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## THE MEMPHIS DEPOT TENNESSEE

## ADMINISTRATIVE RECORD COVER SHEET

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Defense Distribution Center (Memphis) Main Installation

# PCP Dip Vat Soil Investigation Work Plan

Rev. 1

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PREPARED FOR



U.S. Army Engineering and Support Center, Huntsville 4820 University Square Huntsville, AL 35816

PREPARED BY

CH2M HILL 115 Perimeter Center Place NE, Suite 700 Atlanta, GA 30346

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## 1. Introduction

This Work Plan presents the scope of work for conducting a soil investigation in the vicinity of the former pentachlorophenol (PCP) Dip Vat [Screening Site (SS) 42] on the Main Installation (MI) within the Defense Distribution Center (Memphis), referred to as the Memphis Depot (see Figure 1-1). This Plan has been prepared for the U.S. Army Corps of Engineers (USACE), Huntsville Center in support of site activities led by the Defense Logistics Agency (DLA). The supporting regulatory agencies include the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC). Together, DLA, EPA, and TDEC constitute the Base Realignment and Closure (BRAC) Base Cleanup Team (BCT).

A Long Term Operational Area (LTOA) assessment for the MI was conducted from September to December 2001 to evaluate groundwater downgradient of known or suspected historical LTOAs where hazardous materials were used or stored, as identified by TDEC. Based on this LTOA study, TDEC indicated that additional studies, including soil sampling and data modeling, as necessary, were required to effect closure of the PCP Dip Vat site.

The purpose of this Work Plan is to document the proposed sampling and analysis procedures for evaluation of potential PCP and reductive degradation product concentrations in subsurface soils in the vicinity of the former PCP Dip Vat. This Plan also includes procedures to evaluate the possible threat to groundwater and human health posed by soil contamination through fate and transport modeling calculations, if necessary. The Plan also presents a description of reporting requirements, health and safety requirements, and a project schedule

## 1.1 Soil Investigation Objectives

The overall objective described in the Statement of Work (SOW) is to conduct soil sampling and analysis in the vicinity of the former PCP Dip Vat. Specifically, this study is focused on evaluating the presence or absence of PCP and PCP degradation products, which have been identified as posing risk to human health, in the loess deposits underlying the site. Applicable degradation products include those listed on EPA's 2002 Region 9 Preliminary Remediation Goals (PRGs) table, in the Integrated Risk Information system (IRIS) database-<u>http://www.epa.gov/iriswebp/iris</u>, or in the Health Effects Summary Tables (HEAST-<u>http://www.epa.gov/radiation/heast</u>). The only degradation products identified were 2,3,4,6-tetrachlorophenol (TeCP), 2,4,5-trichlorophenol (TCP); 2,4,6-TCP; 2,4-dichlorophenol (DCP); 2-chlorophenol (CP); and phenol; these parameters are summarized in Section 3 of this Plan.

This project is required by TDEC to assess whether any contamination exists above levels protective of human health and the environment. Assuming that such contamination is present in the soil, the data will be evaluated using vadose zone fate and transport modeling to define the potential impact to groundwater. To evaluate the potential risk to human



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health posed by PCP and applicable degradation products in soil, concentrations detected during this investigation will be compared to the 2002 Region 9 Preliminary Remediation Goals (PRGs) for surface and subsurface soils; these are discussed further in Section 3.

Dioxins and furans, which are typically associated with PCP operations, are not being addressed in this Work Plan. As discussed in the MI Soil Feasibility Study (FS), (CH2M HILL, July 2000), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and tetrachlorodibenzofurans (TCDFs) are common in urban environments, concentrations detected in the Memphis

Depot soils are similar to those found in other background conditions. During the RI (CH2M HILL, January 2000), TCDD was identified as a chemical of potential concern (COPC) in soil at Functional Unit (FU) 4 because the total TCDD equivalents within soil at were slightly above background. However, the total TCDD equivalents were below the 1 part per billion (ppb) action level set by EPA, which is an Applicable or Relevant and Appropriate Requirement (ARAR) (EPA, October 1988). Therefore, TCDD was not selected as a chemical of concern (COC) in soil in the FS.

