessible. Alternatively, in the absence of any remedial action or controls, future wells could be installed or contaminants could migrate. In accordance with EPA (1989) guidance, ingestion of contaminated water is included as a possible exposure pathway. This pathway included residents who may incidentally ingest small quantities of contaminated water during bathing or showering or from cooking with contaminated water, and those who may use the contaminated water as a potable water source. In addition, children may ingest small quantities of water during outdoor summer water play activities such as running through water sprinklers or playing in small child pools filled with well water.

Indirect ingestion of contaminants from groundwater was also evaluated in the exposure analysis. During the summer growing season, residents may use water from contaminated wells to spray- or flood-irrigate home vegetable gardens. Contaminants in plants would be present in edible portions. Residents consuming homegrown vegetables watered with contaminated water may ingest contaminants that have bioaccumulated from the groundwater.

Through these uses of groundwater, persons may be exposed to contaminants originating from the two identified source areas. Therefore, these pathways were included in the exposure analysis at TYAD.

5.2.3 Inhalation Route

Volatilization from groundwater use was evaluated in the exposure analysis. Residents using contaminated well water for showers, baths, and other nonconsumptive household uses may be exposed to vapors released during these activities, inhalation of vapors during showering was quantified in the exposure analysis for TYAD. Residents using contaminated well water for showers, baths, and other nonconsumptive household uses may be exposed to vapors released during these activities (e.g., running through sprinklers or playing in small child pools); therefore, this exposure route was quantified in the exposure analysis for TYAD. Residents may receive repeated exposures through these activities and may accumulate a significant intake of the contaminants over time. Therefore, this pathway was included in the exposure analysis for TYAD.

5.3 Contamination Migration

Prior to the removal action conducted in 1995, contaminants detected in the two source areas (Areas A and B) could migrate toward potential receptor areas and into other environmental media adjacent to the source areas. Contaminants in the soil could either have leached through rainfall infiltration to the groundwater or been transported via surface runoff to surface water bodies. As a result of their high vapor pressures and Henry's law (H5) constants, any volatile contaminants at the soil surface and in surface water were likely to volatilize into the atmosphere where contaminant oxidation can occur. It is also possible for the VOCs that have reached groundwater to volatilize from the water table and diffuse through soil pore spaces to reach the surface where the compounds eventually are released to the atmosphere. However, because VOC contaminated soils have been removed, the chemical migration pathway discussion focuses on groundwater pathways. Based on groundwater flow patterns in conjunction with surface water and sediment analytical data, no contaminants from either Area A or B are expected to reach any of the surface waters adjacent to Areas A and B. These sources are not thought to represent a significant pathway in terms of exposure to contaminants originating from either Area A or B.

6.0 Summary of Site Risks

6.1 Introduction

The Baseline Risk Assessment for air, groundwater, surface water, sediment, and soil contamination at TYAD was performed as part of the EA (ESE, 1992a) to determine if the chemical concentrations observed in the soil and groundwater samples from the site pose a significant risk to human health and the environment. Although certain chemicals of potential concern (COPCs) were detected in sediments and surface waters, they did not pose unacceptable risks to human health and the environment and were not considered during the RA. Consequently, with respect to OU1, the EA only evaluated potential risks in terms of air, soil, and groundwater.

As previously stated, due to the limited amount of contaminated soils identified during predesign and remedial design investigations, the Army conducted a removal action in July 1995 and removed approximately 2,100 yd 3 of VOC-contaminated soils from Area B. Following the completion of the removal action, site sampling showed concentrations of VOCs in soils were less than soil cleanup levels (see page 2-5). With this information, PADEP agreed with EPA and the Army that no further action was necessary for soils in Area B; therefore, this RA section only addresses groundwater.

The RA was developed for both onpost and offpost populations. With respect to the onpost population, exposure to Areas A and B were considered separately. Offpost exposure from Area B was evaluated by dividing the community into three distinct areas (Offpost Areas 1, 2, and 3), based on the movement of VOCs determined from groundwater monitoring data. OffPost Area 1 is defined by the land overlying groundwater where VOCs have been found. The Army has already provided a drinking water supply to the majority of individuals within Offpost Area 1. Offpost Area 2 consists of areas downgradient of the groundwater plume. Some of these individuals are also currently receiving a water supply from TYAD. Although groundwater from Tobyhanna Water Company supply well [designated as R2-28 in the RI (ESE, 1988a) and RI Addendum (ESE, 1992c)] is included within Offpost Area 2, it was evaluated as a separate area from the wells in Offpost Area 2 because it is a water supply well (OffPost Area 3). All three offpost areas are shown on Fig. 6-1.

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6.2 Human Health Risks

The methods used in assessing the risks associated with reasonable maximum exposure (RME) to the site contaminants are those presented in EPA's Risk Assessment Guidance for Superfund (RAGS), Human Health Evaluation Manual (1989a); RAGS Supplemental Guidance, Standard Default Exposure Factors (1991); and other EPA guidance. According to RAGS, actions at Superfund sites should be based on an estimate of the RME expected to occur under both current and future land-use conditions. The RME is defined in RAGS as "the highest exposure that is reasonably expected to occur at a site." The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) (EPA, 1989a).

Based on RAGS, RME human health risks were determined for each exposure pathway at each study area and offsite receptor location (See. 6.2.5) based on RME concentrations and exposure factors [Sec. 5.0 and Apps. E and F-1 of the EA (ESE, 1992a)]. The exposure factor values are a combination of 50th percentile (for factors such as body weight) and 90th percentile (for factors such as exposure duration) values. The combination of values is selected to obtain an overall RME estimate. Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit [i.e., the 95 percent upper confidence limit (UCL 95)] on the mean is the preferred exposure concentration to use in determining potential health risks. However, according to RAGS, if there is great variability in measured or modeled concentration values, the UCL. 95 may be high, and could exceed the maximum detected value. In this case, the maximum detected or modeled concentration was used as the exposure concentration. A majority of the exposure factors were provided in RAGs while several were site-specific factors obtained from site information (e.g., climatic conditions conducive to dermal exposure).

The health risks were evaluated separately for carcinogenic and noncarcinogenic effects, with potential carcinogens evaluated for their carcinogenic and noncarcinogenic effects, where a specific carcinogen has published noncarcinogen criteria.

Risk estimates relevant to aquifer uses are presented for hypothetical future onpost exposure pathways and both current and future offpost water uses. Worker exposure to contaminated groundwater exceeding MCLs was not evaluated under the current use exposure scenario since these individuals are not currently using contaminated groundwater. Therefore, in the case of OUI, it was not necessary to evaluate risk under the current land use scenario because workers are not being exposed to either groundwater exceeding MCLs or unacceptable risks. Although the waterline extension provides water to residences/businesses that have wells that exceed TCE and PCE MCLs, the RA assumed those affected residences/businesses were still using well water.

Offpost exposure scenarios also include the ingestion of potentially contaminated vegetables, and the inhalation of volatile COPCs from irrigation water.

6.2.1 Media of Concern

The RA process outlined in the EA (ESE, 1992a) involves a consideration of COPCs for each medium and routes of current and future exposure for human and nonhuman populations. Although certain COPCs were detected in sediments and surface water, they did not pose unacceptable risks to human health and were not considered further during the human RA. Consequently, with respect to OUI, the potential risks in terms of air, groundwater, and related media were only evaluated for potential impacts to human health in the EA (ESE, 1992a).

6.2.2 COPCs

During the initial steps of the RA, COPCs for human receptors were developed based on the information contained in the RI (ESE, 1988a) and RI Addendum (ESE, 1992c). COPCs were developed and evaluated separately for all environmental media.

The final list of COPCs for the TYAD human endangerment assessment (Table 6-1) was determined by evaluating the results of the ChemScreen analysis and other site-specific evaluation criteria. ChemScreen is a process that compares site maximum chemical concentrations to published toxicity data and provides a general basis for comparison between chemicals. Other site-specific evaluation criteria include background concentration, frequency of detection, and extent of contamination. The following sections (Secs. 6.2.2.1 through 6.2.2.6) provide a description of the COPCs selected for groundwater, surface water, and/or sediment in Areas A and B.

6.2.2.1 Area A

Area A groundwater data indicate the presence of VOCs and inorganics. No potential human COPCs were identified based on the chemical-toxicity screening procedure. Based on the frequency of detection, only seven inorganics (arsenic, chromium, copper, mercury, lead, manganese, and zinc) and three VOCs [TCE, 1,2-dichloroethene (1,2-DCE), and vinyl chloride] of the 31 identified compounds may be considered potential human COPCs. Of the seven inorganics, lead and mercury were evaluated quantitatively in the RA to represent the inorganic class of compounds. However, as discussed in Sec. 5.1.2, lead and mercury are not considered attributable to Area A. A fourth VOC, PCE, was added as a final human COPC based on available information concerning the past practices at this OU.

Table 6-1. Final COPCs for Groundwater

Site	COPC
Area A	1,2-DCE PCE TCE Vinyl chloride Lead Mercury
Area B	1,2-DCE PCE TCE Lead
Area B-Offpost Area 1	1,2-DCE PCE
Area B-Offpost Areas 2 and 3	TCE PCE

Note: COPC = chemical of potential concern.
1,2-DCE = 1,2-dichloroethene.
PCE = tetrachloroethene.
TCE = trichloroethene.

Source: ESE.

6.2.2.2 Area B

Area B groundwater data indicate the presence of VOCs and inorganics. Based on the frequency of detection, five inorganics (copper, lead, manganese, mercury, and zinc) and three VOCs (TCE, PCE, and 1,2-DCE) were considered as potential human COPCs. Of the five inorganics, lead and mercury were evaluated quantitatively in the RA to represent the inorganic class of compounds.

