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Final

Work Plan for the Characterization Phase of Pilot Studies at the Solvent Disposal Pit Area of Site 1

Allegany Ballistics Laboratory
Rocket Center, West Virginia

Contract Task Order 170

November 2004

Prepared for

Department of the Navy
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Naval Facilities Engineering Command

Under the

LANTDIV CLEAN II Program
Contract N62470-95-D-6007

Prepared by

CH2MHILL

Herndon, Virginia

SIGNATURE PAGE

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Prepared by

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Acronyms and Abbreviations

ABL	Allegany Ballistics Laboratory
AOC	Area of Concern
bgs	below ground surface
COPC	constituents of potential concern
1,2-DCE	1,2-dichloroethene
DNAPL	dense non-aqueous phase liquid
DOC	dissolved organic carbon
DPT	direct push technology
FSP	Field Sampling Plan
gpm	gallons per minute
HASP	Health and Safety Plan
IDW	investigation-derived waste
IDWMP	Investigation-Derived Waste Management Plan
ISCO	in situ chemical oxidation
MC	methylene chloride
NAPL	nonaqueous phase liquid
OPTV	optical/acoustical televiewer
PPE	personal protective equipment
PRAP	Proposed Remedial Action Plan
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SOP	Standard Operation Procedure
SWMU	Solid Waste Management Unit
TAL	target analyte list
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TOC	Total Organic Carbon
TOD	Total Oxidant Demand
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency

VOC	volatile organic compound

SECTION 1

Introduction

This work plan presents the background, rationale, and procedures for conducting the characterization phase of the groundwater pilot studies (one in the alluvial aquifer and another in the bedrock aquifer) at the Solvent Pit Area of Site 1, at Allegany Ballistics Laboratory (ABL) in Rocket Center, West Virginia. The primary purpose of the pilot studies is to determine if in situ source treatment using current remediation technologies is effective or feasible in reducing contaminant mass at Site 1. To assess the effectiveness of the technologies to be tested, the bedrock and alluvial aquifers must first be better characterized. The results of this characterization phase will help evaluate the feasibility of implementing in situ chemical oxidation (ISCO). The long-term goal for the pilot studies is to identify a technology that will cost-effectively reduce contaminant mass in the areas of Site 1 groundwater that may contain dense non-aqueous phase liquids (DNAPLs) with the intent to expedite remediation and/or reduce life-cycle cost of the current pump and treat system.

This work plan is an addendum to the *Final Work Plan for the Phase III Solid Waste Management Unit (SWMU) and Areas of Concern (AOC) Investigation* (CH2M HILL, 2002a), hereafter referred to as the Phase III SWMU/AOC Work Plan. Other documents referenced throughout this document are listed in Section 6. This Work Plan Addendum makes reference to background and procedural information in the aforementioned documents, as appropriate, and presents only new information that is specific to the characterization phase of these pilot studies or procedural information that varies from that documented in the aforementioned documents.

1.1 Background

Site 1 is an 11-acre area that consists of several disposal units, including an active 8-acre, fenced burning ground for reactive wastes including propellants and explosive wastes, three inactive disposal pits for spent solvents and acids, a former drum storage area for drums containing hazardous wastes, a former landfill for ash, and a former burning area for inert substances. The three disposal pits have been backfilled, all drums have been removed from the drum storage area, and both the ash landfill and the inert burning ground are overgrown with vegetation.

Site 1 has been part of a number of investigations conducted at ABL. Information gathered during the Remedial Investigation (RI) and Focused RI (CH2M HILL, 1996a and 1995) indicated that volatile organic compounds (VOCs; specifically trichloroethene [TCE], 1,2-dichloroethene [1,2-DCE], 1,1,1-trichloroethane [1,1,1-TCA], methylene chloride [MC], and acetone) were the most widespread constituents of potential concern (COPCs) detected at Site 1 in soil, alluvial and bedrock groundwater, surface water, and sediment. Groundwater at Site 1 was further evaluated as documented in the Focused RI (CH2M HILL, 1995) and the Focused Feasibility Study (CH2M HILL, 1996c).

The Navy issued a Proposed Remedial Action Plan (PRAP) for groundwater, surface water, and sediment in October 1996 and the associated ROD was signed in May 1997. The selected remedy for Site 1 groundwater and the surface water and sediment of the North Branch Potomac River adjacent to Site 1 was site-wide alluvial and bedrock groundwater containment (i.e., capture and removal) with subsequent onsite treatment and discharge of treated water to the river.

In order to evaluate the hydraulic properties of the alluvial and bedrock aquifers at Site 1 and to determine the optimal number, configuration, and withdrawal rates of extraction wells, Phase I Aquifer Testing, Phase II Aquifer Testing, and Phase III Aquifer Testing were conducted in 1995, 1996, and 2001, respectively.

Construction of a groundwater treatment facility for the extracted groundwater at Site 1 began in September 1997. The treatment plant began continuous operation in September 1998 and has treated an average of more than 100 gallons per minute (gpm) of groundwater extracted from Site 1 since that time. Currently, treated groundwater is utilized by the ABL boiler plant, with excess water being discharged to the river.

The solvent disposal pit area comprises SWMUs 6, 8, and 20. This area is located approximately 250 feet from the river (see Figure 1) and is considered to be the primary source of VOC contamination of groundwater in the alluvial and bedrock aquifers beneath Site 1.

1.2 Objectives

The objectives for the characterization phase of the pilot studies at the Solvent Pit Area of Site 1 are:

- Assess current alluvial and bedrock groundwater conditions at one solvent disposal pit area of Site 1 to delineate vertical and lateral distribution of VOCs.
- Evaluate the potential for metals to be released from the formation during and after the injection of chemical oxidants.
- Determine the site-specific oxidant demand, which will be used to calculate the amount of potassium permanganate or sodium persulfate required to oxidize both the contaminants present and the natural organics in the formation.

1.3 Work Plan Organization

This work plan is divided into the following sections:

Section 2—Rationale and Approach for the Site Characterization Activities. Provides an overview of the investigation and explains how the investigation activities will be implemented.

Section 3—Site Characterization Activities. Describes the field procedures that will be followed to install the monitoring wells, to conduct groundwater sampling, to implement the FLUTe™ technology and/or assess Sudan IV analyses, and collect samples for bench scale testing.

Section 4—Project Reporting. Describes how the results of the characterization will be evaluated and reported.

Section 6—Project Schedule. Provides the estimated schedule for the characterization phase of the pilot studies.

Section 7—References. Lists references cited in the work plan.

SECTION 2

Rationale and Approach for the Site Characterization Activities

2.1 Characterization Rationale

Various technologies were evaluated to reduce contaminant mass in groundwater beneath the solvent disposal pit area of Site 1. The results of this evaluation were presented to the ABL partnering team (consisting of members of the Navy, West Virginia Department of Environmental Protection and United States Environmental Protection Agency [USEPA]) and discussed during partnering team meetings in June and August, 2004. The technology recommended for pilot testing is ISCO using sodium persulfate ($NaSO_4$, and a catalyst) in the alluvial groundwater and potassium permanganate ($KMnO_4$) in the bedrock aquifer. The pilot studies include the following four phases:

1. Characterizing the alluvial and bedrock aquifers in the pilot study area (well installation and sampling).
2. Installing additional wells that are required to implement the remedial technologies in the pilot study areas and conducting a baseline sampling event.
3. Implementing the remediation technologies (i.e., conducting sodium persulfate and permanganate injections).
4. Performing efficacy monitoring of the remedial technologies at determined frequencies.

This work plan addresses the first phase of the pilot studies, concentrating on characterization of both the alluvial and bedrock aquifers. The results of this characterization will guide the subsequent phases of the pilot studies.

2.2 Characterization Approach

The pilot studies will be conducted in the alluvial and bedrock aquifers. The pilot study in the alluvial aquifer will be conducted in an approximately 120-foot by 90-foot area covering the footprint of the western-most former solvent disposal pit and the area hydraulically downgradient from the pit (Figure 1). The pilot study in the bedrock will be conducted in an approximately 50-foot by 50-foot area below the western-most former solvent disposal pit (Figure 2).