The specific objectives of this soil investigation are:

- Advance soil borings within the former PCP Dip Vat area; collect composite soil samples for analysis to determine the presence or absence of PCP contamination.
- Evaluate whether concentrations of PCP, or reductive degradation compounds, in soil
  pose a threat to groundwater using soil screening calculations and fate and transport
  modeling.
- Incorporate the findings into a Technical Memorandum (TM), including future recommendations.

### 1.2 Site History and Background

The former PCP Dip Vat area (SS 42) is located in BRAC Parcel 33 in FU 4 on the MI. The site is adjacent to SS 43, the former Underground PCP Tank area, and to the southwest of SS 46, the former Pallet Drying area. Figure 1-1 presents a site location map, and Figure 1-2 presents the site layout. Sites SS42 and SS43 are located in the vicinity of Building 737, the Entomology Shop. SS46 is located in the center of the MI, south of Building 720, as shown on Figure 1-3.

Beginning in 1952, Depot personnel treated wood products, particularly pallets, in a metal shed, also known as the Dip Vat Building. The wood was treated with a product called POL-NU, consisting of approximately 11 percent PCP, contained in a 5,000-gallon Dip Vat. After the pallets were treated with the PCP product, they were dried in open storage areas (SS 46). A 12,000-gallon underground storage tank (UST), south of Building 737, was used to store additional PCP liquid. In 1971, when it became more economical to purchase pre-treated pallets, use of the vat on a regular basis was discontinued

In August 1985, a sample of the liquid PCP was collected from the Dip Vat; results indicated the sample contained 15.5 percent PCP. Consequently, OH Materials (OHM) conducted an extensive soil sampling event to delineate site contamination. A longitudinal sampling grid was constructed across the Dip Vat area and around the Building 737 area; samples were

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excavation in 1985 The sump associated with Building 737 was filled and abandoned in the early 1990's. The purpose of the Building 737 sump was to collect spilled material into the building for recoupment, however, no spills occurred and the pump was never utilized

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Figure 1-2 Site Layout PCP Dip Vat Investigation Memphis Depot Main Installation



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Memphis Depot Main Installation

taken at 5-foot intervals to a depth of 35 feet (ft) Soil contamination was identified as being the greatest in a 20-foot long area to the north of the Dip Vat and drain pan, to a depth of 25 ft. Additionally, soil samples were collected in the six areas suspected of receiving the PCP/waste oil mixture. Seven soil samples in the PCP Dip Vat and Storage Tank areas were analyzed for PCP; other soil samples were analyzed for dioxins and furans. Analytical results are summarized in Table 1-1. Soil boring locations are presented on Figure 1-4.

Based on the results of the soil investigation in 1985, OHM removed the PCP Dip Vat, the PCP UST, the associated pump house and sump, and approximately 602 cubic yards (cy) of contaminated soil, which had total dioxin and furan concentrations exceeding 200 parts per billion (ppb). The Dip Vat Building was also disassembled and removed. During the UST removal, the structural integrity of the tank was determined to be sound. However, leaking was discovered at six joints between the pump house and the tank and between the pump house and the Dip Vat

Soil in the Dip Vat and UST area was excavated to depths between 2 and 14 ft below land surface (ft bls). According to the OHM report on the removal, per agreement between the U.S. Army, EPA Region 4, and the State of Tennessee Department of Health and Environment, the soil excavation was conducted to a depth of 10 ft in the immediate Dip Vat area, although soil contamination was detected below the excavation (OHM, February 1986). Three inches of surface soil were removed in an area to the east of the former Dip Vat area; this area and the surface of the former PCP Dip Vat and the PCP UST are currently covered by concrete. Four to 6 inches of surface soil were removed in an area north of the Dip Vat Building. The soil excavation pit was backfilled with native soil and crushed stone. The limits of the excavation are presented on Figures 1-5 and 1-6. The former Pallet Drying area was covered by 8 to 10 inches of gravel.

In 1989 and 1990, Law Environmental conducted a remedial investigation (RI) for the Memphis Depot (Law, August 1990) One surface soil sample (SS-47) was collected in the vicinity of the former Dip Vat area, to the north of Building 737. Three subsurface soil samples (19 ft bls, 26 ft bls, and 102 ft bls) were collected from boring STB-4, located to the west of the former Pallet Drying area. Neither PCP nor degradation products were detected in any of these samples The sampling locations are presented on Figure 1-3.