6.2.2.3 Offpost Area 1 From Area B

The screening process for Offpost Area 1 (Fig. 6-1) resulted in the selection of three VOCs (TCE, PCE, and 1,2-13CE) as the human COPCs for the groundwater media.

6.2.2.4 Offpost Area 2 From Area B

The screening process for Offpost Area 2 (Fig. 6-1) resulted in the selection of two VOCs (TCE and PCE) as the human COPCs for the groundwater media.

6.2.2.5 Offpost Area 3 From Area B

The analytical data for Offpost Area 3 indicate the presence of TCE and inorganics in well R2-28. Although this well is within Offpost Area 2, it was evaluated as a separate area from the monitor wells in Offpost Area 2 because it is a water supply well for the Tobyhanna Water Company. Based on these analytical results, TCE and PCE were selected as COPCs for groundwater at this location.

6.2.2.6 COPC Concentrations

Groundwater sampling locations at Offpost Areas 1, 2, and 3 are presented on Fig. 6-1. Onpost monitor well locations are presented on Fig. 6-2.

A fate and transport model was implemented as part of the exposure assessment to evaluate the maximum areal movement of the contaminant plume at the site and assess the migration potential of VOCs in three downgradient wells, R1-110-2, R-102, and R2-28. R1-110-2 was selected because it is near the installation boundary. R1-102 was selected because, based on RI Addendum data, this well contained a high concentration of total VOCs. The third well modeled was R2-28 (Tobyhanna Water Company supply well) because it is representative of Offpost Area 2 as well as a source for potable water supply for a number of residences in the area.

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The model was adapted to account for the time-decay of contaminants leaching into groundwater and migrating offpost to potential receptor well locations. Contamination present at Areas A and B [prior to the 1995 removal action and based on data reported in the RI (ESE 1988a)], represent the source concentrations for input into the model. The model treated the contaminant sources in Areas A and B as one large source to model to the downgradient locations previously described. Because the model assumed the continued leaching of contaminants from the soils (which have since been determined to not require further action due to new data collected in 1994 and the completion of the removal action in 1995), future concentrations (Table 6-2) predicted by the groundwater model are likely over estimated; therefore, related risks calculated using these modeled concentrations should be considered conservative.

6.2.3 Exposure Assessment

The exposure assessment performed for TYAD focuses on Areas A and B, the two primary source areas, described in the RI (ESE, 1988a) and RI Addendum (ESE, 1992c). Environmental monitoring has confirmed that these areas are the principal sources of volatile chlorinated hydrocarbons detected in soil and groundwater.

Groundwater from Areas A and B has been found to be contaminated with VOCs. Groundwater contamination at Area A is contained onpost; however, groundwater contamination at Area B has been identified both onpost and offpost. Currently, onpost personnel receive supplied water for potable purposes. Offpost individuals who were receiving bottled water are now connected to a waterline from TYAD that provides water for domestic use. The wells in the homes to the waterline were to have been rendered unusable for domestic purposes (however, these wells are still accessible to the Army for monitoring purposes); therefore, all exposure to contaminated groundwater for those individuals should have been eliminated. However, because some of the contaminated wells may still be accessible, and because baseline (no action) evaluation was necessary, residential consumption of groundwater was included in the RA (i.e., the waterline was not factored into the RA).

Many of the exposure pathways and potential receptors are similar for the two identified source areas (Areas A and B). These similarities allow consolidated discussions of common exposure pathways and the application of common exposure assumptions and factors in the risk estimation process. For those exposure pathways that are not shared or are more site specific, independent discussions and exposure analyses are presented in this ROD.

Table 6-2. Current and Future Onpost and Offpost Groundwater Concentrations, UCL 95

		Area (Ig/L)				
Compound		A	B	Offpost 1	Offpost 2	Offpost 3 (R2-28)
Current (UCL 95)						
PCE		1.05	1.12 x 10 +2	4.83	--	--
TCE		3.59 x 10 +2	4.59 x 10 +1	1.14 x 10 +1	1.30	--
1,2-DCE		4.85 x 10 +3	1.94 x 10 +2	3.98 x 10 -1	--	--
Vinyl Chloride		1.04 x 10 +3	--	--	--	--
Lead		6.42 x 10 +1	5.20 x 10 +1	NA	NA	--
Mercury		1.30	4.38	NA	NA	--
Future (Modeled Concentrations) ++						
PCE	7 year	NM	NM	4.41	+	4.17 x 10 -1
	70 year	NM	NM	3.76	+	3.44 x 10 -1
TCE	7 year	NM	NM	9.37	+	3.45
	70 year	NM	NM	7.99	+	2.67
1,2-DCE	7 year	NM	NM	--	+	--
	70 year	NM	NM	4.0 x 10 -3	+	--

Note: 1,2-DCE = 1,2-dichloroethene.
NA = not appropriate to include as constituent may be due to plumbing in residential wells.
NM = not modeled.
PCE = tetrachloroethene.
TCE = trichloroethene.
UCL 95 = 95 percent upper confidence level.
Ig/L = micrograms per liter.
-- = below detection limits.
\+ = not modeled; however, data for Offpost 3 (which is a subset of Offpost 2) is representative of this area.
++ = lead and mercury were not modeled because levels reported in groundwater are not considered attributable to Areas A and B (Sec. 5.1.2). Vinyl chloride was not modeled because it has only be reported in MW01 and MW02, both of which are located in Area A.

Source: ESE.

6.2.3.1 Exposure Pathways

Based on EPA (1989) guidance, a number of potential exposure pathways were considered for inclusion in the exposure assessment and are described in the following sections. A list of the potential exposure pathways, including those that were selected and those that were not selected for quantification were presented in Sec. 5.2 (Table 5-2) of this ROD.

As stated in Sec. 6.2.3, current use and hypothetical future use exposure scenarios were developed to evaluate the risks to human health from exposure to groundwater. The future residential use scenario is hypothetical and assumes that the source areas in Areas A and B can be used for unrestricted land use. An unrestricted land use would permit groundwater wells and residential areas to be constructed anywhere in Areas A and B. The hypothetical future residential use scenario, which was evaluated for comparative purposes, is the most conservative choice for land use and will generate the greatest potential exposure. However, it is unlikely that TYAD's mission will be eliminated and the land used for residential purposes. Since TYAD currently fulfills a critical mission that will be necessary as part of future Army operations and it is Army practice to clean up to the current land use scenario, no soil cleanup levels were based on the future residential use scenario (groundwater risks are based on potential residential use, as appropriate for this medium, particularly offsite). If, in the future, TYAD would be subject to base closure, site-related risk would be re-evaluated in accordance with DoD base closure policy (10 U.S.C. 2687 and NOTE).

6.2.3.2 Potentially Exposed Populations

The potentially exposed populations that may be affected by the VOC groundwater contamination were estimated by running a contaminant transport model of VOCs in the groundwater media (Sec. 6.2.3.3).

6.2.3.3 Exposure Point Concentrations

Exposure point concentration levels represent the contaminant concentrations in an environment medium (i.e., groundwater) that may impact potential human or nonhuman receptors through direct contact of the receptor with the contaminated environmental medium. The exposure concentrations are defined by EPA as the RME. The RME represents the highest exposure that is reasonably expected to occur at the site.

Two exposure scenarios to groundwater are evaluated: current and hypothetical future. For the current scenario, RME concentrations [App. E, of the EA (ESE, 1992a)] derived from the analytical data were used as the exposure concentrations, while the hypothetical future scenario used groundwater modeled values. A fate and transport model was implemented as part of the exposure assessment to evaluate the maximum areal movement of the contaminant plume at the site and assess the migration potential of VOCs in three downgradient wells, R1-110-2, R-102, and R2-28. R1-110-2 was selected because it is near the installation boundary. R1-102 was selected because, based on RI Addendum data, this well contained a high concentration of total VOCs. The third well modeled was R2-28 (Tobyhanna Water Company supply well) because it is representative of Offpost Area 2 as well as a source for potable water supply for a number of residences in the area.

Current Use

Groundwater--The extent of TCE contamination presented in Fig. 6-3 is based on data obtained during the 1990 groundwater sampling event, and served as the basis for TCE characterization in the EA. TCE is the most widespread of the contaminants and occurs in wells offpost. The highest concentrations of TCE are well distributed vertically, and concentrations are greater in the aquifer in some areas (Fig. 6-3).

The extent of PCE contamination presented in Fig. 6-4 is based on the data obtained during the 1990 groundwater sampling event, and served as the basis for PCE characterization in the EA. PCE was not detected in the bedrock in Area A. PCE was present in a very localized area in the shallow zone wells of Area B and widely dispersed in the deep zone downgradient of Area B, extending several hundred feet offpost.

Risk calculations were based on groundwater data collected through 1990. Risks have not been quantified since finalization of the EA in 1992; however, because contaminant concentrations have decreased over time, overall site risks are expected to be lower than those presented in the EA.

Hypothetical Future Use

Areas A and B--Risks associated with the future residential use scenario are hypothetical and are based on the assumption that unrestricted land use would occur at Areas A and B. The Army anticipates that TYAD will continue to function as an active military installation, in which case, the hypothetical future exposure scenario would not occur. Since contaminated groundwater would be addressed as part of OUI, it is highly unlikely that such exposure would occur in the future.

<IMG SRC 97096Q>
<IMG SRC 97096R>

6.2.3.4 Exposure Assessment Assumptions

Area-specific carcinogenic risks and noncarcinogenic hazard indexes (HIs) were calculated in the EA (ESE, 1992a). Assumptions used when calculating carcinogenic and noncarcinogenic risks are presented in App. F of the EA. Based on the conservative assumptions presented in App. F of this report, excess cancer risks and HIs were calculated for each of the exposure scenarios.

