01040701-060502 0004

U.S. Department of Energy

Miamisburg Closure Project
1075 Mound Road
Miamisburg, Ohio 45342

MAY 5 2005

MCP-201-05

Mr. Tim Fischer
U.S. Environmental Protection Agency
77 W. Jackson Boulevard, SR-6J
Chicago, IL 60604

Mr. Brian Nickel
Ohio Environmental Protection Agency
401 E. Fifth Street
Dayton, OH 45402

Dear Mr. Fischer & Mr. Nickel:

Enclosed please find the "Phase I Remedy (Monitored Natural Attenuation) Groundwater Monitoring Plan (Final, dated September 29, 2004)." As you know, this monitoring plan was prepared in accordance with the Phase I Parcel Record of Decision (ROD), and was approved by the *Mound 2000* Core Team on September 29, 2004. The enclosed plan requires DOE to submit a draft annual report to the regulators, by March 31st of each year, that documents the progress of the MNA remedy towards meeting the remedial objectives of the Phase I parcel. On March 30, 2005, DOE submitted the first-ever annual report (draft) to the regulators for review and comment.

If you have any questions on the enclosed Final Phase I Remedy MNA Groundwater Monitoring Plan, please contact me at (937) 847-8350, ext. 309.

Sincerely,

Margaret L. Marks
Director

Enclosure: As Stated

cc w/enc:
Paul Lucas, DOE-MCP
Sue Smiley, DOE-MCP
Cliff Carpenter, DOE-LM
Ron Staubly, DOE-LM
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Donna Gallaher, SM Stoller
CERCLA Administrative Record

01040701-0605020004

U.S Department of Energy
Ohio Field Office

Phase I Remedy (Monitored Natural Attenuation) Groundwater Monitoring Plan

September 29, 2004

Final

MIAMISBURG
CLOSURE PROJECT

CH2MHILL

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Phase I Remedy (Monitored Natural Attenuation) Groundwater Monitoring Plan

September 29, 2004

Final

MIAMISBURG
CLOSURE PROJECT

CH2MHILL

Phase I Remedy (Monitored Natural Attenuation) Groundwater Monitoring Plan

Mark D. Gilliat
David R. Rakel
Kathy Trapp

September 29, 2004

Final

Prepared for the
U.S. Department of Energy
Ohio Field Office

ABSTRACT

The final remedy for Phase I combines institutional controls in the form of deed restrictions on future land and groundwater use and monitored natural attenuation (MNA). MNA is being utilized as a remedy for a small section of the bedrock groundwater system contaminated with trichloroethene (TCE). The combined remedy will prevent current and future exposure of workers, the public and the environment to contaminated groundwater within Phase I. This groundwater monitoring plan is an enforceable document that addresses the MNA component of the CERCLA remedy for the Phase I parcel. Operation and maintenance requirements for the Institutional Controls component of the Phase I parcel remedy are addressed in a separate, enforceable document. MNA is being utilized as a remedy to ensure the concentration of TCE within the bedrock groundwater is decreasing to levels below the MCL and does not impact the BVA. This document summarizes the need for the remedy and outlines the development of the criteria (well placement, analytes and monitoring frequency) necessary for demonstrating the effectiveness of the remedy.

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Appendix A Well Construction Information for the Phase I Monitored Natural Attenuation Monitoring Wells

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Appendix C Procedure for Collection of Groundwater Samples for Stainless Steel Wells for Nickel and Chromium Analysis

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BVA	Buried Valley Aquifer
COC	contaminant of concern
DCE	1,2 cis-dichloroethene
DOE	Department of Energy
HI	Hazard Index
MCL	maximum contaminant level
MCP	Miamisburg Closure Project
MNA	monitored natural attenuation
OEPA	Ohio Environmental Protection Agency
ppb	parts per billion
ppm	parts per million
pCi	pico curie
ROD	Record of Decision
RRE	Residual Risk Evaluation
SDWA	Safe Drinking Water Act
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound

1.0 INTRODUCTION

This Groundwater Monitoring Plan was prepared in support of the selected remedy for the Phase I Record of Decision (ROD) at the Department of Energy (DOE) Miamisburg Closure Project (MCP) in Miamisburg Ohio.

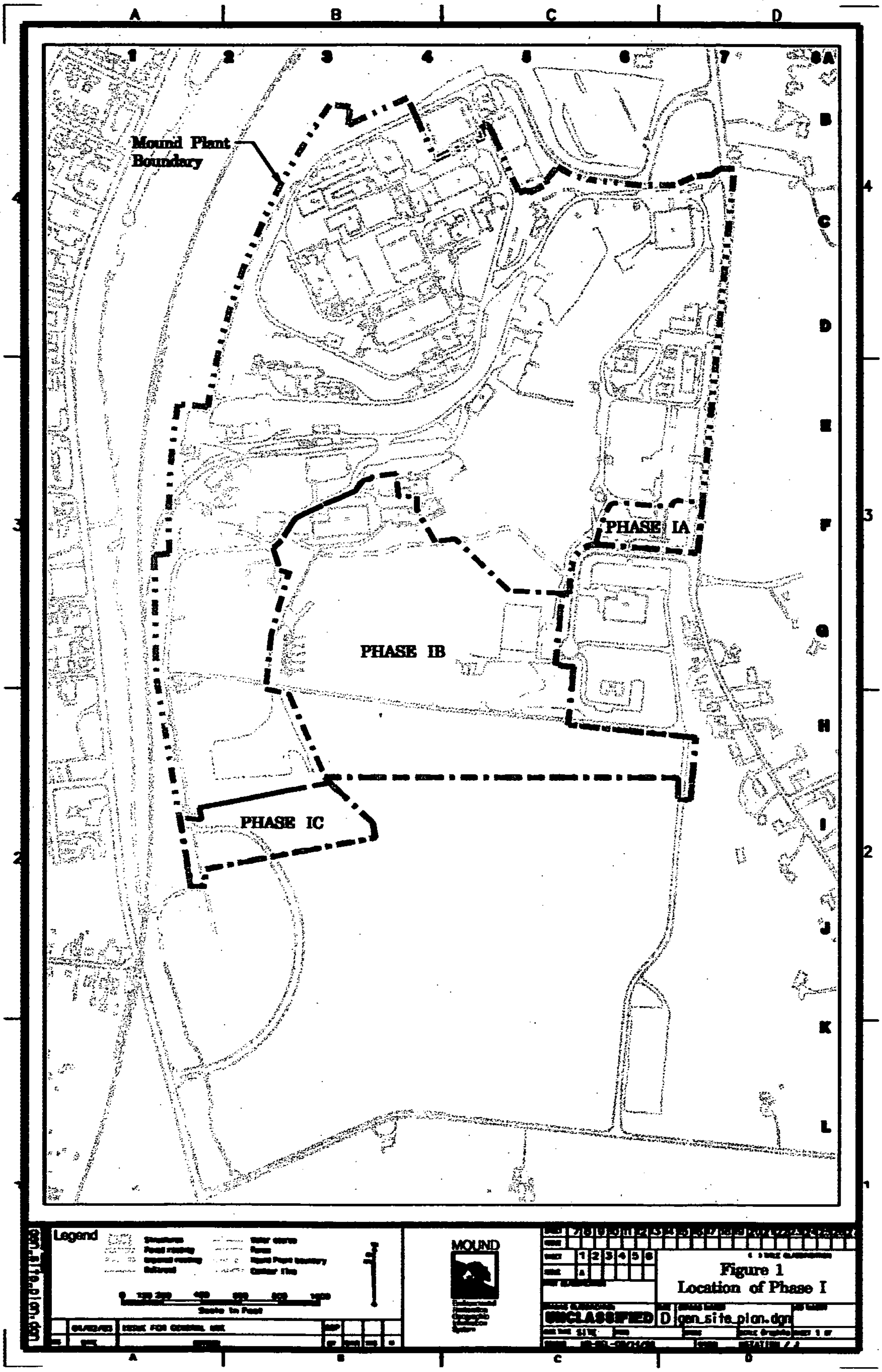
This plan addresses the implementation of monitored natural attenuation (MNA) at Phase 1, which is the remedy for groundwater contaminated with trichloroethene (TCE) in the bedrock groundwater system within a small section of the Phase I property.

The Mound Facility is preparing to transfer a parcel of land known as "Phase 1" (Figure 1). The parcel is broken into three geographic elements (Phase 1A, Phase 1B and Phase 1C) for purposes related to transfer dates (see Appendix C of the Phase 1 Record of Decision,Final, July 2003). The parcel contains groundwater monitoring wells that are screened in both the permeable glacial sediments of the Federal and State designated Sole Source Buried Valley Aquifer (BVA) and the relatively impermeable bedrock aquifer system. There are currently six groundwater monitoring wells and one seep located within the boundary of Phase I that show exceedances of Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL). Four of the monitoring wells (0411, 0443, 0445, and 0399) are screened in the bedrock groundwater system, and two of the monitoring wells (0319 and 0400) are screened in the BVA. Wells 0411, 0443, and Seep 0617 exceed the MCL (5 parts per billion [ppb]) for TCE. Well 0445 exceeds the MCL for barium (2 parts per million [ppm]) and the MCL for radium-226 and 228 (5 pCi/L combined). Wells 0400, 0319, 0399, and 0411 have exceeded the MCLs for nickel (100 ppb) and chromium (100 ppb). The location of these wells is shown in Figure 2. SDWA MCLs constitute chemical specific Applicable or Relevant and Appropriate Requirements (ARARs) that apply to the groundwater beneath Phase I. The MCL values establish the acceptable concentration of a chemical that may be found in a drinking water source.

As documented in the Phase I Residual Risk Evaluation (RRE), (Reference 1), the non-carcinogenic hazard for future industrial/commercial groundwater use exceeds the target Hazard Index (HI) of one. The selected remedy for Phase I is institutional controls in the form of deed restrictions on future land and groundwater use and MNA for the TCE contamination found in Phase I bedrock groundwater. TCE is the only contaminant of concern (COC) identified in the Phase I groundwater system, (see discussion in Section 2.0). The purpose of this groundwater monitoring plan is to establish the requirements necessary to ensure the concentration of TCE within the bedrock groundwater is decreasing to levels below the MCL and does not impact the BVA. This plan also describes work activities necessary to ensure that continued monitoring and evaluation of MNA's effectiveness are performed as required.

