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U.S Department of Energy
Ohio Field Office

Parcel 6, 7, and 8 Remedy (Monitored Natural Attenuation) Groundwater Monitoring Plan

December 2006

Final

MIAMISBURG
CLOSURE PROJECT

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ABSTRACT

Parcels 6, 7, and 8 are three tracts of land that comprise the majority of the remaining Mound Closure Project in Miamisburg, Ohio. The final remedy for Parcels 6, 7, and 8 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 the main hill bedrock groundwater system commonly known as the Main Hill Seeps. The seeps have historically shown elevated levels of trichloroethene (TCE) and tritium. MNA is also being used as a remedy for TCE detected in groundwater at monitoring wells 0315 and 0347. The combined remedies will prevent current and future exposure of workers, the public and the environment to contaminated groundwater. This groundwater monitoring plan is an enforceable document that addresses the MNA component of the CERCLA remedy for Parcels 6, 7, and 8. MNA is being utilized as a remedy to ensure the concentration of TCE and tritium in groundwater is decreasing to levels below the Maximum Contaminant Level and does not impact the Buried Valley Aquifer. 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. Operation and maintenance requirements for the Institutional Controls component of the remedy are addressed in a separate, enforceable document.

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BVA	Buried Valley Aquifer
COC	Contaminant of Concern
DCE	cis-1,2-dichloroethene
DOE	Department of Energy
FFA	Federal Facilities Agreement
HI	Hazard Index
IC	Institutional Controls
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
PCE	tetrachloroethene
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 Parcels 6, 7, and 8 Record of Decision (ROD) at the Department of Energy (DOE) Miamisburg Closure Project (MCP) in Miamisburg Ohio. The Miamisburg Closure Project is an environmental remediation project at the former DOE Mound Facility. DOE is preparing to transfer three parcels of land known as "Parcels 6, 7, and 8" (Figure 1).

This groundwater monitoring plan applies to the monitored natural attenuation (MNA) component of the CERCLA remedy for the Parcels 6, 7, and 8. MNA is the selected remedy for contaminated groundwater in the bedrock groundwater system at the Mound Facility's main hill, commonly known as the Main Hill Seeps, and for groundwater at monitoring wells 0315 and 0347 (Figure 2). This plan also describes work activities necessary to ensure that continued monitoring and evaluation of MNA's effectiveness are performed as required.

The Main Hill Seeps are associated with Potential Release Sites (PRS) 91-92 and 94-98 which are also known as Seeps 0601, 0602, 0604/0605, 0606, 0607 and 0608 (Figure 2). Seep 0604-0605 is hereafter referred to as seep 0605. The seeps have been part of the environmental monitoring program at Mound since the early 1990's. Contaminants detected at the seeps include the volatile organic compounds (VOCs) trichloroethene, (TCE), cis-1,2-dichloroethene (DCE), and tetrachloroethene, (PCE). Radionuclides of interest include tritium, and recent indications of radium-226/228, and strontium-90.

Prior to the initiation of the SW-R Demolition Project VOC levels in the offsite seeps (seeps 0605, 0606, 0607 and 0608) and onsite seep 0602 were below or very close to the drinking water maximum contaminant levels (MCLs) for VOCs. Onsite seep 0601 showed PCE levels slightly in excess of 30 ppb with TCE and DCE at or below the MCL. With the physical changes occurring to the site as a result of the SW-R Demolition Project (e.g. removal of buildings, building slabs and extensive misting for dust suppression) VOC levels have increased in several offsite seeps with concentrations approaching 100 ppb in seep 0605 in the summer of 2005, during remediation of the SW-R Demolition Project. A vast majority of the contaminated soils have been removed from SW-R thereby removing the likely source of VOCs.

Prior to initiation of the SW-R Demolition Project tritium concentrations in a majority of the seeps (with the exception of seep 0602 and 0608) were above the MCL of 20,000 pCi/L. Concentration vs. time plots for tritium at the seeps did show trends that suggested tritium levels in all seeps (with the exception of onsite seep 0601 which has a considerably higher tritium concentration than the other seeps) should be below the MCL by sometime in 2008. With the physical changes occurring to the site as a result of the SW-R Demolition Project (e.g. removal of buildings, building slabs and extensive misting operations) tritium levels increased sharply in all the seeps. Ongoing sampling results suggest that peak tritium concentrations may have passed through the system with maximum concentrations observed in mid 2005. A vast majority of the contaminated soils have been removed from SW-R thereby likely removing the largest source of tritium. The observed, declining, tritium data trend is expected to continue.

As noted above, prior to the SW-R Demolition Project, both tritium and VOC seep concentrations were, in the case of tritium, trending downward towards the MCL, or in the case of VOCs, at or below the MCL, (an exception is onsite seep 0601 which has always had higher concentrations because of its closer proximity to the source area). As the SW-R Demolition Project progressed, significant physical changes occurred in the suspected tritium and VOC source areas. Both SW and R buildings were demolished with subsequent removal of the building foundation, slabs, and soils. Demolition required the use of significant volumes of misting water to suppress airborne particulate from entering the atmosphere. In the past, with the buildings in place, contaminated soils were largely covered by building slabs and pavement. Most precipitation falling onto the area was quickly routed away to the storm sewers and did not permeate in to source area soils. With the removal of the building slabs soils were exposed, and due to the misting operations significant volumes of water were now available for infiltration into the soil. Ultimately this water emerges as hillside seeps or discharges into the adjacent down gradient buried valley aquifer. As the water was free to interact with the contaminated soils, soluble contaminants entered the infiltrating water and migrated away from the source area. Tritium and VOC concentrations increased largely as a result of the increased and focused volume of mist water entering the groundwater system in the vicinity of the SW-R project.

At project completion, both tritium levels and VOC levels have not returned to pre-SW-R demolition levels. As a result, all seeps associated with PRS 91-92 and 94/95, 96, 97 and 98 as well as several select BVA wells will be monitored to insure levels return to acceptable levels.

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, this remedy also uses Institutional Controls in the form of deed restrictions. Separate from this groundwater monitoring plan, the Mound Plant Operation and Maintenance (O&M) Plan For The Implementation of Institutional Controls (Reference 1) is also a primary and enforceable document under the FFA. The O&M Plan for Institutional Controls (IC) describes the DOE actions required to monitor and maintain the IC remedy for all land parcels for which the CERCLA 120(h) process is complete.