6.2.4 Toxicity Assessment

The objective of the toxicity assessment is to characterize the nature of the potential health effects to human receptors associated with the COPCs identified at TYAD. The characterization includes a qualitative evaluation of the available pharmacokinetic and health effects data to provide a toxicological profile for each COPC, and a quantitative evaluation of the available dose-response information to provide values for estimating acceptable intake levels and quantifying risks.

Cancer slope factors (CSFs) have been developed by EPA's Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of milligrams per kilogram per day (mg/kg-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 CSF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CSFs 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 on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Table 6-3. Chronic Dose-Response Toxicity Constants for the Human COPCs at TYAD

Chemical	Oral RfD (UF)*	Inhal RfD (UF)*	Oral CSF*	Oral WoE*	Inhal CSF*	Inhal WoE*
Inorganic Chemicals						
Lead	-- 11	--	nd 12	B2	nd 12	B2
Mercury	3.0E-04 (1,000)	8.6E-05 (30)	--		--	
Volatile Organic Chemicals						
1,2-DCE	9.0E-03 (1,000)	--	--		--	
PCE	1.0E-02 (1,000)	--	5.1E-02 v1	B2 v1	1.8E-03 v1	B2 v1
TCE	--	--	1.1E-02 v1	B2 v1	5.9E-03 v1	B2 v1
Vinyl chloride	--	--	1.9E+00	A	3.0E-01	A

Note: COPC = chemical of potential concern.
CSF = cander slope factor [(mg/kg/day) -1].
1,2-DCE = 1,2-dichloroethene.
inhal = inhalation.
mg/kg/day = milligrams per kilogram per day.
nd = not determined.
PCE = tetrachloroethane.
RfD = reference dose (mg/kg/day].
UF = uncertainty factor.
TCE = trichloroethene.
WoE = weight-of-evidence for ranking as a human carcinogen.

11 EPA prefers to use a biokinetic uptake model to evaluate lead exposure rather than the reference dose method.
12 Although EPA has classified lead as a Group B2 suspect human carcinogen via ingestion and inhalation, no CSF has been developed for either of these exposure pathways.
VI CSFs and WoEs for this VOC have been withdrawn from IRIS pending further review.

* All RfDs, CSFs, and WoEs are available in IRIS, 1992; EPA/HEAST, 1992 Annual Update, or EPA/HEAST, Supplement A to the 1992 Annual Update, unless otherwise noted.

Source: ESE.

Table 6-3 provides a summary of the available noncarcinogenic and carcinogenic chronic dose-response information for both the oral and inhalation exposure routes for each COPC. Due to the absence of established dermal dose-response values, dermal exposure was estimated using the oral dose-response values. When insufficient data are available to determine dose-response values for human risk characterization, health-based values are developed using the available regulatory references and resources for human health dose-response values.

6.2.5 Risk Characterization

The objective of the risk characterization is to integrate information developed in the toxicity assessment and the exposure assessment into a complete evaluation of the potential and actual health risks associated with contaminants at TYAD. The RA evaluates the nature and degree of risk to potential receptor populations. Wherever possible, risks are derived for individual source areas and for the total contaminant contribution from the identified sources to aid in developing priorities for remedial action planning.

The carcinogenic risks and HIs were calculated for both onpost areas and the three offpost receptor locations. Because the activities performed at each of the five study areas differ and the areas are not in close proximity to each other, the risks were presented separately for each area. Characterizing each study area separately allows for prioritization of remedial activities that may be required.

The EA (ESE, 1992a) indicated that contaminated groundwater at this site is well within the target risk range of 1 x 10 -6 to 1 x 10 -4 for carcinogens [which complies with Office of Solid Waste and Emergency Response (OSWER) Directive 9355, 0-30] for the current use scenario. A future use scenario was evaluated in the EA; however, the future residential use scenario is hypothetical and assumes that the source areas in Areas A and B can be used for unrestricted land use. An unrestricted land use would permit groundwater wells and residential areas to be constructed anywhere in Areas A and B. The future residential use scenario, which was evaluated for comparative purposes, is the most conservative choice for land use and will generate the greatest potential exposure, and hence risk. However, it is unlikely that TYAD's mission will be eliminated and the depot land be used for residential purposes. Since TYAD currently fulfills a critical mission that will be necessary as part of future Army operations and it is Army practice to clean up to the current land use scenario, no soil cleanup levels were based on the future residential use scenario (groundwater risks are based on potential residential use, as appropriate for this medium, particularly offsite). If, in the future, TYAD would be subject to base closure, site-related risk would be re-evaluated in accordance with DoD base closure policy (10 U.S.C. 2687 and NOTE).

Although EPA generally uses the upper boundary of the carcinogenic risk range (i.e., 1 x 10 -4) to make risk management decisions, the necessity of taking remedial actions would also involve consideration of factors such as exceedances, of the noncarcinogenic hazard quotient, compliance with chemical-specific applicable and relevant or appropriate requirements (ARARs) and potential adverse impacts to the environment, along with an evaluation of unique site-specific conditions. The acceptability of a particular level of risk is the provence of risk management, where the quantitative estimates of risk are just one of many factors considered in the decision-making process. A cancer risk of 10 -4 is not a de facto decision point, nor is it a "target" risk level. However, it is generally accepted that risks above the range of 10 -4 to 10 -6 require attention. The 10 -6 level of risk is often referred to as the de minimis level of risk, although that level has not been endorsed as a universally acceptable risk level. If risks are below 1 x 10 -2, then a linear equation is used (e.g., Risk = CSF x intake); however, if the risk exceeds 1 X 10 -2, then an exponential equation is used instead [i.e., 1-exp (-intake x CSF)].

An HI is used to determine whether the most sensitive individuals in a population could be adversely affected by noncarcinogenic chemicals. An HI exceeding 1.0 is a possible concern for potential noncarcinogenic or toxic effects. The EA (ESE, 1992a) indicated that contaminated groundwater at this site does exceed HI levels of 1. The acceptability of a particular level of HI is the provence of risk management, where quantitative estimates of HI are just one of many factors considered in the decision-making process. An HI of 1 is not a defacto decision point, or is it a "target" level. However, it is generally accepted that HIs greater than 1 require attention.

Table 6-4 presents a summary of the current and hypothetical future area-specific carcinogenic risks for the exposure scenarios that were evaluated at the TYAD site. Table 6-5 presents a summary of the current and hypothetical future area-specific noncarcinogenic HIs for the exposure scenarios that were evaluated. Presenting the risks and HIs in this manner allows for the identification of those exposure pathways and COPCs that contribute the most risk or HI. The industrial HI and risk values for all COPCs and all exposure scenarios are presented in App. F-3 of the EA (ESE, 1992a).

The following sections summarize the carcinogenic risks and noncarcinogenic HIs associated with the COPCs in each of the five areas: Area A; Area B; and Offpost Area 1, Offpost Area 2, and Offpost Area 3 from Area B.

Table 64. Summary of Area-Specific Carcinogenic Risks

Exposure Scenario	Media	Risk Current	Risk Future
Area A			
Hypothetical Lifetime Residential	Groundwater	NE	2.5E-02 -+
	TOTAL		2.5E-02
Area B			
Hypothetical Lifetime Residential	Groundwater	NE	7.2E-05
	TOTAL		7.2E-05
Area B-OffPost 1			
Lifetime Residential	Groundwater	4.3E-06	3.8E-06
	Irrigation--Air	1.5E-10	1.1E-10
	Vegetables--Ingestion	3.9E-07	2.9E-07
	TOTAL	4.7E-06	4.1E-06
Area B-Offpost 2			
Lifetime Residential	Groundwater	1.6E-07	**
	Irrigation--Air	1.5E-11	**
	Vegetables--Ingestion	1.2E-08	**
	TOTAL	1.7E-07	
Area B-Offpost 3			
Lifetime Residential	Groundwater	++	7.0E-07***
	TOTAL		7.0E-07

Note: NE = not evaluated for this scenario.

\+ 84 percent of groundwater risk is due to the presence of vinyl chloride.
**Not modeled; however, data for Offpost 3 (which is a subset of Offpost 2) is representative of this area.
++Area B--Offpost 3 is represented by one well, R2-28 (Tobyhanna Water Company supply well), which was evaluated as part of Area B--Offpost 2 because this supply well is located within that area.
***Future concentrations were modeled separately for the R2-28 to determine the potential future risks associated with this supply well.

Source: ESE.

Table 6-5. Summary of Area-Specific Noncarcinogenic Hazard Indices

Exposure Scenario	Media	Current HI Adult	Current HI Child	Future HI Adult	Future HI Child
Area A					
Hypothetical Lifetime Residential	Groundwater	NE	NE	14.7+	35.0 +
	TOTAL			14.7	35.0
Area B					
Hypothetical Lifetime Residential	Groundwater	NE	NE	1.3**	3.0**
	TOTAL			1.3	3.0
Area B-Offpost 1					
Lifetime Residential	Groundwater	0.015	0.035	0.013	0.030
	Irrigation--Air	NA	NA	NA	NA
	Vegetables--Ingestion	0.0015	0.0034	0.0013	0.0030
	TOTAL	0.02	0.04	0.02	0.03
Area B-Offpost 2					
Lifetime Residential	Groundwater	NA	NA	++	++
	Irrigation--Air	NA	NA	++	++
	Vegetables--Ingestion	NA	NA	++	++
	TOTAL	NA	NA		
Area B-Off-post 3					
Lifetime Residential	Groundwater	***	***	0.001	0.003+++
	TOTAL			0.001	0.003

Note: HI = hazard index.
NA = dose-response information has not been established for the compounds evaluated for this pathway.
NE = not evaluated for this scenario.