Characterization of the alluvial aquifer consists of installing one monitoring and three injection wells to top of bedrock (assumed to be about 30 feet below ground surface [bgs]) within the area to be treated (Figure 1). Prior to well installation, a direct push technology (DPT) rig will be used to evaluate the aquifer for the presence of DNAPL by using the FLUTe™ nonaqueous phase liquid (NAPL) liner at each of the proposed well locations. Soil samples will also be collected at each location using the DPT rig. Should cobbles hinder drilling process with the DPT, hollow stem auger drilling will be used to collect soil samples. After well installation and development, groundwater will be sampled and analyzed for target compound list (TCL) VOCs, target analyte list (TAL) metals, and selected geochemical parameters. In addition, soil samples will be collected in order to perform bench scale studies to determine the total oxidant demand (TOD). Measured groundwater levels will be used to establish the hydraulic gradient and groundwater direction across the area. The FLUTe™ NAPL liners and/or Sudan IV tests will be used to help determine if DNAPL is present. All data collected will be used to assess the concentration and distribution of VOC mass within the area, determine the hydrogeologic properties within the area, and assist in optimizing the pilot study layout (e.g., location of any additional monitoring wells, locations for oxidant injection and required amounts of oxidant).

Characterization of the bedrock consists of installing two monitoring wells and one injection well. After development, the wells will be sampled and analyzed for the same parameters as the alluvial groundwater. Geophysical logging of the bedrock holes will be performed to determine the location and orientation of fractures. FLUTe™ NAPL liners and/or Sudan IV tests will be used to help determine if DNAPL is present. All data collected will be used to assess the concentration and distribution of VOC mass within the area, determine the hydrogeologic properties within the area, and assist in optimizing the pilot study layout (e.g., location of any additional monitoring wells, if needed, locations for oxidant injection, and required amounts of oxidant).

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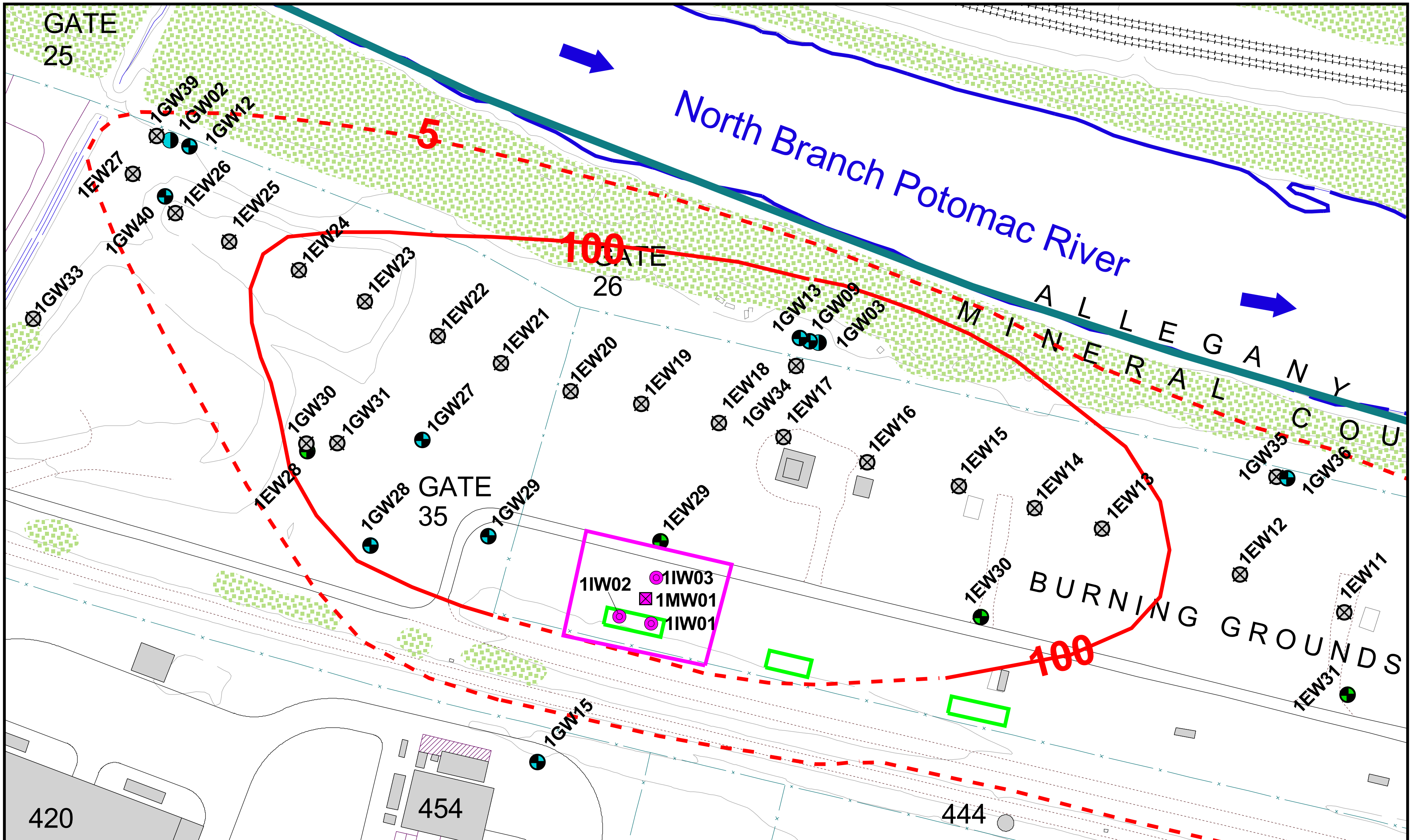

LEGEND

- Extraction Well - Bedrock
- Monitoring Well - Bedrock
- Monitoring Well - Hybrid
- Extraction and Monitoring Wells - Alluvial
- Solvent disposal pits
- TCE Isoconcentration Line for Alluvium in µg/L
- Pilot Study Alluvial Injection Well
- Pilot Study Alluvial Monitoring Well
- Proposed Pilot Study Area (120' x 90')

N

0 60 120 Feet

Figure 1
Proposed Pilot Study Area in
Alluvial Groundwater Plume
Site 1
Allegany Ballistics Laboratory

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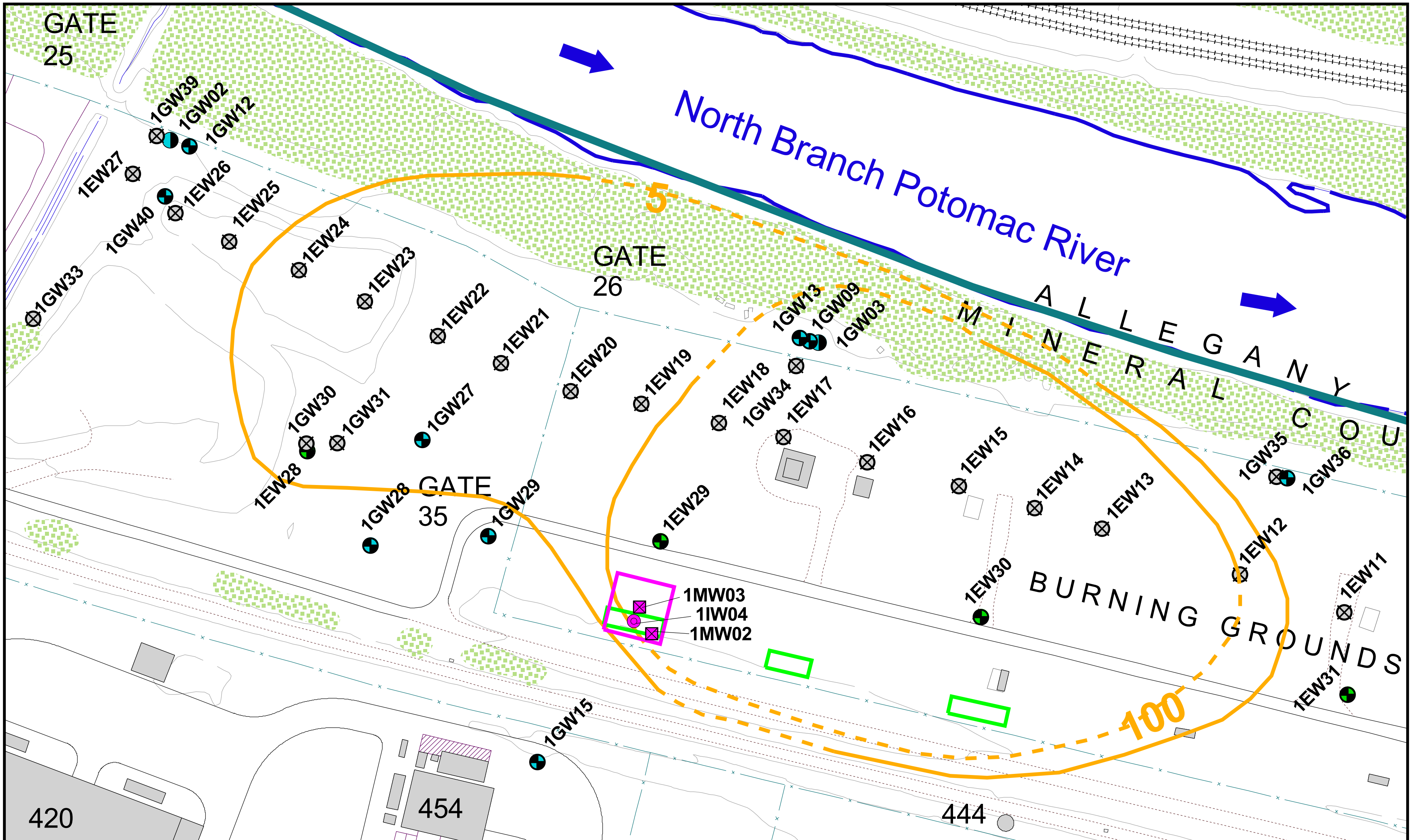