Figure 1: Location of Parcels 6, 7, and 8

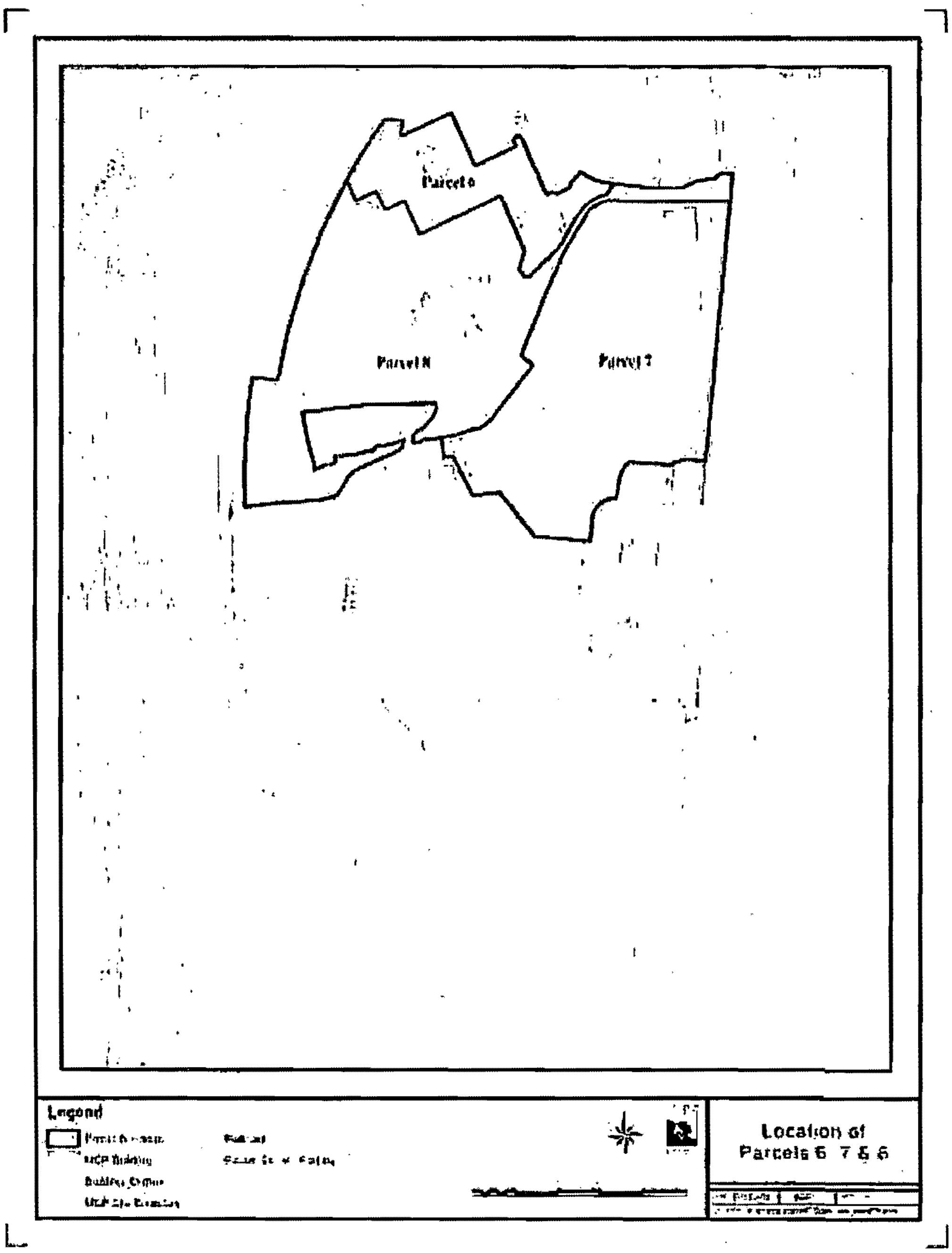
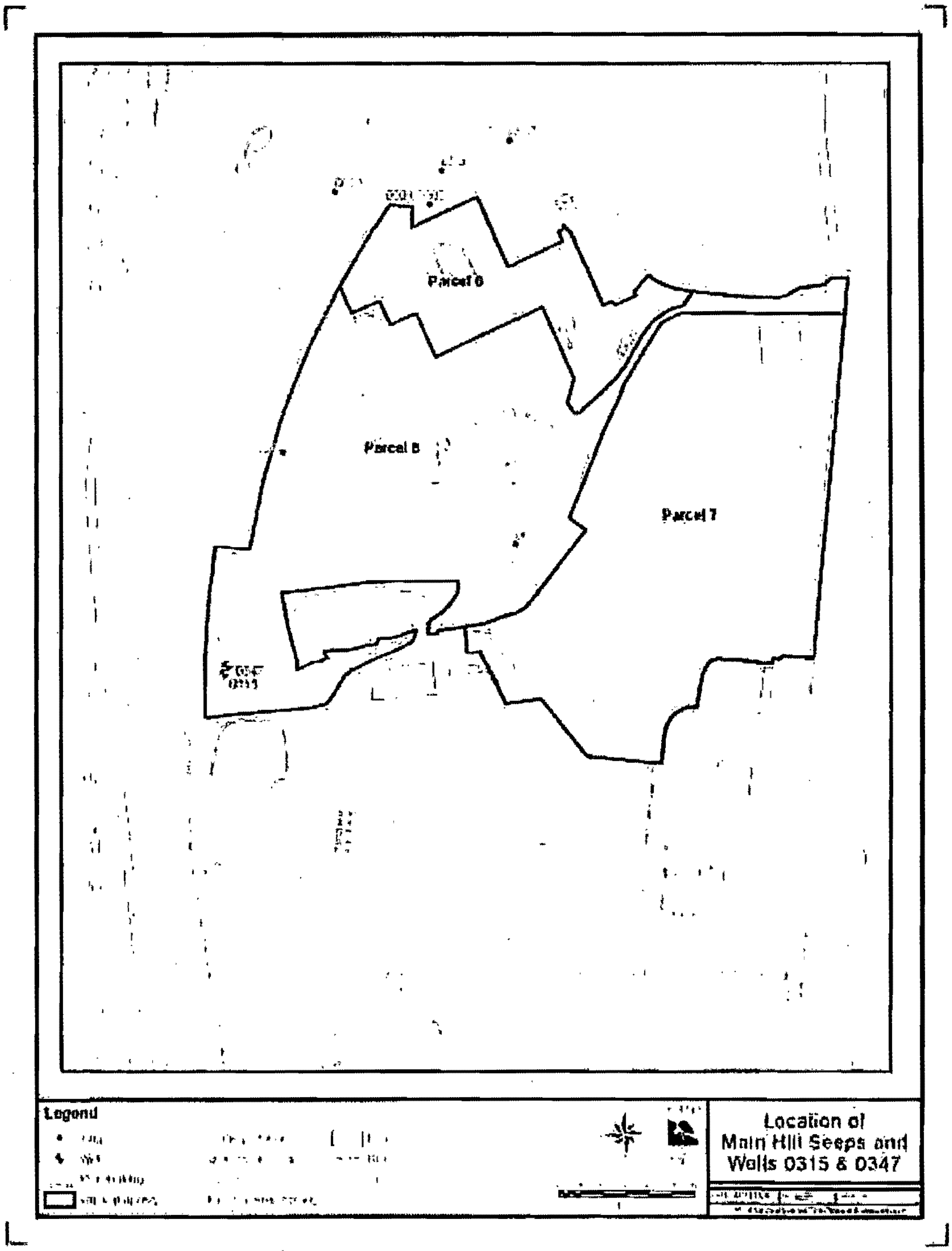


Figure 2: Parcels 6, 7, and 8 Seeps and Wells 0315 and 0347.



2.0 CURRENT CONDITIONS

This section describes the general hydrogeologic setting within the Parcels 6, 7, and 8 and the nature of the MCL exceedances within the Parcels 6, 7, and 8 groundwater system.

2.1 General Hydrogeologic Setting

The general hydrogeologic setting of the Mound Closure Project (MCP) is described in the Parcels 6, 7, and 8 ROD, (Reference 2). For a detailed description of the groundwater flow regimes at MCP the reader is referred to the following references:

1) Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan, Final, May 1992, (Reference 3)

2) Operable Unit 9; Hydrogeologic Investigation: Buried Valley Aquifer Report, Technical Memorandum (Reference 4)

3) Operable Unit 9; Hydrogeologic Investigation: Bedrock Report, Technical Memorandum (Reference 5)

Parcel 6, 7, and 8 property contains two interconnected groundwater flow regimes; a low flow bedrock system dominated by fracture flow through inter-bedded Ordovician shale and limestone and the highly permeable glacial outwash deposits that comprise the sole source BVA. A thin tributary valley divides the two main portions of the plant site 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. The southwestern area of Parcel 8 lies above the BVA and the Tributary Valley groundwater system. Figure 3 shows the approximate boundary of the BVA, relative to the parcels.

Parcel 6 is located mostly on the topographically high northern end of the plant site. The southeastern end of Parcel 6 has sloping hillsides that drain in a southeasterly direction. Parcel 7 is located primarily on the topographically high eastern portion of the plant site. The area is dominated by steeply sloping hillsides that drain westward towards the tributary valley. Parcel 8 is located on the topographically high western portion of the plan and includes the lower western edge of the plant that overlays the tributary valley. Figure 4 shows a topographic map of the plant site with the parcel boundaries outlined.

The 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: Parcels 6, 7, and 8 with Approximate Boundary of the BVA