+ Majority of HI (99 percent, 97 percent for child) due to 1,2-DCE.
**Exceedance of HI of 1 due to 1,2-DCE (46 percent), mercury (30 percent), and PCE (24 percent).
++Not modeled; however, data for Offpost 3 (which is a subset of Offpost 2) is representative of this area.
***Area B--Offpost 3 is represented by one well, R2-28 (Tobyhanna Water Company supply well), which was evaluated as part of Area B--Offpost 2 because this supply well is located within that area.
+++Future concentrations were modeled separately for the R2-28 to determine the potential future HI associated with this supply well.

Source: ESE.

The hypothetical future residential land use scenario was evaluated in the EA (ESE, 1992a). This scenario was evaluated because it is the most conservative and will generate the greatest potential exposure to risk. However, the probability that TYAD's mission would be eliminated and the land then used for residential purposes is remote. TYAD fulfills a critical mission for the Army and there are no plans to eliminate any property near Areas A and B; however, if plans were to change, the Army would evaluate the site conditions and risks.

6.2.5.1 Area A

One exposure scenario was evaluated for Area A: hypothetical lifetime residential exposure. The risk characterization of this scenario is described below.

Hypothetical Future Exposure Evaluation

Carcinogenic Risks--The risk analysis results indicate that the hypothetical future (lifetime) residential exposure scenario may result in an overall lifetime risk that exceeds EPA's target risk range of 1.0×10^{-4} to 1.0×10^{-6}. Based on the exposure assumptions evaluated, the risk exceedance is due to potential future potable use of the groundwater at Area A. A majority of the total risk of 2.5×10^{-2} is due to the presence of vinyl chloride, which contributes 99.8 percent of the total risk (84 percent from oral exposure to groundwater and 15 percent from inhalation of vapors volatilized from groundwater). The remaining risk is primarily due to the presence of TCE (App. F-3 of the EA (ESE, 1992a). The contribution by TCE results in a risk of 6.8×10^{-5}, which is less than the acceptable cumulative risk level of 1.0×10^{-4}.

Noncarcinogenic HIs--As with the risk analysis, the HI analysis indicates that the hypothetical future residential exposure scenario results in total HIs greater than 1 for both adult and child exposures due to groundwater use as a potable water source. Exposure of adults and children result in calculated HIs of 14.7 and 35.0, respectively. These HIs indicate that potential adverse effects cannot be ruled out. The HI exceedance is due to the presence of 1,2-DCE.

As described in the EA (ESE, 1992a) and in the RI Addendum (ESE, 1992c), there are no patterns or trends of lead in groundwater. The analytical results of onpost and offpost monitoring indicate that lead is not attributable to the site. However, to provide a perspective on the contribution of nonsite-related compounds to the overall site risks, lead was included in the risk evaluation. The lead concentrations in groundwater samples collected from some wells at this area exceed the EPA Action Level of 15 micrograms per liter (ug/L) [56 Federal Register (FR) 26478], indicating that potential adverse effects cannot be ruled out should the groundwater be used for potable purposes. The exceedances are also higher in upgradient wells, indicating that lead is not attributable to activities at Area A, and may be of concern at offpost locations as well.

6.2.5.2 Area B

One exposure scenario was evaluated for Area B: hypothetical future lifetime residential exposure. The risk characterization of this scenario is described in the following section.

Hypothetical Future Exposure Evaluation

Carcinogenic Risks--The risk analysis results indicate that the hypothetical future lifetime residential exposure scenario resulted in a total risk of 7.2×10^{-5}, which does not result in risks that exceed EPA's 1.0×10^{-4} acceptable cumulative risk level. This lifetime risk indicates that unacceptable risks are not posed to future residential exposures, based on the exposure assumptions evaluated.

Noncarcinogenic HIs-The HI analysis indicates that the hypothetical future residential exposure results in total HIs of 1.3 and 3.0 for adult and child exposures, respectively. The HI exceedance indicates that potential adverse effects cannot be ruled out based on the exposure assumptions evaluated. The exceedance is due to the presence of 1,2-DCE, PCE, and mercury in groundwater.

As described for Area A, the lead concentrations in offpost and onpost areas do not indicate any pattern or trends. Furthermore, as discussed in Sec. 5.1.2, mercury concentrations have not exceeded drinking water standards in onsite wells since 1989. As such, lead and mercury do not appear attributable to the activities of Area B. However, to provide a perspective on the contribution of nonsite-related compounds to the overall site risk, lead was included in the risk analysis. The lead concentrations in groundwater samples collected from some wells at this area exceed the EPA Action Level of 15 Ig/L (56 FR 26478), indicating that potential adverse effects, associated with exposure to lead in groundwater, cannot be ruled out in the event that the groundwater at Area B is used for potable purposes.

6.2.5.3 Offpost Area 1 From Area B

Two exposure scenarios were evaluated for Offpost Area 1: (1) current, and (2) future residential exposure. The risk characterization of these scenarios is described in the following sections.

Current Exposure Evaluation

Carcinogenic Risks--Based on the exposure assumptions evaluated, current exposure to Offpost Area 1 by domestic groundwater uses, ingestion of homegrown vegetables, and vapors from using groundwater for irrigation, results in a total carcinogenic risk of 4.7 x 10 -6, which does not result in a risk that exceeds EPA's target risk range of 1.0 x 10 -4 to 1.0 x 10 -6.

Noncarcinogenic HIs--The results of the HI analysis indicate that current residential exposure results in total HIs of < 1, indicating that this scenario should not result in chronic adverse health effects, based on the exposure assumptions evaluated.

Hypothetical Future Exposure Evaluation

Carcinogenic Risks--Hypothetical future residential exposure Offpost Area 1 by domestic groundwater uses, ingestion of homegrown vegetables, and vapors from using groundwater for irrigation, results in a total carcinogenic risk of 4.1 x 10-6, which does not result in a risk that exceeds EPA's target risk range of 1.0 x 10 -4 to 1.0 x 10 -6.

Noncarcinogenic HIs--The HI analysis results indicate that hypothetical future residential exposure results in total His of < 1, indicating that future residential exposure should not result in chronic adverse health effects based on the exposure assumptions evaluated.

As described for Areas A and B, lead does not appear attributable to the site; however, it was included in the risk evaluation to provide a perspective on the relative risk contribution of nonsite-related compounds to the overall site risk. The lead concentrations in groundwater samples collected from some wells at this area exceed the EPA Action Level of 15 ug/L (56 FR 26478), indicating that potential adverse effects, associated with exposure to lead in groundwater, cannot be ruled out in the event that the groundwater at Offpost Area 1 is used for potable purposes.

6.2.5.4 Offpost Area 2 From Area B

Two exposure scenarios were evaluated for Offpost Area 2: (1) current, and (2) future residential exposure. The risk characterization of these scenarios is described in the following sections.

Current Exposure Evaluation

Carcinogenic Risks--Current exposure to Offpost Area 2 by domestic uses of groundwater, ingestion of homegrown vegetables, and inhalation of vapors from using groundwater for irrigation, resulted in a total carcinogenic risk of 1.7 x 10 -7, which does not result in a risk that exceeds EPA's target risk range of 1.0 x 10 -4 to 1.0 x 10 -6.

Noncarcinogenic HIs-The results of the HI analysis indicate that current residential exposure results in total HIs of < 1, indicating that this exposure scenario should not result in chronic adverse health effects based on the exposure assumptions evaluated.

Hypothetical Future Exposure Evaluation

Modeling was not specifically completed for Offpost Area 2. However, because Offpost Area 3 is a subarea of Offpost Area 2, results for Offpost Area 3 would be representative of Offpost Area 2. Refer to Sec. 6.2.5.5 (next section) for further information.

As described for Areas A and B, lead does not appear attributable to the site; however, it was included in the risk evaluation to provide a perspective on the relative risk contribution of nonsite-related compounds to the overall site risk. The lead concentrations in groundwater samples collected from some wells at this area exceed the EPA Action Level of 15 Ig/L (56 FR 26478), indicating that potential adverse effects, associated with exposure to lead in groundwater, cannot be ruled out in the event the groundwater monitored at Offpost Area 2 is used for potable purposes.

6.2.5.5 Offpost Area 3 From Area B (Future Exposure Evaluation)

This area is located within the area designated as Offpost Area 2, and is represented by a single well (R2-28), which is the Tobyhanna Water Company supply well. This well was evaluated as part of the Offpost Area 2 current lifetime residential scenario, but was evaluated separately in the hypothetical future residential scenario to determine the potential future impacts associated with a supply well that serves residences.

Carcinogenic Risks

Based on the exposure assumptions evaluated, one hypothetical future exposure scenario was evaluated for Offpost Area 3, residential exposure. The risk analysis for total exposure to groundwater (domestic uses), ingestion of homegrown vegetables, and inhalation of vapors from using groundwater for irrigation, resulted in a total risk of 7.0 x 10 -7, which does not result in a risk level that exceeds EPA's target risk range of 1.0 x 10 -4 to 1.0 x 10 -6.

Noncarcinogenic HIs

The results of the HI analysis indicate that hypothetical future residential exposure results in total HIs of < 1, indicating that exposures to the media evaluated should not result in chronic adverse health effects based on the exposure assumptions evaluated.

As described for Areas A and B, lead does not appear attributable to the site; however, it was included in the risk evaluation to provide a perspective on the relative risk contribution of nonsite-related compounds to the overall site risk. The maximum lead concentration detected in R2-28 (the Tobyhanna Water Company supply well) was 18.97 ug/L, and the mean concentration detected was 8.91 Ig/L. The maximum concentration exceeds EPA's Action Level of 15 Ig/L (56 FR 26478), indicating that potential adverse effects cannot be ruled out if the water supply concentration remains at the maximum concentration.

