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2006

# EPA Superfund
# Record of Decision:

LETTERKENNY ARMY DEPOT (SE AREA)
EPA ID: PA6213820503
OU 10
CHAMBERSBURG, PA
09/11/2006

# Record of Decision for Conococheague Drainage System Southern Southeast Industrial Area (SSIA) Southeastern Area Operable Unit 10 (SE OU 10), AEDBR Sites LEAD-090, -091, -095, -100, -101, -128 Letterkenny Army Depot

U.S. Army Corps of Engineers
Baltimore District

March 2006

05P-0847

*Final*

*Final*

# RECORD OF DECISION FOR CONOCOCHEAGUE DRAINAGE SYSTEM SOUTHERN SOUTHEAST INDUSTRIAL AREA (SSIA) SOUTHEASTERN AREA OPERABLE UNIT 10 (SE OU 10) AEDBR SITES LEAD-090, -091, -095, -100, -101, -128

(Includes Hawbaker Spring, Dozens Springs, Chambers Spring, and Building 12)

**Letterkenny Army Depot**
**Chambersburg, Pennsylvania**

Delivery Order 0004
Contract Number DACA31-00-D-0023

Prepared for

**U.S. Army Corps of Engineers**
**Baltimore District**
Baltimore, Maryland

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**March 2006**

W.O. No. 03886.518.004.0050

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# LIST OF ACRONYMS

# LIST OF ACRONYMS

| | |
|---|---|
| ADD | average daily dose |
| AEDBR | Army Environmental Database – Restoration (formerly DSERTS) |
| ARAR | applicable or relevant and appropriate requirement |
| BRAC | Base Realignment and Closure |
| BTEX | benzene, toluene, ethylbenzene, and xylene |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CFR | Code of Federal Regulations |
| cm/sec | centimeters per second |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| CR | cancer risk |
| CSF | cancer slope factor |
| DA | Disposal Area |
| DCA | dichloroethane |
| DCE | dichloroethene |
| DNAPL | Dense Non Aqueous Phase Liquid |
| DoD | U.S. Department of Defense |
| EPA | U.S. Environmental Protection Agency |
| EPC | exposure point concentration |
| ESD | Explanation of Significant Differences |
| ESE | Environmental Science and Engineering |
| FFA | Federal Facilities Agreement |
| FFS | focused feasibility study |
| FS | feasibility study |
| ft | feet |
| HEAST | Health Effects Assessment Summary Tables |
| HCl | hydrochloric acid |
| HI | hazard index |
| HQ | Hazard Quotient |
| IC | Institutional Control |
| IWTP | industrial wastewater treatment plant |
| IWWS | industrial wastewater sewers |
| LADD | the lifetime average daily dose |
| LEAD | Letterkenny Army Depot |
| LIDA | Letterkenny Industrial Development Authority |
| LUC | Land Use Control |
| µg/L | micrograms per liter (parts per billion) |
| MCL | maximum contaminant level |
| MNA | monitored natural attenuation |
| MSC | medium-specific concentration |

## LIST OF ACRONYMS (Continued)

| | |
|---|---|
| NAPL | nonaqueous phase liquid |
| NCP | National Contingency Plan |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NSIA | Northern Southeast Industrial Area |
| OMB | Office of Management and Budget, The Executive Office of the President |
| O&M | operation and maintenance |
| OU | Operable Unit |
| PADEP | Pennsylvania Department of Environmental Protection |
| PDO | Property Disposal Office |
| ppb | parts per billion |
| RAO | remedial action objective |
| RBC | risk-based concentration |
| RfD | reference dose |
| RI | remedial investigation |
| RME | reasonable maximum exposure |
| ROD | Record of Decision |
| SE | Southeastern |
| SIA | Southeast Industrial Area |
| SQL | sample quantitation limit |
| SSIA | Southern Southeast Industrial Area |
| TCA | trichloroethane |
| TCE | trichloroethene |
| THQ | target hazard quotient |
| TMV | toxicity, mobility, or volume |
| TR | target cancer risk |
| UCL | upper confidence limit |
| USAEC | U.S. Army Environmental Center |
| USATHAMA | U.S. Army Toxic and Hazardous Materials Agency |
| UST | Underground Storage Tank |
| VOC | volatile organic compound |
| WESTON | Weston Solutions, Inc. (formerly Roy F. Weston, Inc.) |
| WQC | water quality criteria for Toxic substances |

# DECLARATION FOR THE RECORD OF DECISION

LETTERKENNY ARMY DEPOT
CHAMBERSBURG, FRANKLIN COUNTY, PENNSYLVANIA

# CONOCOCHEAGUE DRAINAGE SYSTEM SOUTHERN SOUTHEAST INDUSTRIAL AREA (SSIA) SOUTHEASTERN (SE) AREA OPERABLE UNIT (OU) 10 AEDBR SITES LEAD-090, -091, -095, 100, -101, -128

(Includes Hawbaker Spring, Dozens Springs, Chambers Spring, and Building 12)

# DECLARATION FOR THE RECORD OF DECISION

**MARCH 2006**

## SITE NAME AND LOCATION

Site Name: Conococheague Drainage System, Southern Southeast Industrial Area (SSIA), Southeastern (SE) Area, Groundwater Operable Unit (OU) 10; Army Environmental Database – Restoration (AEDBR) Site numbers LEAD-101 (Building 37 volatile-organic contaminated groundwater), LEAD-128 (entire SE OU 10 area), LEAD-090 (Hawbaker Spring), LEAD-091 (Dozens Spring), LEAD-095 (Chambers Spring) , and LEAD-100 (Building 12).

Address: Letterkenny Army Depot, Chambersburg, Franklin County, Pennsylvania.

EPA ID: PA6213820503 (Southeastern Area, Letterkenny Army Depot).

CERCLIS ID: 110000332961.

## STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the Selected Remedy for the Conococheague Drainage System, SSIA, SE Area groundwater OU 10 (hereafter referred to as SE OU 10). The SE Area is listed on the Federal facilities National Priorities List (NPL). SE OU 10 is defined as the volatile organic compound (VOC)-contaminated groundwater located in the southeastern corner of Letterkenny Army Depot (LEAD), referred to as the “on-post” portion, and extending "off-post" beyond the LEAD boundary. The “on-post” portion of SE OU 10 consists of Base Realignment and Closure (BRAC) property that is currently owned by the Army (not yet transferred), and BRAC land that has already been transferred and is now part of the Cumberland Valley Business Park. The boundary between the on-post and off-post areas of SE OU 10 is located approximately along the Innovation Avenue (formerly Texas Avenue) and East Patrol Road (see Figure 3).

Under the Defense Authorization Amendments and Base Closure and Realignment Act of 1988 (Public Law 100-526, 102 Statutes at Large 2623) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Statutes at Large 1808), more than 100 Department of the Army facilities were selected for closure and / or realignment (i.e., a change in mission). As a result of the 1995 BRAC Commission recommendations, the U.S. Department of the Army (Army) must realign the mission at LEAD. As part of the realignment, approximately 1,450 acres at LEAD have been designated for release (i.e., to-be-excessed or transferred to a non-DoD entity). The first three sets of parcels that the Army identified for transfer were the Phase I, Phase II, and Phase III parcels, which were transferred to the Letterkenny Industrial Development Authority (LIDA) in 1998, 2001, and 2004, respectively. Some of the Phase I and Phase II BRAC parcels that were transferred are located within the on-post SE OU 10 groundwater boundary. As a result, these parcels were transferred with an interim remedy for groundwater consisting of groundwater usage restrictions referred to as land use controls. Part of this Record of Decision is to document the final groundwater remedy for these parcels and document that the groundwater restriction can be removed for these Phase I and Phase II parcels after the SE OU 10 remediation is completed (i.e., concentrations of VOCs in groundwater are at levels allowing for unrestricted use and unlimited exposure).

The remedy presented in this ROD was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and

Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the Administrative Record for SE OU 10. This Record of Decision is issued jointly by the Army, the owner of the property and the lead agency for Site activities under CERCLA, and the U.S. Environmental Protection Agency (EPA). The Pennsylvania Department of Environmental Protection (PADEP) (on behalf of the Commonwealth of Pennsylvania), concurs with the selected remedy. The concurrence letter from PADEP is contained in the Site Administrative Record. The LEAD anticipates that this will be the final decision for this OU.

## ASSESSMENT OF THE SITE

Releases of chlorinated solvents associated with leaking industrial wastewater sewer (IWWS) lines in the Building 37 area have been identified as the primary source of VOC groundwater contamination in SE OU 10. By the early 1990s, the condition of the IWWS lines had deteriorated. VOC-solvent-laden wastewater leaked through breaks in the pipes into near-surface soils or directly into the underlying fractured, weathered, karstic limestone bedrock aquifer. Groundwater flows in an east-southeast direction.

In 1994, two monitor wells downgradient of Building 37 were found to be contaminated with chlorinated solvents. In the early 1980s the Army discovered that On- and Off-post groundwater was contaminated with chlorinated solvents. From the early 1980s through 1992, the Army installed alternate potable water supplies to a number of off-post residences where LEAD/SE OU 10 site-related VOC contamination had reached domestic supply wells in the Sunset Pike area at concentrations exceeding the Maximum Contaminant Levels (MCLs) published by the EPA for drinking water. These residents remain connected to the public water supply.

The Army and EPA have determined that the response action selected in this ROD for the SE OU 10 groundwater is necessary to protect public health, welfare, or the environment from actual or threatened releases of hazardous substances (VOCs) into the environment, based on the current and likely future commercial/industrial use in the on-post areas (within the Cumberland Valley Business Park and the LEAD property) and the current and future residential use in the off-post areas. PADEP concurs with this determination.

## DESCRIPTION OF THE SELECTED REMEDY

The selected remedy, Enhanced Biodegradation with Monitored Natural Attenuation and Land Use Controls involves methods of stimulating the natural microbial populations in the vicinity of Building 37 to speed the bio-degradation process (breaking down of chemicals) by addition of nutrients to enhance the anaerobic processes that are already degrading chlorinated solvents. Specific components of the selected remedy for SE OU 10 are as follows:

- Injection of nutrients in the vicinity of Building 37.
- Periodic sampling to monitor the effectiveness at existing off-post wells and Hawbaker Spring.
- Conduct periodic sampling to evaluate the progress of the enhanced biodegradation and the monitored natural attenuation (MNA) in the immediate area and downgradient of the diesel spill where elevated benzene levels persist.
- Conduct a 5-year review as required by CERCLA (see below).

A component of the remedy is land use controls, due to the presence of volatile organic compounds in the groundwater above the Maximum Contaminant Levels (MCLs). The objectives are as follows:

- Reduce risks to human health by: preventing bathing with, showering with and drinking VOC-contaminated groundwater throughout SE OU 10; prohibiting people from digging into or drilling into or otherwise disturbing soil below the water table in on-post areas (Army-retained and BRAC property); and prohibiting people from building subsurface structures designed for human occupation in on-post areas (Army-retained and BRAC property).
- Maintain the integrity of any current or future remedial or monitoring system associated with SE OU 10 remedial actions, such as monitoring wells.

The Army has implemented land use controls on the on-post Army-owned property as part of the LEAD Master Plan. In addition, the Army is implementing land use controls as part of the BRAC land transfer process to LIDA to prohibit groundwater use and prevent contact with VOC-contaminated groundwater on-post and within the Cumberland Valley Business Park boundaries. The land use controls in the areas that have been transferred are described in the existing LUCAP (Army, EPA, PADEP, 2002).

In the off-post portion of SE OU 10, the Army has already hooked residences with VOC-contaminated groundwater at levels above MCLs to public water. Also, as discussed in more detail in Section 9 of the ROD, existing codes are in place and implemented by Greene Township that require connection to public water supply for specified areas and situations as defined in Chapters 85 and 101 of the 2005 Code of the Township of Greene.

The enhanced bioremediation program will be operated at full-scale and groundwater monitoring will be conducted as specified in the remedial action work plan.

The land use controls will be implemented as described in Section 12.2 of the ROD Decision Summary. The Army will be responsible for implementing and maintaining land use controls on-post, including restricting groundwater use on-post and within the Cumberland Valley Business Park until concentrations of VOCs in groundwater throughout SE OU 10 are reduced to levels allowing for unrestricted use and unlimited exposure. Greene Township is responsible for enforcing their existing codes and ordinances. The Army will coordinate with Greene Township concerning code and ordinance issues related to SE OU 10 and will report on off-post land use controls as specified in the remedial action work plan. The Army, with EPA and PADEP approval, may arrange with other entities such as LIDA or local interest groups/municipalities to maintain land use controls. The Army remains ultimately responsible for protecting human health and the environment through this remedy.

## STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining in groundwater above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Statutory reviews will be conducted at the prescribed intervals until such time as land use controls can be removed; land use controls may be removed after concentrations of VOCs in groundwater are at levels allowing for unrestricted use and unlimited exposure.

## ROD CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for LEAD.

- **Chemicals of concern and their respective concentrations:** Section 5.2, Nature and Extent of Contamination.
- **Baseline risk represented by the chemicals of concern:** Section 7, Summary of Site Risks.
- **Remediation levels for chemicals of concern and the basis for these levels:** Section 8, Remedial Action Objectives.
- **How source materials constituting principal threats are addressed:** According to the EPA guidelines, the contaminated groundwater in SE OU 10 is not considered to be a source material that would represent a principal threat.

- **Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD:** Section 6, Current and Potential Future Land and Resource Uses.
- **Potential land and groundwater use that will be available at the site as a result of the selected remedy:** Section 12.4, Selected Remedy (Expected Outcomes of the Selected Remedy).
- **Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected:** Section 9, Description of Alternatives,.
- **Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision):** Section 10, Summary of Comparative Analysis of Alternatives, and Section 13, Statutory Determinations.

**AUTHORIZING SIGNATURES**

Thomas E Lederle 10 Aug 2006

Thomas E. Lederle
Branch Chief
Army BRAC Division

Date

9/11/06

Abraham Ferdas, Director
Hazardous Site Cleanup Division
EPA, Region III

Date

# DECISION SUMMARY

# LETTERKENNY ARMY DEPOT

CHAMBERSBURG, FRANKLIN COUNTY, PENNSYLVANIA

## CONOCOCHEAGUE DRAINAGE SYSTEM SOUTHERN SOUTHEAST INDUSTRIAL AREA (SSIA) SOUTHEASTERN (SE) AREA OPERABLE UNIT (OU) 10 AEDBR SITES LEAD-090, -091, -095, 100, -101, -128

(Includes Hawbaker Spring, Dozens Springs, Chambers Spring, and Building 12)

# DECISION SUMMARY

**MARCH 2006**

***Note to the reader:*** ***Definitions of bold-faced terms in the text is provided in the "Glossary of Terms" located at the end of this document.***

## SECTION 1 SITE NAME, LOCATION, AND DESCRIPTION

### 1.1 SITE NAME AND LOCATION

The Conococheague Drainage System, Southern Southeast Industrial Area (SSIA), Southeastern Area **Operable Unit** 10 (SE OU 10) is located in the Southeastern (SE) Area of the Letterkenny Army Depot (LEAD), Chambersburg, Pennsylvania. The location of LEAD is shown in Figure 1. The SE Area is listed in the **National Priorities List (NPL)**. The U.S. Environmental Protection Agency (EPA) ID for the SE Area is PA6213820503. Cleanup monies for the implementation of the SE OU 10 Selected Remedy will be provided by the Department of Defense (DoD).

The site (hereafter referred to as SE OU 10) is one of seven SE Area groundwater operable units at LEAD (Figure 2). SE OU 10 originates in the southeastern corner of LEAD, which is referred to as the "on-post" portion of SE OU 10, and extends downgradient in a south/southeastern direction to Hawbaker spring located along the Conococheague Creek (Figure 3). The extended area of SE OU 10 is designated as the "**off-post**" portion. The "**on-post**" area consists of areas to be retained by the Army as well as the portions of LEAD that are currently, or will be a part of the Cumberland Valley Business Park after the property is transferred. The remedy for SE OU 10 represents the final remedy for the following sites (AEDBR[1] numbers listed in parenthesis): Building 37 **volatile organic compound** (VOC)-contaminated groundwater (LEAD-101), entire SE OU 10 area (LEAD-128), Hawbaker Spring (LEAD-090), Dozens Spring (LEAD-091), Chambers Spring (LEAD-095) and Building 12 (LEAD-100).

The U.S. Army is the owner of the property and the lead agency under the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**. EPA is the lead regulatory agency, and the Pennsylvania Department of Environmental Protection (PADEP) has a concurrence role as a support regulatory agency. The Army and EPA are issuing this ROD in consultation with PADEP.

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[1] AEDBR number = Number assigned to the site to track the progress in the Army Environmental Database - Restoration

## 1.2 SITE DESCRIPTION

### 1.2.1 Letterkenny Army Depot

LEAD is located in south-central Pennsylvania in Franklin County, 5 miles north of the Borough of Chambersburg (Figure 1). Prior to the first phase of Base Realignment and Closure (**BRAC**) property transfer, LEAD consisted of 19,243 acres, most of which is devoted to ammunition storage (16,614 acres). LEAD was established in 1942 as “Letterkenny Ordnance Depot,” an ammunition storage facility. In subsequent years, various other operations were added to the facility. Studies have indicated that toxic materials associated with operations at LEAD, along with uncertain past disposal practices, offered significant potential for contamination by chlorinated hydrocarbons and subsequent contaminant migration. As a result of various site investigations conducted at LEAD, the Southeastern (SE) area and the Property Disposal Office (PDO) area were placed on the Federal Facilities NPL in 1987 and 1989, respectively.

The BRAC Act of 1988 (Public Law 100-526, 102 Stat. 2623) (BRAC 88) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Stat. 1808) (BRAC 91, 93, 95) designated more than 100 Department of the Army facilities for closure and/or realignment. On February 28, 1995, the U.S. Secretary of Defense submitted a recommendation to Congress that the LEAD mission be realigned. As part of this decision, a portion of LEAD was identified to be released for reuse by the local community. The property designated for transfer under BRAC consists of approximately 1,450 acres. The Army is transferring BRAC property to the Letterkenny Industrial Development Authority (LIDA). The SSIA, including the portion of SE OU 10 that is within the LEAD boundary, is currently part of the BRAC areas that will be transferred by the Army. The Army will retain only three small areas in the SSIA. The remainder of the property will be transferred as investigations are completed and approved by the appropriate authorities.

### 1.2.2 SE OU 10

SE OU 10 is defined as the VOC-contaminated groundwater located in the southeastern corner of LEAD in the vicinity of Building 37 and extending downgradient in a south/southeastern direction to Hawbaker spring located along the Conococheague Creek off of Airport Road, approximately 2 miles south of Building 37 (Figures 2 and 3). The SE OU 10 groundwater originates in the southeastern corner of Letterkenny in the area referred to as "on-post." The "on-post" area consists of areas to be retained by the Army as well as portions of the Letterkenny Army Depot that are now or will be, after the property is transferred, part of the Cumberland Valley commercial/industrial business park. The SE OU 10 operable unit also extends "off-post," which is beyond the LEAD boundary, as defined by conditions before any property was transferred as part of BRAC, to areas where there are farms, residences, and other existing commercial/industrial areas. The boundary defining the on-post and off-post is approximately along Innovation Avenue (formerly Texas Avenue) and East Patrol Road.

# SECTION 2
# SITE HISTORY AND ENFORCEMENT ACTIVITIES

## 2.1 HISTORY OF ACTIVITIES

### 2.1.1 Letterkenny Army Depot

Prior to the establishment of LEAD in 1942, the area consisted of agricultural and forest lands. The area was predominantly single-family farms used for both subsistence and commercial purposes.

The Letterkenny Ordnance Depot was established in January 1942 as an ammunition storage facility. In subsequent years, the following missions were added:

- Reserve storage and export advance storage of parts, tools, supplies, and equipment for combat vehicles, artillery, small munitions, and vehicle fire control equipment (1943).
- Receipt and storage of hardware, heavy-duty trucks, and parts (1944).
- Establishment of transport and combat vehicle shops and expansion of the maintenance program (1947).
- Establishment of a rebuild system for guided missile ground control, launching, and handling equipment; missile propellant systems; and internal guidance systems (1954).
- Assignment of the special weapons mission (1958).
- Designation of the Depot as the Eastern Equipment Assembly Area (1959). This mission gave the Depot responsibility for the handling and shipment of equipment for guided missile and special weapons units to overseas locations.
- Acceptance and destruction of contaminated U.S. Air Force missile fuel (1961).
- Letterkenny Ordnance Depot renamed as Letterkenny Army Depot (1962).
- Disposal of explosive ordnance generated from the Army as well as state and local police (1964).
- Maintenance and storage of U.S. Air Force missiles (1966).
- Receipt, storage, and dispersal of batteries and tires to Army units (1972).
- Operation of a washout facility to reclaim explosives from munitions (1973).

These operations consisted of cleaning, stripping, painting, lubrication, and plating activities, which involved the use of solvents, blast media (such as sand from sandblasting operations), paints, chemicals, petroleum products, and metals. Storage, spills, releases, and disposal of these materials led to the current environmental concerns at LEAD.

### 2.1.2 SE OU 10

The groundwater beneath the SSIA had been contaminated with chlorinated solvents that leaked from the IWWS serving Building 37. VOC-contaminated groundwater from SE OU 10 discharges to three downgradient surface springs, located up to 1.6 miles off-post. In 2002, off-post groundwater contamination south of Gate 6 (formerly part of SE OU 6) was incorporated into SE OU 10, with off-post groundwater contamination north of Gate 6 remaining as SE OU 6. The Army is addressing the contaminated soils within the SSIA under SE OU 8 as part of the BRAC process and under SE OU 2.

Releases of chlorinated solvents associated with Building 37 industrial waste water sewers have been identified as the primary source of the VOC groundwater contamination in SE OU 10. Prior to the 1970s, industrial wastewater and solvents from facility activities were discharged to nearby storm water sewers. In the 1970s, the existing industrial wastewater sewer (IWWS) was extended to Building 37 to dispose of industrial wastes. Drain lines from solvent-use stations inside the building were connected to a collection loop extending around all but the northern perimeter of the building. The collection line was, in turn, connected to a pipeline that coveys the wastewater under pressure (referred to as a “force main”) extending to the industrial wastewater treatment plant (IWTP). However, by the early 1990s, the condition of the IWWS lines had deteriorated. Solvent-laden wastewater leaked through breaks in the pipes into near-surface soils or directly into the underlying bedrock aquifer.

In the early 1980s the Army discovered that the on- and off-post groundwater was contaminated with chlorinated solvents. From the early 1980s through 1992, the Army installed alternate potable water supplies to a number of off-post residences where LEAD / SE OU 10 site-related VOC contamination had reached domestic supply wells in the Sunset Pike area at concentrations exceeding the Maximum Contaminant Levels (MCLs) published by the EPA for drinking water. These residences remain connected to the public water supply.

In 1993, the Army issued a report entitled “Remedial Investigation of the Southeastern Area at LEAD, Final Report” (ESE, 1993). The report summarized remedial investigations (RIs) and source abatement in the vicinity of Buildings 37 and 47. The Army identified the leaking IWWS lines in the Building 37 area as the primary source of VOC groundwater contamination in the southern portion of the SE Area (ESE, 1993).

The 1993 RI report identified the groundwater system underlying the Building 37 area as a limestone bedrock aquifer that is fractured, and where groundwater can flow in large amounts through channeled areas and cavities formed when portions of the limestone rock dissolved over time (referred to as “karstic”). The elevation of the hydraulic head of pressure for the groundwater, in other words, for this type of aquifer, the top of the groundwater surface (referred to as “potentiometric surface”) was mapped as sloping toward the east-southeast. In 1994, two monitor wells were installed downgradient of Building 37. Both were contaminated with chlorinated solvents. Further investigations were conducted to determine the nature and extent of contamination associated with the Building 37 groundwater/SE OU 10, as discussed in Section 5 of this ROD.

## 2.2 SUMMARY OF PREVIOUS INVESTIGATIONS

The SE OU 10 site was investigated as part of the overall remedial investigation and risk assessment for the SE Area at LEAD (ESE, 1993, 1994). A Focused Feasibility Study (FFS) was conducted between 1996 and 2000 to further investigate the VOC-contaminated groundwater. Additional information was collected in 2003 and 2004 and was reported in the Addendum to the FFS (WESTON, 2005). During the course of the investigations, the following work was completed:

- Surface geologic mapping
- Shallow soil borings and small well-like structures used to measure the groundwater surface and head pressure (referred to as “piezometers”) to evaluate the **epikarst** and shallow groundwater
- Geophysical surveys to determine fracture trends and the geometry of the bedrock surface
- Installation and geophysical logging of 23 extraction and monitor wells
- Groundwater sampling and monitoring of groundwater elevations
- Two dye studies to determine movement of VOC-contaminated groundwater
- Hydraulic aquifer tests to determine preferential flow paths, well hydraulics, and aquifer characteristics
- Bench-scale degradation/enhanced biodegradation pilot studies using model ecosystems to examine the feasibility of using enhanced natural biodegradation as a remedy (these are referred to as “microcosm studies”)
- Preparation of work plan for field biopilot test
- Field pilot study of remediation of groundwater by enhanced biodegradation (note: the term “bioremediation” will be used throughout in this ROD in place of the phrase “remediation using biodegradation”)

## 2.3 HISTORY OF CERCLA COMPLIANCE ACTIVITIES AT LETTERKENNY ARMY DEPOT

In 1986, EPA ranked the LEAD SE Area (including the Disposal Area [DA] and the Southeast Industrial Area [SIA]), and the PDO Area under the Uncontrolled Hazardous Waste Site Ranking System, and proposed these two areas for inclusion on the NPL. The SE Area was placed on the NPL in July 1987. The PDO Area was added to the NPL in March 1989.

Since the listing of the two sites at LEAD on the NPL, all of the remedial activities at the sites have been Army-led, in coordination with EPA Region III and the SouthCentral Region of PADEP. No other potentially responsible parties have been identified.

As a result of the proposed NPL ranking, the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), later renamed the U.S. Army Environmental Center (USAEC), took the initiative in conducting the response actions at LEAD in accordance with Executive Order 12316 and a Memorandum of Understanding of August 12, 1983. The Executive Order was signed on August 14, 1981 by President Reagan. It delegates to the Secretary of Defense the authority to take the lead on CERCLA activities at Federal facilities. The Memorandum of Understanding is between EPA and the DoD defines the relationship for Federal facilities to take the lead on such activities with EPA input. Executive Order 12580 was signed in January 1987, which superseded Executive Order 12316. This Executive Order transferred authority for site investigations and remedial actions at Federal facilities to the secretaries of the applicable Federal agencies.

On February 3, 1989, a Federal Facilities Agreement was reached under CERCLA Section 120 among the DoD, EPA, and PADEP (EPA, Army, and PADEP, 1989). The 1989 Federal Facilities Agreement established the framework for the CERCLA response actions at LEAD and required the review of all documents concerning the investigation of environmental contamination at LEAD produced prior to the Federal Facilities Agreement.

## SECTION 3
## COMMUNITY PARTICIPATION

Pursuant to CERCLA Section 113(k)(2)(B) and Section 117, the **Proposed Plan** for the SE OU 10 at LEAD was released to the public for comment on April 4, 2005. This Proposed Plan, as well as the Remedial Investigation Report, **Risk Assessment** Report, and the Feasibility Study reports, were made available to the public, in the **Administrative Record**, located in Building 14 at LEAD, and in the Coyle Free Library in Chambersburg. Documents in the Administrative Record are also available on the Letterkenny library page of LEAD's environmental Website at http://209.235.100.233/letterkennylibrary/.

A public comment period was held from April 4, to May 4, 2005. On April 20, 2005, a public meeting was held at the Building 14 conference room to present the Proposed Plan and to entertain questions and comments from the public. The notification for the Proposed Plan public meeting was published in the Shippensburg News Chronicle on April 1 and 5, 2005, the Waynesboro Record Herald on April 1 and 2, 2005 and the Chambersburg Public Opinion on April 1 and 2, 2005. A summary of the community participation process is provided in the Responsiveness Summary, which is included as part of this ROD. There were no comments received during the public comment period. Representatives from LIDA, EPA, PADEP, and the Army attended the meeting. In addition, the community co-chairperson of the local Restoration Advisory Board (RAB) was in attendance. There were no comments during the public meeting. There were 2 questions at the public meeting, which were answered by the Army to the satisfaction of the public, as discussed in the Responsiveness Summary.

## SECTION 4
## SCOPE AND ROLE OF RESPONSE ACTION

The subject of this ROD is SE OU 10, one of the six groundwater operable units in the SE Area at LEAD. Past leaks from the IWWS serving Building 37 have caused VOC groundwater contamination in SE OU 10 at LEAD. The role of the response action is to mitigate potential environmental threats posed by VOC contamination present in on-post and off-post groundwater associated with the Building 37 area, while also making the BRAC parcels in the SSIA available for beneficial reuse as industrial/commercial areas in a timely manner.

The SE OU 10 at LEAD is located within the SE Area NPL site. The OUs within the SE Area are presented below.

The SE Area consists of SIA and DA, and encompasses approximately 1,136 acres. A total of 14 OUs exist within the SE Area. These OUs are listed below (the groundwater OUs are shown on Figure 2)

At the time the K Area ROD was signed in 1991, the following three OUs were identified:

- SE OU 1 — K-Areas
- SE OU 2 — Industrial Wastewater Sewer System

- SE OU 3 — Disposal Area VOC-Contaminated Groundwater

In 2002, SE OU 3 was divided into two OUs (SE OU 3A and SE OU 3B) so that the area upgradient of the VOC-contaminated groundwater from the Disposal Area source could be managed separately as SE OU 3B. The designations of the new OUs that replaced SE OU 3 are as follows:

- SE OU 3A — Disposal Area VOC-Contaminated Groundwater
- SE OU 3B — Area Upgradient of VOC-Contamination Source in SE OU 3A

Additional OUs were designated based on the results of the former SE OU 3 Remedial Investigation (RI) Report (ESE 1993). The four additional OUs created within the SE Area included:

- SE OU 4 — Stormwater Sewer Lines and Associated Drainageways
- SE OU 5 — Area A and B Contaminated Soils
- SE OU 6 — Off-Post VOC-Contaminated Groundwater North of Gate 6 and East of East Patrol Road [Rowe Run Drainage System]
- SE OU 7 — Truck Open Storage Area

SE OU 6 originally included all off-post SE Area VOC-contaminated groundwater; however, in 2002 the portion of this OU associated with SE OU 10 (south of the groundwater divide in the vicinity of the old Gate 6) was moved to SE OU 10 in 2002 so that SE OU 6 is now associated only with Rowe Run drainage.

To support the 1995 Base Closure and Realignment (BRAC) decision to realign the LEAD mission, SE OU 8 was created to deal with all waste sites within the BRAC property boundary.

- SE OU 8 — BRAC Waste Sites

In February 1999, two additional OUs were created

- SE OU 9 — Landfill J
- SE OU 10 — SSIA VOC-Contaminated Groundwater South of Gate 6 (Conococheague Drainage System)

SE OU 10 was originally part of SE OU 3 and was separated from SE OU 3 since there is a different source of contamination and there is a groundwater divide between the two areas.

In 2001, two additional OUs were created:

- SE OU 11 — Northern Southeast Industrial Area (NSIA) VOC-Contaminated Groundwater North of Gate 6
- SE OU 12 — Landfill G

SE OU 11 was originally part of SE OU 3 and was separated from SE OU 3 since there is a different source of contamination. In 2002, SE OU 13 was added so that the Southern Martinsburg Shale Region (SMSR) could be managed separately (originally, this was a part of SE OU 10 and SE OU 11).

- SE OU 13— Southern Martinsburg Shale Region

The response action in this ROD concerns SE OU 10 (Figure 3).The only potential threat to human health within SE OU 10 is the potential exposure to VOC-contaminated groundwater. The overall implementation of the preferred alternative will 1) mitigate the potential for exposure to VOC-contaminated groundwater, 2) facilitate the reuse of the property, 3) positively impact on-post and off-post groundwater quality 4) mitigate the discharge of VOC-contaminated groundwater to off-post surface springs.

# SECTION 5
# SITE CHARACTERISTICS

The following information is presented to document the site characteristics of the SE OU 10 groundwater. Some of the environmental setting information is general to all of LEAD, with specific references to the SE OU 10 groundwater as appropriate. The information pertaining to the site conceptual model and the nature and extent of contamination is presented in Subsection 5.2. A map of extent of SE OU 10 is shown in Figure 3. Detailed information on SE OU 10 characteristics can be found in the *Final Focused Feasibility Study for the Southern Southeast Industrial Area Operable Unit (OU) 10, Letterkenny Army Depot* and the *Addendum to the Final Focused Feasibility Study for the SSIA, SE OU 10, Letterkenny Army Depot* (see list of References).

The on-post portion of SE OU 10 is an industrial area. There are no residential facilities for civilian personnel within the on-post areas (Army-retained and Cumberland Valley Business Park land). There are temporary military barracks in Building 416 (approximately 3 months stays). Groundwater is not used as a potable water source in the on-post areas. Some of the buildings and temporary sheds that formerly covered the area have been demolished, and some of the land surrounding Building 37 is now vacant. Various parcels within the property are being leased for **commercial/industrial use** as part of the Cumberland Valley Business Park. The current use of the remaining buildings is light industrial.

The off-post area of SE OU 10 is used for agricultural, residential, and recreational activities. Fields and orchards are common, with a few farmhouses and residential structures. Groundwater withdrawals are primarily for agricultural purposes, but some residences derive potable water from wells. Groundwater flowing beneath Building 37 discharges to off-post springs (Hawbaker, Dozens, and Chambers) and, ultimately, to the Conococheague Creek, approximately 2 miles from Building 37.

## 5.1 ENVIRONMENTAL SETTING

### 5.1.1 Topography and Surface Water Drainage

LEAD is located in the Great Valley section of the Valley and Ridge Province of the eastern United States, and is referred to locally as the Cumberland Valley. The Cumberland Valley trends northeast to southwest through central Pennsylvania and is bordered to the west by the Appalachian Mountain Province. The South Mountain section of the Blue Ridge Province is situated east of Chambersburg and marks the eastern edge of the Cumberland Valley.

The Cumberland Valley is characterized by southwest-trending limestone ridges and valleys. The valley floors are underlain primarily by carbonate rocks (limestone and dolomites), while the ridges are underlain by more resistant clastic rocks (i.e., fragments of preexisting rock including sandstones, siltstones, and shales). Weathering of the folded and faulted underlying geological formations imparts a gently rolling aspect to the local topography. The majority of LEAD is underlain by the Martinsburg Shale, except for bands of carbonate rocks along the eastern and western edges of LEAD. The PDO Area and the Southeast Industrial Area (including SE OU 10) of LEAD are underlain primarily by limestones of the St, Paul Group and Chambersburg Formation. Figure 2 shows the general locations of the PDO and SE Areas. Surface elevations throughout the SSIA areas of LEAD range from approximately 600 to 750 ft above mean sea level (msl).

Streams cutting through the limestone terrain flow through broad, open valleys and are usually intermittent. In contrast to this, streams cutting through the upper shale units of the Martinsburg Formation usually meander in small, steep-walled valleys and are perennial. Surface drainage at LEAD is divided into two watersheds—the Susquehanna River to the northeast and the Potomac River to the southwest. Both the Susquehanna and Potomac Rivers eventually drain into the Chesapeake Bay.

SE OU 10 lies within the Potomac watershed. Within the SE OU 10 on-post area, overland flow is toward the south-southeast. There are no surface water bodies in the on-post portion of SE OU 10. Surface water is present only in drainage ditches during precipitation events and most of the surface flow is directed into underground stormwater sewers. The drainage ditches and stormwater sewers in the on-post portion of SE OU 10 flow into the Southeast Drainage Way, located at the on-post/off-post boundary. The Southeast Drainageway was built by the Army to convey stormwater from the southeast portion of the Letterkenny Depot. This drainage ditch eventually discharges to the Conococheague Creek a distance of about 1.5 miles off-post. Except for rainfall and snowmelt, the Southeast Drainageway is predominantly dry until it intersects with Dozens Spring further downstream (approximately 1.3 miles from the LEAD boundary). Beyond the on-post/off-post boundary, the only surface water flow associated with SE OU 10 is that associated with the off-post springs (Hawbaker, Dozens, and Chambers), which discharge to Conococheague Creek off of Airport Road. Hawbaker Spring is located along the Conococheague Creek approximately 2 miles south of Building 37.

### 5.1.2 Geology

The LEAD Site is located in the Great Valley section of the Valley and Ridge physiographic province. Ordovician limestone, dolomite, and shale formations underlie the area. The geologic formations include: black shales of the Martinsburg Formation, limestones of the Chambersburg Formation and the St. Paul Group, limestones and dolomites of the Rockdale Run Formation, and dolomites of the Pinesburg Station Formation. The rocks are fractured and complexly folded as a result of the deformational processes that formed the Great Valley.