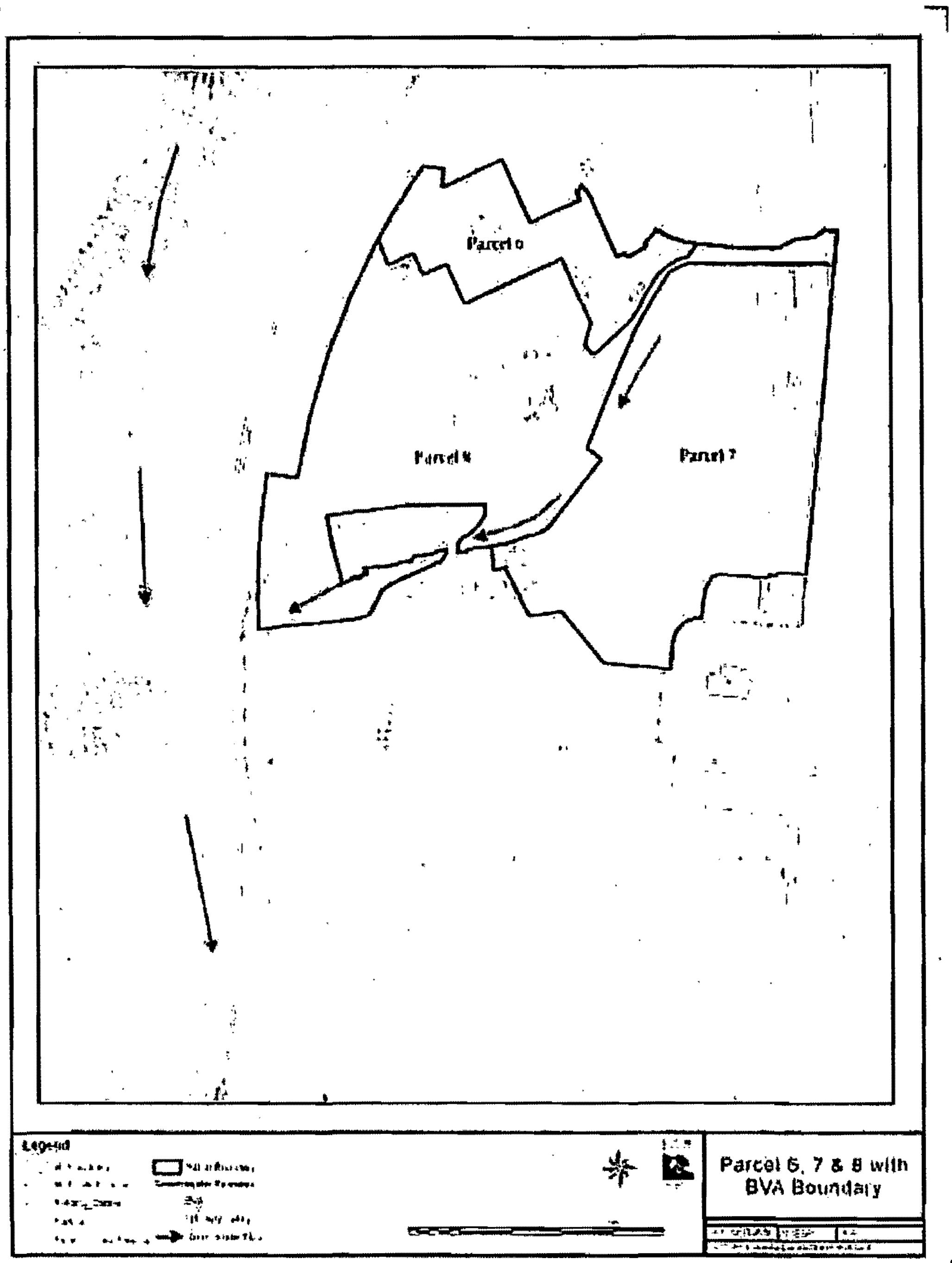


Figure 4. Topography in Parcels 6, 7, and 8

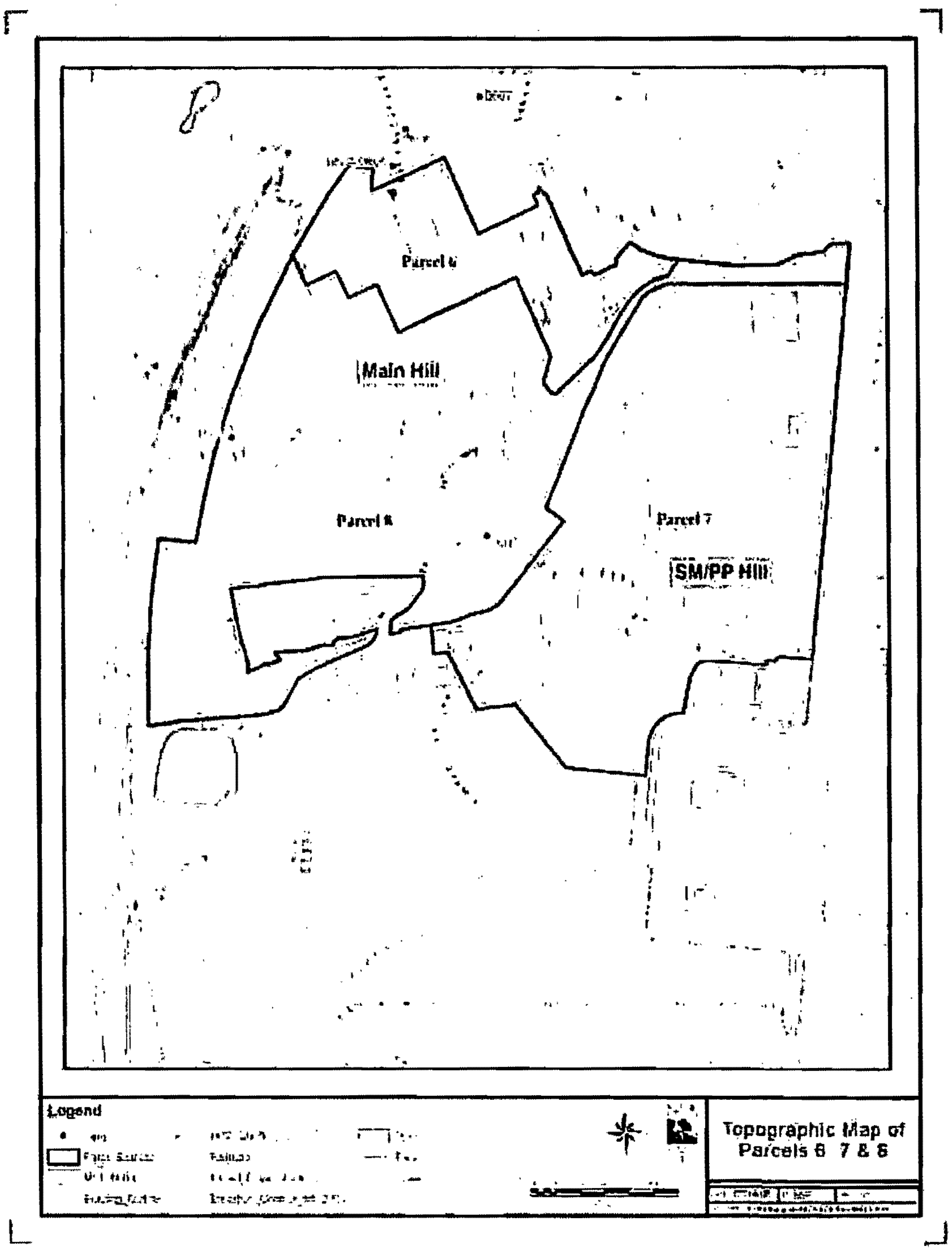
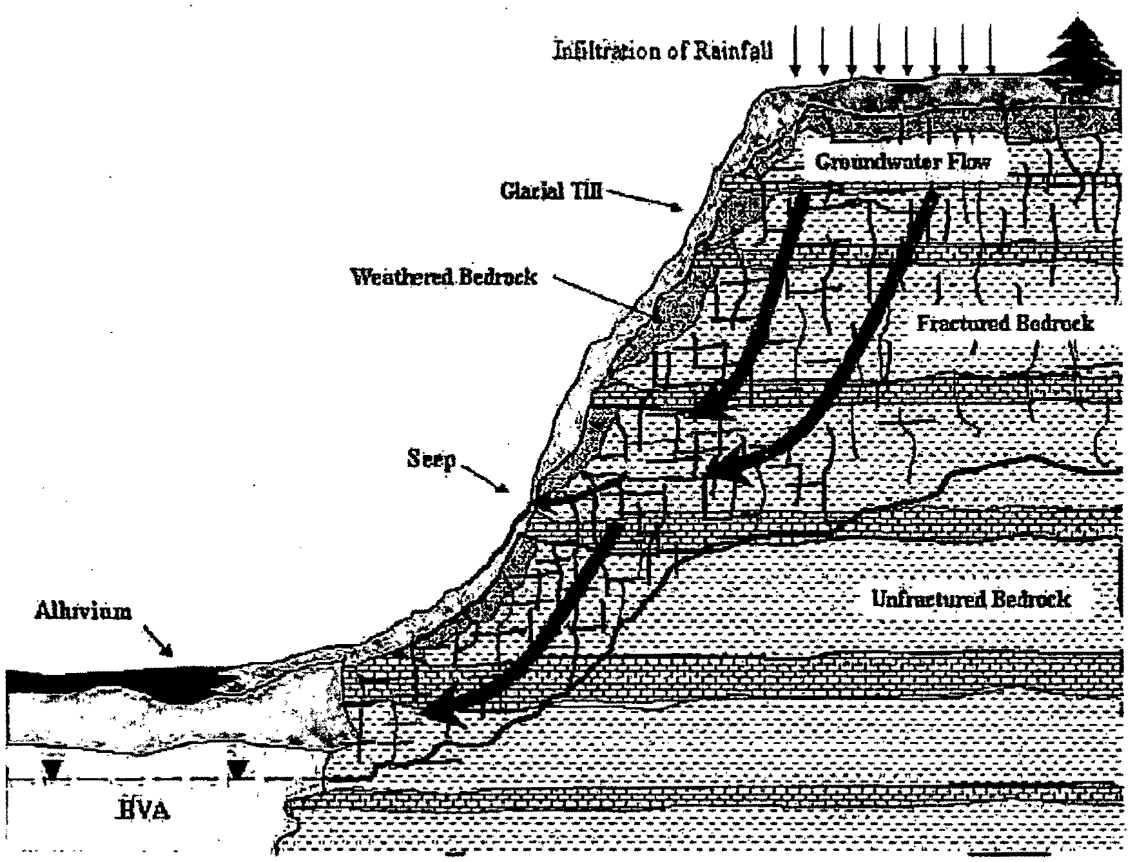


Figure 5: Generalized Bedrock Groundwater Flow



2.2 Parcels 6, 7, and 8 Groundwater MCL Exceedances

As noted in section 1.0 of this document, the Parcels 6, 7, and 8 contain groundwater monitoring wells showing MCL exceedances for trichloroethene and seeps with MCL exceedances for trichloroethene, tetrachloroethene, and tritium. Elevated levels of strontium-90 and radium-226/228 have also been detected in seep 601. Elevated levels of trichloroethene have been detected in wells 0315 and 0347 in Parcel 8 but not in adjacent wells. The Parcel 6, 7, and 8 Record of Decision selected monitored natural attenuation as the remedy to address these issues.

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

2.2.1 Well 0315, 0347 Trichloroethene (TCE) Groundwater Contamination

Groundwater monitoring wells 0315 and 0347 show MCL exceedances for trichloroethene (TCE). The wells both show recent (summer 2005) TCE concentrations in excess of the MCL of 5 µg/l (5 ppb). Figures 6 and 7 show time series charts of TCE concentration in wells 0315 and 0347 respectively. As can be seen from the charts, recent concentrations in well 0347 have ranged between 15 and 25 ppb while those in well 0315 have recently ranged from 5 to 15 ppb. Neither chart offers a clear indication of a trend although it does appear that concentrations may have stabilized in both wells.