LEGEND

- Extraction Well - Bedrock
- Monitoring Well - Bedrock
- Monitoring Well - Hybrid
- Extraction and Monitoring Wells - Alluvial
- Solvent disposal pits
- TCE Isoconcentration Line for Bedrock in µg/L
- Pilot Study Bedrock Injection Well
- Pilot Study Bedrock Monitoring Well
- Proposed Pilot Study Area (50' x 50')

N

0 60 120 Feet

Figure 2
Proposed Pilot Study Area in
Bedrock Groundwater Plume
Site 1
Allegany Ballistics Laboratory

CH2MHILL

SECTION 3

Site Characterization Activities

Site characterization activities include determining the presence or lack of free phase DNAPL, installing of monitoring and injection wells, collecting and analyzing soil, bedrock, and groundwater samples, and completing of bench scale testing. Specific procedures for each of these activities in the alluvial and bedrock aquifers are detailed below.

The activities will be conducted in the following sequence:

1. Distribution of any existing free phase DNAPL will be evaluated in the alluvial aquifer by installing and extracting a reactive FLUTe™ NAPL liner using DPT. If the liners are inconclusive as to whether there is DNAPL in the alluvial aquifer, Sudan IV dye tests will be used to make the determination.
2. Using DPT, soil samples will be collected, for laboratory analyses and possibly Sudan IV dye tests, at determined intervals of interest, based on the results of the reactive FLUTe™ liner.
3. If free phase DNAPL is encountered in the subsurface, the ABL Partnering Team will be consulted to determine which of the subsequent work plan activities are to be completed. If no free phase DNAPL is encountered, then the subsequent steps will be executed without further consultation with the partnering team.
4. Alluvial wells will be drilled to the top of the bedrock using air rotary techniques, then cased, and developed. Following development, groundwater samples will be collected.
5. The open borehole bedrock wells will be drilled using an air rotary/hammer method. Bedrock samples will be collected during drilling. Following well installation, groundwater samples will be collected.
6. Distribution of free phase DNAPL will be evaluated in the bedrock boreholes by everting a FLUTe™ liner into the holes.
7. Geophysical testing will be conducted if the location of the fractures is not defined using FLUTe™ liners or geophysical information from nearby wells.

3.1 DNAPL Presence Determination

FLUTe™ and/or Sudan IV technologies may be used for the characterization of DNAPL in the subsurface. The Sudan IV dye will be used as necessary to confirm the presence of DNAPL detected by the FLUTe™ NAPL liner or as the primary method of DNAPL determination in the alluvial aquifer if the FLUTe™ technology proves to not be viable at Site 1.

3.1.1 FLUTe™ NAPL Liners

The FLUTe ™ technology will be used to locate potential layers, filled fractures, or globules of pure product in the subsurface. The FLUTe ™ technology utilizes a liner with a reactive coating, which is everted into a punched or drilled hole. The reactive coating contacts the sides of the hole and reacts with the NAPL to produce a stain on the reactive coating. The liner is then inverted to remove it from the hole. Removal of the liner by inversion prevents contact with other surfaces, which may distort the staining. The stains on the liner are then evaluated to determine the distribution of free phase NAPL in the hole.

A DPT rig will be used to install the liner in the alluvial formation. The reactive liner will be installed via the interior of the push rod. As the push rod is retracted, the borehole wall will be exposed. The liner will be filled with water as the rod is extracted so that the liner expands against the exposed borehole. Once the entire liner is installed, it will remain in place for a minimum of one hour and up to a maximum of 24 hours. DNAPL presence determination will be conducted in the four proposed alluvial monitoring well/injection point locations shown in Figure 1.

Installation of the FLUTe ™ technology into the bedrock boreholes will differ in that the reactive liner will be everted into an open borehole. After the well is installed, the liner will be everted into the bedrock borehole by filling the liner with water. The hydraulic pressure inside of the liner will facilitate contact between the liner and the sides of the bedrock hole. Once the minimum time of one hour has elapsed, the liner will be removed by pulling a tether attached to the bottom, thereby inverting the liner, and expelling the water inside.

3.1.2 Sudan IV Testing

The Sudan IV tests will be conducted to qualitatively verify the results of the FLUTe™ liners in the alluvial soil. Soil samples will be collected from the depth at which DNAPL was observed using the FLUTe™ technology. If the FLUTe™ technology proves inconclusive, Sudan IV samples will be collected at the top, middle and bottom of the saturated zone. The soil will be mixed with potable water and the Sudan IV dye in a clean plastic vial. An additional dye may also be added to turn the water a different color in order to better view the red stained DNAPL. The vial will then shaken vigorously until contents are thoroughly mixed. Any DNAPL present in the mixture will be highlighted red by the Sudan IV dye. Since DNAPL is heavier than water it will most likely be found at the bottom of the jar. The red DNAPL may also be found attached to the walls of the vial near the bottom.

3.2 Well Installation

If no DNAPL is encountered or if DNAPLs are encountered and the ABL Partnering Team approves, injection wells and monitoring wells will be installed in the alluvial and bedrock aquifers. The wells will be installed using casing advancement air rotary drilling techniques. All soil and rock cuttings will be handled as investigation-derived waste (IDW) and placed in a roll-off bin for further characterization, to be properly disposed. Drilling fluids, from decontamination and well development, will be conveyed to drums or a tank and transported to the on-site treatment plant. Appendix D presents the IDW management plan associated with this project. Prior to mobilization to the site, the subcontractor’s equipment will be cleaned. Equipment, tools, and well materials will be decontaminated, as described in the Phase II and Phase III SWMU/AOC Investigation work plans, prior to each boring and well installation.

3.2.1 Alluvial Wells

Three injection wells and one monitoring well will be installed in the alluvial aquifer. The wells will be installed using casing advancement drilling techniques, and will extend to the top of the bedrock located approximately 30 feet bgs. A 6-inch diameter borehole will be advanced through the unconsolidated overburden to the top of bedrock.

Both the alluvial monitoring well and the injection wells will be constructed with 2-inch diameter carbon-steel with threaded connections. Carbon steel is required since steam will be used as a catalyst for the injection and carbon steel can withstand high temperatures. The well screens, installed at the bottom of the well (unless DNAPL is confirmed in higher portion of saturated zone), will be 15 feet long with 0.010-inch machined slots.

3.2.2 Bedrock Wells

Two monitoring wells and one injection well will be installed in the bedrock. The bedrock wells will extend approximately 60 feet into the saturated bedrock, with a final well depth of 90 feet bgs. A 6-inch diameter borehole will be advanced, using casing advancement techniques, through the unconsolidated overburden to approximately 3 to 5 feet into the top of bedrock. The remainder of the well boring will be 4 inches in diameter and drilled to 90 feet below ground surface. The lithology of the rock fragments will be identified and recorded by a CH2M HILL geologist.

3.3 Sampling

Table 1 summarizes the sampling activities at each location. Table 2 lists the samples to be collected, analytical parameters for each sample, analytical methods that will be used, bottleware, and holding times for the samples. All samples will be collected in accordance with the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) addenda provided in Appendices A and B, respectively.