This groundwater monitoring plan applies to the monitored natural attenuation (MNA) component of the CERCLA remedy for the Phase I parcel. This plan is a primary, and enforceable, document under the Federal Facility Agreement (FFA). As with all other parcels that have completed the CERCLA 120(h) process for property transfer to-date, the Phase I parcel remedy also includes Institutional Controls in the form of deed restrictions. Separate from this "Phase I Remedy MNA Groundwater Monitoring Plan," the "O&M Plan for the Implementation of Institutional Controls at the 1998 Mound Plant Property" is also a primary, and enforceable, document under the FFA. The O&M Plan for Institutional Controls (IC) describes those DOE actions required to monitor and maintain the IC remedy for all land parcels that have completed the CERCLA 120(h) process to-date.

Consistent with the Core Team's Path to Closure agreement on October 16, 2003, DOE plans to consolidate all remedy-specific, enforceable O&M (or Groundwater Monitoring) Plans under the umbrella of a "final, site-wide O&M Plan." Development of the final site-wide O&M Plan will occur no later than Fiscal Year 2006; in the interim, each remedy-specific O&M (or Groundwater Monitoring) Plan remains a primary, enforceable document under the FFA.


Mound Plant Boundary
PHASE IA
PHASE IB
PHASE IC
Legend
Scale In Feet
MOUND
UNCLASSIFIED
gen_site_plan.dgn
Figure 1
Location of Phase I

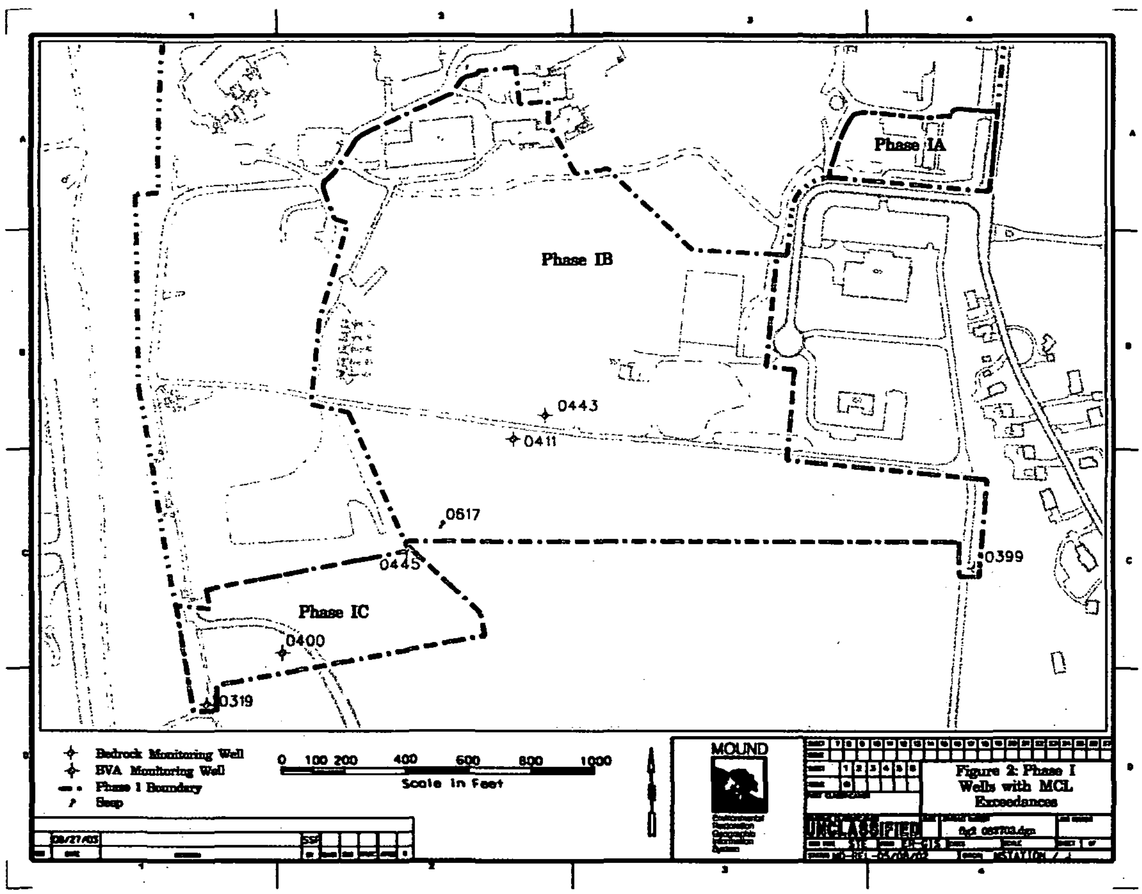


Figure 2: Phase I Wells with MCL Exceedances

2.0 CURRENT CONDITIONS

This section describes the general hydrogeologic setting within the Phase I property and the nature of the MCL exceedances within the Phase I groundwater system.

2.1 General Hydrogeologic Setting

The general hydrogeologic setting of the Mound Plant is described in section 2.5.2 of the Phase I ROD, (Reference 2). For a detailed description of the groundwater flow regimes at Mound the reader is referred to the following ROD references: 1) Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan, Final, May 1992, 2) Operable Unit 9; Hydrogeologic Investigation: Buried Valley Aquifer Report, Technical Memorandum, Revision 1, September 1994, 3) Operable Unit 9; Hydrogeologic Investigation: Bedrock Report, Technical Memorandum, Revision 0, January 1994. This section describes the general hydrogeologic setting within Phase I.

Phase I property contains two interconnected groundwater flow regimes; a low flow bedrock system dominated by fracture flow through interbedded Ordovician shale and limestone and the highly permeable glacial outwash deposits that comprise the sole source BVA. Figure 3 shows the approximate location of the BVA boundary in relation to Phase I property. The west portion of Phase IC lies directly above the BVA.

A thin tributary valley divides the two main portions of the plantsite and contains a narrow tongue of glacial deposits that are in hydraulic communication with the BVA. The groundwater within the tributary valley ultimately discharges westward into the main portion of the BVA. A small section of the northern portion of Phase IB lies above the tributary Valley groundwater system. Figure 3 shows the approximate boundary of the BVA, relative to the Phase I parcel.

Phase I property is located primarily on the topographically high south-southeastern portion of the plantsite. The area is dominated by steeply sloping hillsides that drain westward towards the tributary valley and the BVA. Figure 4 shows a topographic map of the Plantsite with the Phase I property boundary outlined in a dashed line. These topographically high areas are underlain by the fractured bedrock flow system. The bedrock surface mimics the overlying topographic surface and is typically overlain by a thin veneer (2 – 10 feet) of glacial till followed by a weathered upper section of bedrock. Groundwater flow in the bedrock system is confined to an upper fractured carapace that extends from the surface to a depth of approximately 60 feet into the bedrock. Groundwater flow directions in the bedrock system follow the topographic slope of the bedrock surface with flow ultimately discharging as surface seeps or into the BVA. Figure 5 is a schematic showing the general structure and flow characteristics of the bedrock groundwater system.