Figure 6. TCE Concentration Trends in Well 0315.

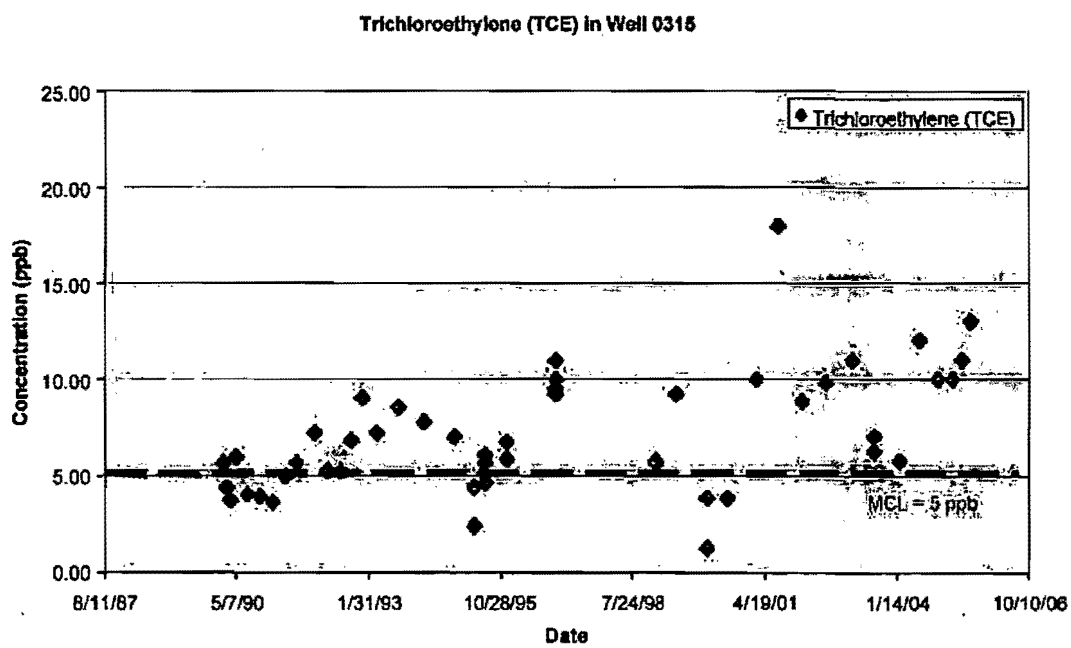
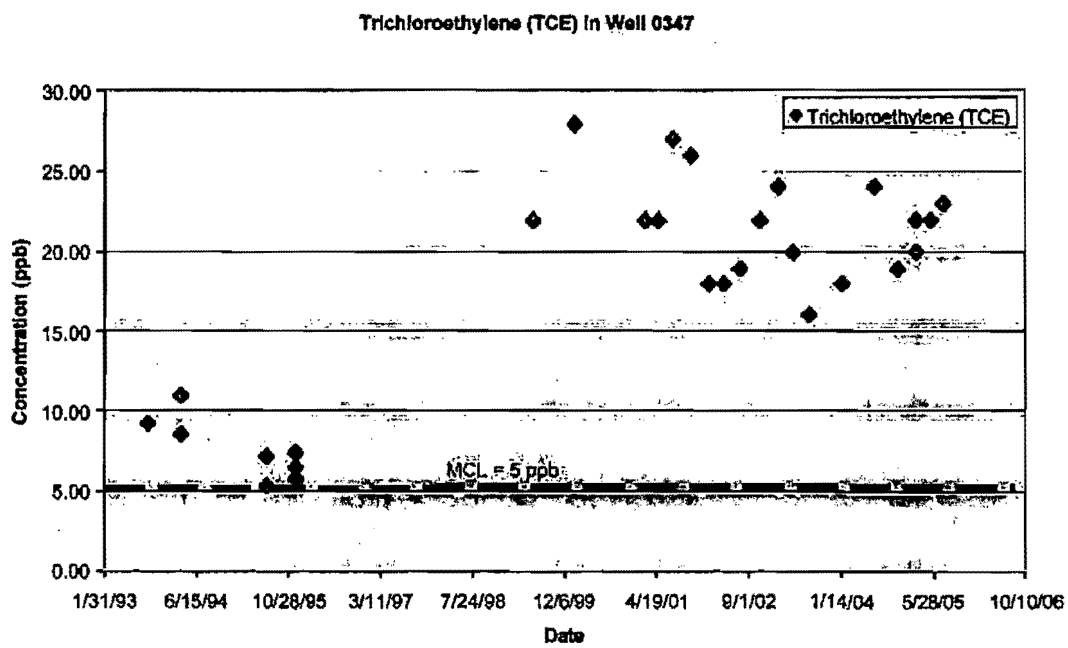


Figure 7. TCE Concentration Trends in Well 0347.



2.2.2 Main Hill Seeps VOC and Tritium Contamination

Figure 10 shows the observed tritium concentrations in the offsite seeps 0605, 0606, 0607, and 0608. Seep 0605 consistently has shown the highest tritium concentration among the offsite seeps, which has declined since reaching a peak in the 4th quarter of 2004. On-site seeps 0601 and 0602 (not charted) also reached peak tritium concentrations of 1,084,000 pCi/L and 41,000 pCi/L respectively. Seep 0601 reached its peak in the 4th quarter of 2004, and Seep 0602 appears to have peaked in the 2nd quarter of 2005. The most recently measured concentrations (4th quarter 2005) were 463,000 pCi/L at Seep 0601 and 21,000 pCi/L at Seep 0602.

Figure 10. Tritium Concentrations In Offsite Seeps

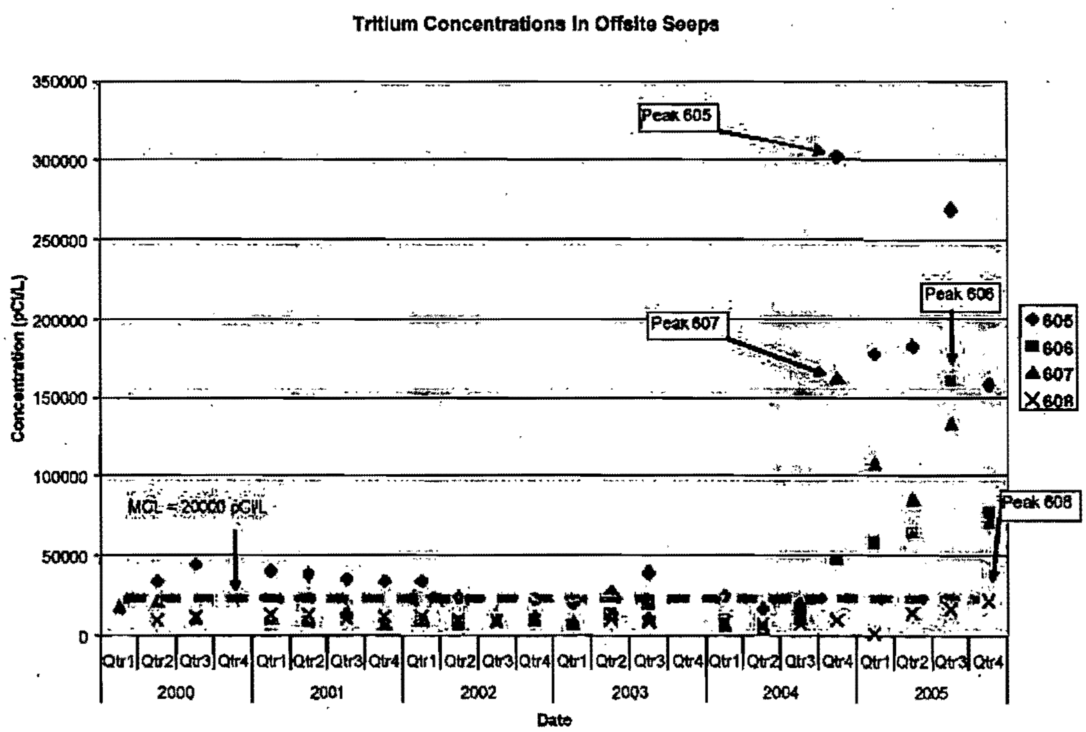
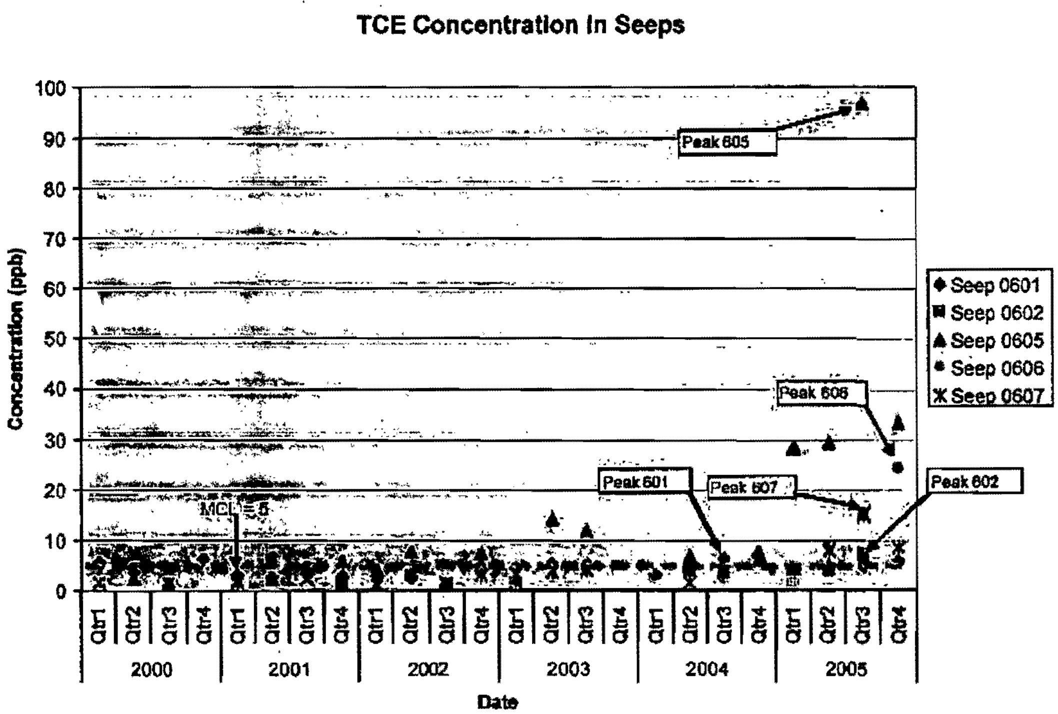