3.3.1 Alluvial Soil Samples

Based on the results of the FLUTe™ liners in the alluvium, soil samples will be collected from the depths where free phase DNAPL contamination was apparent. The soil samples will be collected using DPT, inserted into the ground as close as possible to the hole used to insert the FLUTe™ liner. A maximum of three soil samples will be collected from each borehole for a total of 12 soil samples. If FLUTe™ technology liners and Sudan IV are inconclusive, the three samples will be collected from the top, middle, and bottom of the saturated zone. One 8-oz jar will be collected at all locations for the bench scale test; however only one or two samples will be used based on FLUTe™ liner results and soil logging. Soil samples will be placed in appropriate containers and placed on ice for transport to the laboratory.

Soil samples will be submitted to the laboratory for the TCL VOCs, TAL metals, total organic carbon (TOC), sulfate, nitrate, and nitrite analysis. Table 2 presents the sample requirements including the holding times, preservation method and container size. Additional sample jars will be collected at each location for bench scale testing as described in section 3.4.

In addition to the analytical samples, soil will be collected from 1IW01 and 1IW02 for soil grain size analysis. These samples will be double bagged in plastic bags and sent to the chosen laboratory.

3.3.2 Bedrock Samples

Bedrock samples will be collected from the drill cuttings while installing well 1IW04 approximately 20 feet below top of bedrock. The bedrock will be crushed and analyzed for TAL metals. The samples will only be analyzed for TAL metals, and it is not expected that air rotary drilling activities will negatively impact the bedrock samples will occur from air rotary drilling activities.

3.3.3 Groundwater Samples from the Alluvial and Bedrock Aquifers

After the wells have been installed and developed, groundwater samples will be collected from the alluvial and bedrock aquifers. One sample will be collected from each alluvial well using a low-flow submersible pump positioned in the middle of the screen or open bedrock borehole.

The bedrock groundwater samples will target a specific zone, which will be selected based on the results of the DNAPL characterization and potential applied geophysics tests. A low-flow pump will be used to extract the groundwater for collection.

Groundwater samples will be bottled as detailed in Table 2 and sent to the laboratory for the indicated analyses. The groundwater samples will be labeled and packaged in accordance with the packing and shipping standard operation procedures (SOP) of the *Project Plans for the Phase II Investigation of SWMUs and AOCs* (CH2M HILL, 2000) and sent to the laboratory to be analyzed for TCL VOCs, dissolved and total TAL metals (including cyanide), nitrate, nitrite, sulfate, chloride, TOC, dissolved organic carbon (DOC), ortho-phosphate, hardness, total dissolved solids (TDS), total suspended solids (TSS), and alkalinity.

3.4 Bench Scale Testing

ISCO is being evaluated as a component of the long-term strategy to remediate groundwater containing high VOC concentrations (potentially including DNAPLs); TCE is the most prevalent VOC in both the alluvial and bedrock groundwater. Two oxidants, sodium persulfate and potassium permanganate, will be evaluated as potential oxidants for treating contamination in the groundwater at Site 1.

During the pilot studies, these oxidants will be injected into the subsurface where high concentration of VOCs reside. In order to determine the site-specific quantities of oxidants required to treat the contaminant mass in the subsurface, and to predict geochemical shifts in dissolved metal concentrations, bench scale testing will be conducted on samples collected from the alluvial aquifer during the characterization field activities. Bench-scale tests reflecting true bedrock environments are difficult to set up, thus bench-scale testing for bedrock will not be performed. However, geochemical testing of the bedrock materials will be used to test for potential geochemical shifts (metal concentrations potentially going into solution due to manganese dioxide reactions). Because the finely ground bedrock does not reflect subsurface conditions, the oxidant demand determination for potassium permanganate will be based on aquifer assumptions and stoichiometric calculations, rather than bench scale test results.

3.4.1 Objectives of the Bench-scale Testing

Laboratory bench-scale testing will be conducted on site-specific samples to evaluate the geochemical changes that may occur during and after applying ISCO, and to aid in the selection of oxidant quantities for the in situ pilot studies in the alluvial aquifers. Specific objectives of the bench-scale test include:

- Determine the TOD of the subsurface for the sodium persulfate in the alluvium.
- Assess the potential for the alluvial materials to mobilize metals upon the addition of oxidant. (for bedrock this will be determined based on geochemical testing)
- Identifying reaction rate kinetics for the oxidation of VOCs in the alluvial aquifer.

3.4.2 Laboratory Analysis

Bedrock samples will be crushed in the laboratory and analyzed for TAL metals. Bench scale tests will not be performed on the bedrock samples as explained previously.

Soil samples collected from various stratigraphic layers in the alluvium will be used in the bench scale tests. Prior to initiating the bench scale tests, the soil samples will be analyzed for geochemical parameters, total TAL metals and TCL VOCs, as described in section 3.3. One soil sample will be collected for bench-scale testing at each location where a geochemical sample is collected. The samples will be submitted to the laboratory, however only a few will be tested. The number of bench-scale tests and the samples analyzed will be determined based on geochemical results. The metal concentrations detected in the soil will serve as the hypothetical maximum quantity of metals that could potentially be mobilized to groundwater.

The bench scale tests will assist in calculating the TOD. Laboratory procedures to determine TOD are not yet standardized. The bench scale studies for Site 1 are designed to determine the natural oxidant demand of the soil matrix, which consists of the oxidant used by the soil matrix in the absence of VOC contamination. The TOD equals the natural oxidant demand of the matrix plus the stoichiometric oxidant demand as calculated from for the oxidation of TCE by sodium persulfate.

Natural oxidant demand will be determined for the soil by removing potential oxidant demands posed by the groundwater or VOC contamination. The dry soil will then be saturated with sodium persulfate solution. Aliquots of the liquid will be extracted at determined time intervals and analyzed for persulfate concentrations. Additionally, the aliquot of the last time interval will be analyzed for TAL metals to better estimate the potential for metals release during VOC oxidation. Utilizing the results of the bench scale analyses, TOD and reaction kinetics will be calculated.

3.5 Downhole Geophysical Characterization

If FLUTe™ technology does not determine the location of the fractures in bedrock, geophysics will be conducted in the three open boreholes drilled into bedrock. The purpose of the downhole geophysical logging is to identify discrete fracture zones in bedrock boreholes and to determine the direction and relative magnitude of flow at each fracture zone. The borehole characterization would consist of caliper logs, fluid temperature and resistivity, and optical televiewer (OPTV). Downhole geophysics would be conducted according to the standard operating procedures presented in Appendix A.

TABLE 1
Proposed Plan for Characterization and Sampling of Pilot Study Areas
Solvent Pit Area Characterization Work Plan
Site 1, Allegany Ballistics Laboratory
Rocket Center, West Virginia

Location	Well Location and Type	DNAPL Characterization [1]	Soil Sampling[2]	Bedrock Sampling	Installation of New Well	Groundwater Level	Alluvial Groundwater Sample [3]	Vertical Interval Groundwater Sampling in Bedrock [4]
1IW01	alluvium, injection	X	X		X	X	X	
1IW02	alluvium, injection	X	X		X	X	X	
1IW03	alluvium, injection	X	X		X	X	X	
1MW01	alluvium, monitoring	X	X		X	X	X	
1MW02	bedrock, monitoring	X			X	X		X
1MW03	bedrock, monitoring	X			X	X		X
1IW04	bedrock, injection	X		X	X	X		X
Total:		**7**	**4 to 12**	**1**	**7**	**7**	**4**	**6**

Notes:

1. The DNAPL characterization will be performed using FLUTe [TM] NAPL liners. If the liners prove to be unsuccessful or if the areas of DNAPL contamination is not clear, Sudan IV testing will be used as deemed appropriate by CH2M HILL field geologist or engineer.
2. Up to 3 soil samples from the alluvial zone of all wells will be sent to the lab for VOC, TAL metals, TOC, sulfate, nitrate, and nitrite analysis. Soil samples will be collected where FLUTe technology indicates free phase DNAPL may be present. Hach field tests will be used for ferrous iron.
3. Groundwater samples collected from the alluvium will be analyzed for TCL VOCs, TAL metals, nitrate, nitrite, sulfate, chloride, TOC, DOC, phosphate, TDS, TSS, hardness, and alkalinity. Slug tests may be conducted on two alluvium wells to determine the hydraulic conductivity of the aquifer.
4. Up to two vertical interval samples per well will be collected from the bedrock wells. These samples will be analyzed for TCL VOCs, unfiltered TAL metals, nitrate, nitrite, sulfate, chloride, TOC, DOC, phosphate, TDS, TSS, hardness, and alkalinity.