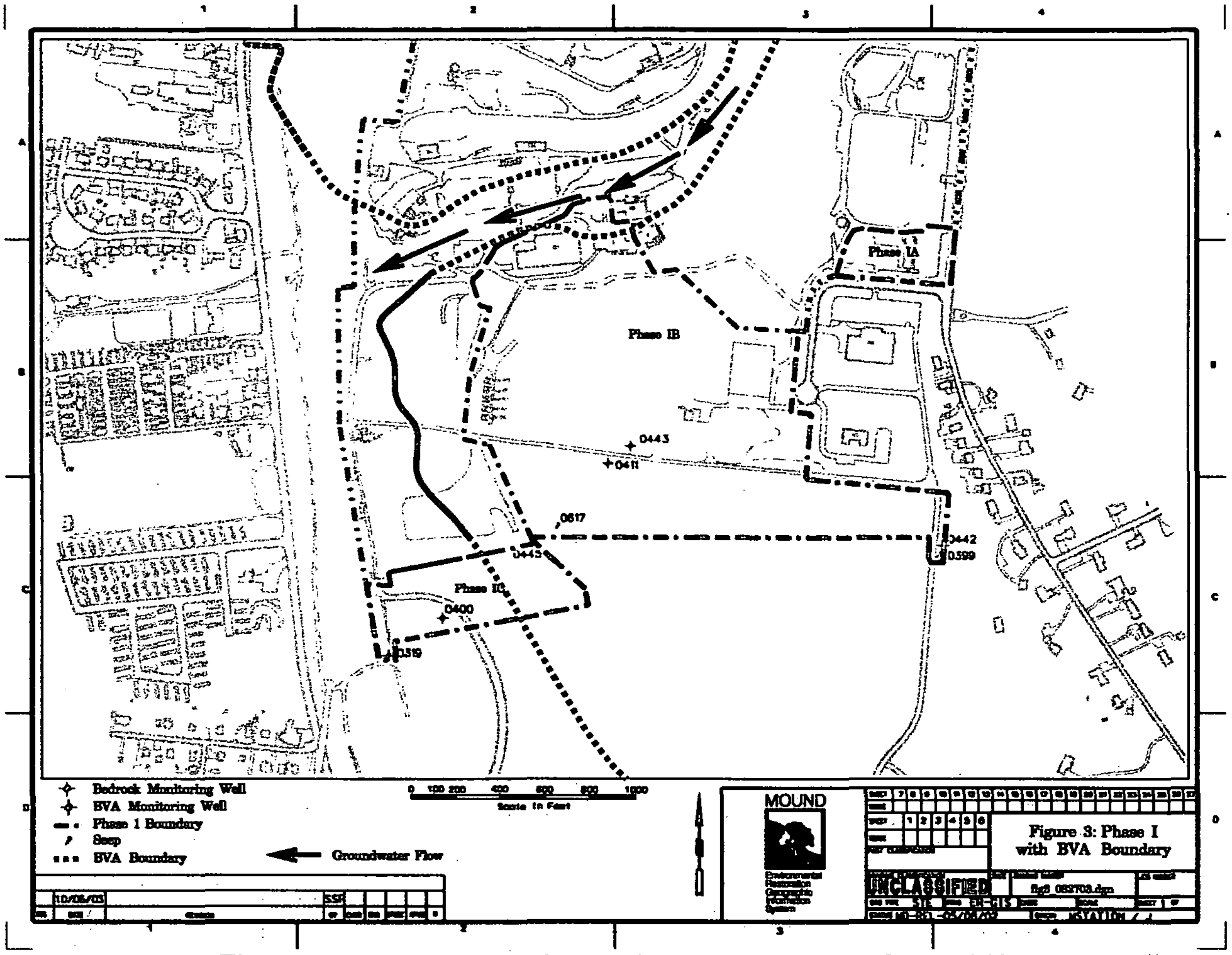


Figure 3: Phase I with Approximate Boundary of the BVA

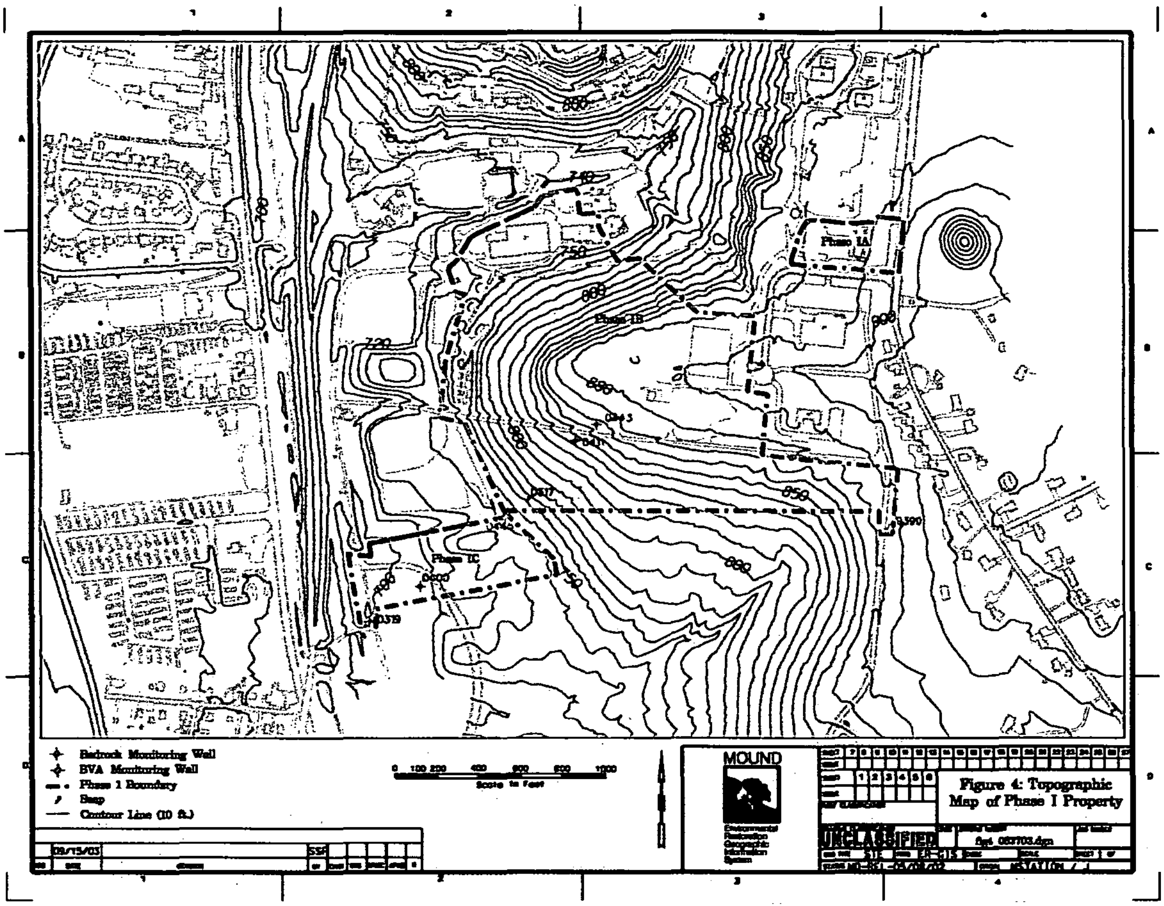


Figure 4 Topography in Phase I

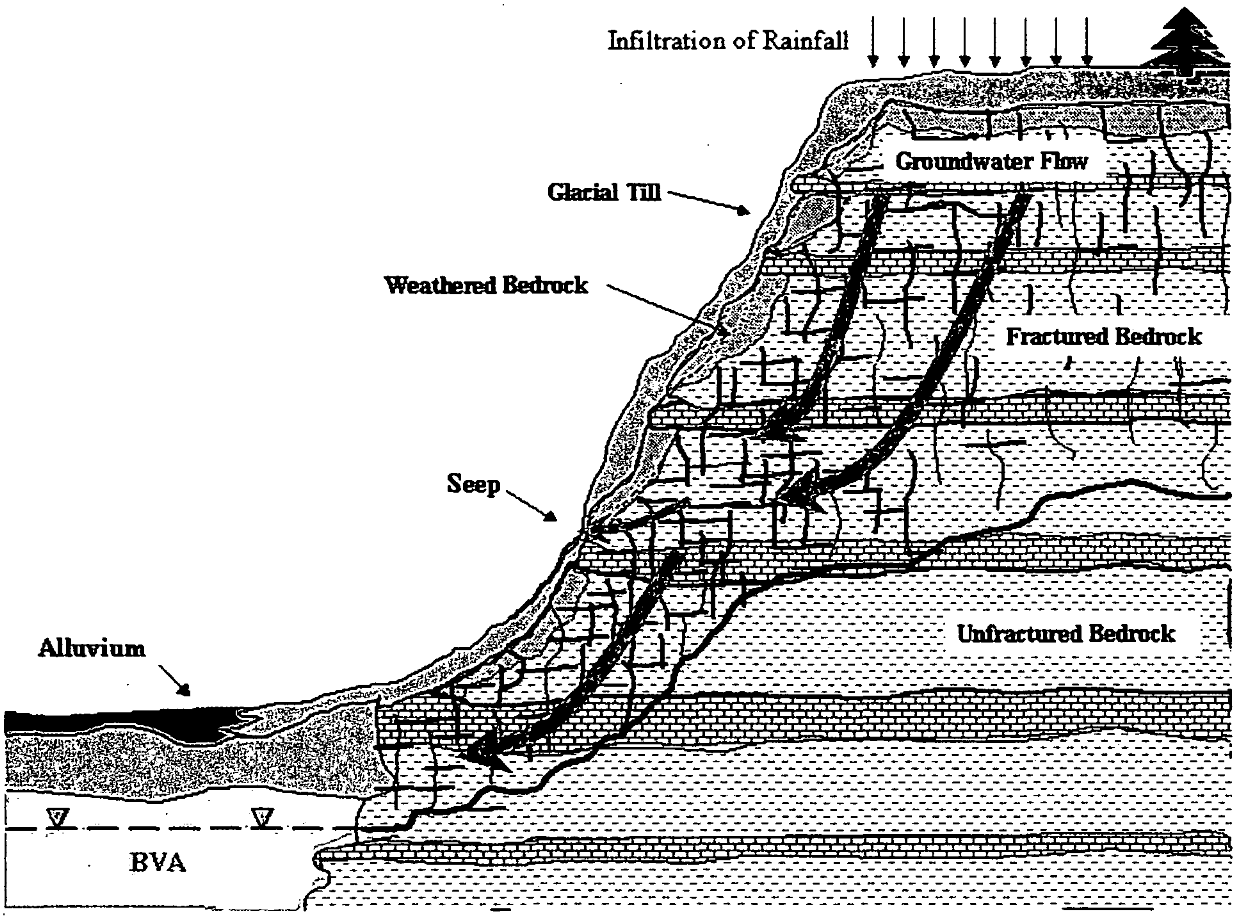


Figure 5: Generalized Bedrock Groundwater Flow

2.2 Phase I Groundwater MCL Exceedances

As noted in section 1.0 of this document, the Phase I property contains groundwater monitoring wells showing MCL exceedances for trichloroethene, barium, radium 226/228, chromium and nickel. The Record of Decision selected monitored natural attenuation as the remedy to address the elevated levels of trichloroethene in Phase I bedrock groundwater.

Elevated levels of barium and radium226/228 in well 0445 (Phase I bedrock groundwater) were evaluated and determined to be naturally occurring with the local bedrock matrix serving as the mineral source. The elevated chromium and nickel groundwater concentrations were determined to be the result of corrosion of the stainless steel wellcasings. The Department of Energy will continue to monitor select wells for barium, Radium 226/228, chromium and nickel to confirm the results of previous investigations.

Details regarding the MCL exceedances are discussed in sections 2.2.1, 2.2.2 and 2.2.3 below.

2.2.1 Trichloroethene TCE Groundwater Contamination

Wells 0411, 0443, and Seep 0617 exceed the MCL (5 ppb) for TCE. Groundwater monitoring well 0411 has consistently shown elevated levels of TCE. Maximum levels occurred in the mid 1990s with concentrations exceeding 20 ppb. Recent results show TCE concentrations remaining above the MCL of 5 ppb (Spring 2003 concentration at 12 ppb). Well 0443 located approximately 200 ft upgradient of well 0411 and Seep 0617, located approximately 350 feet downgradient from well 0411, also show TCE contamination (spring 2003 results show TCE at 8 ppb in well 0443 and 6 ppb in seep 0617). Figures 6 - 8 show plots of TCE and 1,2 cis-dichloroethene (DCE) concentration in wells 0411, 0443 and seep 0617 over time. DCE is a known intermediary (daughter) product formed during the natural breakdown of TCE. The presence of 1,2 cis-dichloroethene is a strong indicator that TCE is naturally degrading. Although soil sampling has shown that there is no known continuing source of TCE contamination in the soil, TCE is not naturally occurring and was widely used in plant operations. Therefore, TCE is a COC for the groundwater in Phase 1 and will be addressed by the selected remedy.