Figure 11 shows TCE concentrations observed in the seeps. The TCE concentration has been highest in Seep 0605 and has decreased substantially since the peak concentration of 97 ppb in the 3rd quarter of 2005. Additional sampling events are required to determine whether Seep 606 reached a peak concentration in the 4th quarter of 2005.

Figure 11. TCE Concentrations in Main Hill Seeps



3.0 SELECTED REMEDY: MONITORED NATURAL ATTENUATION

The selected remedy for the groundwater contamination observed at wells 0315 and 0347 and at the seeps is Monitored Natural Attenuation (MNA). This plan outlines the details associated with the requirements necessary to demonstrate that MNA is an effective remedy given the scope and magnitude of the low-level TCE groundwater contamination. The DOE will monitor groundwater in wells 0315 and 0347 and at the seeps to verify that the concentration of contaminants is decreasing due to MNA. Several down gradient wells will also be monitored to provide early warning if contaminants begin to migrate and to provide assurance that the down gradient BVA is not being negatively impacted.

The regulators have the ability to participate in any of the sampling events to observe or to split a sample.

3.1 Remedial Action Objectives

The remedial action objectives include the following:

- protect the down gradient BVA by verifying that TCE concentrations in the vicinity of wells 0315 and 0347 are decreasing and not impacting the BVA.

- monitor the reduction of TCE concentrations to below the MCL in wells 0315, 0347 and to verify the hypothesis that natural decomposition of TCE will result in concentrations below MCL over time.

- monitor the reduction of TCE, PCE, and tritium concentrations to below the MCL in seeps 0601, 0602, 0605, 0606, and 607 and to verify the hypothesis that with removal of the source below the SW/R/Building complex natural decomposition will result in concentrations below MCL over time.

- monitor concentrations of strontium-90 and radium-226/228 in Seep 0601.

3.2 Estimated Remedial Action Time Frame

Given the data trends observed at monitoring wells 0315 and 0347 there is currently no reliable way to estimate remediation time frame based on regression analysis. In fact, given the nature of the problem, (low-level localized VOC groundwater contamination with no clear source) any estimate would be conjecture. What can be said with confidence is that based on the dense network of monitoring wells located in this area, the DOE has excellent spatial control from which to assess any negative impacts from this localized contamination problem. Additionally, it does appear the TCE levels have been relatively stable for the past several years.

Concentration vs. time plots for tritium at the seeps show trends that suggest tritium levels in all seeps (with the exception of onsite Seep 601 which has a considerably higher tritium concentration than the other seeps) should be below the MCL by sometime in 2008. However, the data set is sparse since completion of SW/R/B Building remediation activities so the margin for error in regards to this time estimate is significant. As additional data become available over time, a comparison can be made of data trends at these locations.

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 Parcels 6, 7, and 8 bedrock system in order to demonstrate the selected remedy (Monitored Natural Attenuation) is effective at mitigating the contamination. The monitoring locations are selected to take advantage of the flow dynamics of the bedrock system such that potential migration of contaminants will be detected. The monitoring frequency is selected to insure any change in the system will be detected without significant opportunity for down gradient migration. Parcel 6, 7, and 8 Remedy Groundwater Monitoring Plan will become effective 4th quarter 2006 sampling events.

If the Operable Unit 1 groundwater remedy is modified, this Parcels 6, 7, and 8 groundwater monitoring plan must be reviewed to determine potential impacts.

4.1 Well 0315/0347 Monitoring Locations and Analytes

As noted previously groundwater flow in the vicinity of wells 0315 and 0347 is westward out of the tributary valley and subsequently southwesterly upon discharge to the main BVA.

Figure 12 shows a plan view of the wells screened within the BVA and Tributary Valley in the vicinity of wells 0315 and 0347. Monitoring wells 0386 and 0389 lie on the northern flank of the tributary valley bedrock channel, while wells 0387 and 0392 lie on the southern flank of the bedrock channel (see Figure 13). These wells lie in a zone in which water exiting the tributary valley flow system discharges into the main BVA flow system. Wells 0389 and 0386 have previously exhibited TCE concentrations slightly above MCLs while wells 0387 and 0392 have not shown TCE detections. Well 0124 was screened in the BVA immediately west of wells 0389 and 0386 and has not shown VOC detections. Wells P026 and 0126 screened in the BVA immediately west of 0387 and 0392 (with the exception of very low level tetrachloroethene, PCE, detections at 0126) have not shown detections of VOCs. In the unlikely event that contaminated groundwater would migrate westward past wells 0386, 0389, 0387 and 0392, monitoring at wells 0126 and 0124 provides an extra layer of protection for the BVA. The pattern of VOC detections in the vicinity of wells 0315 and 0347 demonstrates that the TCE contamination is localized to the groundwater in the vicinity of those wells.

The cross-sections A-A' and B-B' shown on Figures 12 and 13 profile bedrock where the Tributary Valley meets the BVA.

Figure 12. Monitoring Wells in the Vicinity of Wells 0315/0347.

