OVERSIZE PAGES

LOCATED AT

END OF

DOCUMENT

300401-0605020003

CH2M HILL
Mound, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, OH
45343-3030

CH2MHILL

SMO-123/05
May 31, 2005

Ms. Margaret L. Marks, Director
Miamisburg Closure Project
U. S. Department of Energy
1075 Mound Road
Miamisburg, OH 45342

ATTENTION: Paul Lucas

SUBJECT: **Contract No. DE-AC24-03OH20152:** Deliverable #39 Potential release site and removal action documentation; Section C.2.3.1.3 Remaining Response Actions; PRS 87, Action Memorandum, Final

Dear Ms. Marks:

Attached is the following Final document for your records:

- PRS 87, Action Memorandum, Final

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at 937-865-4203.

Sincerely,

John Lehew
Site Manager

JL/ms

Enclosures

cc: T. Fischer, USEPA, (1) w/attachments
B. Nickel, OEPA, (1) w/attachments
R. Vandegrift, ODH, (1) w/attachments
M. Wojciechowski, Tetra Tech, (1) w/attach
C. White, DOE/MCP, (1) w/attachments
L. Rawls, MCP, w/o attachments
R. Tormey, DOE/OH, (1) w/attachments
G. Desai, DOE/HQ, (1) w/attachments
F. Bullock, MMCIC, (2) w/attachments
Public Reading Room, (4) w/attachments
Admin. Record, CH2M Hill, (2) w/attachs
DCC (1) w/attachments
ER Records, CH2M Hill, (1) w/attachments
K. Arthur, CH2M Hill, (1) w/attachments
B. Ransbottom, CH2M Hill, (1) w/attachments
V. Darnell, CH2M Hill, (1) w/attachments
J. Lehew, CH2M Hill, w/o attachments
K. Armstrong, CH2M Hill, w/o attachments
D. Rakel, CH2M Hill, w/o attachments
J. Fontaine, CH2M Hill, w/o attachments
MOAT Coordinator, CH2M Hill, w/o attachs
W. Webb, CH2M Hill, w/o attachments
M. McDougal, CH2M Hill, w/o attachments
file, CH2M Hill, w/o attachments

300401-0605020003

ACTION MEMORANDUM
ENGINEERING EVALUATION/COST ANALYSIS

PRS 87 ACTION MEMO

REMOVAL ACTION OF VOLATILE ORGANIC COMPOUND (VOC) CONTAMINATED SOIL

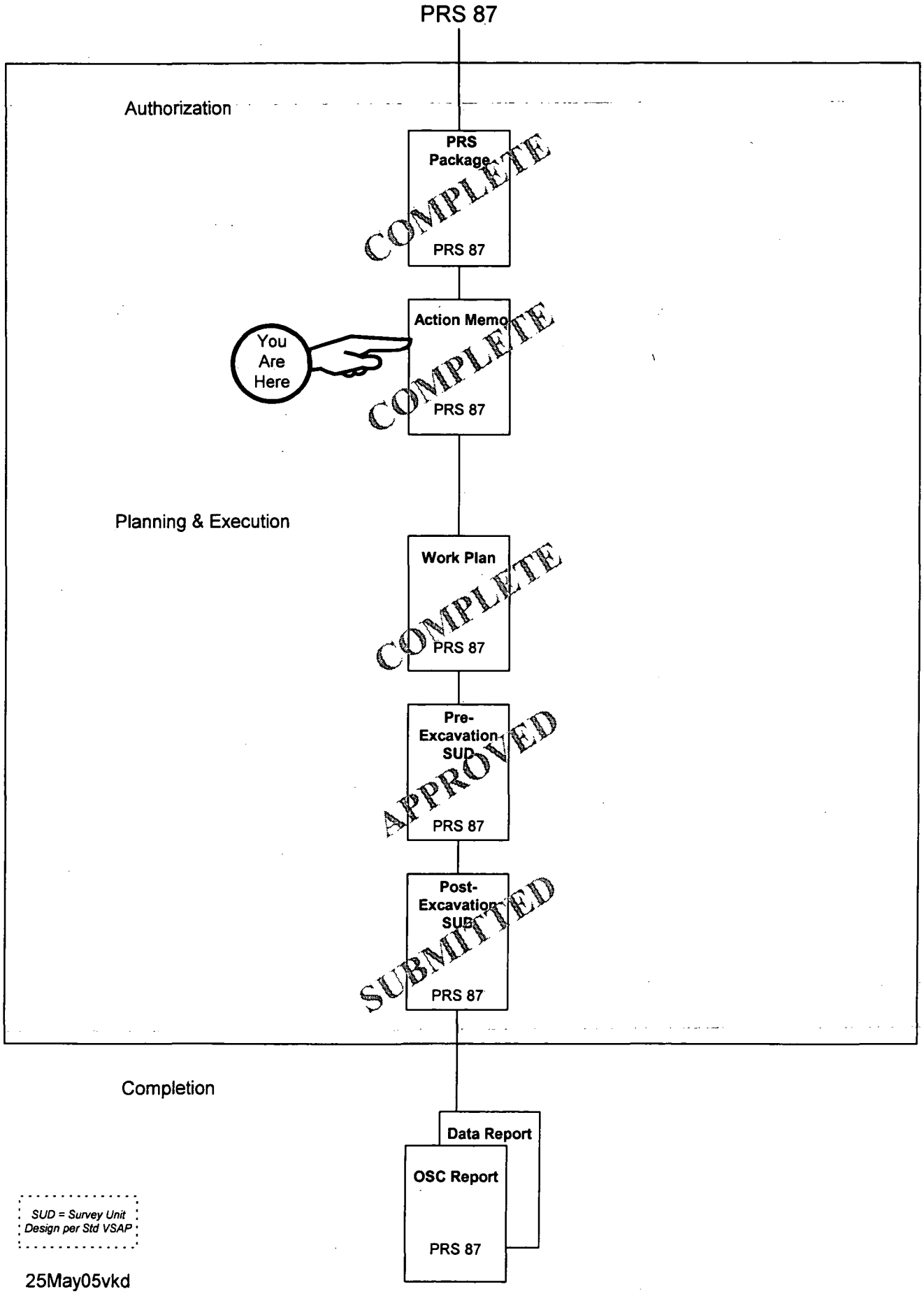
MAY 2005

FINAL

Department of Energy
Miamisburg Closure Project

CH2MHILL

PRS 87



25May05vkd

MIAMISBURG CLOSURE PROJECT

ACTION MEMORANDA

The following documents are available (November 17, 2004) for public information in the CERCLA Public Reading Room, 305 E. Central Ave., Miamisburg, Ohio.

PRS 76 Action Memorandum (Warehouse 9),
and
PRS 87 Action Memorandum (Bldg 49 Solvent Shed)

Questions can be referred to Paul Lucas at (937) 847-8350 ext. 314

U.S. Department of Energy
U.S. Environmental Protection Agency
Ohio Environmental Protection Agency

The Mound Core Team
500 Capstone Circle
Miamisburg, OH 45342

December 2004

Mr. Frank Bullock, PE
Director of Operations
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bullock:

The Core Team, consisting of the U.S. Department of Energy Miamisburg Closure Project (DOE-MCP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comments on the PRS 87 Action Memorandum, Public Review Draft, November 2004.

Attached is our response.

Should the responses to comments require additional detail, please contact Paul Lucas at (937) 847-8350, x314 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MCP:	Paul Lucas	12/16/04
	Paul Lucas, Remedial Project Manager	date
USEPA:	Timothy J. Fischer	12/15/04
	Timothy J. Fischer, Remedial Project Manager	date
OEPA:	B. K. Nickel	12/16/04
	Brian K. Nickel, Project Manager	date

Response to MMCIC/ EHS Technology Group, LLC Comments on the PRS 87 Action Memorandum Public Review Draft November 2004

Comment 1.
Reference Document: PRS 87 Action Memo/EE/CA for Removal Action of Volatile Organic Compound (VOC) Contaminated Soils, November 2004, Public Review Draft.

Purpose: The purpose of this document is to document and allow public comment on the propped Removal Action at PRS 87.

Assessment of Review: PRS 87 refers to the location of the solvent storage sheds that supplied solvents to the cleaning operations performed in Building 49. The first of these sheds was located under what was subsequently the northwest corner of Building 49. The second shed, built after the Building 49 addition displaced the original shed, was located approximately 100-feet east of the Building 49 addition. Records indicate that both sheds were used for similar operations, including the storage and supply of trichloroethene (TCE), isopropyl alcohol, and ethyl alcohol. While in operation, the solvents were piped from the sheds into the building for use. Spent solvents were piped back to the shed and stored in 55 gallon waste drums. Freon and hexane, used for parts cleaning, were also occasionally stored here. There were no site records of any leaks or spills from these sheds.

Technical Analysis: Four separate sampling events were performed around the perimeter of Building 49, underneath Building 49, through the floor slab and in the utility trench drain. The sampling results show TCE, cis-1,2 dichloroethene (DCE) and vinyl chloride (VC) in both soils and groundwater. The highest detections in soils were 23 ppm TCE, 11 ppm DCE and 0.4 ppm VC. The highest groundwater detections were 0.16 ppm TCE, 17 ppm DCE and 3.5 ppm VC. A model of the PRS 87 site was developed using this sampling data and locations. The model predicted that leaching of VOCs into the groundwater could be a potential problem. As a result, the Core team recommended Removal Action for this PRS. As part of this Action Memo, other alternative technologies were investigated; however, soils removal was found to be the preferred alternative.

As always, coordination between CH2M Hill, the cleanup contractor at the Mound site, and Miamisburg Mound Community Improvement Corp. (MMCIC - the developer of the site) will result in the return of these areas to that proposed in the Mound Comprehensive Reuse Plan.

Substantive Comments: EHS concurs with the proposed Removal Action for PRS 87 soils. Coordination between CH2M Hill, the DOE and MMCIC is important to ensure that the PRS 87 site is left in a condition consistent with the Mound Reuse Plan.

EHS, along with MMCIC, will monitor the progress of the removal action. Notification of the Verification Sampling and Analysis Plan and the On-Scene Coordinator Report for this site would be appreciated.

If EHS's understandings are correct, no specific response to the above comment is necessary, and we understand that these comments will be included in the OSC report.

Response 1. Thank you for your review and input to the document. Public comments are included in the final version of the document to which they pertain; accordingly, these comments will not be included in an OSC Report as your comment indicated, but are included in the Final version of the PRS 87 Action Memorandum.

Project status is provided via the FFA meeting; if additional information is required, please contact Paul Lucas at 937-847-8350, ext. 314. Verification sampling will be performed in accordance with the Standard VSAP, in conjunction with the PRS 87 Survey Unit Design. Following project completion, the final OSC Report will be sent to MMCIC and placed in the public reading room.

MMCIC is encouraged to coordinate with DOE and the clean-up contractor regarding demolition activities. The individual demolition Work Plans will specify any site restoration activities following structure removal. The Core Team understands MMCIC's request and encourages MMCIC to meet with DOE to obtain an agreeable end state.

TABLE OF CONTENTS

Section Page

1.0 PURPOSE 1

2.0 SITE CONDITIONS AND BACKGROUND 1
- 2.1 Site Description 1
  - 2.1.1 Physical Location 1
  - 2.1.2 Site Characteristics 1
  - 2.1.3 Site Sampling 2
  - 2.1.4 Site Geology 9
  - 2.1.5 Release or Threatened Release into the Environment 10
  - 2.1.6 National Priorities List Status 10
- 2.2 Other Actions to Date 10
  - 2.2.1 Previous Removal Actions 10
  - 2.2.2 Current Actions 10
- 2.3 State and Local Authorities' Roles 11
  - 2.3.1 State and Local Action to Date 11
  - 2.3.2 Potential for Continued State and Local Response 11

3.0 THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT 11
- 3.1 Threats to Public Health or Welfare 11
- 3.2 Threats to the Environment 11
- 3.3 Removal Site Evaluation 11

4.0 ENDANGERMENT DETERMINATION 12

5.0 PROPOSED ACTION AND ESTIMATED COSTS 13
- 5.1 Proposed Action 13
  - 5.1.1 Proposed Action Description 13
  - 5.1.2 Contribution to Future Remedial Actions 15
  - 5.1.3 Description of Alternative Technologies 15
  - 5.1.4 Preferred Alternative 16
  - 5.1.5 EE/CA 16
  - 5.1.6 Applicable or Relevant and Appropriate Requirements (ARARs) 16
  - 5.1.7 Other Standards and Requirements 17
  - 5.1.8 Project Schedule 18
- 5.2 Estimated Costs 18

6.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN 18

7.0 OUTSTANDING POLICY ISSUES 18

8.0 ENFORCEMENT 18

9.0 REFERENCES 19

10.0 RECOMMENDATION 20

TABLE OF CONTENTS

Continued

Figures

Figure 1 Location of PRS 87 3
Figure 2 Locations of Soil Borings 4
Figure 3 Locations of Soil VOC Detections 5
Figure 4 Locations of Groundwater VOC Detections 6
Figure 5 Trichloroethene (TCE) Soil Concentration Relative to Cleanup Objective 7
Figure 6 cis-1,2 dichloroethene (DCE) Soil Concentration Relative to Cleanup Objective 7
Figure 7 Vinyl Chloride (VC) Soil Concentrations Relative to Cleanup Objective 8
Figure 8 PRS 87 Groundwater Monitoring Wells 8
Figure 9 Generalized Geologic Cross-section Showing Contamination at TF99 9

Tables

Table 1 Soil Volatile Organic Compound Detections ..... (Appendix A)
Table 2 Groundwater VOC Detections ..... (Appendix A)
Table 3 Well Monitoring Data ..... (Appendix A)
Table 4 Evaluation of Removal Action Appropriateness Criteria 12
Table 5 Soil Cleanup Objectives 14
Table 6 Remediation Option Matrix ..... (Appendix A)
Table 7 Schedule 18
Table 8 Cost Estimate 18

Appendices

Appendix A Tables 1, 2, 3, & 6
Appendix B Development of VOC Soil Cleanup Guideline Values

TABLE OF CONTENTS

Continued

ACRONYMS

AM	Action Memorandum
ARARs	Applicable or Relevant and Appropriate Requirements
BVA	Buried Valley Aquifer
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCE	cis-1,2, dichloroethene
DOE	Department of Energy
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
ER	Environmental Restoration
FFA	Federal Facilities Agreement
MCP	Miamisburg Closure Project
MEMP	Mound Environmental Management Project
MMCIC	Miamisburg Mound Community Improvement Corporation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
PEC	tetrachloroethene
PRS	Potential Release Site
RA	Removal Action
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RSE	Removal Site Evaluation
SARA	Superfund Amendments and Reauthorization Act
SM-PP	Special Metallurgical- Plutonium Processing
SSL	soil screening level
TEC	trichloroethene
ug/kg	micrograms per kilogram
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound
VSAP	Verification Sampling and Analysis Plan

1.0 PURPOSE

The U.S. Department of Energy (DOE) is the designated lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and removal actions at the Miamisburg Closure Project (MCP) (previously called the Mound Environmental Management Project or MEMP) are implemented as non-Superfund, federal-lead actions. DOE acts as the On-Scene Coordinator (OSC). Non-Superfund, federal-lead removal actions are not subject to United States Environmental Protection Agency (USEPA) limitations on the OSC ($50,000 authority) and are not subject to National Oil and Hazardous Substances Pollution Contingency Plan (NCP) limitations on removal actions (i.e., $2,000,000 in cost and 12 months in duration).

This Action Memorandum (AM) Engineering Evaluation/Cost Analysis (EE/CA) has been generated to document the general site conditions that would justify application of a Removal Action (RA) consistent with CERCLA, to propose the RA described herein, and to allow public input.

2.0 SITE CONDITIONS AND BACKGROUND

2.1 Site Description

2.1.1 Physical Location

The MCP Site is located on the southern border of the City of Miamisburg in Montgomery County, Ohio, approximately 10 miles south-southwest of Dayton and 45 miles north of Cincinnati. This RA is proposed for the removal of the Volatile Organic Compound (VOC) contaminated soils at the Potential Release Site (PRS) 87 area.

2.1.2 Site Characteristics

PRS 87 refers to the solvent storage sheds that supplied solvents to the cleaning operations performed in Building 49 (demolished in 2003). The first shed was located under what was subsequently the northwest corner of Building 49. The second shed was located approximately 100-feet east of the Building 49 addition. Hereafter, these sheds will be referred to as West Shed and East Shed, respectively.

The West Shed was built in 1968 and operated until 1986 at which time it was demolished to provide space for an addition to Building 49. The exact dimensions of this shed are not known. Based on historical photos the shed is estimated to be a small metal structure with an approximate footprint of 10 feet by 10 feet.

The East Shed was in operation from 1986 to late 1990 at which time it was taken out of service. In late 1990, major portions of the Building 49 parts cleaning operations were moved to the Building M plating shop. The East Shed was equipped with a ventilation fan and a metal grid floor overlying a catch basin. It had a footprint of 8 feet by 12 feet, with a 10-foot ceiling. The East Shed was demolished in 2003, during the Building 49 demolition activities.

Records indicate that both sheds were used for similar operations. These operations included storage and supply of trichloroethene (TCE), isopropyl alcohol, and ethyl alcohol. These solvents were piped directly from storage drums into Building 49. The spent solvents were poured into a drain, piped back to the solvent shed(s), and contained in a 55-gallon waste drum. Freon and hexane were occasionally used for cleaning parts and were stored in the shed(s) in 5-gallon cans. Waste freon and hexane were put in separate 5-gallon cans and also stored in the solvent shed(s). All solvents were picked up by Mound Waste Management personnel and transferred to the hazardous waste storage area in Building 72. There are no records of a solvent spill or leak from the storage sheds. Based on Mound records of Building 49, the solvent sheds did not involve radioisotopes. Building 49 and the East Shed were demolished in the summer of 2003; however, the building foundation pad remains in place. Figure 1 shows the location of PRS 87.

2.1.3 Site Sampling

The PRS 87 area has been undergone four separate VOC sampling events. The first effort involved soil sampling around the northern perimeter of Building 49. The results for this sampling effort are contained in the PRS 72/73/87 Test Fire Valley Further Assessment Data Report, March 2002 (Ref 1). The second, third, and fourth sampling events involved soil sampling around the southern perimeter, sampling within the facility proper (through the floor slab), and utility trench sampling. The results for these sampling efforts are contained in the PRS 87 Further Assessment Data Report, June 2003 (Ref 2).

Figure 2 shows the distribution of VOC soil sample locations within the PRS 87 area. Lithologic logs were constructed for each boring location to develop an understanding of the underlying hydrogeologic conditions.

Sampling results show TCE, cis- 1,2 dichloroethene (DCE) and vinyl chloride (VC) detections in both the soil and perched groundwater. The perched groundwater is limited to water collecting in the building foundation excavation backfill materials. This water is not in hydraulic communication with the underlying saturated glacial sediments. The highest soil detections for TCE, DCE, and VC are 23 ppm, 11 ppm, and 0.4 ppm respectively. The highest VOC soil and groundwater concentrations are limited to TF99 with all remaining locations showing either non-detect or significantly lower concentrations. The highest groundwater (perched water) detections for TCE, DCE, and VC are 0.16 ppm, 17 ppm, and 3.5 ppm respectively. Table 1 and Table 2 (see Appendix A) show the VOC soil and groundwater detections. Figures 3 and 4 show the distribution of soil and groundwater detections included in the tables.

A three dimensional model of the PRS 87 area was developed to allow visualization of the subsurface soil VOC contaminant distribution. The model shows VOC contaminant distribution for each borehole from surface to bedrock. Figures 5 through 7 show the distribution of TCE, DCE, and VC (respectively) in the PRS 87 subsurface.

Three groundwater monitoring wells were installed adjacent to Building 49 in the Fall of 2002. The wells are screened in saturated glacial sediments of the tributary valley. The wells have been sampled quarterly for more than one year with no VOCs detected to date. The well monitoring data are presented in Table 3 (see Appendix A) with well locations shown on Figure 8.