Figure 6 Trichloroethene (TCE) and 1,2 cis-dichloroethene (DCE) in Monitoring Well 0411

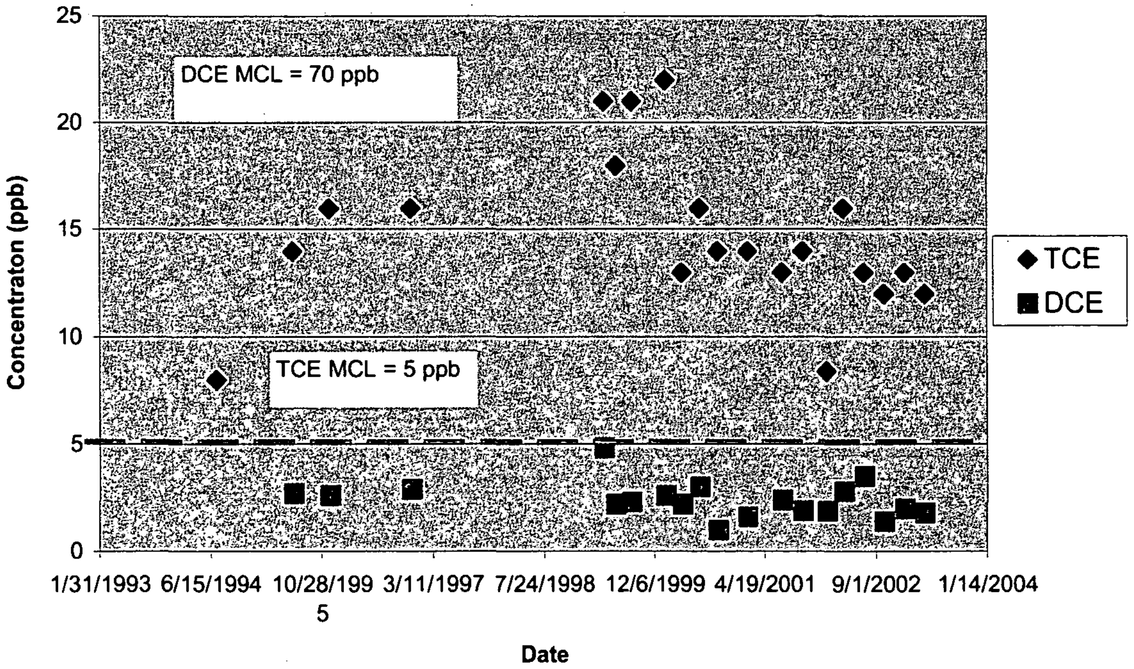


Figure 7 Trichloroethene (TCE) and 1,2 cis-dichloroethene (DCE) in Monitoring Well 0443

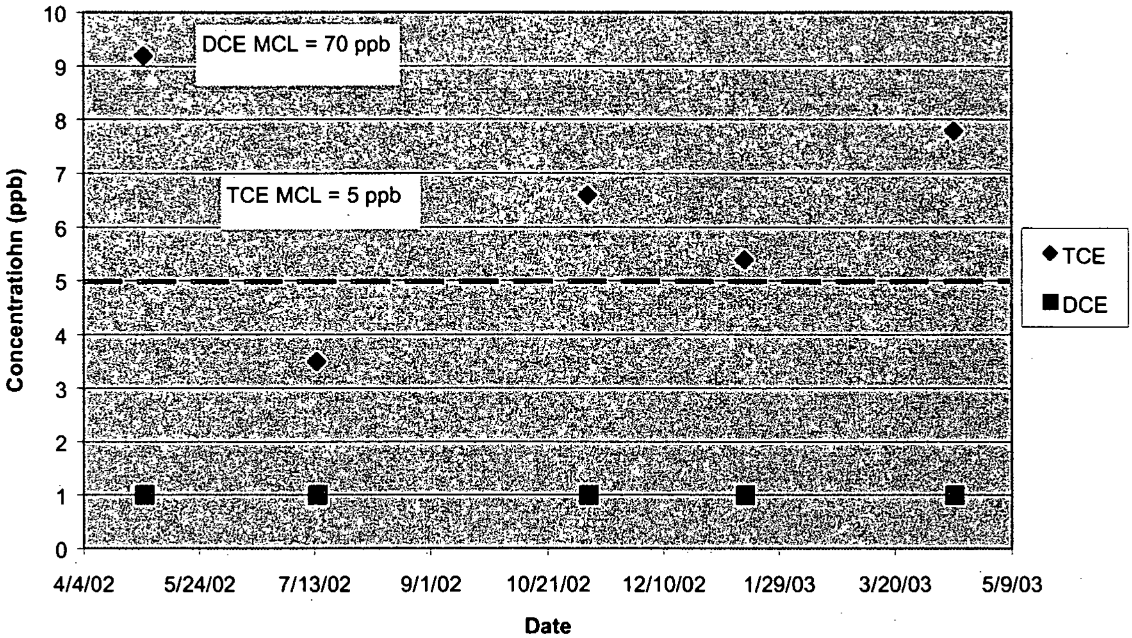
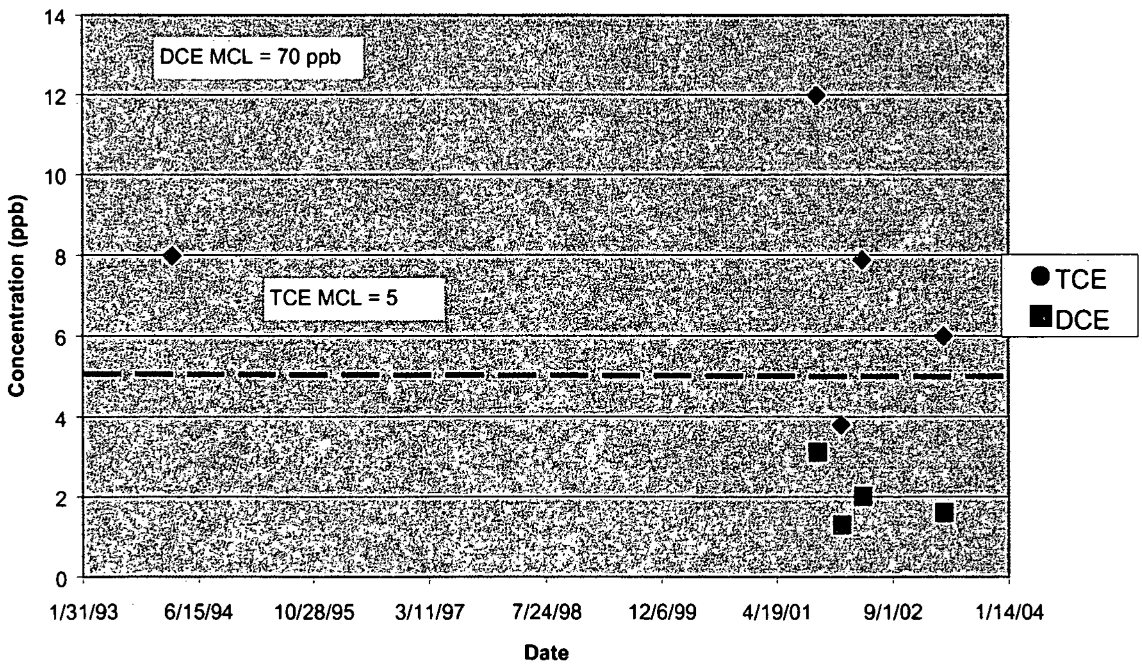


Figure 8 Trichloroethene (TCE) and 1,2 cis-dichloroethene (DCE) in Seep 0617



2.2.2 Radium and Barium in Groundwater

Groundwater in well 0445, (screened within the bedrock flow system), exceeded the MCLs for both barium and radium 226/228 combined. The well has consistently shown barium in the 5 – 7 ppm range, while radium 226/228 combined concentrations have typically been in excess of 40 pCi/L. Recent work completed by Mound in conjunction with the Savannah River Environmental Technology Center demonstrated that the unusual water chemistry observed at well 0445 is likely due to the interaction of surface salt and the underlying bedrock. The surface salt source is thought to be the SST Building (wooden structure used to store road salt) located in Phase I upgradient of well 0445. Details of this work can be found in Reference 3 (WSRC-TR-00281 "Geochemical Evaluation of Elevated Barium and Radium in Bedrock at the Miamisburg Closure Project", August, 2003). In light of the conclusions reached in this study, DOE has ceased utilizing this building for salt storage. Based on the results of this study and the action taken by DOE to cease use of the salt storage shed, barium and radium are not considered COCs to be addressed by the proposed remedies. However, to confirm the understanding of the barium, radium-226, and radium-228 in groundwater situation is correct, DOE will continue to monitor for these constituents. The details of this additional monitoring are described in Section 6.0 "Confirmatory Monitoring".

2.2.3 Nickel and Chromium in Groundwater

Limited Field Investigations (References 4 and 5) indicate the nickel and chromium concentrations observed at wells 0400, 0319, 0399, and 0411 are likely the result of corrosion of the wellcasing and not the result of plant operations. Therefore, nickel and chromium are not considered contaminants of concern to be addressed in the proposed remedies. However, because the data set supporting this conclusion is limited, DOE will continue to monitor for nickel and chromium. With continued monitoring showing consistent or decreasing nickel and chromium results, DOE could, with the concurrence of USEPA and OEPA, discontinue monitoring groundwater in Phase I for nickel and chromium.

3.0 SELECTED REMEDY: MONITORED NATURAL ATTENUATION

The selected remedy for TCE groundwater contamination in Phase I is Monitored Natural Attenuation. This groundwater plan outlines the details associated with the requirements necessary to demonstrate that Monitored Natural Attenuation is an effective remedy for TCE contamination in Phase I groundwater.

DOE will monitor groundwater in Phase I for TCE and its degradation products (1,2 cis-dichloroethene and vinyl chloride) to verify that the concentration of TCE is decreasing due to natural attenuation. Groundwater monitoring will also provide assurance that the TCE observed in Phase I is not impacting the BVA.

The regulators have the ability to participate in any of the sampling events for purposes of observation or to split a sample.`

3.1 Remedial Action Objectives

The remedial action objectives include the following:

- Protect the BVA by verifying that the concentrations of TCE in the vicinity of wells 0411, 0443 and seep 0617 are decreasing and that TCE is not impacting the BVA.

- An objective as stated in the ROD reads as follows: "Demonstrate the TCE in the groundwater of wells 0411, 0443 and seep 0617 does not exceed the MCL" As TCE concentrations in wells 0411, 0443 and Seep 0617 already exceed the MCL of 5 ppb for TCE, the true objective is to reduce TCE concentrations to below the MCL in wells 0411, 0443 and Seep 0617.

3.2 Estimated Remedial Action Time Frame

Linear regression analysis has been utilized to determine the approximate time frame in which the remedy may be expected to be complete (i.e. for TCE concentrations in the bedrock to drop to 5 ppb). The analysis utilizes the TCE data set from well 0411 after peak concentrations occurred. TCE concentrations have been declining in the well for approximately the last four years and linear extrapolation of that data set indicates MCLs could be attained as early as sometime in 2006 or 2007. Figure 9 shows a plot of the regression analysis.

Note: The data sets for well 0443 and seep 0617 are not sufficient to allow a meaningful linear regression for comparison to the remedial time estimate at well 0411. As additional data become available over time, a comparison can be made of data trends at these locations. However, based on the limited VOC data set for wells 0443 and Seep 0617, it is expected that these concentrations will be reduced in the same time frame as that estimated for well 0411.