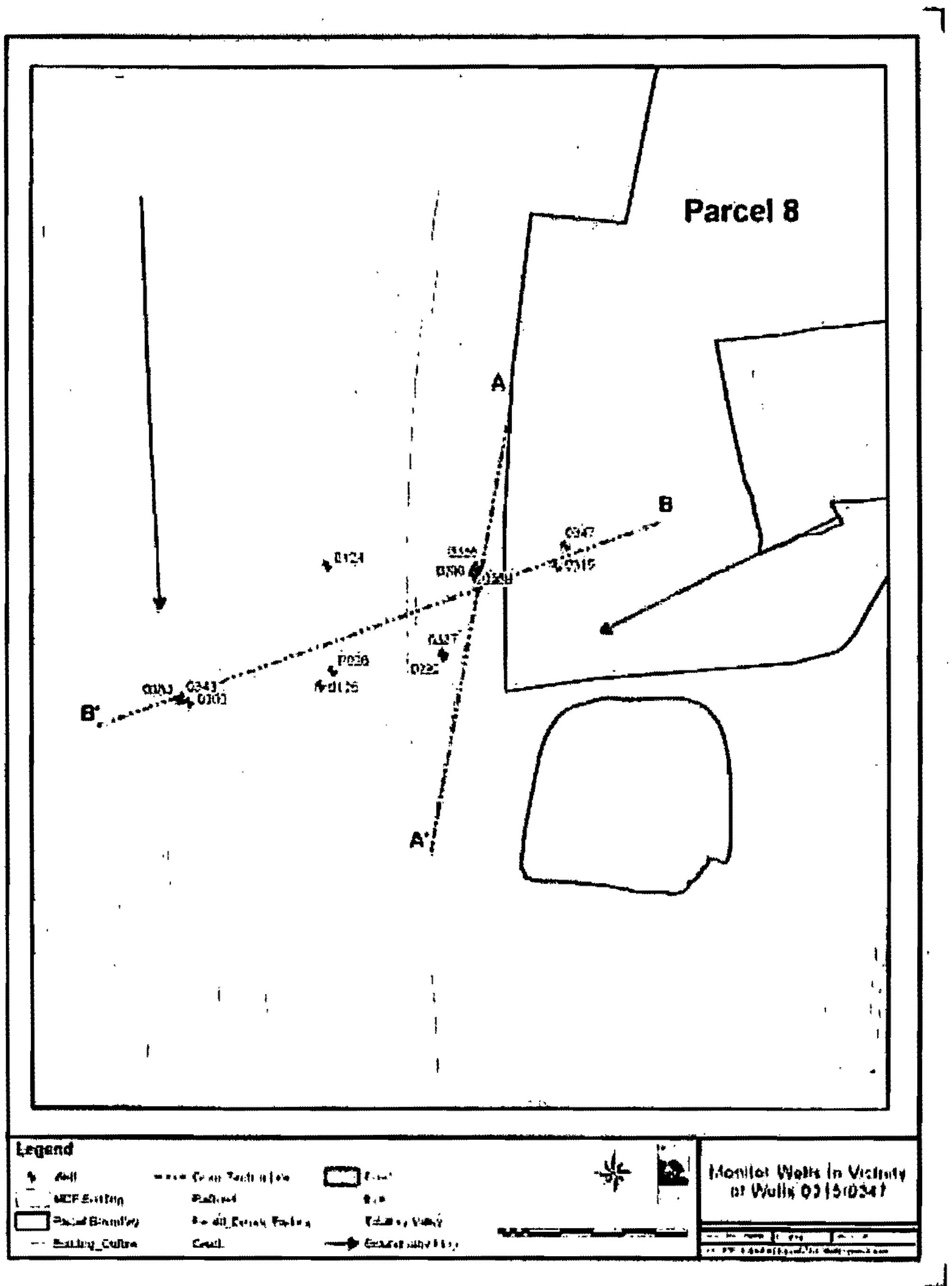
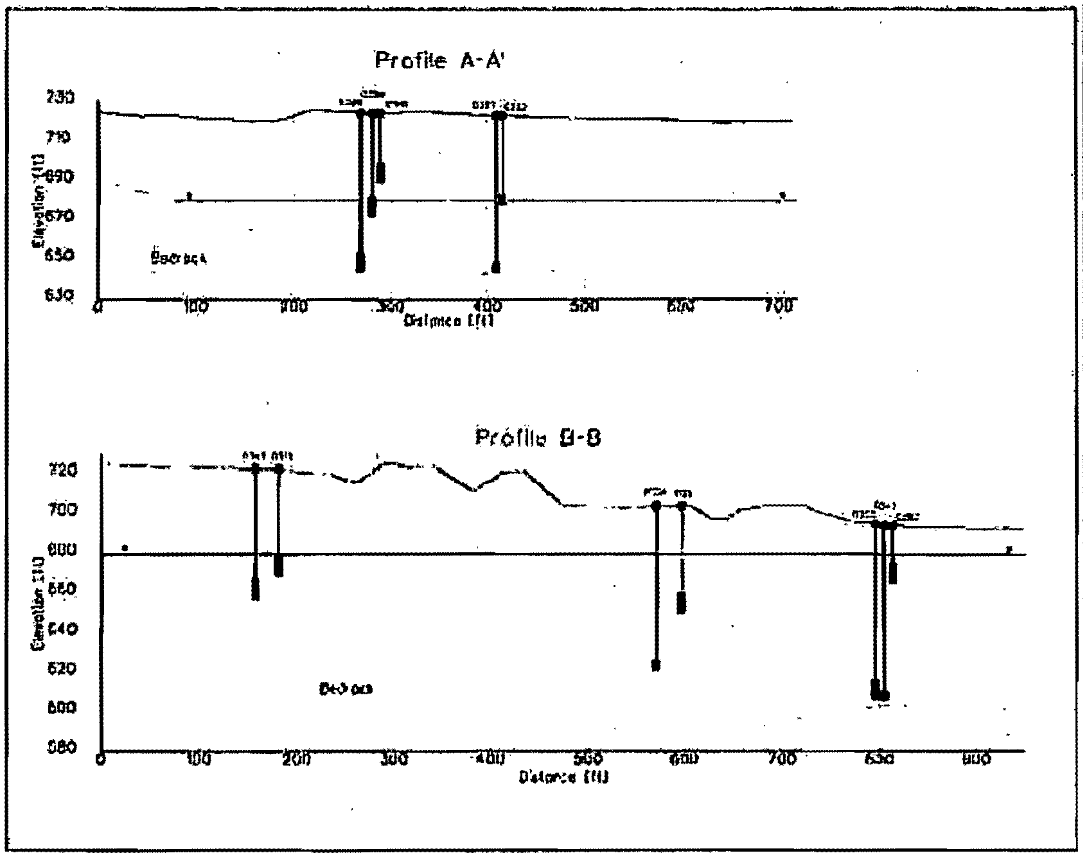


Figure 13. Vertical Cross-Section Showing Monitoring Wells in the Vicinity of Wells 0315/0347 (see Figure 12 for cross-section location).



Well 0315 and 0347 Area Monitoring Locations

BVA wells 0315 and 0347 will be monitored for VOCs to provide spatial monitoring coverage of the zone of localized TCE groundwater contamination.

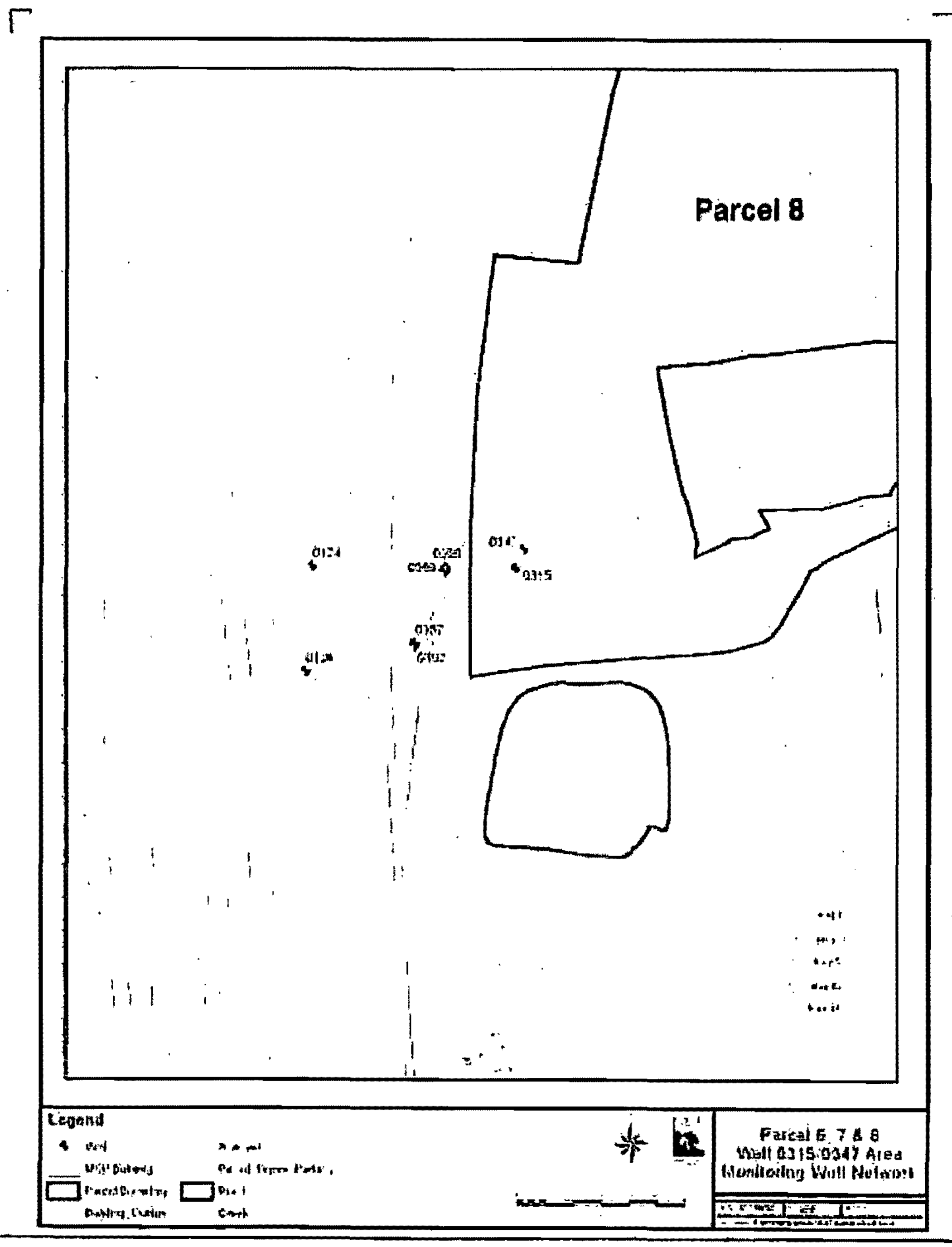
Down gradient BVA Monitoring Locations

The following BVA wells will be monitored for VOCs to provide spatial coverage of groundwater flow paths down gradient from the well 0315/0347 area:

Well 0386	Well 0389	Well 0387	Well 0392
Well 0124	Well 0126		

Figure 14 shows the distribution of monitoring wells utilized for demonstrating the effectiveness of Monitored Natural Attenuation with the well 0347-0315 Area.

Figure 14. Wells To Be Monitored in the Well 0315/0347 Area.



Analytes and Field Parameters

VOC analysis will be conducted via EPA SW-846 Method 8021B to obtain chemical concentrations of TCE, DCE, and VC. Dichloroethene (DCE) and vinyl chloride (VC) are degradation products of TCE and their presence indicates that TCE is being decomposed. In addition to TCE, DCE and VC, the following field parameters will be taken during each sampling event: Dissolved oxygen, temperature, Eh, pH

Well Construction

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.

Monitoring Frequency

The monitoring frequency is determined based on concentration trends previously observed in TCE data collected from the monitoring locations noted in the section above. Quarterly sampling has been effective in the past at capturing both the general trend and minor fluctuations in TCE concentration observed in these wells. Based on the data, TCE 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 6.0 on reporting requirements).