When collecting alluvial and bedrock groundwater samples, water quality parameters DO, T, pH, ORP, conductivity, and turbidity will be measured and documented.

Table 2
Soil and Groundwater Sampling Requirements
Solvent Pit Area Characterization Work Plan
Site 1, Allegany Ballistics Laboratory
Rocket Center, West Virginia

SOIL SAMPLES

					TCL VOCs	TAL Metals (Total) [4]	Sulfate	Nitrate	Nitrite	TOC
				Method	OLM04.2	ILM04.1	USEPA 300	USEPA 300	USEPA 300	Lloyd Kahn or Walkley-Black Method
				Sample Container Type [1]	3 - EnCore	2 - 8 oz. Glass jar with Teflon lined lid	2 - 8 oz. Glass jar with Teflon lined lid			1-500 mL plastic
				Preservative	None	None	None	None	None	None
				Holding Times	14 days	28 days for Mercury, 14 days for cyanide, all others 6 months to analysis	Prep ASAP/48 hrs after prep			28 days
Station ID	**Sampling Zone**	**Expected Sample Interval (ft bgs)** [6]	**Sample ID**	**Sample Media**						
1IW01	Alluvial	TBD	AS01-1IW01-XXX	Soil	X	X	X	X	X	X
1IW02	Alluvial	TBD	AS01-1IW02-XXX	Soil	X	X	X	X	X	X
1IW03	Alluvial	TBD	AS01-1IW03-XXX	Soil	X	X	X	X	X	X
1MW01	Alluvial	TBD	AS01-1MW01-XXX	Soil	X	X	X	X	X	X
1IW04	Bedrock	TBD	AS01-1IW04-XXX	Bedrock		X				

GROUNDWATER SAMPLES

					TCL VOCs	TAL Metals (Total) [4]	TAL Metals (Dissolved) [5]	Cyanide (Total)	Sulfate	Nitrate	Nitrite	Chloride	TOC	DOC	Ortho-phosphate	Hardness	TSS	TDS	Alkalinity
				Method	OLM04.2	ILM04.1		ILM04.1	USEPA 300				SW-846 9060		USEPA 365.1	USEPA 130.2	USEPA 160.2	USEPA 160.1	USEPA 310.0
				Sample Container Type	3 - 40 mL glass VOA vial	1000 mL HDPE		500 mL	1000 mL				250 mL HDPE		125 mL HDPE	250 mL HDPE	250 mL HDPE	250 mL HDPE	500 mL HDPE
				Preservative	HCl to pH<2	HNO_3 to pH<2		NaOH	None				HCl or H_2SO_4 to pH<2		H_2SO_4 to pH<2	HNO_3 to pH<2	None	None	None
				Holding Times	14 days to analysis	28 days for mercury; all others 6 months to analysis		14 days	28 days	48 hours	48 hours	28 days	28 days		24 hours	6 months	7 days	7 days	14 Days
Station ID	**Sampling Zone**	**Expected Sample Interval (ft bgs)** [6]	**Sample ID**	**Sample Media**															
1IW01	Alluvial	15-30	AS01-1IW01-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1IW02	Alluvial	15-30	AS01-1IW02-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1IW03	Alluvial	15-30	AS01-1IW03-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1MW01	Alluvial	15-30	AS01-1MW01-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1MW02	Bedrock	TBD	AS01-1MW02-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1MW03	Bedrock	TBD	AS01-1MW03-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1IW04	Bedrock	TBD	AS01-1IW04-XXX	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Field QA/QC Samples		**Duplicates**	AS01-XXXXXXP-XXX	**QC**	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		MS/MSDs	AS01-XXXXXX-XXX MS/MSD	**QC**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Trip Blank [2]	AS01-TB[MMDDYY]-XXX	**QC**	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
		Field Blank	AS01-FB[MMDDYY]-XXX	**QC**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Equipment Blank [3]	AS01-EB[MMDDYY]-XXX	**QC**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Notes:
1. Number of soil sampling container include one extra container for bench scale testing. The sample containers may vary slightly depending upon the laboratory.
2. The actual number of trip blanks to be sent to the analytical laboratory will be determined by the number of coolers containing TCL VOC samples. The sample ID of trip blanks (and field and equipment blanks) will be determined based upon the day that it was shipped to the analytical laboratory.
3. The actual number of equipment blanks to be collected will be based upon the number of days it takes to perform sampling.
4. The total TAL metals soil sample analysis includes cyanide.
5. The dissolved TAL metals analysis does not include cyanide.
6. The depth of the soil and bedrock groundwater samples will be determined in the field by a CH2M HILL geologist or engineer after DNAPL characterization. The depth interval for the alluvial groundwater samples correspond to the screened interval.

All samples will be placed on ice in the coolers from sample collection time until the samples arrive at the laboratory.

Laboratory Address:

Sample Custodian
RedoxTech, LLC
112 Pheasant Wood Court, Suite B
Morrisville, NC
919-460-0330
Contact: John Haselow

SECTION 4

Project Reporting

Following the completion of the alluvial and bedrock characterization the results will be incorporated in the work plan for the subsequent phase of the pilot studies. The work plan will include the methods, findings, and recommended path forward. The findings will describe groundwater, soil, FLUTe™, Sudan IV, and bench scale test results. The conclusions will focus on how to best implement the pilot studies at Site 1.

SECTION 5

Project Schedule

The estimated project duration is approximately two months following work plan approval (assumed to be November 12, 2004), as shown in the following table.

Proposed Project Milestones and Schedule

Key Project Milestones	Start Date	End Date	Duration (Days)
Work Plan Approval	11/12/2004	11/12/2004	1
Procurement of Project Funds and Mobilization	11/15/2004	11/26/2004	15
Installation and Collection of Alluvium FLUTe™ Liners	11/29/2004	11/30/2004	2
Installation/Development of Monitoring Wells / Soil Sampling, Bedrock FLUTe™ Liners	12/13/2004	12/22/2004	8
Collection of Groundwater Samples	12/27/2004	12/28/2004	2
Analysis/Data Validation and Management	1/08/2004	02/18/2004	42
Pilot Studies Implementation Work Plan	02/18/2004	03/18/2005	30

SECTION 6

References

CH2M HILL. 2002a. *Work Plan for the Phase III Solid Waste Management Unit and Areas of Concern Investigation at the Allegany Ballistics Laboratory Superfund Site, Rocket Center, West Virginia.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. July.

CH2M HILL. 2002b. *Health and Safety Plan (HASP) for the Site 5 Landfill Methane Gas Extraction Pilot Test, Allegany Ballistics Laboratory (ABL) Superfund Site, Rocket Center, West Virginia.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. May.

CH2M HILL. 2000. *Final Project Plans for the Phase II Investigation of Solid Waste Management Units and Areas of Concern at the Allegany Ballistics Laboratory Superfund Site, Rocket Center, West Virginia.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. June.

CH2M HILL. 1996a. *Remedial Investigation of the Allegany Ballistics Laboratory.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. January.

CH2M HILL. 1996b. *Phase II Remedial Investigation at Allegany Ballistics Laboratory Superfund Site.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. August.

CH2M HILL. 1996c. *Site 1 Focused Feasibility Study for Groundwater at Allegany Ballistics Laboratory.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. September.

CH2M HILL. 1995. *Focused Remedial Investigation of Site 1 at Allegany Ballistics Laboratory.* Prepared for Department of the Navy, Atlantic Division, Naval Facilities Engineering Command, Norfolk, Virginia. September.

Appendix A
Field Sampling Plan (FSP) Addendum

APPENDIX A

Field Sampling Plan (FSP) Addendum

This appendix describes the additions or changes to the FSP contained in the Phase II and Phase III SWMU/AOC Investigation Work Plans. The changes contained herein supercede all other documentation.

Field activities proposed in this Work Plan Addendum include:

- Alluvial monitoring well installation,
- Bedrock monitoring well installation,
- Well Development,
- FLUTe™ liner well testing for DNAPL,
- Sudan IV testing of soils
- Surveying,
- Soil and bedrock sampling, and
- Monitoring well groundwater sampling.