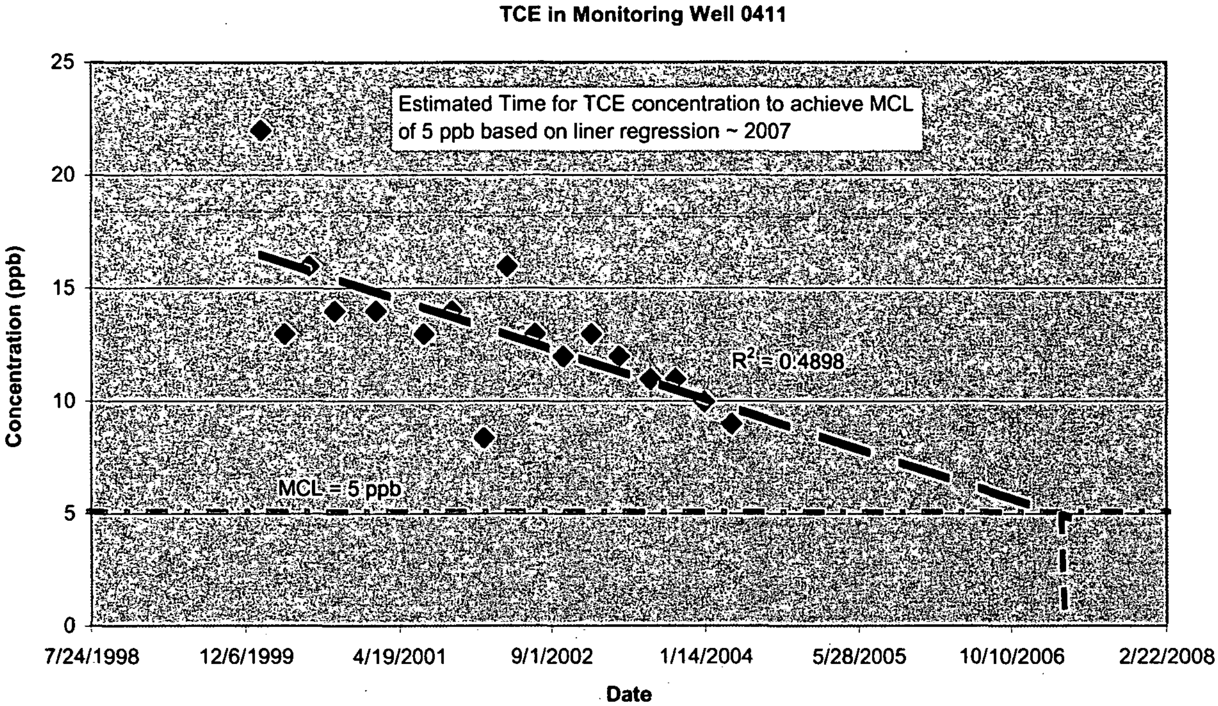


Figure 9 Estimated Time Frame for Remediation

4.0. REMEDY MONITORING LOCATIONS, ANALYTES, FREQUENCY AND CONTINGENCIES

The objectives associated with selection of monitoring locations, specific analytes and monitoring frequency are to provide adequate spatial and temporal groundwater monitoring coverage of the Phase I bedrock system in order to demonstrate the selected remedy (Monitored Natural Attenuation) is effective at mitigating the TCE contamination. The monitoring locations are selected to take advantage of the flow dynamics of the bedrock system such that potential migration of TCE will be detected. The monitoring frequency is selected to insure any change in the system will be detected without significant opportunity for downgradient migration.

If the Operable Unit 1 groundwater remedy is modified, this Phase 1 groundwater monitoring plan must be reviewed to determine potential impacts.

4.1 Monitoring Locations and Analytes

As noted in Section 2.1, groundwater flow in the bedrock systems occurs in the upper fractured zone with flow direction following the general slope of the bedrock surface. Figure 10 is a generalized section showing groundwater flow in the vicinity of monitoring well 0411.

TCE, DCE and vinyl chloride (VC) data collected from wells and seeps in the vicinity of well 0411 demonstrate a hydraulic connection between bedrock wells 0443, 0411 and seep 0617. The geochemistry of the water is similar and both TCE and DCE are found in the wells and seeps. Volatile Organic Compounds (VOCs) have not been detected in bedrock wells 0444, 0445 or 0353 or in BVA wells 0402, 0400 or P033.

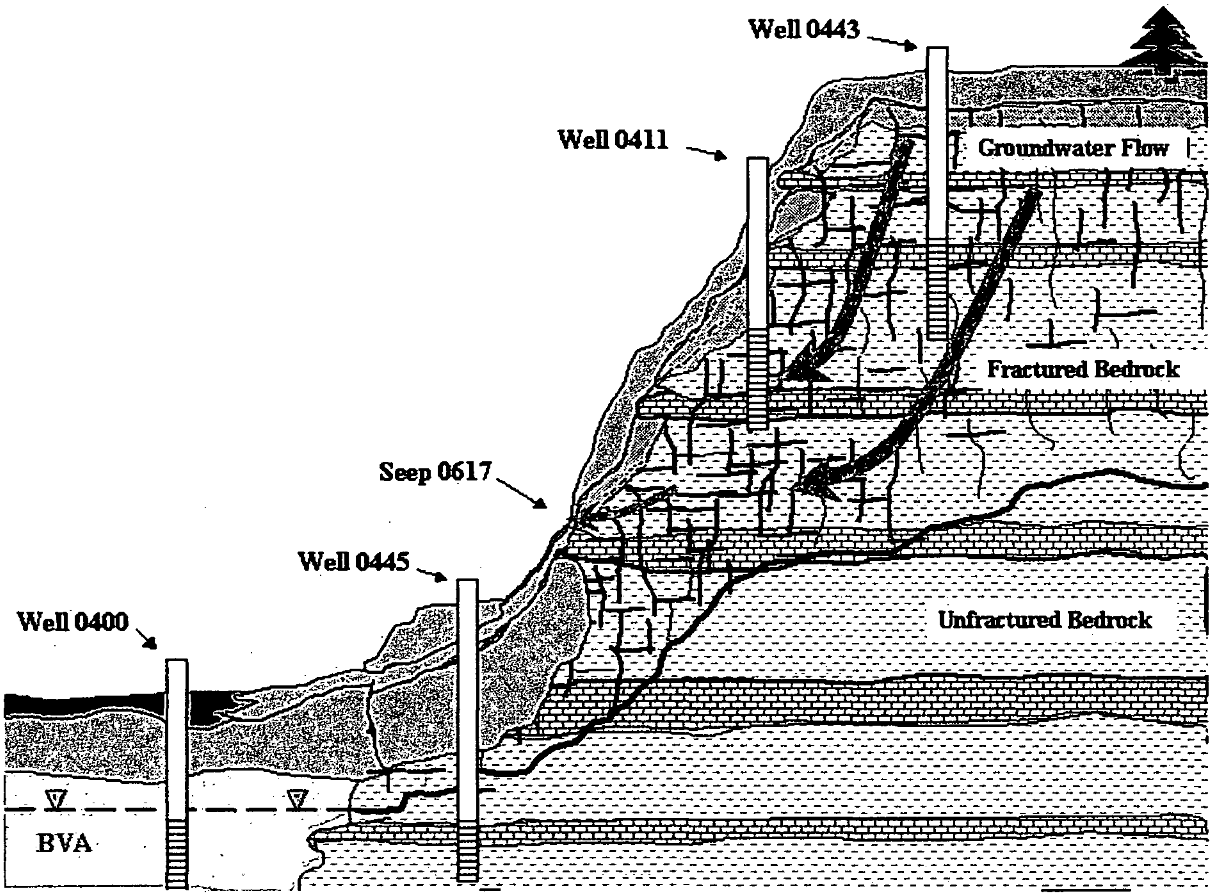


Figure 10 Generalized Bedrock Groundwater Flow in the Well 0411 Area

Note: vinyl chloride is daughter product of TCE degradation and is therefore an indicator of TCE degradation;additionally, both the "trans" and "cis" isomers of DCE will be analyzed for.

4.1.1 Well 0411 Area Monitoring

The following bedrock monitoring wells will be monitored for TCE, DCE and VC to provide spatial coverage of flow paths in the immediate vicinity of the well 0411 area:

Well 0411
Well 0443

4.1.2 Downgradient Bedrock Monitoring

The following bedrock monitoring wells and seep will be monitored for TCE, DCE and VC to provide spatial coverage of flow paths downgradient of the well 0411 area:

Well 0444
Well 0445
Well 0353
Seep 0617

4.1.3 Downgradient BVA Monitoring

The following BVA wells will be monitored for TCE, DCE and VC to provide data that can be used in conjunction with the TCE data from the above noted bedrock wells to assess potential movement of TCE from the bedrock flow system to the BVA flow system.

Well 0402
Well P033
Well 0400

Figure 11 shows the distribution of the monitoring wells utilized for demonstrating the effectiveness of Monitored Natural Attenuation within Phase I

4.1.4 Additional Analytes and Field Parameters

In addition to TCE, DCE and VC, the following field parameters will be taken during each sampling event:

Dissolved oxygen, temperature, Eh, pH

4.2 Well Infrastructure

The monitoring wells being utilized for the remedy have been in place for various lengths of time. The wells were installed in support of various site characterization activities and were designed and constructed to provide high quality groundwater data. Appendix A provides a summary of the well construction details for each well being utilized in support of the remedy.