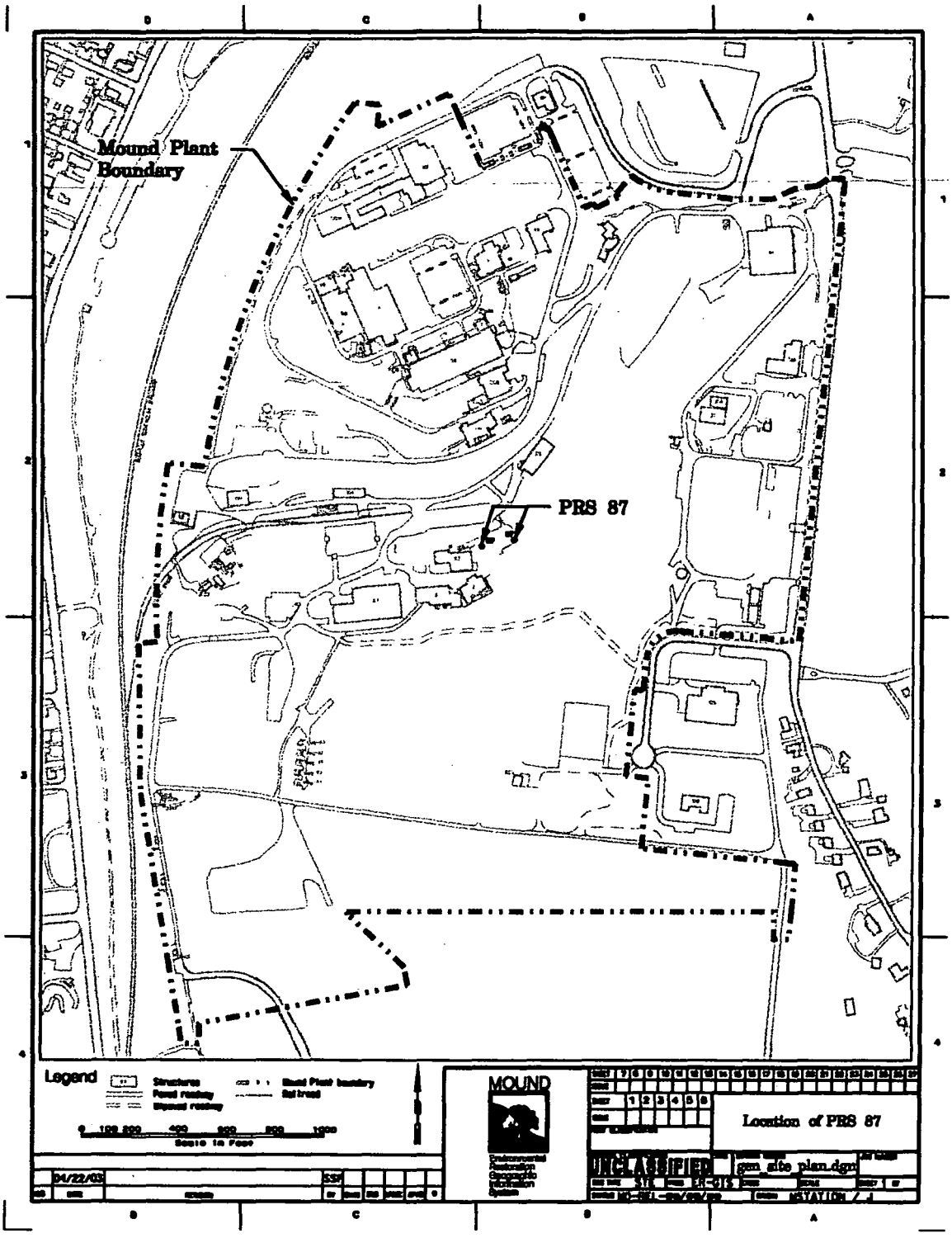


Figure 1 - Location of PRS 87

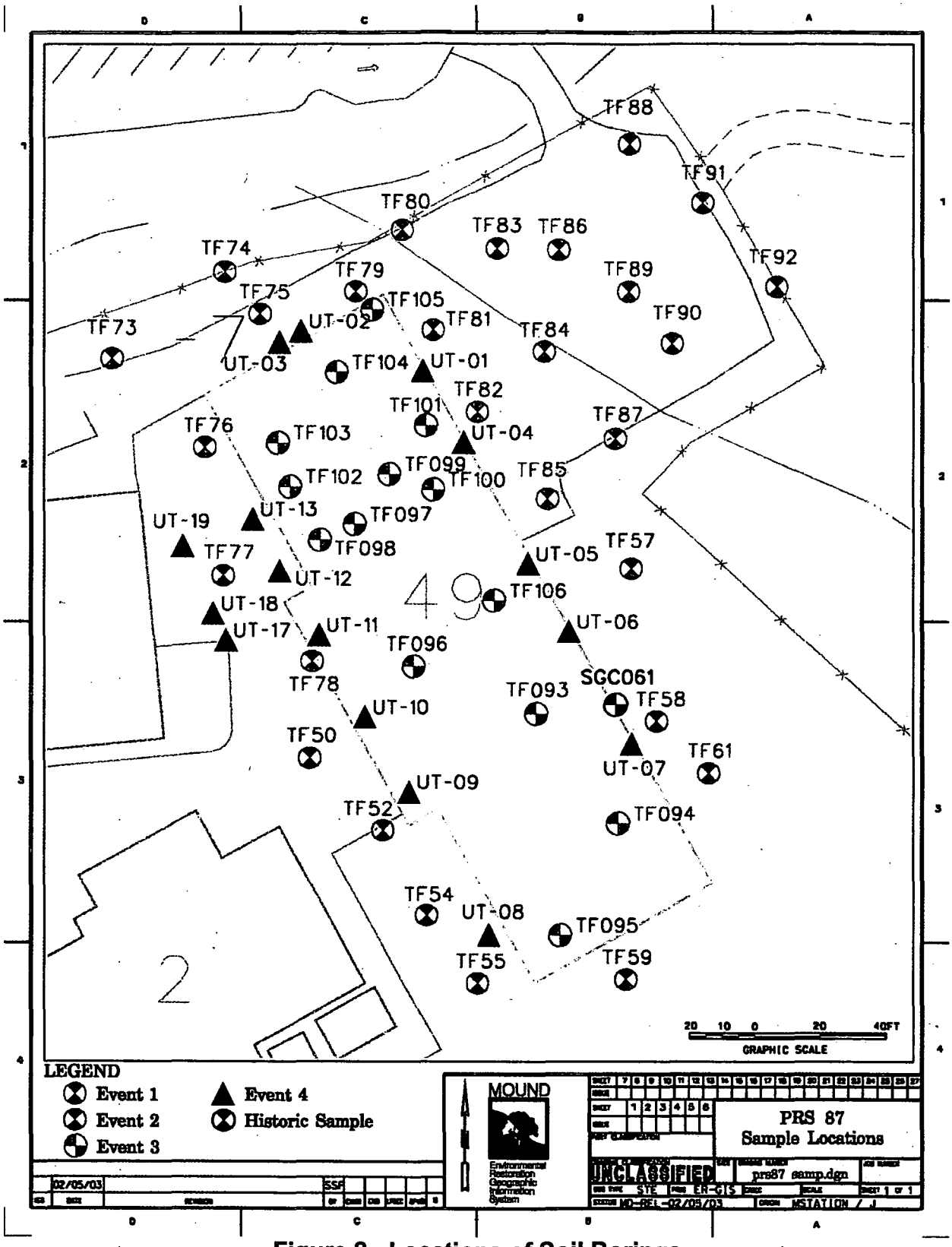


Figure 2 - Locations of Soil Borings

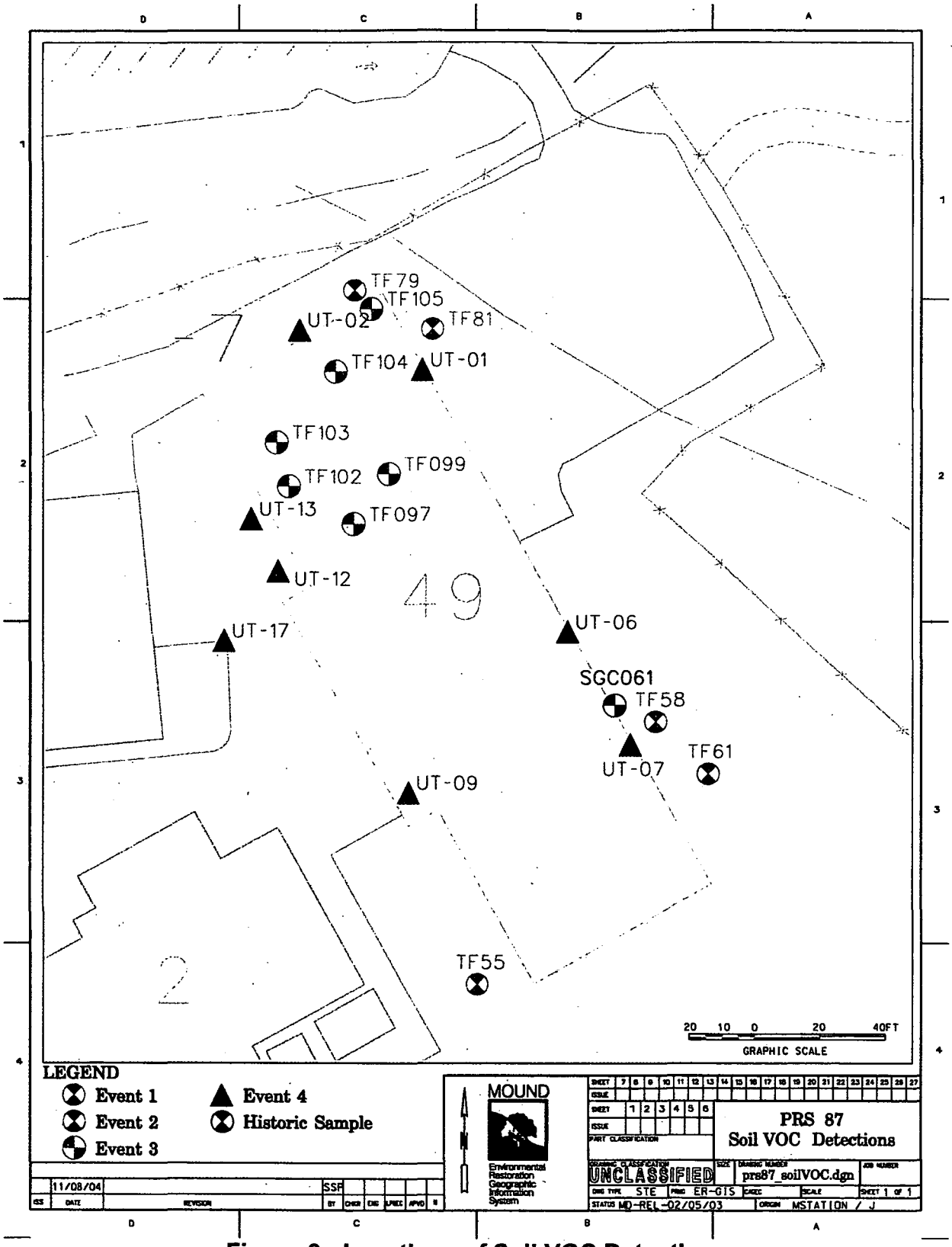


Figure 3 - Locations of Soil VOC Detections

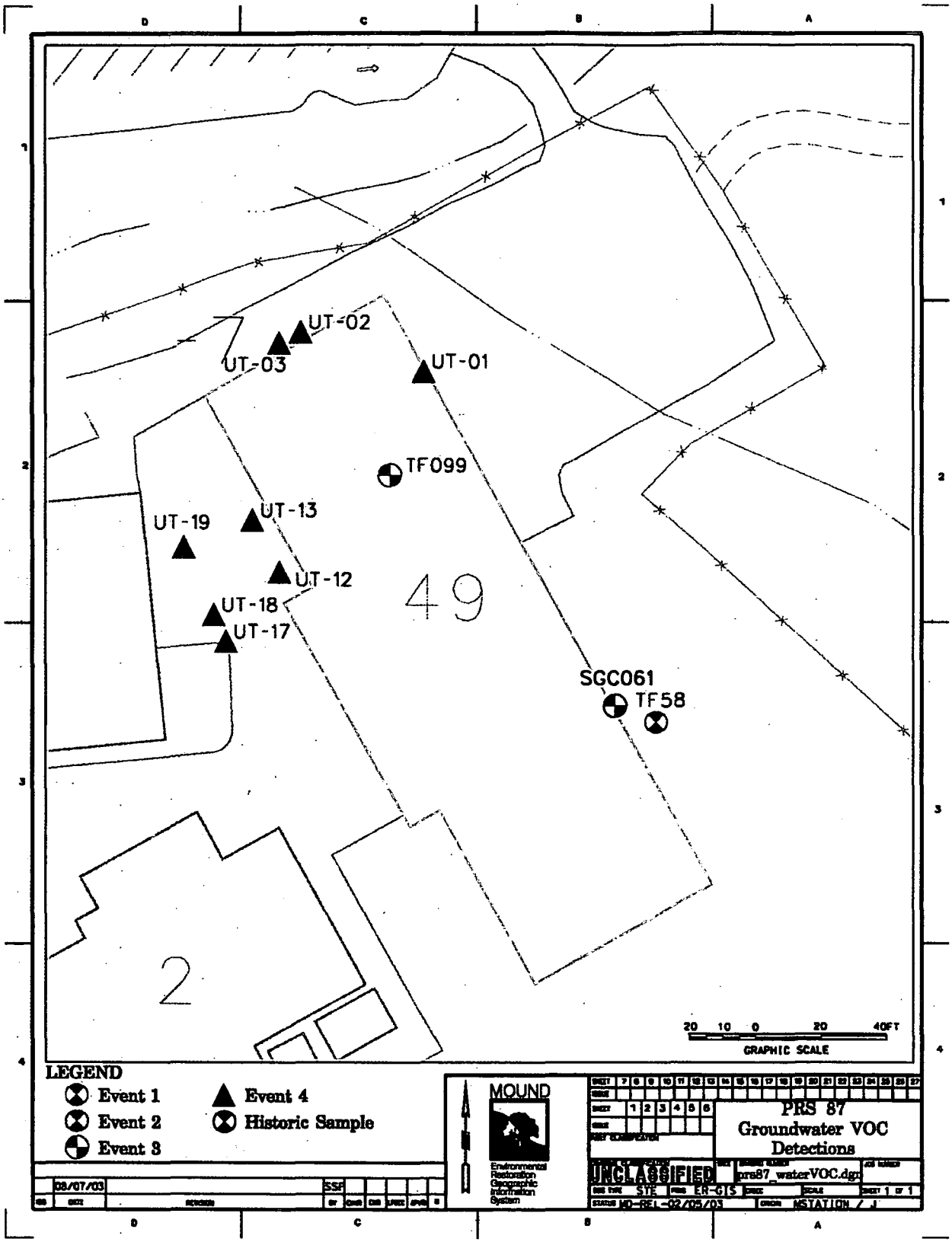


Figure 4 - Locations of Groundwater VOC Detections

Figure 5 - Trichloroethene (TCE) Soil Concentration Relative to Cleanup Objective
(view is looking northeasterly)

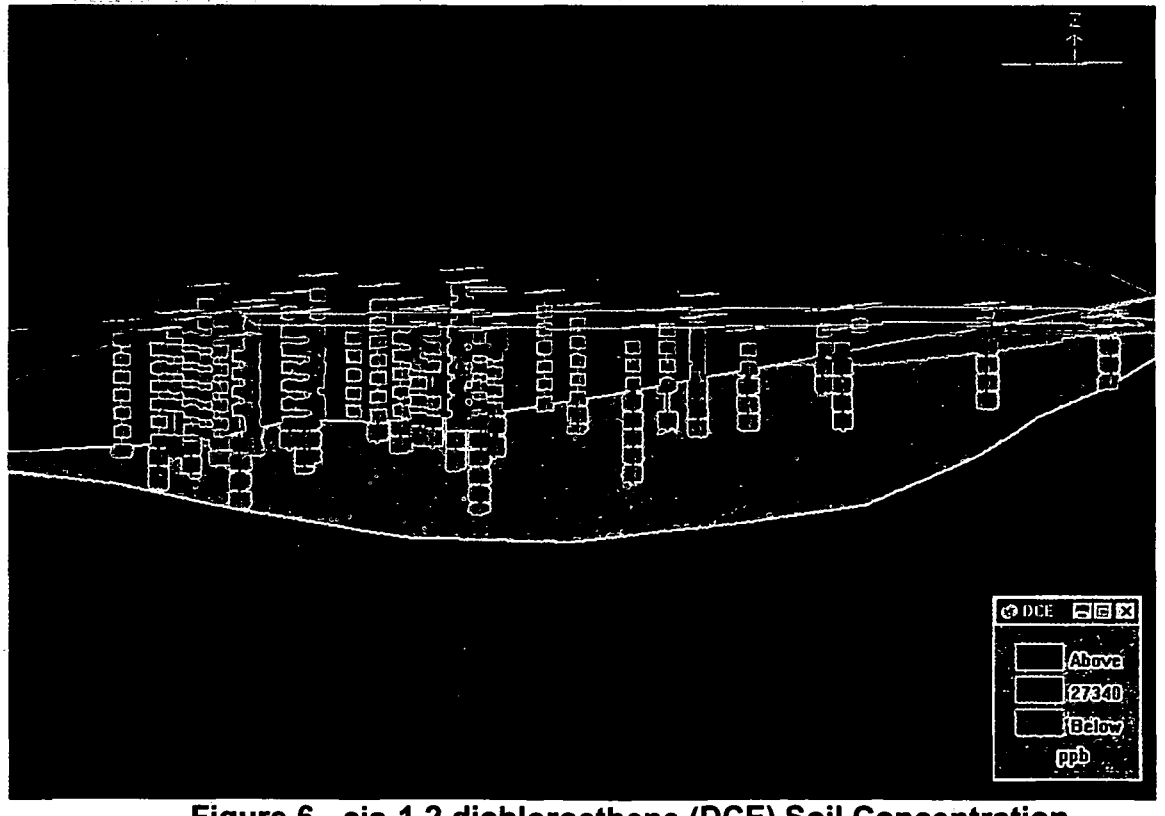


Figure 6 - cis-1,2 dichloroethene (DCE) Soil Concentration Relative to Cleanup Objective (view is looking northeasterly)

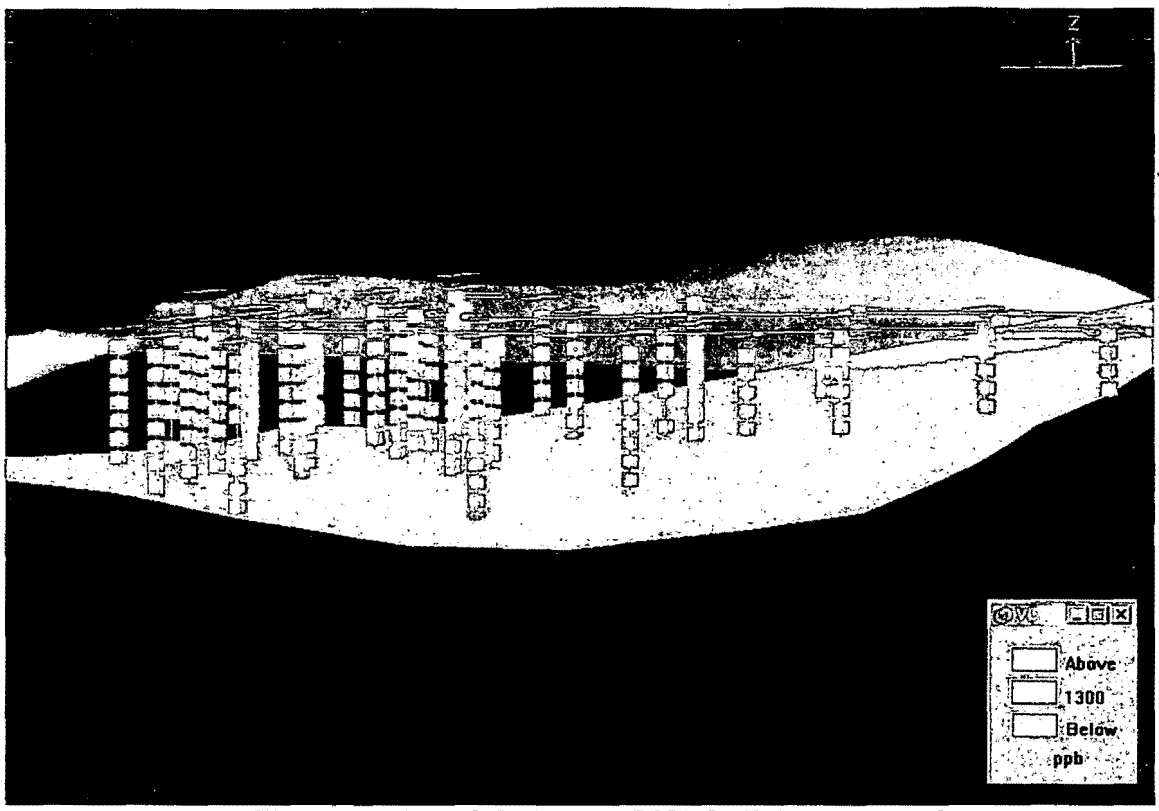


Figure 7 - Vinyl Chloride (VC) Soil Concentrations Relative to Cleanup Objective (view is looking northeasterly)

NOTE: The vinyl chloride concentration at TF 99 above 1,300 ppb is listed as a non-detect. The actual concentration may be anywhere from low ppb to just below 1,300 ppb. The sample was diluted due to high TCE and PCE levels.