The field activities listed above will be conducted in accordance with the general CH2M HILL Standard Operation Procedures (SOPs) previously provided in the Phase II and Phase III SWMU/AOC Investigation Work Plans (CH2M HILL, 2000 and 2002a). SOPs for those activities included in this Work Plan Addendum but not included in the previous Phase II and Phase III SWMU/AOC Investigation Work Plans are included in this appendix. Specific requirements for well construction contained in this FSP Addendum supersede the information in the SOPs.

Field Investigation Procedures

A summary of field investigation procedures for field activities not previously described in the Phase III SWMU/AOC Work Plan (CH2M HILL, 2002a) is provided below.

Alluvial Monitoring Well Installation

Monitoring well in the alluvial aquifer will be installed using casing advancement, following the SOP of the Phase II SWMU/AOC. However, the riser and screen installed in the well will be made of carbon steel. Carbon steel has better heat resistant properties than PVC. The well will be used to inject the oxidant sodium persulfate, followed by steam which functions as the heat catalyst to activate the sodium persulfate. Therefore carbon steel screen and risers will be used.

The monitoring well will have a 2- to 3-foot riser extending above the ground surface. The three injection wells will have a 6-inch riser extending above the ground surface. A Morie Grade No. 0 or 00N sand filter pack will be installed in the annular space between the borehole wall and the screen to an elevation approximately 5 feet above the top of the screen. A minimum 5-foot-thick, bentonite seal will be added to the top of the sand filter pack, followed by a bentonite slurry grout to approximately 1-foot below the ground surface.

All wells will be finalized using a 6-inch inner diameter outer protective steel casing equipped with a locking cap, installed around the wells and extending at least 3 feet below ground surface and 2 feet above ground. In addition, a 4-foot by 4-foot by 1-foot concrete pad with 4 embedded steel bollards shall be constructed around each well. Well development of all monitoring wells will include: removing water from the well using a submersible pump capable of flow rates from 0.5 to 2 gallons per minute; and transferring development water to 55-gallon drums.

FLUTe ™ Technology DNAPL Determination

The FLUTe™ NAPL liners will be used to determine if DNAPL is present in the subsurface in the vicinity of the former solvent pits. The FLUTe ™ technology utilizes a liner with a reactive coating, which is everted into a punched or drilled hole. The reactive coating contacts the sides of the hole for a minimum of one hour and reacts with the NAPL to produce a stain on the reactive coating. The liner is then inverted to remove it from the hole. Removal of the liner by inversion prevents contact with other surfaces, which may distort the staining. The stains on the liner may then be evaluated to locate areas of free phase NAPL in the hole.

Two installation methods, by DPT and by eversion of the liner, will be used to install the NAPL liners in the alluvial and bedrock boreholes, respectively. When using the DPT installation, the reactive liner is installed to the maximum depth via the interior of the push rod. A 2 1/8 inch push rod will be used to install the NAPL liner. The driller will also have the 3¼ inch push rods on-site in case they are needed. The DPT rods will be installed until refusal, which is estimated to occur at approximately between 27 and 30 feet bgs where a cobble zone exists at the base of the alluvium.

As the push rods are retracted, the hole wall is exposed. The liner is filled with water, using appropriate FLUTe™ injector, as the rod is extracted so that the liner expands against the exposed hole wall. The liner should not expand inside the push rod since the friction against the interior of the rod could tear the liner.

Once the entire liner is installed, it will remain in place for a minimum of one hour and up to a maximum of 24 hours. At Site 1 it is anticipated that the liners will be installed in the morning and removed in the afternoon providing a contact time of approximately four hours. The time of installation and removal of each liner will be noted in the field notebook. The NAPL liners will be installed and removed in the alluvium, prior to well installation, at the proposed four alluvium well locations.

Installation into the bedrock zone differs in that the reactive liner is everted into the open bedrock borehole using the pressure canister system. For the bedrock well locations, an open hole well will be installed with a single steel outer casing through the alluvium. The liner is everted into the bedrock hole by attaching the end to the sides of the well, turning the liner inside out and filling the inside with water so that the liner to roll out downward against the hole wall. The hydraulic pressure inside of the liner will facilitate contact between the liner and the sides of the bedrock hole. It is anticipated that the bedrock liners will be installed in the morning and removed in the afternoon, providing for a contact time of approximately four hours.

Sudan IV Testing

The Sudan IV tests will be conducted to qualitatively verify the results of the FLUTe™ liners in the alluvial soil. Soil samples will be collected from the depth at which DNAPL was observed using the FLUTe™ technology. If the FLUTe™ technology proves inconclusive, Sudan IV samples will be collected at the top, middle and bottom of the saturated zone. The soil will be mixed with potable water and the Sudan IV dye in a clean plastic vial. An additional dye may also be added to turn the water a different color in order to better view the red stained DNAPL. The vial will then shaken vigorously until contents are thoroughly mixed. Any DNAPL present in the mixture will be highlighted red by the Sudan IV dye. Since DNAPL is heavier than water it will most likely be found at the bottom of the jar. The red DNAPL may also be found attached to the walls of the vial near the bottom.

STANDARD OPERATING PROCEDURE

Downhole Geophysical Logging

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for methods of downhole geophysical logging that are commonly used in investigations. The methods covered in this procedure are: fluid resistivity, temperature, caliper, and optical televiewer (OPTV). Such methods as natural gamma, spontaneous potential, electric resistivity of geologic materials, and flow logging are not covered.

Downhole geophysical logging normally is subcontracted to professionals who are experienced, and their expertise should be relied upon. The procedure focuses on key aspects of the work that should be observed and documented.

II. Equipment and Materials

- Caliper logging tool
- Temperature logging tool
- Fluid resistivity logging tool
- Fluid conductivity logging tool
- Optical Televiewer
- Decontamination materials

III. Procedures and Guidelines

A. Fluid-Resistivity Logging

Fluid-resistivity logging provides a measurement of the resistivity of the borehole fluid between closely spaced electrodes in the probe. Abrupt and significant changes in fluid resistivity in the borehole may indicate the entry of groundwater of differing resistivity into the borehole via fractures and other openings in the geologic materials surrounding the borehole. The logging record is taken continuously in units of ohm-meters.

Fluid-resistivity logging should be run at slow speeds to assure the proper flow of water through the tool. As long a time as possible should be allowed between drilling and logging the borehole so that the fluid resistivity can equilibrate between borehole and surrounding geologic materials. The fluid-resistivity log should be one of the first logs run because other logging methods will disturb the water in the borehole.

The logging equipment should be adequately decontaminated before the first use on the site and between boreholes.

B. Temperature Logging

Temperature logs are the continuous records of the temperature of the water in a borehole. They can provide information on the source and movement of groundwater into and out of the borehole. Generally the temperature of the groundwater in the borehole will increase with depth with the geothermal gradient. Deviations from this general trend may indicate where groundwater is flowing up, down, into, or out of the borehole.

All temperature sensors have an inherent response lag, or time constant, so that the logging speed must be constant and slow enough that the temperatures are accurately reflected at the true depths on the log. The temperature log may be made using the same tool as the fluid-resistivity log. As long a time as possible should be allowed between drilling and logging the borehole so that the temperature can equilibrate between borehole and surrounding geologic materials. The temperature log should be one of the first logs run because other logging methods will disturb the water in the borehole.

The logging equipment should be adequately decontaminated before the first use on the site and between boreholes.

C. Caliper Logging

The caliper log is a record of the average diameter of the borehole. Caliper logs primarily are run to determine where fractures or other openings might intersect the borehole and whether or not squeezing or other effects may have reduced the diameter of the borehole.

A caliper log featuring arm-type devices is preferable to one featuring bow springs because of greater sensitivity of the arms. Logs should have at least 1 inch of chart width per inch of hole diameter to provide adequate sensitivity of recording. Several feet of casing should be logged so that the accuracy of the tool can be checked.

The logging equipment should be adequately decontaminated before the first use on the site and between boreholes.

D. OPTV

OPTV logging provides an oriented image of the actual conditions in the borehole. The video log typically is used to identify the depths of fractures and other openings in the borehole.

If a NAPL, particularly one that floats on the surface, is present in the borehole, the image may be so deleteriously affected that the NAPL may have to be removed from the borehole before logging can be completed. The field geologist should obtain a copy of the digital image.

The logging equipment should be adequately decontaminated before the first use on the site and between boreholes.