The Martinsburg Shale is more resistant to chemical weathering than the limestones/dolomites, and tends to form the hills in the area. The more soluble limestones and dolomites, which are susceptible to chemical weathering, generally underlie the valley floor of the SE Area, including SE OU 10. The valley areas underlain by these carbonate rocks have developed what is referred to as a karstic terrane which is characterized by sinkholes, sinking streams and closed depressions.

Structural deformation during the late Paleozoic resulted in a sequence of northeast-trending anticlines, synclines, and high-angle reverse faults. The primary fault associated with the SE Area is the Pinola Fault located immediately north of the Disposal Area, which is in the northern section of the SE Area. The Pinola Fault represents the structural boundary between the Martinsburg Formation and the St. Paul Group. Investigations in the SE Area, including evaluations of bedding orientation in borehole geophysical logs and bedrock outcrops/exposures in test trenches, indicates the presence of complex folding and faulting, but there is a lack of evidence for any other major faults in the SE area.

### 5.1.3 Hydrogeology

The regional surface water flow system of Franklin County controls the general groundwater flow patterns within LEAD. The surface water drainage divide, discussed previously, also divides the groundwater flow system into two basins. Groundwater elevation contours within LEAD generally reflect surface topography. The water table is located at moderate depth in areas of topographic highs, and is shallow near stream valleys and other topographic lows (ERM, 1995).

The shale and carbonate rock that underlie LEAD have been disturbed and faulted during deformational events that ultimately formed the Great Valley. The two major faults located within the confines of LEAD (the Pinola fault and the Letterkenny fault) influence groundwater flow. Where faulting is present and dissimilar rocks have been brought into contact, the fault tends to act as a barrier to groundwater movement, occasionally in low-lying areas forcing water within the formation to discharge as a fault spring. Where similar rocks are in contact along a fault (i.e., two limestone units), the groundwater movement may be only minimally affected (ERM, 1995).

Groundwater flow within the limestone of the Chambersburg Formation and St. Paul Group, which includes SE OU 10, is complex because it occurs predominantly through more isolated fractures and solution cavities typical of what is referred to as a "**karst**" terrain. Groundwater flow is controlled by the structural orientation of bedding planes, density of fractures, joints and karst features, hydraulic head, and geomorphology. Fractures in the limestones are mostly aligned with the regional northeast tectonic grain and are much more irregular and widely spaced than those in the adjacent shales. Where solution cavities are present in the limestone, groundwater flow more closely resembles open channel flow rather than the fracture flow described previously. Groundwater velocity in the overburden deposits is much slower due to the low permeability ($10^{-8}$ centimeters per second [cm/sec]) of the clay-rich soils.

The quantity and density of fractures and solution cavities within the limestone units are generally greatest in the upper 150 ft and generally decrease with depth. During three-quarters of the year (high and base flow conditions) groundwater levels are above the soil-bedrock interface. Leaching or resuspension of any materials or potential contaminants buried in the overburden soils may be enhanced during high water table conditions (ERM, 1995).

Groundwater “recharge” occurs primarily through precipitation. “Recharge” refers to replenishing of supplies of groundwater. Recharge areas occur throughout the central part of LEAD, wherever fractured and jointed sandstone, siltstone, and shale bedrock are close to the surface. Actual points of recharge for the limestone aquifers have not been determined; however, the most likely routes are the many faults, joints, and sinkholes present at LEAD (ERM, 1995). Groundwater underlying LEAD generally occurs under unconfined conditions in the SE Area.

Groundwater movement in SE OU 10 is primarily in a southeasterly direction toward the Conococheague Creek. It is difficult to predict contaminant migration in this karst geologic setting. Depending on whether a particular monitor well is located within, near, or some distance away from available migration pathways, observed contaminant concentrations may vary considerably from those predicted by a strict linear flow model.

## 5.2 NATURE AND EXTENT OF CONTAMINATION

Remedial investigations/risk assessments were performed for SE OU 10 groundwater to provide information to support a decision to investigate further, implement a removal action, or conduct no further action at the site. The objectives of the remedial investigation for the site were to: (1) identify the type, location, levels of contamination, and extent of contamination at the study site; (2) identify the physical site-specific characteristics that may influence contaminant distributions; (3) determine the potential for contaminant migration; and (4) determine if there are potentially unacceptable levels of risk to people or the environment at the sites. The remedial investigation/risk assessment documents are available in the LEAD Administrative Record.

### 5.2.1 Site Conceptual Model

The site conceptual model for SE OU 10 is illustrated in Table 1 and Figure 4 and discussed below. The conceptual model lists exposure pathways for people, animals, and plants that could possibly be exposed to SE OU 10 groundwater. Investigations are discussed in more detail in the following subsections. The VOC-contaminated groundwater associated with SE OU 10 migrates from the Building 37 area (on-post), flows off-post, and then ultimately to springs located approximately 1.5 to 2 miles from the on-post/off-post boundary. In the on-post areas, current and future commercial/industrial workers (and unlikely but possible future scenario of adult and child residents) could be exposed by the inhalation, ingestion, and dermal contact (child) pathways. Off-post residents could be exposed via ingestion, inhalation, and dermal contact (child). Even though the VOC-contaminated groundwater is not being used for drinking water and is not expected to be used as such in the future, ingestion and inhalation of groundwater are possible future pathways based on possible future beneficial use of groundwater. Also, industrial/commercial workers and residents may be exposed to vapors from VOC-contaminated groundwater via migration to indoor air. The only biota potentially exposed is at the off-post springs.

### 5.2.2 SE OU 10 Groundwater

Investigations have been completed to determine the nature and extent of groundwater contamination in the SE OU 10 area, as well as gather information to build the site conceptual model and evaluate fate (i.e., migration pathways, how fast and where the groundwater moves, if chemicals degrade or get diluted, etc.) and transport and other site characteristics necessary to evaluate potential remedial actions. Field activities were performed from 1999 through 2004 with periodic groundwater sampling ongoing in 2005. Monitor wells were installed and surveyed; groundwater at numerous locations across the site was sampled and analyzed; geologic mapping was performed; geophysical, geochemistry, and biochemistry studies were conducted; aquifer tests and dye tracer studies were completed; data validation was performed on numerous rounds of sampling; groundwater levels were taken; and risk assessments were conducted for both on-post and off-post areas of SE OU 10. The findings are reported in the remedial investigation/risk assessment and FFS reports (ESE, 1993 and 1994, WESTON, 2003 and 2005a, and Shaw, 2004).

The residual VOCs released from the leaking IWWS lines surrounding Building 37 were determined through the FFS investigations to have been the source of the groundwater contamination. The IWWS lines were subsequently repaired and are no longer a source of contamination. Concentrations of VOCs have declined over time indicating that ongoing releases of VOCs into the bedrock matrix are no longer occurring. Free-phase DNAPL was not encountered during any of the investigations.

As a result of a diesel fuel tank underground return line leak in the early 1990s, a localized area of elevated benzene, toluene, ethylbenzene, and xylene (BTEX) compounds exist in the groundwater near the southeast corner of Building 37. The surface soil sources of diesel contamination were removed in 1991/1992 (the underground storage tanks [USTs] and contaminated soils).

#### 5.2.2.1 Historical Data, COPCs, and Trends

Historical groundwater sampling results from on-post SE OU 10 monitor wells showed a variety of VOCs present in 1994 as the **contaminants of potential concern (COPCs)**. In wells adjacent to Building 37, detected compounds included benzene up to 211 µg/L (microgram per liter or parts per billion), chloroethane (up to 230 ppb), 1,1-dichloroethane (1,1-DCA) (up to 340 ppb), 1,2-dichloroethene (1,2-DCE) (up to 59 ppb), ethylbenzene (up to 150 ppb), tetrachloroethene (PCE) (up to 7.1 ppb), toluene (up to 283 ppb), 1,1,1-trichloroethane (1,1,1-TCA) (up to 300 ppb), trichloroethene (TCE) (up to 200 ppb), vinyl chloride (up to 90 ppb), 1,1-dichloroethene (1,1-DCE) (up to 13 ppb), and xylenes (up to 440 ppb).

Sampling of wells and springs in the off-post portion of SE OU 10 between 1991 and 1996 indicated that, while site-related VOCs were present at significantly lower concentrations than in on-post groundwater, VOC levels were generally above either Federal drinking water MCLs in wells or Pennsylvania Water quality criteria for Toxic Substances (WQC), human health criteria, in springs. The primary VOCs detected in off-post wells included TCE (up to 13.9 ppb) and 1,1-DCE (up to 16.2 ppb). The primary VOCs detected in off-post springs included TCE (up to 6.4 ppb), 1,2-DCA (up to 5 ppb) and 1,1-DCE (up to 4.5 ppb).

Since the start of the enhanced bioremediation pilot study program in 1999 (which is still on-going), groundwater sampling results have shown significantly declining VOC concentrations both in the Building 37 area wells, as well as in downgradient, off-post wells and at surface water spring discharges at Hawbaker Spring, Dozens Spring, and Chambers Spring. Note that the Army has sampled Hawbaker Spring in the more recent years of the studies to represent concentrations and trends for Hawbaker, Dozens and Chambers springs, since Hawbaker Spring has the greatest flow and is the best indicator of groundwater quality in the vicinity of the springs. Figure 5 provides chlorinated VOC concentrations depicting the reduction and breakdown of chlorinated VOCs in groundwater from 1998 through 2004 at representative on-post and off-post sampling locations. More information is provided in the Addendum to the FFS for SE OU 10 (WESTON, 2005b).

During 2003, VOC concentrations in the Army's on-post groundwater monitoring wells were all below MCLs in 3 of the 5 sampling rounds. There were isolated exceedances of MCLs for either vinyl chloride or TCE in 2 wells during the January sampling event and for vinyl chloride in 1 well during the December sampling event. In 2003, the maximum levels of COPCs in the Building 37 area monitor wells included TCE (7.9 ppb), PCE (0.4 ppb), vinyl chloride (13 ppb), 1,1,1-TCA (0.5 ppb), 1,2-DCE (26 ppb), 1,1-DCA (11 ppb), chloroethane (5.7 ppb), toluene (0.24 ppb), benzene (1.3 ppb), ethylbenzene (1.4 ppb), and xylenes (0.68 ppb).

Elevated concentrations of BTEX compounds associated with the historic release from the diesel fuel tank line in the early 1990s still persist; primarily in 2 wells in the close proximity of Building 37 (wells UST-3 and 96-37-15). The maximum concentrations of BTEX compounds exists in well UST-3 (last sampled in January 2002) and included benzene (55 ppb), toluene (30 ppb), ethylbenzene (63 ppb) and xylenes (370 ppb). Only benzene was present above the MCL of 5 ppb (MCL for toluene is 1,000 ppb; ethylbenzene is 700 ppb; xylenes is 10,000 ppb).

Building 37 historical groundwater sampling results collected as part of the FFS indicated that BTEX compounds degrade slowly within the diesel spill area, but degrade rapidly outside of the diesel spill area (Figure 6). This is due to the anaerobic groundwater conditions within the diesel spill area and aerobic conditions outside the spill area. Under aerobic conditions, BTEX compounds degrade fairly rapidly (e.g., the aerobic biodegradation **half-life** of benzene is 5 to 16 days whereas the half-life under anaerobic conditions is 4 to 24 months) (Howard, 1991). "Half-life" is the period of time it takes for ½ of a substance to degrade; the shorter the half-life, the faster the degradation rate. This diesel area is an important part of the enhanced biodegradation effort for the chlorinated VOCs due to the anaerobic conditions in the area.

As a result of the aquifer being in an aerobic condition at a relatively short distance downgradient from the diesel spill area (approximately 200 feet), BTEX compounds have not historically been detected in downgradient or off-post locations. In May 2004, the Army initiated a groundwater sampling effort to verify the natural attenuation of the BTEX compounds in the diesel spill area of SE OU 10. Well UST-3 contained 29 to 37 ppb of benzene, whereas in 6 nearby downgradient wells, benzene was only detected once (at a concentration 0.57 ppb), well below the MCL of 5 ppb. Additional sampling data from recent sampling efforts supports the conclusion that there is a localized anaerobic zone in the spill area which quickly transitions to aerobic conditions downgradient of the release area. The data to support a claim of natural attenuation is discussed in more detail in the Addendum to the FFS for the SE OU 10 (WESTON, 2005b).

Sampling of the off-post wells and springs in 2003 indicated that VOC concentrations were below drinking water MCLs (in wells) and WQC (Hawbaker Spring) at all locations. In off-post wells, the maximum COPC levels detected in 2003 were TCE (3.3 ppb), PCE (0.25 ppb), 1,2-DCE (0.62 ppb) and 1,1,1-TCA (0.41 ppb). At Hawbaker spring, the only COPCs detected during 2003 included TCE (0.41 ppb), 1,1,1-TCA (0.48 ppb), and 1,2-DCE (0.13 ppb). The chemical 1,2-DCA has not been detected in the off-post springs since 1999; therefore, it was dropped as COPC. Provided on Figure 7 is a map of the SE OU 10 groundwater plume showing the approximate area where COPC concentrations are currently (based on 2004 data) periodically above **Applicable or Relevant and Appropriate Requirements (ARARs)**.

The overall decline of VOC concentrations can be attributed to the implementation of the pilot study program. However, due to the dynamic nature of the karst groundwater system, it is possible that concentrations will fluctuate in the future by increasing or decreasing slightly due to changing groundwater heights. For example, during periods of increased precipitation and groundwater recharge, as was the case in 2003, high groundwater conditions can have a diluting effect, resulting in lowered VOC concentrations in wells and springs.

#### 5.2.2.2 Current Extent of Contamination and COCs

The past as well as the current updated risk assessment showed that there are potential adverse impacts to public health and welfare if SE OU 10 groundwater would be used as a drinking water source. Note that the entire on-post area of SE OU 10 and the off-post areas with VOC-contaminated groundwater above MCLs are served by piped public drinking water systems, reducing the need to rely on groundwater for drinking water. The on-post areas have never been used by the Army as a drinking water supply. In addition, the land will be part of the Cumberland Valley Business Park, and in accordance with the business park's Codes, Covenants, and Restrictions, one of the prohibited uses of the property is drilling for water. In addition, there are some restrictions implemented by Greene Township in the off-post regarding groundwater use near existing public water supply lines.

The **contaminants of concern (COCs)** identified in the most current risk assessment (see Section 7) are the following VOCs: benzene, TCE, and vinyl chloride. The extent of contamination of COCs consists of the on-post areas extending to approximately 1,000 feet off-post, as depicted in Figures 5, 6 and 7. Due to the enhanced and naturally-occurring biodegradation occurring in the SE OU 10 groundwater, the following compounds are also potential COCs since they are possible (degradation) compounds (degradation products) of the TCE **dechlorination** process that may be of concern, that are not already listed as COCs: 1,1,-DCA; 1,1-DCE; 1,2-DCE; and chloroethane.

# SECTION 6
# CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

## 6.1 LAND USE

The "on-post" area of SE OU 10 (SSIA) is designated for disposal under the 1995 BRAC decision. Prior to realignment, 4,800 civilians and 90 military personnel were employed at LEAD (ESE, 1996). The SSIA was an industrial area and as per the BRAC realignment the military mission has now terminated in most of the SSIA. There are no residential facilities for civilian personnel within the SSIA. There are temporary military barracks in Building 416 (approximately 3 months stays). Some of the buildings and temporary sheds in the SSIA have been demolished, and some of the land surrounding Building 37 is vacant. Various parcels within the property are being leased for commercial or light industrial use, including some areas that are being leased by the Army for light industrial use to support the remaining mission. The SSIA is now a part of the Cumberland Valley commercial/industrial business park; as the various parcels are transferred to LIDA as per BRAC, the Army-owned land then becomes part of the business park.

The off-post portion of the SE OU 10 (area between the southern boundary of LEAD and Hawbaker Spring) is used for agricultural, residential, and recreational activities. Fields and orchards are common with a few farmhouses and residential structures. It is likely that this area will continue to be used for the same purposes in the future.

## 6.2 GROUNDWATER USE

Currently, SE OU 10 groundwater is not used for potable water supply at on-post areas (Cumberland Valley Business Park and Army-retained property) at LEAD. All potable water for LEAD is supplied by the Letterkenny Reservoir on Conodoguinet Creek near Roxbury, PA, which is located far upgradient of SE OU 10. The Letterkenny Reservoir began supplying potable water to the base in 1957. Ownership of the potable water supply system, including the Letterkenny Reservoir, water distribution system, and the on-post water treatment plant, was transferred to LIDA in January 2004. It is anticipated that the groundwater will not be used for potable or any other purposes in the future in the on-post areas.

Groundwater in the off-post areas (between the southern boundary of LEAD and Hawbaker Spring) are used primarily for agricultural purposes, but some residences derive potable water from wells. Residences with groundwater known to be contaminated with concentrations of VOCs above MCLs associated with SE OU 10 have been placed on public water supply. Groundwater may be used for agricultural as well as for human consumption in the off-post areas in the future. Groundwater flowing beneath Building 37 discharges to off-post springs (Hawbaker, Dozens, and Chambers) and, ultimately, to the Conococheague Creek.

## 6.3 SURFACE WATER USE

There are no surface water bodies in the on-post portion of SE OU 10. The drainage ditches and stormwater sewers in the on-post portion of SE OU 10 flow into the Southeast Drainageway, which then flows off-post. The Southeast Drainageway ditch conveys stormwater from the southeast portion of the Letterkenny Depot. This drainage ditch eventually discharges to the Conococheague Creek a distance of about 1.5 miles off-post. Except for rainfall and snowmelt, the Southeast Drainageway is predominantly dry until it intersects with Dozens Spring further downstream (approximately 1.3 miles from the LEAD boundary). Beyond the on-post/off-post boundary, the only surface water flow associated with SE OU 10 is that associated with the off-post springs (Hawbaker, Dozens, and Chambers), which discharge to Conococheague Creek off of Airport Road. Hawbaker Spring is located along the Conococheague Creek approximately 2 miles south of Building 37. The Conococheague Creek is a recreational trout fishing stream. The off-post springs and Conococheague Creek are not currently used and are not expected to be used in the future for potable water supply.

# SECTION 7
# SUMMARY OF SITE RISKS

As part of the remedial investigation/feasibility study (RI/FS) process for SE OU 10, the Army, in conjunction with EPA and PADEP, conducted risk assessments to determine the current and future effects of contaminants on human health and the environment. The past risk assessments evaluated the potential risks associated with exposure to groundwater under the scenarios of continued industrial use as well as potential future residential or commercial use (ESE, 1994 and WESTON, 2001). The Army, EPA and PADEP concluded that risks to plants and animals from potential contact with spring water and surface water in SE OU 10 were acceptable, whereas the risks to human health from potential contact to the groundwater were unacceptable. In addition, for the purposes of this ROD, an updated risk assessment was performed for the direct contact pathways associated with groundwater beneath the SE OU 10 Area. Human health and ecological risks for the SE OU 10 groundwater are summarized in Subsections 7.1 and 7.2, respectively. The **human health risk assessment** results summarized in this ROD are: (1) the vapor intrusion pathway analysis performed in 2001 (WESTON, 2001); and (2) the current (2004 data) update to the direct contact exposure pathways evaluated in the past risk assessment (ESE, 1994). The update to the risk assessment for the SE OU 10 Area was done since concentrations of contaminants have changed dramatically since the 1990s due to the naturally-occurring biodegradation process and enhanced biodegradation due to the pilot study work performed at the site. The updated risk assessment focused on evaluation of groundwater conditions associated with the Building 37 source area (SE OU 10 on-post area); this was done to be more representative of the currently-existing primary contaminant plume. The updated risk assessment was performed using sampling data from 3 sampling events in 2004 (June, October and December) for on-post wells representative of the VOC-contaminated SE OU 10 groundwater and migration pathway (monitoring well numbers 96-37-11, 96-37-6, 97-37-24, and 97-37-23, see Table 20).

## 7.1 HUMAN HEALTH RISKS

Potential human health risks were evaluated for exposure to groundwater underlying SE OU 10 using the CERCLA baseline risk assessment process. Because soil contamination is being managed under SE OU 8, the discussion in this ROD deals only with groundwater issues. The steps and the technical elements of each of those steps used in the baseline risk assessment are provided in the following inset box.

**WHAT IS RISK AND HOW IS IT CALCULATED?**

A CERCLA human health risk assessment estimates the “baseline risk.” This is an estimate of the likelihood of health problems occurring if no cleanup action was taken at a site. To estimate the baseline risk at a CERCLA site, the Army, EPA, and PADEP undertake a four-step process:

Step 1: Analyze contamination
Step 2: Estimate exposure
Step 3: Assess potential health dangers
Step 4: Characterize site risk

In Step 1, the concentrations of contaminants found at a site, as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable), are considered. Comparisons between site-specific concentrations and concentrations reported in past studies help determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure are considered. Using this information, a “reasonable maximum exposure” (RME) scenario is calculated, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, the information from Step 2 is used in combination with information on the toxicity of each chemical to assess potential health risks. There are two types of risk: **cancer risk** and noncancer risk. The likelihood of any kind of cancer resulting from a CERCLA site is generally expressed as an upperbound probability; for example, a “1-in-1,000,000 chance.” In other words, for every 1,000,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For noncancer health effects, a "**hazard index**" (HI) is calculated. The key concept here is that a "threshold level” (measured usually as an HI of less than 1) exists below which noncancer health effects are no longer predicted.

In Step 4, a determination is made on whether site risks are great enough to cause health problems for people at or near the CERCLA site. Results from the three previous steps are combined, evaluated, and summarized. The potential risks from the individual exposure pathways are added to provide the total risk.

The human health risk assessment identifies all chemicals found in concentrations that might cause cancer in greater than 1 out of 1,000,000 people (this means one additional chance in one million that a person might develop cancer if exposed to contaminated soil or groundwater). In addition, the risk assessment identifies whether or not these concentrations would result in harmful effects other than cancer by calculating hazard quotients (HQs) for all chemicals (i.e., carcinogens and noncarcinogens). A HQ is the comparison of the potential exposure dose from an existing amount of a chemical to the safe dose recognized by the EPA (i.e., the amount that does not cause harmful noncancer health effects in people. The sum of all HQs is the hazard index (HI). If the HI is greater than one, then there may be concern that harmful health noncancer effects may occur in people. The assessment also considers uncertainty in the risk assessment process (i.e., issues related to sampling, exposure and chemical toxicity), which includes comparison to naturally occurring site background levels where available (e.g., for metals), which can be naturally occurring.

Human health risks were evaluated for exposures to contaminants (referred to as chemicals of potential concern [COPCs]). COPCs are chemicals that are found in site media, such as soil, groundwater, or air, that are identified for further risk evaluation based on a number of factors. These factors include the chemical’s toxicity potential, concentration, frequency of detection, and chemical properties important to the release, transport, and potential to come in contact with people. COPCs are specific to each site and medium of concern (e.g., soil, air, and groundwater).

The completion of the risk assessment process and subsequent site-specific background (i.e., reference) data comparison are intended to provide the necessary information to facilitate a decision by the BRAC Cleanup Team to recommend site clearance or a more detailed investigation such as additional sampling or a baseline risk assessment. Chemicals that are selected for the cleanup process are referred to as “chemicals of concern” (COCs) and represent those chemicals evaluated in the risk assessment that pose the majority of risk to the potential populations. EPA’s site target risk range for cancer-causing substances under CERCLA is 1 x $10^{-4}$ to 1 x $10^{-6}$. This range indicates that a hypothetical individual has a 1-in-10,000 to 1-in-1,000,000 chance of developing cancer as a result of exposure to site-related chemicals through all exposure pathways. EPA usually does not require remediation when site risk is less than 1 x $10^{-4}$. For non-cancer causing chemicals, site remediation is usually required if the site HI is greater than one (i.e., contaminant levels are above those that can lead to harmful health effects). An HI of less than 1 indicates that no adverse health effects are likely to occur based on the concentrations of chemicals present. If the target organ-specific hazard index for non-cancer causing chemicals is less than 1, remediation is not required. Acceptable levels of risk or exposure are explained in the following inset box.

***WHAT ARE ACCEPTABLE LEVELS OF EXPOSURE?***

Current Federal guidelines for acceptable exposures are:

(1) an individual lifetime excess carcinogenic risk in the range of a one-in-ten-thousand (1-in-10,000 or 1 x $10^{-4}$) to one-in-one-million (1-in-1,000,000 or 1 x $10^{-6}$); and
(2) a hazard index equal to or less than 1.0 for noncancer (also referred to as noncarcinogenic) effects. A hazard index greater than 1.0 indicates a potential for noncancer effects

### 7.1.1 Overview of Updated Risk Assessment

The updated risk assessment discussion presented in this ROD focuses on those human populations assumed to be the most likely exposed to on-site contamination. This approach ensures that the range of risks in all potentially exposed population subgroups have been characterized for all current and future activities. Each population assessed in the risk assessment was evaluated using "reasonable maximum exposure" (RME) assumptions. The RME case is designed to be a measure of high-end exposure and ultimately leads to an estimate of upper-bound population risk (EPA, 1989). A central tendency exposure (CTE) assessment, which is based on average exposure assumptions, was not performed.

Table 1 of this ROD presents the selection of current and future exposure pathways for the Building 37 (On-Post) Site used for the updated risk assessment. An exposure pathways analysis describes the chemical sources, chemical migration pathways in affected media, potential exposure routes, and current or potential future human populations. A key function of this analysis is to identify complete exposure pathways that guide the development of exposure scenarios and dose estimation models for potentially exposed populations and their likely activities. The rationale for choosing specific exposure scenarios was based on the previous discussions of land and water uses and the types of population activities with they would be associated. The exposure scenarios evaluated in this updated risk assessment are listed in Section 7.1.3.

### 7.1.2 Identification of COCs

Past activities at LEAD have resulted in the contamination of groundwater underlying the SSIA in the vicinity and downgradient of Building 37. VOCs are the primary chemicals identified in SE OU 10 groundwater. VOCs such as DCE and TCE are in a class of chemical solvents that, among other applications, were used for cleaning and degreasing mechanical equipment. Because of their chemical characteristics, VOCs are highly mobile in soil and, as a result of historic releases at LEAD as well as other military and industrial facilities, are common groundwater contaminants. The VOC benzene has also been identified in the groundwater, which resulted from the diesel spill on the southeast corner of Building 37. As previously cited, the occurrence of benzene in the SE OU 10 groundwater is isolated to one distinct area at Building 37.

COPCs are defined in EPA (1989) as those chemicals that are potentially site-related and where analytical data are of sufficient quality for use in a quantitative risk assessment. A chemical was selected as a COPC if its maximum groundwater concentration exceeded the lesser of the EPA Region III tap water risk-based concentrations (RBC) and PADEP residential medium-specific concentrations (MSCs) values for used aquifers values (EPA, 2005a and PADEP, 2001). The RBCs were obtained and appropriately modified from the EPA Region III Risk-Based Concentration (RBC) table (EPA, 2005a**)**. The PADEP MSCs were obtained from Pa. Code Title 25, Chapter 250, Administration of the Land Recycling Program (also known as "Act 2"). An RBC or MSC is the concentration of chemical in a specified medium (e.g., groundwater or tap water) that causes a defined level of risk. The PADEP MSCs are based on a cancer risk of 1 x $10^{-5}$., which means one-in-100,000. These types of numbers that express cancer risk can also be expressed as "1E-05." For this ROD, the "1E-05" type of notation is used throughout to express the cancer risk terms). For each chemical, the target cancer risk (TR) for the RBCs was set at 1E-06 and the noncancer target hazard quotient (THQ) was set at 0.1 in accordance with EPA policy.

Table 2 is the "Occurrence, Distribution, and Selection of COPCs" for groundwater and represents the COPC selection results from screening all chemicals detected at the site based on a residential exposure (i.e., the most sensitive receptor). The minimum and maximum concentrations, maximum concentration locations, frequencies of detection, and lowest human health benchmarks (i.e., RBCs or MSCs) are presented. The site maximum concentration of each detected chemical in groundwater was compared with its respective chemical-specific, human health benchmark values associated with **residential use**. The COPC flags designated "Yes" indicate those chemicals whose maximum detected concentration exceeded the lower of the EPA Region III tap water RBC or PADEP residential MSC and were further evaluated in the risk assessment. Those chemicals not exceeding these benchmarks were eliminated from further evaluation since their contribution to total site risk is very low.

Maximum concentrations of 7 of the 14 detected chemicals exceeded the lowest chemical-specific residential benchmarks (Table 2). Based on these results, the following chemicals were selected as COPCs for SE OU 10 groundwater and evaluated for the future resident (child and adult) and commercial/industrial worker as shown in Table 3:

1,1-Dichloroethane (1,1-DCA)
1,2-Dichloropropane
Benzene
Chloroethane
cis-1,2-Dichloroethene (1,2-DCE)
Trichloroethene (TCE)
Vinyl chloride

There were no COPCs or COCs (i.e., chemicals targeted for cleanup) associated with the SE OU 10 groundwater based on the 2001 Vapor Intrusion Risk Assessment.

### 7.1.3 Exposure Assessment

The objectives of the exposure assessment are to characterize potentially exposed human populations and to identify actual or potential exposure pathways for predicting the potential extent of exposure. The exposure assessment process involves several elements, including the following:

- Characterization of current and future local land and water uses (this was presented in Section 6).
- Identification of the potential sources, exposure routes, and receptors/exposure scenarios (exposure pathways analyses) (see Subsection 7.1.1).
- Estimation of exposure point concentrations (EPCs).
- Identification of the exposure models and description of the assumptions used to calculate chronic daily intakes (CDIs) or exposure doses.
- Estimation of CDIs for both carcinogenic and noncancer effects.

The receptors and direct exposure pathways of groundwater exposure that were evaluated under the current and future land use conditions for the SE OU 10 area included:

- *Current/Future On-Site Industrial/Commercial Worker.* A current/future commercial/industrial worker was evaluated for direct contact with groundwater through ingestion of groundwater (i.e., tap water) while working and indoor tap water uses related to inhalation of volatiles while showering.

- *Future On-Post Resident*. A child aged 1 to 6 years and an adult were evaluated for direct contact with groundwater through ingestion (child and adult), and indoor tap water uses related to inhalation of volatiles while showering (adult), and dermal contact while bathing (child).

Groundwater use in SE OU 10 was evaluated as a potential current and future tap water source even though it is unlikely to be used as such because of the presence and current use of an alternative potable water supply. Only on-post scenarios were evaluated at the time because the highest COPC concentrations are on-post within the business park boundaries and this represents the most conservative (i.e., highest) exposure potential.

An evaluation was previously performed for on-post workers and residential users for risks due to vapor intrusion from groundwater tables underlying building structures and construction trenches (WESTON, 2001). “Vapor intrusion” is defined as the ability of VOCs to volatilize from groundwater, migrate upwards through the soil as a gas, and then enter buildings (i.e., residences or industrial buildings) through the basement. The inhalation risk of cancer in residents (unrestricted use scenario) associated with exposure through this potential pathway was evaluated using approved EPA vapor intrusion guidance, maximum historical concentrations of VOCs detected in groundwater in limestone areas at LEAD, including SE OU 10, and a representative depth to groundwater. For all chemicals evaluated, the predicted indoor air concentrations in residences were less than their respective EPA indoor inhalation risk-based screening levels for both the child and adult resident for limestone areas. Therefore, none of the VOCs were identified as COPCs at the screening step, and EPA indicated that no further risk calculations were necessary for this scenario. Consequently, it can be concluded that conditions in the SE OU 10 area are protective of human health based on the vapor intrusion pathway. In addition, more current concentrations of VOCs in groundwater measured in 2004 in off-post areas of SE OU 10 were less than the generic screening levels for groundwater listed in Table 2a of the updated draft EPA vapor intrusion guidance (EPA, 2002a).

### 7.1.3.1 Exposure Point Concentrations

The EPC for each COPC in groundwater was calculated as follows:

- For future residents and current/future commercial/industrial workers, EPCs in tap water (i.e., ingestion, shower water, and bath water) were based on groundwater data from all on-post wells.
- For VOCs in groundwater, EPCs for indoor air for exposure of adults while showering were calculated according to the method of Foster and Chrostowski (1987).

The EPCs were calculated for the groundwater data using a statistical software program called ProUCL (EPA, 2004b; Version, 3.0). EPA recommends this program for EPC calculation in its recently published guidance (EPA, 2002b). The software program calculates EPCs by several statistical approaches and then recommends which approach provides the most statistically valid estimate of the average concentration. For example, EPA recommends what is referred to as the 95% upper confidence limit (UCL) concentration of the arithmetic mean. This program was developed for data sets when the results of statistical distribution tests indicate the data are neither normally nor log normally distributed (EPA, 1992b). Sample non-detects were included at one-half the sample quantitation limit (SQL).

If the 95% UCL concentration recommended by ProUCL exceeded the maximum detected concentration for a chemical, the EPC defaulted to the maximum detected concentration. Table 3 presents the EPCs for the on-post groundwater. This table lists the statistical distribution of the data and the mathematical formula on which the EPCs were based.

#### 7.1.3.2 Exposure Models and Assumptions

The mathematical models and exposure assumptions that were used to calculate the daily intakes (i.e., the daily doses) of COPCs for each receptor population through the applicable exposure routes are presented in this subsection. Many of the exposure parameters that were used are standard default values recommended by EPA guidance (EPA, 1989, 1991a, 1997a, 2004c). Site-specific assumptions and professional judgment were used where information was available.

Two types of exposure doses were calculated. The first model, in which the doses were averaged over the assumed exposure duration, was used to evaluate the potential for noncancer health effects (i.e., the average daily dose [ADD]). The second model, in which the doses were averaged over a 70-year lifetime, was used to evaluate potential carcinogenic risk (i.e., the lifetime average daily dose; LADD). The final exposure doses were expressed as either administered (oral, inhalation) or absorbed (dermal) doses, in milligrams of contaminant per kilogram body weight per day (mg/kg-day).

#### 7.1.3.3 Dose Models

Tables 4 and 5 present the algorithms for adult resident contact with drinking water via ingestion and inhalation (while showering). Drinking water ingestion was assumed to be 2-liters/day (EPA, 1991a). Showering time was assumed to be 30-minutes. The inhalation exposure concentration in the shower was calculated using the Foster-Chrostowski model as shown in Table 5 (Foster and Chrostowski, 1987). The EPCs were obtained from Table 3. The water flow rate in the shower was assumed to be 10-liters/min, and the bathroom volume was assumed to be 12-m$^3$.

Table 4 presents the algorithms for child resident contact with drinking water via ingestion and dermal contact (while bathing). Drinking water ingestion was assumed to be 1-liter/day (EPA, 1991a). Exposed body surface area was 6,600-cm$^2$/day. The child was assumed to bathe for 60 minutes (Exhibit 3-2, EPA, 2004c). Chemical-specific permeability coefficients ($K_p$) were obtained from the *RAGS Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004c).The EPCs were obtained from Table 3. Inhalation of VOCs from bathwater was not evaluated.

Similar to the adult resident, tables 4 and 5 present the algorithms for commercial/industrial worker contact with drinking water via ingestion and inhalation (while showering). Drinking water ingestion was assumed to be 1-liter/day (EPA, 1991a). Showering time was assumed to be 30-minutes (EPA, 2004c). The inhalation exposure concentration in the shower was calculated using the Foster-Chrostowski model shown at the bottom of Table 5 (Foster and Chrostowski, 1987). The EPCs were obtained from Table 3. The water flow rate in the shower was assumed to be 10-liters/min, and the bathroom volume was assumed to be 12-m$^3$.

### 7.1.4 Toxicity Assessment

In evaluating potential health risks, the toxicities of both carcinogenic and noncarcinogenic COPCs were characterized. The potential for producing cancer is limited to those chemicals classified as potential human carcinogens by the EPA. Excessive exposure to all substances, carcinogenic or not, can produce adverse noncancer health effects. Therefore, cancer slope factors (CSFs) were identified for those chemicals classified as carcinogens, and reference doses (RfDs) were identified for every chemical selected regardless of its classification. The CSFs and RfDs are quantitative estimates of the toxic potency of chemicals and used in conjunction with the exposure dose information to calculate cancer risk or hazard quotients, respectively.

EPA recently recommended the appropriate sources and hierarchy of toxicity information (EPA, 2003b). The current guidance for obtaining toxicity values for Superfund risk assessments recommends that the *Integrated Risk Assessment System* (IRIS) serve as the primary source of both RfDs and CSFs (EPA, 2003b). Secondary sources should be peer-reviewed provisional toxicity values which can be found in the *Provisional Peer-Reviewed Toxicity Values* database available through Oak Ridge National Laboratory (EPA, 2005b). However, this database is restricted to EPA use only, and can only be accessed with the authorization of the EPA Superfund Office (EPA, 2005b). Finally, sources such as the California EPA (CalEPA, 2003) and the ATSDR *Minimal Risk Levels*

(ATSDR, 2004) can serve as third tier sources. HEAST is listed as the last source of toxicity information since many of its provisional toxicity values are outdated (EPA, 1997b).