6.2.5.6 Conclusions

A summary of the risk characterization for the site indicates that the highest current lifetime residential exposure in the offpost area results in a cumulative cancer risk that is within the EPA's target risk range of 1.0 x 10-4 to 1.0 x 10 -6.

Although the calculated risks and HIs do not indicate that the current land use scenario will have an adverse impact on human health, constituents in groundwater exceed MCLs at both onpost and offpost locations. The Army has developed response action objectives that will prevent further groundwater degradation and decrease the concentrations of VOCs in groundwater to levels safe for human use.

For the hypothetical future onpost residential scenarios, the cumulative cancer risks associated with exposures to Area A exceed the upperbound of the EPA acceptable risk range. However, the hypothetical future onpost residential cumulative risk associated with exposures to Area B are within the EPA limits. For the noncarcinogenic health evaluation, none of the current exposures should result in chronic adverse effects. In addition, hypothetical future offpost exposures are not expected to result in adverse chronic effects. However, potential hypothetical future onpost residential exposures to Areas A and B may result in an HI greater than 1 indicating that potential adverse effects cannot be ruled out based on the assumption evaluated.

SARA requires that remedial actions attain a degree of contaminant remediation that assures the protection of public health and the environment.

Actual or threatened releases of hazardous substances from OU1, 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. Actual releases have been addressed via the waterline extension that connects impacted users to the depot water supply system.

6.3 Ecological Risks

A basewide ecological RA for TYAD was conducted in 1994. Results of that risk assessment are contained in the 30 January 1997 Draft Ecological Risk Assessment Report which has been reviewed by the regulators and is currently under revision. The report concludes that, while a high concentration of DDT has been found in one mammal tissue collected at Area A, there is no record of disposal of DDT in this location. DDT was also found in several upland soil samples both on- and offpost. A more likely explanation of the presence of DDT is that the pesticide was widely used at TYAD and surrounding private and state lands in the past for insect control. Therefore, it was concluded that no significant impacts to ecological receptors have been identified as being associated with contaminants disposed at either Area A or Area B.

6.4 Residual Risk Evaluation

The groundwater ARARs were determined to be 5.0 Ig/L for TCE and PCE, 2.0 Ig/L for vinyl chloride, and 70 Ig/L for 1,2-DCE. These values represent MCLs, pursuant to the Safe Drinking Water Act, as defined in 40 CFR Part 141.61. EPA, PADEP, and TYAD have agreed that MCLs are protective of human health and the environment. Residual risks associated with a lifetime exposure to these constituents at MCLs are presented as follows:

Chemical	MCL (ug/L)	HI Adult	HI Child	Cancer Risk
PCE	5	0.05	0.2	2E-05
TCE	5	0.05	0.2	3E-06
DCE*	70	0.2	0.5	Not Applicable
Vinyl Chloride	2	Not Applicable	Not Applicable	7E-05
Total	Not Applicable	0.3	0.9	9E-05

Note: These risks were derived based on standard default assumptions for ingestion, the 1992 non-steady state equations for dermal exposure, and the 1987 Foster and Chrostowski Model for showing exposure.

* The MCL shown for 1,2-DCE is for cis-1,2-DCE which is more conservative than that of trans-1,2-DCE.

This table shows that the total HI is less than 1 and the total cancer risk is within the risk range of 1 x 10 -6 to 1 x 10-4. It is assumed for this table that once MCLs are achieved at the site, the concentrations of VOCs in groundwater would not change overtime.

7.0 Description of Alternatives

In accordance with Sec. 300.430 of the NCP, 40 Code of Federal Regulations (CFR), a list of a number of remedial response actions and representative technologies were identified and screened to determine whether they would meet the remedial action objectives (discussed in Sec. 4.0) at OU1 Those that would meet the remedial action objectives are discussed below as Remedial Alternatives. Sec. 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state standards, requirements, criteria and limitations, which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Sec. 121 (d) (4). Applicable requirements are those substantive environmental protection standards, requirements, criteria or limitations promulgated under federal or state law that specifically address hazardous substances found at the site, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection standards, requirements, criteria or limitations promulgated under federal or state law which, while not applicable to the hazardous substances found at the site, the remedial action itself, the site location, or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site. ARARs may relate to the substances addressed by the remedial action (chemical-specific), to the location of the site (location-specific) or to the manner in which the remedial action is implemented (action-specific).

The five alternatives presented in the FS, and originally presented to the public in November 1993 are as follows: (The "P" in the alternative titles below denotes that this alternative was previously considered. However, since the collection of pre-design field data, this alternative is no longer considered applicable.)

- Alternative 1P--No action;

- Alternative 2P--Installation of multimedia caps, extraction wells, air stripping, ion-exchange (may have been necessary if water was discharged to Hummler Run), and discharge to the TYAD potable water system and Hummler Run;

- Alternative 3P--In situ volatilization of soils, in situ biodegradation of groundwater, extraction wells, air stripping, ion-exchange (may have been necessary if water was discharged to Hummler Run), and discharge to the TYAD potable water system and Hummler Run;

- Alternative 4P--Passive soil volatilization, extraction wells, air stripping, ion-exchange (may have been necessary if water was discharged to Hummler Run), and discharge to TYAD potable water system and Hummler Run;

- Alternative 5P--Thermal desorption of soils, extraction wells, air stripping, ion-exchange (may have been necessary if water was discharged to Hummler Run), and discharge to TYAD potable water system and Hummler Run.

The preferred alternative presented at the November 1993 public meeting was Alternative 4P, which involved soil and groundwater treatment. Soil treatment would have consisted of excavating soil in excess of soil cleanup levels at Areas A and B and reducing VOC concentrations using a technology called passive volatilization. This approach would have involved placing soil within a lined treatment cell, which is referred to as a bubble, and forcibly drawing air through the soils to remove VOCs.

Groundwater treatment was to have involved an extraction and treatment system consisting of four onpost extraction wells and one offpost extraction well. Groundwater would have been processed through an onpost treatment system, consisting of an air stripper to remove VOCs from the groundwater. If necessary, VOC emissions from the air stripping tower would have been treated, using vapor phase carbon, prior to discharging air to the atmosphere. After treatment, groundwater would have been discharged to one of several locations; the specific location was to have been defined in a later phase of work.

Groundwater at TYAD was contaminated by VOCs that were leached from soils that had been exposed to spills and leaks. Therefore, EPA and PADEP required the Army to evaluate the site to predict levels that would not allow groundwater to be contaminated at levels above those safe for human health and the environment. Soil cleanup levels are discussed on page 2-5.

These soil cleanup levels represent the maximum allowable concentrations of TCE and PCE in soil that will not result in groundwater being contaminated at levels above MCLs.

The results of the predesign and remedial design investigation conducted in 1994 indicated that the conditions on which the proposed Remedial Action Plan (ESE, 1993a) were based had changed since the RI/FS report. The remedial design soil sampling results indicated a much smaller volume of contaminated soil existed, as compared to the original volume estimate. The soils data also indicated that VOCs were not present in Area A at levels that exceeded cleanup criteria. Only a limited amount of soil from Area B was found to contain VOCs at concentrations that exceeded soil cleanup levels. Furthermore, the four onsite extraction wells installed for groundwater recovery had little or no VOCs when tested.

Due to the limited amount of contaminated soils identified during predesign and remedial design investigations, the Army conducted a removal action in July 1995 and removed approximately 2,100 yd^3 of VOC-contaminated soils from Area B. Following the completion of the removal action, site sampling showed concentrations of VOCs in soils were less than soil cleanup levels. With this information, the EPA and Army agreed that no further action was necessary for soils in Area B. As discussed in the previous paragraph, contaminant concentrations in Area A were present at concentrations less than soil cleanup levels.

Field testing showed that optimally placed newly installed groundwater extraction wells would be inefficient in recovering contaminated groundwater. This led the Army to conclude the installation of extraction wells would not recover contaminated groundwater efficiently. The Army also performed tests to determine if groundwater could be efficiently recovered from existing monitor wells. These tests concluded that appropriate flow rates of groundwater could not be sustained from monitor wells.

EPA and PADEP agreed with the Army's conclusions and recommended that the Army revise the original proposed Remedial Action Plan to delete four of the original alternatives and address two new alternatives:

- Groundwater: Natural Attenuation/Long-Term Monitoring/Institutional Controls (the preferred alternative); Soils: No Further Action, and
- Groundwater: Limited Groundwater Treatment/Institutional Controls/Monitoring; Soils: No Further Action

These two alternatives, in addition to the revised no-action alternative were presented for public evaluation and comment in the Revised Remedial Action Plan (ESE, 1997).

As previously stated, because contaminated soils were removed from Area B in July 1995 and all soils in Area A and B have PCE and TCE concentrations less than the soil cleanup level, EPA has stated (correspondence dated February 13, 1996) that no further soil cleanup is required in OU1. Therefore, the following alternatives only address VOC-contaminated groundwater.

Implementation time-frames and treatment rates (presented for the following alternatives) are estimates based on the Administrative Record for OU1. [Summary of Technical Data Regarding Predesign Engineering Services for Areas A and B (Weston, 1995) and Remedial Design for Areas A and B Soil and Groundwater Treatment Systems (Weston, 1995)]. This information will be further refined with respect to the selected remedial alternative during the remedial design phase of work.

7.1 Alternative Description

7.1.1 Alternative 1: Groundwater: No Action; Soil: No Further Action

CERCLA/SARA and the NCP require that the no-action alternative be evaluated at every NPL site to establish a baseline for comparison with other remedial alternatives. Under this alternative, current and/or future VOC-containing groundwater associated with Areas A and B would not be addressed; there would be no groundwater monitoring or institutional controls implemented with this alternative.