Quarterly Groundwater Monitoring

Wells 0347, 0315, 0386, 0389, 0387, 0392, 0124 and 0126 will be monitored quarterly for VOCs (in particular TCE). 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 initial quarterly monitoring defined in this section must be agreed to by the regulatory agencies and the DOE. Table 1 summarizes the sampling requirements associated with Parcels 6, 7, and 8 remedy monitoring.

Reduction to Semi-Annual Groundwater Monitoring (2 sampling events)

If TCE/DCE/VC concentrations in monitoring wells 0315 and 0347 decline after 4 quarterly sampling events, the DOE may petition for a sampling reduction to semi-annually for wells in the Well 0315/0347 area. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

Reduction to Annual Groundwater Monitoring

If TCE/DCE/VC concentrations in monitoring wells 0315 and 0347 continue to decline after 2 semi-annual sampling events, the DOE may petition for a sampling reduction to annually for all the wells in the Well 0315/0347 area. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

If TCE/DCE/VC concentrations in monitoring wells 0315 and 0347 continue to decline after 3 annual sampling events, the DOE may petition to discontinue sampling for all the wells in the Well 0315/0347 area. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

Discontinuation of Sampling

If at any time TCE/DCE/VC concentrations in wells 0315 and 0347 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 the wells in the Well 0315/0347 area.

Table 1. Well 0315/0347 Remedy Monitoring

Remedy (MNA) Monitoring	Monitoring Analytes	Sampling Frequency	Analytical Methods	Data Validation Methods
Well				
0347	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0315	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0386	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0389	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0387	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0392	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0124	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002
0126	TCE/DCE/VC	Quarterly	EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002

Monitoring Procedures

Wells will be sampled using the low-flow micro-purge sampling methodology. Some 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.

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-80045.

4.2 Main Hill Seeps Monitoring - Analytes and Locations

This section outlines the relevant seeps and wells, the sampling frequency, sampling parameters and sampling methodology required to ensure contaminant levels in the seep water return to acceptable levels. The seeps comprise the seeps associated with PRS 91-92 and 94-98. Figure 15 shows the monitoring network for the seeps.

Seep Monitoring Locations

Water from seeps 0601, 0602, 0605, 0606, and 0607 will be collected and tested for the contaminants of concern as shown in Table 2. Seep 0608 will not have water collected and tested as part of this remedy. This location is upstream and has not shown an increase in activity.

Down Gradient Monitoring for Seep Contaminants

The following groundwater monitoring wells will be monitored as part of the remedy. The wells are located within the BVA down gradient of the bedrock groundwater discharge area of the SW-R Hillside. Monitoring wells 0346 and 0138 both show a response to migrating tritium and are therefore suitable for continued monitoring to track the progress of both tritium and VOC concentrations in the BVA. Well 0379 is in the vicinity of well 0347 and will be sampled as well. The remaining wells are located in the vicinity of well 0138 or are down gradient of well 0346 and samples will not be collected as part of this remedy. Well 0347 will continue to be monitored as part of wells 0315/0347. Figure 15 shows the monitoring network for the seeps.

Wells West of SW-R	Tributary Valley Wells
Well 0138	Well 0346
Well 0118	Well 0379
Well 0334	Well 0347
Well 0333	
Well 0301	

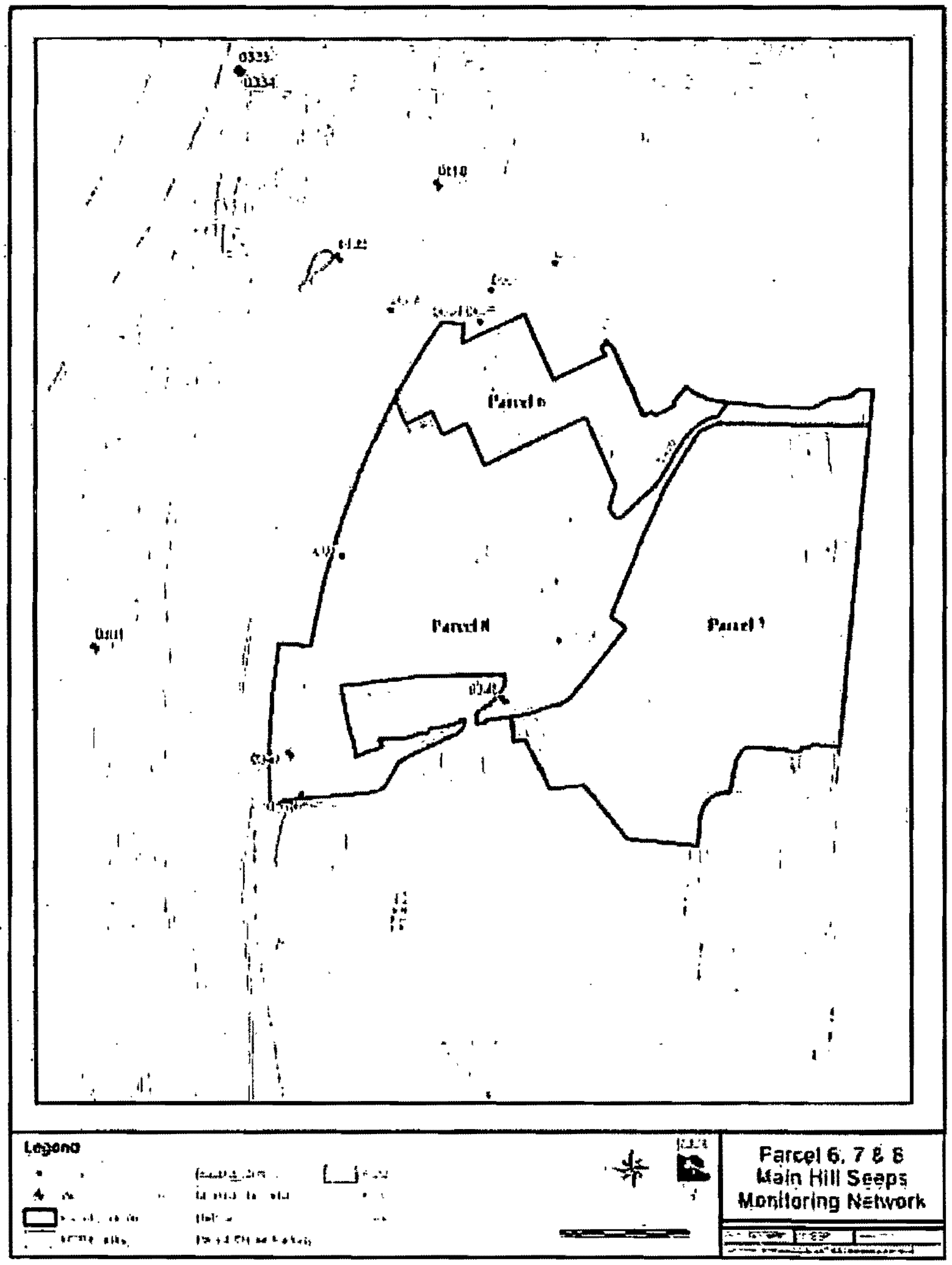
Analytes and Field Parameters

VOC analysis will be conducted via EPA SW-846 Method 8021B to obtain chemical concentrations of TCE, PCE, DCE, and VC. Dichloroethene (DCE) and vinyl chloride (VC) are degradation products of TCE and PCE and their presence indicates that TCE and PCE are being decomposed. Tritium analysis will be conducted via EPA method 906.0A. In addition, the following field parameters will be taken during each sampling event: dissolved oxygen, temperature, Eh, pH.

Well Construction

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 15 Monitoring Locations for Seep Contaminants



Monitoring Frequency

Quarterly sampling has been effective in the past at capturing both the general trend and minor fluctuations in contaminant concentration observed in these wells. Based on the data, 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 6.0 on reporting requirements).

Quarterly Groundwater Monitoring

Table 2 identifies the wells and seeps to be monitored as the remedy for contamination observed at the seeps. 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 this section must be agreed to by the regulatory agencies and the DOE.

Reduction to Semi-Annual Groundwater Monitoring (2 sampling events)

If concentrations in seeps 0601, 0602, 0605, 0606 and 0607 continue to decline after 4 quarterly sampling events, the DOE may petition for a sampling reduction to semi-annually for these wells and seeps. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

Reduction to Annual Groundwater Monitoring

If concentrations in seeps 0601, 0602, 0605, 0606 and 0607 continue to decline after 2 semi-annual sampling events, the DOE may petition for a sampling reduction to annually for these wells and seeps. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling frequency.

If TCE/DCE/VC concentrations in seeps 0601, 0602, 0605, 0606 and 0607 continue to decline after 3 annual sampling events the DOE may petition to discontinue sampling for wells 0138, 0346 and 0379 and seeps 0602 and 0606. The Monitoring Frequency for seeps 0601, 0605, and 0607 would remain annual until the concentrations drop below MCLs. If the geochemical conditions remain stable the USEPA and OEPA will evaluate a request for decreased sampling.

Concentrations in Seeps 0601, 0605, and 0607 Drop Below MCLs

If at any time TCE/DCE/VC concentrations in seeps 0601, 0605, and 0607 drop below MCLs for the analytes listed in Table 2, for a minimum period of two years, the DOE may petition to discontinue sampling for Main Hill seep monitoring wells and seeps.