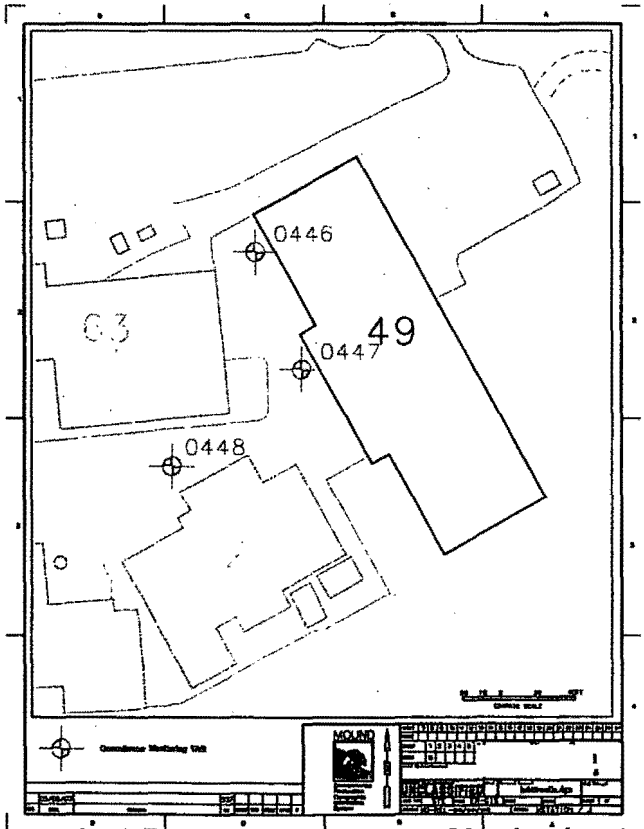


Figure 8 - PRS 87 Groundwater Monitoring Wells

2.1.4 Site Geology

Building 49 was located in the test fire valley, adjacent to the base of the steep sided Special Metallurgical- Plutonium Processing (SM-PP) hillside. The southern portion of the building butted up to the steep hillside, while the northern portion of the building was adjacent to the plant drainage ditch. Geologic logs from the sampling efforts shows depth to bedrock at two to three feet below the surface at the southern portion of the building. The bedrock surface follows the general topographic slope of the SM-PP hillside with logs showing depth to bedrock at nearly 40 feet below the surface at the northern portion of the building. The general stratigraphic sequence at the northern portion of the former Building 49 location includes the following lithologic units: 1) five to six feet of sandy-gravelly backfill located within the footprint of the building foundation excavation, 2) thick (> 20 feet) dense olive grey silty clay (glacial till), 3) thin (approximately 5 feet) grey, well sorted saturated sand (glacial outwash) and 4) Ordovician interbedded shale and limestone units. A generalized schematic developed from the boring logs is shown in Figure 9. As noted above, there have been no VOC detections in the underlying glacial outwash sand unit.

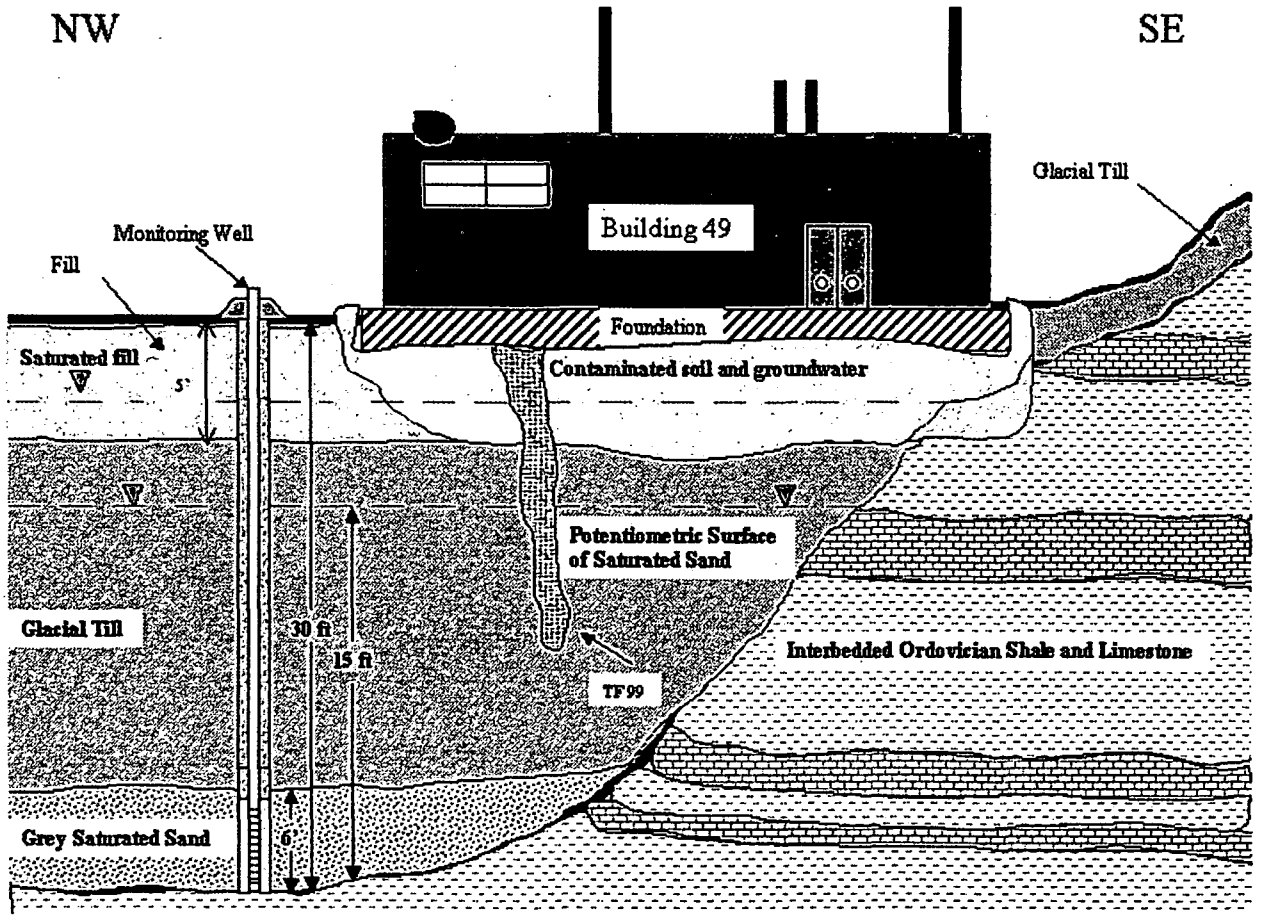


Figure 9 - Generalized Geologic Cross-section Showing Contamination at TF99

2.1.5 Release or Threatened Release into the Environment

The potential for leaching of VOCs to the underlying groundwater system has been evaluated using the Mound Soil Screening Level (SSL) Model (Ref 3). The model predicted that leaching of VOCs into the groundwater could be a potential problem. As a result, the Core team recommended this RA.

The Soil Screening Level Model was used to develop soil cleanup guidelines for TCE, DCE, and VC. Details regarding model development and results are outlined in Appendix B.

2.1.6 National Priorities List Status

The USEPA placed the Mound Plant on the NPL by publication in the Federal Register on November 21, 1989.

2.2 Other Actions to Date

The Mound Plant initiated a CERCLA program in 1989, now guided by the agreement among the DOE, OEPA, and USEPA. A Federal Facilities Agreement (FFA) under CERCLA Section 120 was executed between DOE and USEPA Region V on October 12, 1990 (Reference 4). It was revised on July 15, 1993 (EPA Administrative Docket No. OH 890-008984) to include OEPA as a signatory (Ref 5). The general purposes of the FFA are to:

- ensure that the environmental impacts associated with past and present activities at the site are thoroughly investigated and appropriate remedial actions taken as necessary to protect the public health, welfare, and the environment,
- establish a procedural framework and schedule for developing, implementing, maintaining, and monitoring appropriate response actions at the site in accordance with CERCLA, Superfund Amendments and Reauthorization Act (SARA), the NCP, Superfund guidance and policy, and Resource Conservation and Recovery Act (RCRA) guidance and policy, and
- facilitate cooperation, exchange of information, and participation of the parties in such actions.

PRS 87 was binned Further Assessment in November 1996 and in January 2002; and Removal Action in December 2002.

2.2.1 Previous Removal Actions

No previous RAs have been performed at PRS 87.

2.2.2 Current Actions

Current actions pertinent to PRS 87 soil removal include work planning, and review of characterization data. Work planning consists of the up-front work required to execute PRS

87 soil disposition activities in accordance with Environmental Safety & Health requirements, DOE orders, and best management practices.

2.3 State and Local Authorities' Roles

2.3.1 State and Local Action to Date

In 1990, as a result of the Mound Plant placement onto the NPL, DOE and USEPA entered into an FFA that specified the manner in which the CERCLA-based environmental restoration (ER) was to be implemented. In 1993, the FFA was amended to include OEPA as a signatory (Ref 5). DOE remains the lead agency.

2.3.2 Potential for Continued State and Local Response

Eventual release of the MCP Site for industrial/commercial use is planned. Periodic environmental monitoring of the area may continue for a limited time, as part of DOE's plant-wide Environmental Monitoring Program. However, any environmental monitoring required as part of the CERCLA remedy for the parcel in which PRS 87 lies, will be defined in the enforceable ROD for that parcel. This monitoring would require coordination with local, state, and federal authorities. Current plant-wide environmental monitoring programs will continue until such time as remediation is completed. OEPA will continue its oversight role until all terms of the FFA have been completed.

3.0 THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT

3.1 Threats to Public Health or Welfare

The potential release of VOCs via leaching to the groundwater may create a potential threat to the public health or welfare. Since the VOCs are subsurface, there is currently no threat to the Public Health or Welfare via direct contact or ingestion.

3.2 Threats to the Environment

The potential release of VOCs via leaching to the groundwater may create a potential threat to the environment.

3.3 Removal Site Evaluation

The Removal Site Evaluation (RSE) requirements, as outlined under USEPA's NCP regulations in the Code of Federal Regulations (CFR) 40 CFR 300.415 (Reference 6), are presented throughout this AM/EE/CA. The source and nature of the potential release are described in the PRS Data Packages for the PRS 87. On the basis of this information, the Core Team recommended a RA for PRS 87. The NCP identifies eight factors that must be considered in determining the appropriateness of a RA [40 CFR 300.415(b)(2)]. These criteria are presented and evaluated in Table 4.

Table 4 – Evaluation of Removal Action Appropriateness Criteria

Criteria	Evaluation
"...potential exposure to nearby human populations, animals, or the food chain..."	There is potential exposure to nearby human populations, animals, or the food chain from hazardous chemicals if present institutional controls were relaxed.
"Actual or potential contamination of drinking water supplies..."	There is potential contamination of onsite drinking water supplies by hazardous chemicals. The contaminants could migrate to the groundwater that is the source for the site drinking water.
"Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;"	Not applicable.
"High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;"	There is potential contamination of onsite drinking water supplies by hazardous chemicals. The contaminants could migrate to the groundwater that is the source for the site drinking water.
"Weather conditions that may cause hazardous substances to migrate or be released;"	This site is exposed to weather conditions. The contaminated soils are largely covered by the former Building 49 foundation pad which restricts infiltration of rainwater.
"Threat of fire or explosion;"	Not applicable.
"The availability of other appropriate federal or state response mechanisms to respond to the release;" and	There are no other state or federal mechanisms required to respond. The FFA established a combined state and federal mechanism to respond under CERCLA. DOE is the designated lead agency at the MCP under CERCLA.
"Other situations or factors that may pose threats to public health or welfare or the environment."	Not applicable.

4.0 ENDANGERMENT DETERMINATION

As this location is currently configured and access controlled, the subsurface VOC soil contamination does not pose an immediate danger to public health or welfare or to the environment. The Mound Soil Screening Level model does predict that the soil VOC concentrations are sufficient to potentially cause leaching to the underlying groundwater system. The model predicts leachate concentrations sufficient to cause groundwater concentrations of TCE, DCE and VC above their respective MCLs of 5 ppb, 70 ppb and 2 ppb. Because of the possibility of endangerment as the site transfers from DOE ownership and control, DOE has determined that removal of the contaminants is appropriate.

5.0 PROPOSED ACTION AND ESTIMATED COSTS

5.1 Proposed Action

The proposed action is the removal of the soils at PRS 87 that exceed the cleanup criteria. Verification of sufficient removal will be performed at PRS 87. Since the proposed action is within the site boundaries, it is not expected to have a disproportionate impact on low income or minority populations.

5.1.1 Proposed Action Description

The proposed action is expected to result in multiple fieldwork efforts. In general the action is expected to involve removal of the subsurface soils that exceed the cleanup criteria for TCE, DCE and VC. Soil removal activities appear limited to approximately 20 feet in depth and as a result, no unusual or unique excavation techniques are required for removal of this soil. Components of the proposed action include the following where applicable:

Project Planning

The major component of the proposed action is removal of VOC contaminated soils that exceed cleanup criteria.

Due to the complexity of the work, multiple work plans may be generated. Appropriate environmental controls will be considered, identified, included in the work plan documents, and applied through the work planning effort. Work plan documents will be made available to USEPA and OEPA for input and approval.

Public Notification

A notice of the availability of this AM for 30-day public review will be published in a local newspaper.

Establish Work Zones

This activity includes where applicable, establishing work zones, installing temporary facilities and utilities, performing construction hazard abatement, performing general housekeeping, and establishing dust control measures prior to removal and excavation activities.

Removal of Soil

This activity includes, as appropriate, required lockout/tagout of utilities in the vicinity of work areas and excavation and removal of contaminated soil.

Verification

This step includes sampling and analysis of soil to verify that contaminated soil has been removed and the remaining soils meet cleanup objectives. SSLs are more stringent than risk-based cleanup objectives; therefore, by meeting SSLs, any risk-based cleanup objectives will also be met. Soil cleanup objectives are outlined in Table 5, (see Appendix B

for details associated with development of the soil cleanup guidelines). Verification sampling and analysis will be in accordance with the Standard VSAP, Final, August 2004.

If information is realized before or during the course of an RA that could change the COCs verified, the information will be brought to the attention of the Core Team for evaluation.

Table 5 – Soil Cleanup Objectives (ug/kg)

Contaminant	Cleanup Objective
Trichloroethene (TCE)	6,310
Cis-1,2 dichloroethene (DCE)	27,340
Vinyl Chloride (VC)	1,300

Site Restoration

Equipment, materials, waste containers, and barricades will be removed. Excavations resulting from removal of contaminated soil will be backfilled and compacted to original contours and elevation unless otherwise specified. The area will be seeded, if appropriate.

Documentation of Completion

Completion and documentation of all activities required by this AM will be presented in a single OSC Report.

5.1.1.1 Rationale, Technical Feasibility, and Effectiveness

The RA chosen is necessary for the removal of known contamination and to ensure that migration of the contamination does not occur.

Verification sampling will be employed to confirm the effectiveness of the RA. Verification sampling results will be documented in the OSC Report.

5.1.1.2 Monitoring

Health and safety monitoring will be performed throughout the RAs according to standard MCP procedures.

5.1.1.3 Uncertainties

An uncertainty is the concentration levels of the contaminants and the extent of contamination (lateral and depth). This uncertainty is considered minor due to the extensive characterization data for the PRS.

5.1.1.4 Institutional Controls

DOE will remain in control of the locations addressed by this RA until transfer of ownership of the parcel it is in. If necessary, enforceable deed restrictions will be in place at the time of transfer in order to ensure future protection of human health and the environment.

5.1.1.5 *Post-Removal Site Control*

Initially, post-removal site control will be provided by DOE/ MCP. The property is to be sold to Miamisburg Mound Community Improvement Corporation (MMCIC). The institutional and site controls needed at the time of the site transfer in order to ensure future protection of human health and the environment will be included in the ROD for the parcel in which PRS 87 lies.

5.1.1.6 *Cross-Media Relationships and Potential Adverse Impacts*

The potential cross-media impact associated with a RA is the potential for unintended release of contaminated materials into the atmosphere. Industrial hygiene monitoring and control will be implemented during the RA.

No potential adverse impacts of the RA have been identified.

5.1.2 Contribution to Future Remedial Actions

To facilitate Further Assessments and RAs in or near the site of this RA, the exact dimensions of the excavation and the levels of contamination identified and removed will be documented. The OSC Report will document the RA with photographs, drawings, and other information collected during the fieldwork.

The information obtained, as a result of this removal, will be used in determining the availability of the site for final disposition and will be subject to review in the subsequent residual risk evaluation.

5.1.3 Description of Alternative Technologies

Alternative technologies frequently evaluated for CERCLA remediation include institutional controls, containment, collection, treatment and disposal. Based on the conditions at PRS 87 (Vadose zone soils contaminated with VOCs), the following alternatives (in addition to the proposed action of soil removal) are developed for consideration:

- In-situ Chemical Oxidation
- Enhanced Bioremediation
- Resistive Heating with or without Steam Injection
- Air Sparging
- Soil Vapor Extraction
- Excavation
- Groundwater Recovery / vertical wells dewatering, Air Stripping and Granular Activated Carbon
- No Action
- Institutional Controls

The no action and the institutional control alternatives were eliminated from further consideration. The no action alternative will not alleviate the potential for migration

(leaching) of VOCs into the underlying groundwater system. One or more institutional controls, specific for PRS 87, was eliminated from further consideration because (per DOE Policy 454.1 "Use of Institutional Controls") DOE typically uses institutional controls to supplement active remediation, public and resource protection, physical security, or to bolster the integrity of engineered remedies. Accordingly, institutional controls (as a sole remedy) were eliminated from further consideration for PRS 87. However, the DOE has already determined, in previous RODs for discrete land parcels, that a limited number of institutional controls are appropriate on a "site-wide" basis. The institutional controls that have been applied to all parcels that have completed the CERCLA process for property transfer to-date include: prohibition against use of groundwater, prohibition against removal of soil from the original DOE Mound Plant boundaries, and prohibition against any land use other than Industrial/Commercial. At a minimum, the above three "site-wide" institutional controls will be included in the ROD for the parcel in which PRS 87 lies.