The EPA recently published the *Draft Trichloroethylene Health Risk Assessment* (EPA, 2001) and proposed a CSF range for TCE of from 2E-02 to 4E-01 $(mg/kg\text{-}day)^{-1}$. In this document, EPA recommends using the upper bound value in risk assessments. The TCE risk assessment performed in 2001 by EPA is an "external review draft," and is still undergoing the peer review process within EPA as of this date. Older provisional values for TCE were approximately 36 to 66 times less potent than the recently proposed values. TCE was evaluated in this risk assessment on the bases of both the newer draft proposed values and the older provisional values. This was done at the request of EPA Region III. It is noted that in instances where a chemical has only provisional or proposed toxicity values, such as TCE, EPA does not require the quantitative evaluation of the risk or hazard quotient. However, RAGS guidance recommends that the uncertainties of the chemical's toxicity be discussed.

#### 7.1.4.1 Noncarcinogens

EPA has developed media-specific reference doses for indicating the potential for adverse health effects from exposure to COCs exhibiting noncancer effects. Toxicity values used to determine noncancer health effects are termed reference doses (RfDs). Reference doses are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. RfDs represent the daily dose for an individual that are anticipated not to result in any deleterious noncancer health effects over a lifetime of exposure (EPA, 1989). Therefore, it is assumed that there is a "safe" dose below which no adverse health effects will occur, even over a lifetime of exposure (i.e., there is a dose "threshold"). The lower the RfD value, the more potent is the chemical in potentially producing noncancer health effects. RfDs have been developed for chronic (>7 years of exposure) or subchronic (≤7 years of exposure) exposure periods. Chronic RfDs were used throughout this report, even for the construction worker and on-site trespasser, which were subchronic exposures. Oral and dermal RfDs are conventionally expressed as the dose in milligrams of chemical per kilogram of body weight per day (mg/kg-d). Inhalation RfDs are derived as reference concentrations (RfCs; $mg/m^3$ for a 70-kg person breathing 20-$m^3$/day). These are converted into units of mg/kg-d for purposes of calculation in the risk assessment.

#### 7.1.4.2 Carcinogens

EPA has developed cancer slope factors for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic COCs. Toxicity values used to determine carcinogenicity are termed cancer slope factors (CSFs), which are a measure of carcinogenic potency. CSFs are derived from the results of human epidemiological studies or animal **bioassays** to which animal-to-human extrapolation and uncertainty factors have been applied. The higher the CSF value, the more potent is the chemical in potentially producing cancer over a lifetime. Oral and dermal CSFs are conventionally expressed as $(mg/kg\text{-}d)^{-1}$, (i.e., risk per unit dose). Inhalation CSFs are derived as unit risk factors (URFs; $[mg/m^3]^{-1}$ for a 70-kg person breathing 20-$m^3$/day). These are converted into units of $(mg/kg\text{-}d)^{-1}$ for purposes of calculation in the risk assessment. CSFs are generally developed from lifetime animal studies in which very high doses are used, much higher than would be expected to occur in humans with typical exposures. The human CSF is determined by extrapolating downward the carcinogenic dose in animals to a dose more representative of human environmental exposure. Most CSFs are very conservative because the statistical extrapolation tests used assume the extrapolation is linear down to infinitesimally small doses (i.e., it is assumed that there is no threshold for carcinogenesis). Infrequently, some CSFs may be derived from human epidemiologic studies. Note that EPA's currently used classification system assumes that even if a chemical is only suspected to cause cancer in humans, it is evaluated as a human carcinogen.

#### 7.1.4.3 Dermal Toxicity Values

EPA has not derived dermal RfDs and CSFs for specific chemicals, but has provided guidance for deriving these values for chemicals with available oral RfDs (EPA, 1989). Toxicity values were adjusted with appropriate oral-to-dermal adjustment factors. These factors were obtained from the Dermal Risk Assessment Guidance (EPA, 2004c).

Tables 6 and 7 list the values and sources of RfDs for the oral, dermal and inhalation routes. Tables 8 and 9 list the values and sources of CSFs for the oral, dermal and inhalation routes.

### 7.1.5 Risk Characterization

The risk characterization presents the likelihood, nature, and degree of the potential carcinogenic and noncarcinogenic (noncancer) risks posed to the current and future human health receptors occurring as a result of exposure to COPCs presented previously in the exposure assessment. The potential for human carcinogenic risks and noncancer health effects of COPCs were evaluated separately because of differences in the processes by which these health effects are believed to occur. Carcinogenic risks were calculated for those COPCs with evidence of carcinogenicity and for which cancer toxicity values are available. Noncancer health effects were evaluated for COPCs (i.e., including carcinogens) for which noncancer toxicity values are available.

In accordance with EPA policy (EPA, 1989), carcinogenic risk was expressed as the probability that an individual will develop cancer during a 70-year lifetime in excess of the background risk for developing cancer (i.e., approximately 1 in 3 individuals). Carcinogenic risk was calculated for each carcinogen through each applicable exposure route (i.e., oral, inhalation, or dermal) using the following equation:

Lifetime Excess Carcinogenic Risk = LADD x CSF

Where:

LADD = Lifetime average daily intake (dose) of the carcinogen, averaged over a 70-year lifetime (mg/kg-day).

CSF = Chemical- and route-specific cancer slope factor (mg/kg-day)$^{-1}$.

These risks are probabilities that are usually expressed in scientific notation (e.g., $1 \times 10^{-6}$; also expressed as 1E-06). An excess lifetime cancer risk of $1 \times 10^{-6}$ indicates that an individual has a 1-in-1,000,000 chance of developing cancer as a result of site-related exposure. EPA's generally acceptable range for site-related exposures is $1 \times 10^{-4}$ to $1 \times 10^{-6}$. For the resident, cancer risks were calculated separately for the child and adult. The total lifetime excess cancer risk for each scenario was calculated by adding the cancer risks calculated for each chemical for all exposure routes.

The potential for noncancer toxicity in an individual as a result of exposure to a single chemical through a single exposure pathway is referred to as the hazard quotient (HQ) using the following equation:

Hazard Quotient = ADD/RfD

Where:

ADD = Chronic average daily dose for the chemical averaged over the appropriate exposure period (mg/kg-day).

RfD = Chemical- and route-specific reference dose (mg/kg-day) for a similar exposure period.

Total noncancer health effects (hazard index; HI) were calculated for each age-specific receptor by adding the HQs calculated for each chemical by exposure route, and then adding the HIs across all exposure routes. If the total HI for a given scenario is less than or equal to one, it is believed that there is not a significant potential for noncancer health effects in that receptor, even in the most susceptible members of the population (EPA, 1989). If the total HI exceeds one, there may be a risk of noncancer health effects. In that case, the HIs for the unique critical toxic endpoint are calculated for each chemical (EPA, 1989). If the target endpoint HIs are all less than one, then there is no need for remediation. If any one segregated HI exceeds 1, then those chemicals with the common target endpoint are considered for cleanup. (EPA, 1989).

### 7.1.6 Noncancer Health Effects

Table 10 (RAGS Part D Table 7.1) summarizes the individual chemical non-cancer HQs for the child resident. The total HI (sum of all HQs) was 3.3. For the groundwater ingestion pathway, TCE showed the greatest noncancer effect with a HQ of 2.3. All other chemicals had HQs less than 1.0.

Table 11 (RAGS Part D Table 7.2) shows the non-cancer HQs and HI for the adult resident. The total HI was 1.5, but all chemicals had HQs less than 1.0.

Table 12 (RAGS Part D Table 7.3) summarizes the chemical non-cancer HQs for the commercial/industrial worker. The total HI was 0.64 (i.e., all chemicals had HQs less than 1.0).

### 7.1.7 Cancer Risks

Table 10 (RAGS Part D Table 7.1) shows the chemical cancer risk (CR) for the child resident. Chemicals primarily responsible for the CR are presented with their respective contributions. Cancer risks in excess of 1E-06 occurred via the tap water ingestion and dermal contact with tap water. For the tap water ingestion pathway, vinyl chloride and TCE had CRs of 6.8E-04 and 2.3E-05, respectively. The dermal contact with tap water pathway (i.e., child bathing) had the greatest contributions from vinyl chloride and TCE with CRs of 3.7E-06 and 3.9E-06, respectively. All other cancer risks were less than 1E-06.

Table 11 ((RAGS Part D Table 7.2) shows the chemical cancer risks for the adult resident. Chemicals primarily responsible for the CR are presented with their respective contributions. Cancer risks in excess of 1E-06 occurred via the tap water ingestion and inhalation of VOCs while showering pathways. For the tap water ingestion pathway, vinyl chloride, TCE, and benzene had CRs of 1.1E-04, 5.0E-05, and 1.2E-06, respectively. The inhalation of VOCs while showering pathway had the greatest CRs from the same three chemicals: TCE (1.8E-04), vinyl chloride (1.1E-05), and benzene (2.4E-06). All other cancer risks were less than 1E-06.

Table 12 (RAGS Part D Table 7.3) shows the chemical cancer risks for the commercial/industrial worker. Chemicals primarily responsible for the CR are presented with their respective contributions. Cancer risks in excess of 1E-06 via the tap water ingestion and inhalation of VOCs while showering pathways. For the tap water ingestion pathway, vinyl chloride and TCE had CRs of 3.3E-05 and 1.5E-05, respectively. The inhalation of VOCs while showering pathway had the greatest CRs from TCE, vinyl chloride, and benzene with CRs of 1.3E-04, 7.9E-06, and 1.8E-06, respectively. All other cancer risks were less than 1E-06.

### 7.1.8 Risk Summary

#### 7.1.8.1 Summary of Noncancer Health Effects

**<u>Child Resident</u>**

The total HI for the child resident across all groundwater pathways was 3.30 (Table 13). Eighty-seven percent of the HI was through groundwater ingestion (HQ, 2.9), with the remaining 13 % through dermal contact with groundwater (HQ, 0.43). (As stated earlier, the Foster and Chrostowski (1987) model cannot be used to estimate bath water volatilization and subsequent inhalation of vapors by the child).

The HI for groundwater ingestion for the child resident was approximately 2.9. TCE contributed 79% (HQ, 2.3) of the groundwater ingestion HI. No other COPCs exceeded a HQ of 1.

**Adult Resident**

The HI for the adult resident for all groundwater pathways was 1.5 (Table 14). Nearly eighty-two percent of the groundwater HI was through groundwater ingestion (HQ, 1.23); the remaining 18% was through inhalation while showering (HQ, 0.27).

The HI for groundwater ingestion for the adult resident was approximately 1.23. No individual COPC exceeded a HQ of 1.0 (TCE contributed 79% with a HQ of 0.97).

**Industrial/Commercial Worker**

The HI for the commercial/industrial worker across the groundwater pathway was 0.64 (Table 15). Nearly sixty-nine percent of the groundwater HI was through groundwater ingestion (HQ, 0.44); the remaining 31% was through inhalation while showering (HQ, 0.20). No COPC exceeded a HQ of 1.

### 7.1.8.2 Summary of Carcinogenic Risks

**Child Resident**

The total cancer risk for the child resident for all groundwater pathways was 7.5E-04 (Table 13). The majority (94%) of the groundwater risk was through groundwater ingestion with the remaining 6% from dermal contact with groundwater while bathing.

The total cancer risk through groundwater ingestion was approximately 7.0E-04. Vinyl chloride contributed approximately 96% (6.8E-04) of the total cancer risk though groundwater ingestion. TCE accounted for the remaining 4% of the groundwater ingestion risk with a CR of approximately 2.3E-05.

The total cancer risk from dermal exposure while bathing was approximately 4.1E-05. Vinyl chloride and TCE contributed approximately 90% (3.7E-05) and 10% (3.9E-06), respectively, of the total cancer risk though dermal contact with groundwater.

**Adult Resident**

The total cancer risk for the adult resident across the groundwater pathway was 3.5E-04 (Table 14). Seventy-three (54)% of the groundwater risk was through inhalation of VOCs while showering with the remaining 46% from groundwater ingestion.

The total cancer risk via the inhalation of VOCs while showering pathway was approximately 1.9E-04. TCE and vinyl chloride contributed approximately 93% (1.76E-04) and 6% (1.1E-05) respectively; of the total cancer risk though inhalation of VOCs while showering. Benzene contributed the remaining 1% of the total inhalation of VOC while showering risk with a CR of 2.4E-06.

The total cancer risk across the groundwater ingestion pathway was approximately 1.62E-04. Vinyl chloride and TCE contributed approximately 69% (1.11E-04) and 30% (5.01E-05) respectively, of the total cancer risk though groundwater ingestion. Benzene had a CR of 1.16E-06 which contributed less than one percent (0.72%) of the total groundwater ingestion risk. All other COPCs had CRs below 1E-06.

**Industrial/Commercial Worker**

The total cancer risk for the commercial/industrial worker across the groundwater pathway was 1.89E-04 (Table 15). A large portion (74%) percent of the groundwater risk was through inhalation of VOCs while showering with the remaining 26% from groundwater ingestion.

The total cancer risk via the inhalation of VOCs while showering pathway was approximately 1.40E-04. TCE and vinyl chloride contributed approximately 94% (1.31E-04) and 6% (7.91E-06) respectively; of the total cancer risk though inhalation of VOCs while showering. Benzene contributed the remaining 1% of the total inhalation of VOC while showering risk with a CR of 1.78E-06.

The total cancer risk across the groundwater ingestion pathway was approximately 4.83E-05. Vinyl chloride and TCE contributed approximately 68% (3.29E-05) and 31% (1.49E-05) respectively, of the total cancer risk though groundwater ingestion. All other COPCs had CRs below 1E-06.

### 7.1.9 Summary of Risks Exceeding Points of Departure

Tables 16 to 18 present summaries of those chemicals exceeding a HQ of 1 or a cancer risk of 1E-06.

TCE exceeded the noncancer point of departure of 1 for the child resident with a HQ of 2.7 (Table 16). This exceedance was largely due to groundwater ingestion. There were no chemicals in any of the other scenarios or exposure pathways exceeding 1.

Target endpoint analysis of critical effects for the child resident indicated HI values of 2.95 for liver. Other target endpoints with HI values greater than one were fetotoxicity (2.65), and kidney effects (2.65).

With the exception of liver effects (HI, 1.30) for the commercial/industrial worker (Table 18), no other target organs exceeded a HI of 1.0 for the adult resident or commercial/industrial worker.

Vinyl chloride and TCE exceeded the point of departure of 1E-06 for the child resident as follows (Shown in Table 16):

- Child Resident:
  - TCE (Ingestion, 2.34E-05; Dermal contact, 3.90E-06)
  - Vinyl chloride (Ingestion, 6.79E-04; Dermal contact, 3.72E-05)

Vinyl chloride, TCE, and benzene exceeded the point of departure of 1E-06 for the adult resident and commercial/industrial worker as follows (See Tables 17 and 18):

- Adult Resident:
  - Benzene (Ingestion, 1.16E-06; Inhalation of VOCs, 2.39E-06)
  - TCE (Ingestion, 5.01E-05; Inhalation of VOCs, 1.76E-04)
  - Vinyl chloride (Ingestion, 1.11E-04; Inhalation of VOCs, 1.06E-05)

- Commercial/Industrial Worker:
  - Benzene (Inhalation of VOCs, 1.78E-06)
  - TCE (Ingestion, 1.49E-05; Inhalation of VOCs, 1.31E-04)
  - Vinyl chloride (Ingestion, 3.29E-05; Inhalation of VOCs, 7.91E-06)

### 7.1.10 Uncertainty Analysis

#### 7.1.10.1 General Uncertainties

The primary purpose of the uncertainty analysis is to examine the factors associated with the chemicals that "drive" the risk assessment (i.e., those chemicals contributing the greatest to site risk. The extent to which these factors accurately predict risk depends on how similar they are to site-specific conditions. The key factors typically discussed in the uncertainty analysis relate to data quality and/or data robustness, the exposure assumptions, and the toxicity assumptions.

- *Site data* can affect exposure and risk calculations if the sample numbers are too low, or if the samples are not representative of the exposure area. For example, when there are too few samples, the EPCs may default to the maximum detected value, which may result in risk overestimation.

- The *exposure assumptions* directly influence the calculated doses (daily intakes), and ultimately the calculation of risk. If dose calculation is based on conservative default exposure assumptions, the resultant risk may be overestimated. The concept of reasonable maximum exposure (RME) is a case in point. The RME is the "maximum exposure that is reasonably expected to occur at the site" (EPA, 1989). Default RME exposure assumptions typically result in exposure dose calculations that are representative of upper bound distributions of the population (typically 90th to 95th percentile). The use of these upper-bound exposure parameters contributes to overestimation of plausible real-life exposures and, therefore, true risks are overestimated. These assumptions allow risk managers to be reasonably assured that human health risks are not underestimated (i.e., are health protective). However, overestimations also lead to potentially high and unnecessary remediation costs.

- *Toxicity values* (i.e., CSFs and RfDs) are typically very conservative (i.e., they tend to overestimate the real toxicity potential in humans). This precaution is part of EPA's policy to insure that the toxicity of a chemical is not underestimated. Most human toxicity data are derived from animal toxicity studies. Extrapolation of animal data to humans is extremely difficult and requires extensive judgment. As a result, the models EPA uses to estimate human toxicity potential tend to overestimate the potential to cause cancer or noncancer adverse effects.

### 7.1.10.2 Site-Specific Uncertainties

The major chemical drivers for cancer were TCE and vinyl chloride. Groundwater ingestion (child and adult resident, and worker), inhalation from indoor uses (adult resident and worker) and dermal contact (child resident) contributed to these risks. TCE was also responsible for an HQ of 2.7 in the child primarily through groundwater ingestion.

*Trichloroethene*

The calculated TCE cancer risks are highly uncertain and may have been significantly overestimated. The oral and inhalation TCE risks calculated in this risk assessment were based on the recently proposed draft criteria for TCE (EPA, 2003b). These values are approximately 66 and 36 times more potent, respectively, than the older EPA provisional toxicity criteria (1989). For example, if the older values were used for the risk calculations, then the revised total cancer risk for the child would have decreased from 7.5E-04 to 5.7E-04. For the adult resident, the total cancer risk of 3.5E-04 would have decreased to 1.0E-04. Therefore, for the child, the groundwater risk would be acceptable, and total site risk for the adult would also be acceptable.

The draft proposed CSFs published in *Draft Trichloroethylene Health Risk Assessment* (EPA, 2001) used in the tapwater RBC calculations have generated significant comments from peer reviewers. The EPA's *Science Advisory Board* raised a number of important questions about the derivation of the CSF and requested EPA to re-evaluate its study in a number of areas (SAB, 2002). As of this date, EPA is still in the process of reviewing the risk assessment (EPA, 2005b) and has asked the *Science Advisory Board* for additional guidance before they submit a final revised risk assessment that will recommend toxicity values for IRIS.

*Showering Time*

A showering time of 30 minutes was selected as directed by the Foster and Chrostowski model (Foster and Chrostowski, 1987). This is conservatively higher than traditional values used in risk assessments (i.e., 12 to 15 minutes. This is an approximate 2-fold difference. Inhalation cancer risk was primarily responsible for total risk for the resident adult, and the risk was predominantly associated with TCE exposure. In view of the TCE risk overestimation discussion above, this 2-fold difference will not result in a change in the conclusions of this risk assessment.

### 7.1.11 Conclusions of Human Health Risk Assessment

The risk assessment for the SE OU 10 Area showed that current on-post workers under both industrial and commercial use and future residents are at risk from exposure to VOCs in groundwater if groundwater use is not restricted (tap water is used for consumption as drinking water and for showering and bathing). The excess risks (i.e., greater than the points of departure as discussed in Section 7.1.9) are primarily related to potential exposure to TCE and vinyl chloride.

Vinyl chloride had a groundwater ingestion cancer risk greater than or equal to 1E-04 for the child and adult residents (6.8E-04 and 1.1E-04), respectively. TCE had cancer risks greater than 1E-04 via the inhalation while showering pathway for the adult resident (CR, 1.8E-04) and industrial worker (CR, 1.3E-04). Benzene exceeded the point of departure of 1E-06 for the adult resident and commercial/industrial worker for the ingestion and inhalation pathways but was within EPA's generally acceptable range for site-related exposures of 1E-06 to 1E-04. These COCs will continue to be evaluated as part of the CERCLA 5-year review, as discussed in Section 8 of this ROD.A previously conducted risk assessment, which was approved by EPA, showed that vapor intrusion into current or future buildings would not pose an excess cancer risk or hazard index of concern to workers or residents.

The uncertainty analysis showed that the total risk to residents and workers may have been overestimated with respect to the older provisional values for TCE. For example, if the risk had been calculated using the older provisional values, the total risk would be lower; the groundwater cancer risk would be within the acceptable range for the child. However, the groundwater cancer risk for the adult would still be greater than the maximum acceptable risk value of 1E-04. The draft proposed CSF is currently under review by EPA as a result of issues raised by the EPA's *Science Advisory Board* and other parties. It is not known if or when EPA will approve the draft proposed value for inclusion in IRIS, which would require the value be used in risk assessments.

Overall, the scenarios evaluated for SE OU 10 showed that risks exceeding the points of departure are associated with ingestion of groundwater (child and adult resident, and commercial/industrial worker), dermal contact (child resident), and inhalation while showering (adult resident and commercial/industrial worker). To better manage human health risks at SE OU 10, and provide an added level of protection, the Army and EPA, in consultation with PADEP, are selecting additional measures in this ROD to prevent other types of contact with VOC-contaminated groundwater in on-post areas. These additional measures, described in more detail in Section 9, include preventing people from building subsurface structures in on-post areas and preventing contact with ground water by keeping people from digging into, drilling into or otherwise disturbing the ground in on-post areas at depths where ground water is encountered.

## 7.2 ECOLOGICAL RISK

For SE OU 10, the only location that ecological receptors are potentially exposed to VOC-contaminated groundwater is at the surface discharge of off-post springs. However, the levels of COCs in the surface water at Hawbaker Spring (most representative location) are less than the respective Pennsylvania WQC, Fish and Aquatic Life Criteria for toxic substances, as provided in Title 25 PA Code (Environmental Protection), Chapter 16 (Water Quality Toxics Management Strategy – Statement of Policy), Table 1, Water Quality Criteria for Toxic Substances (PADEP, 2000).

# SECTION 8
# REMEDIAL ACTION OBJECTIVES

The development of remedial action objectives (RAOs) was focused on protection of human health and the environment through treatment of the on-post VOC source area, reducing the concentrations of VOCs discharging to off-post springs and through the application of land-use controls. The following RAOs were identified for lands associated with SE OU 10:

- Protect human health and the environment.
- Restore the aquifer to federal and state drinking water standards within a reasonable timeframe.
- Comply with all federal and state environmental laws and ARARs.
- Reduce or eliminate further contamination of groundwater.
- Reduce or eliminate the migration of VOC-contaminated groundwater off-post and the discharge of VOC-contaminated groundwater to surface waters at off-post springs.
- Provide a suitable remedial alternative so that land can be transferred for beneficial use with minimal limitations.
- Prevent human exposure to contaminants associated with VOC-contaminated groundwater and springs at concentration in excess of the remediation levels.

The remediation levels for SE OU 10 are as follows:

- In groundwater throughout SE OU 10, attain the EPA Maximum Contaminant Levels (MCLs) listed in Section 13.2 of this ROD and the Pennsylvania Statewide Health Standards, Residential Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater in groundwater throughout SE OU 10;
- Reduce concentrations of volatile organic chemicals, which are known or suspected carcinogens, in groundwater throughout SE OU 10 to acceptable exposure levels, which, as defined by the NCP in 40 CFR 300.430 (e)(2)(i), are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between $10^{-4}$ and $10^{-6}$; and
- Reduce concentrations of volatile organic chemicals, which are systemic toxicants, in groundwater throughout SE OU 10 to levels to which the human population may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety.
- In surface water at Hawbaker spring, attain the Pennsylvania Water Quality Criteria (WQC) for Toxic Substances listed in Section 13.2 of this ROD.

As part of the first CERCLA 5-year review cycle, the Army and EPA will evaluate the post-ROD data from the periodic groundwater and surface water monitoring (off-post spring) monitoring (specified in the approved Remedial Action Work Plan). A work plan will be submitted to EPA that will include the development of a trends analysis and risk assessment to demonstrate the performance of the treatment system and document attainment of the groundwater and surface water remediation levels.

# SECTION 9
# DESCRIPTION OF ALTERNATIVES

CERCLA requires that each selected remedial alternative be: 1) protective of human health and the environment; 2) cost effective; 3) comply with all applicable or relevant and appropriate Federal and state requirements; and 4) use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume (TMV) of the hazardous substances.

Based on these investigations and field tests, the groundwater remedial options that were considered for screening included: no action, natural attenuation, enhanced biodegradation, pump-and-treat, reactive wall, land use controls, C-Sparge™ ozone in-situ treatment, direct ozone injection, permanganate injection, hydrogen peroxide introduction, and in-situ stripping. Additionally, remediation methods that might impact residual solvents in bedrock were also reviewed. They included: enhanced biodegradation, excavation, soil vapor extraction, and land use controls. Information related to the FFS was presented in the FFS report and the Addendum to the FFS. The term "land use controls," also referred to as "LUCs" means any restriction or administrative action, including engineering and institutional controls, arising from the need to reduce risk to human health and the environment. In past SE OU 10 documents, including the FFS and Proposed Plan, the term "institutional controls" was used to denote land use controls.

**Common Elements**

Many of the remedial alternatives contain land use controls to achieve the following objectives:

- Reduce risks to human health by: preventing bathing with, showering with and drinking VOC-contaminated groundwater throughout SE OU 10; prohibiting people from digging into or drilling into or otherwise disturbing soil below the water table in on-post areas (Army-retained and BRAC property); and prohibiting people from building subsurface structures designed for human occupation in on-post areas (Army-retained and BRAC property).
- Maintain the integrity of any current or future remedial or monitoring system associated with SE OU 10 remedial actions, such as monitoring wells.

In the future, it is anticipated that the Army will transfer portions of the SE OU 10 site to the Letterkenny Industrial Development Authority. In addition, the SE OU 10 site includes off-post groundwater. As a result of the anticipated property transfer and off-post groundwater contamination, the remedy for SE OU 10 will include pre-transfer land use controls, post-transfer land use controls, and off-post land use controls.

A map depicting the location of the on-post and off-post land use controls is provided in Figure 8.

The Army has implemented land use controls on the on-post Army-owned property as part of the LEAD Master Plan (LEAD, 2005). In addition, the Army is implementing land use controls as part of the BRAC land transfer process to LIDA to prohibit groundwater use and prevent contact with VOC-contaminated groundwater on-post and within the Cumberland Valley Business Park boundaries. Some of the on-post property within the SE OU 10 area has already been transferred and other areas are yet to be transferred as shown on Figure 8. The land use controls in the areas that have been transferred are described in the existing Land Use Controls Assurance Plan (LUCAP) (Army, EPA, PADEP, 2002). The on-post land use controls are included in the LEAD Master Plan and are in the form of a covenant in the property Deed (for BRAC land that has been already transferred). The on-post land use controls are described in more detail as follows:

- Restrict soil excavation, digging, drilling, or other disturbance of soil activities below the water table without the prior approval of the Army.
- Restrict access to or use of the groundwater underlying the property without the prior approval of the Army, PADEP, and EPA.
- Restrict construction of any subsurface structure for human occupation without the prior approval of the Army, PADEP, and EPA.

In the off-post portion of SE OU 10, the Army has already hooked residences with VOC-contaminated groundwater at levels above MCLs to public water. Also, existing codes are in place and implemented by Greene Township that require connection to public water supply for specified areas and situations as defined in Chapters 85 and 101 of the 2005 Code of the Township of Greene. Chapter 85 states that if any part of a proposed subdivision, mobile home park, or land development is located within 500 feet of an existing or planned public water system, it shall be connected to said water system and shall serve every lot, dwelling unit or other occupancy within the proposed subdivision. Chapter 101 of Greene Township code requires connection to public water supply for existing structures located within 150 feet of a public water system where the existing individual or semipublic water supply becomes nonfunctional or inadequate, as defined by the code. Also in accordance with Chapter 101, if a residential, commercial, or industrial structure is constructed on an undeveloped parcel and is located within 150 feet of a public water supply system, then the parcel must be connected to the public water supply. The Greene Township code Chapter 101 also contains a provision requiring additional analysis of a water supply if the township has reason to suspect that harmful substances are present in amounts that are significantly adverse to human health and safety.

Although land use controls do not contribute to remediation of the VOC-contaminated groundwater, they do limit the potential for exposure of persons working on transferred lands to come into contact with contamination. The land use controls thus become an integral part of the remedial strategy and provide for protection of human health and the environment by limiting human exposure to the VOC-contaminated groundwater while the cleanup progresses. The Army shall implement, maintain, monitor report on, and enforce the on-post land use controls as discussed in more detail in Section 12 of this ROD. The land use controls shall be maintained until the concentrations of hazardous substances in the groundwater have been reduced to levels that allow for unrestricted use. Greene Township is responsible for enforcing their existing codes and ordinances; the Army will coordinate with Greene Township concerning issues related to SE OU 10.

Consistent with CERCLA, none of the evaluated remedies rely exclusively on land use controls to achieve protectiveness. Monitoring to ensure effectiveness of the Selected Remedy, including land use controls to prevent groundwater use/exposure, are components of each alternative except the ‘no-action’ alternative.

The no-action alternative was included as a baseline alternative as required by CERCLA, against which other alternatives may be compared. Based on this information, the Army has examined the alternatives discussed in the following subsections which were evaluated against the nine CERCLA-mandated criteria.

The summary of each alternative includes a general description of the alternative plus results of any site-specific bench or pilot studies performed to evaluate the technology used in the alternative.

The estimated total costs listed below are present worth costs calculated using the estimated operation and maintenance (O&M) and capital costs based on an annual discount rate[2] of 3%.

## 9.1 SUMMARY OF REMEDIAL ALTERNATIVES FOR SE OU 10, ON-POST AND OFF-POST GROUNDWATER

The following remedial alternatives were evaluated for the remediation of on-post and off-post SE OU 10 groundwater:

Alternative 1: No Action

Alternative 2: Monitored Natural Attenuation (MNA) and Land Use Controls

Alternative 3: Enhanced Biodegradation with Monitored Natural Attenuation and Land Use Controls

Alternative 4: Chemical Oxidation Methods and Land Use Controls

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[2] Note: The present worth cost is based on a “discount rate” of 3%. EPA and the Federal Office of Management and Budget (OMB) guidance currently recommends a 7% discount rate for present worth value analyses. However, for Federal Sites being cleaned up using Superfund Authority, EPA states that it is generally appropriate to apply the "real discount rates" found in Appendix C of OMB Circular A-94. The "real discount rates" for 2004 in Appendix C range from 1.6 to 3.5 % (3-year to 30-year rates) and these values are already adjusted to eliminate the effect of expected inflation. For this remedy evaluation and selection, a rounded interpolated rate of 3% was used.

- 4A: C-Sparger™ Ozone Injection
- 4B: Direct Ozone Injection
- 4C: Permanganate
- 4D: Hydrogen Peroxide

Alternative 5: Pump-and-Treat and Land Use Controls

The costs for land use controls were included in all alternatives except for Alternative 1, no action. Costs for land use controls are primarily absorbed in the legal costs of transferring BRAC property or routine Army updates of the Master Plan. Costs for monitoring and maintaining land use controls and reporting are estimated at approximately $3,600 per year; however, costs to enforce the land use controls could be higher. A more accurate cost to maintain the land use controls will be formulated during the final design phase of the program.

The costs for each alternative do not include 5-Year CERCLA reviews because the cost for such are included in a different operable unit – SE OU 1 (referred to as the K-Areas). This is because the 5-Year review process had already been initiated for SE OU 1 and the 5-Year review report covers the entire LEAD SE NPL Site and information pertaining to all SE OUs will be updated each time the 5-Year review is performed for SE OU 1.

### 9.1.1 Alternative 1: No Action

*Estimated Capital Cost: $0*
*Estimated Annual O&M Cost: $0*
*Estimated Present Worth Cost: $0*
*Estimated Construction Timeframe: None*
*Estimated Time to Achieve RAOs: 20 years**

CERCLA guidance requires that the no-action alternative be considered as a baseline for comparison of other alternatives. No remedial actions would be implemented under this alternative. Although concentrations of primary solvents in SE OU 10 groundwater are decreasing over time, the no action alternative will not ensure that groundwater quality and discharges to off-post surface waters will improve in the short-term. *Implementation of this alternative does not include monitoring; therefore, it would not be known when an endpoint is reached.

### 9.1.2 Alternative 2: Monitored Natural Attenuation and Land Use Controls

*Estimated Capital Cost: $0*
*Estimated Annual O&M Cost: $34,400*
*Estimated Present Worth Cost: $511,800*
*Estimated Construction Timeframe: None*
*Estimated Time to Achieve RAOs: 20 years*

The occurrence of natural attenuation of VOCs in the SE OU 10 groundwater has been documented from studies of historical analytical data and pilot tests that show a reduction in contaminant levels with time (Geophex, 1998a). Aerobic biodegradation processes most rapidly biodegrade the levels of BTEX compounds, while anaerobic biodegradation processes most rapidly degrade the chlorinated VOCs.

No remedial treatment actions would be implemented under this alternative. The primary action under this alternative would be the monitoring of natural attenuation parameters and VOCs in on-post wells and off-post wells and springs to document the natural processes that are reducing contaminant levels over time. Land use controls limiting groundwater use and exposure to VOC-contaminated groundwater in SE OU 10 would also be a component of this remedy until COC levels are reduced and remain at acceptable risk-based levels.

Costs for the monitoring program to document the on-going effectiveness or natural attenuation are estimated at approximately $30,800 per year (not including $3,600 per year O&M for land use controls). This assumes sufficient monitoring wells are already in-place. This program is also used as a basis for cost analysis for monitoring other remedial options. Costs are adjusted to reflect the specific requirements of the remedial option, but the monitoring points would remain the same for each technology. The exact time of the operation for this alternative is not certain; however for alternatives evaluation and cost estimation purposes, the estimated overall timeframe has been assumed to be approximately 20 years.

### 9.1.3 Alternative 3: Enhanced Biodegradation with Monitored Natural Attenuation and Land Use Controls

*Estimated Capital Cost: $32,500*
*Estimated Annual O&M Cost: $82,400*
*Estimated Present Worth Cost: $281,900*
*Estimated Construction Timeframe: 3 months*
*Estimated Time to Achieve RAOs: 5 years*

Enhanced biodegradation involves methods of stimulating natural biological degradation processes (breaking down of chemicals) by addition of nutrients to enhance the anaerobic processes that are already destroying chlorinated solvents.

While enhanced biodegradation has been shown to effectively destroy chlorinated VOCs at the SE OU 10 site, it is less effective at reducing the isolated benzene levels on the southeast corner of Building 37. However, benzene levels have been shown to aerobically biodegrade rapidly to levels less than the EPA safe drinking water standard only a short distance downgradient, where aerobic groundwater conditions exist. Monitored natural attenuation data indicate that BTEX compounds in the site groundwater will degrade via aerobic biodegradation processes.

Monitoring of enhanced bioremediation indicators and VOCs in on-post wells and off-post wells and springs, along with land use controls limiting use of groundwater and exposure to VOC-contaminated groundwater in SE OU 10, would be components of this remedy. Monitoring would continue and land use controls would remain in place until concentrations of hazardous substances are reduced to levels that allow for unrestricted use; this would occur when the remediation levels are reached (i.e., COC levels are reduced to MCLs, MSCs, and the carcinogen and systemic toxicant remediation levels as described in Section 8 of this ROD, based on a minimum of 4 consecutive calendar quarters of groundwater sampling and analysis).

Site-specific technology considerations obtained from the bench and pilot studies are as follows:

**Anaerobic** biodegradation of VOCs was evident from field data within, surrounding, and downgradient of the primary source area near Building 37. Anaerobic biodegradation is when chemicals are degraded (broken down) to their (often less toxic) chemical components by **microbes** (bacteria or other one-celled organisms), in a process where oxygen is absent. Analytical indicators of activity from naturally occurring microbes suggested that the diesel contamination south and east of Building 37 was a primary carbon source for stimulating anaerobic microbes. The **dechlorination** processes resulting from the increased microbial activity was shown to effectively transform the primary solvents (TCE, TCA, and PCE) through three or more dechlorination steps.

The feasibility of further enhancing the naturally occurring biodegradation was studied in bench- and pilot-scale field tests during preparation of the FFS (Geophex, 1998a, 1998b, 1999a, 2000b, 2000c). The positive impacts of enhancing the naturally occurring microbes with introduction of lactate nutrients are summarized below:

- Complete reductive chlorination of solvents and their daughter (e.g., breakdown) products was accelerated by nutrient introduction to the natural microbial community. Ethane production in the latter stages of the test demonstrates that complete degradation to final end products was occurring.
- The dominant means of solvent reduction was **methanogenic** under anaerobic conditions.
- **Reaction kinetics** for the natural system were rapid for the primary solvents PCE, TCE, and TCA. Concentrations of these solvents at off-post springs were reduced to less than analytical detection limits

within six weeks of nutrient introduction. While some rebounding of primary solvent concentrations occurred in the months following nutrient introduction, which was expected, successive nutrient introductions have resulted in a continued reduction of the rebound effect.