IV. Attachments

- None

V. Key Checks and Preventive Maintenance

- Ensure that subcontractor follows their procedures, particularly those for calibration of the instruments and the rate of logging.
- Obtain copies of logs at the site.
- Temperature and fluid-resistivity logs should be run first so that the disturbance caused by the other logging methods does not disrupt the results of these two methods.
- Adequate development of the well is important so that fluids such as drilling mud that may have been used in the borehole do not provide false readings of changes in fluid resistivity.
- Decontaminate as necessary.

Appendix B

Quality Assurance Project Plan (QAPP) Addendum

APPENDIX B

Quality Assurance Project Plan Addendum

This appendix describes the additions or changes to the QAPP in the Phase III SWMU/AOC Investigation Work Plan (CH2M HILL, 2002a). The changes contained herein supercede all other documentation.

Analyses proposed in this characterization Work Plan include:

- TCL VOCs
- TAL metals (total and dissolved)
- Sulfate
- Chloride
- Nitrate
- Nitrite
- Phosphate
- TOC
- Alkalinity
- TDS
- TSS
- DOC

The analyses proposed for each sample at Site 1 are presented in Table 1 and Table 2. The same analytical methods used during previous investigations will be used during this phase of investigation. Table B-1 in the Phase III SWMU/AOC Work Plan (CH2M HILL, 2002a) and Tables 4-1 and 8-1 in the Phase II SWMU/AOC Work Plan (CH2M HILL, 2000) list the analytical methods, precision, and accuracy for the analyses proposed in this Work Plan Addendum.

Table 3-4 in the Phase III SWMU/AOC Investigation Work Plan (CH2M HILL, 2002a) and Tables 8-2 and 8-3 in the Phase II SWMU/AOC Investigation Work Plan (CH2M HILL, 2000) list containers, preservatives, and holding times for samples.

Quality assurance/quality control samples will be collected at the same frequency as during the previous SWMU/AOC investigations. Section 10 of the Phase II SWMU/AOC Investigation Work Plan (CH2M HILL, 2000) summarizes the frequency for collecting QA/QC samples.

TABLE B-1
Precision, Accuracy, and Completeness Objectives
Solvent Pit Area Characterization Work Plan
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Parameter	Precision (Relative Percent Difference)	Accuracy (% Spike Recovery)	Intended Data Use
Soil			
TCL VOCs	< ±25	75-125	Determine nature of contamination
TAL Metals	< ±25	75-125	Determine nature of contamination
Sulfate	< ±30	70-130	Determine nature of contamination
Nitrate	< ±30	75-125	Determine nature of contamination
Nitrite	< ±30	75-125	Determine nature of contamination
TOC	< ±30	70-130	Determine nature of contamination
Water			
TCL VOCs	< ±20	80-120	Determine nature of contamination
TAL Total Metals (plus Cyanide)	< ±20	80-120	Determine nature of contamination
TAL Dissolved Metals	< ±20	80-120	Determine nature of contamination
Sulfate	< ±25	75-125	Determine nature of contamination
Nitrate	< ±25	75-125	Determine nature of contamination
Nitrite	< ±25	75-125	Determine nature of contamination
Chloride	< ±25	75-125	Determine nature of contamination
TOC	< ±25	75-125	Determine nature of contamination
DOC	< ±25	75-125	Determine nature of contamination
Ortho-phosphate	< ±25	75-125	Determine nature of contamination
Hardness	< ±25	75-125	Determine nature of contamination
TSS	< ±25	75-125	Determine nature of contamination
TDS	< ±25	75-125	Determine nature of contamination
Alkalinity	< ±25	75-125	Determine nature of contamination

Notes: TCL = Target Compound List; TAL = Target Analyte List; TOC = total organic carbon; DOC = dissolved organic carbon, VOC = Volatile Organic Compound

Appendix C
Health and Safety Plan (HASP) Addendum

APPENDIX C

Health and Safety Plan (HASP) Addendum

The HASP for the Site 5 Landfill Methane Gas Extraction Pilot Test and this HASP addendum will be used to complete the work described in the Work Plan for the Characterization of Pilot Studies at the Solvent Disposal Pit Area of Site 1, dated November 2004.

AMENDMENT
CH2M HILL HEALTH AND SAFETY PLAN

This amendment must accompany the health and safety plan (HASP) for the Final Site 5 Landfill Methane Gas Extraction Pilot Test at the Allegany Ballistics Laboratory, Rocket Center, West Virginia approved in May 2002. The purpose of the HASP amendment is to include supplemental information, as it becomes available. Supplemental information is used to reevaluate hazards associated with the planned tasks and to revise protective procedures (e.g., air monitoring). Where the amendment contains information different from the HASP, the amendment will take precedence for the specified task. The amendment includes new information or revises existing HASP information. Sections of the HASP that are not addressed in the amendments do not have changes; therefore, the HASP will be followed. All employees performing tasks covered by this amendment must read both the HASP and this amendment and agree to abide by their provisions (see Attachment 1).

1 PROJECT INFORMATION AND DESCRIPTION

CLIENT OR OWNER: Naval Facilities Engineering Command,

PROJECT NO: 157976.PP.WP

PROJECT MANAGER: Steve Glennie

OFFICE: WDC

TASK MANAGER: Jose Amaya

OFFICE: WDC

SITE NAME: Allegany Ballistics Laboratory

SITE ADDRESS: Rocket Center, West Virginia

DATE AMENDMENT PREPARED: 11/09/2004

DATE(S) OF SITE WORK: November 2004 through February 2005

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HSE-113, *Medical Monitoring,* and HSE-110, *HS&E Training)*

Employee Name	Office	Responsibility	SSC/FA-CPR
Cassandra Brown	WDC	Field Team Member	Level B SSC; FA-CPR
Ryan Murley	WDC	Field Team Member	Level C SSC; FA-CPR
Elisha French	WDC	Field Team Member	Level C SSC; FA-CPR
Jose Amaya	WDC	Task Manager	Level C SSC; FA-CPR
Steve Glennie	WDC	Project Manager	Level C SSC; FA-CPR

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226	
Medical Emergency – 911 Facility Medical Response #: 304-726-5310 or 304-726-5136 Call 5400 (using a facility phone) Local Ambulance #: 304-726-5310 or 304-726-5136 Call 5400 (using a facility phone)	**CH2M HILL Medical Consultant** Dr. Jerry Burke Health Resources 600 West Cummings Park, Suite 3400 Woburn, MA, 01801-4511 800-350-4511
Fire/Spill Emergency – 911 Facility Fire Response #: 304-726-5310 or 304-726-5136 Call 5400 (using a facility phone)	**Local Occupational Physician** Corporate Health Center 46440 Benedict Drive, Suite 108 Sterling, VA 20164 703-444-5656
Security & Police – 911 Facility Security #: 304-726-5308 WV State Police #: 304-788-1101	**Corporate Director Health and Safety** Name: Dave McCormack/SEA Phone: 206/453-5005 **24-hour emergency beeper: 888-444-1226**
Utilities Emergency Water: Mac Robinson at 304-726-5759 Potomac Edison Electric: 304-263-3700	**Health and Safety Manager (HSM)** Name: Steve Beck / MKE Phone: 414-272-2426 Cell Phone: 414-526-4517
Designated Safety Coordinator (DSC) Name: Phone: 703-471-6405	**Regional Human Resources Department** Name: Cindy Bauder/WDC Phone: 703/471-6405 ext. 4243
Project Manager Name: Steve Glennie/WDC Phone: 703-471-6405 x4257	**Corporate Human Resources Department** Name: Pete Hannon/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation** Contact the Regional Human Resources Department to have an Incident Report Form (IRF) completed. If after hours, contact: Julie Zimmerman at 303/664-3304 **Auto Claims** Rental: Carol Dietz/COR 303/713-2757 CH2MHILL owned: Zurich Insurance Co. 1-800-987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: * Wail Sound (alternating frequency) = Plant fire alarm
* Siren (alternating volume) = Emergency alarm. Take cover
* Westminster chimes = All clear

Evacuation Assembly Area(s) and Facility Evacuation Routes: Upon hearing the Plant Fire or Emergency Alarm, exit rooftops, scaffolding, ladders, or similar areas and assemble at the jobsite location. When the fire signal sounds, all motor vehicle movement will immediately cease. Park clear of the right-of -way and remain parked until any emergency response vehicles have passed. All employees must be accounted for in the event of emergency/fire on plant. Employees shall report to the ATK site representative. Remain at the job site during an emergency/fire alarm unless the emergency has impacted your immediate work area at which time exit to building 415 and remain there until the all clear signal is activated.