The performance capabilities of each alternative with respect to threshold criteria and balancing criteria are discussed in Table 6 (see Appendix A).

5.1.4 Preferred Alternative

The preferred alternative for PRS 87 is excavation of soil above guideline values. This option is selected as the preferred alternative based on the following primary factors:

- confidence in removal of all contaminated material above guideline values, (e.g. in-situ options involve more uncertainty and may therefore require engineering changes that could drive cost and more importantly schedule beyond acceptable limits)

- schedule requirements (e.g. other in-situ options would involve pilot testing and potentially longer operation time frames than schedule can permit

The excavation will require dewatering the Building 49 foundation fill. There are several options for handling the water including:

Pump water and treat with a portable air stripper

Collect waste and send to plant sanitary system

Collect water and send through Operable Unit 1 air stripper

The best option will depend on the recharge capacity of the foundation fill area. An investigation into the recharge capacity of this area will be conducted in the summer of 2004. The final details will be outlined in the PRS 87 work package.

5.1.5 EE/CA

This document serves as the Action Memorandum and EE/CA.

5.1.6 Applicable or Relevant and Appropriate Requirements (ARARs)

Site ARARs for the ER Program have been identified and CERCLA regulations require that RAs comply with ARARs.

The following have been identified as applicable, or relevant and appropriate to this RA:

5.1.6.1 Air Quality

- 40 CFR Part 61 Subpart H: National Emissions Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities.
- Ohio Administrative Code (OAC) 3745-15-07(A): Air Pollution Nuisances Prohibited.
- OAC 3745-17-02 (A, B, C): Particulate Ambient Air Quality Standards
- OAC 3745-17-05: Particulate Non-Degradation Policy
- OAC 3745-17-08: (A1), (A2), (B), (D): Emission Restrictions for Fugitive Dust

5.1.6.2 To Be Considered

- EPA/230/02-89/042: Methods for Evaluating the Attainment of Cleanup Standards.
- DOE Order 5400.5: Radiation Protection of the Public and the Environment

5.1.6.3 Worker Safety

- 29 CFR Part 1910: Occupational Safety and Health Act (OSHA) - General Industry Standards
- 29 CFR Part 1926: OSHA - Safety and Health Standards
- 29 CFR Part 1904: OSHA - Record keeping, Reporting, and Related Regulations

5.1.6.4 Stormwater Runoff

- National Pollutant Discharge Elimination System (NPDES) Permit No. 1IO00005*HD, June 1998

5.1.6.5 Hazardous Waste

- OAC 3745-52-11: Hazardous waste determination
- OAC 3745-55-71 through 74, 3745-52-34(C)(1)(b): Container management
- OAC 3745-52-20 through 33: Hazardous waste transportation

5.1.7 Other Standards and Requirements

- 49 CFR 172, 173: Department of Transportation (DOT) hazardous material transportation and employee training requirements.

Other standards or requirements related to the actual implementation of the RA may be identified subsequently during the design phase and will be incorporated into the Work Plans for these RAs.

5.1.8 Project Schedule

The schedule established for planning and implementing the fieldwork is illustrated in Table 7. The schedule indicates fieldwork campaigns for this Action Memorandum.

Table 7–Schedule

PRS 87 VOC Contaminated Soil Removal	Start	Finish
Planning	Q2-FY2004	Q3-FY2004
Field Work	Q1-FY2005	Q2-FY2005
Verification/OSC	Q2-FY2005	Q2-FY2005

5.2 Estimated Costs

The cost estimate to perform the RA is shown in Table 8. Costs include the construction activities, all engineering and construction management, and site restoration. The cost estimate does not include waste disposal costs.

Table 8–Cost Estimate

PRS 87 VOC Contaminated Soil Removal	Cost
Planning	$50,000
Field Work	$125,000
Verification/OSC	$10,000
TOTAL	**$ 185,000**

6.0 EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

There is the potential for the contaminants to migrate if action is delayed or not taken. Based on historical groundwater data from the PRS 87 area there has not been any migration of VOC contaminants into the groundwater system, however, the potential does still exist.

7.0 OUTSTANDING POLICY ISSUES

There are currently no outstanding policy issues affecting performance of this RA.

8.0 ENFORCEMENT

The Core Team consisting of DOE, USEPA, and OEPA has agreed on the need to perform the removal. The work described in this document does not create a waiver of any rights under the FFA, nor is it intended to create a waiver of any rights under the FFA. The DOE

is the sole party responsible for implementing this cleanup. Therefore, DOE is undertaking the role of lead agency, per CERCLA and the NCP, for the performance of this RA. The funding for this RA will be through DOE budget authorization and no Superfund monies will be required.

9.0 REFERENCES

Reference 1. PRS 72/73/87 Test Fire Valley Further Assessment Data Report, March 2002

Reference 2. PRS 87 Further Assessment Data Report, June 2003

Reference 3. Potential Release Site packages *Reading and Understanding* Volume II, Attachment D4, August 1996

Reference 4. Federal Facilities Agreement under CERCLA Section 120, USEPA, October 12, 1990

Reference 5. USEPA 1993. Federal Facilities Agreement under CERCLA Section 120, USEPA, July 15, 1993

Reference 6. Code of Federal Regulations, 40CFR 300.415(b)(2)

10.0 RECOMMENDATION

This decision document represents the selected Removal Action for the PRS 87 VOC contaminated soils, developed in accordance with CERCLA as amended by SARA, and not inconsistent with the NCP. This decision is based on the administrative record for the site.

Conditions at the site meet the NCP Section 300.415 (b)(2) criteria for a removal and we recommend initiation of the Removal Action.

Approved:

DOE/MCP:	Paul Lucas Paul Lucas, Remedial Project Manager	11/16/04 Date
USEPA:	Timothy J. Fischer Tim Fischer, Remedial Project Manager	11/16/04 Date
OEPA:	B. K. Nickel Brian K. Nickel, Project Manager	11/16/04 Date

APPENDIX A

Tables 1, 2, 3, & 6

Table 1

SOIL VOLATILE ORGANIC COMPOUND DETECTIONS
(bold type indicates measured value exceeds Cleanup Objective)

Location_name	Value_name	Measured_value	Value_units	Data_qualifier	Lab_qualifier	End_depth
TF094	TCE	3	UG/KG		J	1
TF097	1,2-Dichloroethene*	85	UG/KG			8
TF097	Tetrachloroethene**	8	UG/KG			28
TF097	TCE	3	UG/KG		J	4
TF097	TCE	20	UG/KG			8
TF097	VC	20	UG/KG			8
TF098	TCE	2	UG/KG		J	4
TF099	1,2-Dichloroethene	6	UG/KG			4
TF099	1,2-Dichloroethene	11,000	UG/KG		D	8
TF099	1,2-Dichloroethene	5,100	UG/KG		D	12
TF099	1,2-Dichloroethene	840	UG/KG		D	16
TF099	1,2-Dichloroethene	92	UG/KG			20
TF099	1,2-Dichloroethene	16	UG/KG			24
TF099	1,2-Dichloroethene	5	UG/KG		J	28
TF099	1,2-Dichloroethene	23	UG/KG			28
TF099	1,2-Dichloroethene	4	UG/KG		J	33
TF099	TCE	210	UG/KG			4
TF099	**TCE**	**23,000**	**UG/KG**		**D**	**8**
TF099	TCE	27	UG/KG			12
TF099	TCE	6	UG/KG			16
TF099	TCE	2	UG/KG		J	20
TF099	TCE	2	UG/KG		J	24
TF099	TCE	1	UG/KG		J	28
TF099	TCE	3	UG/KG		J	28
TF099	TCE	3	UG/KG		J	33
TF099	VC	400	UG/KG		JD	12
TF099	VC	160	UG/KG			16
TF099	VC	18	UG/KG			20
TF100	1,2-Dichloroethene	2	UG/KG		J	4
TF100	TCE	4	UG/KG		J	4
TF102	1,2-Dichloroethene	12	UG/KG			4
TF102	1,2-Dichloroethene	160	UG/KG			8
TF102	TCE	120	UG/KG			4
TF102	TCE	1	UG/KG		J	8
TF102	VC	3	UG/KG		J	8
TF103	1,2-Dichloroethene	5	UG/KG		J	8
TF103	TCE	7	UG/KG			4
TF103	TCE	3	UG/KG		J	8
TF104	1,2-Dichloroethene	8	UG/KG			4
TF104	1,2-Dichloroethene	1,900	UG/KG		D	8
TF104	1,2-Dichloroethene	1,800	UG/KG		D	12
TF104	1,2-Dichloroethene	5	UG/KG		J	16
TF104	1,2-Dichloroethene	2	UG/KG		J	24
TF104	1,2-Dichloroethene	5	UG/KG		J	32
TF104	1,2-Dichloroethene	3	UG/KG		J	36
TF104	TCE	160	UG/KG			4

Location_name	Value_name	Measured_value	Value_units	Data_qualifier	Lab_qualifier	End_depth
TF104	TCE	24	UG/KG			8
TF104	TCE	8	UG/KG			12
TF104	VC	8	UG/KG		J	16
TF105	1,2-Dichloroethene	9	UG/KG			8
TF105	1,2-Dichloroethene	1	UG/KG		J	12
TF105	1,2-Dichloroethene	1	UG/KG		J	16
TF105	1,2-Dichloroethene	1	UG/KG		J	20
TF105	1,2-Dichloroethene	2	UG/KG		J	29
TF55	1,2-Dichloroethene	24	UG/KG			12
TF58	TCE	23	UG/KG			4
TF59	TCE	4	UG/KG		J	4
TF61	1,2-Dichloroethene	4	UG/KG		J	4
TF61	TCE	150	UG/KG			4
TF61	TCE	100	UG/KG			4
TF74	TCE	1	UG/KG		J	12
TF79	1,2-Dichloroethene	110	UG/KG			8
TF79	1,2-Dichloroethene	3,100	UG/KG		D	12
TF79	1,2-Dichloroethene	470	UG/KG		D	16
TF79	1,2-Dichloroethene	240	UG/KG		D	20
TF79	1,2-Dichloroethene	79	UG/KG			24
TF79	1,2-Dichloroethene	300	UG/KG		D	28
TF79	1,2-Dichloroethene	2	UG/KG		J	32
TF79	1,2-Dichloroethene	25	UG/KG			36
TF79	TCE	1	UG/KG		J	4
TF79	TCE	1	UG/KG		J	12
TF79	VC	24	UG/KG			12
TF79	VC	88	UG/KG			16
TF79	VC	140	UG/KG			20
TF79	VC	13	UG/KG			24
TF79	VC	20	UG/KG			28
TF81	1,2-Dichloroethene	140	UG/KG			8
TF81	TCE	2	UG/KG	J	J	4
TF81	TCE	2	UG/KG		J	8
TF82	TCE	2	UG/KG		J	4
TF82	TCE	3	UG/KG		J	4
TF82	TCE	4	UG/KG		J	8
TF85	TCE	6	UG/KG		J	4
TF89	TCE	2	UG/KG		J	24
UT-01	1,2-Dichloroethene	140	UG/KG			0
UT-01	TCE	2	UG/KG		J	0
UT-02	1,2-Dichloroethene	35	UG/KG			0
UT-02	TCE	47	UG/KG			0
UT-03	TCE	4	UG/KG		J	0
UT-04	TCE	4	UG/KG		J	0
UT-05	TCE	1	UG/KG		J	0
UT-06	1,2-Dichloroethene	48	UG/KG			0
UT-06	TCE	21	UG/KG			0
UT-07	1,2-Dichloroethene	1	UG/KG		J	0
UT-07	TCE	38	UG/KG			0
UT-09	1,2-Dichloroethene	53	UG/KG			0
UT-09	TCE	69	UG/KG			0
UT-11	1,2-Dichloroethene	2	UG/KG		J	0

Location_name	Value_name	Measured_value	Value_units	Data_qualifier	Lab_qualifier	End_depth
UT-11	TCE	1	UG/KG		J	0
UT-12	1,2-Dichloroethene	81	UG/KG			0
UT-12	TCE	81	UG/KG			0
UT-13	1,2-Dichloroethene	20	UG/KG			0
UT-13	TCE	7	UG/KG		J	0
UT-17	TCE	8	UG/KG		J	0
UT-18	TCE	3	UG/KG		J	0
SGC061	VC	11	UG/KG		U	0
SGC061	1,2-Dichloroethene	36	UG/KG			0
SGC061	TCE	5,400	UG/KG		E	0
SGC061	Tetrachloroethene	1	UG/KG		J	0

Collection_date for SCG061
19960208

- *1,2-Dichloroethene includes both cis and trans isomers; however, based on process knowledge, this data represents the cis configuration*

This page intentionally left blank.

Table 2 Groundwater VOC Detections

Sample Location	Value name	Measured value	Value units	Lab qualifier
TF099	1,2-Dichloroethene*	17,000	UG/L	
TF099	Trichloroethylene	160	UG/L	
TF099	Vinyl Chloride	3,500	UG/L	
TF58	1,2-Dichloroethene	48	UG/L	
TF58	Trichloroethylene	14	UG/L	
TF58	Vinyl Chloride	54	UG/L	
UT-01	1,2-Dichloroethene	2,400	UG/L	
UT-01	1,2-Dichloroethene	2,500	UG/L	
UT-01	Trichloroethylene	24	UG/L	
UT-01	Vinyl Chloride	130	UG/L	
UT-02	1,2-Dichloroethene	42	UG/L	
UT-02	1,2-Dichloroethene	44	UG/L	
UT-02	Trichloroethylene	54	UG/L	
UT-02	Vinyl Chloride	3.3	UG/L	
UT-03	Trichloroethylene	2.3	UG/L	
UT-12	1,2-Dichloroethene	28	UG/L	
UT-12	1,2-Dichloroethene	28	UG/L	
UT-12	Trichloroethylene	17	UG/L	
UT-13	1,2-Dichloroethene	10	UG/L	
UT-13	1,2-Dichloroethene	10	UG/L	
UT-13	Trichloroethylene	19	UG/L	
UT-17	1,2-Dichloroethene	0.9	UG/L	J**
UT-17	Trichloroethylene	1.8	UG/L	
UT-18	1,2-Dichloroethene	2	UG/L	
UT-18	Trichloroethylene	12	UG/L	
UT-19	1,2-Dichloroethene	0.94	UG/L	J
UT-19	Trichloroethylene	9	UG/L	

* *1,2-Dichloroethene includes both cis and trans isomers; however, based on process knowledge, and TCE biodegradation mechanics this data represents the cis configuration.*

** *J = Indicates an estimated value.*

This page intentionally left blank.