- Reaction kinetics for degradation of most daughter products were also rapid with the exception of 1,1-DCA which decayed at a slower rate than other daughter products. Despite the production of these compounds during the pilot test, they did not appear in the off-post springs. This observation suggests that they are degraded during the ten-day transit time to the springs.
- The total mass of chlorinated VOCs (e.g., VOCs containing chlorine molecules) in the groundwater was reduced during the course of the pilot test.
- **Lactate injection** into the upper part of the karstic bedrock aquifer where the larger fissures/solution cavities exist (referred to as “epikarst”) demonstrated that slow release of nutrient from the epikarst maintains high concentrations of lactate in the groundwater system over a sustained period of time.

The test caused decreased discharge of VOC contaminants to the off-post springs. No adverse impacts to the environment or groundwater quality were observed in any of the monitoring locations.

Consequently, the enhanced biodegradation method is believed to have excellent potential for 1) both short- and long-term reduction in groundwater VOC contamination, and 2) destruction of residual VOC concentrations residing in the bedrock matrix. The ability to destroy VOCs in the source bedrock matrix indicates that this method offers the possibility of a permanent cleanup (within the feasible limits of source removal in fractured and weathered karst).

Groundwater sampling data reported in the FFS Addendum (WESTON, 2005) indicate that the benzene, toluene, ethylbenzene, and xylene (BTEX) compounds in the SE OU 10 groundwater will be mitigated via aerobic biodegradation processes. The BTEX contamination was caused by the release of diesel fuel from an underground return line associated with a former storage tank. While the preferred alternative will not directly impact benzene concentrations in the anaerobic zone near Building 37, such BTEX compounds are rapidly degraded within the downgradient, aerobic portions of the aquifer. The Army proposes to continue to track this natural BTEX attenuation by regular groundwater monitoring in the aerobic zone. Implementation of the enhanced bioremediation alternative may also cause an increase in microbial populations that will speed up BTEX degradation. Existing monitoring data indicates that the BTEX and chlorinated VOC contaminants will continue to be controlled by the preferred alternative.

The pilot test demonstrated that the enhanced biodegradation method can be easily applied and monitored at reasonable cost relative to other treatment options. Capital costs for installing the system are estimated at $32,500 including tanks and hardware. Annual O&M costs are estimated at $48,000, based on two 45-day lactate injections per year, plus $30,800 for a lactate and methane analyses groundwater monitoring program (the same as was described for Alternative 2), and $3,600 for land use controls, as described in “Common Elements”. The period of treatment (based on the observed results of the pilot test) is expected to be two years, followed by one to three years of monitoring. The exact time of the operation for this alternative is not certain; however for alternatives evaluation and cost estimation purposes, the overall timeframe has been assumed to be approximately 5 years.

### 9.1.4 Alternative 4: Chemical Oxidation and Land Use Controls

*Estimated Capital Cost: $182,000*
*Estimated Annual O&M Cost: $61,000*
*Estimated Present Worth Cost: $910,200*
*Estimated Construction Timeframe: 6 – 9 months*
*Estimated Time to Achieve RAOs: 15 years*

Chemical **oxidation** methods involve introduction of strong **oxidizing agents** into the groundwater to break down hydrocarbon contaminants into harmless end products. A number of compounds have been used in various applications, but the most commonly used oxidants are hydrogen peroxide and ozone.

Four alternative oxidation technologies were selected for evaluation at LEAD: C-Sparger™ ozone injection, direct ozone injection, permanganate, and hydrogen peroxide. These technologies are discussed individually in the following sections. Three methods (ALTERNATIVE 4A: C-Sparger™ ozone injection, ALTERNATIVE 4D: hydrogen peroxide and ALTERNATIVE 4B: direct ozone injection) were pilot tested at LEAD. Because it is an emerging method with applicability to chlorinated solvents, ALTERNATIVE 4C: Permanganate was examined as a fourth chemical oxidation alternative.

Although oxidative technologies have been considered as remedial alternatives, and could effectively treat the isolated benzene levels on the southeast corner of Building 37 under “ideal” conditions, there are potential highly negative impacts from the application of chemical oxidizing agents at the site. In addition, benzene levels drop quickly to levels less than the EPA safe drinking water standard or non-detectable levels in only a relatively short distance (approximately 200 feet) downgradient from Building 37 via existing natural, aerobic biodegradation processes. Strong oxidizers would change the groundwater geochemistry from anaerobic to aerobic conditions, effectively killing the anaerobic bacteria associated with the reductive dechlorination processes that are currently being enhanced to biodegrade the chlorinated VOCs at the site. The oxidative environment that such materials would create would prevent the re-colonization of the site by anaerobic bacteria (i.e., reductive dechlorination would discontinue). Other concerns would be mobilization of contaminants and escape of oxidizers into the environment.

Monitoring of chemical oxidation parameters and VOCs in on-post wells and off-post wells and springs, along with land use controls limiting use of groundwater and exposure to VOC-contaminated groundwater in SE OU 10, would be components of each chemical oxidation alternative until COC levels are reduced and remain at acceptable risk-based levels.

Total estimated costs presented above are based on Alternative 4A: C-Sparger™ ozone injection. Costs for Alternative 4B (Direct Ozone Injection) are assumed to be similar to Alternative 4A, because the implementation costs are comparable. Costs associated with Alternative 4C (Permanganate) would be similar to the costs associated with Alternative 3. Costs for Alternative 4D (Hydrogen Peroxide) have not been calculated because it was deemed to be one of the less effective methods of treatment. The exact time of the operation for this alternative is not certain; however for alternatives evaluation and cost estimation purposes, the estimated overall timeframe has been assumed to be approximately 15 years.

### *Alternative 4A: C-Sparger™ Ozone Injection*

The C-Sparger™ process is an in-situ system that combines in-well air stripping with microencapsulated, ozone-oxidative decomposition. The process consists of two unit operations. First, micro-bubbles extract dissolved chlorinated solvents from VOC-contaminated groundwater. Second, ozone contained within the bubbles decomposes solvents in an extremely rapid gas/liquid phase reaction. The end products are carbon dioxide, very dilute hydrochloric acid (HCl), and water. The C-Sparger™ system uses mechanical agitation, through pumping, to direct the cloud of bubbles into desired zones of treatment. The resulting reactions rapidly detoxify dissolved VOCs.

The Army conducted a field pilot test of the C-Sparger™ process in the Northern Southeast Industrial Area (NSIA) (OU 3) during 1998 (Geophex, 1999b). Positive results produced by the tests included:

- increased concentrations of dissolved oxygen downgradient, particularly in the shallow zones of the aquifer;
- mobilization and air-lifting of contaminants by rising bubbles and cyclical pumping; and

- changes in oxidation-reduction potential and pH indicating possible chemical oxidation effects in the shallow section of the aquifer at distances of up to 125 feet from the injection well.

Negative results included:

- downgradient contaminant mobilization without subsequent treatment;
- injection velocity insufficient to recirculate VOC-contaminated groundwater through the micro-bubble field;
- limitation of effects to the shallow zone of the aquifer; and
- development of a **heterogeneous** and generally unpredictable treatment zone.

The following conclusions were drawn regarding the effectiveness and future use of the C-Sparger™ system in the **karst aquifer**s at LEAD:

- The mechanical agitation process was not effective at exposing ozone bubbles to deeper aquifer zones. Agitation displaced contaminants into areas outside the zone of ozone treatment.
- Treatment was dependent upon the mechanical process of air stripping from in-situ micro-bubble injection. This process should occur with, or without, the addition of ozone. The ozone simply eliminates the need for off-gas treatment. Therefore, the C-Sparger™ system has some of the same limitations as conventional air sparging for treating contaminants in a fractured and karstic bedrock aquifer.
- Mobilization effects of operating the C-Sparger™ system would likely lead to a short-term increase in contaminant concentrations downgradient toward the off-post springs.
- Additional testing of pump-cycle manipulation for the existing system would be required to evaluate the potential to mechanically mobilize stubborn contaminants.

Capital costs for a six-well program provided by the supplier are $130,000 for equipment. Additional costs for the two compliance wells and a pilot study to optimize operational parameters for the system would cost $25,000 and $27,000, respectively, bringing total capitalization to $182,000. Operational costs for O&M plus monitoring nine locations for VOCs are estimated at $57,400 for the first year of operation (not including $3,600 per year O&M for land use controls).

### Alternative 4B: Direct Ozone Injection

Direct ozone injection is a passive version of the treatment process used in the C-Sparger™ technology, with two notable exceptions: ozone is injected in dissolved form rather than as discrete bubbles, and there is no in-well pumping and surging to help distribute ozone-bearing water through the fractured bedrock.

The method was pilot tested by IT Corporation in an area near the IWTP lagoons (IT, 2000). Because the method is passive, ozone was not readily dispersed. The pilot study indicated that minimal mixing of injected ozone occurred in the groundwater regime, and that injected ozone-bearing water displaced VOC-contaminated groundwater away from the injection points.

### Alternative 4C: Permanganate

Potassium permanganate is an effective oxidizing agent under either **acidic** or **alkaline** conditions. Oxidation can proceed by extraction of electrons or hydrogen atoms, or direct donation of oxygen to the material being treated. As with other oxidative methods, permanganate is not selective for VOCs. It also reacts with other **organic compounds** and inorganic ions.

Documentation of other than bench-scale tests on the application of potassium permanganate is not currently available. The method has not been widely field-tested and has not been attempted at Letterkenny. Additional research would be required to formulate concentrations, potential chemical reactions, and ionic species of dissolved manganese.

Potential disadvantages of the method include the introduction of manganese to the groundwater (in high concentrations the solution is colored purple) and the potential precipitation of manganese oxide or manganese carbonate. However, it is likely that some dissolved forms of manganese could migrate within the groundwater. It is possible that concentrations of manganese could exceed the EPA MCLs as a result of the injection and that addition of excessive concentration could prove toxic to the microbial population that is currently present and that is degrading site VOCs.

### *Alternative 4D: Hydrogen Peroxide*

Hydrogen peroxide is a strong oxidizing agent which, when mixed with ferrous iron salts, produces hydroxyl radicals that attack and decompose organic contaminants (Fenton's chemistry). The application of hydrogen peroxide in this manner causes a lowering of the pH and an increase in temperature in the treatment zone. The reactions occur rapidly and degrade the solvent without generating toxic degradation products that are toxic and resistant to being broken down by microbes. Strong oxidizers can react violently in the presence of petroleum fuel and some reactions have caused combustion and explosions in fuel/peroxide reactions.

This treatment technology is offered by a number of commercial contractors. One such contractor states that the technology is not well suited to application in limestone terrain due to the pH buffering by the aquifer matrix (optimal conditions for Fenton's chemistry are in pH range of 5-6). However, a pilot test at LEAD in the K Area was successful in lowering the pH of the groundwater to between 6 and 6.5, with significant VOC mass destruction being demonstrated (WESTON, 2000b).

Difficulties with peroxide introduction in the Building 37 Area include: (1) the low permeability of the source area on the west side of Building 37; (2) the destruction of existing natural anaerobic attenuation conditions by oxidation; (3) danger to subsurface utilities; (4) difficulty in maintaining pressure containment because of thin soils above open fractures; and (5) difficulty in controlling the flow of peroxide-treated water through the east limb of the fold axis where transmissivities are high.

Hydrogen peroxide treatments have the potential to remediate the contamination in bedrock sources and groundwater, but would suffer from the same potential flaws as other oxidative methods and pose the threat of uncontrolled rapid oxidation of the petroleum products.

## 9.1.5 Alternative 5: Pump-and-Treat and Land Use Controls

*Estimated Capital Cost: $798,000*
*Estimated Annual O&M Cost: $121,500*
*Estimated Present Worth Cost: $2,248,500*
*Estimated Construction Timeframe: 6 – 9 months*
*Estimated Time to Achieve RAOs: 15 years*

With this technology, VOC-contaminated groundwater is pumped from extraction wells, treated in a surface installation to remove contaminants (i.e.. air stripping and/or carbon treatment) , and discharged to stormwater sewer/surface water or a sanitary sewer. Pump-and-treat technology has been used as an interim remedial action at LEAD in treatment of the IWTP lagoon area. The method has not been successful in achieving significant containment or remediation of the VOC-contaminated groundwater for the lagoon area, which also has karst geology. This technology has a very limited ability to remove source materials from fractured karst bedrock.

Pump testing, groundwater sampling, and groundwater elevation monitoring were conducted at SE OU 10 to evaluate the feasibility of pump-and-treat methods. Evaluation of the data showed that numerous problems are associated with pump-and-treat scenarios as either: (1) a primary method of site groundwater remediation; or (2) a containment mechanism to prevent off-post discharge of contaminants to downgradient springs.

Aquifer test data indicated that hydraulic containment of off-post migration of contaminants is, to some extent, feasible. Prior to implementation of a pump-and-treat strategy, additional data would be needed on the yield and hydraulic effect of groundwater extraction under seasonally low groundwater level conditions (Geophex, 2000a).

The tests indicated that a hydraulic boundary exists in the bedrock parallel to the middle (axis) of the arch-shaped layers of folded rock (referred to as the anticlinal fold) that underlies the eastern edge of Building 37. While pumping of test wells east of the fold axis exerted a significant **hydraulic influence** on wells as much as 600 feet to the east, little if any observable hydraulic influence was observed in wells west of the fold axis. This is caused by the near vertical orientation of the limestone beds west of the fold axis that results in very low aquifer permeability, and hence, produces a hydraulic boundary.

Test results indicate that pump-and-treat is most likely an inefficient method of site remediation because of the extreme hydrologic variations in the bedrock. The method would also require construction of substantial infrastructure and long-term operation and maintenance. Most of the contaminant removal would occur via molecular diffusion from contaminated microfractures in the limestone block west of the fold axis.

Monitoring of VOCs in on-post wells and off-post wells and springs, along with land use controls limiting use of groundwater and exposure to VOC-contaminated groundwater in SE OU 10, would be components of this alternative until COC levels are reduced and remain at acceptable risk-based levels. Analytical costs for monitoring would approximate $6,500 per year.

Capital costs for installation of a pump-and-treat system are based on the assumption that a plant with a capacity of 250 gpm will be required to handle maximum groundwater flow. However, considering seasonal variation in water levels, an average throughput has been estimated at 200 gpm. This assumption should be verified by conducting pumping tests on multiple wells (during high, low and base flow conditions), to determine interference characteristics and maximum flow rates under load. This pilot test is estimated to cost $45,000. An additional pilot test to finalize recovery circuitry in the plant should also be conducted. This study would cost approximately $3,000 to verify the assumptions used here that air stripping, UV treatment, and carbon polishing would be required. In addition, $25,000 is budgeted as a capital expense for installation of compliance wells at the Depot/Cumberland Valley Business Park boundary.

Based on these assumptions, the cost of the pump and treat plant installation and supporting installations (using six existing extraction points) is approximately $798,000. Operation and maintenance costs for a system of this capacity can be based on LEAD operating costs for the current system in the NSIA. Average annual O&M cost for this system has historically been $111,000 per year (based on the period from 1996 through 1999). Addition of monitoring costs to this number provides a year one cost of approximately $117,900 (not including $3,600 per year O&M for land use controls). The exact time of the operation for this alternative is not certain; however for alternatives evaluation and cost estimation purposes, the estimated overall timeframe has been assumed to be approximately 15 years.

## SECTION 10
## COMPARATIVE ANALYSIS OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section presents the relative performance of each alternative against the nine criteria, noting how it compares with the other options under consideration. The comparative analysis is also summarized in Table 19 of this ROD. The nine evaluation criteria are described as follows:

### EVALUATION CRITERIA FOR CERCLA REMEDIAL ALTERNATIVES

**Threshold Criteria:**

1. **Overall Protectiveness of Human Health and the Environment** determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through land use controls, engineering controls, or treatment.
2. **Compliance with ARARs** evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

**Primary Balancing Criteria:**

3. **Long-Term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
4. **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
5. **Short-Term Effectiveness** considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
6. **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. **Cost** includes estimated capital and annual operation and maintenance (O&M) costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30%.

**Modifying Criteria:**

8. **State/Support Agency Acceptance** considers whether the state agrees with the Army's analyses and recommendations, as described in the RI/FS and Proposed Plan.
9. **Community Acceptance** considers whether the local community agrees with the Army's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

## THRESHOLD CRITERIA

## 10.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1, No Action, does not provide any protection of human health and the environment. In Alternative 1, natural degradation of the VOCs in groundwater would occur; however, this process would not be monitored and there would be no way of knowing if and when VOCs in groundwater would reach acceptable levels. Alternative 2 (MNA) may provide slight protection through the reduction of VOC concentration through natural attenuation processes because it would allow for the measurement of the degradation process and the estimation of an endpoint. However, it might take a long time to achieve acceptable concentration levels. Until such time, groundwater would continue to discharge to off-post springs for the indefinite future, and the potential for exposure to VOC-contaminated groundwater would continue to remain. Although there is potential for Alternative 4 technologies (Chemical Oxidation Methods) to reduce the VOC concentrations in groundwater, there are uncertainties associated with the chemical oxidation methods that could impact the effectiveness and the time required for treatment. Alternative 5 (Pump-and Treat) would eventually provide adequate protection; however, it would take a long time to achieve the acceptable VOC concentrations in groundwater. In addition, pump-and-treat would interfere with the existing degradation that is destroying the VOC-contaminated groundwater in the bedrock matrix. Alternative 3 (Enhanced Biodegradation with MNA and Land Use Controls) appears to be the most effective alternative that offers the greatest potential for reduction of the VOC contamination in groundwater to the lowest levels in a timely manner.

## 10.2 COMPLIANCE WITH ARARs

Alternative 1 is not expected to achieve the ARARs in a timely manner; degradation would take place naturally but the process would not be measured and it would not be known if it would be possible to comply with ARARs. Although Alternative 2 may achieve ARARs through natural attenuation processes, it might take a long time due to the slow natural degradation process and the non-uniformity of the treatment based on the site-specific conditions. Pilot testing of Alternative 3 (Enhanced Biodegradation with MNA and Land Use Controls) demonstrated that concentrations of target VOCs were below ARARs in off-post springs within several weeks after the introduction of nutrients. While ARARs were not attained in the main portion of the plume near Building 37 during the course of the pilot test program, the results of the pilot testing indicate that continued treatment could potentially meet ARARs for all groundwater in SE OU 10 and maintain ARARs for surface water. All Chemical Oxidation Methods evaluated under Alternative 4 are believed to be capable of destroying the source contaminants and could therefore likely achieve ARARs. However, there are some concerns, for example, it would take a long time to achieve ARARs in Alternatives 4A, 4B, and 4D, and Alternative 4C would require pilot testing to assess the actual rate of oxidation. Alternative 5, Pump-and-Treat would eventually achieve the ARARs, but it would take a long time, and there is a possibility that the VOC levels could bounce back above acceptable levels once the operation is shutdown.

## PRIMARY BALANCING CRITERIA

## 10.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 does not meet the requirements for long-term effectiveness and permanence. Natural degradation occurs in Alternative 1; however, VOC-contaminated groundwater would continue to discharge to off-post springs for a considerable length of time and would not be monitored, so it would not be known when an endpoint could be or would be reached. This may affect the desirability and usability of the property. In addition, tenants/owners of the property could be exposed to contamination through exposure to groundwater, excavation, or contact with the groundwater. Alternative 2 is expected to be protective in the long-term since it would allow for the measurement of the natural degradation process, which would eventually reduce VOCs in the groundwater plume to levels that are protective of human health, and the monitoring allows for the estimation of a final endpoint. Alternative 3 is expected to meet the requirements for long-term effectiveness and permanence. Pilot testing has demonstrated that discharges to off-post springs are reduced, and that destruction of the contaminants in the source area to harmless byproducts begins to occur in a six-month time frame. Chemical Oxidation Methods considered under Alternative 4 are expected to meet the goals for long-term effectiveness and permanence. Additional tests may be required to determine the actual long-term effectiveness and permanence. Alternative 5 is expected to meet goals for long-term effectiveness and permanence. The major drawbacks of the method include: 1) inability to treat residual NAPLs in shallow soils and within the cone of depression needed to capture groundwater, 2) disposal of large volumes of treated water, and 3) uncertainty in the ability of the system to maintain capture during periods of high groundwater flow. Extensive long-term management and monitoring are required.

## 10.4 REDUCTION IN TOXICITY, MOBILITY, OR VOLUME (TMV)

Alternatives 1 and 2 do not include treatment as a component of the remedy. Therefore, these alternatives would not reduce TMV at the site. In Alternative 3, pilot testing has demonstrated that TMV is positively impacted by biodegradation and the reduction in concentrations is irreversible because the volatile organics are destroyed by the biodegradation process. Solvent mass in the source area, and in VOC-contaminated groundwater, was markedly reduced over a six-month period during the pilot test. Mobility of contamination to the off-post springs was reduced within weeks of the start of nutrient injection. All Chemical Oxidation Methods discussed under Alternative 4, are expected to reduce TMV of the contaminants at varying degrees and where VOC concentrations would be reduced, the process is irreversible because the volatile organics are destroyed by the chemical oxidation process. Alternative 4A did not perform effectively in the heterogeneous karsted aquifer, and showed poor ability to treat NAPL in deep fractures. Alternative 4B would require pilot tests to assess the reduction of TMV more accurately. Alternatives 4C and 4B may result in harmful by-products. Alternative 5, Pump-and-Treat will require removal of large quantities of low VOC concentration water to achieve the mass removal necessary to reach cleanup levels. However, the method is capable of reducing TMV once the **capture zone** has been created. The reduction in concentrations associated with Alternative 5 is irreversible because the organics would ultimately be destroyed when the carbon (from the air stripping and water polishing step treatment) is regenerated. Pump-and-treat will not treat residual contamination in bedrock, because areas of depressions will form in the water table near each pumping well (referred to as drawdown cones), that will isolate parts of the bedrock system from remediation. The potential for recontamination of the groundwater is expected to decrease from Alternative 5 to 4 to 3. Alternatives 3 and 4 are expected to provide a higher degree of source treatment than Alternative 5 because some of the contaminated groundwater may not be recoverable with the pumping step. The mass that would be destroyed in each alternative is unknown since the exact amount of contaminated groundwater is not known due to the makeup of the complicated fractured bedrock system. The groundwater that is recovered / treated with implementation of Alternatives 3, 4 and 5 is eventually expected to be successfully treated so that concentrations meet remediation levels, which can be expressed as approximately 90% removal, when considering reduction in concentrations of TCE (based on pre-enhanced biopilot study data compared to the MCL).

## 10.5 SHORT-TERM EFFECTIVENESS

Alternatives 1 and 2 have no short-term effectiveness. A number of the other alternatives would be effective in the short term with minimal risks of exposure. Alternative 3, Enhanced Biodegradation with MNA and Land Use Controls, was demonstrated to be highly effective in the short term with no risks to on-post workers. The least effective method in a short time frame is probably Alternative 4A, C-Sparger™ that may displace VOC-contaminated groundwater downgradient and cause a near-term increase in discharge of contaminants from the off-post springs.

Land use controls add an extra measure of short-term effectiveness since groundwater use restrictions are already in place on-post and within the Cumberland Valley Business Park, and the alternative drinking water system is already in place on-post and in off-post residents where VOC contamination is known or was known in the past to be above MCLs. In addition, the Army will formally document land use controls by amending the LEAD Master Plan.

In the absence of any active remediation, Alternatives 1 and 2 would not have any short-term effects. Pilot testing demonstrated that Alternative 3 would be effective for most areas in the short-term protection of human health. VOC concentrations in off-post springs declined to ARARs within weeks of lactate injection, and major declines in VOC concentrations in SE OU 10 groundwater were noted during the course of the test. Worker safety is not an issue with this method because there is no need for site workers to contact VOC-contaminated groundwater to inject nutrients. The short-term effectiveness in Alternative 4 varies with each chemical oxidation method. Pilot testing indicated that in Alternative 4A, VOC-contaminated groundwater discharge to off-post springs could be increased in the short-term. If ozone injection is not properly controlled in Alternative 4B, there is a risk of damage to infrastructure, because of the rapid oxidation of petroleum products in the vicinity of Building 37. Alternative 4C is expected to cause short-term improvements in the water quality of the off-post springs with the exception of increased manganese content. In Alternative 4D, handling of strong oxidants could lead to excessive production of gasses and heat from the rapid oxidation of the petroleum products present, which would pose a potential risk to site workers and the general public (both on- and off-post). Operation of Alternative 5 would require construction of surface infrastructure and will produce hazardous materials for off-site disposal. Required services and materials are readily available. There is a risk of potential exposure for workers during installation and operation and maintenance of the system.

## 10.6 IMPLEMENTABILITY

Alternatives 1 and 2 can be easily implemented. In Alternative 1, there are no active remedial measures to be implemented. Under the Alternative 2, a monitoring program would be implemented by utilizing existing wells and off-post springs to monitor the progress of solvent destruction by natural attenuation processes. Pilot testing in SE OU 10 has demonstrated that Alternative 3, Enhanced Biodegradation with MNA and Land Use Controls, can be readily implemented with minimal effort for establishing surface infrastructure, injection points, and monitoring wells. Materials required are readily available. All of the chemical oxidation methods considered in Alternative 4 can be implemented for treatment of groundwater contamination. However, each method has different problems that must be overcome before the respective methods could be employed. When implementing oxidative methods, uncontrolled oxidation of chemicals and production of significant heat could occur that could potentially impact infrastructure. Materials and technology associated with Alternative 4 are readily available. Alternative 5, Pump-and Treat technology has a long history of operation at LEAD and could be readily implemented after further testing to establish pumping patterns required to create a capture zone at SE OU 10. The large volume of treated groundwater needs to be discharged to the stormwater sewer or sanitary sewer. A National Pollutant Discharge Elimination System (NPDES) permit for stormwater/surface water discharge would be need to be obtained and would take additional effort to get approved by the regulatory agencies. Materials required for the Alternative 5 are readily available.

## 10.7 COST

Estimated present-worth costs for the alternatives are summarized below. The costs vary from zero for Alternative 1 (No Action) to $2,248,500 for Alternative 5 (Pump-and-Treat). With the exception of Alternative 1 with zero cost, the next lowest cost is associated with Alternative 3 (Enhanced Biodegradation with MNA and Land Use Controls). This is also the preferred alternative based on the overall effectiveness and cost.

| | | |
|---|---|---|
| Alternative 1: | No Action | $0 |
| Alternative 2: | Monitored Natural Attenuation (MNA) and Land Use Controls | $511,800 |
| Alternative 3: | Enhanced Biodegradation with MNA and Land Use Controls | $281,900 |
| Alternative 4: | Chemical Oxidation Methods and Land Use Controls | $910,200 |
| Alternative 5: | Pump-and-Treat and Land Use Controls | $2,248,500 |

For the purposes of the comparative cost evaluation for SE OU 10, the No Action alternative does not include 5-year reviews. The estimated present-worth cost for Alternative 3 is based on a 5-year operation. Alternative 2, MNA and Land Use Controls, has a higher estimated present-worth value cost than the enhanced biodegradation because the MNA alternative assumes a longer period of monitoring (assumed to be 20 years). The present-worth cost for Alternative 4 is based on Alternative 4A: C-Sparger™ Ozone Injection (see Section 9.1.4).

## MODIFYING CRITERIA

## 10.8 SUPPORTING AGENCIES ACCEPTANCE

PADEP, on behalf of the Commonwealth of Pennsylvania, concurs with the selected Alternative of Enhanced Biodegradation with Monitored Natural Attenuation and Land Use Controls.

## 10.9 COMMUNITY ACCEPTANCE

The community does not object to the Selected Remedy. No written or verbal comments were received during the public comment period on the Proposed Plan (WESTON, 2005b). The public review and community involvement process is discussed in more detail in the Responsiveness Summary of this ROD.

# SECTION 11
# PRINCIPAL THREAT WASTE

Principal threat wastes are “source materials” considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contaminants to groundwater, surface water, or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, if present, nonaqueous phase liquids in groundwater may be viewed as a source material, which is not the case at SE OU 10.

VOCs released from the leaking IWWS lines and the diesel return line were determined through investigations to have been the source of the VOC groundwater contamination in SE OU 10. The IWWS and diesel lines were subsequently repaired and are no longer an active source of contamination. Declining concentrations of VOCs indicate that VOCs are not being added to the source area (bedrock matrix) and that natural biodegradation is removing this source area.

Therefore, the VOC-contaminated groundwater in SE OU 10 is not considered to be a source material that would represent a **principal threat**.

# SECTION 12
# SELECTED REMEDY

## 12.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

Based on the requirements of CERCLA and the NCP, and on a detailed analysis of the response alternatives using the nine criteria (which includes public and state comments), the Army and EPA have selected Alternative 3 (Enhanced Biodegradation with Monitored Natural Attenuation and Land use Controls) as the remedy for the SE OU 10**.** Enhanced biodegradation technology was shown to be effective at the site based on the results of bench-scale and full-scale field pilot tests and comes out ahead of the other alternatives based on the nine evaluation criteria. PADEP concurs with this determination. The pilot test demonstrated several unique advantages over other technologies:

- Complete dechlorination of solvents to ethane was stimulated by nutrient introduction;
- Costs for introduction of the nutrients into the groundwater system and monitoring are low relative to other technologies;
- Method produces no byproducts for further off-site treatment;
- Technology is easy to implement and monitor;
- The area of solvent degradation was greatly expanded by nutrient introduction to encompass most of the contaminant plume; and
- Concentrations of contaminants discharged to off-post were reduced to non-detect levels in a six-week time frame.

Enhanced biodegradation offers a major advantage over pump-and-treat alternatives. Enhanced biodegradation would expand the areal extent of the methanogenic dechlorination zone into most of the contaminant plume, thus treating residual VOCs and high concentrations of dissolved solvents in confined fractures or adsorbed onto clay particles that pump-and-treat technology could not reach. Implementation of the method also poses no risk of exposure to site workers because all injection is gravity fed from surface installations. Additionally, the method will treat all groundwater that is exposed to nutrient introduction, irrespective of water level fluctuations. The effect of seasonal variation in water table will only limit the effective time required for degradation to occur in shallow areas where water is only present seasonally.

## 12.2 DESCRIPTION OF THE SELECTED REMEDY

The primary component of the selected remedy, Enhanced Biodegradation with Monitored Natural Attenuation and Land use Controls, is injection of the nutrient (sodium lactate) on the western edge of Building 37.

Monitoring of the effectiveness of treatment will be gauged by the periodic sampling of existing on-post and off-post wells and Hawbaker Spring for contaminants and natural attenuation parameters. Monitoring locations and schedules will be optimized by continued testing and presented in detail in the approved Remedial Action Work Plan for the Selected Remedy.

The Army will also conduct periodic sampling to evaluate MNA in the immediate area and downgradient of the diesel spill where elevated benzene levels persist. The objectives of this MNA program are to document the continued decrease in benzene levels within the isolated anaerobic zone and the more rapid decrease of benzene levels to levels below the EPA safe drinking water standard or non-detectable levels within the aerobic zone a short distance downgradient of Building 37.

The enhanced bioremediation program will be operated at full-scale and groundwater monitoring will be conducted as specified in the approved SE OU 10 Remedial Action Work Plan. Information on the progress of the groundwater cleanup, including the results of the off-post groundwater and surface water quality sampling, will be made available to the general public on a regular basis as part of the land use controls program. The sampling results will be available in the Administrative Record and on the LEAD Environmental Website.

Implementation of Alternative 3 is expected to have the following effects:

- Reduction of discharge of chlorinated-VOCs to off-post springs to ultimately reach non-detect levels of VOCs at the springs.
- Rapid destruction of chlorinated solvents in groundwater to harmless end products.
- Be easy to implement, at a relatively reduced cost.
- Address risk while making the property available quickly for public reuse and benefit.

In addition, the selected remedy includes land use controls (LUCs) to prevent exposure to groundwater with concentrations greater than MCLs, MSCs, and carcinogen and systemic toxicant remediation levels, as described in Section 8, and to provide an additional level of protection (risk management measures) as described in Section 7.1.11 of this ROD.

The SE OU 10 LUC objectives are as follows:

- Reduce risks to human health by: preventing bathing with, showering with and drinking VOC-contaminated groundwater throughout SE OU 10; prohibiting people from digging into or drilling into or otherwise disturbing soil below the water table in on-post areas (Army-retained and BRAC property); and prohibiting people from building subsurface structures designed for human occupation in on-post areas (Army-retained and BRAC property).
- Maintain the integrity of any current or future remedial or monitoring system associated with SE OU 10 remedial actions, such as monitoring wells.

In the future, it is anticipated that the Army will transfer portions of the SE OU 10 site to the Letterkenny Industrial Development Authority. In addition, the SE OU 10 site includes off-post groundwater. As a result of the anticipated property transfer and off-post groundwater contamination, the SE OU 10 remedy will include pre-transfer land use controls, post-transfer land use controls, and off-post land use controls.

A map depicting the location of the on-post and off-post land use controls is provided in Figure 8.

The Army has implemented land use controls on the on-post Army-owned property as part of the LEAD Master Plan (LEAD, 2005). In addition, the Army is implementing land use controls as part of the BRAC land transfer process to LIDA to prohibit groundwater use and prevent contact with VOC-contaminated groundwater on-post and within the Cumberland Valley Business Park boundaries. The land use controls in the areas that have been transferred are described in the existing LUCAP (Army, EPA, PADEP, 2002). The on-post Land use Controls are included in the LEAD Master Plan and are in the form of a covenant in the property Deed (for BRAC land that has been already transferred). The on-post land use controls are described in more detail as follows:

- Restrict soil excavation, digging, drilling, or other disturbance of soil activities below the water table without the prior approval of the Army.
- Restrict access to or use of the groundwater underlying the property without the prior approval of the Army, PADEP, and EPA.
- Restrict construction of any subsurface structure for human occupation without the prior approval of the Army, PADEP, and EPA.

In the off-post portion of SE OU 10, the Army has already hooked residences with VOC-contaminated groundwater at levels above MCLs to public water. Also, existing codes are in place and implemented by Greene Township that require connection to public water supply for specified areas and situations as defined in Chapters 85 and 101 of the 2005 Code of the Township of Greene. Chapter 85 states that if any part of a proposed subdivision, mobile home park, or land development is located within 500 feet of an existing or planned public water system, it shall be connected to said water system and shall serve every lot, dwelling unit or other occupancy within the proposed subdivision. Chapter 101 of Greene Township code requires connection to public water supply for existing structures located within 150 feet of a public water system where the existing individual or semipublic water supply becomes nonfunctional or inadequate, as defined by the code. Also in accordance with Chapter 101, if a residential, commercial, or industrial structure is constructed on an undeveloped parcel and is located within 150 feet of a public water supply system, then the parcel must be connected to the public water supply. The Greene Township code Chapter 101 also contains a provision requiring additional analysis of a water supply if the township has reason to suspect that harmful substances are present in amounts that are significantly adverse to human health and safety.

Within 90 days of ROD signature, the Army shall prepare and submit to EPA and PADEP for review the SE OU 10 Remedial Action Work Plan specifying how Alternative 3 (Enhanced Bioremediation and Land use Controls) will be implemented, including implementation, maintenance and periodic monitoring plans for the land use controls.

The Army shall implement, maintain, monitor report on, and enforce the on-post land use controls according to the approved Remedial Action Work Plan for SE OU 10. The approved Remedial Action Work Plan will summarize the LUC Objectives and Pre-transfer, Post-transfer, and Off-post LUC Implementation Actions that will be used to minimize the potential for future land use control violations. Although the Army may later transfer LUC procedural responsibilities to LIDA or some other party as part of the Phase V Property transfer, the Army shall retain ultimate responsibility for the SE OU 10 Remedy integrity. The land use controls shall be maintained until the concentrations of hazardous substances in the groundwater have been reduced to levels that allow for unrestricted use. This would occur when the remediation levels are reached (i.e., COC levels are reduced to MCLs, MSCs, and the carcinogen and systemic toxicant remediation levels, as described in Section 8 of this ROD, based on a minimum of 4 consecutive calendar quarters of groundwater sampling and analysis of monitoring wells identified in the approved Remedial Action Work Plan).

The Greene Township Zoning Officer is responsible for implementing enforcing and internal reporting of the Greene Township existing codes and ordinances which are the land use controls for off-post areas of SE OU 10. The Army will monitor and report on off-post land use controls as specified in the remedial action work plan.

If the Army, EPA, and PADEP conclude that the groundwater has been remediated to unrestricted use, the Remedial Action Work Plan will be revised to remove the land use controls.