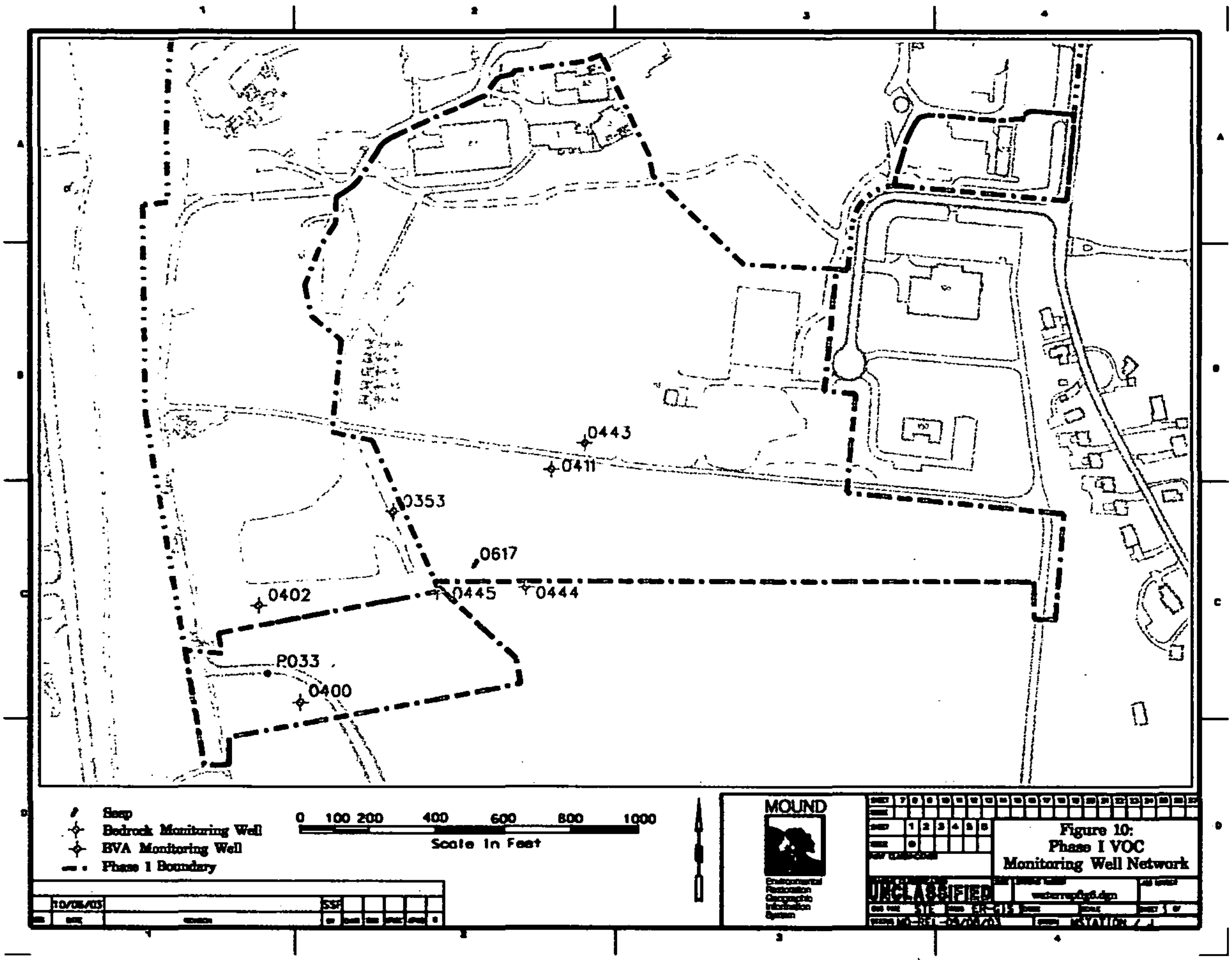


Figure 11 Phase I VOC Groundwater Monitoring Network

4.3 Monitoring Frequency

The monitoring frequency is determined based on concentration trends previously observed in TCE/DCE/VC data collected from these monitoring wells. As noted in section 3.1, there is a hydraulic connection (as evidenced by groundwater with similar geochemical profiles) between wells 0443, 0411 and seep 0617. Figures 6 – 8 show that changes in TCE/DCE/VC concentrations are similar in the wells and the seep over time. Quarterly sampling has been effective in the past at capturing both the general trend and minor fluctuations in TCE/DCE/VC concentration observed in these wells. Based on the trend data, TCE/DCE/VC concentrations in these wells are not expected to fluctuate rapidly and therefore initial quarterly monitoring will be sufficient to capture any potential geochemical changes that may occur in the future.

If geochemical conditions improve the monitoring frequency can be adjusted to reflect the increased understanding and predictability of the flow system. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

If geochemical conditions do not remain stable or improve (TCE concentrations trend above pre-established trigger levels) an appropriate sampling frequency shall be determined by the DOE and regulatory agencies during the annual data review (see Section 7.0 on Reporting requirements).

4.3.1 Quarterly Groundwater Monitoring

Wells 0411, 0443, 0353, 0445, 0444, 0402, P033, 0400 and seep 0617 will be analyzed quarterly for TCE, DCE and VC. The quarterly monitoring frequency must be maintained for a minimum of one year.

The following schedule represents an outline for potential monitoring frequency. Any change to the standard initial quarterly monitoring defined in section 4.3.1 must be agreed to by the regulatory agencies and the DOE.

4.3.2 Semi-Annual Groundwater Monitoring (2 sampling events)

If VOC concentrations in monitoring well 0411 decline after 4 quarterly sampling events, the DOE may petition for a sampling reduction to semi-annually for all wells and the seep. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

4.3.3 Annual Groundwater Monitoring (3 sampling events)

If VOC concentrations in monitoring well 0411 continue to decline after 6 sampling events, the DOE may petition for a sampling reduction to annually for all wells and the seep. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

4.3.4 Annual Groundwater Monitoring for wells 0411 and Seep 0617 (4 sampling events)

If VOC concentrations in monitoring wells 0411, 0443 and seep 0617 continue to decline after 9 sampling events the DOE may petition to discontinue sampling for all wells with the exception of 0411, 0443 and seep 0617. The Monitoring Frequency for wells 0411, 0443 and seep 0617 would remain annual. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

4.3.5 Concentration in Wells 0411 and 0443 and Seep 0617 Drop Below MCLs

If at any time VOC concentrations in Wells 0411 and Well 0443 and Seep 0617 drop below MCLs for the analytes listed in Table 1,for a minimum period of two years, the DOE may petition to discontinue sampling for all wells listed in section 4.3.1

Table 1 summarizes the sampling requirements associated with Phase I remedy monitoring.

Remedy (MNA) Monitoring	Monitoring Analytes	Sampling Frequency
WELL/SEEP		
0411	TCE, DCE, VC	Quarterly
0443	TCE, DCE, VC	Quarterly
0444	TCE, DCE, VC	Quarterly
0445	TCE, DCE, VC	Quarterly
0353	TCE, DCE, VC	Quarterly
0402	TCE, DCE, VC	Quarterly
P033	TCE, DCE, VC	Quarterly
0400	TCE, DCE, VC	Quarterly
Seep 0617	TCE, DCE, VC	Quarterly

Table 1 Remedy Monitoring

4.4 Monitoring Procedures

All analytical methods, field procedures, quality assurance/quality control and data management and reporting requirements associated with this monitoring plan are outlined in the Mound Methods Compendium, TECHNICAL MANUAL MD-800-45.

Wells will be sampled using the low-flow micro-purge sampling methodology. Many of the wells being utilized in support of this remedy are screened in the low-yield bedrock groundwater system. Depending on aquifer conditions, some of the wells may not be capable of supporting micro-purge sampling. In this case the wells will be sampled with bailers. A sampling procedure outlining all details associated with physically collecting groundwater and seep samples for this remedy is included in Appendix B.

4.5 Monitoring Contingencies

If the quarterly monitoring results indicate that Monitored Natural Attenuation is not adequately addressing the contamination, DOE, USEPA and OEPA will evaluate more active remediation approaches. Performance criteria for remedy monitoring are listed below in Section 5.0 "Remedy Trigger Levels and Response Actions".

5.0 REMEDY TRIGGER LEVELS AND RESPONSE ACTIONS

The objective of the trigger level is to provide a threshold level that is indicative of a definitive change in the geochemical condition of the Phase I bedrock groundwater system. The objective of the response action is to provide notification of the detected geochemical change to the DOE, USEPA and Ohio EPA. Collectively, they will re-evaluate the situation and determine a course of action.

5.1 Indicator Wells and Seep

Monitoring well 0411 represents the location within the bedrock system showing the highest concentrations of TCE. TCE concentrations have been relatively stable for the past three years averaging approximately 15 ppb (Figure 6). Additionally, seep 0617 TCE concentrations have been stable at approximately 7 ppb (Figure 8), while well 0443 TCE concentrations have been stable at approximately 8 ppb (Figure 7). The following trigger levels are designed to indicate that a change has occurred in the current bedrock conditions relative to TCE contamination. Any of the conditions noted below would be interpreted as a potential change in the bedrock system and will require the associated response action. The trigger levels and associated response actions are broken down according to the specific location that is being monitored.

5.1.1 Bedrock Flow Paths Downgradient of the Well 0411 Area

Monitoring Wells

Wells 0444, 0445, 0353

Trigger Level:

Monitoring results show the concentration of TCE, DCE or VC at or above their respective MCLs of 5 ppb, 70 ppb and 2 ppb.

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies.

Seep

Seep 0617

Trigger Level:

Monitoring result shows the concentration of TCE double the initial baseline concentration of 8 ppb (or 16 ppb). Monitoring results show DCE or VC above their respective MCLs of 70 ppb and 2 ppb.

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies.

5.1.2 Bedrock Flow Paths in the immediate vicinity of the well 0411 area

Bedrock Monitoring Wells 0443 and 0411

Trigger Level:

Well 0411: Monitoring result shows the concentration of TCE double the initial baseline concentration of 15 ppb (or 30 ppb). Monitoring results show the concentration of DCE or VC above their respective MCLs of 70 ppb and 2 ppb.

Well 0443: Monitoring result shows the concentration of TCE double the initial baseline concentration of 9 ppb (or 18 ppb). Monitoring results show the concentration of DCE or VC above their respective MCLs of 70 ppb and 2 ppb.

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies.

5.1.3 BVA Wells Downgradient of Well 0411 Area

Monitoring Wells 0400, 0402 and P033

Trigger Level:

Monitoring results show the concentration of TCE, DCE or VC at or above their respective MCLs of 5 ppb, 70 ppb and 2 ppb.

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies.

6.0 CONFIRMATORY MONITORING

This section outlines the details associated with selection of monitoring locations, analytes and frequency for conducting confirmatory groundwater monitoring for barium, radium 226/228, and chromium and nickel. This monitoring is being conducted as a best management practice to confirm the understanding of the barium, radium-226, and radium-228 and chromium and nickel in groundwater situation is correct.

6.1 Monitoring Locations and Analytes for Barium, and Radium

As noted in Section 2.1, groundwater flow in the bedrock systems occurs in the upper fractured zone with flow direction following the general slope of the bedrock surface.

Figure 10 is a generalized section showing groundwater flow in the vicinity of monitoring well 0411.

Data collected from monitoring well 0445 show elevated barium, radium 226 and radium 228 (all in excess of the MCLs). The unusual geochemistry seen in well 0445 is not shown in any other bedrock or BVA wells located in this area. Recent work completed by Mound in conjunction with the Savannah River Environmental Technology Center demonstrated that the unusual water chemistry observed at well 0445 is likely due to the interaction of surface salt and the underlying bedrock. The surface salt source is thought to be the salt formerly stored in the SST Building (wooden structure used to store road salt) located in Phase I upgradient of well 0445. Details of this work can be found in Reference 3 (WSRC-TR-00281 "Geochemical Evaluation of Elevated Barium and Radium in Bedrock at the Miamisburg Closure Project", August, 2003).