This alternative also incorporates a no further action component for soils. As previously stated, soils in Area A did not have VOC contaminants at levels in excess of soil cleanup levels (see page 2-5). All soils with contaminants in excess of soil cleanup levels in Area B were removed in an action conducted in July 1995.

Capital costs:	$0
Present-worth operation and maintenance (O&M) costs:	$0
Present worth:	$0
Time to complete:	0 year

7.1.2 Alternative 2: Groundwater: Natural Attenuation/Long-Term Monitoring/Institutional Controls; Soil: No Further Action

Alternative 2 involves natural attenuation, which is defined as a natural process that results in a reduction of contaminant concentrations in the environment through biological processes, physical phenomena, and chemical reactions. In addition, semiannual monitoring would be conducted to continually assess the effectiveness of natural processes in reducing the extent of groundwater contamination over time.

Details of the monitoring plan, such as constituents to be evaluated, frequency, duration, and wells to be monitored, will be outlined in the remedial action work plan. Data collected since

1988 show that the areal extent of groundwater contamination is decreasing over time and that contaminant levels are declining. This would be an indication that the contaminants in the groundwater are being controlled through natural attenuation.

Institutional Controls prevent human consumption of contaminated groundwater until monitoring determines that controls are no longer necessary. Institutional controls have already been implemented and include the waterline agreement with the residents and an agreement between TYAD and the Coolbaugh Township Zoning Office to ensure that future residents will not be exposed to groundwater contaminated at levels above MCLs. These existing institutional controls will become part of the selected remedy. Additionally, an institutional control prohibiting the construction of any onpost drinking water well in the plume of groundwater contamination will be implemented. This institutional control will be incorporated into the TYAD Master Plan and will also become part of the selected remedy.

As this alternative involves natural attenuation and monitoring, information will be provided about changes in the VOC plume and concentrations over time. These data would project potential future plume movements over time. Until VOC levels in groundwater are restored to concentrations below MCLs, users of groundwater near TYAD would be protected against using water in excess of MCLs through continued the use of interim measures (i.e., the waterline or other source of safe water).

This alternative also incorporates a no further action component for soils. As previously stated, soils in Area A did not have contaminants at levels in excess of soil cleanup levels (see page 2-5). All soils with contaminants in excess of soil cleanup levels in Area B were removed in an action conducted in July 1995. The residual contamination in soils in Areas A and B are not considered to be a threat to human health and the environment.

In the event that future data shows this alternative to be ineffective, Alternative 3, or another new alternative, may be implemented. This alternative will be re-evaluated in 5 years. Costs are based on groundwater monitoring for a 15-year period.

Capital costs:	$0
Present-worth O&M costs:	$1,038,000
Present worth:	$1,038,000
Time to complete:	15 years

7.1.3 Alternative 3: Groundwater: Limited Groundwater Treatment/Institutional Controls/Monitoring; Soil: No Further Action

With this alternative, several monitor wells with the highest VOCs concentrations would be equipped with pumps that would be used to extract groundwater. Based on field testing, the maximum withdrawal rate of groundwater is expected to be low, on the order of less than 2 gpm.

The limited amount of groundwater that can be recovered will be processed through diffused aeration, an air stripper, or carbon adsorption unit, which would be located next to each monitor well. The first two processes involve the transfer of VOCs in the groundwater to the air which is then passed out of the system. When treatment of air is required, this air is then passed through a carbon filter which removes the VOCs in the air before it is released to the atmosphere. Carbon adsorption involves the transfer of VOCs from water directly to carbon. Carbon that has been exhausted would be replaced with new carbon. The exhausted carbon would be managed at an appropriately permitted offsite waste management facility. The treated groundwater would be discharged to the TYAD wastewater treatment plant through underground piping.

Institutional Controls prevent human consumption of contaminated groundwater until monitoring determines that controls are no longer necessary. Institutional controls have already been implemented and include the waterline agreement with the residents and an agreement between TYAD and the Coolbaugh Township Zoning Office to ensure that future residents will not be exposed to groundwater contaminated at levels above MCLs. These existing institutional controls will become part of the selected remedy. Additionally, an institutional control prohibiting the construction of any onpost drinking water well in the plume of groundwater contamination will be implemented. This institutional control will be incorporated into the TYAD Master Plan and will also become part of the selected remedy.

This alternative also incorporates groundwater sample collection. Details of the monitoring plan, such as constituents to be evaluated, frequency, duration, and wells to be monitored, will be outlined in the remedial action work plan. Data from this collection effort would be evaluated to assess the effectiveness of this alternative with respect to decreasing plume size and strength over time.

As this alternative involves monitoring, information will be provided about changes in the VOC plume and concentrations over time. These data would project potential future plume movements over time. Until VOC levels in groundwater are restored to concentrations below MCLs, users of groundwater near TYAD would be protected against using water in excess of MCLs.

This alternative also incorporates a no further action component for soils. As previously stated, soils in Area A did not have contaminants at levels in excess of soil cleanup levels (see page 2-5). All soils with contaminants in excess of soil cleanup levels in Area B were removed in an action conducted in July 1995.

This alternative will be re-evaluated in 5 years. Costs are based on groundwater treatment and monitoring for a 15-year period.

Capital costs:	$65,000
Present-worth O&M costs:	$1,660,752
Present worth:	$1,726,000
Time to complete:	15 years

8.0 Summary of Comparative Analysis of Alternatives

The remedial action alternatives for OU1 described in the preceding section were evaluated under the nine evaluation criteria set forth in the NCP at 40 CFR º 300.430(e)(9). These nine criteria are organized according to the following categories listed in 40 CFR º 300.430(f)(1):

Threshold Criteria

- Protection of human health and the environment, and
- Compliance with ARARs.

Primary Balancing Criteria

- Long-term effectiveness,
- Reduction in toxicity, mobility, and volume (TMV),
- Short-term effectiveness,
- Implementability, and
- Cost.

Modifying Criteria

- State acceptance, and
- Community acceptance.

In accordance with the provisions set forth in CERCLA/SARA and the NCP, the Army evaluated the groundwater components for each of the alternatives against nine established criteria.

Overall protection of human health and the environment and attainment of ARARs are threshold criteria and the primary objectives of a remedial action. In addition, the selected remedial alternative must reflect the best balance among criteria such as reduction of TMV of hazardous substances; short- and long-term effectiveness; implementability; and cost. Finally, the remedial action must also consider support agency and community acceptance.

This section details the comparative analysis of all three alternatives against the nine evaluation criteria.

8.1 Overall Protection of Human Health and the Environment

Risks associated with the future residential use scenario are hypothetical and are based on the assumption that unrestricted land use would occur at Areas A and B. The Army anticipates that TYAD will continue to function as an active military installation, in which case, the hypothetical scenario would not occur. In the event that TYAD is closed at some point in the future, and the land transferred/sold to private or other public interests, DoD policy would require a re-evaluation of the carcinogenic risks and noncarcinogenic HIs presented in Tables 6-4 and 6-5, respectively. The scenario relevant to TYAD is the industrial use scenario. Calculations for this scenario show that exposure to site media results in risks that are within an acceptable range to EPA. Additionally, no unacceptable chronic adverse health effects to exposed populations are anticipated.

Alternative 2, Natural Attenuation, and Alternative 3, Limited Groundwater Treatment, were rated highest with respect to this criterion, because data would be collected to evaluate whether human health and the environment are continually protected. Alternative 1, No Action, does not provide adequate protection for human health because residences/businesses with private wells would not be provided with safe water to drink, and thus may be exposed to groundwater with VOCs in excess of MCLs. Additionally, without monitoring, the community would not know the nature and extent of contaminated groundwater downgradient from TYAD; thus, there would be no control over where new wells are installed by the Township of Tobyhanna or private residences in the area.

8.2 Compliance with ARARs

The Safe Drinking Water Act (SDWA) requires that domestic water supplies comply with MCLs. Currently, VOCs are exceeding MCLs in groundwater. However, because the Army has supplied water to all residences/businesses where MCLs are exceeded by installing a waterline, no one is exposed to groundwater that does not comply with the SDWA requirements. Because Alternatives 2 (Natural Attenuation) and 3 (Limited Groundwater Treatment) require continued groundwater data collection, the Army would be able to evaluate the continued protection of human health and the environment over time. The plan for data collection involves analyzing information that would detect a potential threat to human health and the environment before it could actually impact offsite residences or businesses. If data collected show an unanticipated change in site conditions, the Army would institute a measure that would ensure continued compliance with ARARs (for example, implementation of Alternative 3, or another alternative) and would be able to change the selected remedy to ensure that everyone whose groundwater exceeds MCLs, could be provided safe water to drink. Prior to changing the selected remedy, the Army would present the changed alternative to the public to allow their participation in the revision of the selected alternative. The monitoring and alternate water supply will provide interim protection to the communities in the short term, until MCL compliance for Alternatives 2 or 3 can be achieved. In the case of Alternative 2, MCL compliance will be achieved through natural attenuation.

Alternative 3 (Limited Groundwater Treatment) involves pumping and treatment of groundwater. Extracted groundwater would be treated to levels that would comply with ARARs that address water discharges. In the case of Alternative 3, the treated groundwater would be discharged to the TYAD wastewater treatment system, which must comply with National Pollution Discharge Elimination System (NPDES), as specified by the Clean Water Act. The discharge of treated groundwater to the TYAD wastewater treatment plant would not prevent the system from complying with its discharge requirements. Any air emissions from the groundwater treatment system would comply with all federal, state, and local requirements. Air pollution control devices would be installed on the groundwater treatment units as necessary to meet these requirements.