## 12.3 SUMMARY OF THE ESTIMATED COSTS

A summary of the estimated costs for the Selected Remedy (Enhanced Biodegradation with MNA and Land Use Controls) is presented below:

*Estimated Capital Cost: $32,500*
*Estimated Annual O&M Cost: $82,400*
*Estimated Present Worth Cost: $281,900*
*Estimated Construction Timeframe: 3 months*
*Estimated Time to Achieve RAOs: 5 years*

The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements may occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes, if they occur, may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

## 12.4 EXPECTED OUTCOMES OF THE SELECTED REMEDY

Based on the information available at this time, the Army and EPA believe that the preferred alternative, Enhanced Biodegradation with MNA and land use controls, would be protective of human health and the environment, would comply with ARARs, and would be cost-effective. PADEP concurs with this determination. Upon implementation of the selected remedy, the full use of the on-post portion of SE OU 10 as industrial/commercial purpose and off-post for residential will be expected because of the land use controls that are in-place to prevent exposure to contaminated groundwater. It is expected the remedial action objectives will be achieved and remediation levels will be reached within 5 years after implementing the selected remedy, after which land use controls can be removed and the full use of the on-post property as industrial/commercial and off-post as residential will be achieved. There is some uncertainty in this value because MNA progress cannot always be accurately predicted. Final remediation (cleanup) levels for SE OU 10 are as follows:

- In groundwater throughout SE OU 10, attain the EPA Maximum Contaminant Levels (MCLs) listed in Section 13.2 of this ROD and the Pennsylvania Statewide Health Standards, Residential Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater in groundwater throughout SE OU 10;

- Reduce concentrations of volatile organic chemicals, which are known or suspected carcinogens, in groundwater throughout SE OU 10 to acceptable exposure levels, which, as defined by the NCP in 40 CFR 300.430 (e)(2)(i), are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between $10^{-4}$ and $10^{-6}$; and

- Reduce concentrations of volatile organic chemicals, which are systemic toxicants, in groundwater throughout SE OU 10 to levels to which the human population may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety.

- In surface water at Hawbaker spring, attain the Pennsylvania Water Quality Criteria (WQC) for Toxic Substances listed in Section 13.2 of this ROD.

As part of the first CERCLA 5-year review cycle, the Army and EPA will evaluate the post-ROD data from the periodic groundwater monitoring (specified in the approved remedial action work plan). A work plan will be submitted to EPA that will include the development of a trends analysis and risk assessment to demonstrate the performance of the treatment system and document attainment of the groundwater remediation levels.

The groundwater in SE OU 10 will be available for unrestricted uses (for example, drinking water) following achievement of the remediation levels.

No direct impacts on socio-economic conditions are expected since the on-post portions of SE OU will remain with the Army or the industrial park, where an established drinking water supply is provided through LIDA (Letterkenny Reservoir located off post a distance upgradient of SE OU 10). In addition, established residences off-post within the SE OU 10 plume have been connected to public water supply. However, implementing the remedy will allow for the remaining BRAC property within SE OU 10 to move forward with the property transfer process which will ultimately be available for sale within the business park, resulting in creation of jobs. There will be some improvement to the local surface water quality by eliminating the source of VOCs discharging to the springs associated with SE OU 10 groundwater plume.

# SECTION 13
# STATUTORY DETERMINATIONS

Under CERCLA Section 121, the Army and 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 utilize 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 reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following subsections discuss the remedy in light of these statutory requirements.

## 13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The Selected Remedy will be protective of human health and the environment through treatment of the on-post VOC source area, reducing the concentrations of VOCs discharging to off-post springs and through the application of land use controls. The risks associated with the site are described in Section 7.

## 13.2 COMPLIANCE WITH ARARs

Pilot testing of Alternative 3 demonstrated that concentrations of target VOCs were below ARARs in off-post springs within several weeks after the introduction of nutrients. While ARARs were not attained in the main portion of the plume near Building 37 during the course of the pilot test program, significant reductions in contaminant concentrations were observed. The Selected Remedy will comply with the chemical-specific ARARs. There are no action-specific or location-specific ARARS associated with implementing the Selected Remedy at SE OU 10 groundwater. This ROD's compliance with ARARs is summarized in the Table presented below. ARARs will be obtained for groundwater and surface water within the entire SE OU 10 operable unit area (Figure 8) as measured by the monitoring wells identified in the approved Remedial Action Work Plan.

Chemical-specific ARARs consist of the following:

- Title 25 of the Pennsylvania Administrative Code (25 PA. Code) § 250.309 (Administration of the Land Recycling Program, also known as Act 2), Appendix A, Table 1, Residential Medium-Specific Concentrations (MSCs) for Organics in Groundwater, Used Aquifer, total dissolved solids (TDS)<2,500.
- U.S. EPA Current Drinking Water Standards – National Primary Drinking Water Regulations, Maximum Contaminant Level (MCLs) (http://www.epa.gov/OGWDW/mcl.html). MCLs are listed in Title 40 Code of Federal Regulations (CFR) Part 141 Subpart G.
- Water Quality Criteria for Toxic Substances, human health criteria and fish/aquatic criteria (Title 25 of the Pennsylvania Administrative Code (25 PA. Code), Chapter 16, Appendix A, Table 1, November 2000. http://www.pacode.com/secure/data/025/chapter16/chap16toc.html.

The chemical-specific ARARs for the groundwater COCs and potential breakdown product COCs are as follows:

| Chemical | EPA MCL micrograms per liter (µg/L) | PADEP MSC µg/L Residential | WQC µg/L (lower of fish and aquatic life or human health criteria) |
|---|---|---|---|
| benzene | 5 | 5 | 1.2 (human health, cancer risk level at 1 x $10^{-6}$) |
| chloroethane | NA | 230 | NA |
| 1,1-dichlorothane (1,1-DCA) | NA | 27 | NA |
| 1,1-dichloroethene (1,1-DCE) | 7 | 7 | 0.057 (human health, cancer risk level at 1 x $10^{-6}$,regulation allows for achievable detection limit of 0.13) |
| cis-1,2-dichloroethene (cis-1,2-DCE) | 70 | 70 | NA |
| trans-1,2-dichloroethene (trans-1,2-DCE) | 100 | 100 | 700 (threshold effect human health criterion) |
| trichloroethene (TCE) | 5 | 5 | 2.7 (human health, cancer risk level at 1 x $10^{-6}$) |
| vinyl chloride | 2 | 2 | 2 (human health, cancer risk level at 1 x $10^{-6}$) |

NA = no criteria listed for these chemicals

The EPA MCLS and Pennsylvania MSCs listed in the above table shall be attained throughout groundwater in SE OU 10 as measured by the samples from the monitoring wells identified in the approved Remedial Action Work Plan. The area of SE OU 10 groundwater is shown on Figure 3 of this ROD. The Pennsylvania WQCs listed in the above table shall be attained at Hawbaker spring.

## 13.3 COST EFFECTIVENESS

Of the options available that will treat the source area and reduce the level of contamination through proven methods, Enhanced Biodegradation with MNA and Land Use Controls is the most cost-effective active treatment method, with an estimated present worth value cost based on 5 years of approximately $281,900.

The Selected Remedy, Enhanced Biodegradation with MNA and Land Use Controls, was chosen because it provides the best balance among criteria used to evaluate the alternatives considered in the detailed analysis. The alternative was found to achieve both adequate protection of human health and the environment, and to meet the statutory requirements of Section 121 of CERCLA. The Selected Remedy was found to be cost-effective. The estimated cost of Alternative 3 is $281,900.

## 13.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The EPA and the Army have determined, with concurrence from PADEP, that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective and timely manner for the SE OU 10 groundwater. The Army and EPA have determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria. Short-term effectiveness, implementability, and cost were most decisive balancing criteria in the remedy selection decision.

## 13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The Selected Remedy, Enhanced Biodegradation with MNA and Land Use Controls, satisfies the statutory preference for treatment as a principal element of the remedy by enhancing the natural breakdown of the contaminants by the indigenous microbial population and will reduce TMV in SE OU 10 groundwater.

## 13.6 FIVE-YEAR REVIEW REQUIREMENTS

Because this remedy may result in hazardous substances, pollutants, or contaminants remaining in SE OU 10 groundwater above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

# SECTION 14

# DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for SE OU 10 was released for public comment from April 4, to May 4, 2005. The Proposed Plan identified Alternative 3, Enhanced Biodegradation with Monitored Natural Attenuation and Land use Controls as the Preferred Alternative for groundwater remediation. No verbal or written comments were submitted during the public comment period. Two questions were asked at the Public Meeting, as discussed in the Responsiveness Summary. The Army and EPA, in consultation with PADEP, reviewed the questions and determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

# RESPONSIVENESS SUMMARY

# LETTERKENNY ARMY DEPOT

CHAMBERSBURG, FRANKLIN COUNTY, PENNSYLVANIA

## CONOCOCHEAGUE DRAINAGE SYSTEM
## SOUTHERN SOUTHEAST INDUSTRIAL AREA (SSIA)
## SOUTHEASTERN (SE) AREA OPERABLE UNIT (OU) 10
## AEDBR SITES LEAD-090, -091, -095, 100, -101, -128

(Includes Hawbaker Spring, Dozens Springs, Chambers Spring, and Building 12)

## RESPONSIVENESS SUMMARY

MARCH 2006

## SECTION 1 OVERVIEW

Based on an assessment of the site conditions, the U.S. Department of the Army (Army), the lead agency for Site activities under CERCLA, and the U.S. Environmental Protection Agency (EPA) selected a remedy for the Southeastern (SE) Area operable unit (OU) 10 groundwater at Letterkenny Army Depot (LEAD or Depot), Chambersburg, PA. The Commonwealth of Pennsylvania Department of Environmental Protection (PADEP) concurs with the Selected Remedy. The Selected Remedy for SE OU 10 represents the final remedy for the following sites (AEDBR numbers listed in parenthesis): Building 37 volatile-organic contaminated groundwater (LEAD-101), entire SE OU 10 area (LEAD-128), Hawbaker Spring (LEAD-090), Dozens Spring (LEAD-091), Chambers Spring (LEAD-095) and Building 12 (LEAD-100). The Selected Remedy applies to the VOC contaminated groundwater (On- and Off-post) and the Off-post Springs associated with the above-described sites.

The Selected Remedy for the SE OU 10 is Enhanced Biodegradation with Monitored Natural Attenuation and Land Use Controls. The Army, EPA and PADEP have determined that this response action is necessary to protect human health and the environment, based on the current and likely future commercial/industrial use in the on-post areas (within the Cumberland Valley Business Park and the LEAD property), the current and future residential use in the off-post areas, as well as return the groundwater in SE OU 10 to future beneficial uses.

Based on the fact that no comments were received during the public comment period from off-post residents, residents of the Greene Township, and the Letterkenny Industrial Development Authority (LIDA), it appears that there are no objections to the Selected Remedy for the SE OU 10 groundwater. No written or verbal comments were received during the public comment period on the Proposed Plan.

## SECTION 2 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

The 30-day public comment period on the Proposed Plan for the SE OU 10 groundwater was held from April 4, to May 4, 2005. No comments were received during this time. On April 20, 2005, a public meeting was held at the Building 14 conference room to present the Proposed Plan and to entertain questions and comments from the public. A fact sheet describing the background for SE OU 10 and the preferred remedy was available for the public at the meeting. Representatives from LIDA, EPA, PADEP, and the Army attended the meeting. In addition, the community co-chairperson of the local Restoration Advisory Board (RAB) was in attendance. None of the citizens present objected to the Army and EPA's preferred remedy, nor did they recommend an alternative approach.

The Army and EPA answered all of the questions during the meeting. A citizen asked if the Army actually approves requests to dig/access the groundwater (in on-post area where there are restrictions). The LEAD representative answered yes, that requests have been approved, for example, installing new monitoring wells. A representative from LIDA inquired whether the groundwater in the private wells of the Salem Road residents had been tested, and whether the Army had discussed with the local township or any other party regarding taking over management of the land use controls. The LEAD representative answered that the wells on the Salem Road had been tested and the groundwater is not VOC-contaminated. In regards to taking over management of land use controls, the Army will retain responsibility for land use controls established on-post as long as they have a presence at LEAD, which is expected to be for a long time. [*]

The community appears to fully support the Army's findings and the alternative selected by the Army and EPA.

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[*] Note that, to date, informal conversations have been held between the BRAC Environmental Coordinator and Greene Township officials regarding the township ordinances pertaining to installation of potable water wells and public water hookup requirements as discussed on pages 26 and 27 of the Decision Summary of the ROD. The involvement needed by Greene Township is enforcing their own existing township ordinances regarding installation of potable water wells in the off-post area of SE OU 10 and use of existing public potable water supply where public hookups exist. The Greene Township codes listed on pages 26 and 27 of the Decision Summary of the ROD are existing ordinances that are being used as part of the "institutional controls" portion of the remedy for the OU for protection of human health. However, these codes were already in place and were not setup solely to be part of the remedy for the OU at the LEAD site.

# TABLES

# TABLE 1 - Site Conceptual Model
## RAGS PART D Table 1
## SELECTION OF EXPOSURE PATHWAYS
## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current/Future Industrial/ Commercial Worker | Groundwater | Shallow aquifer | Tap | Adult | ED, 25 yr | Ingestion | On-Site | Quantitative | Worker drinks water |
| | | | | | | Inhalation | On-Site | Quantitative | Worker inhales VOCs from indoor water use |
| Future Resident | Groundwater | Shallow aquifer | Tap | Child | 1 - 6 yr | Ingestion | On-Site | Quantitative | Child resident drinks water |
| | | | | | | Dermal Contact | On-Site | Quantitative | Child resident dermally absorbs contaminants while bathing |
| | | | | Adult | ED, 30 yr | Ingestion | On-Site | Quantitative | Adult resident drinks water |
| | | | | | | Inhalation | On-Site | Quantitative | Adult resident inhales VOCs from indoor water use |

ED = Exposure duration

### Table 2

### RAGS Part D TABLE 2.1

### OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum Concentration | Maximum Concentration | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening (1) | Background Value (2) | Screening Toxicity Value (3) (N/C) | Potential ARAR/TBC Value | Potential ARAR/TBC Source | COPC Flag (Y/N) | Rationale for Selection or Deletion (4) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 71-55-6 | 1,1,1-Trichloroethane | 0.195 | 5.5 | µg/L | 973723M002 | 7/11 | 1.00-1.00 | 5.50 | N/A | 200 M | N/A | N/A | No | BSL |
| | 75-34-3 | 1,1-Dichloroethane | 1.2 | 30 | µg/L | 973723M002 | 11/11 | - | 30.0 | N/A | 27.0 I | N/A | N/A | Yes | ASL |
| | 75-35-4 | 1,1-Dichloroethene | 0.72 | 1.1 | µg/L | 973723M002 | 2/11 | 1.00-1.00 | 1.10 | N/A | 7.00 M | N/A | N/A | No | BSL |
| | 78-87-5 | 1,2-Dichloropropane | 0.16 | 0.26 | µg/L | 963711M035 | 2/11 | 1.00-1.00 | 0.26 | N/A | 0.16 C | N/A | N/A | Yes | ASL |
| | 78-93-3 | 2-Butanone | 1.1 | 1.5 | µg/L | 973724M021 | 3/11 | 5.00-5.00 | 1.50 | N/A | 2800 I | N/A | N/A | No | BSL |
| | 71-43-2 | Benzene | 0.16 | 3.2 | µg/L | 963711M035 | 7/11 | 1.00-1.00 | 3.20 | N/A | 0.34 C | N/A | N/A | Yes | ASL |
| | 75-00-3 | Chloroethane | 0.45 | 7.2 | µg/L | 963706M035 | 7/11 | 1.00-1.00 | 7.20 | N/A | 3.64 C | N/A | N/A | Yes | ASL |
| | 156-59-2 | Cis-1,2-Dichloroethene | 0.41 | 61 | µg/L | 973723M002 | 9/11 | 0.10-0.95 | 61.0 | N/A | 6.08 N | N/A | N/A | Yes | ASL |
| | 100-41-4 | Ethylbenzene | 0.12 | 0.12 | µg/L | 973724M021 | 1/11 | 1.00-1.00 | 0.12 | N/A | 700 M | N/A | N/A | No | BSL |
| | 75-09-2 | Methylene Chloride | 0.22 | 0.31 | µg/L | 963711M036_AVG | 3/11 | 1.00-2.00 | 0.31 | N/A | 3.00 H | N/A | N/A | No | BSL |
| | 108-88-3 | Toluene | 0.11 | 0.11 | µg/L | 963711M035 | 1/11 | 1.00-1.00 | 0.11 | N/A | 74.7 N | N/A | N/A | No | BSL |
| | 156-60-5 | Trans-1,2-Dichloroethene | 0.17 | 0.35 | µg/L | 973723M002 | 3/11 | 1.00-1.00 | 0.35 | N/A | 100 M | N/A | N/A | No | BSL |
| | 79-01-6 | Trichloroethene | 0.115 | 19 | µg/L | 973723M002 | 9/11 | 1.00-1.00 | 19.0 | N/A | 0.026 C | N/A | N/A | Yes | ASL |
| | 75-01-4 | Vinyl Chloride | 0.22 | 16 | µg/L | 973723M002 | 10/11 | 1.00-1.00 | 16.0 | N/A | 0.015 C | N/A | N/A | Yes | ASL |

(1) Maximum concentration used for screening.

(2) To date, no background study has been completed.

(3) Lower value of EPA Region III tap water risk-based screening concentrations (RBSCs) and PA DEP residential medium-specific concentrations (MSCs) (PADEP, 2001).

(4) Rationale Codes:

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | Below Screening Level (BSL) |

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
COPC = Chemical of Potential Concern
C = Carcinogenic. TR, 1E-06.
H = Lifetime health advisory level.
I = Inhalation
M = Maximum Contaminant Level.
N = Non-Carcinogenic. THQ, 0.1.
N/A = Not Applicable

## TABLE 3

## RAGS Part D TABLE 3.1 RME

## EXPOSURE POINT CONCENTRATION SUMMARY

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | Chemical of Potential Concern | Units | Arithmetic Mean (1) | 95% UCL (1) (Distribution) | Maximum Concentration (Qualifier) | Exposure Point Concentration | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Value | Units | Statistic | Rationale |
| Groundwater | 1,1-Dichloroethane | µg/L | 8.79 | 16.25 (G) | 30.0 | 16.25 | µg/L | 95% UCL-G | W-Test (1) |
| | 1,2-Dichloropropane | µg/L | 0.45 | 0.51 (N) | 0.26 | 0.26 | µg/L | Maximum | W-Test (5) |
| | Benzene | µg/L | 1.05 | 1.80 (G) | 3.2 | 1.80 | µg/L | 95% UCL-G | W-Test (1) |
| | Chloroethane | µg/L | 2.29 | 9.69 (NP) | 7.2 | 7.20 | µg/L | Maximum | W-Test (5) |
| | Cis-1,2-Dichloroethene | µg/L | 11.54 | 45.34 (G) | 61.0 | 45.34 | µg/L | 95% UCL-G | W-Test (4) |
| | Trichloroethene | µg/L | 3.27 | 10.67 (G) | 19.0 | 10.67 | µg/L | 95% UCL-G | W-Test (4) |
| | Vinyl Chloride | µg/L | 5.92 | 13.08 (G) | 16.0 | 13.08 | µg/L | 95% UCL-G | W-Test (1) |

Statistics: Maximum Detected Value (Maximum); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Transformed Data (95% UCL-T); 95% U

Nondetects were included at half the sample quantitation limit.

The EPC is based on the lower of the 95% UCL and the maximum detected concentration.

(1) ProUCL indicates data are gamma. The Approximate Gamma UCL was the ProUCL recommendation.

(2) ProUCL indicates data are normal. The Student's-t UCL was the ProUCL recommendation.

(3) ProUCL indicates data are nonparametric (0.01). The 99% Chebyshev (Mean, Sd) UCL was the ProUCL recommendation.

(4) ProUCL indicates data are gamma. The Adjusted Gamma UCL was the ProUCL recommendation.

(5) The chosen UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

Definitions:
G = Gamma
N = Normal
N/A = Not Applicable
NP = Nonparametric
T = Transformed

## TABLE 4

## RAGS Part D Table 4.1

## VALUES USED FOR DAILY INTAKE CALCULATIONS

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium:  Groundwater
Exposure Medium:  Groundwater

| Exposure Route | Receptor Population | Receptor Age | Exposure Point | Parameter Code | Parameter Definition | Value | Units | Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Resident | Child | Tap Water | EPC | Exposure Point Concentration | Chemical-specific | µg/L | See Table TBD [1] | Chronic daily intake (CDI)(mg/kg-day) = |
| | | | | IR-G | Ingestion Rate of Groundwater | 1 | L/day | EPA, 2001a | EPC x IR-G x CF x EF x ED x 1/BW x 1/AT |
| | | | | CF | Conversion Factor | 1.00E-03 | mg/µg | ----- | |
| | | | | EF | Exposure Frequency | 350 | days/year | EPA, 2001a | |
| | | | | ED | Exposure Duration | 6 | years | EPA, 2001a | |
| | | | | BW | Body Weight | 15 | kg | EPA, 1989 | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | EPA, 1989 | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 2,190 | days | EPA, 1989 | |
| | | Adult | Tap Water | EPC | Exposure Point Concentration | Chemical-specific | µg/L | See Table TBD [1] | Chronic daily intake (CDI)(mg/kg-day) = |
| | | | | IR-G | Ingestion Rate of Groundwater | 2 | L/day | EPA, 2001a | EPC x IR-G x CF x EF x ED x 1/BW x 1/AT |
| | | | | CF | Conversion Factor | 1.00E-03 | mg/µg | ----- | |
| | | | | EF | Exposure Frequency | 350 | days/year | EPA, 2001a | |
| | | | | ED | Exposure Duration | 30 | years | EPA, 2001a | |
| | | | | BW | Body Weight | 70 | kg | EPA, 1989 | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | EPA, 1989 | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 10,950 | days | EPA, 1989 | |
| | Commercial/Industrial Worker | Adult | Tap Water | EPC | Exposure Point Concentration | Chemical-specific | µg/L | See Table TBD [1] | Chronic daily intake (CDI)(mg/kg-day) = |
| | | | | IR-G | Ingestion Rate of Groundwater | 1 | L/day | EPA, 2001a | EPC x IR-G x CF x EF x ED x 1/BW x 1/AT |
| | | | | CF | Conversion Factor | 1.00E-03 | mg/µg | ----- | |
| | | | | EF | Exposure Frequency | 250 | days/year | EPA, 2001a | |
| | | | | ED | Exposure Duration | 25 | years | EPA, 2001a | |
| | | | | BW | Body Weight | 70 | kg | EPA, 1989 | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | EPA, 1989 | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 9,125 | days | EPA, 1989 | |

## TABLE 4
## RAGS Part D Table 4.1
## VALUES USED FOR DAILY INTAKE CALCULATIONS
## REASONABLE MAXIMUM EXPOSURE
## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Route | Receptor Population | Receptor Age | Exposure Point | Parameter Code | Parameter Definition | Value | Units | Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Dermal | Resident | Child | Tap Water While Bathing | SA | Skin Surface Area Available for Contact | 6,600 | $cm^2$ | EPA, 2003a, 2004c | Dermally Absorbed Dose (DAD)(mg/kg-day) = |
| | | | | $DA_{EVENT}$ | Absorbed Dose Per Event | Chemical-specific | $mg/cm^2$-event | EPA, 2004c | $DA_{EVENT}$ x EV x SA x EF x ED x 1/BW x 1/AT |
| | | | | EV | Event Frequency | 1 | event/day | EPA, 2004c | |
| | | | | EF | Exposure Frequency | 350 | days/year | EPA, 2001a | |
| | | | | ED | Exposure Duration | 6 | years | EPA, 2001a | |
| | | | | BW | Body Weight | 15 | kg | EPA, 1989 | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | EPA, 1989 | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 2,190 | days | EPA, 1989 | |
| | | | | FA | Fraction Absorbed Water | Chemical-specific | unitless | EPA, 2004c | if $t_{event} \le t^*$, then $DA_{EVENT}$ (Organic) = |
| | | | | $K_p$ | Dermal Permeability Coefficient | Chemical-specific | cm/hour | EPA, 2004c | 2 FA x $K_p$ x $C_w$ x $CF_1$ x $CF_2$ x $\sqrt{}$ $(6\tau_{event}$ x $t_{event}/\pi)$ |
| | | | | $C_w$ | Chemical Concentration in Water | Chemical-specific | µg/L | TBD | |
| | | | | $CF_1$ | Conversion Factor | 1.0E-03 | mg/µg | ----- | otherwise if $t_{event} > t^*$, then $DA_{EVENT}$ (Organic) = |
| | | | | $CF_2$ | Conversion Factor | 1.0E-03 | $L/cm^3$ | ----- | FA x $K_p$ x $C_w$ x $CF_1$ x $CF_2$ x |
| | | | | B | Ratio of Permeability Coefficient | Chemical-specific | unitless | EPA, 2004c | $[((t_{event})/(1+B)) + 2\tau_{event} ((1 + 3B + 3B^2)/(1+B)^2)$ |
| | | | | t* | Time to Reach Steady State | Chemical-specific | hour | EPA, 2004c | |
| | | | | $\tau_{event}$ | Lag Time Per Event | Chemical-specific | hr/event | EPA, 2004c | |
| | | | | $t_{event}$ | Event Duration | 1.00 | hr/event | EPA, 2004c | |

[1] The EPC is based on the lower of the 95% UCL and the maximum detected concentration.

## TABLE 5

## RAGS Part D Table 4.2

## VALUES USED FOR DAILY INTAKE CALCULATIONS FOR ADULT INHALATION OF VOCs WHILE SHOWERING

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Air

| Exposure Route | Receptor Population | Receptor Age | Exposure Point | Parameter Code | Parameter Definition | Value | Units | Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Resident | Adult | Vapors While Showering | D | Inhalation Dose | Chemical-specific | mg/kg-shower | [1] | Inhalation dose (D)(mg/kg-shower) = |
| | | | | CF | Conversion Factor | 0.001 | mg/ug | | |
| | | | | EV | Event Frequency | 1 | event/day | | IEC x CF x EV x VR x EF x ED/BW x AT |
| | | | | VR | Ventilation Rate | 8.40E-01 | $m^3$/event | | |
| | | | | EF | Exposure frequency | 350 | days/yr | | |
| | | | | ED | Exposure duration | 24 | years | | |
| | | | | BW | Body weight | 70.0 | kg | | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 8,760 | days | | |
| | | | | IEC | Inhalation Exposure Concentration in Shower | Chemical-specific | µg/$m^3$ | | $\mathrm{IEC}=\left(\frac{\mathrm{S}}{\mathrm{Ra}}\times\left(\mathrm{Ds}+\frac{e^{-\mathrm{Ra}\times\mathrm{Dt}}}{\mathrm{Ra}}-\frac{e^{\mathrm{Ra}(\mathrm{Ds}-\mathrm{Dt})}}{\mathrm{Ra}}\right)\times\mathrm{n}\right)\div\mathrm{Dt}$ |
| | | | | n | Showers per day | 1 | shower/day | | |
| | | | | Ra | Rate of air exchange | 0.01667 | 1/min | | |
| | | | | Ds | Shower Duration | 30 | min | | |
| | | | | Dt | Total Time In Shower | 60 | min | | |
| | | | | S | Indoor VOC generation rate | Chemical-specific | µg/$m^3$-min | | S = CWD x FR/ SV |
| | | | | FR | Shower flow rate | 10 | L/min | | |
| | | | | SV | Shower room air volume | 12 | $m^3$ | | |
| | | | | Cwd | Concentration leaving shower droplet after time | Chemical-specific | µg/L | | $\mathrm{Cwd}=\mathrm{Cw0}\left(1-e^{\frac{-\mathrm{KaL}\times\mathrm{ts}}{60\mathrm{d}}}\right)$ |
| | | | | Cw0 | Shower concentration in water or EPC | Chemical-specific | µg/L | | |
| | | | | KaL | Adjusted mass transfer coefficient | Chemical-specific | cm/hr | | |
| | | | | ts | Shower droplet time | seconds | 0.5 | | |
| | | | | d | Droplet diameter | mm | 1 | | |

## TABLE 5

## RAGS Part D Table 4.2

## VALUES USED FOR DAILY INTAKE CALCULATIONS FOR ADULT INHALATION OF VOCs WHILE SHOWERING

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Air

| Exposure Route | Receptor Population | Receptor Age | Exposure Point | Parameter Code | Parameter Definition | Value | Units | Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|---|
| | Industrial Worker | Adult | Vapors While Showering | D | Inhalation Dose | Chemical-specific | mg/kg-shower | [1] | Inhalation dose (D)(mg/kg-shower) =<br>IEC x CF x EV x VR x EF x ED/BW x AT |
| | | | | CF | Conversion Factor | 0.001 | mg/ug | | |
| | | | | EV | Event Frequency | 1 | event/day | | |
| | | | | VR | Ventilation Rate | 8.40E-01 | m$^3$/event | | |
| | | | | EF | Exposure frequency | 250 | days/yr | | |
| | | | | ED | Exposure duration | 25 | years | | |
| | | | | BW | Body weight | 70.0 | kg | | |
| | | | | AT-C | Averaging Time (Cancer) | 25,550 | days | | |
| | | | | AT-NC | Averaging Time (Non-Cancer) | 9,125 | days | | |
| | | | | IEC | Inhalation Exposure Concentration in Shower | Chemical-specific | µg/m$^3$ | | $\mathrm{IEC} = \left( \frac{\mathrm{S}}{\mathrm{Ra}} \times \left( \mathrm{Ds} + \frac{e^{-\mathrm{Ra} \times \mathrm{Dt}}}{\mathrm{Ra}} - \frac{e^{\mathrm{Ra}(\mathrm{Ds}-\mathrm{Dt})}}{\mathrm{Ra}} \right) \times \mathrm{n} \right) \div \mathrm{Dt}$ |
| | | | | n | Showers per day | 1 | shower/day | | |
| | | | | Ra | Rate of air exchange | 0.01667 | 1/min | | |
| | | | | Ds | Shower Duration | 30 | min | | |
| | | | | Dt | Total Time In Shower | 60 | min | | |
| | | | | S | Indoor VOC generation rate | Chemical-specific | µg/m$^3$-min | | S = CWD x FR/ SV |
| | | | | FR | Shower flow rate | 10 | L/min | | |
| | | | | SV | Shower room air volume | 12 | m$^3$ | | |
| | | | | Cwd | Concentration leaving shower droplet after time | Chemical-specific | µg/L | | $\mathrm{Cwd} = \mathrm{Cw0}\left( 1 - e^{\frac{-\mathrm{KaL} \times \mathrm{ts}}{60\mathrm{d}}} \right)$ |
| | | | | Cw0 | Shower concentration in water or EPC | Chemical-specific | µg/L | | |
| | | | | KaL | Adjusted mass transfer coefficient | Chemical-specific | cm/hr | | |
| | | | | ts | Shower droplet time | seconds | 0.5 | | |
| | | | | d | Droplet diameter | mm | 1 | | |

[1] Foster-Chrostowski (1987) Model.

### TABLE 6

### RAGS Part D TABLE 5.1

### NON-CANCER TOXICITY DATA -- ORAL/DERMAL

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD | | Oral Absorption Efficiency for Dermal (1) | Absorbed RfD for Dermal (1) | | Primary Target Organ(s) | Combined Uncertainty/Modifying Factors | RfD: Target Organ(s) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Value | Units | | Value | Units | | | Source(s) | Date(s) (MM/DD/YYYY) |
| 1,1-Dichloroethane | Chronic | 2.00E-01 | mg/kg/day | 1.0 | 2.00E-01 | mg/kg/day | NOEL | NA | PPRTV : HEAST | 5/3/2005 |
| 1,2-Dichloropropane | NA | NA | NA | 1.0 | NA | NA | NA | NA | NA | NA |
| Benzene | Chronic | 4.00E-03 | mg/kg/day | 1.0 | 4.00E-03 | mg/kg/day | Blood | 300 | IRIS | 5/3/2005 |
| Chloroethane | Chronic | 4.00E-01 | mg/kg/day | 1.0 | 4.00E-01 | mg/kg/day | Fetotoxicity | NA | NCEA | 5/3/2005 |
| Cis-1,2-Dichloroethene | Chronic | 1.00E-02 | mg/kg/day | 1.0 | 1.00E-02 | mg/kg/day | Blood | NA | PPRTV : NCEA | 5/3/2005 |
| Trichloroethene | Chronic | 3.00E-04 | mg/kg/day | 1.0 | 3.00E-04 | mg/kg/day | Liver/Kidney/Fetotoxicity | NA | NCEA | 5/3/2005 |
| Vinyl Chloride | Chronic | 3.00E-03 | mg/kg/day | 1.0 | 3.00E-03 | mg/kg/day | Liver | 30 | IRIS | 5/3/2005 |

(1) Source: EPA, 2001c.

Definitions:
HEAST=Health Effects Assessment Summary Tables, July 1997.
IRIS=Integrated Risk Information System
NA=Not available
NCEA=National Center for Environmental Assessment
NOEL=No observed effect level
PPRTV = Provisional Peer Review Toxicity Values for Superfund

## TABLE 7

## RAGS Part D TABLE 5.2

## NON-CANCER TOXICITY DATA -- INHALATION

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

| Chemical of Potential Concern | Chronic/ Subchronic | Inhalation RfC | | Extrapolated RfD (1) | | Primary Target Organ(s) | Combined Uncertainty/Modifying Factors | RfC: Target Organ(s) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Value | Units | Value | Units | | | Source(s) | Date(s) (MM/DD/YYYY) |
| 1,1-Dichloroethane | Chronic | 4.90E-01 | mg/m3 | 1.40E-01 | mg/kg/day | Kidney | NA | HEAST | 5/3/2005 |
| 1,2-Dichloropropane | Chronic | 3.99E-03 | mg/m3 | 1.14E-03 | mg/kg/day | Respiratory system | 300 | IRIS | 5/3/2005 |
| Benzene | Chronic | 3.01E-02 | mg/m3 | 8.60E-03 | mg/kg/day | Blood | 300 | IRIS | 5/3/2005 |
| Chloroethane | Chronic | 1.02E+01 | mg/m3 | 2.90E+00 | mg/kg/day | Fetus | 300 | IRIS | 5/3/2005 |
| Cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | Chronic | 3.50E-02 | mg/m3 | 1.00E-02 | mg/kg/day | CNS/Liver/Endocrine System | NA | NCEA | 5/3/2005 |
| Vinyl Chloride | Chronic | 9.80E-02 | mg/m3 | 2.80E-02 | mg/kg/day | Liver | 30 | IRIS | 5/3/2005 |

(1) See Risk Assessment text for the derivation of the "Extrapolated RfD".

Definitions:
IRIS=Integrated Risk Information System
NA=Not available
NCEA=National Center for Environmental Assessment

## TABLE 8

## RAGS Part D TABLE 6.1

## CANCER TOXICITY DATA -- ORAL/DERMAL

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

| Chemical of Potential Concern | Oral Cancer Slope Factor | | Oral Absorption Efficiency for Dermal (1) | Absorbed Cancer Slope Factor for Dermal (1) | | Weight of Evidence/ Cancer Guideline Description | Oral CSF | |
|---|---|---|---|---|---|---|---|---|
| | Value | Units | | Value | Units | | Source(s) | Date(s) (MM/DD/YYYY) |
| 1,1-Dichloroethane | NA | NA | 1.0 | NA | NA | C | NA | NA |
| 1,2-Dichloropropane | 6.80E-02 | 1/mg/kg/day | 1.0 | 6.80E-02 | 1/mg/kg/day | B2 | NA : HEAST | 5/3/2005 |
| Benzene | 5.50E-02 | 1/mg/kg/day | 1.0 | 5.50E-02 | 1/mg/kg/day | A | IRIS | 5/3/2005 |
| Chloroethane | 2.90E-03 | 1/mg/kg/day | 1.0 | 2.90E-03 | 1/mg/kg/day | NA | NA | 5/3/2005 |
| Cis-1,2-Dichloroethene | NA | NA | 1.0 | NA | NA | D | NA | NA |
| Trichloroethene | 4.00E-01 | 1/mg/kg/day | 1.0 | 4.00E-01 | 1/mg/kg/day | NA | NCEA : NA | 5/3/2005 |
| Vinyl Chloride | 7.20E-01 | 1/mg/kg/day | 1.0 | 7.20E-01 | 1/mg/kg/day | A | IRIS | 5/3/2005 |

(1) Source: EPA, 2001c.

Definitions: HEAST = Health Effects Assessment Summary Table, July 1997.
IRIS = Integrated Risk Information System
NA = Not available
NCEA=National Center for Environmental Assessment
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.

### TABLE 9

### RAGS Part D TABLE 6.2

### CANCER TOXICITY DATA -- INHALATION

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

| Chemical of Potential Concern | Unit Risk |  | Inhalation Cancer Slope Factor |  | Weight of Evidence/ Cancer Guideline Description | Unit Risk: Inhalation CSF |  |
|---|---|---|---|---|---|---|---|
|  | Value | Units | Value | Units |  | Source(s) | Date(s) (MM/DD/YYYY) |
| 1,1-Dichloroethane | NA | NA | NA | NA | C | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | B2 | NA | NA |
| Benzene | 7.71E-06 | 1/µg/m3 | 2.70E-02 | 1/mg/kg/day | A | IRIS | 5/3/2005 |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA |
| Cis-1,2-Dichloroethene | NA | NA | NA | NA | D | NA | NA |
| Trichloroethene | 1.14E-04 | 1/µg/m3 | 4.00E-01 | 1/mg/kg/day | NA | NCEA : NA | 5/3/2005 |
| Vinyl Chloride | 4.29E-06 | 1/µg/m3 | 1.50E-02 | 1/mg/kg/day | A | IRIS | 5/3/2005 |

Definitions:

HEAST = Health Effects Assessment Summary Table, July 1997.