The SST is no longer used for salt storage and all salt was removed from this structure in July 2003.

6.1.1 Well 0445 Area

The following bedrock monitoring well will be monitored for barium and radium 226/228.

Well 0445

6.1.2 BVA Wells

The following BVA wells will be monitored for barium and radium 226/228.

Wells 0400, 0402 and P033

Figure 12 shows the distribution of the monitoring wells within Phase I that will be used for Ba and Ra monitoring.

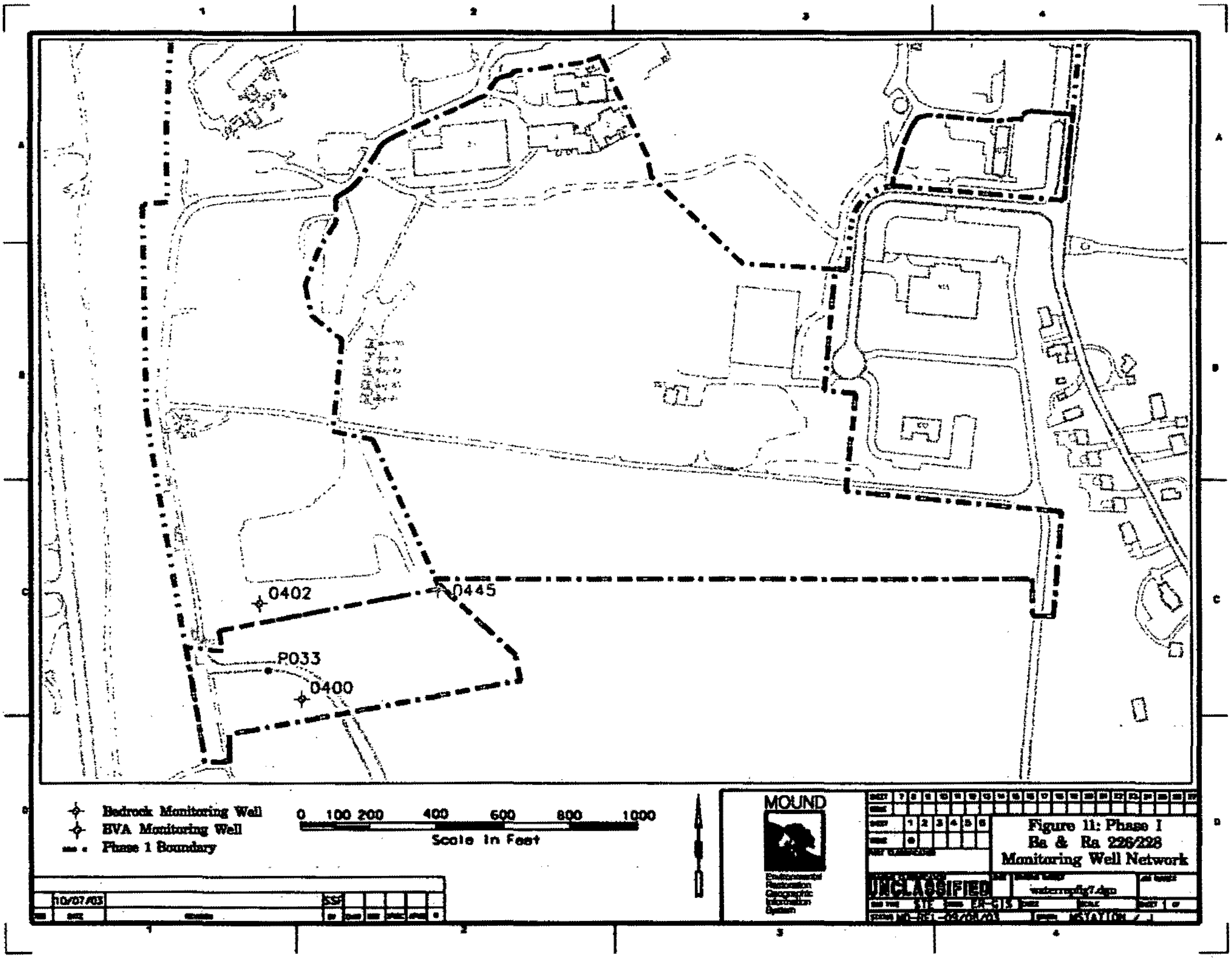


Figure 12 Ba and Ra Monitoring Well Network

6.2 Confirmatory Monitoring levels of concern for Barium and Radium

The levels of concern are designed to indicate that a change has occurred in the current bedrock conditions relative to the elevated barium and radium 226/228 concentration. The conditions noted below would be interpreted as indicating the potential for increased mobility and mass transfer of barium and or radium away from the well 0445 region.

<u>6.2.1 Bedrock Monitoring Well 0445</u>

Level of concern:

. The maximum Ra226/228 concentration observed in well 0445 has been 75 pCi/L. The most recent Ra 226/228 concentrations are approximately 50 pCi/L. The level of concern for Ra 226/228 is therefore set at 75 pCi/L The MCL for Ra 226/228 combined is 5 pCi/L.Barium concentrations have shown more fluctuation with most recent concentrations at approximately 12 ppm. The level of concern for barium in well 0445 is therefore set at 15 ppm.

Note: sodium and chloride concentrations are also evaluated to help assess any variations observed in radium and barium concentration.

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies. Core team to determine appropriate course of action.

6.2.2 BVA Wells

Monitoring Wells 0402, 0400 and P033

Level of Concern:

Monitoring results show an increase of barium concentration at or above 1 ppm (MCL = 2 ppm) or radium 226/228 concentration increases to 5 pCi/L (MCL = 5 pCi/L)

Response Action:

- Immediately Notify Federal and State Environmental Protection Agencies. Core team to determine appropriate course of action.

6.2.2.1 Additional Analytes and Field Parameters

In addition to barium, radium 226 and radium 228, the following analytes and field parameters will be determined:

Chloride ion, sodium, dissolved oxygen, temperature, Eh and pH. Sodium and chloride concentrations will be determined because of the suspected relationship between sodium chloride and barium/radium concentration.

6.3 Monitoring Frequency for Barium and Radium

October 2003 – July 2004 (4 quarters)

All groundwater wells noted above will be analyzed quarterly for barium, radium 226 and radium 228 and field parameters listed above.

If the quarterly groundwater data indicate stable geochemical conditions (i.e. concentrations do not go above confirmatory levels of concern) or declining concentrations for four consecutive quarters, the DOE may petition to have barium and radium 226/228 monitoring decreased to semi annually. If the barium and radium 226/228 concentrations drop below MCLs for a minimum of two years,, the DOE may petition to have monitoring discontinued or the frequency decreased.

6.4 Any change to the quarterly monitoring must be agreed to by the regulatory agencies and the DOE. Monitoring Locations and Analytes for Nickel and Chromium

As noted in section 2.2.3, the nickel and chromium MCL exceedances are observed at wells BVA wells 400 and 0319 and Bedrock wells 0399 and 0411. Previous studies indicate that these exceedances are likely related to corrosion of the wellcasing and not the result of plant operations (References 4 and 5). Details of the sampling protocol to determine the ambient chrome and nickel concentration in both BVA wells and bedrock wells is detailed in Appendix C

6.4.1 BVA Wells

BVA Wells 0400 and 0319 will be sampled for chromium and nickel utilizing a high flow sampling protocol (Reference 5).

6.4.2 Bedrock Well 0399 and 0411 areas

Bedrock "mirror" wells 0442 and 0443 will be sampled to assess chromium and nickel concentrations in the well 0399 and 0411 area respectively. The wells will be sampled utilizing a bailer.

6.5 Confirmatory Monitoring Levels of Concern for Nickel and Chromium

The levels of concern are designed to indicate that a potential change has occurred in the current aquifer conditions relative to the elevated nickel and chromium concentration.

Level of Concern

Monitoring results show an increase in chromium concentration above the Federal and State of Ohio MCL of 100 ppb. Monitoring results show an increase in nickel concentration above the State of Ohio MCL of 100 ppb.

Note: There is no federal MCL for Nickel

Response Action

Immediately Notify Federal and State Environmental Protection Agencies. Core team to determine appropriate course of action.

6.6 Confirmatory Monitoring Frequency for Nickel and Chromium

All groundwater wells noted above will be analyzed quarterly for chromium and nickel. With a minimum of two years of quarterly sampling results remaining below the nickel and chromium MCL, DOE may petition to discontinue monitoring groundwater in Phase I for nickel and chromium.

Table 2 below summarizes the sampling requirements associated with Phase I confirmatory monitoring.

Confirmatory Monitoring	Monitoring Analytes	Sampling Frequency
WELL		
0445	Ba, Ra-226/228	Quarterly
0402	Ba, Ra-226/228	Quarterly
P033	Ba, Ra-226/228	Quarterly
0400	Ba, Ra-226/228, Cr, Ni	Quarterly
0319	Cr, Ni	Quarterly
0443	Cr, Ni	Quarterly
0442	Cr, Ni	Quarterly

Table 2 Confirmatory Monitoring

7.0 DATA REPORTING AND MONITORING PLAN REVIEW

Data and data reports will be provided to the regulators, as defined in Sections 7.1 through 7.3 below, in order to allow the progress of the Phase I parcel MNA remedy to be evaluated. The table below summarizes all monitoring requirements (previously identified in Tables 1 and 2) outlined in this plan.

Confirmatory Monitoring	**Monitoring Analytes**	**Sampling Frequency**
Well #		
0445	Ba, Ra-226/228	Quarterly
0402	Ba, Ra-226/228	Quarterly
P033	Ba, Ra-226/228	Quarterly
0400	Ba, Ra-226/228, Cr, Ni	Quarterly
0319	Cr, Ni	Quarterly
0443	Cr, Ni	Quarterly
0442	Cr, Ni	Quarterly
NOTE: Both Na and Cl are also collected at the confirmatory monitoring wells		
Remedy (MNA) Monitoring	**Monitoring Analytes**	**Sampling Frequency**
Well/Seep #		
0411	TCE, DCE, VC	Quarterly
0443	TCE, DCE, VC	Quarterly
0444	TCE, DCE, VC	Quarterly
0445	TCE, DCE, VC	Quarterly
0353	TCE, DCE, VC	Quarterly
0402	TCE, DCE, VC	Quarterly
P033	TCE, DCE, VC	Quarterly
0400	TCE, DCE, VC	Quarterly
Seep 0617	TCE, DCE, VC	Quarterly

7.1 Data Reporting

All MNA groundwater monitoring data will be compiled and validated by DOE each calendar quarter, and forwarded to the regulators. The data will be provided to the regulators in electronic format, and will not be accompanied by a report.