Table 3: Monitoring Well Data

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20021014	1,1-Dichloroethene	1.3	UG/L	U
446	20021014	1,2-cis-Dichloroethene	1	UG/L	U
446	20021014	1,2-Dichloroethene	1	UG/L	U
446	20021014	1,2-trans-Dichloroethene	1	UG/L	U
446	20021014	Tetrachloroethene	0.3	UG/L	U
446	20021014	Trichloroethylene (TCE)	1.2	UG/L	U
446	20021014	Vinyl Chloride	1	UG/L	U
446	20021028	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20021028	1,1,1-Trichloroethane	0.3	UG/L	U
446	20021028	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20021028	1,1,2-Trichloroethane	0.2	UG/L	U
446	20021028	1,1-Dichloroethane	0.7	UG/L	U
446	20021028	1,1-Dichloroethene	1.3	UG/L	U
446	20021028	1,2,3-Trichloropropane	1	UG/L	U
446	20021028	1,2-cis-Dichloroethene	1	UG/L	U
446	20021028	1,2-Dichlorobenzene	1.5	UG/L	U
446	20021028	1,2-Dichloroethane	0.3	UG/L	U
446	20021028	1,2-Dichloropropane	0.4	UG/L	U
446	20021028	1,2-trans-Dichloroethene	1	UG/L	U
446	20021028	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20021028	1,3-Dichlorobenzene	3.2	UG/L	U
446	20021028	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20021028	1,4-Dichlorobenzene	2.4	UG/L	U
446	20021028	1-Chlorohexane	1	UG/L	U
446	20021028	2-Butanone	2	UG/L	U
446	20021028	2-Chloroethylvinylether	1.3	UG/L	U
446	20021028	2-Chlorotoluene	1	UG/L	U
446	20021028	4-Chlorotoluene	1	UG/L	U
446	20021028	Benzene	2	UG/L	U
446	20021028	Bromodichloromethane	1	UG/L	U
446	20021028	Bromoform	2	UG/L	U
446	20021028	Carbon Tetrachloride	1.2	UG/L	U
446	20021028	Chlorobenzene	2	UG/L	U
446	20021028	Dibromochloromethane	0.9	UG/L	U
446	20021028	Dibromomethane	2	UG/L	U
446	20021028	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20021028	Ethylbenzene	2	UG/L	U
446	20021028	FREON-113	2	UG/L	U
446	20021028	Monobrombenzene (Phenyl bromide)	2	UG/L	U
446	20021028	Tetrachloroethene	0.3	UG/L	U
446	20021028	Toluene	2	UG/L	U
446	20021028	Trichloroethylene (TCE)	1.2	UG/L	U
446	20021028	Trichlorofluoromethane	2	UG/L	U
446	20021028	Trichloromethane	0.5	UG/L	U
446	20021028	Vinyl Chloride	1	UG/L	U
446	20021028	Xylenes, Total	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20030205	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20030205	1,1,1-Trichloroethane	0.3	UG/L	U
446	20030205	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20030205	1,1,2-Trichloroethane	0.2	UG/L	U
446	20030205	1,1-Dichloroethane	0.7	UG/L	U
446	20030205	1,1-Dichloroethene	1.3	UG/L	U
446	20030205	1,2,3-Trichloropropane	1	UG/L	U
446	20030205	1,2-cis-Dichloroethene	1	UG/L	U
446	20030205	1,2-Dichlorobenzene	1.5	UG/L	U
446	20030205	1,2-Dichloroethane	0.3	UG/L	U
446	20030205	1,2-Dichloropropane	0.4	UG/L	U
446	20030205	1,2-trans-Dichloroethene	1	UG/L	U
446	20030205	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20030205	1,3-Dichlorobenzene	3.2	UG/L	U
446	20030205	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20030205	1,4-Dichlorobenzene	2.4	UG/L	U
446	20030205	1-Chlorohexane	1	UG/L	U
446	20030205	2-Butanone	2	UG/L	U
446	20030205	2-Chloroethylvinylether	1.3	UG/L	U
446	20030205	2-Chlorotoluene	1	UG/L	U
446	20030205	4-Chlorotoluene	1	UG/L	U
446	20030205	Benzene	2	UG/L	U
446	20030205	Bromodichloromethane	1	UG/L	U
446	20030205	Bromoform	2	UG/L	U
446	20030205	Carbon Tetrachloride	1.2	UG/L	U
446	20030205	Chlorobenzene	2	UG/L	U
446	20030205	Dibromochloromethane	0.9	UG/L	U
446	20030205	Dibromomethane	2	UG/L	U
446	20030205	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20030205	Ethylbenzene	2	UG/L	U
446	20030205	FREON-113	2	UG/L	U
446	20030205	Monobrombenzene (Phenyl bromide)	2	UG/L	U
446	20030205	Tetrachloroethene	0.3	UG/L	U
446	20030205	Toluene	2	UG/L	U
446	20030205	Trichloroethylene (TCE)	1.2	UG/L	U
446	20030205	Trichlorofluoromethane	2	UG/L	U
446	20030205	Trichloromethane	0.5	UG/L	U
446	20030205	Vinyl Chloride	1	UG/L	U
446	20030205	Xylenes, Total	2	UG/L	U
446	20030425	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20030425	1,1,1-Trichloroethane	0.3	UG/L	U
446	20030425	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20030425	1,1,2-Trichloroethane	0.2	UG/L	U
446	20030425	1,1-Dichloroethane	0.7	UG/L	U
446	20030425	1,1-Dichloroethene	1.3	UG/L	U
446	20030425	1,2,3-Trichloropropane	1	UG/L	U
446	20030425	1,2-cis-Dichloroethene	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20030425	1,2-Dichlorobenzene	1.5	UG/L	U
446	20030425	1,2-Dichloroethane	0.3	UG/L	U
446	20030425	1,2-Dichloropropane	0.4	UG/L	U
446	20030425	1,2-trans-Dichloroethene	1	UG/L	U
446	20030425	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20030425	1,3-Dichlorobenzene	3.2	UG/L	U
446	20030425	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20030425	1,4-Dichlorobenzene	2.4	UG/L	U
446	20030425	1-Chlorohexane	1	UG/L	U
446	20030425	2-Butanone	2	UG/L	U
446	20030425	2-Chloroethylvinylether	1.3	UG/L	U
446	20030425	2-Chlorotoluene	1	UG/L	U
446	20030425	4-Chlorotoluene	1	UG/L	U
446	20030425	Benzene	2	UG/L	U
446	20030425	Bromodichloromethane	1	UG/L	U
446	20030425	Bromoform	2	UG/L	U
446	20030425	Carbon Tetrachloride	1.2	UG/L	U
446	20030425	Chlorobenzene	2	UG/L	U
446	20030425	Dibromochloromethane	0.9	UG/L	U
446	20030425	Dibromomethane	2	UG/L	U
446	20030425	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20030425	Ethylbenzene	2	UG/L	U
446	20030425	FREON-113	2	UG/L	U
446	20030425	Monobrombenzene (Phenyl bromide)	2	UG/L	U
446	20030425	Tetrachloroethene	0.3	UG/L	U
446	20030425	Toluene	2	UG/L	U
446	20030425	Trichloroethylene (TCE)	1.2	UG/L	U
446	20030425	Trichlorofluoromethane	2	UG/L	U
446	20030425	Trichloromethane	0.5	UG/L	U
446	20030425	Vinyl Chloride	1	UG/L	U
446	20030425	Xylenes, Total	2	UG/L	U
446	20030718	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20030718	1,1,1-Trichloroethane	0.3	UG/L	U
446	20030718	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20030718	1,1,2-Trichloroethane	0.2	UG/L	U
446	20030718	1,1-Dichloroethane	0.7	UG/L	U
446	20030718	1,1-Dichloroethene	1.3	UG/L	U
446	20030718	1,2,3-Trichloropropane	1	UG/L	U
446	20030718	1,2-cis-Dichloroethene	1	UG/L	U
446	20030718	1,2-Dichlorobenzene	1.5	UG/L	U
446	20030718	1,2-Dichloroethane	0.3	UG/L	U
446	20030718	1,2-Dichloropropane	0.4	UG/L	U
446	20030718	1,2-trans-Dichloroethene	1	UG/L	U
446	20030718	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20030718	1,3-Dichlorobenzene	3.2	UG/L	U
446	20030718	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20030718	1,4-Dichlorobenzene	2.4	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20030718	1-Chlorohexane	1	UG/L	U
446	20030718	2-Butanone	2	UG/L	U
446	20030718	2-Chloroethylvinylether	1.3	UG/L	U
446	20030718	2-Chlorotoluene	1	UG/L	U
446	20030718	4-Chlorotoluene	1	UG/L	U
446	20030718	Benzene	2	UG/L	U
446	20030718	Bromodichloromethane	1	UG/L	U
446	20030718	Bromoform	2	UG/L	U
446	20030718	Carbon Tetrachloride	1.2	UG/L	U
446	20030718	Chlorobenzene	2	UG/L	U
446	20030718	Dibromochloromethane	0.9	UG/L	U
446	20030718	Dibromomethane	2	UG/L	U
446	20030718	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20030718	Ethylbenzene	2	UG/L	U
446	20030718	FREON-113	2	UG/L	U
446	20030718	Monobrombenzene (Phenyl bromide)	2	UG/L	U
446	20030718	Tetrachloroethene	0.3	UG/L	U
446	20030718	Toluene	2	UG/L	U
446	20030718	Trichloroethylene (TCE)	1.2	UG/L	U
446	20030718	Trichlorofluoromethane	2	UG/L	U
446	20030718	Trichloromethane	0.5	UG/L	U
446	20030718	Vinyl Chloride	1	UG/L	U
446	20030718	Xylenes, Total	2	UG/L	U
446	20040120	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20040120	1,1,1-Trichloroethane	0.3	UG/L	U
446	20040120	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20040120	1,1,2-Trichloroethane	0.2	UG/L	U
446	20040120	1,1-Dichloroethane	0.7	UG/L	U
446	20040120	1,1-Dichloroethene	1.3	UG/L	U
446	20040120	1,2,3-Trichloropropane	1	UG/L	U
446	20040120	1,2-cis-Dichloroethene	1	UG/L	U
446	20040120	1,2-Dichlorobenzene	1.5	UG/L	U
446	20040120	1,2-Dichloroethane	0.3	UG/L	U
446	20040120	1,2-Dichloropropane	0.4	UG/L	U
446	20040120	1,2-trans-Dichloroethene	1	UG/L	U
446	20040120	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20040120	1,3-Dichlorobenzene	3.2	UG/L	U
446	20040120	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20040120	1,4-Dichlorobenzene	2.4	UG/L	U
446	20040120	1-Chlorohexane	1	UG/L	U
446	20040120	2-Butanone	2	UG/L	U
446	20040120	2-Chloroethylvinylether	1.3	UG/L	U
446	20040120	2-Chlorotoluene	1	UG/L	U
446	20040120	4-Chlorotoluene	1	UG/L	U
446	20040120	Benzene	2	UG/L	U
446	20040120	Bromodichloromethane	1	UG/L	U
446	20040120	Bromoform	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20040120	Carbon Tetrachloride	1.2	UG/L	U
446	20040120	Chlorobenzene	2	UG/L	U
446	20040120	Dibromochloromethane	0.9	UG/L	U
446	20040120	Dibromomethane	2	UG/L	U
446	20040120	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20040120	Ethylbenzene	2	UG/L	U
446	20040120	FREON-113	2	UG/L	U
446	20040120	Monobromobenzene (Phenyl bromide)	2	UG/L	U
446	20040120	Tetrachloroethene	0.3	UG/L	U
446	20040120	Toluene	2	UG/L	U
446	20040120	Trichloroethylene (TCE)	1.2	UG/L	U
446	20040120	Trichlorofluoromethane	2	UG/L	U
446	20040120	Trichloromethane	0.5	UG/L	U
446	20040120	Vinyl Chloride	1	UG/L	U
446	20040120	Xylenes, Total	2	UG/L	U
446	20040414	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20040414	1,1,1-Trichloroethane	0.36	UG/L	
446	20040414	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20040414	1,1,2-Trichloroethane	0.2	UG/L	U
446	20040414	1,1-Dichloroethane	0.7	UG/L	U
446	20040414	1,1-Dichloroethene	1.3	UG/L	U
446	20040414	1,2,3-Trichloropropane	1	UG/L	U
446	20040414	1,2-cis-Dichloroethene	1	UG/L	U
446	20040414	1,2-Dichlorobenzene	1.5	UG/L	U
446	20040414	1,2-Dichloroethane	0.3	UG/L	U
446	20040414	1,2-Dichloropropane	0.4	UG/L	U
446	20040414	1,2-trans-Dichloroethene	1	UG/L	U
446	20040414	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20040414	1,3-Dichlorobenzene	3.2	UG/L	U
446	20040414	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20040414	1,4-Dichlorobenzene	2.4	UG/L	U
446	20040414	1-Chlorohexane	1	UG/L	U
446	20040414	2-Butanone	1.9	UG/L	J
446	20040414	2-Chloroethylvinylether	1.3	UG/L	U
446	20040414	2-Chlorotoluene	1	UG/L	U
446	20040414	4-Chlorotoluene	1	UG/L	U
446	20040414	Benzene	2	UG/L	U
446	20040414	Bromodichloromethane	1	UG/L	U
446	20040414	Bromoform	2	UG/L	U
446	20040414	Carbon Tetrachloride	1.2	UG/L	U
446	20040414	Chlorobenzene	2	UG/L	U
446	20040414	Dibromochloromethane	0.9	UG/L	U
446	20040414	Dibromomethane	2	UG/L	U
446	20040414	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20040414	Ethylbenzene	2	UG/L	U
446	20040414	FREON-113	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20040414	Monobromobenzene (Phenyl bromide)	2	UG/L	U
446	20040414	Tetrachloroethene	0.3	UG/L	U
446	20040414	Toluene	2	UG/L	U
446	20040414	Trichloroethylene (TCE)	1.2	UG/L	U
446	20040414	Trichlorofluoromethane	2	UG/L	U
446	20040414	Trichloromethane	0.5	UG/L	U
446	20040414	Vinyl Chloride	1	UG/L	U
446	20040414	Xylenes, Total	2	UG/L	U
446	20040707	1,1,1,2-Tetrachloroethane	1	UG/L	U
446	20040707	1,1,1-Trichloroethane	0.3	UG/L	U
446	20040707	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
446	20040707	1,1,2-Trichloroethane	0.2	UG/L	U
446	20040707	1,1-Dichloroethane	0.7	UG/L	U
446	20040707	1,1-Dichloroethene	1.3	UG/L	U
446	20040707	1,2,3-Trichloropropane	1	UG/L	U
446	20040707	1,2-cis-Dichloroethene	1	UG/L	U
446	20040707	1,2-Dichlorobenzene	1.5	UG/L	U
446	20040707	1,2-Dichloroethane	0.3	UG/L	U
446	20040707	1,2-Dichloropropane	0.4	UG/L	U
446	20040707	1,2-trans-Dichloroethene	1	UG/L	U
446	20040707	1,3-cis-Dichloropropene	3.4	UG/L	U
446	20040707	1,3-Dichlorobenzene	3.2	UG/L	U
446	20040707	1,3-trans-Dichloropropene	3.4	UG/L	U
446	20040707	1,4-Dichlorobenzene	2.4	UG/L	U
446	20040707	1-Chlorohexane	1	UG/L	U
446	20040707	2-Butanone	2	UG/L	U
446	20040707	2-Chloroethylvinylether	1.3	UG/L	U
446	20040707	2-Chlorotoluene	1	UG/L	U
446	20040707	4-Chlorotoluene	1	UG/L	U
446	20040707	Benzene	2	UG/L	U
446	20040707	Bromodichloromethane	1	UG/L	U
446	20040707	Bromoform	2	UG/L	U
446	20040707	Carbon Tetrachloride	1.2	UG/L	U
446	20040707	Chlorobenzene	2	UG/L	U
446	20040707	Dibromochloromethane	0.9	UG/L	U
446	20040707	Dibromomethane	2	UG/L	U
446	20040707	Dichloromethane (Methylene Chloride)	5	UG/L	U
446	20040707	Ethylbenzene	2	UG/L	U
446	20040707	FREON-113	2	UG/L	U
446	20040707	Monobromobenzene (Phenyl bromide)	2	UG/L	U
446	20040707	Tetrachloroethene	0.3	UG/L	U
446	20040707	Toluene	2	UG/L	U
446	20040707	Trichloroethylene (TCE)	1.2	UG/L	U
446	20040707	Trichlorofluoromethane	2	UG/L	U
446	20040707	Trichloromethane	0.5	UG/L	U
446	20040707	Vinyl Chloride	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
446	20040707	Xylenes, Total	2	UG/L	U
447	20021018	1,1-Dichloroethene	1.3	UG/L	U
447	20021018	1,1-Dichloroethene	1.3	UG/L	U
447	20021018	1,1-Dichloroethene	1.3	UG/L	U
447	20021018	1,2-cis-Dichloroethene	1	UG/L	U
447	20021018	1,2-cis-Dichloroethene	1	UG/L	U
447	20021018	1,2-cis-Dichloroethene	1	UG/L	U
447	20021018	1,2-Dichloroethene	1	UG/L	U
447	20021018	1,2-Dichloroethene	1	UG/L	U
447	20021018	1,2-Dichloroethene	1	UG/L	U
447	20021018	1,2-trans-Dichloroethene	1	UG/L	U
447	20021018	1,2-trans-Dichloroethene	1	UG/L	U
447	20021018	1,3-trans-Dichloropropene	1	UG/L	U
447	20021018	Tetrachloroethene	0.3	UG/L	U
447	20021018	Tetrachloroethene	0.35	UG/L	
447	20021018	Tetrachloroethene	0.3	UG/L	U
447	20021018	Trichloroethylene (TCE)	1.2	UG/L	U
447	20021018	Trichloroethylene (TCE)	1.2	UG/L	U
447	20021018	Trichloroethylene (TCE)	1.2	UG/L	U
447	20021018	Vinyl Chloride	1	UG/L	U
447	20021018	Vinyl Chloride	1.3	UG/L	U
447	20021018	Vinyl Chloride	1	UG/L	U
447	20021028	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20021028	1,1,1-Trichloroethane	0.3	UG/L	U
447	20021028	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20021028	1,1,2-Trichloroethane	0.2	UG/L	U
447	20021028	1,1-Dichloroethane	0.7	UG/L	U
447	20021028	1,1-Dichloroethene	1.3	UG/L	U
447	20021028	1,2,3-Trichloropropane	1	UG/L	U
447	20021028	1,2-cis-Dichloroethene	1	UG/L	U
447	20021028	1,2-Dichlorobenzene	1.5	UG/L	U
447	20021028	1,2-Dichloroethane	0.3	UG/L	U
447	20021028	1,2-Dichloropropane	0.4	UG/L	U
447	20021028	1,2-trans-Dichloroethene	1	UG/L	U
447	20021028	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20021028	1,3-Dichlorobenzene	3.2	UG/L	U
447	20021028	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20021028	1,4-Dichlorobenzene	2.4	UG/L	U
447	20021028	1-Chlorohexane	1	UG/L	U
447	20021028	2-Butanone	2	UG/L	U
447	20021028	2-Chloroethylvinylether	1.3	UG/L	U
447	20021028	2-Chlorotoluene	1	UG/L	U
447	20021028	4-Chlorotoluene	1	UG/L	U
447	20021028	Benzene	2	UG/L	U
447	20021028	Bromodichloromethane	1	UG/L	U
447	20021028	Bromoform	2	UG/L	U
447	20021028	Carbon Tetrachloride	1.2	UG/L	U
447	20021028	Chlorobenzene	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20021028	Dibromochloromethane	0.9	UG/L	U
447	20021028	Dibromomethane	2	UG/L	U
447	20021028	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20021028	Ethylbenzene	2	UG/L	U
447	20021028	FREON-113	2	UG/L	U
447	20021028	Monobrombenzene (Phenyl bromide)	2	UG/L	U
447	20021028	Tetrachloroethene	0.3	UG/L	U
447	20021028	Toluene	2	UG/L	U
447	20021028	Trichloroethylene (TCE)	1.2	UG/L	U
447	20021028	Trichlorofluoromethane	2	UG/L	U
447	20021028	Trichloromethane	0.5	UG/L	U
447	20021028	Vinyl Chloride	1	UG/L	U
447	20021028	Xylenes, Total	2	UG/L	U
447	20030205	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20030205	1,1,1-Trichloroethane	0.3	UG/L	U
447	20030205	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20030205	1,1,2-Trichloroethane	0.2	UG/L	U
447	20030205	1,1-Dichloroethane	0.7	UG/L	U
447	20030205	1,1-Dichloroethene	1.3	UG/L	U
447	20030205	1,2,3-Trichloropropane	1	UG/L	U
447	20030205	1,2-cis-Dichloroethene	1	UG/L	U
447	20030205	1,2-Dichlorobenzene	1.5	UG/L	U
447	20030205	1,2-Dichloroethane	0.3	UG/L	U
447	20030205	1,2-Dichloropropane	0.4	UG/L	U
447	20030205	1,2-trans-Dichloroethene	1	UG/L	U
447	20030205	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20030205	1,3-Dichlorobenzene	3.2	UG/L	U
447	20030205	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20030205	1,4-Dichlorobenzene	2.4	UG/L	U
447	20030205	1-Chlorohexane	1	UG/L	U
447	20030205	2-Butanone	2	UG/L	U
447	20030205	2-Chloroethylvinylether	1.3	UG/L	U
447	20030205	2-Chlorotoluene	1	UG/L	U
447	20030205	4-Chlorotoluene	1	UG/L	U
447	20030205	Benzene	2	UG/L	U
447	20030205	Bromodichloromethane	1	UG/L	U
447	20030205	Bromoform	2	UG/L	U
447	20030205	Carbon Tetrachloride	1.2	UG/L	U
447	20030205	Chlorobenzene	2	UG/L	U
447	20030205	Dibromochloromethane	0.9	UG/L	U
447	20030205	Dibromomethane	2	UG/L	U
447	20030205	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20030205	Ethylbenzene	2	UG/L	U
447	20030205	FREON-113	2	UG/L	U
447	20030205	Monobrombenzene (Phenyl bromide)	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20030205	Tetrachloroethene	0.3	UG/L	U
447	20030205	Toluene	2	UG/L	U
447	20030205	Trichloroethylene (TCE)	1.2	UG/L	U
447	20030205	Trichlorofluoromethane	2	UG/L	U
447	20030205	Trichloromethane	0.5	UG/L	U
447	20030205	Vinyl Chloride	1	UG/L	U
447	20030205	Xylenes, Total	2	UG/L	U
447	20030425	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20030425	1,1,1-Trichloroethane	0.3	UG/L	U
447	20030425	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20030425	1,1,2-Trichloroethane	0.2	UG/L	U
447	20030425	1,1-Dichloroethane	0.7	UG/L	U
447	20030425	1,1-Dichloroethene	1.3	UG/L	U
447	20030425	1,2,3-Trichloropropane	1	UG/L	U
447	20030425	1,2-cis-Dichloroethene	1	UG/L	U
447	20030425	1,2-Dichlorobenzene	1.5	UG/L	U
447	20030425	1,2-Dichloroethane	0.3	UG/L	U
447	20030425	1,2-Dichloropropane	0.4	UG/L	U
447	20030425	1,2-trans-Dichloroethene	1	UG/L	U
447	20030425	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20030425	1,3-Dichlorobenzene	3.2	UG/L	U
447	20030425	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20030425	1,4-Dichlorobenzene	2.4	UG/L	U
447	20030425	1-Chlorohexane	1	UG/L	U
447	20030425	2-Butanone	2	UG/L	U
447	20030425	2-Chloroethylvinylether	1.3	UG/L	U
447	20030425	2-Chlorotoluene	1	UG/L	U
447	20030425	4-Chlorotoluene	1	UG/L	U
447	20030425	Benzene	2	UG/L	U
447	20030425	Bromodichloromethane	1	UG/L	U
447	20030425	Bromoform	2	UG/L	U
447	20030425	Carbon Tetrachloride	1.2	UG/L	U
447	20030425	Chlorobenzene	2	UG/L	U
447	20030425	Dibromochloromethane	0.9	UG/L	U
447	20030425	Dibromomethane	2	UG/L	U
447	20030425	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20030425	Ethylbenzene	2	UG/L	U
447	20030425	FREON-113	2	UG/L	U
447	20030425	Monobrombenzene (Phenyl bromide)	2	UG/L	U
447	20030425	Tetrachloroethene	0.3	UG/L	U
447	20030425	Toluene	2	UG/L	U
447	20030425	Trichloroethylene (TCE)	1.2	UG/L	U
447	20030425	Trichlorofluoromethane	2	UG/L	U
447	20030425	Trichloromethane	0.5	UG/L	U
447	20030425	Vinyl Chloride	1	UG/L	U
447	20030425	Xylenes, Total	2	UG/L	U