IRIS = Integrated Risk Information System.

NA = Not available.

NCEA=National Center for Environmental Assessment

A - Human carcinogen.

B1 - Probable human carcinogen - indicates that limited human data are available.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.

C - Possible human carcinogen.

D - Not classifiable as a human carcinogen.

## Table 10
## RAGS Part D TABLE 7.1.RME
## CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
## REASONABLE MAXIMUM EXPOSURE
## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Child (Younger)

| Medium | Exposure Medium | Exposure Point | Exposure Route | Chemical of Potential Concern | EPC | | Cancer Risk Calculations | | | | | Non-Cancer Hazard Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Value | Units | Intake/Exposure Concentration | | CSF/Unit Risk | | Cancer Risk | Intake/Exposure Concentration | | RfD/RfC | | Hazard Quotient |
| | | | | | | | Value | Units | Value | Units | | Value | Units | Value | Units | |
| Groundwater | Groundwater | Tap Water | Ingestion | 1,1-Dichloroethane | 16.25 | µg/L | 8.90E-05 | mg/kg/day | NA | NA | NA | 1.04E-03 | mg/kg/day | 2.0E-01 | mg/kg/day | 0.0052 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 1.42E-06 | mg/kg/day | 6.80E-02 | 1/mg/kg/day | 9.69E-08 | 1.66E-05 | mg/kg/day | NA | NA | NA |
| | | | | Benzene | 1.80 | µg/L | 9.86E-06 | mg/kg/day | 5.50E-02 | 1/mg/kg/day | 5.42E-07 | 1.15E-04 | mg/kg/day | 4.0E-03 | mg/kg/day | 0.029 |
| | | | | Chloroethane | 7.20 | µg/L | 3.95E-05 | mg/kg/day | 2.90E-03 | 1/mg/kg/day | 1.14E-07 | 4.60E-04 | mg/kg/day | 4.0E-01 | mg/kg/day | 0.0012 |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 2.48E-04 | mg/kg/day | NA | NA | NA | 2.90E-03 | mg/kg/day | 1.0E-02 | mg/kg/day | 0.29 |
| | | | | Trichloroethene | 10.67 | µg/L | 5.85E-05 | mg/kg/day | 4.00E-01 | 1/mg/kg/day | 2.34E-05 | 6.82E-04 | mg/kg/day | 3.0E-04 | mg/kg/day | 2.27 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 7.17E-05 | mg/kg/day | 7.20E-01 | 1/mg/kg/day | 6.79E-04 | 8.36E-04 | mg/kg/day | 3.0E-03 | mg/kg/day | 0.28 |
| | | | Exp. Route Total | | | | | | | | 7.04E-04 | | | | | 2.88 |
| | | | Dermal | 1,1-Dichloroethane | 16.25 | µg/L | 6.93E-06 | mg/kg/day | NA | NA | NA | 8.08E-05 | mg/kg/day | 2.00E-01 | mg/kg/day | 0.00040 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 1.38E-07 | mg/kg/day | 6.80E-02 | 1/mg/kg/day | 9.35E-09 | 1.60E-06 | mg/kg/day | NA | NA | NA |
| | | | | Benzene | 1.80 | µg/L | 1.82E-06 | mg/kg/day | 5.50E-02 | 1/mg/kg/day | 1.00E-07 | 2.13E-05 | mg/kg/day | 4.00E-03 | mg/kg/day | 0.0053 |
| | | | | Chloroethane | 7.20 | µg/L | 2.35E-06 | mg/kg/day | 2.90E-03 | 1/mg/kg/day | 6.82E-09 | 2.74E-05 | mg/kg/day | 4.00E-01 | mg/kg/day | 0.000069 |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 2.20E-05 | mg/kg/day | NA | NA | NA | 2.56E-04 | mg/kg/day | 1.00E-02 | mg/kg/day | 0.026 |
| | | | | Trichloroethene | 10.67 | µg/L | 9.75E-06 | mg/kg/day | 4.00E-01 | 1/mg/kg/day | 3.90E-06 | 1.14E-04 | mg/kg/day | 3.00E-04 | mg/kg/day | 0.38 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 3.92E-06 | mg/kg/day | 7.20E-01 | 1/mg/kg/day | 3.72E-05 | 4.57E-05 | mg/kg/day | 3.00E-03 | mg/kg/day | 0.015 |
| | | | Exp. Route Total | | | | | | | | 4.12E-05 | | | | | 0.43 |
| | | Exposure Point Total | | | | | | | | | 7.45E-04 | | | | | 3.30 |
| | Exposure Medium Total | | | | | | | | | | 7.45E-04 | | | | | 3.30 |
| Groundwater Total | | | | | | | | | | | 7.45E-04 | | | | | 3.30 |
| | | | | | | | | | | Total of Receptor Risks Across All Media | 7.45E-04 | | | | Total of Receptor Hazards Across All Media | 3.30 |

## Table 11

## RAGS Part D TABLE 7.2.RME

## CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Exposure Route | Chemical of Potential Concern | EPC | | Cancer Risk Calculations | | | | | Non-Cancer Hazard Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Value | Units | Intake/Exposure Concentration | | CSF/Unit Risk | | Cancer Risk | Intake/Exposure Concentration | | RfD/RfC | | Hazard Quotient |
| | | | | | | | Value | Units | Value | Units | | Value | Units | Value | Units | |
| Groundwater | Groundwater | Tap Water | Ingestion | 1,1-Dichloroethane | 16.25 | µg/L | 1.91E-04 | mg/kg/day | NA | NA | NA | 4.45E-04 | mg/kg/day | 2.0E-01 | mg/kg/day | 0.0022 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 3.05E-06 | mg/kg/day | 6.8E-02 | 1/mg/kg/day | 2.08E-07 | 7.12E-06 | mg/kg/day | NA | NA | NA |
| | | | | Benzene | 1.80 | µg/L | 2.11E-05 | mg/kg/day | 5.5E-02 | 1/mg/kg/day | 1.16E-06 | 4.93E-05 | mg/kg/day | 4.0E-03 | mg/kg/day | 0.012 |
| | | | | Chloroethane | 7.20 | µg/L | 8.45E-05 | mg/kg/day | 2.9E-03 | 1/mg/kg/day | 2.45E-07 | 1.97E-04 | mg/kg/day | 4.0E-01 | mg/kg/day | 0.00049 |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 5.32E-04 | mg/kg/day | NA | NA | NA | 1.24E-03 | mg/kg/day | 1.0E-02 | mg/kg/day | 0.12 |
| | | | | Trichloroethene | 10.67 | µg/L | 1.25E-04 | mg/kg/day | 4.0E-01 | 1/mg/kg/day | 5.01E-05 | 2.92E-04 | mg/kg/day | 3.0E-04 | mg/kg/day | 0.97 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 1.54E-04 | mg/kg/day | 7.2E-01 | 1/mg/kg/day | 1.11E-04 | 3.58E-04 | mg/kg/day | 3.0E-03 | mg/kg/day | 0.12 |
| | | | Exp. Route Total | | | | | | | | 1.62E-04 | | | | | 1.23 |
| | | Exposure Point Total | | | | | | | | | 1.62E-04 | | | | | 1.23 |
| | Exposure Medium Total | | | | | | | | | | 1.62E-04 | | | | | 1.23 |
| | | | Inhalation | 1,1-Dichloroethane | 16.25 | µg/L | 7.32E-04 | mg/kg/day | NA | NA | NA | 2.14E-03 | mg/kg/day | 1.40E-01 | mg/kg/day | 0.015 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 1.08E-05 | mg/kg/day | NA | NA | NA | 3.15E-05 | mg/kg/day | 1.14E-03 | mg/kg/day | 0.028 |
| | | | | Benzene | 1.80 | µg/L | 8.84E-05 | mg/kg/day | 2.7E-02 | 1/mg/kg/day | 2.39E-06 | 2.58E-04 | mg/kg/day | 8.60E-03 | mg/kg/day | 0.030 |
| | | | | Chloroethane | 7.20 | µg/L | NA | mg/kg/day | NA | NA | NA | NA | mg/kg/day | 2.90E+00 | mg/kg/day | NA |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 2.03E-03 | mg/kg/day | NA | NA | NA | 5.93E-03 | mg/kg/day | NA | NA | NA |
| | | | | Trichloroethene | 10.67 | µg/L | 4.39E-04 | mg/kg/day | 4.0E-01 | 1/mg/kg/day | 1.76E-04 | 1.28E-03 | mg/kg/day | 1.00E-02 | mg/kg/day | 0.13 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 7.09E-04 | mg/kg/day | 1.5E-02 | 1/mg/kg/day | 1.06E-05 | 2.07E-03 | mg/kg/day | 2.80E-02 | mg/kg/day | 0.074 |
| | | | Exp. Route Total | | | | | | | | 1.89E-04 | | | | | 0.27 |
| | | Exposure Point Total | | | | | | | | | 1.89E-04 | | | | | 0.27 |
| | Exposure Medium Total | | | | | | | | | | 1.89E-04 | | | | | 0.27 |
| Groundwater Total | | | | | | | | | | | 3.51E-04 | | | | | 1.51 |
| | | | | | | | | | | Total of Receptor Risks Across All Media | 3.51E-04 | | | | Total of Receptor Hazards Across All Media | 1.51 |

## Table 12

## RAGS Part D TABLE 7.3.RME

## CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: Commercial/Industrial Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Exposure Route | Chemical of Potential Concern | EPC | | Cancer Risk Calculations | | | | | Non-Cancer Hazard Calculations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Value | Units | Intake/Exposure Concentration | | CSF/Unit Risk | | Cancer Risk | Intake/Exposure Concentration | | RfD/RfC | | Hazard Quotient |
| | | | | | | | Value | Units | Value | Units | | Value | Units | Value | Units | |
| Groundwater | Groundwater | Tap Water | Ingestion | 1,1-Dichloroethane | 16.25 | µg/L | 5.68E-05 | mg/kg/day | NA | NA | NA | 1.59E-04 | mg/kg/day | 2.0E-01 | mg/kg/day | 0.00080 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 9.09E-07 | mg/kg/day | 6.8E-02 | 1/mg/kg/day | 6.18E-08 | 2.54E-06 | mg/kg/day | NA | NA | NA |
| | | | | Benzene | 1.80 | µg/L | 6.29E-06 | mg/kg/day | 5.5E-02 | 1/mg/kg/day | 3.46E-07 | 1.76E-05 | mg/kg/day | 4.0E-03 | mg/kg/day | 0.0044 |
| | | | | Chloroethane | 7.20 | µg/L | 2.52E-05 | mg/kg/day | 2.9E-03 | 1/mg/kg/day | 7.30E-08 | 7.05E-05 | mg/kg/day | 4.0E-01 | mg/kg/day | 0.00018 |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 1.58E-04 | mg/kg/day | NA | NA | NA | 4.44E-04 | mg/kg/day | 1.0E-02 | mg/kg/day | 0.044 |
| | | | | Trichloroethene | 10.67 | µg/L | 3.73E-05 | mg/kg/day | 4.0E-01 | 1/mg/kg/day | 1.49E-05 | 1.04E-04 | mg/kg/day | 3.0E-04 | mg/kg/day | 0.35 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 4.57E-05 | mg/kg/day | 7.2E-01 | 1/mg/kg/day | 3.29E-05 | 1.28E-04 | mg/kg/day | 3.0E-03 | mg/kg/day | 0.043 |
| | | | Exp. Route Total | | | | | | | | 4.83E-05 | | | | | 0.44 |
| | | Exposure Point Total | | | | | | | | | 4.83E-05 | | | | | 0.44 |
| | Exposure Medium Total | | | | | | | | | | 4.83E-05 | | | | | 0.44 |
| | | | Inhalation | 1,1-Dichloroethane | 16.25 | µg/L | 5.45E-04 | mg/kg/day | NA | NA | NA | 1.53E-03 | mg/kg/day | 1.40E-01 | mg/kg/day | 0.011 |
| | | | | 1,2-Dichloropropane | 0.26 | µg/L | 8.04E-06 | mg/kg/day | NA | NA | NA | 2.25E-05 | mg/kg/day | 1.14E-03 | mg/kg/day | 0.020 |
| | | | | Benzene | 1.80 | µg/L | 6.58E-05 | mg/kg/day | 2.7E-02 | 1/mg/kg/day | 1.78E-06 | 1.84E-04 | mg/kg/day | 8.60E-03 | mg/kg/day | 0.021 |
| | | | | Chloroethane | 7.20 | µg/L | NA | mg/kg/day | NA | NA | NA | NA | mg/kg/day | 2.90E+00 | mg/kg/day | NA |
| | | | | Cis-1,2-Dichloroethene | 45.34 | µg/L | 1.51E-03 | mg/kg/day | NA | NA | NA | 4.24E-03 | mg/kg/day | NA | NA | NA |
| | | | | Trichloroethene | 10.67 | µg/L | 3.27E-04 | mg/kg/day | 4.0E-01 | 1/mg/kg/day | 1.31E-04 | 9.15E-04 | mg/kg/day | 1.00E-02 | mg/kg/day | 0.091 |
| | | | | Vinyl Chloride | 13.08 | µg/L | 5.27E-04 | mg/kg/day | 1.5E-02 | 1/mg/kg/day | 7.91E-06 | 1.48E-03 | mg/kg/day | 2.80E-02 | mg/kg/day | 0.053 |
| | | | Exp. Route Total | | | | | | | | 1.40E-04 | | | | | 0.20 |
| | | Exposure Point Total | | | | | | | | | 1.40E-04 | | | | | 0.20 |
| | Exposure Medium Total | | | | | | | | | | 1.40E-04 | | | | | 0.20 |
| Groundwater Total | | | | | | | | | | | 1.89E-04 | | | | | 0.64 |
| | | | | | | | Total of Receptor Risks Across All Media | | | | 1.89E-04 | Total of Receptor Hazards Across All Media | | | | 0.64 |

### Table 13

### TABLE 9.1.RME

### SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

### REASONABLE MAXIMUM EXPOSURE

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: On-Site Resident
Receptor Age: Child (Younger)

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | 1,1-Dichloroethane | --- | --- | --- | --- | --- | NOEL | 0.0052 | --- | 0.00040 | 0.0056 |
| | | | 1,2-Dichloropropane | 9.69E-08 | --- | 9.35E-09 | --- | 1.06E-07 | NA | --- | --- | --- | --- |
| | | | Benzene | 5.42E-07 | --- | 1.00E-07 | --- | 6.43E-07 | Blood | 0.029 | --- | 0.0053 | 0.034 |
| | | | Chloroethane | 1.14E-07 | --- | 6.82E-09 | --- | 1.21E-07 | Fetotoxicity | 0.0012 | --- | 0.000069 | 0.0012 |
| | | | Cis-1,2-Dichloroethene | --- | --- | --- | --- | --- | Blood | 0.29 | --- | 0.026 | 0.32 |
| | | | Trichloroethene | 2.34E-05 | --- | 3.90E-06 | --- | 2.73E-05 | Liver/Kidney/Fetotoxicity | 2.27 | --- | 0.38 | 2.65 |
| | | | Vinyl Chloride | 6.79E-04 | --- | 3.72E-05 | --- | 7.17E-04 | Liver | 0.28 | --- | 0.015 | 0.29 |
| | | | Chemical Total | 7.04E-04 | --- | 4.12E-05 | --- | 7.45E-04 | | 2.88 | --- | 0.43 | 3.30 |
| | | | | | | | | | | | | | |
| | | | Radionuclide Total | | | | | | | | | | |
| | | Exposure Point Total | | | | | | 7.45E-04 | | | | | 3.30 |
| | Exposure Medium Total | | | | | | | 7.45E-04 | | | | | 3.30 |
| Groundwater Total | | | | | | | | 7.45E-04 | | | | | 3.30 |
| Receptor Total | | | | | | | | 7.45E-04 | | | | | 3.30 |

| | |
|---|---|
| Total Risk Across All Media | 7.45E-04 |

| | |
|---|---|
| Total Hazard Across All Media | 3.30 |
| Total Liver HI Across All Media | 2.95 |
| Total Blood HI Across All Media | 0.35 |
| Total Fetotoxicity HI Across All Media | 2.65 |
| Total Kidney HI Across All Media | 2.65 |
| Total NOEL HI Across All Media | 0.0056 |

### Table 14

### TABLE 9.2.RME

### SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

### REASONABLE MAXIMUM EXPOSURE

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: On-Site Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | 1,1-Dichloroethane | --- | --- | --- | --- | --- | NOEL | 0.0022 | --- | --- | 0.0022 |
| | | | 1,2-Dichloropropane | 2.08E-07 | --- | --- | --- | 2.08E-07 | NA | --- | --- | --- | --- |
| | | | Benzene | 1.16E-06 | --- | --- | --- | 1.16E-06 | Blood | 0.012 | --- | --- | 0.012 |
| | | | Chloroethane | 2.45E-07 | --- | --- | --- | 2.45E-07 | Fetotoxicity | 0.00049 | --- | --- | 0.00049 |
| | | | Cis-1,2-Dichloroethene | --- | --- | --- | --- | --- | Blood | 0.12 | --- | --- | 0.12 |
| | | | Trichloroethene | 5.01E-05 | --- | --- | --- | 5.01E-05 | Liver/Kidney/Fetotoxicity | 0.97 | --- | --- | 0.97 |
| | | | Vinyl Chloride | 1.11E-04 | --- | --- | --- | 1.11E-04 | Liver | 0.12 | --- | --- | 0.12 |
| | | | Chemical Total | 1.62E-04 | --- | --- | --- | 1.62E-04 | | 1.23 | --- | --- | 1.23 |
| | | | | | | | | | | | | | |
| | | | Radionuclide Total | | | | | | | | | | |
| | | Exposure Point Total | | | | | | 1.62E-04 | | | | | 1.23 |
| | Exposure Medium Total | | | | | | | 1.62E-04 | | | | | 1.23 |
| | Air | Inhalation of Water Vapors | 1,1-Dichloroethane | --- | --- | --- | --- | --- | Kidney | --- | 0.015 | --- | 0.015 |
| | | | 1,2-Dichloropropane | --- | --- | --- | --- | --- | Respiratory system | --- | 0.028 | --- | 0.028 |
| | | | Benzene | --- | 2.39E-06 | --- | --- | 2.39E-06 | Blood | --- | 0.030 | --- | 0.030 |
| | | | Chloroethane | --- | --- | --- | --- | --- | Fetus | --- | --- | --- | --- |
| | | | Cis-1,2-Dichloroethene | --- | --- | --- | --- | --- | NA | --- | --- | --- | --- |
| | | | Trichloroethene | --- | 1.76E-04 | --- | --- | 1.76E-04 | CNS/Liver/Endocrine System | --- | 0.13 | --- | 0.13 |
| | | | Vinyl Chloride | --- | 1.06E-05 | --- | --- | 1.06E-05 | Liver | --- | 0.074 | --- | 0.074 |
| | | | Chemical Total | --- | 1.89E-04 | --- | --- | 1.89E-04 | | --- | 0.27 | --- | 0.27 |
| | | | | | | | | | | | | | |
| | | | Radionuclide Total | | | | | | | | | | |
| | | Exposure Point Total | | | | | | 1.89E-04 | | | | | 0.27 |
| | Exposure Medium Total | | | | | | | 1.89E-04 | | | | | 0.27 |
| Groundwater Total | | | | | | | | 3.51E-04 | | | | | 1.51 |
| Receptor Total | | | | | | | | 3.51E-04 | | | | | 1.51 |

| | | | |
|---|---|---|---|
| Total Risk Across All Media | 3.51E-04 | Total Hazard Across All Media | 1.51 |

## Table 14
## TABLE 9.2.RME
## SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
## REASONABLE MAXIMUM EXPOSURE
## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: On-Site Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |

| | |
|---|---|
| Total Liver HI Across All Media | 1.17 |
| Total Blood HI Across All Media | 0.17 |
| Total NOEL HI Across All Media | 0.0022 |
| Total Kidney HI Across All Media | 0.99 |
| Total Respiratory System HI Across All Media | 0.028 |
| Total Fetotoxicity HI Across All Media | 0.97 |
| Total CNS HI Across All Media | 0.13 |
| Total Endocrine System HI Across All Media | 0.13 |

**Table 15**

### TABLE 9.3.RME
### SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
### REASONABLE MAXIMUM EXPOSURE
### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: Commercial/Industrial Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | 1,1-Dichloroethane | --- | --- | --- | --- | --- | NOEL | 0.00080 | --- | --- | 0.00080 |
| | | | 1,2-Dichloropropane | 6.18E-08 | --- | --- | --- | 6.18E-08 | NA | --- | --- | --- | --- |
| | | | Benzene | 3.46E-07 | --- | --- | --- | 3.46E-07 | Blood | 0.0044 | --- | --- | 0.0044 |
| | | | Chloroethane | 7.30E-08 | --- | --- | --- | 7.30E-08 | Fetotoxicity | 0.00018 | --- | --- | 0.00018 |
| | | | Cis-1,2-Dichloroethene | --- | --- | --- | --- | --- | Blood | 0.044 | --- | --- | 0.044 |
| | | | Trichloroethene | 1.49E-05 | --- | --- | --- | 1.49E-05 | Liver/Kidney/Fetotoxicity | 0.35 | --- | --- | 0.35 |
| | | | Vinyl Chloride | 3.29E-05 | --- | --- | --- | 3.29E-05 | Liver | 0.043 | --- | --- | 0.043 |
| | | | Chemical Total | 4.83E-05 | --- | --- | --- | 4.83E-05 | | 0.44 | --- | --- | 0.44 |
| | | | | | | | | | | | | | |
| | | | Radionuclide Total | | | | | | | | | | |
| | | Exposure Point Total | | | | | | 4.83E-05 | | | | | 0.44 |
| | Exposure Medium Total | | | | | | | 4.83E-05 | | | | | 0.44 |
| | Air | Inhalation of Water Vapors | 1,1-Dichloroethane | --- | --- | --- | --- | --- | Kidney | --- | 0.011 | --- | 0.011 |
| | | | 1,2-Dichloropropane | --- | --- | --- | --- | --- | Respiratory system | --- | 0.020 | --- | 0.020 |
| | | | Benzene | --- | 1.78E-06 | --- | --- | 1.78E-06 | Blood | --- | 0.021 | --- | 0.021 |
| | | | Chloroethane | --- | --- | --- | --- | --- | Fetus | --- | --- | --- | --- |
| | | | Cis-1,2-Dichloroethene | --- | --- | --- | --- | --- | NA | --- | --- | --- | --- |
| | | | Trichloroethene | --- | 1.31E-04 | --- | --- | 1.31E-04 | CNS/Liver/Endocrine System | --- | 0.091 | --- | 0.091 |
| | | | Vinyl Chloride | --- | 7.91E-06 | --- | --- | 7.91E-06 | Liver | --- | 0.053 | --- | 0.053 |
| | | | Chemical Total | --- | 1.40E-04 | --- | --- | 1.40E-04 | | --- | 0.20 | --- | 0.20 |
| | | | | | | | | | | | | | |
| | | | Radionuclide Total | | | | | | | | | | |
| | | Exposure Point Total | | | | | | 1.40E-04 | | | | | 0.20 |
| | Exposure Medium Total | | | | | | | 1.40E-04 | | | | | 0.20 |
| Groundwater Total | | | | | | | | 1.89E-04 | | | | | 0.64 |
| Receptor Total | | | | | | | | 1.89E-04 | | | | | 0.64 |

| | | | |
|---|---|---|---|
| Total Risk Across All Media | 1.89E-04 | Total Hazard Across All Media | 0.64 |
| | | Total Liver HI Across All Media | 0.44 |
| | | Total Blood HI Across All Media | 0.070 |

### Table 15

### TABLE 9.3.RME

### SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

### REASONABLE MAXIMUM EXPOSURE

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: Commercial/Industrial Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical of Potential Concern | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| | | | | | | | | | | | | Total NOEL HI Across All Media | 0.00080 |
| | | | | | | | | | | | | Total Kidney HI Across All Media | 0.36 |
| | | | | | | | | | | | | Total Respiratory System HI Across All Media | 0.020 |
| | | | | | | | | | | | | Total Fetotoxicity HI Across All Media | 0.35 |
| | | | | | | | | | | | | Total CNS HI Across All Media | 0.091 |
| | | | | | | | | | | | | Total Endocrine System HI Across All Media | 0.091 |

### Table 16

### TABLE 10.1.RME

### RISK SUMMARY

### REASONABLE MAXIMUM EXPOSURE

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: On-Site Resident
Receptor Age: Child (Younger)

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | Trichloroethene | 2.34E-05 | --- | 3.90E-06 | --- | 2.73E-05 | Liver/Kidney/Fetotoxicity | 2.27 | --- | 0.38 | 2.65 |
| | | | Vinyl Chloride | 6.79E-04 | --- | 3.72E-05 | --- | 7.17E-04 | Liver | 0.28 | --- | 0.015 | 0.29 |
| | | Exposure Point Total | | | | | | 7.44E-04 | | | | | 2.95 |
| | Exposure Medium Total | | | | | | | 7.44E-04 | | | | | 2.95 |
| Groundwater Total | | | | | | | | 7.44E-04 | | | | | 2.95 |
| Receptor Total | | | | | | | | 7.44E-04 | | | | | 2.95 |
| | | | | | | | Total Risk Across All Media | 7.44E-04 | | | | Total Hazard Across All Media | 2.95 |

| | |
|---|---|
| Total Liver HI Across All Media | 2.95 |
| Total Fetotoxicity HI Across All Media | 2.65 |
| Total Kidney HI Across All Media | 2.65 |

## Table 17

## TABLE 10.2.RME

## RISK SUMMARY

## REASONABLE MAXIMUM EXPOSURE

## Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: On-Site Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | Benzene | 1.16E-06 | --- | --- | --- | 1.16E-06 | Blood | 0.012 | --- | --- | 0.012 |
| | | | Trichloroethene | 5.01E-05 | --- | --- | --- | 5.01E-05 | Liver/Kidney/Fetotoxicity | 0.97 | --- | --- | 0.97 |
| | | | Vinyl Chloride | 1.11E-04 | --- | --- | --- | 1.11E-04 | Liver | 0.12 | --- | --- | 0.12 |
| | | Exposure Point Total | | | | | | 1.62E-04 | | | | | 1.11 |
| | Exposure Medium Total | | | | | | | 1.62E-04 | | | | | 1.11 |
| | Air | Inhalation of Water Vapors | Benzene | --- | 2.39E-06 | --- | --- | 2.39E-06 | Blood | --- | 0.030 | --- | 0.030 |
| | | | Trichloroethene | --- | 1.76E-04 | --- | --- | 1.76E-04 | CNS/Liver/Endocrine System | --- | 0.13 | --- | 0.13 |
| | | | Vinyl Chloride | --- | 1.06E-05 | --- | --- | 1.06E-05 | Liver | --- | 0.074 | --- | 0.074 |
| | | Exposure Point Total | | | | | | 1.89E-04 | | | | | 0.23 |
| | Exposure Medium Total | | | | | | | 1.89E-04 | | | | | 0.23 |
| Groundwater Total | | | | | | | | 3.51E-04 | | | | | 1.34 |
| Receptor Total | | | | | | | | 3.51E-04 | | | | | 1.34 |
| | | | | | | | Total Risk Across All Media | 3.51E-04 | | | | Total Hazard Across All Media | 1.34 |

| | |
|---|---|
| Total Liver HI Across All Media | 1.30 |
| Total Fetotoxicity HI Across All Media | 0.97 |
| Total Kidney HI Across All Media | 0.97 |
| Total Blood HI Across All Media | 0.042 |
| Total CNS HI Across All Media | 0.13 |
| Total Endocrine System HI Across All Media | 0.13 |

### Table 18

### TABLE 10.3.RME

### RISK SUMMARY

### REASONABLE MAXIMUM EXPOSURE

### Building 37 Site (On-Post), Letterkenny Army Depot, Chambersburg, PA

Scenario Timeframe: Current/Future
Receptor Population: Commercial/Industrial Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | External (Radiation) | Exposure Routes Total | Primary Target Organ(s) | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Groundwater | Groundwater | Tap Water | Benzene | 3.46E-07 | --- | --- | --- | 3.46E-07 | Blood | 0.0044 | --- | --- | 0.0044 |
| | | | Trichloroethene | 1.49E-05 | --- | --- | --- | 1.49E-05 | Liver/Kidney/Fetotoxicity | 0.35 | --- | --- | 0.35 |
| | | | Vinyl Chloride | 3.29E-05 | --- | --- | --- | 3.29E-05 | Liver | 0.043 | --- | --- | 0.043 |
| | | Exposure Point Total | | | | | | 4.82E-05 | | | | | 0.40 |
| | Exposure Medium Total | | | | | | | 4.82E-05 | | | | | 0.40 |
| | Air | Inhalation of Water Vapors | Benzene | --- | 1.78E-06 | --- | --- | 1.78E-06 | Blood | --- | 0.021 | --- | 0.021 |
| | | | Trichloroethene | --- | 1.31E-04 | --- | --- | 1.31E-04 | CNS/Liver/Endocrine System | --- | 0.091 | --- | 0.091 |
| | | | Vinyl Chloride | --- | 7.91E-06 | --- | --- | 7.91E-06 | Liver | --- | 0.053 | --- | 0.053 |
| | | Exposure Point Total | | | | | | 1.40E-04 | | | | | 0.17 |
| | Exposure Medium Total | | | | | | | 1.40E-04 | | | | | 0.17 |
| Groundwater Total | | | | | | | | 1.89E-04 | | | | | 0.56 |
| Receptor Total | | | | | | | | 1.89E-04 | | | | | 0.56 |
| | | | | | | | Total Risk Across All Media | 1.89E-04 | | | | Total Hazard Across All Media | 0.56 |

| | |
|---|---|
| Total Liver HI Across All Media | 0.53 |
| Total Fetotoxicity HI Across All Media | 0.35 |
| Total Kidney HI Across All Media | 0.35 |
| Total Blood HI Across All Media | 0.026 |
| Total CNS HI Across All Media | 0.091 |
| Total Endocrine System HI Across All Media | 0.091 |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **OVERALL PROTECTIVENESS** | | | | | |
| **Human Health Protection** | Not protective of human health | Protection through land use controls until VOC concentrations reduce to levels acceptable by EPA and PADEP through natural attenuation processes, by preventing use of groundwater for drinking purposes and limiting excavation depths to prevent exposure from contaminated groundwater. | Protection through land use controls until VOC concentrations reduce to levels acceptable by EPA and PADEP through enhanced biodegradation, by preventing use of groundwater for drinking purposes and limiting excavation depths to prevent exposure from contaminated groundwater. | Protection through land use controls until VOC concentrations reduce to levels acceptable by EPA and PADEP through chemical oxidation, by preventing use of groundwater for drinking purposes and limiting excavation depths to prevent exposure from contaminated groundwater. | Protection through land use controls until VOC concentrations reduce to levels acceptable by EPA and PADEP by removal of contaminated groundwater, by preventing use of groundwater for drinking purposes and limiting excavation depths to prevent exposure from contaminated groundwater. |
| **Environmental Protection** | Not protective of environment | Would provide protection after VOC concentrations in groundwater reduce to acceptable levels. | Same as Alternative 2. | Same as Alternative 2. | Would provide protection after VOC concentrations in groundwater reduce to acceptable levels. However, there is a possibility that VOC concentrations may rebound after system is shutdown due to removal of drawdown cone, which could reduce protection to environment. |
| **COMPLIANCE WITH ARARs** | | | | | |
| **Chemical-Specific ARARs** | Would not comply. VOC concentrations in groundwater will always exceed federal and state MCLs. | Expected to achieve MCLs in groundwater through natural attenuation processes. Estimated time frame to attain MCLs is approximately 20 years. | Would achieve MCLs in groundwater. Estimated time frame to attain MCLs is approximately 3 to 5 years. | Would achieve MCLs in groundwater. Estimated time frame to attain MCLs is approximately 15 years. | Would achieve MCLs in groundwater. Estimated time frame to attain MCLs is approximately 15 years. |
| **Location-Specific ARARs** | No location-specific ARARs. | No location-specific ARARs. | No location-specific ARARs. | No location-specific ARARs. | No location-specific ARARs. |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES
## (Continued)

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **Action-Specific ARARs** | No action-specific ARARs. | No action-specific ARARs. | No action-specific ARARs | No action-specific ARARs | Recovered/treated groundwater will be discharged to stormwater or sanitary sewer. Will meet air release standards (for air stripper), NPDES discharge requirements, and/or acceptance criteria for municipal treatment plant as applicable. |
| **LONG-TERM EFFECTIVENESS AND PERMANANCE** | | | | | |
| **Magnitude of Residual Risk** | Groundwater contamination has not been addressed. Current risks will continue to exist. | Risks are expected to reduce through reduction of VOC concentrations by natural attenuation processes. Rate of reduction can be measured through monitoring program. | Risks will be minimized or eliminated once federal and state drinking water standards are achieved in groundwater through enhanced biodegradation. | Risks will be minimized or eliminated once federal and state drinking water standards are achieved in groundwater through chemical oxidation. | Risks will be minimized or eliminated once contaminated groundwater has been adequately pumped and treated. Monitoring may be necessary to determine whether VOC rebound has occurred after pumping has terminated. Residual contamination may remain in fractures isolated due to pump cone of influence. |
| **Adequacy and Reliability of Controls** | No controls in place. | No controls in place. Any reduction in VOC concentrations will be achieved through passive natural attenuation processes. Adequacy and reliability can be assessed through monitoring program. | Controls are adequate and highly reliable. Effectiveness of enhanced biodegradation for site groundwater has been demonstrated through pilot test. | Controls used in oxidation methods are adequate and reliable. They have been proven reliable over years, and some have been verified through pilot tests. | Permanent removal of contaminated groundwater is adequate and highly reliable. |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES
# (Continued)

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT** | | | | | |
| **Treatment Process Used** | None. | None. | Enhanced biodegradation. | Chemical oxidation methods:<br>(a) C-Sparger$^{TM}$ Ozone Injection ; (b) Direct Ozone Injection; (c) Permanganate; (d) Hydrogen peroxide. | Treatment methods will depend on treatment/discharge option used (i.e., discharged to stormwater or sanitary sewer). |
| **Amount Destroyed or Treated** | None. | No treatment process is involved. Amount of VOCs destroyed through natural attenuation processes is unquantifiable. | Mass destroyed unknown since exact amount of contaminated groundwater is not known due to complicated fractured bedrock system. Treated groundwater expected to be successfully treated to ARARs - approximately 90% “removal” (concentration reduction), when considering reduction in concentrations of TCE (pre-enhanced biopilot study data compared to MCL). | Mass destroyed unknown since exact amount of contaminated groundwater is not known due to complicated fractured bedrock system. Treated groundwater expected to be successfully treated to ARARs - approximately 90% “removal” (concentration reduction), when considering reduction in concentrations of TCE (pre-enhanced biopilot study data compared to MCL). | Mass destroyed unknown since exact amount of contaminated groundwater is not known due to complicated fractured bedrock system. Recovered/treated groundwater expected to be successfully treated to ARARs - approximately 90% “removal” (concentration reduction), when considering reduction in concentrations of TCE (pre-enhanced biopilot study data compared to MCL). |
| **Reduction of TMV through treatment** | None. | None. | TMV will be reduced through enhanced biodegradation by transforming VOCs into less toxic products. | TMV will be reduced through chemical oxidation by breaking down VOCs into harmless compounds. | TMV will be reduced through removal and treatment of contaminated groundwater (i.e., air stripping or carbon treatment). |
| **Irreversible Treatment** | Not applicable. | Not applicable. | Enhanced biodegradation treatment is irreversible. | Treatment by chemical oxidation is irreversible. | Treatment methods such as air stripping and carbon are irreversible – contaminants are destroyed when carbon is regenerated. |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES (Continued)

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **Type and Quantity of Residuals Remaining After Treatment** | No treatment is involved in this alternative. | No treatment is involved in this alternative. | Degradation (“daughter”) products exist in interim and eventually break down to harmless end products. Minimal excess lactate expected based on pilot study results. | Depending on method employed, strong oxidants or harmful by-products could remain in groundwater and reach springs or surface water and may cause manganese increases in off-post springs. | Carbon from air strippers requires regeneration and treated groundwater needs to be discharged to stormsewer or sanitary sewer. |
| **Statutory preference for treatment** | Does not satisfy. | Does not satisfy. | Satisfies. | Satisfies. | Satisfies. |
| **SHORT-TERM EFFECTIVENESS** | | | | | |
| **Community Protection** | Risk to community will not increase. | Community will be protected by implementation of land use controls (preventing use of groundwater). | Community will be protected by implementation of land use controls (preventing use of VOC-contaminated groundwater). No impact on community is expected due to implementation of remedial technology. | Same as Alternative 3. Howecver, depending on method employed, strong oxidants could lead to excessive production of gases and heat which could cause potential risk to public or introduction of oxidants may lead to damage to infrastructure. | Same as Alternative 3. |
| **Worker Protection** | No risk to workers. | No risk to workers. | Protection against vapor inhalation and skin contact with groundwater and treatment additives will be used during construction and implementation activities. | Same as Alternative 3. | Same as Alternative 3. |
| **Environmental Impacts** | Continued impact from existing conditions. | Current conditions will continue to exist until VOC concentrations in groundwater decrease to safe levels through natural attenuation. | No additional environmental impacts are expected due to implementation of technology. Any excess lactate is expected to be degraded and will not adversely impact downgradient springs or surface waters | Same as Alternative 3. Howecver, depending on method employed, strong oxidants could remain in groundwater and reach springs or surface water and may cause manganese increases in off-post springs. | Same as Alternative 3. |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES
## (Continued)