Beginning on March 31, 2005, the DOE will provide a draft annual report to the regulators that documents the progress of the Phase I parcel MNA remedy towards meeting the remedial objectives identified in Section 3.1 of this monitoring plan. Delivery of the draft report by March 31st of each year will be a recurring, annual FFA milestone. DOE may petition the regulators to decrease the frequency of the report (e.g., if quarterly groundwater monitoring frequencies are decreased to semi-annually or annually in the future). The regulators must approve any petition, before DOE can decrease the reporting period from annually. The "Phase I Remedy MNA Groundwater Monitoring Plan Annual Report" will cover four calendar quarters' worth of data. Because it typically takes a minimum of 60 days to get validated data back, the annual report will include only those data gathered prior to 90 days of the report's issuance (e.g., for the very first draft report submitted on March 31, 2005, the report will cover groundwater monitoring data gathered through December 2004). The annual report will include analytical results, trend analyses, interpretations and any operational changes that may have occurred during the reporting period. The report will also identify any maintenance and/or repair activities associated with the monitoring wells being sampled under this plan for the Phase I parcel. Upon receipt of DOE's draft annual report on March 31st of each year, the regulators will provide comments to DOE, and DOE will publish a final report as soon as practicable. This final report will be subject to review and approval by the regulators. DOE will place a copy of the final report in the CERCLA Administrative Record and will make the final report available to the public (e.g, via placement in a Public Reading Room or on a public Internet site).

A final report will be provided to the regulators at the completion of the MNA remedy for the Phase I parcel. The report will serve to document and support the agencies' decision that the remedial action has been successful.

7.2 Monitoring Plan Review

As noted in previous sections of this monitoring plan, the bedrock groundwater system (i.e., water quality) within the Phase I parcel is not expected to deteriorate in the future. Monitoring locations and sampling frequencies have been defined such that any change in the bedrock system will be detected. Trigger levels and response actions have been defined that serve to ensure appropriate action can be taken to preclude negative impacts to the drinking water system (i.e., the buried valley aquifer). This groundwater monitoring plan must remain flexible, such that changes can easily and quickly be made to reflect new groundwater data. If, as anticipated, the bedrock groundwater system shows no signs of further degradation over time, this groundwater monitoring plan will be adjusted to reflect that condition (e.g., if TCE concentrations begin to decline and reach compliance with the MCL, the sampling frequency will be reduced or eliminated). The DOE and regulators must agree on any changes to this groundwater monitoring plan. Requests for changes can be initiated by DOE at any time during the operation and maintenance (O&M) of the MNA remedy for the Phase I parcel (e.g., requests to change monitoring locations, frequencies, or list of analytes do not need to be tied to the annual reporting cycle described in Section 7.1 above).

At a minimum, this groundwater monitoring plan will be reviewed annually, in order to ensure the monitoring objectives are aligned with and reflect the groundwater data being collected. The results of this review of the monitoring plan will be documented in the annual report that DOE provides to the regulators (in draft form) by March 31st of each year. It will be the decision of the DOE, USEPA and OEPA to determine when MNA has been successful and groundwater monitoring in the Phase I parcel can be eliminated. The anticipated time frame to complete the remedial action, as documented in section 3.2, is approximately 2006 to 2007. However, if the remedial action is not complete by 2007, this shall not constitute outright failure of the MNA remedy. DOE, USEPA and OEPA will continue to monitor the effectiveness of the MNA remedy until the third five-year review of the Phase I parcel (and all other site) remedies currently scheduled for completion in FY2011. If, by the time of that five-year review, the Phase I parcel MNA remedial action objective has not been achieved, DOE, USEPA and OEPA will initiate a thorough analysis of whether MNA remains an appropriate remedy for VOC contamination present in groundwater in the Phase I parcel.

7.3 CERCLA Five Year Review

In addition to the annual reports and consistent with the CERCLA process for conducting (at a minimum) reviews of all remedies every five years, the Phase I parcel MNA remedy (and all other remedies for the MCP site) will be reviewed every five years. The first five-year review of all MCP remedies was completed in late Fiscal Year 2001. The Phase I Record of Decision (ROD) was issued on July 31, 2003. Therefore, the Phase I parcel MNA remedy will be included in DOE's next five-year review cycle, scheduled for Fiscal Year 2006. The final DOE report on the five-year review will be placed in the CERCLA Administrative Record and will be made available to the public (e.g, via placement in a Public Reading Room or on a public Internet site).

8.0 REFERENCES

Reference 1 Phase I Residual Risk Evaluation, Final, March 2003

Reference 2 Phase I Record of Decision, Final, July 2003

Reference 3 Geochemical Evaluation of Elevated Ba and Ra in Bedrock at the Miamisburg Closure Project, DRAFT, WSRC-TR-2003-00281, June 2003

Reference 4 Sampling Investigation to Determine the Nature of Elevated Chromium and Nickel Levels in Two Stainless Steel Monitoring Wells at Mound, Final, August 2002

Reference 5 CY 2002 Groundwater Sampling results for Wells Showing Nickel and Chromium MCL Exceedances Within the Phase I Boundary, Letter Report, Final, June 2003

Appendix A

Well Construction Information for the Phase I Monitored Natural Attenuation Monitoring Wells

Table A-1. Well Construction Information for the Phase I MNA Monitoring Wells

Well Name	Elevation at Top of casing (ft above MSL)	Well Depth (ft)	Screened Interval (ft below surface)	Formation Screened In	Well Construction Material
0443	858.78 *	39	28 - 38	Bedrock	2 inch PVC
0411	838.4	34	28 - 33	Bedrock	2 inch Stainless Steel
0353	747.07	18	13 - 18	Bedrock	4 inch Stainless Steel
0445	743.43 *	41	30 - 40	Bedrock	2 inch PVC
0444	773 *	31	20 - 30	Bedrock	2 inch PVC
0402	706.08	31	21 - 31	BVA	2 inch Stainless Steel
P033	704.20	115	20 - 25	BVA	2 inch PVC
0400	707.21	32	22 - 32	BVA	2 inch Stainless Steel
0442	888.6	33	23 -33	Bedrock	4 inch PVC

* elevation taken from ground surface

Appendix B

Procedures for Collection of Groundwater and Seep Samples for Phase I Monitored Natural Attenuation

The following two procedures (B1 and B2) will be utilized to collect representative groundwater samples from the monitoring wells utilized for Phase I Monitored Natural Attenuation.

Procedure B1 Low-flow Micro-purge Sampling

The following procedure will be utilized for collection of low flow groundwater samples for all wells that will support micro-purge sampling.

Measurements to be recorded:

Dissolved oxygen, pH, Eh, temperature, turbidity and water level

Low flow micropurge samples will be collected using the following procedural steps:

1) Gently lower a submersible pump into the well and lower until the pump intake lies at the approximate location of the wellscreen center. Take an initial water level measurement.

2) Turn pump on at lowest setting and slowly increase the flow rate until water begins emerging from discharge tube. Adjust the flow rate to approximately 0.5 liters/minute

3) Record field parameters as water is being pumped from the well. Periodically measure the water level during pumping to insure that the water level has stabilized under low-flow pumping. If the water level will not stabilize the well will not support low-flow sampling. Document that the well will not support low-flow sampling and switch sampling methodology to Procedure B2.

4) Continually check turbidity levels until the water reaches 50 NTUs. If 50 NTUs cannot be reached in a reasonable time, the well may require re-development. Collect the sample and note that the sample was collected with turbidity > 50 NTUs. This information shall be reported along with the field parameters (dissolved oxygen, pH, Eh, temperature) data.

5) Collect samples once the field parameters have stabilized and the water has stabilized at a turbidity level of 50 NTUs.

Procedure B2 Bailer Sampling

The following procedure will be utilized for collection of groundwater samples at wells that will not support micro-purge sampling.

Measurements to be recorded:

Dissolved oxygen, pH, Eh, temperature, and water level

Bailed groundwater samples will be collected using the following procedural steps:

1) Bail well dry.

2) Allow well to recharge (typically requires 12 – 24 hours)

3) Return to well and gently lower bailer into well and retrieve volume sufficient for analytical requirements and field parameter measurements.

Note: When utilizing this method the bailer must be gently lowered into and raised out of the water column such that a very gentle surge action is imparted to the water to collect a sample.

The following procedure (B3) will be utilized to collect representative samples from the seep utilized for Phase I Monitored Natural Attenuation.

Procedure B3 Seep Sampling

Measurements to be recorded:

Dissolved oxygen, pH, Eh, temperature

1) create a surface basin for ponding of seep water

2) allow water to flush through the basin until it becomes clear

3) gently obtain sample by submerging sample bottle into basin

Appendix C

Procedure for Collection of Groundwater Samples for Phase I Stainless Steel Wells for Nickel and Chromium Analysis

Procedure C1 Low flow Micropurge Sample

Measurements to be recorded include, dissolved oxygen, pH, Eh, temperature, turbidity and water level

Low flow micropurge samples will be collected using the following procedural steps:

Gently lower a submersible pump into the well and lower until the pump intake lies at the approximate location of the wellscreen center. Record an initial water level measurement.

Turn pump on at lowest setting and slowly increase the flow rate until water begins emerging from discharge tube. Adjust the flow rate to approximately 0.5 liters/minute

Record field parameters as water is being pumped from the well. Periodically measure the water table during pumping to ensure that the water level has stabilized under low flow pumping. If the water level will not stabilize the well will not support low flow sampling, note and contact the project geologist[1].

Continually check turbidity levels until the water reaches 10 NTUs. If 10 NTUs cannot be reached in a reasonable time, note and contact the project geologist[1].

Collect samples once the field parameters have stabilized and the water has reached a turbidity level of 10 NTUs.

1 If sampling criteria can't be met, record in logbook and continue on to any remaining wells. Consult with CH2M Hill project geologist to determine appropriate action for those wells unable to meet the sampling criteria.

Procedure C2 High-flow Purge Sample

Measurements to be recorded:

Dissolved oxygen, pH, Eh, temperature and turbidity.

High flow purge samples will be collected using the following procedural steps:

Immediately following collection of the low-flow micropurge sample, increase the pump flow rate to approximately 5 gpm.

Record field parameters as water is being pumped from the well.

Continually check turbidity levels until the water reaches 10 NTUs. If 10 NTUs cannot be reached within a reasonable time, note and contact the project geologist.

Allow the well to purge at 5 gpm for 15 minutes.

Collect samples once the field parameters have stabilized and the water has reached a turbidity level of 10 NTUs.