447	20030718	1,1,1,2-Tetrachloroethane	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20030718	1,1,1-Trichloroethane	0.3	UG/L	U
447	20030718	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20030718	1,1,2-Trichloroethane	0.2	UG/L	U
447	20030718	1,1-Dichloroethane	0.7	UG/L	U
447	20030718	1,1-Dichloroethene	1.3	UG/L	U
447	20030718	1,2,3-Trichloropropane	1	UG/L	U
447	20030718	1,2-cis-Dichloroethene	1	UG/L	U
447	20030718	1,2-Dichlorobenzene	1.5	UG/L	U
447	20030718	1,2-Dichloroethane	0.3	UG/L	U
447	20030718	1,2-Dichloropropane	0.4	UG/L	U
447	20030718	1,2-trans-Dichloroethene	1	UG/L	U
447	20030718	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20030718	1,3-Dichlorobenzene	3.2	UG/L	U
447	20030718	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20030718	1,4-Dichlorobenzene	2.4	UG/L	U
447	20030718	1-Chlorohexane	1	UG/L	U
447	20030718	2-Butanone	2	UG/L	U
447	20030718	2-Chloroethylvinylether	1.3	UG/L	U
447	20030718	2-Chlorotoluene	1	UG/L	U
447	20030718	4-Chlorotoluene	1	UG/L	U
447	20030718	Benzene	2	UG/L	U
447	20030718	Bromodichloromethane	1	UG/L	U
447	20030718	Bromoform	2	UG/L	U
447	20030718	Carbon Tetrachloride	1.2	UG/L	U
447	20030718	Chlorobenzene	2	UG/L	U
447	20030718	Dibromochloromethane	0.9	UG/L	U
447	20030718	Dibromomethane	2	UG/L	U
447	20030718	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20030718	Ethylbenzene	2	UG/L	U
447	20030718	FREON-113	2	UG/L	U
447	20030718	Monobrombenzene (Phenyl bromide)	2	UG/L	U
447	20030718	Tetrachloroethene	0.3	UG/L	U
447	20030718	Toluene	2	UG/L	U
447	20030718	Trichloroethylene (TCE)	1.2	UG/L	U
447	20030718	Trichlorofluoromethane	2	UG/L	U
447	20030718	Trichloromethane	0.5	UG/L	U
447	20030718	Vinyl Chloride	1	UG/L	U
447	20030718	Xylenes, Total	2	UG/L	U
447	20040120	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20040120	1,1,1-Trichloroethane	0.3	UG/L	U
447	20040120	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20040120	1,1,2-Trichloroethane	0.2	UG/L	U
447	20040120	1,1-Dichloroethane	0.7	UG/L	U
447	20040120	1,1-Dichloroethene	1.3	UG/L	U
447	20040120	1,2,3-Trichloropropane	1	UG/L	U
447	20040120	1,2-cis-Dichloroethene	1	UG/L	U
447	20040120	1,2-Dichlorobenzene	1.5	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20040120	1,2-Dichloroethane	0.3	UG/L	U
447	20040120	1,2-Dichloropropane	0.4	UG/L	U
447	20040120	1,2-trans-Dichloroethene	1	UG/L	U
447	20040120	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20040120	1,3-Dichlorobenzene	3.2	UG/L	U
447	20040120	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20040120	1,4-Dichlorobenzene	2.4	UG/L	U
447	20040120	1-Chlorohexane	1	UG/L	U
447	20040120	2-Butanone	2	UG/L	U
447	20040120	2-Chloroethylvinylether	1.3	UG/L	U
447	20040120	2-Chlorotoluene	1	UG/L	U
447	20040120	4-Chlorotoluene	1	UG/L	U
447	20040120	Benzene	2	UG/L	U
447	20040120	Bromodichloromethane	1	UG/L	U
447	20040120	Bromoform	2	UG/L	U
447	20040120	Carbon Tetrachloride	1.2	UG/L	U
447	20040120	Chlorobenzene	2	UG/L	U
447	20040120	Dibromochloromethane	0.9	UG/L	U
447	20040120	Dibromomethane	2	UG/L	U
447	20040120	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20040120	Ethylbenzene	2	UG/L	U
447	20040120	FREON-113	2	UG/L	U
447	20040120	Monobromobenzene (Phenyl bromide)	2	UG/L	U
447	20040120	Tetrachloroethene	0.3	UG/L	U
447	20040120	Toluene	2	UG/L	U
447	20040120	Trichloroethylene (TCE)	1.2	UG/L	U
447	20040120	Trichlorofluoromethane	2	UG/L	U
447	20040120	Trichloromethane	0.5	UG/L	U
447	20040120	Vinyl Chloride	1	UG/L	U
447	20040120	Xylenes, Total	2	UG/L	U
447	20040414	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20040414	1,1,1-Trichloroethane	0.3	UG/L	U
447	20040414	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20040414	1,1,2-Trichloroethane	0.2	UG/L	U
447	20040414	1,1-Dichloroethane	0.7	UG/L	U
447	20040414	1,1-Dichloroethene	1.3	UG/L	U
447	20040414	1,2,3-Trichloropropane	1	UG/L	U
447	20040414	1,2-cis-Dichloroethene	1	UG/L	U
447	20040414	1,2-Dichlorobenzene	1.5	UG/L	U
447	20040414	1,2-Dichloroethane	0.3	UG/L	U
447	20040414	1,2-Dichloropropane	0.4	UG/L	U
447	20040414	1,2-trans-Dichloroethene	1	UG/L	U
447	20040414	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20040414	1,3-Dichlorobenzene	3.2	UG/L	U
447	20040414	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20040414	1,4-Dichlorobenzene	2.4	UG/L	U
447	20040414	1-Chlorohexane	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20040414	2-Butanone	2	UG/L	U
447	20040414	2-Chloroethylvinylether	1.3	UG/L	U
447	20040414	2-Chlorotoluene	1	UG/L	U
447	20040414	4-Chlorotoluene	1	UG/L	U
447	20040414	Benzene	2	UG/L	U
447	20040414	Bromodichloromethane	1	UG/L	U
447	20040414	Bromoform	2	UG/L	U
447	20040414	Carbon Tetrachloride	1.2	UG/L	U
447	20040414	Chlorobenzene	2	UG/L	U
447	20040414	Dibromochloromethane	0.9	UG/L	U
447	20040414	Dibromomethane	2	UG/L	U
447	20040414	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20040414	Ethylbenzene	2	UG/L	U
447	20040414	FREON-113	2	UG/L	U
447	20040414	Monobromobenzene (Phenyl bromide)	2	UG/L	U
447	20040414	Tetrachloroethene	0.3	UG/L	U
447	20040414	Toluene	2	UG/L	U
447	20040414	Trichloroethylene (TCE)	1.2	UG/L	U
447	20040414	Trichlorofluoromethane	2	UG/L	U
447	20040414	Trichloromethane	0.5	UG/L	U
447	20040414	Vinyl Chloride	1	UG/L	U
447	20040414	Xylenes, Total	2	UG/L	U
447	20040707	1,1,1,2-Tetrachloroethane	1	UG/L	U
447	20040707	1,1,1-Trichloroethane	0.3	UG/L	U
447	20040707	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
447	20040707	1,1,2-Trichloroethane	0.2	UG/L	U
447	20040707	1,1-Dichloroethane	0.7	UG/L	U
447	20040707	1,1-Dichloroethene	1.3	UG/L	U
447	20040707	1,2,3-Trichloropropane	1	UG/L	U
447	20040707	1,2-cis-Dichloroethene	1	UG/L	U
447	20040707	1,2-Dichlorobenzene	1.5	UG/L	U
447	20040707	1,2-Dichloroethane	0.3	UG/L	U
447	20040707	1,2-Dichloropropane	0.4	UG/L	U
447	20040707	1,2-trans-Dichloroethene	1	UG/L	U
447	20040707	1,3-cis-Dichloropropene	3.4	UG/L	U
447	20040707	1,3-Dichlorobenzene	3.2	UG/L	U
447	20040707	1,3-trans-Dichloropropene	3.4	UG/L	U
447	20040707	1,4-Dichlorobenzene	2.4	UG/L	U
447	20040707	1-Chlorohexane	1	UG/L	U
447	20040707	2-Butanone	2	UG/L	U
447	20040707	2-Chloroethylvinylether	1.3	UG/L	U
447	20040707	2-Chlorotoluene	1	UG/L	U
447	20040707	4-Chlorotoluene	1	UG/L	U
447	20040707	Benzene	2	UG/L	U
447	20040707	Bromodichloromethane	1	UG/L	U
447	20040707	Bromoform	2	UG/L	U
447	20040707	Carbon Tetrachloride	1.2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
447	20040707	Chlorobenzene	2	UG/L	U
447	20040707	Dibromochloromethane	0.9	UG/L	U
447	20040707	Dibromomethane	2	UG/L	U
447	20040707	Dichloromethane (Methylene Chloride)	5	UG/L	U
447	20040707	Ethylbenzene	2	UG/L	U
447	20040707	FREON-113	2	UG/L	U
447	20040707	Monobromobenzene (Phenyl bromide)	2	UG/L	U
447	20040707	Tetrachloroethene	0.3	UG/L	U
447	20040707	Toluene	2	UG/L	U
447	20040707	Trichloroethylene (TCE)	1.2	UG/L	U
447	20040707	Trichlorofluoromethane	2	UG/L	U
447	20040707	Trichloromethane	0.5	UG/L	U
447	20040707	Vinyl Chloride	1	UG/L	U
447	20040707	Xylenes, Total	2	UG/L	U
448	20021019	1,1-Dichloroethene	1.3	UG/L	U
448	20021019	1,2-Dichloroethene	1	UG/L	U
448	20021019	1,2-trans-Dichloroethene	1	UG/L	U
448	20021019	1,3-cis-Dichloropropene	1	UG/L	U
448	20021019	Tetrachloroethene	0.3	UG/L	U
448	20021019	Trichloroethylene (TCE)	1.2	UG/L	U
448	20021019	Vinyl Chloride	1	UG/L	U
448	20021028	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20021028	1,1,1-Trichloroethane	0.3	UG/L	U
448	20021028	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20021028	1,1,2-Trichloroethane	0.2	UG/L	U
448	20021028	1,1-Dichloroethane	0.7	UG/L	U
448	20021028	1,1-Dichloroethene	1.3	UG/L	U
448	20021028	1,2,3-Trichloropropane	1	UG/L	U
448	20021028	1,2-cis-Dichloroethene	1	UG/L	U
448	20021028	1,2-Dichlorobenzene	1.5	UG/L	U
448	20021028	1,2-Dichloroethane	0.3	UG/L	U
448	20021028	1,2-Dichloropropane	0.4	UG/L	U
448	20021028	1,2-trans-Dichloroethene	1	UG/L	U
448	20021028	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20021028	1,3-Dichlorobenzene	3.2	UG/L	U
448	20021028	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20021028	1,4-Dichlorobenzene	2.4	UG/L	U
448	20021028	1-Chlorohexane	1	UG/L	U
448	20021028	2-Butanone	2	UG/L	U
448	20021028	2-Chloroethylvinylether	1.3	UG/L	U
448	20021028	2-Chlorotoluene	1	UG/L	U
448	20021028	4-Chlorotoluene	1	UG/L	U
448	20021028	Benzene	2	UG/L	U
448	20021028	Bromodichloromethane	1	UG/L	U
448	20021028	Bromoform	2	UG/L	U
448	20021028	Carbon Tetrachloride	1.2	UG/L	U
448	20021028	Chlorobenzene	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20021028	Dibromochloromethane	0.9	UG/L	U
448	20021028	Dibromomethane	2	UG/L	U
448	20021028	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20021028	Ethylbenzene	2	UG/L	U
448	20021028	FREON-113	2	UG/L	U
448	20021028	Monobrombenzene (Phenyl bromide)	2	UG/L	U
448	20021028	Tetrachloroethene	0.3	UG/L	U
448	20021028	Toluene	2	UG/L	U
448	20021028	Trichloroethylene (TCE)	1.2	UG/L	U
448	20021028	Trichlorofluoromethane	2	UG/L	U
448	20021028	Trichloromethane	0.5	UG/L	U
448	20021028	Vinyl Chloride	1	UG/L	U
448	20021028	Xylenes, Total	2	UG/L	U
448	20030205	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20030205	1,1,1-Trichloroethane	0.3	UG/L	U
448	20030205	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20030205	1,1,2-Trichloroethane	0.2	UG/L	U
448	20030205	1,1-Dichloroethane	0.7	UG/L	U
448	20030205	1,1-Dichloroethene	1.3	UG/L	U
448	20030205	1,2,3-Trichloropropane	1	UG/L	U
448	20030205	1,2-cis-Dichloroethene	1	UG/L	U
448	20030205	1,2-Dichlorobenzene	1.5	UG/L	U
448	20030205	1,2-Dichloroethane	0.3	UG/L	U
448	20030205	1,2-Dichloropropane	0.4	UG/L	U
448	20030205	1,2-trans-Dichloroethene	1	UG/L	U
448	20030205	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20030205	1,3-Dichlorobenzene	3.2	UG/L	U
448	20030205	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20030205	1,4-Dichlorobenzene	2.4	UG/L	U
448	20030205	1-Chlorohexane	1	UG/L	U
448	20030205	2-Butanone	2	UG/L	U
448	20030205	2-Chloroethylvinylether	1.3	UG/L	U
448	20030205	2-Chlorotoluene	1	UG/L	U
448	20030205	4-Chlorotoluene	1	UG/L	U
448	20030205	Benzene	2	UG/L	U
448	20030205	Bromodichloromethane	1	UG/L	U
448	20030205	Bromoform	2	UG/L	U
448	20030205	Carbon Tetrachloride	1.2	UG/L	U
448	20030205	Chlorobenzene	2	UG/L	U
448	20030205	Dibromochloromethane	0.9	UG/L	U
448	20030205	Dibromomethane	2	UG/L	U
448	20030205	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20030205	Ethylbenzene	2	UG/L	U
448	20030205	FREON-113	2	UG/L	U
448	20030205	Monobrombenzene (Phenyl bromide)	2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20030205	Tetrachloroethene	0.3	UG/L	U
448	20030205	Toluene	2	UG/L	U
448	20030205	Trichloroethylene (TCE)	1.2	UG/L	U
448	20030205	Trichlorofluoromethane	2	UG/L	U
448	20030205	Trichloromethane	0.5	UG/L	U
448	20030205	Vinyl Chloride	1	UG/L	U
448	20030205	Xylenes, Total	2	UG/L	U
448	20030425	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20030425	1,1,1-Trichloroethane	0.38	UG/L	
448	20030425	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20030425	1,1,2-Trichloroethane	0.2	UG/L	U
448	20030425	1,1-Dichloroethane	0.7	UG/L	U
448	20030425	1,1-Dichloroethene	1.3	UG/L	U
448	20030425	1,2,3-Trichloropropane	1	UG/L	U
448	20030425	1,2-cis-Dichloroethene	1	UG/L	U
448	20030425	1,2-Dichlorobenzene	1.5	UG/L	U
448	20030425	1,2-Dichloroethane	0.3	UG/L	U
448	20030425	1,2-Dichloropropane	0.4	UG/L	U
448	20030425	1,2-trans-Dichloroethene	1	UG/L	U
448	20030425	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20030425	1,3-Dichlorobenzene	3.2	UG/L	U
448	20030425	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20030425	1,4-Dichlorobenzene	2.4	UG/L	U
448	20030425	1-Chlorohexane	1	UG/L	U
448	20030425	2-Butanone	2	UG/L	U
448	20030425	2-Chloroethylvinylether	1.3	UG/L	U
448	20030425	2-Chlorotoluene	1	UG/L	U
448	20030425	4-Chlorotoluene	1	UG/L	U
448	20030425	Benzene	2	UG/L	U
448	20030425	Bromodichloromethane	1	UG/L	U
448	20030425	Bromoform	2	UG/L	U
448	20030425	Carbon Tetrachloride	1.2	UG/L	U
448	20030425	Chlorobenzene	2	UG/L	U
448	20030425	Dibromochloromethane	0.9	UG/L	U
448	20030425	Dibromomethane	2	UG/L	U
448	20030425	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20030425	Ethylbenzene	2	UG/L	U
448	20030425	FREON-113	2	UG/L	U
448	20030425	Monobrombenzene (Phenyl bromide)	2	UG/L	U
448	20030425	Tetrachloroethene	0.3	UG/L	U
448	20030425	Toluene	2	UG/L	U
448	20030425	Trichloroethylene (TCE)	1.2	UG/L	U
448	20030425	Trichlorofluoromethane	2	UG/L	U
448	20030425	Trichloromethane	0.5	UG/L	U
448	20030425	Vinyl Chloride	1	UG/L	U
448	20030425	Xylenes, Total	2	UG/L	U
448	20030718	1,1,1,2-Tetrachloroethane	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20030718	1,1,1-Trichloroethane	0.3	UG/L	U
448	20030718	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20030718	1,1,2-Trichloroethane	0.2	UG/L	U
448	20030718	1,1-Dichloroethane	0.7	UG/L	U
448	20030718	1,1-Dichloroethene	1.3	UG/L	U
448	20030718	1,2,3-Trichloropropane	1	UG/L	U
448	20030718	1,2-cis-Dichloroethene	1	UG/L	U
448	20030718	1,2-Dichlorobenzene	1.5	UG/L	U
448	20030718	1,2-Dichloroethane	0.3	UG/L	U
448	20030718	1,2-Dichloropropane	0.4	UG/L	U
448	20030718	1,2-trans-Dichloroethene	1	UG/L	U
448	20030718	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20030718	1,3-Dichlorobenzene	3.2	UG/L	U
448	20030718	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20030718	1,4-Dichlorobenzene	2.4	UG/L	U
448	20030718	1-Chlorohexane	1	UG/L	U
448	20030718	2-Butanone	2	UG/L	U
448	20030718	2-Chloroethylvinylether	1.3	UG/L	U
448	20030718	2-Chlorotoluene	1	UG/L	U
448	20030718	4-Chlorotoluene	1	UG/L	U
448	20030718	Benzene	2	UG/L	U
448	20030718	Bromodichloromethane	1	UG/L	U
448	20030718	Bromoform	2	UG/L	U
448	20030718	Carbon Tetrachloride	1.2	UG/L	U
448	20030718	Chlorobenzene	2	UG/L	U
448	20030718	Dibromochloromethane	0.9	UG/L	U
448	20030718	Dibromomethane	2	UG/L	U
448	20030718	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20030718	Ethylbenzene	2	UG/L	U
448	20030718	FREON-113	2	UG/L	U
448	20030718	Monobrombenzene (Phenyl bromide)	2	UG/L	U
448	20030718	Tetrachloroethene	0.3	UG/L	U
448	20030718	Toluene	2	UG/L	U
448	20030718	Trichloroethylene (TCE)	1.2	UG/L	U
448	20030718	Trichlorofluoromethane	2	UG/L	U
448	20030718	Trichloromethane	0.5	UG/L	U
448	20030718	Vinyl Chloride	1	UG/L	U
448	20030718	Xylenes, Total	2	UG/L	U
448	20040120	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20040120	1,1,1-Trichloroethane	0.3	UG/L	U
448	20040120	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20040120	1,1,2-Trichloroethane	0.2	UG/L	U
448	20040120	1,1-Dichloroethane	0.7	UG/L	U
448	20040120	1,1-Dichloroethene	1.3	UG/L	U
448	20040120	1,2,3-Trichloropropane	1	UG/L	U
448	20040120	1,2-cis-Dichloroethene	1	UG/L	U
448	20040120	1,2-Dichlorobenzene	1.5	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20040120	1,2-Dichloroethane	0.3	UG/L	U
448	20040120	1,2-Dichloropropane	0.4	UG/L	U
448	20040120	1,2-trans-Dichloroethene	1	UG/L	U
448	20040120	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20040120	1,3-Dichlorobenzene	3.2	UG/L	U
448	20040120	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20040120	1,4-Dichlorobenzene	2.4	UG/L	U
448	20040120	1-Chlorohexane	1	UG/L	U
448	20040120	2-Butanone	2	UG/L	U
448	20040120	2-Chloroethylvinylether	1.3	UG/L	U
448	20040120	2-Chlorotoluene	1	UG/L	U
448	20040120	4-Chlorotoluene	1	UG/L	U
448	20040120	Benzene	2	UG/L	U
448	20040120	Bromodichloromethane	1	UG/L	U
448	20040120	Bromoform	2	UG/L	U
448	20040120	Carbon Tetrachloride	1.2	UG/L	U
448	20040120	Chlorobenzene	2	UG/L	U
448	20040120	Dibromochloromethane	0.9	UG/L	U
448	20040120	Dibromomethane	2	UG/L	U
448	20040120	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20040120	Ethylbenzene	2	UG/L	U
448	20040120	FREON-113	2	UG/L	U
448	20040120	Monobromobenzene (Phenyl bromide)	2	UG/L	U
448	20040120	Tetrachloroethene	0.3	UG/L	U
448	20040120	Toluene	2	UG/L	U
448	20040120	Trichloroethylene (TCE)	1.2	UG/L	U
448	20040120	Trichlorofluoromethane	2	UG/L	U
448	20040120	Trichloromethane	0.5	UG/L	U
448	20040120	Vinyl Chloride	1	UG/L	U
448	20040120	Xylenes, Total	2	UG/L	U
448	20040414	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20040414	1,1,1-Trichloroethane	0.3	UG/L	U
448	20040414	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20040414	1,1,2-Trichloroethane	0.2	UG/L	U
448	20040414	1,1-Dichloroethane	0.7	UG/L	U
448	20040414	1,1-Dichloroethene	1.3	UG/L	U
448	20040414	1,2,3-Trichloropropane	1	UG/L	U
448	20040414	1,2-cis-Dichloroethene	1	UG/L	U
448	20040414	1,2-Dichlorobenzene	1.5	UG/L	U
448	20040414	1,2-Dichloroethane	0.3	UG/L	U
448	20040414	1,2-Dichloropropane	0.4	UG/L	U
448	20040414	1,2-trans-Dichloroethene	1	UG/L	U
448	20040414	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20040414	1,3-Dichlorobenzene	3.2	UG/L	U
448	20040414	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20040414	1,4-Dichlorobenzene	2.4	UG/L	U
448	20040414	1-Chlorohexane	1	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20040414	2-Butanone	2	UG/L	U
448	20040414	2-Chloroethylvinylether	1.3	UG/L	U
448	20040414	2-Chlorotoluene	1	UG/L	U
448	20040414	4-Chlorotoluene	1	UG/L	U
448	20040414	Benzene	2	UG/L	U
448	20040414	Bromodichloromethane	1	UG/L	U
448	20040414	Bromoform	2	UG/L	U
448	20040414	Carbon Tetrachloride	1.2	UG/L	U
448	20040414	Chlorobenzene	2	UG/L	U
448	20040414	Dibromochloromethane	0.9	UG/L	U
448	20040414	Dibromomethane	2	UG/L	U
448	20040414	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20040414	Ethylbenzene	2	UG/L	U
448	20040414	FREON-113	2	UG/L	U
448	20040414	Monobromobenzene (Phenyl bromide)	2	UG/L	U
448	20040414	Tetrachloroethene	0.3	UG/L	U
448	20040414	Toluene	2	UG/L	U
448	20040414	Trichloroethylene (TCE)	1.2	UG/L	U
448	20040414	Trichlorofluoromethane	2	UG/L	U
448	20040414	Trichloromethane	0.5	UG/L	U
448	20040414	Vinyl Chloride	1	UG/L	U
448	20040414	Xylenes, Total	2	UG/L	U
448	20040707	1,1,1,2-Tetrachloroethane	1	UG/L	U
448	20040707	1,1,1-Trichloroethane	0.3	UG/L	U
448	20040707	1,1,2,2-Tetrachloroethane	0.3	UG/L	U
448	20040707	1,1,2-Trichloroethane	0.2	UG/L	U
448	20040707	1,1-Dichloroethane	0.7	UG/L	U
448	20040707	1,1-Dichloroethene	1.3	UG/L	U
448	20040707	1,2,3-Trichloropropane	1	UG/L	U
448	20040707	1,2-cis-Dichloroethene	1	UG/L	U
448	20040707	1,2-Dichlorobenzene	1.5	UG/L	U
448	20040707	1,2-Dichloroethane	0.3	UG/L	U
448	20040707	1,2-Dichloropropane	0.4	UG/L	U
448	20040707	1,2-trans-Dichloroethene	1	UG/L	U
448	20040707	1,3-cis-Dichloropropene	3.4	UG/L	U
448	20040707	1,3-Dichlorobenzene	3.2	UG/L	U
448	20040707	1,3-trans-Dichloropropene	3.4	UG/L	U
448	20040707	1,4-Dichlorobenzene	2.4	UG/L	U
448	20040707	1-Chlorohexane	1	UG/L	U
448	20040707	2-Butanone	2	UG/L	U
448	20040707	2-Chloroethylvinylether	1.3	UG/L	U
448	20040707	2-Chlorotoluene	1	UG/L	U
448	20040707	4-Chlorotoluene	1	UG/L	U
448	20040707	Benzene	2	UG/L	U
448	20040707	Bromodichloromethane	1	UG/L	U
448	20040707	Bromoform	2	UG/L	U
448	20040707	Carbon Tetrachloride	1.2	UG/L	U