NOT APPROVED FOR FIELD WORK- SUBCONTRACTOR NOT IDENTIFIED

Hospital

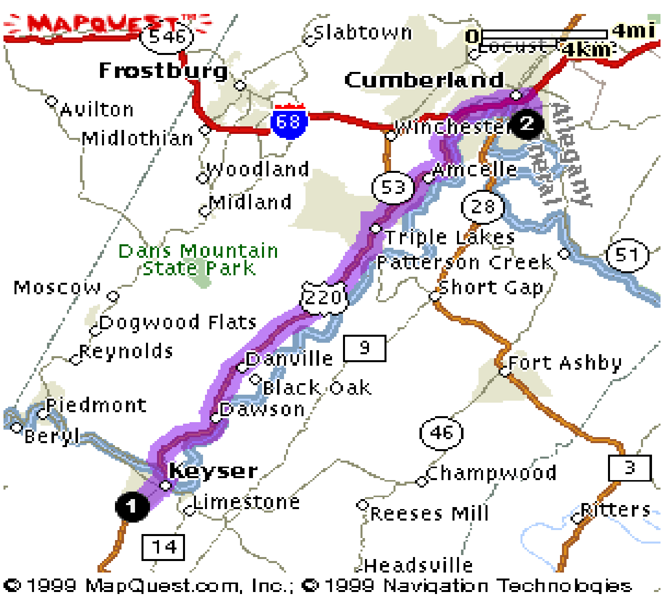
Hospital Name/Address: Memorial Hospital
600 Memorial Ave
Cumberland, MD 21502

Hospital Phone #: 301-723-4000

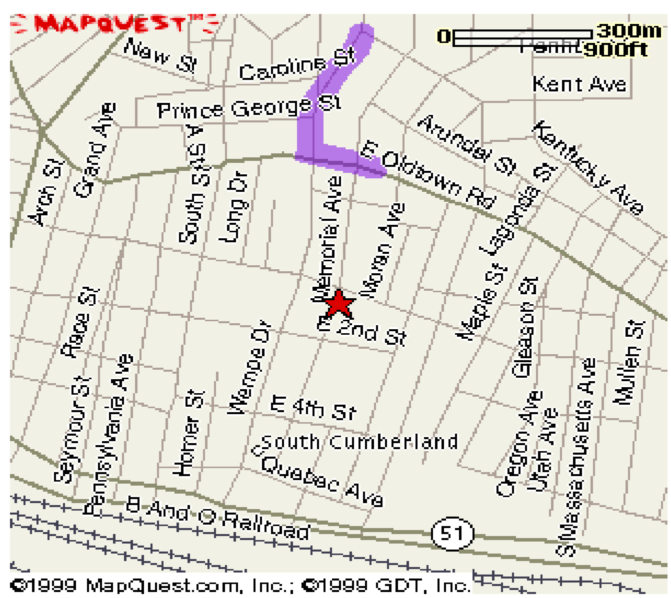
Directions to Hospital

Directions to Hospital

- WV State Route 956 can no longer be accessed from Site 5. You must first go through the tunnel under State Route 956 back to Site 1.
- From Site 1, turn right (west) on WV State Route 956
- Cross river
- Turn right on US Route 220 and head northeast for approximately 10 miles
- Bear right onto the on-ramp to W. Industrial Blvd (Hwy 51) and head south for 0.5 miles
- Continue on W. Oldtown Rd., heading east for 0.7 miles
- Turn left on Memorial Ave., heading north to 600 Memorial Ave.



Full Route



Destination

NOT APPROVED FOR FIELD WORK- SUBCONTRACTOR NOT IDENTIFIED

14 APPROVAL

This site safety plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

14.1 AMENDMENTS

CHANGES MADE BY: Ed Woodford / HNV **DATE:** 11/09/2004

CHANGES TO PLAN:

- Changes in Project Work Dates
- Change in Project Manager & Task Manager
- Changes to CH2M HILL Field Personnel
- Change in Subcontractor

AMENDMENT APPROVED BY: **DATE:**

15 DISTRIBUTION

Name	Office	Responsibility	Number of Copies
Lynn Bong	MKE	Safety Program Assistant	1
Steve Beck	MKE	Health and Safety Manager/Approver	1
Steve Glennie	WDC	Project Manager	1
Jose Amaya	WDC	Task Manager	1
Ryan Murley	TBD	Field Team Leader	
Ryan Murley	TBD	Site Safety Coordinator	
Client		Client Project Manager	

16 ATTACHMENTS

Attachment 1: Employee signoff
Attachment 2: New Project Task Evaluation Checklist

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 1

EMPLOYEE SIGNOFF

NOT APPROVED FOR FIELD WORK- SUBCONTRACTOR NOT IDENTIFIED

EMPLOYEE SIGNOFF

The employees listed below have been given a copy of this health and safety plan, have read and understood it, and agree to abide by its provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE/DATE

NOT APPROVED FOR FIELD WORK- SUBCONTRACTOR NOT IDENTIFIED

Attachment 2

New Project Task Evaluation Checklist

New Project Task Evaluation Form

Allegany Ballistics Laboratory Superfund Site

This evaluation form should be completed to determine if the current site health and safety plan adequately addresses the hazards of a new or continued project or task at the ABL Site.

Project Task:	Field Investigation of Site 12, SWMU 37V, and SWMU 27A		
Project Number:	157976.PP.WP	Project/Task Manager:	Jose Amaya
Name:	Characterization Phase of Pilot Studies at the Solvent Disposal Pit Area of Site 1 Addendum	Employee #:	34467

	New Task Evaluation Checklist	Yes	No
1.	Has the CH2MHILL staff listed in the original HASP changed?	X	
2.	Has a new subcontractor been added to the project?	X	
3.	Is any chemical or product to be used that is not listed Attachment 2 of the plan?		X
4.	Have additional tasks been added to the project which were not originally addressed in Section 1.1 of the plan? **(all tasks are listed in Section 1.1.2 but not described in Section 1.1.1)**		X
5.	Are the Contaminant data HASP out of date or not applicable to the new task?		X
6.	Are other safety or equipment hazards introduced by the new task that are not addressed in Section 2.1 of the plan?		X

If the answer is "YES" to Questions 1-3, an HASP revision is NOT needed. Please take the following actions:

- Confirm that staff's medical and training status is current – check training records at http://www.int.ch2m.com/hands, or contact Lynn Bong/MKE.
- Confirm with the project KA that subcontractor safety performance has been reviewed and is acceptable
- Confirm with H&S that subcontractor safety procedures have been reviewed and are acceptable.

If the answer is "YES" to Questions 4-6, a HASP revision MAY BE NEEDED. To determine if HASP revision is needed please contact H&S directly or complete the field project start-up form at http://www.int.ch2m.com/hsdocgen/fppricing.asp

NOT APPROVED FOR FIELD WORK- SUBCONTRACTOR NOT IDENTIFIED

Appendix D

Investigation Derived Waste Management Plan (IDWMP) Addendum

APPENDIX D

Investigation-Derived Waste Management Plan (IDWMP) Addendum

This appendix describes the additions or changes to the IDWMP from the Phase II and Phase III SWMU/AOC Investigation Work Plans (CH2M HILL, 2000 and 2002a). The changes contained herein supercede all other documentation.

The IDW anticipated to be generated during this investigation includes drill cuttings, purge water, decontamination fluids, acetate liners, personal protective equipment (PPE), and sampling equipment.

IDW composed of drill cuttings, will be containerized prior to sample analysis and waste characterization. Drill cuttings will be sampled by the toxicity characteristic leaching procedure (TCLP) for TCL VOCs and TAL metals and by the standard techniques for reactivity, corrosivity, and ignitability to characterize the waste. If drill cuttings are non-hazardous, the waste will be disposed offsite at a permitted, non-hazardous landfill. If drill cuttings are hazardous, the waste will be manifested and disposed offsite at a regulated hazardous waste landfill.

Aqueous waste will be contained in 55-gallon drums for transport to the Site 1 groundwater treatment plant. The aqueous waste will be treated at the treatment plant.

All PPE and disposable sampling equipment will be placed in 55-gallon steel drums. If drill cuttings are hazardous, PPE drums will be disposed as F-listed hazardous waste. If drill cuttings are disposed as non-hazardous, PPE will be disposed either in a dumpster or as non-hazardous waste.

No additional changes to the IDWMP are noted.