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **Time Until Action is Complete** | Not applicable. | No active treatment method is involved. Estimated time to achieve RAOs is approximately 20 years. | Estimated time frame to complete construction is 3 months. Estimated time to achieve RAOs is approximately 3 to 5 years. | Estimated time frame to complete construction is 6 to 9 months. Estimated time to achieve RAOs is approximately 15 years. | Estimated time frame to complete construction is 6 to 9 months. Estimated time to achieve RAOs is approximately 15 years. |
| **IMPLEMENTABILITY** | | | | | |
| **Ability to Construct and Operate** | No construction or operation involved. | No construction or operation involved. | Easy to construct and operate. | Easy to construct and operate. | Easy to construct and operate. |
| **Ease of Doing More Action if Needed** | May require ROD amendment if problems arise. | May require ROD amendment if problems arise. | Can be easily expanded if required. | Same as Alternative 3. | Same as Alternative 3. |
| **Ability to Monitor Effectiveness** | No monitoring involved. State of groundwater will not be known. | Effectiveness of natural attenuation processes will be monitored through groundwater monitoring (sampling/analysis) program. | Groundwater monitoring program will be in place to monitor effectiveness of enhanced biodegradation process. | Groundwater monitoring program will be in place to monitor effectiveness of chemical oxidation process. | Groundwater monitoring program will be in place to monitor effectiveness of pump-and-treat method. |
| **Ability to Obtain Approvals and Coordinate with Other Agencies** | No approval necessary. | Same as Alternative 1. | Single technology involved. No difficulties are expected in obtaining approvals. | Single technology involved. No difficulties are expected in obtaining approvals. | NPDES permit required to discharge to stormwater sewers/ surface water – LEAD had obtained these in the past. Appropriate approvals are required if discharged to sanitary sewer. |
| **Availability of Equipment, Specialists, and Materials** | None required. | No special equipment required. Monitoring equipment and personnel are readily available. | Equipment, materials, and construction/operation personnel for enhanced biodegradation are readily available. | There are vendors who specialize in chemical oxidation methods who provide designs, materials, and personnel and/or operation oversight. | Pump-and-treat has a long history of operation at LEAD. Materials are readily available to build recovery system from a number of suppliers. |

# TABLE 19 COMPARATIVE ANALYSIS OF ALTERNATIVES (Continued)

| Criteria | Alternative 1<br>No Action | Alternative 2<br>Monitored Natural Attenuation (MNA) with Land Use Controls (LUCs) | Alternative 3<br>Enhanced Biodegradation with MNA and LUCs | Alternative 4<br>Chemical Oxidation with LUCs | Alternative 5<br>Pump-and-Treat with LUCs |
|---|---|---|---|---|---|
| **Availability of Technologies** | None required. | None required. | Readily available. | Commercially available. | Readily available. Standard technology that has been used extensively. |
| **COST** | | | | | |
| **Capital Cost** | $0 | $0 | $32,500 | $182,000 | $798,000 |
| **Annual O&M Cost** | $0 | $34,400 | $82,400 | $61,000 | $121,500 |
| **Present Worth Cost** | $0 | $511,800 | $281,900 | $910,200 | $2,248,500 |
| **STATE ACCEPTANCE** | | | | | |
| | Not acceptable. Not protective of human health or environment. | May not be acceptable. No active treatment involved. Takes a long time to achieve RAOs. | Acceptable. | May be acceptable; further testing maybe required. | May be acceptable if treatment/discharge permits are approved. |
| **COMMUNITY ACCEPTANCE** | | | | | |
| | Not acceptable. | Not acceptable.  No treatment involved. Takes a long time to achieve RAOs | Acceptable. | May be acceptable if proven effective. | Acceptable. |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281001 | 963711M033 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 7 | |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | BENZENE | 71-43-2 | 2.1 | |
| C4F250281001 | 963711M033 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1.8 | |
| C4F250281001 | 963711M033 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281001 | 963711M033 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 0.59 | J |
| C4F250281001 | 963711M033 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 11 | |
| C4F250281001 | 963711M033 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 9.8 | |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281002 | 963706M033 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 6.2 | |
| C4F250281002 | 963706M033 | 6/23/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.77 | J |
| C4F250281002 | 963706M033 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 1 | U |
| C4F250281002 | 963706M033 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 0.54 | J |
| C4F250281002 | 963706M033 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 9.2 | |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 5.8 | |
| C4F250281003 | 963706M133 | 6/23/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.68 | J |
| C4F250281003 | 963706M133 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281003 | 963706M133 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 0.56 | J |
| C4F250281004 | LEHMANM008 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281004 | LEHMANM008 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.2 | |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281005 | MILLERM008 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | CHLOROFORM | 67-66-3 | 3.3 |  |
| C4F250281005 | MILLERM008 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.59 | J |
| C4F250281005 | MILLERM008 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 3 |  |
| C4F250281005 | MILLERM008 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281005 | MILLERM008 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | TRICHLOROETHENE | 79-01-6 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281006 | 02HURTM008 | 6/23/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.67 | J |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | TRICHLOROETHENE | 79-01-6 | 1.1 |  |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281008 | 2ETTERM009 | 6/24/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4F250281009 | HSSW01M033 | 6/24/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | TRICHLOROETHENE | 79-01-6 | 0.57 | J |
| C4F250281009 | HSSW01M033 | 6/24/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4F250281009 | HSSW01M033 | 6/24/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.8 | |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1.9 | |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 2 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | ACETONE | 67-64-1 | 5 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | BENZENE | 71-43-2 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 3.1 | |
| C4F250281010 | 973724M019 | 6/24/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | METHYLENE CHLORIDE | 75-09-2 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | STYRENE | 100-42-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4F250281010 | 973724M019 | 6/24/2004 | TRICHLOROETHENE | 79-01-6 | 4.7 | |
| C4F250281010 | 973724M019 | 6/24/2004 | VINYL CHLORIDE | 75-01-4 | 1.8 | |
| C4F250281010 | 973724M019 | 6/24/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.6 | |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 2-BUTANONE | 78-93-3 | 5 | UJ |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | ACETONE | 67-64-1 | 1.6 | B |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CHLOROFORM | 67-66-3 | 0.63 | J |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.25 | B |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | TETRACHLOROETHENE | 127-18-4 | 0.89 | J |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | TRICHLOROETHENE | 79-01-6 | 1.6 | |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261001 | 2ETTERM011 | 10/20/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.87 | J |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 2-BUTANONE | 78-93-3 | 5 | UJ |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | ACETONE | 67-64-1 | 1.9 | B |
| C4J220261002 | HSSW01M035 | 10/20/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261002 | HSSW01M035 | 10/20/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CHLOROFORM | 67-66-3 | 0.52 | J |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.13 | B |
| C4J220261002 | HSSW01M035 | 10/20/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | TETRACHLOROETHENE | 127-18-4 | 0.23 | J |
| C4J220261002 | HSSW01M035 | 10/20/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | TRICHLOROETHENE | 79-01-6 | 0.45 | J |
| C4J220261002 | HSSW01M035 | 10/20/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261002 | HSSW01M035 | 10/20/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.5 | |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 0.15 | J |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 2-BUTANONE | 78-93-3 | 5 | UJ |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | ACETONE | 67-64-1 | 5 | UJ |
| C4J220261003 | LEHMANM009 | 10/20/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CHLOROFORM | 67-66-3 | 1.1 | |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.57 | B |
| C4J220261003 | LEHMANM009 | 10/20/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | TETRACHLOROETHENE | 127-18-4 | 0.51 | J |
| C4J220261003 | LEHMANM009 | 10/20/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | TRICHLOROETHENE | 79-01-6 | 2.3 | |
| C4J220261003 | LEHMANM009 | 10/20/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261003 | LEHMANM009 | 10/20/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 0.25 | J |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 2-BUTANONE | 78-93-3 | 5 | UJ |
| C4J220261004 | MILLERM009 | 10/20/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | ACETONE | 67-64-1 | 2.1 | B |
| C4J220261004 | MILLERM009 | 10/20/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | CHLOROFORM | 67-66-3 | 7.9 |  |
| C4J220261004 | MILLERM009 | 10/20/2004 | CHLOROMETHANE | 74-87-3 | 0.12 | B |
| C4J220261004 | MILLERM009 | 10/20/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.7 | B |
| C4J220261004 | MILLERM009 | 10/20/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.44 | J |
| C4J220261004 | MILLERM009 | 10/20/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | TETRACHLOROETHENE | 127-18-4 | 0.46 | J |
| C4J220261004 | MILLERM009 | 10/20/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | TRICHLOROETHENE | 79-01-6 | 3 |  |
| C4J220261004 | MILLERM009 | 10/20/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261004 | MILLERM009 | 10/20/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 2-BUTANONE | 78-93-3 | 0.99 | J |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | ACETONE | 67-64-1 | 3.2 | B |
| C4J220261005 | 02HURTM009 | 10/20/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |

## Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261005 | 02HURTM009 | 10/20/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | TRICHLOROETHENE | 79-01-6 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261005 | 02HURTM009 | 10/20/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.37 | J |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 7.7 |  |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 0.26 | J |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 2-BUTANONE | 78-93-3 | 5 | UJ |
| C4J220261006 | 963711M035 | 10/21/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | ACETONE | 67-64-1 | 5 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | BENZENE | 71-43-2 | 3.2 |  |
| C4J220261006 | 963711M035 | 10/21/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1.3 |  |
| C4J220261006 | 963711M035 | 10/21/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | TOLUENE | 108-88-3 | 0.11 | J |
| C4J220261006 | 963711M035 | 10/21/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 0.17 | J |
| C4J220261006 | 963711M035 | 10/21/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261006 | 963711M035 | 10/21/2004 | TRICHLOROETHENE | 79-01-6 | 0.23 | J |
| C4J220261006 | 963711M035 | 10/21/2004 | VINYL CHLORIDE | 75-01-4 | 14 |  |
| C4J220261006 | 963711M035 | 10/21/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 3.1 |  |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 2-BUTANONE | 78-93-3 | 1.1 | J |
| C4J220261007 | 963706M035 | 10/21/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | ACETONE | 67-64-1 | 3.8 | B |
| C4J220261007 | 963706M035 | 10/21/2004 | BENZENE | 71-43-2 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CHLOROETHANE | 75-00-3 | 7.2 |  |
| C4J220261007 | 963706M035 | 10/21/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.95 | B |
| C4J220261007 | 963706M035 | 10/21/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261007 | 963706M035 | 10/21/2004 | TRICHLOROETHENE | 79-01-6 | 0.14 | J |
| C4J220261007 | 963706M035 | 10/21/2004 | VINYL CHLORIDE | 75-01-4 | 0.66 | J |
| C4J220261007 | 963706M035 | 10/21/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.9 |  |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 4.4 |  |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 2-BUTANONE | 78-93-3 | 1.5 | J |
| C4J220261008 | 973724M021 | 10/21/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | ACETONE | 67-64-1 | 4.5 | B |
| C4J220261008 | 973724M021 | 10/21/2004 | BENZENE | 71-43-2 | 0.16 | J |
| C4J220261008 | 973724M021 | 10/21/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CHLOROETHANE | 75-00-3 | 0.99 | J |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C4J220261008 | 973724M021 | 10/21/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.1 | B |
| C4J220261008 | 973724M021 | 10/21/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | ETHYLBENZENE | 100-41-4 | 0.12 | J |
| C4J220261008 | 973724M021 | 10/21/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | TRICHLOROETHENE | 79-01-6 | 0.15 | J |
| C4J220261008 | 973724M021 | 10/21/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C4J220261008 | 973724M021 | 10/21/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 5.5 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1.1 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | UJ |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 2-BUTANONE | 78-93-3 | 1.1 | J |
| C4J220261009 | 973723M002 | 10/21/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | ACETONE | 67-64-1 | 3.2 | B |
| C4J220261009 | 973723M002 | 10/21/2004 | BENZENE | 71-43-2 | 1 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CHLOROETHANE | 75-00-3 | 4.5 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | STYRENE | 100-42-5 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | TOLUENE | 108-88-3 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 0.35 | J |
| C4J220261009 | 973723M002 | 10/21/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | TRICHLOROETHENE | 79-01-6 | 19 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | VINYL CHLORIDE | 75-01-4 | 16 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C4J220261009 | 973723M002 | 10/21/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 30 |  |
| C4J220261009 | 973723M002 | 10/21/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 61 |  |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1.3 |  |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 0.12 | J |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | ACETONE | 67-64-1 | 0.76 | B |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | BENZENE | 71-43-2 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CHLOROFORM | 67-66-3 | 0.47 | J |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.17 | J |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.2 | J |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | TETRACHLOROETHENE | 127-18-4 | 0.54 | J |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | TRICHLOROETHENE | 79-01-6 | 1.2 | |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C5A030104001 | 2ETTERM012 | 12/29/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 25 | |
| C5A030104002 | 973723M003 | 12/29/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 48 | |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 4 | |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 0.72 | J |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | ACETONE | 67-64-1 | 1.1 | B |
| C5A030104002 | 973723M003 | 12/29/2004 | BENZENE | 71-43-2 | 0.85 | J |
| C5A030104002 | 973723M003 | 12/29/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CHLOROETHANE | 75-00-3 | 1.9 | |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C5A030104002 | 973723M003 | 12/29/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.27 | J |
| C5A030104002 | 973723M003 | 12/29/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 0.32 | J |
| C5A030104002 | 973723M003 | 12/29/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104002 | 973723M003 | 12/29/2004 | TRICHLOROETHENE | 79-01-6 | 7.5 |  |
| C5A030104002 | 973723M003 | 12/29/2004 | VINYL CHLORIDE | 75-01-4 | 12 |  |
| C5A030104002 | 973723M003 | 12/29/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1.2 |  |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | ACETONE | 67-64-1 | 5 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | BENZENE | 71-43-2 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CHLOROETHANE | 75-00-3 | 2.2 |  |
| C5A030104003 | 963706M036 | 12/29/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.41 | J |
| C5A030104003 | 963706M036 | 12/29/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | METHYLENE CHLORIDE | 75-09-2 | 2 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | TRICHLOROETHENE | 79-01-6 | 1 | U |
| C5A030104003 | 963706M036 | 12/29/2004 | VINYL CHLORIDE | 75-01-4 | 0.22 | J |
| C5A030104003 | 963706M036 | 12/29/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.41 | J |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |

# Table 20
# 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | ACETONE | 67-64-1 | 1.7 | B |
| C5A030104004 | HSSW01M036 | 12/29/2004 | BENZENE | 71-43-2 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CHLOROFORM | 67-66-3 | 0.31 | J |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.2 | J |
| C5A030104004 | HSSW01M036 | 12/29/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | TRICHLOROETHENE | 79-01-6 | 0.2 | J |
| C5A030104004 | HSSW01M036 | 12/29/2004 | VINYL CHLORIDE | 75-01-4 | 1 | U |
| C5A030104004 | HSSW01M036 | 12/29/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.2 | J |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 5.1 | |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 0.1 | J |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | ACETONE | 67-64-1 | 5 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | BENZENE | 71-43-2 | 2 | |
| C5A030104005 | 963711M036 | 12/30/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C5A030104005 | 963711M036 | 12/30/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.46 | J |
| C5A030104005 | 963711M036 | 12/30/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.31 | J |
| C5A030104005 | 963711M036 | 12/30/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104005 | 963711M036 | 12/30/2004 | TRICHLOROETHENE | 79-01-6 | 0.12 | J |
| C5A030104005 | 963711M036 | 12/30/2004 | VINYL CHLORIDE | 75-01-4 | 3.4 | |
| C5A030104005 | 963711M036 | 12/30/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.19 | J |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 5 | |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 0.16 | J |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | ACETONE | 67-64-1 | 5 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | BENZENE | 71-43-2 | 2 | |
| C5A030104006 | 963711M136 | 12/30/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CHLOROETHANE | 75-00-3 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 0.43 | J |
| C5A030104006 | 963711M136 | 12/30/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.22 | J |
| C5A030104006 | 963711M136 | 12/30/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104006 | 963711M136 | 12/30/2004 | TRICHLOROETHENE | 79-01-6 | 0.11 | J |
| C5A030104006 | 963711M136 | 12/30/2004 | VINYL CHLORIDE | 75-01-4 | 3.2 | |
| C5A030104006 | 963711M136 | 12/30/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,1,1-TRICHLOROETHANE | 71-55-6 | 0.39 | J |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,1,2,2-TETRACHLOROETHANE | 79-34-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,1,2-TRICHLOROETHANE | 79-00-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,1-DICHLOROETHANE | 75-34-3 | 1.8 | |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,1-DICHLOROETHENE | 75-35-4 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2,4-TRICHLOROBENZENE | 120-82-1 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2-DIBROMO-3-CHLOROPROPANE | 96-12-8 | 1 | R |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2-DIBROMOETHANE | 106-93-4 | 1 | U |

# Table 20
## 2004 Data for Groundwater Risk Assessment, SE OU 10

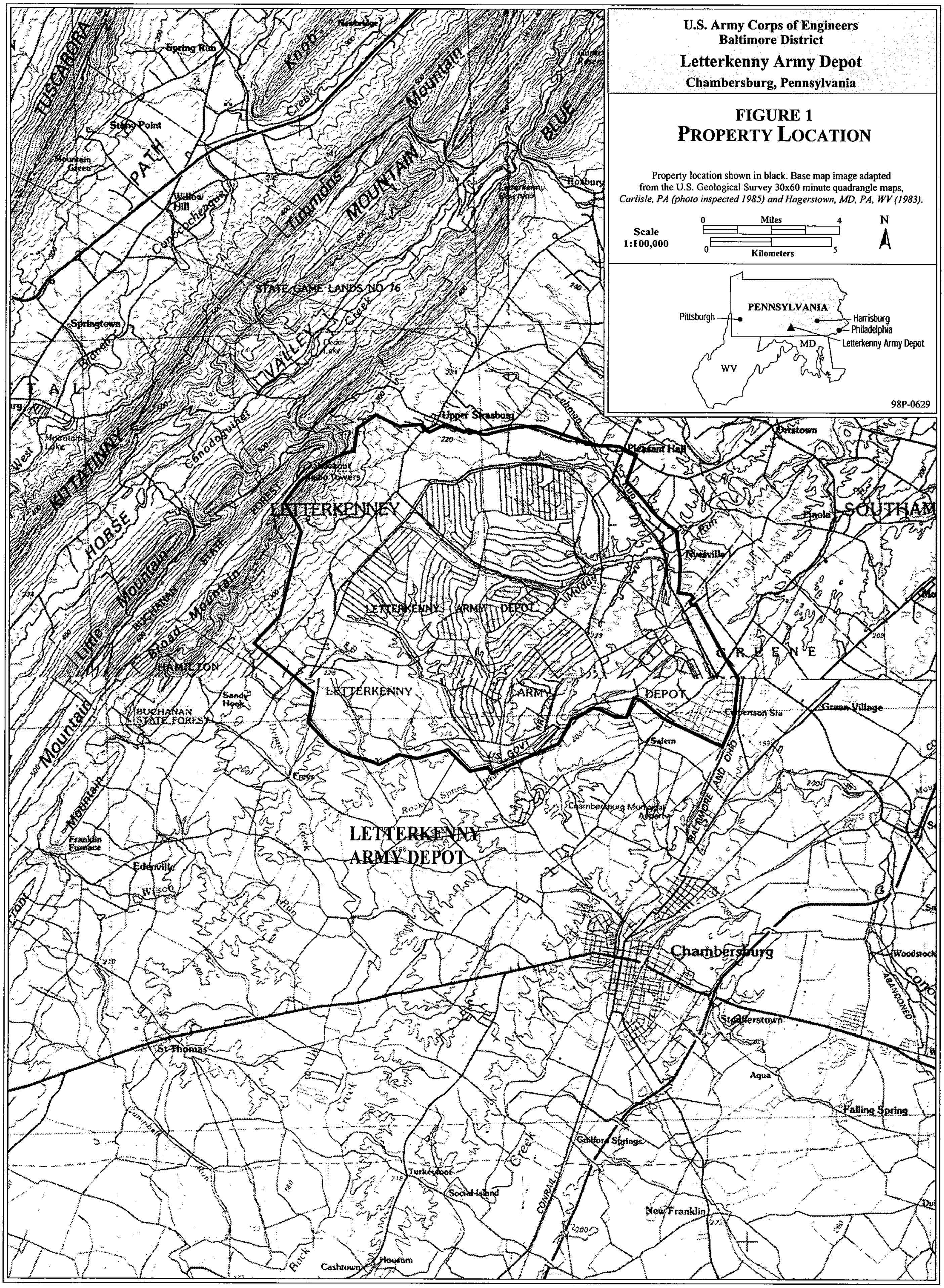
| LAB SAMPLE ID | FIELD SAMPLE ID | SAMPLE DATE | ANALYTE | CAS # | RESULT UG/L | QUALIFIER |
|---|---|---|---|---|---|---|
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2-DICHLOROBENZENE | 95-50-1 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2-DICHLOROETHANE | 107-06-2 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,2-DICHLOROPROPANE | 78-87-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,3-DICHLOROBENZENE | 541-73-1 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 1,4-DICHLOROBENZENE | 106-46-7 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 2-BUTANONE | 78-93-3 | 5 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 2-HEXANONE | 591-78-6 | 5 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | 4-METHYL-2-PENTANONE | 108-10-1 | 5 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | ACETONE | 67-64-1 | 5 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | BENZENE | 71-43-2 | 0.23 | J |
| C5A030104008 | 973724M022 | 12/30/2004 | BROMOCHLOROMETHANE | 74-97-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | BROMODICHLOROMETHANE | 75-27-4 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | BROMOFORM | 75-25-2 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | BROMOMETHANE | 74-83-9 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CARBON DISULFIDE | 75-15-0 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CARBON TETRACHLORIDE | 56-23-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CHLOROBENZENE | 108-90-7 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CHLOROETHANE | 75-00-3 | 0.45 | J |
| C5A030104008 | 973724M022 | 12/30/2004 | CHLOROFORM | 67-66-3 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CHLOROMETHANE | 74-87-3 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | CIS-1,2-DICHLOROETHENE | 156-59-2 | 9.6 | |
| C5A030104008 | 973724M022 | 12/30/2004 | CIS-1,3-DICHLOROPROPENE | 10061-01-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | DIBROMOCHLOROMETHANE | 124-48-1 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | ETHYLBENZENE | 100-41-4 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | METHYLENE CHLORIDE | 75-09-2 | 0.22 | J |
| C5A030104008 | 973724M022 | 12/30/2004 | STYRENE | 100-42-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | TETRACHLOROETHENE | 127-18-4 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | TOLUENE | 108-88-3 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | TRANS-1,2-DICHLOROETHENE | 156-60-5 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | TRANS-1,3-DICHLOROPROPENE | 10061-02-6 | 1 | U |
| C5A030104008 | 973724M022 | 12/30/2004 | TRICHLOROETHENE | 79-01-6 | 2.5 | |
| C5A030104008 | 973724M022 | 12/30/2004 | VINYL CHLORIDE | 75-01-4 | 5.1 | |
| C5A030104008 | 973724M022 | 12/30/2004 | XYLENES (TOTAL) | 1330-20-7 | 1 | U |

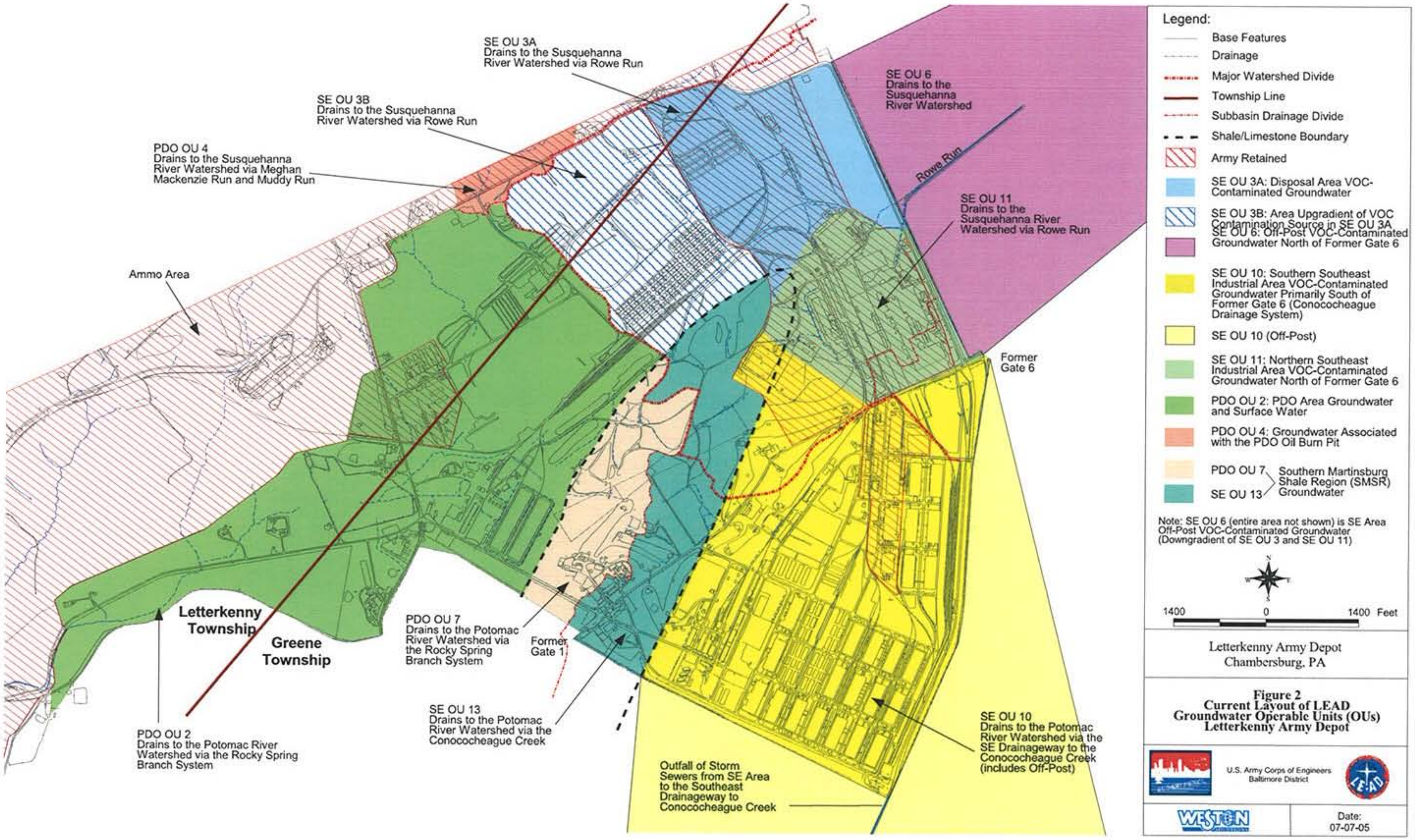
# FIGURES

**U.S. Army Corps of Engineers**
**Baltimore District**
**Letterkenny Army Depot**
**Chambersburg, Pennsylvania**

## FIGURE 1
## PROPERTY LOCATION

Property location shown in black. Base map image adapted from the U.S. Geological Survey 30x60 minute quadrangle maps, *Carlisle, PA (photo inspected 1985) and Hagerstown, MD, PA, WV (1983).*





Letterkenny Army Depot
Chambersburg, PA

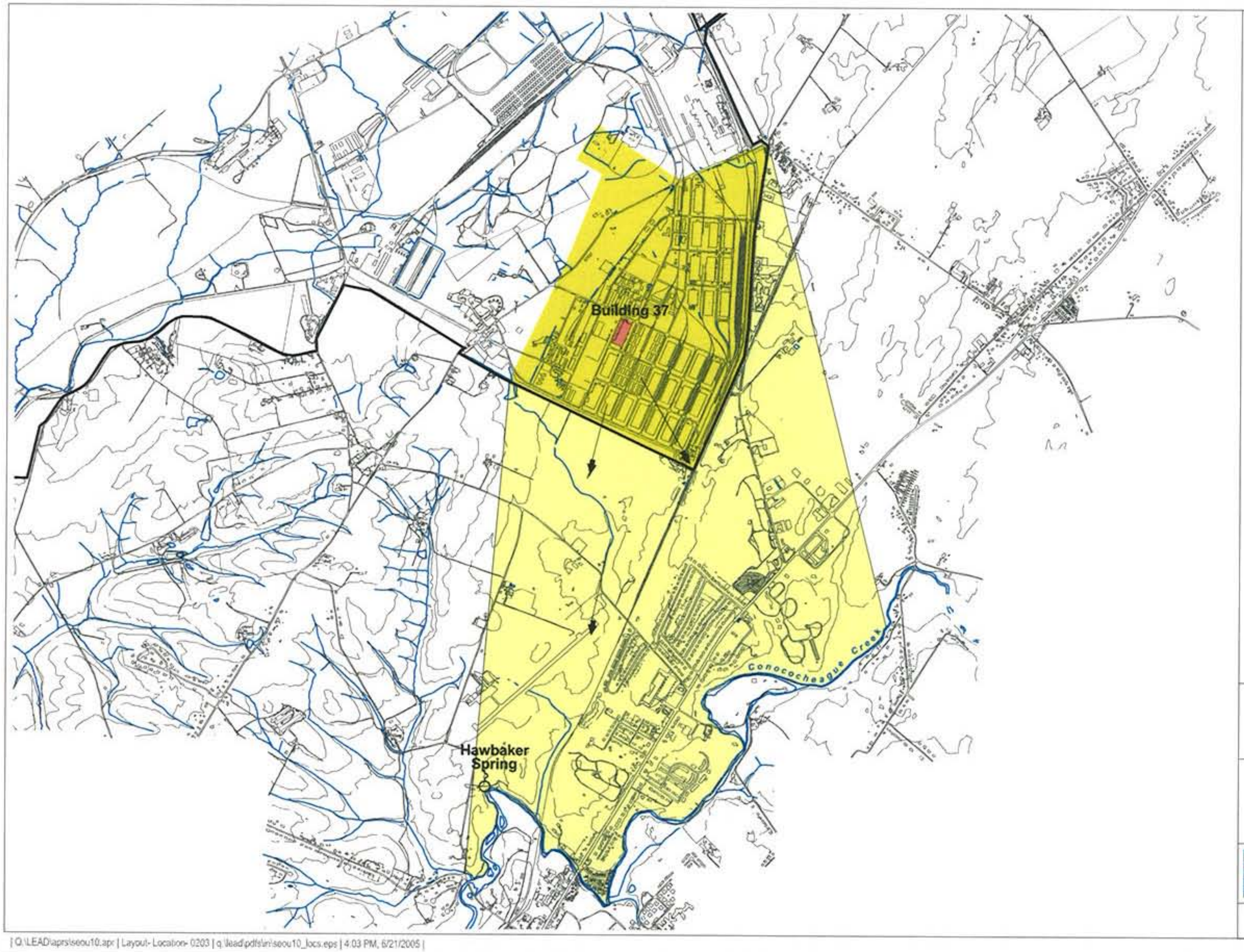
Figure 2
Current Layout of LEAD
Groundwater Operable Units (OUs)
Letterkenny Army Depot

U.S. Army Corps of Engineers
Baltimore District

WESTON

Date:
07-07-05

| Q:\LEAD\aprs\gw_ous.apr | Layout- gw ous rev3 | q:\lead\pdfs\gw_ous\out\gw_ous_rev3_fig2.eps | 3:31 PM, 7/7/2005 |



Legend:

| | |
|---|---|
| ☐ | Buildings |
| ═ | Roads |
| — | Drainage |
| — | Topographic Contours |
| ━ | LEAD Boundary |
| 🟨 | On-Post SE OU 10 |
| ☐ | Off-Post SE OU 10 |
| 🟥 | Building 37 |
| ♁ | Spring Location |
| → | Groundwater Flow Direction |

2000 0 2000 Feet

Letterkenny Army Depot
Chambersburg, PA

Figure 3
Location of SEOU 10
Study Area

U.S. Army Corps of Engineers
Baltimore District

WESTON

Date:
06/21/2005

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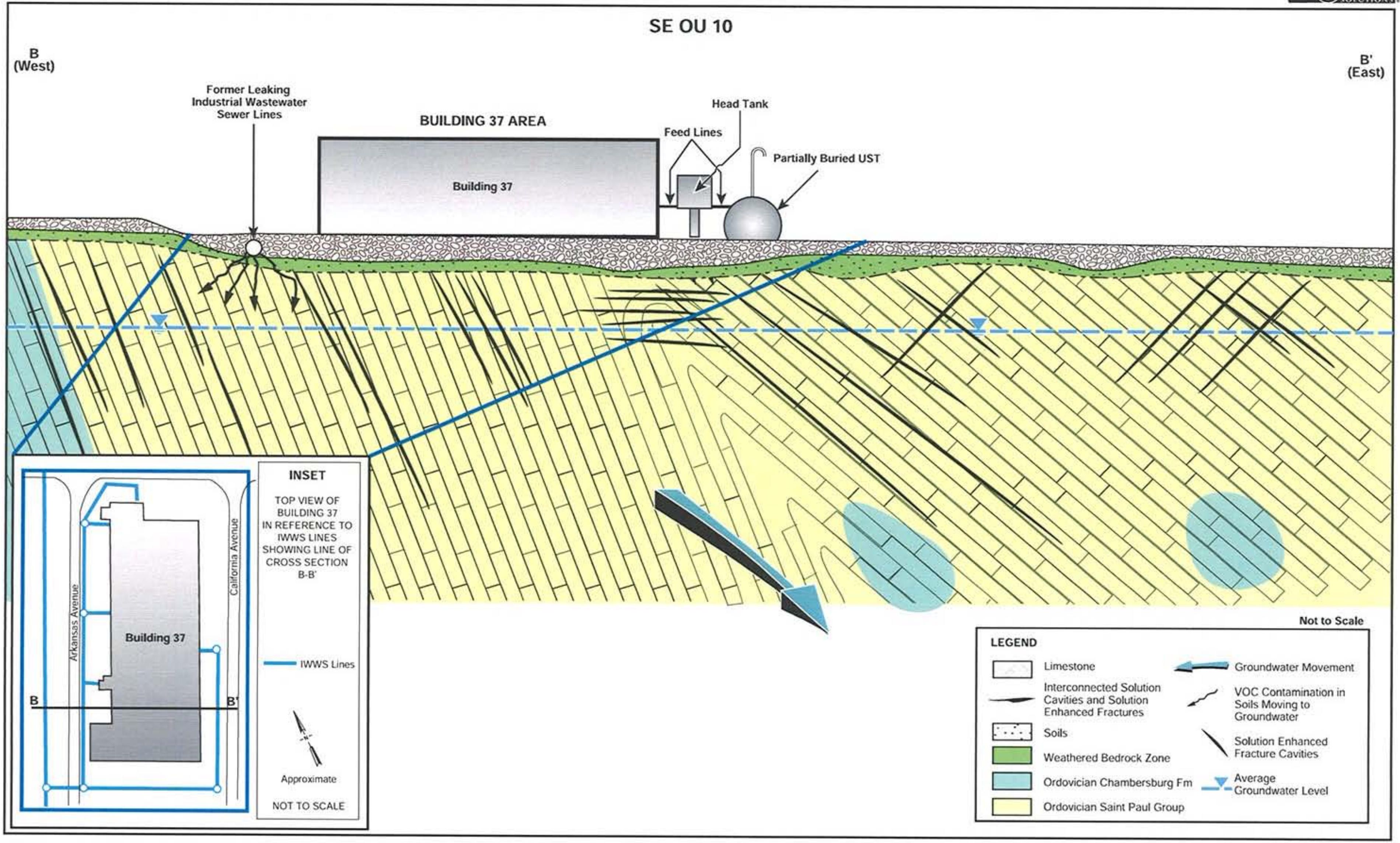