The PADEP has identified Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2 of 1995) as an ARAR. EPA had determined that, with regard to the remediation of groundwater, Act 2 does not under the facts and circumstances impose any requirements that are more stringent than the Federal MCLs.

During the course of preparation of this ROD, PADEP has submitted correspondence to EPA and the Army dated January 11, 1993; November 16, 1995; September 27, 1995; and December 14, 1995. ARARs cited by PADEP include:

- 25 Pa. Code 287.1 et seq (residual waste), and
- 25 Pa. Code 264.100 et seq (groundwater monitoring).

Because Alternative 1, No Action, does not provide for continued data collection, there is no assurance that future residential wells would comply with SDWA ARARs.

For an alternative to be considered for site rehabilitation, it must meet the threshold criteria of being both ARAR compliant and protective of human health and the environment. Because Alternative 1 is not ARAR compliant, this alternative does not meet the threshold criteria and therefore is not eligible for selection as the preferred alternative. For this reason, Alternative 1 is not further discussed in the evaluation of alternatives.

Alternatives 2 (Natural Attenuation) and 3 (Limited Groundwater Treatment) are both ARAR compliant, as both alternatives will result in decreasing concentrations of contaminants in groundwater to levels below MCLs and protection of current and potential future users of groundwater with institutional controls and the waterline agreement.

8.3 Long-Term Effectiveness and Permanence

Implementation of either Alternatives 2 (Natural Attenuation) or 3 (Limited Groundwater Treatment) are both expected to result in the decrease of VOC levels in groundwater below MCLs. Both these alternatives are expected to provide a high degree of long-term effectiveness and permanence because once groundwater is restored to levels safe for drinking (i.e., less than MCLs), the restoration would be permanent, as the source of contaminated groundwater (soils in Area B) have been removed from TYAD.

8.4 Reduction of TMV through Treatment

Alternative 2 (Natural Attenuation) does not reduce TMV through treatment. However, through natural environmental processes, reduction in contaminant concentrations over time is expected with Alternative 2. Alternative 3 (Limited Groundwater Treatment) would reduce TMV through the collection and treatment of contaminated groundwater. However, the amount of groundwater that could be recovered with this alternative is considered insignificant, and the reduction in TMV is expected to be minimal.

8.5 Short-Term Effectiveness

No construction is required with Alternative 2 (Natural Attenuation). Thus no short-term impacts to workers or community are associated with implementation of this alternative. Construction associated with Alternative 3 (Limited Groundwater Treatment) consists of retrofitting selected monitor wells with a submersible pump, modular treatment units (e.g., carbon adsorption, diffused aeration, or air stripper) and construction of a sub-surface discharge line. The construction associated with Alternative 3 (Limited Groundwater Treatment) is minimal and no negative short-term impacts to workers or community are anticipated. Because Alternative 3 (Limited Groundwater Treatment) requires construction, and Alternative 2 (Natural Attenuation) does not, the short term impact to workers and community associated with the former would be greater, albeit minimal.

Alternatives 2 (Natural Attenuation) and 3 (Limited Groundwater Treatment) were considered to be equally practical with respect to short-term effectiveness because no one is exposed to groundwater that does not comply with the MCLs, and site data will continue to be collected to assess the continued protection of human health and the environment until groundwater is restored to levels safe for human consumption.

The estimated time for completion for both alternatives is 15 years. No adverse impacts are anticipated during the period required for completion. Until groundwater is restored to levels safe for human health and the environment, an interim measure, which provides water to private residences/businesses where VOC concentrations are greater than MCLs, will provide protection to human health. Additionally, institutional controls such as monitoring and the agreement that TYAD has with the Coolbaugh Township Zoning Officer (an agreement that requests TYAD "... be notified of any new construction that will require potable water..,") will ensure that potential migration of the VOC plume can not adversely effect other residences/businesses.

8.6 Implementability

Alternative 2 (Natural Attenuation) was considered more implementable than Alternative 3 (Limited Groundwater Treatment) because pump tests performed in March 1996 showed only low groundwater flow rates could be sustained from pumping wells. Low flows from extraction wells would make the system impractical; therefore, Alternative 3 is considered to be inferior to Alternative 2 with respect to implementability because the effectiveness of the alternative is questionable and does require more effort and coordination to implement. Both alternatives are administratively feasible.

8.7 Cost

Alternative 2 (Natural Attenuation) is a less expensive alternative, with a net present-worth cost of $1,038,000. Alternative 3 (Limited Groundwater Treatment) has a net present-worth cost of $1,726,000 for implementation.

8.8 State Acceptance

PADEP documented their concurrence with the selected remedy in a letter to TYAD dated April 4, 1997.

8.9 Community Acceptance

The Revised Remedial Action Plan was released to the public in March 1997. An availability/public meeting announcement was published in The Pocono Record on March 19, 1997. A public meeting was held on March 26, 1997, at the Coolbaugh Township Municipal Building to discuss the extent of contamination, previous work, alternatives evaluated for OU1, and present the preferred alternative. No verbal comments were presented during the March 26, 1997 public meeting regarding OU1. In addition, no written comments were received during the 30-day public comment period. Based on this, the Army concluded that the community does not oppose the selected remedy for OU1.

9.0 Selected Remedy

9.1 Description of Selected Remedy

Following review and consideration of the information in the Administrative Record file, the requirements of CERCLA and the NCP, and public comments received on the Revised Remedial Action Plan, the Army and EPA, in consultation with PADEP, have selected Alternative 2: Natural Attenuation/Long-Term Monitoring/Institutional Controls for groundwater and No Further Action for soils. Alternative 2 meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs, and provides the best balance of long-term effectiveness, reductions in TMV of contaminants through treatment, short-term effectiveness, implementability and cost.

The selected remedy would protect human health and the environment, comply with ARARs or to be considered (TBC) guidance, and reduce VOCs in a cost-effective manner. Therefore, based on current information, the Army believes that the selected remedy would provide the best balance of trade-offs among the remedial alternatives with respect to the nine evaluation criteria.

In the event that TYAD is closed at some point in the future, and the land transferred/sold to private or other public interests, DoD policy would require a re-evaluation of potential site risks at the property prior to transfer of property, to ensure future land owners are protected.

Alternative 2, Natural Attenuation, involves collecting groundwater data twice per year. Groundwater data would be evaluated to determine if the size and strength of the groundwater plume is decreasing over time. If future data collection shows that the plume size and strength is not decreasing over time, implementing Alternative 3, Limited Groundwater Treatment, or another alternative, may be necessary to remove groundwater in areas of highest contaminant concentrations.

This alternative also incorporates an ongoing interim measure that involves supplying water to residences/businesses which have wells with VOC concentrations in excess of MCLs. Additionally, residences/businesses that show VOCs in excess of MCLs in the future will also be supplied with potable water and included in the waterline agreement. An institutional control that requests the Coolbaugh Township Zoning Officer notify TYAD of new construction involving potable water is also incorporated as part of this alternative; this control will ensure that new wells are not placed in areas of known or suspected contamination. An institutional control prohibiting the construction of any onpost drinking water well in the plume of groundwater contamination will also be implemented. This institutional control will be incorporated into the TYAD Master Plan and will also become part of the selected remedy.

Data collected since the initiation of RI/FS studies at TYAD show that natural attenuation is working in groundwater. The area of TCE contamination in excess of MCLs has decreased by more than 77 percent over the period from January 1988 to March 1996. When the RI/FS began, a total of six onpost bedrock monitor wells exceeded MCLs, while in March 1996, a total of three wells exceeded MCLs. In 1988, 12 residential wells exceeded VOC MCLs, while only two wells were above MCLs for TCE and PCE in March 1996. It is anticipated that the natural processes that have caused the groundwater plume to decrease in size and strength will continue with time.

9.2 Estimated Costs

There are no capital costs associated with this alternative. VOC levels in groundwater will be monitored using the existing network of onsite monitor wells, onsite water supply wells, and the offsite residential wells.

The O&M components of this alternative involve groundwater sample collection, groundwater sample analysis, water level measurement, and preparing semi-annual groundwater reports. O&M costs are estimated as $100,000 per year. Assuming a 15-year O&M period, the total prestnt value cost of this alternative is approximately $1,038,000 (assuming a discount rate of 5 percent).

9.3 Performance Standards

The Performance Standard for the selected remedy is the remediation of vinyl chloride, TCE, and PCE to MCLs throughout the entire plume of groundwater contamination. The MCLs are set forth at 40 CFR º 141.61(a) and are as follows: vinyl chloride (2 Ig/l), TCE (5 Ig1) and PCE (5 Ig/l). Attainment of the Performance Standard will be achieved by the selected remedy in the following manner:

1) Natural Attenuation

The selected remedy includes natural attenuation of groundwater which shall be monitored until such time as EPA and the Army, in consultation with PADEP, determine that the Performance Standard has been achieved throughout the entire plume of groundwater contamination.

Performance data will be evaluated to assess the effectiveness of the selected alternative. The initial annual performance evaluation will be conducted within 1 year after the remedial design is finalized. The initial and subsequent annual performance evaluation reports will be based on previously collected data from onsite monitor and water supply wells, as well as offsite residential wells, and will include water level analyses and statistical evaluation of the magnitude and areal extent of VOC contamination. The Army will submit the initial and subsequent annual performance evaluation reports to EPA and PADEP for review. The contents of the annual performance evaluation and the schedule for submitting these reports will be determined during the remedial design.

The Army and EPA, in consultation with PADEP, will review the annual performance evaluation reports to determine whether the selected alternative is achieving general response action objectives. In the event that future data shows this alternative to be ineffective, Alternative 3, discussed in Secs. 7.0 and 8.0, or a new alternative, may be implemented.