Table 2. Seeps Remedy Monitoring

Remedy (MNA) Monitoring	Monitoring Analytes	Sampling Frequency	Analytical Methods	Data Validation Methods
Seep				
0601	Tritium Ra-226/228 TCE/DCE/VC Sr-90	Quarterly	VOCs - EPA SW-846 Method 8021B, Compendium method A-002 Ra 226/228 – Compendium A-017 Tritium - EPA method 906.0A Compendium A-014 Sr-90 - Compendium A-016	Compendium method DV-002, DV-014, DV-016, DV-017
0602	Tritium TCE/DCE/VC	Quarterly	VOCs - EPA SW-846 Method 8021B, Compendium method A-002 Tritium - EPA method 906.0A Compendium A-014	Compendium method DV-002, DV-014
0605	Tritium TCE/DCE/VC	Quarterly	VOCs - EPA SW-846 Method 8021B, Compendium method A-002 Tritium - EPA method 906.0A Compendium A-014	Compendium method DV-002, DV-014
0606	Tritium TCE/DCE/VC	Quarterly	VOCs - EPA SW-846 Method 8021B, Compendium method A-002 Tritium - EPA method 906.0A Compendium A-014	Compendium method DV-002, DV-014
0607	Tritium TCE/DCE/VC	Quarterly	VOCs - EPA SW-846 Method 8021B, Compendium method A-002 Tritium - EPA method 906.0A Compendium A-014	Compendium method DV-002, DV-014
Wells				
0138	Tritium TCE/DCE/VC	Quarterly	Tritium - EPA method 906.0A Compendium A-014 VOCs - EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-002, DV-014
0346	Tritium TCE/DCE/VC	Quarterly	Tritium - EPA method 906.0A Compendium A-014 VOCs - EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-014
0379	Tritium TCE/DCE/VC	Quarterly	Tritium - EPA method 906.0A Compendium A-014 VOCs - EPA SW-846 Method 8021B, Compendium method A-002	Compendium method DV-014

Sampling Procedures

This section outlines the procedures for collecting groundwater seep samples and groundwater samples from monitoring wells.

Groundwater samples are collected from seeps by one of two methods depending on the flow rate. If the flow rate is reasonable and a sample bottle can be placed within the flow a sample can be collected by simply inserting the bottle into the seep flow and collecting the appropriate volume. If the flow is relatively low, it may be necessary to excavate a small basin into which water can slowly flow and accumulate to a sufficient volume. Samples are then carefully collected by submerging the bottle into the basin water and collecting the appropriate volume.

All Buried Valley Aquifer wells are capable of supporting micro-purge sampling. Samples collected from the wells will be collected utilizing the micro-purge sampling protocol as outlined in Appendix B of this monitoring program.

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-80045.

4.3 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 Parcels 6, 7, and 8 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 – 0315/0347 Area

Monitoring wells 0315 and 0347 represent the location within the BVA system showing the highest concentrations of TCE. TCE concentrations have been relatively stable for the past three years *averaging approximately 15 ppb and 15 ppb respectively.* The following trigger levels are designed to indicate that a change has occurred in the current BVA conditions relative to TCE contamination in wells 0315 and 0347. Any of the conditions noted in Table 3 below would be interpreted as a potential change in the local BVA 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.

Table 3. Well 0315/0347 Monitoring Trigger Levels and Actions.

Location	Trigger Level	Response Action
Well 0315 and 0347	Monitoring results show the concentration of TCE increasing to 30 ppb.	Immediately Notify Federal and State Environmental Protection Agencies.
BVA Wells With past TCE Detections down gradient of wells 0315 and 0347		
Monitoring Wells 0386 and 0389	Monitoring results show the concentration of TCE above the MCL of 5 ppb.	Immediately Notify Federal and State Environmental Protection Agencies.
BVA Wells With No Historical TCE Detections down gradient of wells 0315 and 0347		
Monitoring Wells 0387, 0392, 0124 and 0126	Monitoring results show the concentration of TCE above the MCL of 5 ppb.	Immediately Notify Federal and State Environmental Protection Agencies.

5.2 Indicators – Seeps

The following trigger levels are designed to indicate that a change has occurred relative to TCE or tritium contamination in the seeps. Any of the conditions noted in Table 4 below would be interpreted as a potential change in the local BVA 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. Concentrations have not stabilized since completion of the SW/R/B building soils excavations so some variability in monitoring results is expected.

Seep 0601 represents the location showing the highest concentrations of tritium, PCE, radium-226/228 and strontium-90. Significantly exceeding that concentration should trigger a response; therefore the tritium trigger level is set at 1500nCi/L at all seeps. Trigger levels are also established for PCE, strontium-90 and radium-226/228 above the recent maximum concentrations.

Seep 0605 is the location with the highest recorded TCE concentration. Significantly exceeding that concentration should trigger a response; therefore the TCE trigger level is set at 150 ppb.

Table 4. Seeps Monitoring Trigger Levels and Actions.

Location	Trigger Level	Response Action
Seeps		
Seep 0601	Tritium Concentration: Trigger Point 1,500 nCi/L spike or a sustained upward trend over three quarterly monitoring events leading to concentrations in excess of 300 nCi/L above the baseline concentration. Sr-90 Concentration Trigger Point: 20 pCi/L Radium-226/228 Concentration: 20 pCi/L PCE Concentration Trigger Point: 75 ppb	Immediately Notify Federal and State Environmental Protection Agencies.
Seep 0602 Seep 0605 Seep 0606 Seep 0607	TCE Concentration Trigger Point: 150 ppb Tritium Concentration Trigger Point: 1,500 nCi/L spike or a sustained upward trend over three quarterly monitoring events.	Immediately Notify Federal and State Environmental Protection Agencies.

6.0 DATA REPORTING AND MONITORING PLAN REVIEW

6.1 Data Reporting

Data and data reports will be provided to the regulators, as defined in Sections 6.1 through 6.3 below, in order to allow the progress of the Parcel 6, 7, and 8 MNA remedy to be evaluated.

All MNA groundwater monitoring data will be compiled and validated by DOE each calendar quarter and forwarded to US EPA and Ohio EPA. The cumulative data will be provided in an excel spreadsheet with accompanying chart. The data table will begin with the 4th quarter calendar year 2006 sampling event. This data will not be accompanied by a report.

Beginning on March 31, 2007, the DOE will provide a draft annual report to the regulators that documents the progress of the Parcel 6, 7, and 8 MNA remedy towards meeting the remedial objectives of this monitoring plan. 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.

Delivery of the draft report by March 31st of each year will be a recurring, annual Federal Facilities Agreement (FAA) requirement. Upon receipt of the draft annual report the regulators will provide comments to DOE, and DOE will respond to comments and 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.

DOE may petition the regulators to decrease the frequency of the data submissions or 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.

A final report will be provided to the regulators at the completion of the MNA remedy for the Parcels. The report will document completion of the remedial action.

6.2 Monitoring Plan Review

As noted in previous sections of this monitoring plan, the BVA groundwater system (i.e., water quality) is not expected to deteriorate in the future. Monitoring locations and sampling frequencies have been defined such that any change in the BVA 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 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 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 6.1 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 hat 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 parcel can be eliminated.

As noted above, concentrations at the seeps have not stabilized to the point where the time for remediation can be estimated accurately. If the remedial action is not complete within the 2008 timeframe, 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 remedy currently scheduled for completion in FY2011. If, by the time of that five-year review, the Parcel 6, 7, and 8 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 parcels.

6.3 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 Parcel 6, 7, and 8 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. Therefore, this 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.

7.0 REFERENCES

Reference 1	Mound Plant Operation and Maintenance (O&M) Plan For the Implementation of Institutional Controls, US Department of Energy, Miamisburg Environmental Management Project, August 1999.
Reference 2	Parcel 6, 7, and 8 Record of Decision, Final, Miamisburg Closure Project, July 2006
Reference 3	Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan, Final, US Department of Energy, May 1992
Reference 4	Operable Unit 9; Hydrogeologic Investigation: Buried Valley Aquifer Report, Technical Memorandum, Revision 1, US Department of Energy, September 1994
Reference 5	Operable Unit 9; Hydrogeologic Investigation: Bedrock Report, Technical Memorandum, Revision 0, US Department of Energy, January 1994

Appendix A

Well Construction Information for the Parcel 6, 7, and 8 Monitored Natural Attenuation (MNA) Monitoring Wells

Table A-1. Well Construction Information for the Parcel 6, 7, and 8 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
0315	723.99	55	43-53	BVA	4 inch SS
0347	725.20	67	57-67	BVA	4 inch SS
0386	724.79	87	77-87	BVA	4 inch SS
0387	720.89	82	77-82	BVA	4 inch SS
0389	724.65	52	42-52	BVA	4 inch SS
0392	720.84	45	40-45	BVA	4 inch SS
0124	705.12	55	45-55	BVA	4 inch SS
0126	705.54	54	44-54	BVA	4 inch SS
P026	703.83	85	73-83	BVA	2 inch PVC
0118	704.86	42	32-42	BVA	4 inch SS
0138	697.76	42	32-42	BVA	4 inch SS
0301	692.46	86	76-86	BVA	4 inch SS
0333	697.85	75	65-75	BVA	4 inch SS
0334	698.54	29	19-29	BVA	4 inch SS
0346	742.97	53	41-46	BVA	4 inch SS
0379	716.07	40	30-40	BVA	4 inch SS

Appendix B

Procedures for Collection of Groundwater and Seep Samples for 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 micro-purge 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.

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

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