Well_name	Collection_date	Value_name	Measured_value	Value_units	Lab_qualifier
448	20040707	Chlorobenzene	2	UG/L	U
448	20040707	Dibromochloromethane	0.9	UG/L	U
448	20040707	Dibromomethane	2	UG/L	U
448	20040707	Dichloromethane (Methylene Chloride)	5	UG/L	U
448	20040707	Ethylbenzene	2	UG/L	U
448	20040707	FREON-113	2	UG/L	U
448	20040707	Monobromobenzene (Phenyl bromide)	2	UG/L	U
448	20040707	Tetrachloroethene	0.3	UG/L	U
448	20040707	Toluene	2	UG/L	U
448	20040707	Trichloroethylene (TCE)	1.2	UG/L	U
448	20040707	Trichlorofluoromethane	2	UG/L	U
448	20040707	Trichloromethane	0.5	UG/L	U
448	20040707	Vinyl Chloride	1	UG/L	U
448	20040707	Xylenes, Total	2	UG/L	U

APPENDIX B

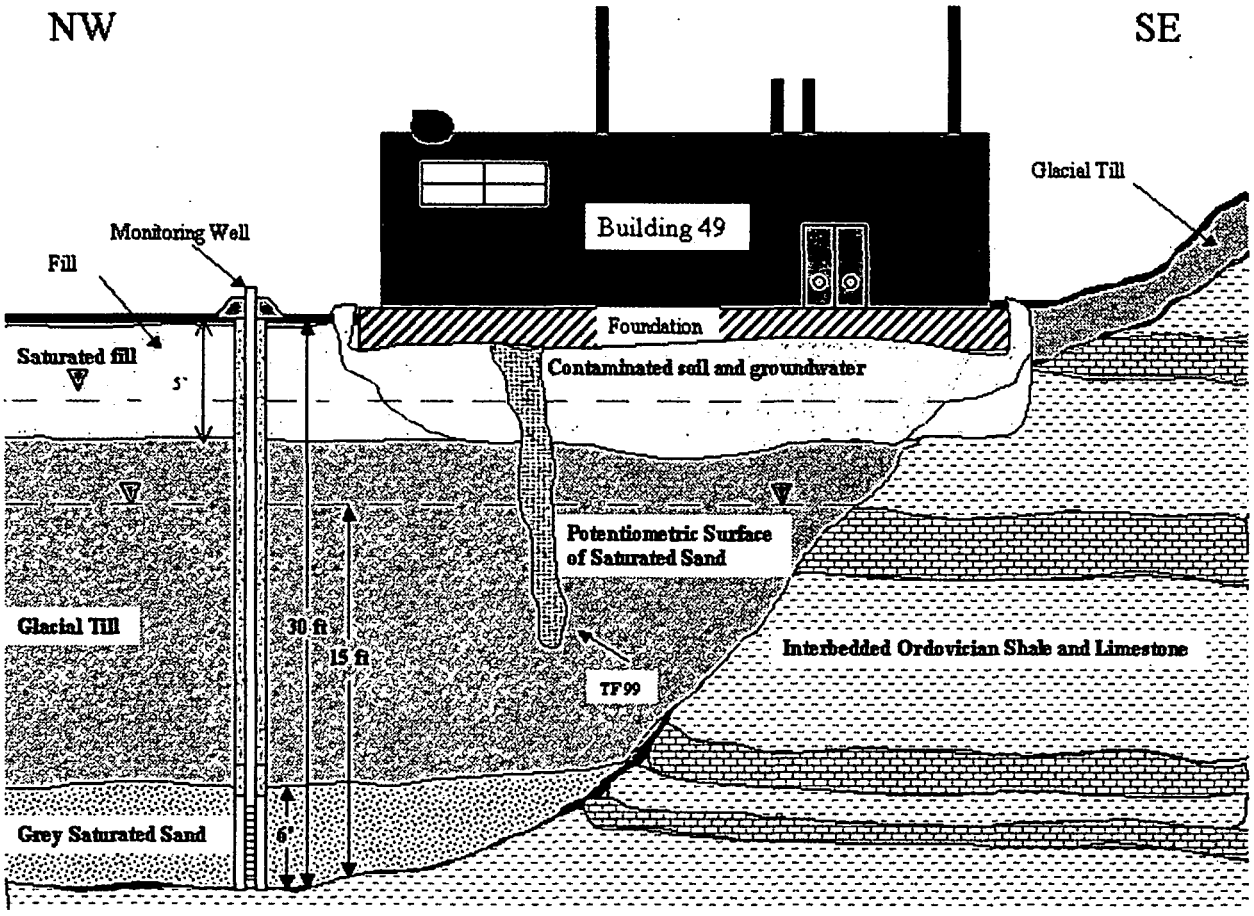
Development of VOC Soil Cleanup Guideline Values

Update from PRS Package SSL evaluation.

The soil screening level model was utilized to develop very conservative estimates of the potential for leachability of VOCs for the September 2003 PRS 87 package Addendum. Actual VOC levels in the soils were at known levels of concern near borehole TF-99 and at that point it was suspected that some type of remediation was likely to be required. When the PRS was binned "removal action" it became important to develop "cleanup" guidelines that reflect reality as closely as possible. At this point, the model is refined using defensible less conservative input parameters that allow calculation of cleanup values that are not unrealistically over conservative. The cleanup guideline values derived for PRS 87 and listed in the PRS 87 Action Memo represent a more refined version of the very conservative estimates presented in Appendix A of the September 2003 PRS Package Addendum.

PRS 87 Soil Screening Level Model Development
Hydrogeologic Setting at PRS 87

The hydrogeologic setting at PRS 87 is characterized by tight silty clay glacial tills overlying a thin saturated sand and gravel seam deposited atop bedrock. The depth to bedrock is anywhere from 1 foot (at the northeast portion of the PRS) to approximately 40 feet (at the eastern portion of the PRS). A small portion of the glacial till under and immediately adjacent to former Building 49 are contaminated with volatile organic compounds (trichloroethene, dichloroethene and vinyl chloride). Additionally, the soil and groundwater in the backfill soils located in and around the foundation (approximately 4 –5 feet of gravelly sand) is also contaminated with those VOCs). The figure below shows a general schematic of the subsurface condition at PRS 87, the figure is for illustrative purposes only and is not to scale. Soil VOC concentrations are shown in Table 1 of Appendix A.



Model Input Parameters

Source Length parallel to groundwater flow (L): Groundwater flow through the tributary valley is southwesterly towards the main BVA. As flow is nearly perpendicular to Building 49 a conservative estimate of the source length parallel to groundwater flow would consider the entire width of the building footprint. The width of Building 49 is approximately 100 feet and therefore "L" is conservatively modeled at 30 meters.

Aquifer Thickness (da): The aquifer thickness below building 49 is relatively thin (3-4 feet) as the sand and gravel pinches out along the bedrock slope. In the axis of the tributary valley the aquifer thickens to approximately 20 feet (see log for well 0346). The aquifer thickness is modeled at 4 meters representing an average thickness for the aquifer below the glacial till.

Hydraulic Conductivity (K): The lowest hydraulic conductivity of the BVA in the vicinity of Mound is approximately 55 ft/day and is in the Mound Tributary Valley, (OU-9 Hydrogeologic Investigation, pump tests and well slug tests). The aquifer in the tributary valley is an extension of the BVA and consists of well-sorted sand and gravel (materials similar to those found in the highly transmissive portions of the BVA). The hydraulic conductivity in the PRS 87 area will be modeled at 5000 meters/year.

Hydraulic Gradient (i): The hydraulic gradient through the tributary valley is fairly high with head levels rapidly declining from the building 49 area to the main BVA. The potentiometric surface at well 0346 is approximately 737 ft MSL. The potentiometric surface at well 0379 (approximately 780 feet downgradient) is approximately 685 ft MSL (both water level measurements were taken in Jan 2004). The hydraulic gradient throughout this area is therefore approximately 0.05 m/m.

Horizontal Distance to Receptor (xr): The horizontal distance to the receptor is modeled as 200 meters. The thin saturated sand and gravel unit located below the glacial till at PRS 87 is located in the Mound Tributary Valley. The discharge point of the tributary valley to the Buried Valley Aquifer is approximately 200 meters downgradient from PRS 76. The soil screening level model allows for dilution of contaminants along the flow path. Dilution ceases when the calculated mixing zone depth equals the aquifer thickness. In the case of PRS 87, due to the relatively thin aquifer, the model allows for dilution only within 10 meters downgradient of the PRS (at this point the entire aquifer thickness has been utilized for dilution). The model is therefore conservative as dilution would actually occur continually along the flowpath to the nearest downgradient drinking water well (Mound Production Well # 2) located over 2000 feet downgradient).

Infiltration Rate (in): The recharge rate is typically modeled at 6.25 inches per year at the Mound Facility. This infiltration rate is overly conservative given the nature of the tight silty clay glacial till at PRS 87. The glacial till is tight enough to provide confining conditions within the underlying saturated sand and gravel unit (this condition is unique and not typical at the Mound site). The Ohio EPA Derived Leach-Based Soil Values allows application of dilution factors to account for conditions other than those assumed (default values) for calculation of the generic SSL values. Recharge rates for silty clay glacial tills are reported in the range of 2-4 inches per year (DRASTIC maps for the State of Ohio and discussions with ODNR personnel).The drainage throughout the PRS 87 area is excellent with a natural southwesterly slope. The conditions at PRS 87 would promote rapid runoff of precipitation and therefore minimal surface recharge is expected. The recharge rate for PRS 87 will be modeled at 2 inches per year.

Fraction of Organic Carbon (f_{oc}): The fraction of organic carbon is modeled at 0.013 g/g. This value is taken directly from the average values of TOC collected at well 0345 and 0395 at depths corresponding to locations of silty clay glacial till. Well 0345 is located directly in the glacial till encountered at PRS 87 and shows an average TOC of approximately 0.013 g/g (see OU-9 Hydrogeologic Investigation Soil Chemistry Report, September 1994).

Calculation of the Mixing Zone Depth:

$$d = (0.0112(L+xr)2)0.5 + da\{1 - \exp[(in(L+xr))/Kida)]\}$$

$$d = 4 \text{ meters}$$

Calculation of the Dilution factor:
df = 1 + Kid/inL
df = 776

The model shows that a reasonable amount of dilution can occur once the contaminant leaches into the sand and gravel. The low mass input (low recharge rate) coupled with the relatively high hydraulic gradient and permeable glacial sediments accounts for the dilution factor. In reality, even less mass would be expected to reach the aquifer and a downgradient receptor given that the entire soil area is modeled as homogeneously contaminated throughout the soil column (elevated VOC contamination at PRS 87 is limited to location TF99) and the nearest downgradient receptor is over 600 meters away (providing for considerable dilution along the flow path).

Input Parameters for Soil Screening Level Calculations at PRS 87

Parameters for soil leaching calculation:			
Definition	**Parameter**	**Main Hilltop soil**	**Units**
source length parallel to ground water flow (Bd 49 width)	L	30	m
aquifer thickness (conservative estimate)	da	4	m
hydraulic conductivity (very conservative estimate)	K	5000	m/y
hydraulic gradient at the source (BVA wells 0345 and 0379)	i	0.05	m/m
horizontal distance to receptor	xr	200	m
infiltration rate (estimated OEPA soil screening level guidance)	in	0.043	m/y
soil-water partition coefficient (Koc * foc for organic chemicals)	Kd	chemical specific	L/kg
saturated porosity	Ow	0.15	
air filled porosity	Oa	0.28	
Henry's Law constant * 41 (0 for metals and radionuclides)	H	chemical specific	
dry soil bulk density	B	1.6	kg/L
soil organic carbon/water partition coefficient	Koc	chemical specific	L/kg
fraction organic carbon in soil (tills at well 0345)	foc	0.013	
mixing zone depth	d	4	m
dilution factor (used to multiply the target concentration)	df=	776	

Mixing Zone Depth Calculation

MIXING ZONE DEPTH (d)
d = (0.0112(L+xr)2)0.5 + da{1 - exp[(in(L+xr))/Kida)]}

DILUTION FACTOR (df)
df = 1 + Kid/inL

Soil Screening Level Calculation

SSL = Cw{Kd + (Ow + (OaH))/B}

Kd = Koc * foc

Note: C_w = target soil leachate concentration = (df * MCL)

SOIL SCREENING LEVELS FOR CONTAMINANTS OF CONCERN

Chemical Name	H	K_{oc}	f_{oc}	K_d	Acceptable Groundwater Concentration	C_w	SSL
		L/kg		L/kg	mg/L	mg/L	ug/kg
1,2 dichloroethene	0.185	29	0.013	0.37	0.07 (MCL)	54.31	27,340
Trichloroethene	0.435	112	0.013	1.45	0.005 (MCL)	3.88	6,310
Vinyl Chloride	3.45	11	0.013	0.14	0.002 (MCL)	1.55	1,300

A Soil Screening Level (SSL) is the level of contamination that can exist in soil that does not adversely affect the quality of groundwater at a potential drinking water source such as the Buried Valley Aquifer (BVA).

Soil Screening Calculations are used to determine if a PRS may adversely affect ground water quality due to leaching of organic soil contaminants. These equations conservatively calculate the effects of soil leaching and ground water mixing at a particular PRS. The input parameters represent conditions at the PRS. MCLs are assumed to be protective of ground water that will be used as a drinking water source.

NOTE: Once the equation calculates a mixing zone depth (d) that is equal to the aquifer thickness (da), no additional mixing or dilution takes place. This is the maximum attenuation that the Soil Screening Level Equation calculates. All distances to a potential receptor greater than the distance that first causes the mixing zone depth to equal the aquifer thickness creates no additional attenuation. For this reason, the tables are only reproduced until (d) is equal to the aquifer thickness.

Comparison of Soil Screening Levels with 10^{-5} Risk Based Guideline Values

Contaminant of Concern	10^{-5} Risk Based Guideline Value	Soil Screening Level
TCE	54,000 ppb	**6,310 ppb**
DCE	None available	**27,340 ppb**
VC	4000 ppb	**1,300 ppb**

Note: bold indicates more restrictive of 10^{-5} Risk Based Guideline Value or Soil Screening Level and therefore the Soil Cleanup Objectives

References

DOE. 1994. "Operable Unit 9, Hydrogeologic Investigation: Bedrock Report." U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. January, 1994.

USEPA. 1994. "Technical Background Document for soil Screening Guidance - Review Draft." U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/R-94/106 December, 1994.