2) Long-Term Monitoring

A long-term groundwater monitoring program shall be implemented to evaluate the effectiveness of the natural attenuation alternative. Semi-annual monitoring of the groundwater shall continue until such time as EPA and the Army, in consultation with PADEP, determine that the Performance Standard has been achieved throughout the entire plume of groundwater contamination.

The number, location, and depth intervals of these wells, along with the list of sampling analytical parameters, will be determined by the Army and EPA, in consultation with PADEP, during

Remedial Design. To the extent deemed practicable by the Army and EPA, in consultation with PADEP, residential wells will be used to augment the existing groundwater monitoring program. The monitoring program shall be consistent with the objectives of the annual performance evaluations. The Remedial Design will be approved by EPA, in consultation with PADEP.

3) Institutional Controls

Institutional controls have been implemented and will continue to be administered until such time that EPA and the Army, in consultation with PADEP, determine that the Performance Standard has been achieved throughout the entire plume of groundwater contamination.

The Army has implemented a waterline agreement with the affected residents which specifies that individual residential wells will not be used for any purpose except for monitoring by the Army until such time that the Army determines that the groundwater from the well does not pose an unacceptable risk to human health. In return, the residents will receive potable water from the TYAD water supply.

The Army has implemented an agreement with the Coolbaugh Township Zoning Office requiring that the Army be alerted when the Zoning Office learns of a resident who plans to construct a well in the area of the contaminated plume. That resident will be connected to the TYAD water supply.

An institutional control which would prohibit the construction of any onpost well in the plume of groundwater contamination will be implemented. This institutional control will be incorporated in the TYAD Master Plan and will remain in effect until such time that the Performance Standard is achieved.

4) Five Year Reviews

Five Year reviews shall be conducted after the remedy is implemented to assure that the remedy continues to protect human health and the environment.

Based on information obtained during the RI/FS, and as documented in the Administrative Record, the Army and EPA believe that it will be possible to achieve general response action objectives for this OU. If the Army and EPA, in consultation with PADEP, determine, on the basis of performance evaluation data, that the general response action objectives cannot be achieved throughout the contaminant plume or area of attainment, additional measures to protect human health and the environment may be undertaken. Such measures will be determined by the Army and EPA, in consultation with PADEP, and may include, but are not limited to, any of the following actions:

- Invoke a waiver of the federal MCL for those portions of the aquifer in which it is technically impractical to achieve further reduction of VOCs.
- Continue to collect and analyze samples as part of the groundwater monitoring program.
- Re-evaluate remedial technologies for groundwater restoration.

The decision to take any or all of these measures may be made during implementation/operation of the remedy, during the annual performance evaluations, or during the 5-year reviews of the remedial action under CERCLA, Sec. 121(c). In the event that such a decision is made, the Army and EPA, in consultation with PADEP, will either issue an Explanation of Significant Differences in accordance with procedures set forth in NCP º 300.435(c)(2)(i) or propose an amendment to the ROD in accordance with procedures set forth in NCP º 300.435(c)(2)(ii).

10.0 Statutory Determinations

Under CERCLA, Sec. 121, EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss each of the statutory determinations.

10.1 Overall Protection of Human Health and the Environment

The selected remedy (Alternative 2) would protect human health and the environment by permanently reducing VOCs in groundwater to levels below MCLs via natural processes (i.e., natural attenuation).

Under a previously completed removal action, TYAD extended the Depot's existing water distribution system to provide a potable water supply to 24 affected residences/businesses. As specified in Agreement for Alternate Water Supply and Services (Waterline Agreement) between the residents of the Village of Tobyhanna and the United States Government, which was executed in November 1990, existing wells at affected residences/businesses were disconnected and may be used only for continued testing as part of TYAD's ongoing groundwater monitoring program. This agreement is transferable to new owners.

Because the Waterline Agreement requires that residences/businesses wells be disconnected, those residences/businesses connected to the waterline will be protected from exposure to contaminated groundwater. Continued groundwater monitoring will ensure that new residences/businesses, that potentially are affected by water with VOCs in excess of MCLs in the future, are identified for the purposes of supplying an alternative water supply, and thus, prevented from exposure to unsafe groundwater.

TYAD will continue to provide a source of potable water to affected residents and extend service as necessary until such time that PADEP or EPA determines that levels of contaminants in these wells or in the aquifer used to supply potable water meet applicable SDWA standards. At that time, affected residents may choose to resume service from their private wells. Therefore, long-term unacceptable risks at these residences/businesses have already been effectively eliminated by this removal action.

An institutional control that requests the Coolbaugh Township Zoning Officer notify TYAD of new construction involving potable water is also incorporated as part of the selected remedy; this control will ensure that new wells are not placed in areas of known or suspected contamination. An institutional control prohibiting the construction of any onpost drinking water well in the plume of groundwater contamination will also be implemented. This institutional control will be incorporated into the TYAD Master Plan and will also become part of the selected remedy.

Once MCLs have been achieved for groundwater under the selected remedy, the carcinogenic risk associated with current and future groundwater exposure will be within EPA's target risk range of 1.0×10^{-4} to 1.0×10^{-6} and there will be no significant potential for adverse noncarcinogenic health effects as a result of exposure to groundwater (i.e., the HI shall be less than or equal to one). Throughout the performance of groundwater remediation, contaminant levels in the bedrock aquifer will be monitored to assess the effectiveness of natural attenuation.

There are no short-term risks associated with the implementation of this alternative. The Army will continue to monitor groundwater, and assess potential future impacts to residents not connected to the TYAD waterline. If monitoring data concludes that other resident's and/or businesses' wells could be impacted by groundwater above MCLs, the Army will extend the waterline service to these locations.

VOCs in groundwater are expected to be reduced to levels below the MCLs by natural attenuation. This remedial action provides long-term effectiveness because it would reduce the existing health risks to onpost and offpost users caused by VOCs in groundwater migrating offsite.

Groundwater compliance levels were chosen as federal and state MCLs since the contamination was detected in the offpost residential wells and the municipal supply well. Onpost soils are not a concern as these soils have been remediated to levels acceptable to EPA and PADEP. Onsite groundwater is not of direct concern as there are no current pathways for exposure. Therefore, because there are no current exposure pathways for onsite contaminated groundwater (no one onpost has access to untreated groundwater), interim measures instituted offsite (i.e., the Waterline Agreement) are not necessary for onsite wells.

10.2 Compliance with ARARs

The selected remedy, when complete, will have reduced VOC concentrations in groundwater to cleanup standards, thereby satisfying the chemical-specific ARARs (federal and state MCLs).

10.2.1 Contaminant-Specific ARARs

The contaminant-specific ARARs for groundwater remediation are federal [40 CFR º 141.61(a)] and state [Pa º 109.202(a)(2) and (3)] MCLs. The natural attenuation process is expected to comply with these ARARS.

The "Statewide Human Health Standards" under the Land Recycling and Environmental Remediation Standards Act is a TBC requirement. The selected remedy is expected to comply with this TBC requirement.

10.2.2 Action-Specific ARARs

There are no action-specific ARARs associated with the implementation of Alternative 2.

10.2.3 Location-Specific ARARs

No location-specific ARARs have been identified for TYAD Areas A and B.

10.3 Cost Effectiveness

The selected remedy, as compared to the alternatives evaluated in Sec. 7.0, achieved an equal or better level of performance at less cost. The net present-worth cost of Alternative 2 has been estimated at approximately $1,038,000.

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

The use of resource recovery technologies is not appropriate for OU1 at TYAD. Alternative treatment technologies cannot be practically used to reduce levels of VOCS in groundwater at TYAD. Implementation of a large-scale groundwater treatment system was determined to be impracticable. Field testing showed that optimally placed, newly installed groundwater extraction wells were inefficient in recovering contaminated groundwater. This led the Army to conclude the installation of extraction wells would not recover contaminated groundwater efficiently. The Army also performed tests to determine if groundwater could be efficiently recovered from existing monitor wells. These tests concluded that appropriate flow rates of groundwater could not be sustained from monitor wells.

With respect to alternatives evaluated that are protective of human health and the environment and meet ARARs, the selected remedy provides the best balance of tradeoffs in terms of long- and short-term effectiveness and permanence, cost implementability, reduction in toxicity, mobility and volume, support agency and community acceptance, and preference for treatment as a principal element. Although no active treatment is employed with the selected remedy, natural attenuation is considered treatment as natural biological processes, physical phenomena, and chemical reactions will reduce contaminant levels over time.

10.5 Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principal element. Although no active treatment is employed with the selected remedy, natural attenuation is considered treatment as natural biological processes, physical phenomena, and chemical reactions will reduce contaminant levels over time.

11.0 References

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Attachment A

Responsiveness Summary

The purpose of the Responsiveness Summary is to provide the public with a summary of citizen comments, concerns, and questions about OU1.

The Proposed Remedial Action Plan (Revised)for Operable Unit 1 at Tobyhanna Army Depot was released to the public in March 1997. An availability/public meeting announcement for the RI; RI Addendum, EA; FS; proposed Remedial Action Plan, as well as new documents which include the Preliminary Remedial Design (Weston, 1996) and the Contaminated Soil Removal from Area B report (OHM, 1996) was published in The Pocono Record on March 19, 1997.

The public meeting for the Revised Remedial Action Plan was held on March 26, 1997, at the Coolbaugh Township Municipal Building. At this meeting, representatives from the Army, EPA, and PADEP were available to summarize the remedial alternatives presented in the proposed Revised Remedial Action Plan, discuss rationale for selecting the preferred alternative, and discuss any site-related issues raised by the public and the remedial alternatives under consideration. No written comments were received during the 30-day public comment period. In addition, no verbal comments were presented during the March 26, 1997 public meeting regarding OU 1.