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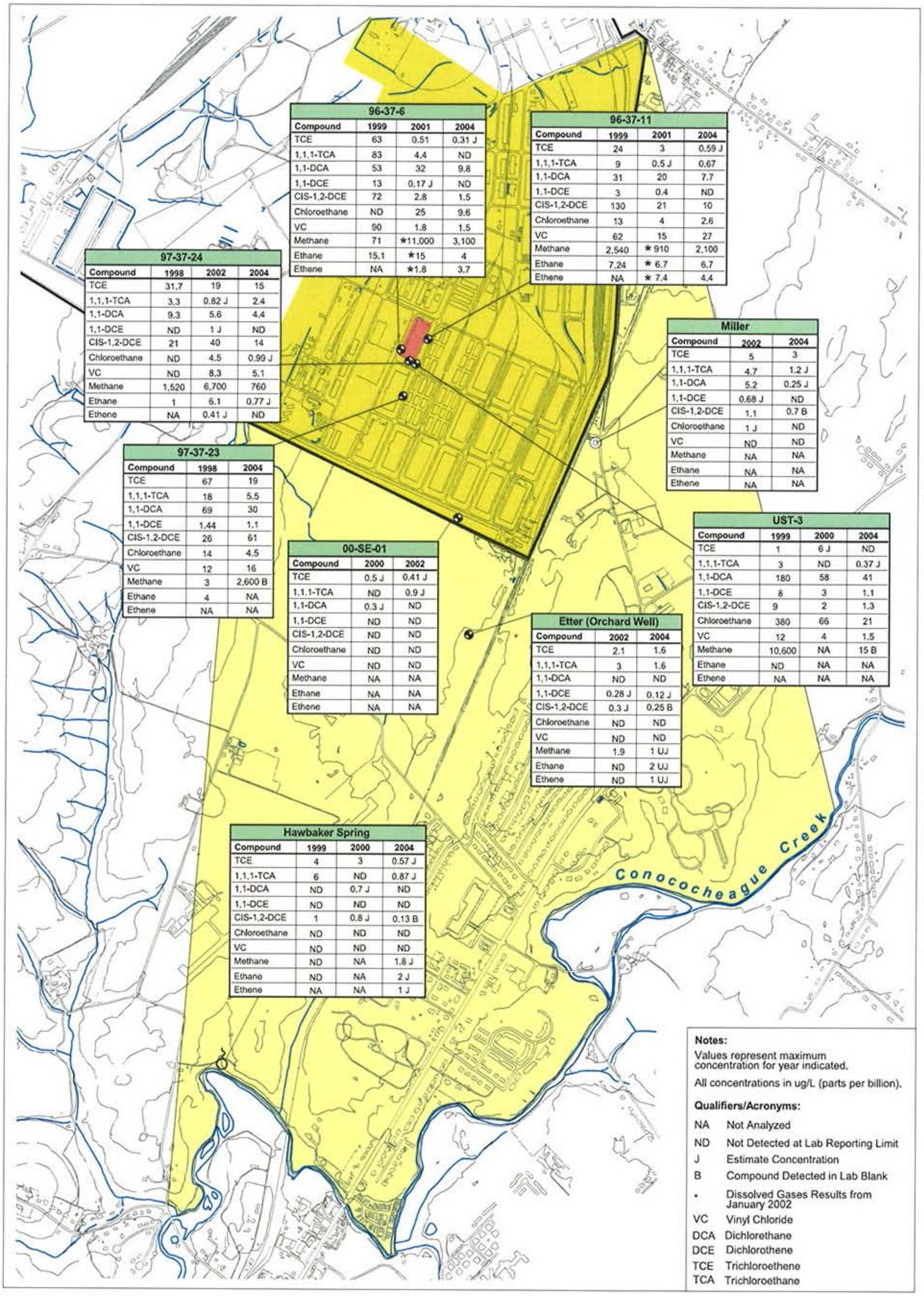
FIGURE 4 CONCEPTUAL MODEL CROSS SECTION OF BUILDING 37 AREA – SE OU 10



| 96-37-6 | | | |
|---|---|---|---|
| Compound | 1999 | 2001 | 2004 |
| TCE | 63 | 0.51 | 0.31 J |
| 1,1,1-TCA | 83 | 4.4 | ND |
| 1,1-DCA | 53 | 32 | 9.8 |
| 1,1-DCE | 13 | 0.17 J | ND |
| CIS-1,2-DCE | 72 | 2.8 | 1.5 |
| Chloroethane | ND | 25 | 9.6 |
| VC | 90 | 1.8 | 1.5 |
| Methane | 71 | *11,000 | 3,100 |
| Ethane | 15.1 | *15 | 4 |
| Ethene | NA | *1.8 | 3.7 |

| 96-37-11 | | | |
|---|---|---|---|
| Compound | 1999 | 2001 | 2004 |
| TCE | 24 | 3 | 0.59 J |
| 1,1,1-TCA | 9 | 0.5 J | 0.67 |
| 1,1-DCA | 31 | 20 | 7.7 |
| 1,1-DCE | 3 | 0.4 | ND |
| CIS-1,2-DCE | 130 | 21 | 10 |
| Chloroethane | 13 | 4 | 2.6 |
| VC | 62 | 15 | 27 |
| Methane | 2,540 | * 910 | 2,100 |
| Ethane | 7.24 | * 6.7 | 6.7 |
| Ethene | NA | * 7.4 | 4.4 |

| 97-37-24 | | | |
|---|---|---|---|
| Compound | 1998 | 2002 | 2004 |
| TCE | 31.7 | 19 | 15 |
| 1,1,1-TCA | 3.3 | 0.82 J | 2.4 |
| 1,1-DCA | 9.3 | 5.6 | 4.4 |
| 1,1-DCE | ND | 1 J | ND |
| CIS-1,2-DCE | 21 | 40 | 14 |
| Chloroethane | ND | 4.5 | 0.99 J |
| VC | ND | 8.3 | 5.1 |
| Methane | 1,520 | 6,700 | 760 |
| Ethane | 1 | 6.1 | 0.77 J |
| Ethene | NA | 0.41 J | ND |

| Miller | | |
|---|---|---|
| Compound | 2002 | 2004 |
| TCE | 5 | 3 |
| 1,1,1-TCA | 4.7 | 1.2 J |
| 1,1-DCA | 5.2 | 0.25 J |
| 1,1-DCE | 0.68 J | ND |
| CIS-1,2-DCE | 1.1 | 0.7 B |
| Chloroethane | 1 J | ND |
| VC | ND | ND |
| Methane | NA | NA |
| Ethane | NA | NA |
| Ethene | NA | NA |

| 97-37-23 | | |
|---|---|---|
| Compound | 1998 | 2004 |
| TCE | 67 | 19 |
| 1,1,1-TCA | 18 | 5.5 |
| 1,1-DCA | 69 | 30 |
| 1,1-DCE | 1.44 | 1.1 |
| CIS-1,2-DCE | 26 | 61 |
| Chloroethane | 14 | 4.5 |
| VC | 12 | 16 |
| Methane | 3 | 2,600 B |
| Ethane | 4 | NA |
| Ethene | NA | NA |

| UST-3 | | | |
|---|---|---|---|
| Compound | 1999 | 2000 | 2004 |
| TCE | 1 | 6 J | ND |
| 1,1,1-TCA | 3 | ND | 0.37 J |
| 1,1-DCA | 180 | 58 | 41 |
| 1,1-DCE | 8 | 3 | 1.1 |
| CIS-1,2-DCE | 9 | 2 | 1.3 |
| Chloroethane | 380 | 66 | 21 |
| VC | 12 | 4 | 1.5 |
| Methane | 10,600 | NA | 15 B |
| Ethane | ND | NA | NA |
| Ethene | NA | NA | NA |

| 00-SE-01 | | |
|---|---|---|
| Compound | 2000 | 2002 |
| TCE | 0.5 J | 0.41 J |
| 1,1,1-TCA | ND | 0.9 J |
| 1,1-DCA | 0.3 J | ND |
| 1,1-DCE | ND | ND |
| CIS-1,2-DCE | ND | ND |
| Chloroethane | ND | ND |
| VC | ND | ND |
| Methane | NA | NA |
| Ethane | NA | NA |
| Ethene | NA | NA |

| Etter (Orchard Well) | | |
|---|---|---|
| Compound | 2002 | 2004 |
| TCE | 2.1 | 1.6 |
| 1,1,1-TCA | 3 | 1.6 |
| 1,1-DCA | ND | ND |
| 1,1-DCE | 0.28 J | 0.12 J |
| CIS-1,2-DCE | 0.3 J | 0.25 B |
| Chloroethane | ND | ND |
| VC | ND | ND |
| Methane | 1.9 | 1 UJ |
| Ethane | ND | 2 UJ |
| Ethene | ND | 1 UJ |

| Hawbaker Spring | | | |
|---|---|---|---|
| Compound | 1999 | 2000 | 2004 |
| TCE | 4 | 3 | 0.57 J |
| 1,1,1-TCA | 6 | ND | 0.87 J |
| 1,1-DCA | ND | 0.7 J | ND |
| 1,1-DCE | ND | ND | ND |
| CIS-1,2-DCE | 1 | 0.8 J | 0.13 B |
| Chloroethane | ND | ND | ND |
| VC | ND | ND | ND |
| Methane | ND | NA | 1.8 J |
| Ethane | ND | NA | 2 J |
| Ethene | NA | NA | 1 J |

**Notes:**

Values represent maximum concentration for year indicated.

All concentrations in ug/L (parts per billion).

**Qualifiers/Acronyms:**

| | |
|---|---|
| NA | Not Analyzed |
| ND | Not Detected at Lab Reporting Limit |
| J | Estimate Concentration |
| B | Compound Detected in Lab Blank |
| * | Dissolved Gases Results from January 2002 |
| VC | Vinyl Chloride |
| DCA | Dichlorethane |
| DCE | Dichlorothene |
| TCE | Trichloroethene |
| TCA | Trichloroethane |

Legend

| | |
|---|---|
| ☐ | Buildings |
| 🟨 | On-Post SE OU 10 |
| 🟨 | Off-Post SE OU 10 |
| 🟥 | Building 37 |
| — | Roads |
| — | Drainage |
| — | Contours |
| — | Letterkenny Boundary |
| ● | Monitoring Well Location |
| ◎ | Residential Well Location |
| ♁ | Spring Location |

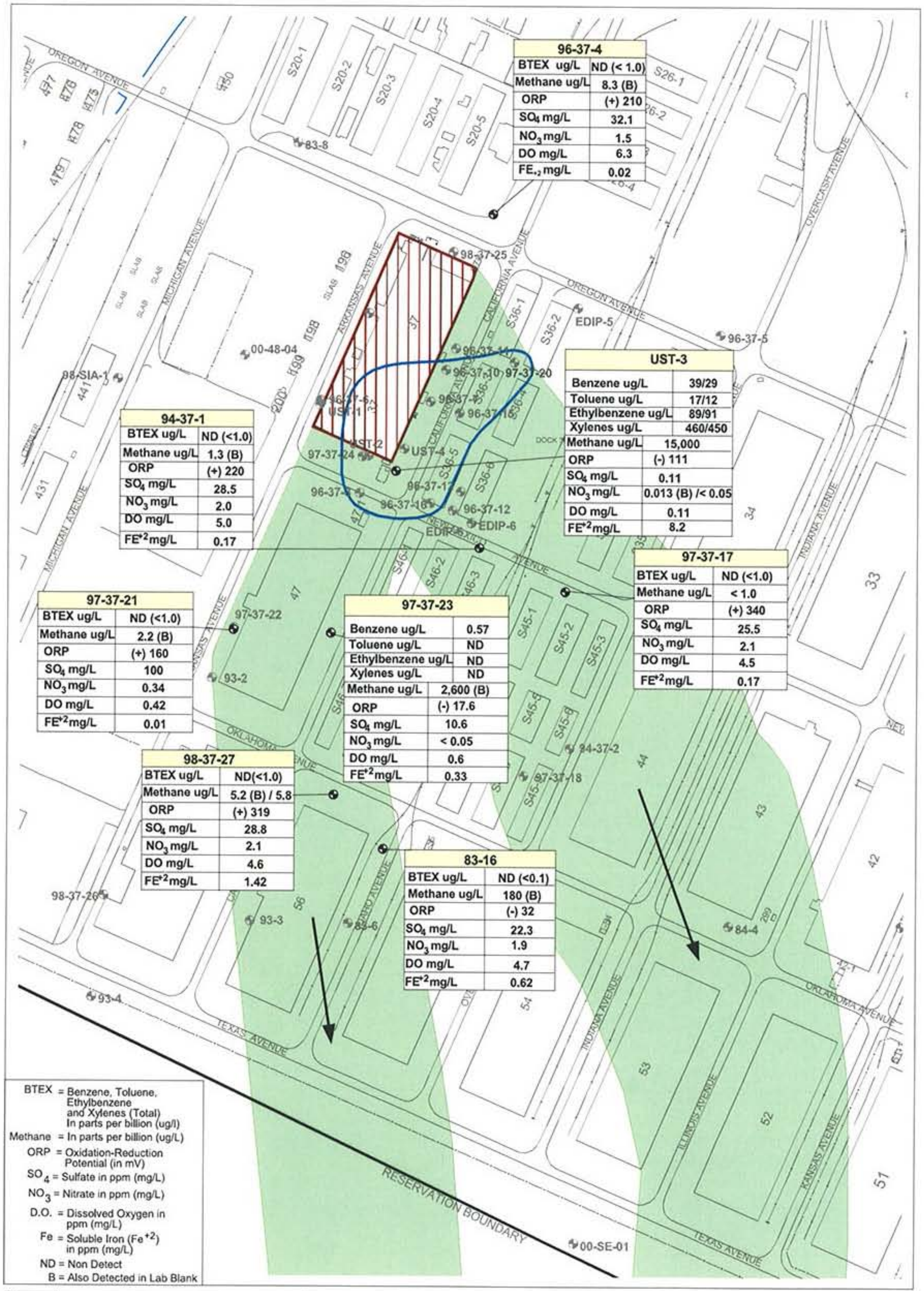
Letterkenny Army Depot
Chambersburg, PA
U.S. Army Corps of Engineers
Baltimore District

Figure 5
Sampling Results at On-Post and Off-Post Locations Showing the Chlorinated VOC Biodegradation Chains- 1998 through 2004
SE OU 10- Letterkenny Army Depot

WESTON SOLUTIONS

Date:
09/27/2005

| Q:\LEAD\aprs\seou10.apr | Layout- Bio Chains | q:\lead\pdfs\seou10_biochains.eps | 8:37 AM, 9/27/2005 |



| 96-37-4 | |
|---|---|
| BTEX ug/L | ND (< 1.0) |
| Methane ug/L | 8.3 (B) |
| ORP | (+) 210 |
| SO$_4$ mg/L | 32.1 |
| NO$_3$ mg/L | 1.5 |
| DO mg/L | 6.3 |
| FE$_{+2}$ mg/L | 0.02 |

| UST-3 | |
|---|---|
| Benzene ug/L | 39/29 |
| Toluene ug/L | 17/12 |
| Ethylbenzene ug/L | 89/91 |
| Xylenes ug/L | 460/450 |
| Methane ug/L | 15,000 |
| ORP | (-) 111 |
| SO$_4$ mg/L | 0.11 |
| NO$_3$ mg/L | 0.013 (B) /< 0.05 |
| DO mg/L | 0.11 |
| FE$^{+2}$mg/L | 8.2 |

| 94-37-1 | |
|---|---|
| BTEX ug/L | ND (<1.0) |
| Methane ug/L | 1.3 (B) |
| ORP | (+) 220 |
| SO$_4$ mg/L | 28.5 |
| NO$_3$ mg/L | 2.0 |
| DO mg/L | 5.0 |
| FE$^{+2}$mg/L | 0.17 |

| 97-37-17 | |
|---|---|
| BTEX ug/L | ND (<1.0) |
| Methane ug/L | < 1.0 |
| ORP | (+) 340 |
| SO$_4$ mg/L | 25.5 |
| NO$_3$ mg/L | 2.1 |
| DO mg/L | 4.5 |
| FE$^{+2}$mg/L | 0.17 |

| 97-37-21 | |
|---|---|
| BTEX ug/L | ND (<1.0) |
| Methane ug/L | 2.2 (B) |
| ORP | (+) 160 |
| SO$_4$ mg/L | 100 |
| NO$_3$ mg/L | 0.34 |
| DO mg/L | 0.42 |
| FE$^{+2}$mg/L | 0.01 |

| 97-37-23 | |
|---|---|
| Benzene ug/L | 0.57 |
| Toluene ug/L | ND |
| Ethylbenzene ug/L | ND |
| Xylenes ug/L | ND |
| Methane ug/L | 2,600 (B) |
| ORP | (-) 17.6 |
| SO$_4$ mg/L | 10.6 |
| NO$_3$ mg/L | < 0.05 |
| DO mg/L | 0.6 |
| FE$^{+2}$mg/L | 0.33 |

| 98-37-27 | |
|---|---|
| BTEX ug/L | ND(<1.0) |
| Methane ug/L | 5.2 (B) / 5.8 |
| ORP | (+) 319 |
| SO$_4$ mg/L | 28.8 |
| NO$_3$ mg/L | 2.1 |
| DO mg/L | 4.6 |
| FE$^{+2}$mg/L | 1.42 |

| 83-16 | |
|---|---|
| BTEX ug/L | ND (<0.1) |
| Methane ug/L | 180 (B) |
| ORP | (-) 32 |
| SO$_4$ mg/L | 22.3 |
| NO$_3$ mg/L | 1.9 |
| DO mg/L | 4.7 |
| FE$^{+2}$mg/L | 0.62 |

BTEX = Benzene, Toluene, Ethylbenzene and Xylenes (Total) In parts per billion (ug/l)
Methane = In parts per billion (ug/L)
ORP = Oxidation-Reduction Potential (in mV)
SO$_4$ = Sulfate in ppm (mg/L)
NO$_3$ = Nitrate in ppm (mg/L)
D.O. = Dissolved Oxygen in ppm (mg/L)
Fe = Soluble Iron (Fe$^{+2}$) in ppm (mg/L)
ND = Non Detect
B = Also Detected in Lab Blank

**Legend:**

- ● Monitoring Well Sampled for MNA of BTEX- May 1998 - July 1999 (GEOPHEX)
- ● Existing Monitor Well Location
- → Groundwater Flow Direction Based on Dye Tracing Results
- ▨ Building 37 (CVOC Contaminant Source Area)
- ☐ Approximate Area of Diesal Fuel Release (BTEX Source Area)
- 🟩 Areas Shown to be in Hydraulic Communication with Building 37 Groundwater based on Dye Tracing Results

125 0 125 250 Feet

N W E S

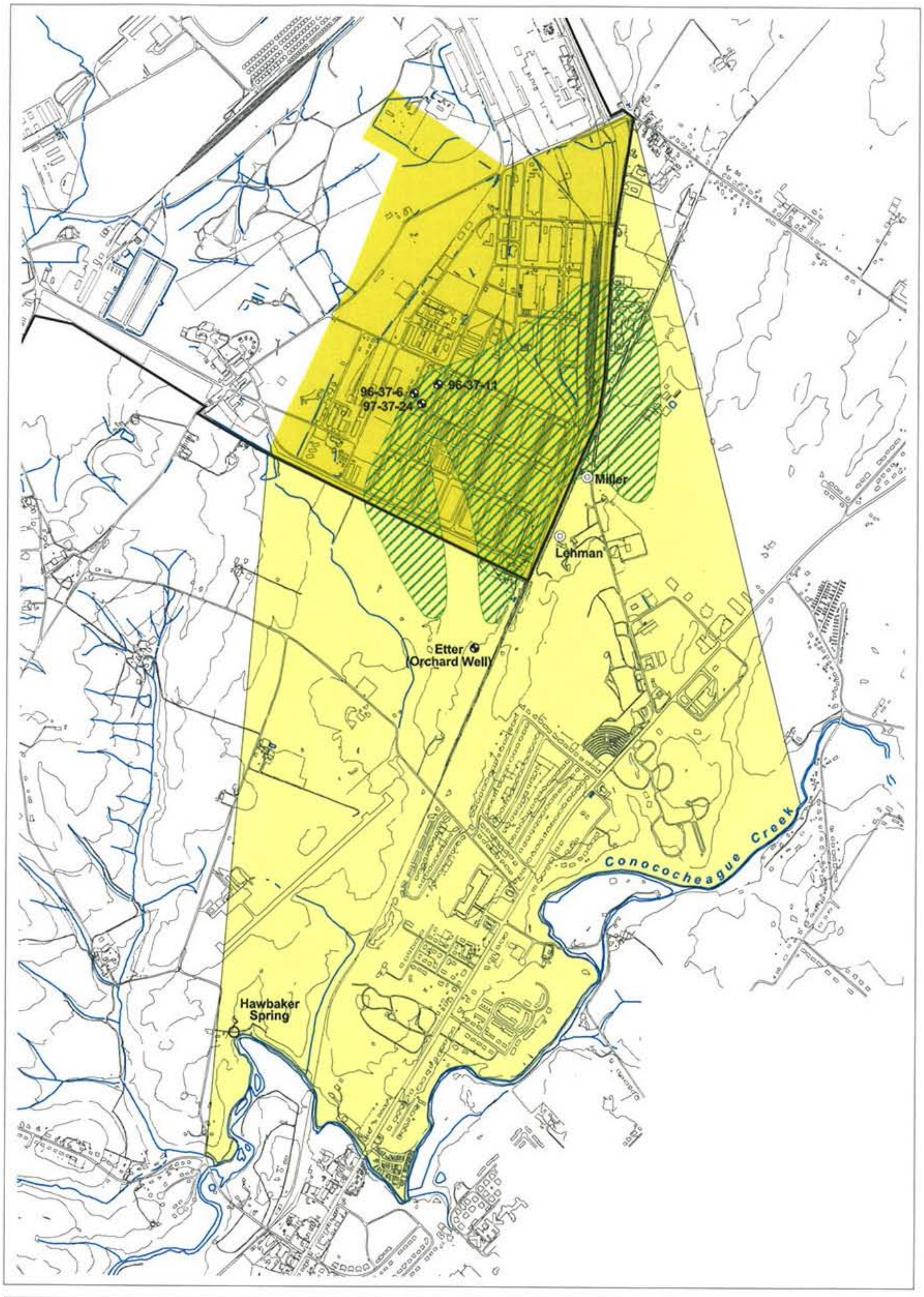
U.S. Army Corps of Engineers
Baltimore District

Figure 6
Results of Monitored Natural Attenuation Sampling for BTEX Compounds in SE OU 10
May 2004

WESTON SOLUTIONS

Date:
06/21/2005

| g:\lead\aprs\seou10_gw_restrict_0405.apr | Layout- BTEX Results | g:\lead\pdfs\in\seou10_gw_restrict_btex_0605.eps | 4:09 PM, 6/21/2005 |



**Legend:**

- ☐ Buildings
- 🟨 On-Post SE OU 10
- 🟨 Off-Post SE OU 10
- — Roads
- — Drainage
- — Contours
- — LEAD/CVBP Boundary
- ● Monitoring Well Location
- ◎ Residential Well Location
- ○ Spring Location
- ▨ Approximate Area of VOC Concentrations Above ARARs

0 1400 Feet

N
W E
S

U.S. Army Corps of Engineers
Baltimore District

Figure 7

Approximate Area of SE OU 10 Groundwater Plume with VOC Concentrations above ARARs

WESTON SOLUTIONS

Date:
06/21/2005

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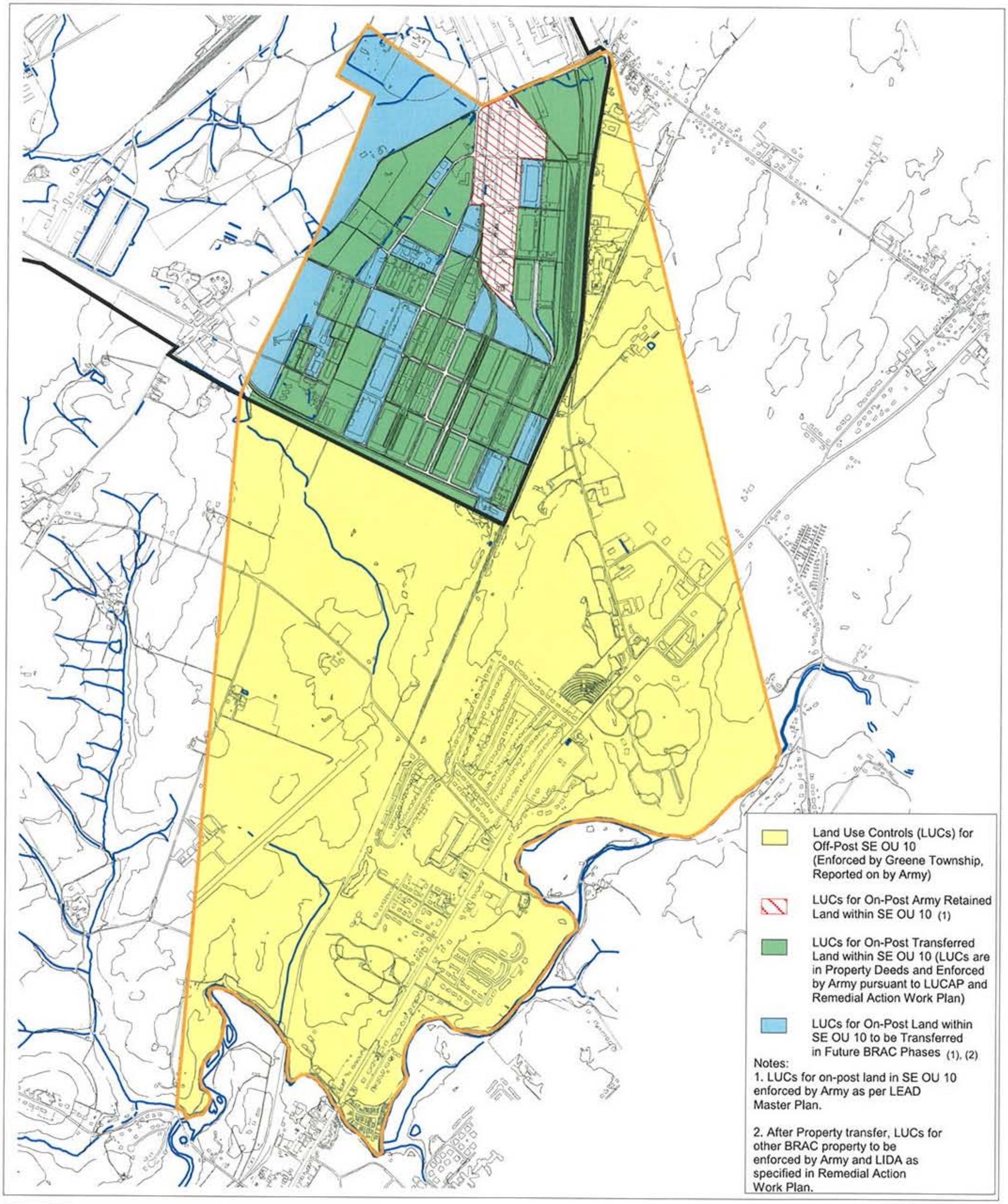

🟨 Land Use Controls (LUCs) for Off-Post SE OU 10 (Enforced by Greene Township, Reported on by Army)

▨ LUCs for On-Post Army Retained Land within SE OU 10 (1)

🟩 LUCs for On-Post Transferred Land within SE OU 10 (LUCs are in Property Deeds and Enforced by Army pursuant to LUCAP and Remedial Action Work Plan)

🟦 LUCs for On-Post Land within SE OU 10 to be Transferred in Future BRAC Phases (1), (2)

Notes:

1. LUCs for on-post land in SE OU 10 enforced by Army as per LEAD Master Plan.

2. After Property transfer, LUCs for other BRAC property to be enforced by Army and LIDA as specified in Remedial Action Work Plan.

**Legend**

| | |
|---|---|
| — Roads | Buildings |
| — Drainage | ☐ Approximate Boundaries of SE OU 10 |
| — Letterkenny Boundary | |
| — Topographic Contours | |

0 2000 Feet

N E S W

Letterkenny Army Depot
Chambersburg, PA
U.S. Army Corps of Engineers
Baltimore District

Figure 8
Land Use Controls (LUC's) by Area for SE OU 10

WESTON SOLUTIONS

Date:
4/3/2006

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# GLOSSARY OF TERMS

## GLOSSARY OF TERMS

*This glossary defines in non-technical language a number of environmental terms. The definitions may not constitute the Army's, EPA's or PADEP's official use of terms and phrases for regulatory purposes, and nothing in this glossary should be construed to alter or supplant any other federal or Commonwealth document. Official terminology may be found in the laws and related regulations as published in such sources as the Congressional Record, Federal Register, and elsewhere.*

| | |
|---|---|
| Administrative Record | A file that contains all the information used, by the lead agency (Army) to make a decision on the selection of a response action under CERCLA. These file are available for public review at LEAD's Administrative Record library located at the Environmental Management Division Office (Building 14), at the information repository (Coyle Free Library), and on LEAD's Administrative Record library website (http://209.235.100.233/letterkennylibrary/).<br>Note: The LEAD's contact for the Administrative Record is Joe Petrasek. e-mail: joseph.e.petrasek@us.army.mil<br>The LEAD's contact for SE OU 10 is Bryan Hoke. e-mail: bryan.l.hoke@us.army.mil<br>Phone: 717-267-9836 |
| Acidic | The condition of water or soil that contains a sufficient amount of acid substances to lower the pH below 7.0. |
| Aerobic | Life or processes that require, or are not destroyed by, the presence of oxygen. |
| Alkaline | The condition of water or soil that contains a sufficient amount of alkali substance to raise the pH above 7.0. Also referred to as basic. |
| Anaerobic | A life or process that occurs in, or is not destroyed by, the absence of oxygen. |

| | |
|---|---|
| Applicable or Relevant and Appropriate Requirements (ARARs) | **Applicable requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.<br>**Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate. |
| Base Realignment and Closure (BRAC) | The process by which the U.S. Department of Defense (DoD) is rightsizing. As part of this procedure, excess infrastructure and property that are no longer needed to support the defense mission are being closed and/or realigned. |
| Bioassay | Determination of the strength or biological activity of a substance, such as a drug or hormone, by comparing its effects with those of a standard preparation on a culture of living cells or a test organism. |
| Cancer Risk | Cancer risks are expressed as numbers reflecting the hypothetical increased chance that a person will develop cancer if exposed to chemicals or substances. For example, EPA’s acceptable risk range for CERCLA sites is $1 \times 10^{-4}$ to $1 \times 10^{-6}$. This means that the probability of cancer should not be greater than a 1-in-10,000 chance to a 1-in-1,000,000 chance above background. |
| Capture Zone | The ground water flow paths which contribute water to the recovery system. |
| Commercial/Industrial Use | As referenced in this Record of Decision means the use as administrative/office space, manufacturing, warehousing, restaurants, hotels/motels, and retail activities (residential use prohibited). |
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | A Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA) to investigate and clean up abandoned and uncontrolled hazardous waste sites. DoD cleanups are funded by the defense budget. |
| Contaminants of Concern (COCs) | Chemical identified through the risk assessment process as the primary chemicals that may cause unacceptable human health and/or ecological risk. |

| | |
|---|---|
| Contaminants of Potential Concern (COPCs) | Chemical identified through the initial screening of the risk assessment process or by comparison to published risk-based criteria as chemicals that need to be further evaluated may potentially cause unacceptable human health and / or ecological risk. |
| Dechlorination | Removal of a chlorine molecule from a substance, chemical or contaminant. Also referred to as dehalogenation. Dechlorination may occur as the result of chemical, weathering, or bio-degradation. |
| Environmental Baseline Survey (EBS) | A detailed search and review of available information (Army, Federal, state, and local), analysis of aerial photographs, interviews with current and /or former employees, review of ongoing response actions, visual inspections, and identification of sources of contamination to determine the environmental condition of a property. |
| Epikarst | The upper surface of karst, consisting of a network of intersecting fissures and cavities that collect and transport surface water and nutrients underground; epikarst depth can range from a few centimeters to tens of meters. The epikarst is relevant to the storage and transport of water in the karst system, and to foundation stability. |
| Half-Life | The time required for half of a substance to disappear or degrade to half of its initial value through natural processes (i.e., time for half of a given amount of TCE to degrade to DCE by reductive dechlorination). |
| Hazard Index (HI) | A number indicative of non-carcinogenic health effects, which is the ratio of the existing level of exposure to an acceptable level of exposure. A value equal to or less than one indicates that the human population is not likely to experience adverse effects. |
| Heterogeneous | Consisting of dissimilar or diverse (i.e., mixed) ingredients or constituents. |
| Human Health Risk Assessment | An evaluation of the risk posed to human health should remedial activities not be implemented. |
| Hydraulic Influence | Ground water flow paths that contribute water to the recovery system as well as those flow paths affected, but not captured, by the recovery system. It is represented by a decline in hydraulic head in response to pumping. |
| Karst | A terrane generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of soluble rocks, and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage and caves. Referred to as karstic when used as an adjective. |
| Karst Aquifer | An aquifer in which the flow of groundwater can be appreciable through one or more of the following; joints, faults, fractures, bedding plane partings and cavities – any or all of which have been enlarge by dissolution. |
| Lactate Injection | Injection of a lactate solution (typically sodium lactate) with a pre-determined concentration to the unsaturated zone of soil at a controlled rate. |

| | |
|---|---|
| Land Use Controls (LUCs) | Refers to any restriction or administrative action, including engineering and institutional controls, arising from the need to reduce risk to human health and the environment. In past SE OU 10 documents, including the FFS and Proposed Plan, the term “institutional controls” was used to denote land use controls. |
| Methanogenic | Methanogenesis is a process that produce $CH_4$ (methane) and $CO_2$ (as waste products) by biological processes in the absence of oxygen. Such organisms are called methanogens. |
| Microbes | Bacteria or other similar one-celled organisms such as those referred to as methanogens that are often naturally occurring and that can breakdown (degrade) organic matter or chemical compounds. |
| National Oil and Hazardous Substances Pollution Contingency Plan (NCP) | The Federal regulation that guides the CERCLA response actions. The NCP was revised in February 1990. |
| National Priorities List (NPL) | The list, compiled by the U.S. Environmental Protection Agency (EPA) pursuant to CERCLA Section 105, identifies the uncontrolled or abandoned hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response. |
| Off-post and On-post | Refers to the 2 major portions of the SE OU 10 groundwater operable unit. The "on-post" area of SE OU 10 consists of areas to be retained by the Army as well as portion of the Letterkenny Army Depot (LEAD) that are now or will be, after the property is transferred, part of the Cumberland Valley commercial/industrial business park. SE OU 10 also extends "off-post," which is beyond the LEAD boundary, as defined by conditions before any property was transferred as part of BRAC, to areas where there are farms, residences, and other existing commercial/industrial areas. The boundary defining the on-post and off-post is approximately along Innovation Avenue (formerly Texas Avenue) and East Patrol Road. |
| Operable Unit (OU) | Term for each of a number of separate activities or actions that each comprises an incremental step toward comprehensively addressing environmental problems at a CERCLA site. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may, for example, address geographical portions of a site or specific site problems, such as groundwater contamination. |
| Organic Compound | Chemicals that are carbon-based compounds, such a solvents, oils, and pesticides. Most are not readily dissolved in water. Exposure to some organic compounds may increase the risk of developing cancer. |
| Oxidation | The chemical addition of oxygen to break down pollutants or organic waste; e.g., destruction of chemicals such as cyanides, phenols, and organic sulfur compounds in sewage by bacterial and chemical means. |
| Oxidizing Agent | A substance that oxidizes something (causes another substance to lose electrons) by accepting electrons. A common oxidizing agent is hydrogen peroxide. |
| Proposed Plan (PP) | A document that describes (for public comment), the preferred cleanup strategy, the rationale for the preference, and the alternatives presented in the detailed analysis of the remedial investigation/feasibility study (RI/FS). |

| | |
|---|---|
| Reaction Kinetics | The branch of physical chemistry that deals with the determination of the rates and mechanisms of chemical reactions. |
| Record of Decision (ROD) | A public document that explains which cleanup alternative will be used at NPL sites. The ROD is based on information and technical analysis generated during the RI/FS process and consideration of public comments and community concerns. |
| Remedial Action | Implementation of plans and specifications, developed as part of the design, to remediate a site. |
| Residential Use | As referenced in this Proposed Plan means use as housing, daycare facilities, schools (excluding education and training programs for persons over 18 years of age), assisted living facilities, and outdoor recreational activities. Unrestricted use (community and commercial/industrial included) is permitted under this definition. |
| Risk Assessment | Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants. |
| Volatile Organic Compound (VOC) | An organic (carbon-containing) compound that evaporates (volatilizes) readily at room temperature. Examples of VOCs are trichloroethene (TCE) and dichloroethene (DCE). |

# REFERENCES

# REFERENCES

## Administrative Record References

The following LEAD documents relevant to SE OU 10 are available in the LEAD Administrative Record. The Administrative Record reference number for each document is included at the end of each reference (i.e., LKD-RT-xxx). These documents are also available online at: http://209.235.100.233/letterkennylibrary/

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(a) *In the mid 1990s, all SE Area on-post groundwater contamination was designated as SE OU 3. SE OU 3 was later subdivided into SE OU 3 and SE OU 11 (areas north of Gate 6), and the on-post VOC- contaminated groundwater related to Building 37 was designated as SE OU 10. Off-post groundwater contamination from SE OU 3, SE OU 11 and SE OU 10 was originally designated as SE OU 6. In 2002, off-post groundwater contamination south of the former Gate 6 was incorporated into SE OU 10 (Conococheague Drainage System), with off-post groundwater contamination north of the former Gate 6 remaining as SE OU 6.*

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