DOE. 1994. "Operable Unit 9 Soils Investigation" U.S. Department of Energy, Albuquerque Field Office, Albuquereque, New Mexico. 1994

Table 6: Remediation Option Matrix

	In Situ Technologies					Ex Situ Technologies			
	In-situ Chemical Oxidation	Enhanced Bioremediation	Resistive Heating with or w/out Steam Injection (DUS)	Air Sparging (AS) (perched water system)	Soil Vapor Extraction (SVE) (perched water system)	Excavation	GW recovery / vertical wells (perched system dewatering)	Air Stripping (AST) (treatment of extracted water)	Granular Activated Carbon (GAC) (treatment of SVE air stream)
Threshold Criteria									
Protection of Human Health and the Environment	* Destroys contaminants through oxidation * Destruction and consequent reduction of contaminant mass is protective of human health and the environment * Workers could be exposed to hazardous compounds, i.e., hydrogen peroxide and sulfuric acid, during implementation	* Destroys and reduces contaminant mass * Destruction and consequent reduction of contaminant mass is protective of human health and the environment	* Reduces contaminant mass by removal for further processing * Off-gas treatment may be required * Consequent reduction of contaminant mass is protective of human health and the environment	* Reduces contaminant mass by mechanical removal and enhancement of bio activity * Low concentrations may require no subsequent treatment	* Reduces contaminant mass by mechanical removal * Low concentrations may require no subsequent treatment	* Removes contaminated soils * Removal prevents contaminant migration by leaching	* Removes contaminated groundwater * Subsequent treatment required * Controls migration of contaminants to reduce exposure	* Removes contaminants from groundwater * Contaminants destroyed by oxidation * Off-gas treatment may be required	* Removes contaminants from waste stream * Subsequent destruction, disposal, and reduction of contaminant mass is protective of human health and the environment
Attainment of Media Cleanup Standards On* Site Set by the Implementing Agency	* Rapid process - destroys contaminants on contact * Substantial contaminant reductions can occur	* Destroys contaminant plume through biodegradation * Relatively slow process, notable results observed at some sites within a few months * Complete removal of contaminants unlikely, but substantial reductions can occur.	* Ideally suited to treat highly contaminated groundwater and soils * Enhances attainment of media cleanup standards * Off-gas treatment may be required * Treatment duration typically 3 to 12 months	* Presumptive remedy * AS w/without SVE successfully used at many sites in U.S * Documented to significantly reduce VOC concentrations * Significant reductions in dissolved contaminant concentrations obtained in six months to a few years	* Remove VOCs from vadose zone but assists in air sparge off-gas control * Successfully used at many sites in U.S. * Assists in meeting the soil cleanup goals	* Successfully for many years at sites across the U.S. * Numerous technical papers published documenting the ability of excavation to remove contaminated soils * Significant reduction of NAPL and contaminated soils/groundwater	* Effectively reduces contaminant mass through extraction * Results obtained in a few to many years depending upon site-specific conditions	* Effectively reduces volatile and semi volatile contaminants to help achieve GWPS in the treated effluent	* Used in conjunction with contaminated media removal by removing contaminants from waste streams and preventing reentry into groundwater
Control the Sources of Releases	* The facility is inactive, No potential for future releases * Use of this technology would eliminate a potential, on-going source of contamination to groundwater * Capture of some hazardous intermediate compounds may be required	* The facility is inactive * No potential for future releases * Bioremediation would reduce dissolved-phase contamination	* The facility is inactive * No potential for future releases * Would reduce residual NAPLs that may be considered a potential, ongoing source of groundwater and soil contamination	* The facility is inactive * No potential for future releases * Not designed to control the source of releases	* The facility is inactive * No potential for future releases * Not designed to control the source of releases	* The facility is inactive * No potential for future releases * Removal would eliminate a potential, on-going source of contamination in groundwater	* The facility is inactive * No potential for future releases * Mass of the contaminated groundwater plume is reduced thereby reducing the potential for migration	* The facility is inactive * No potential for future releases	* The facility is inactive * No potential for future releases
Compliance With Waste Management Standards	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if removed media are hazardous.	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if removed media are hazardous.	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if removed media are hazardous.	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if removed media are hazardous.	* Stack exhaust will be treated if needed. Air permit may be required. * All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if media are hazardous.	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if media are hazardous.	* All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if media are hazardous.	* Stack exhaust will be treated with carbon if needed * All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if media are hazardous.	* Spent adsorbent may be regenerated off-site * All activities will be conducted in accordance with all applicable Federal and State regulations and policies * All waste products (drill cuttings, storage containers, etc.) will be properly disposed at an approved disposal facility as dictated by the nature of the waste * The TCLP criteria (40 CFR 261.24 Table 1) will be the basis for determining if media are hazardous. Adsorbent or treatment media would be supplied by a commercial vendor, and spent media may be regenerated off-site

Table 6: Remediation Option Matrix

	In Situ Technologies					Ex Situ Technologies			
	In-situ Chemical Oxidation	Enhanced Bioremediation	Resistive Heating with or w/out Steam Injection (DUS)	Air Sparging (AS)	Soil Vapor Extraction (SVE)	Excavation	GW recovery / vertical wells (dewatering)	Air Stripping (AST)	Granular Activated Carbon (GA
Balancing Criteria									
ong-term Reliability and ffectiveness	* Expected to be high because permanent destruction of contaminants occurs * Considered a presumptive remedy by EPA	* Generally high because permanent destruction of contaminants occurs * Demonstrated at many sites (EPA SITE Program and Coast Guard)	* Expected to be high because nearly complete removal of contaminants occurs * Used by DOE, DOD, NASA, and the Air Force * Used for groundwater and soils remediation at RCRA and other sites	* Expected to be high because nearly complete removal of contaminants occurs * Used by DOE, DOD, NASA, and the Air Force * Used for groundwater and soils remediation at RCRA and other sites	* Expected to be high because nearly complete removal of contaminants occurs * Used by DOE, DOD, NASA, and the Air Force * Used for soils remediation at RCRA and other sites	* Expected to be high because nearly complete removal of contaminants occurs * Used by DOE, DOD, NASA, and the Air Force * Used for soils remediation at RCRA and other sites * Presumptive remedy	* Expected to be high because nearly removal of contaminants occurs * Technology may requires many years to achieve significant mass reduction * Used by DOE, DOD, NASA, and the Air Force * Used for groundwater remediation at RCRA and other sites * Presumptive remedy	* Expected to be high because nearly complete removal of contaminants occurs * Used by DOE, DOD, NASA, and the Air Force * Used for groundwater remediation at RCRA and other sites * Presumptive remedy	* Expected to be high because nearly complete removal of contaminants occu on most VOC contaminants * Used by DOE, DOD, NASA, and the A Force * Used for groundwater remediation at RCRA and other sites * Presumptive remedy
eduction in the oxicity, Mobility, or Volume of Wastes	* Reduces toxicity and volume (total mass) of contaminated soils and groundwater * Treatment provides destruction of some compounds * Can increase the mobility of residual compounds by reducing viscosity or increasing solubility in groundwater * Hydraulic control of the site is required during treatment	* Reduces toxicity and volume (total mass) of contaminated soils and groundwater * Provides for destruction of VOCs	* Significantly reduces contamination toxicity, mobility, and volume * Removes virtually all VOCs and SVOCs * Elimination of volatile and potentially soluble contaminants will reduce the mobility of the minor amounts of waste that could be left in place after the completion of resistive heating/DUS utilization * Hydraulic control of the site is required during treatment	* Reduces mobility and volume of dissolved VOCs in groundwater by transferring VOCs to other media * Volatilization of VOCs into the air will lead to more rapid breakdown of contaminants into nontoxic forms	* Reduces mobility and volume of VOCs in vadose zone and LNAPL on the water table surface * Volatilization of contaminants into the air leads to rapid breakdown into nontoxic forms * Carbon or other off-gas treatment media or systems may be used to treat vapor-phase contaminants emitted from the SVE system * Periodic carbon regeneration will provide thermal destruction of volatile organics adsorbed onto the carbon	* Reduces toxicity, mobility, and volume of NAPLs and VOC-contaminated soils by removal and subsequent treatment or destruction	* Reduces toxicity and volume (total mass) of contaminated groundwater	* Reduces toxicity and volume (total mass) of contaminated groundwater * Provides for transfer of some compounds from groundwater	* Reduces the toxicity and volume (total mass) of contaminated groundwater an any off* gas stream * Removes compounds from these wast streams
hort-term ffectiveness	* Effective on a short-term basis * Quick acting process * Minimal community risk * Worker's must be protected from contact with oxidizers and acids * As long as migration is controlled, environmental impact is minimal	* Requires a relatively long treatment cycle * Minimal community risk * As long as migration is controlled, environmental impact is minimal	* Treatment requires 3-12 months plus a cool-down period of several additional months * Effective on a short-term basis * Quick acting process * Minimal community risk * Worker's must be protected from contact from electrical and thermal hazards (steam) * As long as migration is controlled, environmental impact is minimal	* Effective in reducing overall concentrations quickly - usually less than a year * Effective on a short-term basis * Quick acting process * Minimal community risk - air is only exposure path * Environmental impact is minimal	* Effective as a supplement to air sparging* Effective on a short-term basis * Minimal community risk (off-gas)	* Highly effective as a short-term measure * Primary risks are from worker and public exposure during handling and transport of contaminated soil * Air modeling/monitoring may be used to ensure that a temporary increase in ambient VOC concentrations do not exceed allowable exposure limits * Dust control is important to community and worker safety * Environmental impact is high but site should recover	* Effective in extending protection to the community during final remedial actions by controlling the migration of the contaminant plume * Proper health and safety procedures, including engineering controls, will be used during remedial activities to limit exposure to contaminants and hazardous media generated during implementation	* Effective in extending protection to the community during * Exposure to remedial workers is minimal * Air modeling/monitoring may be used to ensure that a temporary increase in ambient VOC concentrations do not exceed allowable exposure limits	* Effective in extending protection to the community during final remedial actions removing contaminants from waste stre * Exposure to remedial workers is minim * Effective and reliable with most compounds * Technology commonly accepted by regulators
nplementability	* Relatively straightforward * UIC permit may be required and could delay implementation * Construction/implementation relatively short but repeat applications are required * May not be reliable at all sites or in achieving goals * Measurable results achieved within weeks * Pilot testing prior to full-scale implementation * Technology commonly accepted by regulators	* Relatively straightforward - either injection or recircualting system * UIC permit may be required and could delay implementation * Construction/implementation relatively short lead time * May not be reliable at all sites or in achieving goals * Measurable results may be achieved within a few months * Pilot testing prior to full-scale implementation * Technology usually accepted by regulators	* Employs patented technologies (owned by DOE) * Implemented relatively quickly utilizing specialized equipment * Long lead time may be required to obtain a direct power drop from the utility company or plant * High temperature CPVC or metal must be used for wells * Plastic conduit/piping might require replacement if heated zone extends to within 5 feet of the surface * Demonstrated to be reliable * Technology commonly accepted by regulators	* Straightforward to construct and operate * Low permeability soil reduces sparge rate * Numerous vendors, contractors, equipment, and construction services available * Short lead-time, reliable if site conditions are favorable * Treatment period generally ranges from six months to two years * Pilot testing prior to full-scale implementation to determine spacing of the AS and SVE wells * Technology commonly accepted by regulators	* Straightforward to construct and operate * Low permeability soil hinders effective use * Numerous vendors, contractors, equipment, and construction services available * Short lead-time, reliable in most vadose zones * Treatment period generally ranges from six months to two years * Pilot testing prior to full-scale implementation to determine spacing of the SVE wells * Technology commonly accepted by regulators	* Implementation is relatively straightforward * Executed fairly quickly, usually reliable * Numerous contractors are available to provide equipment and construction services * No unusual equipment or long-lead time is anticipated * Timeframe is generally from a few weeks to a few months * Implementation time is dependent on amount of dewatering required, amount of soils excavated, and depth of excavation, etc. * Treatment and/or disposal of groundwater requires advanced planning and permitting * Technology commonly accepted by regulators	* Construction/implementation is relatively straightforward * Executed fairly quickly * Results can be measured once the system is operational * Long time frame to achieve goals * Reliable even though slow * Technology commonly accepted by regulators	* Construction/implementat ion is relatively straightforward * Executed fairly quickly * Results can be measured once the system is operational * Reliable and effective * Technology commonly accepted by regulators	* Implementation is relatively straightfor * Executed fairly quickly, GAC equipmen readily available * Results can be observed once a treatm system is operational.
osts	* Very high capital (groundwater containment system) * Very low O&M of chem-ox but high on plume containment * Reported 109,000 gallons of 50% H2O2 through 255 injectors over 120 days for TCE in soil, project cost was $5.7 million. * Cost estimate for EST. site - 88 injectors ~ $460,000.	* Usually low capital * Low to moderate O&M * Highly variable depending on methods used * low injection biosparge less expensive * biological amendments can be high cost (nitrate cost is $160 to $230/gallon) * peroxide enhancement O&M costs are highest	* Very high capital and initial operation * Very high O&M (short duration) but low long-term * Only a few vendors that perform this work, only two licensed * Estimates of $200,000 base plus $50/yd3 for treatment. DOE factor raises cost 150-200%	* Moderate capital * Moderate O&M * Rental equipment available	* Low to moderate capital (dependent on number of required SVE wells) * Low to moderate O&M (dependent on off gas treatment requirements)	* High initial cost * No O&M * Costs to dig typically $10/yd3 * T&D costs typically $40 - $50/ton nonhazardous and $250 - $300 hazardous * recent PRS's have experienced costs of ~ $2 cu. Ft. of $ 40 – 50 cu. yd.	* Moderate capital * Moderate to high O&M, long -term * Cost benefit declines over time * Published estimates of $150,000 to $350,000 per acre. Also $420 per pound contaminant removed	* Typical cost ranges from $25K to $500K depending upon the process flow rate, the contaminants, concentrations of contaminants, and other factors	* Largest single expense is cost of carbo regeneration or disposal. * Water adsorption systems are more efficient but require greater pretreatmen remove constituents such as iron, calciu and suspended solids, thus increasing c * Air adsorption systems are generally le efficient but may require little pretreatme

Table 6: Remediation Option Matrix

	In Situ Technologies					Ex Situ Technologies			
	In-situ Chemical Oxidation	Enhanced Bioremediation	Resistive Heating with or w/out Steam Injection (DUS)	Air Sparging (AS)	Soil Vapor Extraction (SVE)	Excavation	GW recovery / vertical wells (dewatering)	Air Stripping (AST)	Granular Activated Carbon (GA
General Process									
	* Process involves exchange of electrons to destroy organic compounds or reduce them to less hazardous compounds * Most commonly used oxidizing agents are sodium or potassium permanganate or hydrogen peroxide (with supplemental ferrous iron and acid)	* Rate of biodegradation of organic contaminants can be enhanced by increasing the concentration of electron acceptors and nutrients for aerobic degradation * Or by increasing hydrogen ion concentrations for reductive dehalogenation	* Uses electrical resistive heating in conjunction with injected steam and conventional extraction technologies * Injected steam reduces viscosity and increases mobility of NAPLs and other contaminants * Increased vapor pressure results in increased volatility * Resistive heating heats low permeability zones and mobilizes contaminants to more permeable zones * Steam is recovered via SVE or extraction wells * Condensed steam is treated at land surface * Geophysical techniques used to monitor heating and underground movement of steam	* Air injection into the contaminated aquifer removes VOCs by volatilization * Introduction of air may also enhance aerobic biodegradation of compounds * Soil vapor capture may be required	* Process where vacuum is applied to unsaturated zone to induce controlled flow of air and remove VOCs and some SVOCs * Soil vapors are collected for off-gas venting or treatment	* Process of digging and removing contaminated media * Ex* situ treatment or off site disposal	* Process of recovering groundwater by pumping * Groundwater treatment ex-situ	* Physically transfers VOCs from groundwater, surface water, or wastewater, to ambient air * Contaminants transferred to air stream * Contaminants destroyed by oxidation or incineration, or removed using GAC adsorption or other off-gas treatment * Many types commercially available (packed towers, tra- type, spray aerators, mist aerators, diffused aerators, low-profile packed towers, centrifugal air strippers) * Sizes range from 10 to 1000 gpm	* Removes low concentrations contaminants in groundwater an off-gas streams * Used to remove organics and adsorb and concentrate inorganics for further treatment * Can be used as a polishing treatment in conjunction with ot remediation technologies * Saturated media can be reactivated (by destruction of contaminants), regenerated (by desorption of contaminants), or discarded
ros	* Process proceeds completely in-situ * High concentrations of contaminants are rapidly converted to innocuous substances	* Takes advantage of indigenous microbes or uses acclimated microbes from other sites * Can provide long term effectiveness * Remediation occurs completely in-situ	* Enhanced recovery from low conductivity portions of aquifer * Creates steam flooding front * Enhanced volatility of SVOCs * High concentrations of contaminants are rapidly converted to innocuous substances * Relatively quick achievement off goals	* Effective on most VOCs * Provides both physical and enhanced biological remediation * Relatively inexpensive and easy to implement * May eliminate need for groundwater recovery and ex-situ treatment of contaminants	* Effectively removes volatile contaminants * Soils more conductive to air than groundwater, enhancing recovery potential	* Removes nearly all contamination (including residual) * Allows direct observation and sampling of contamination	* Proven technology for hydraulic control * Captures mobile dissolved contamination * Easy regulatory approval * Often a component of multi-phase remediation systems	* Used in industry for many years * Applicable to a wide variety of VOCs and certain SVOCs under specific conditions * Minimal energy costs, compared with thermal treatment technologies * Can be Used in conjunction with other treatment technologies * System Can be designed for site-specific treatment goals	* EPA considers adsorption usi GAC a presumptive remedy * Easily implemented
ons	* Requires handling large quantities of hazardous chemicals * Reaction rates highly variable * Ineffective distribution in low permeability soils * Extreme exothermic reaction can damage wells, pipes, etc. and can facilitate vapor migration * Can reduce aquifer permeability downgradient due to precipitation of metals * Reactions affected by naturally occurring electron donors * May have to lower pH, requiring acid injection * UIC approval may be required * Hazardous intermediate compounds may form if reaction is not completed * Cost prohibitive for dissolved phase contamination * Vapor recovery may be required * Hydraulic control required * Contamination migration possible	* Injection effectiveness limited in low permeability strata * Slow process * Anaerobic degradation of aliphatic COCs results in increase in toxic daughter product accumulation * Escape of contaminants associated with injection process * May require hydraulic control * Can be difficult to monitor effectiveness	* Small treatment zones require placement of numerous electrodes * Hydraulic control systems required * High voltage safety concerns * High cost * High injection pressures may cause soil fracturing * Recovery systems required	* Potential uncontrolled movement of dangerous vapors * Soil heterogeneity may cause unaffected zones * Limited to compounds with Henry's constant values >0.001 atm- m3- mol- 1 * May require vapor capture system * Limited effectiveness in low K soils (i.e., K<0.001 cm/sec.) * Radius of influence is minimal at base of injection wells	* May require numerous extraction wells for shallow water table aquifer * Channeling of soils vapors occurs in lower permeability aquifers * Off gas treatment may be required * Efficiency affected by diffusion and volatilization in subsurface, lithology and degree of saturation	* Limited to shallow zones of contamination * Dewatering required to dig below water table * Groundwater treatment may be required * Ex-situ treatment/disposal required	* Cost effectiveness decreases exponentially over time * Difficult to mobilize/capture DNAPLs * Numerous wells required in lower permeability aquifers * Access for well installation and equipment required at all well sites * Precipitation and biological fouling of wells in highly mineralized groundwater * Ex-situ treatment system required	* Requires groundwater recovery * May require prolonged treatment time	* Requires installation of a groundwater recovery system * May require numerous recove wells due to low permeability * Cleanup time dependent upon ability to pump contaminants fro the subsurface
Feasibility at Mound									
	Not feasible * No access for injection distribution points. *Exothermic reactions problematic within active industrial areas. *High indigenous metals concentrations will affect reagent requirements	* Limited feasibility * Chlorinated aliphatics will require anaerobic bacteria production, will result in high concentration daughter products *relatively slow process * Difficult to monitor beneath impervious surfaces, e.g., buildings, slabs, etc.	* Moderately feasible * Effective and quick *Relatively very costly	* Limited feasibility for perched wate * Difficult to monitor beneath impervious surfaces, e.g., buildings, slabs	* Usable only as a supplement to other technologies	* Highly feasible * Contamination not deep; dewatering necessary at PRS 87	* Moderately feasible for shallow aquifer due to low permeability * Long time frame unacceptable except for dewatering	* Limited feasibility * Useful only with groundwater extraction * Effective for use with dewatering	* Moderately feasible * Only works with groundwater (PR 87) tretament or with vapor treatme