CH2M HILL reported on the results of a RI for the MI in 2000 (CH2M HILL, January 2000). The RI report presented results from sampling events conducted between 1996 and 1998. As part of the screening site sampling program, five surface soil samples were collected and two subsurface soil borings were advanced at each of the three PCP sites (SS 42, SS 43, and SS 46) in December 1996; surface and subsurface soil samples were collected in each boring (CH2M HILL, March 1998). Of these soil samples, PCP was analyzed in one surface soil sample (SS-43C) and two subsurface soil samples (SB-42A and SB-43A) in the vicinity of the former PCP Dip Vat and Storage Tank areas. PCP was analyzed in one surface soil sample (SS-46E) and one subsurface soil sample (SB-46A) in the former Pallet Drying area. Analytical results are summarized in Table 1-1 and soil boring locations are presented on Figure 1-3 No samples were collected in the immediate vicinity of the PCP Dip Vat site during 1998 RI investigation activities.

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Boring ID	Sample ID	Date	Sample Depth (ft bls)	PCP Concentration (mg/kg)	Comments
Not Applicable	3057-126	October 1985	1	ND	East wall of storage tank area excavation, composite sample
Not Applicable	3057-127	October 1985	5	ND	North wall of storage tank area excavation, composite sample
Not Applicable	3057-128	October 1985	14	ND	Bottom of storage tank area excavation, after tank removal, composite sample
3	3057-194	November 1985	10	2400	Soil excavation conducted to depth of 10 feet in boring location, boring may have been removed
6	3057-205	November 1985	5	22	Removed during excavation
25	3057-230	November 1985	20	2400	
33	3057-238	November 1985	10	ND	
STB-4	STB-4-1	March/April 1989	19	ND	
STB-4	STB-4-2	March/April 1989	26	ND	
STB-4	STB-4-3	March/April 1989	102	ND	
SS-47	LAWSS47	October 1989	0-1	ND	
SS-43C	SGB079	December 1996	0-1	ND	
SS-46E	SGB080	December 1996	0-1	ND	
SB-42A	SGB143	December 1996	8-10	470 J	
SB-43A	SGB145	December 1996	8-10	ND	
SB-46A	SGB146	December 1996	8-10	ND	
SB-105	MW-105-83	October 2001	83	ND	
SB-105	MW-105-92	October 2001	92	ND	
SB-105	MW-105-97	October 2001	97	ND	
SB-105	MW-105-10-30	October 2001	10-30	0 003 J	Analyzed for SPLP
SB-105	MW-105-30-50	October 2001	30-50	ND	Analyzed for SPLP
SB-105	MW-105-50-70	October 2001	50-70	ND	Analyzed for SPLP
SB-105	MW-105-70-90	October 2001	70-90	ND	Analyzed for SPLP
SB-105	MW-105-90-107	October 2001	90-107	ND	Analyzed for SPLP

#### TABLE1-1 Summary of PCP Concentrations in Soil at the Former PCP Dip Vat Area Memphis Depot, Memphis Tennessee

Notes.
1 Soil samples collected in 1985, as part of on-site remedial activities by OHM, were not reviewed for quality control and are Considered consistent with Level II data There are no reported detected concentrations of PCP breakdown products in historic soil samples in the PCP dip vat area See

2 Section 3 of this report for a description of PCP daughter products

estimated value J

ND not detected

SPLP synthetic precipitation leaching procedure

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Source: On-Site Remedial Activities at the Defense Depot Memphis, OHM, 1986

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Historic Soil Boring Locations for PCP (SS 42 and 43) PCP Dip Vat Investigation Memphis Depot Main Installation





A soil and groundwater sampling event was conducted at the MI in 2001 to evaluate groundwater downgradient of known or suspected historical LTOAs on the MI, where hazardous materials were used/stored, as identified by the TDEC. Soil samples collected from boring SB-105, which is south of the former PCP Dip Vat, were analyzed for PCP (see Figure 1-4). Three discrete soil samples were collected from the boring and analyzed for semivolatile organic compounds (SVOCs), with PCP being the target analyte. Five composite soil samples were collected from the boring and analyzed for leachable SVOCs via the synthetic precipitation leaching procedure (SPLP) Sampling depths and analytcal results are summarized in Table 1-1. PCP was not detected in any of the discrete soil samples Concentration of PCP (0.003J milligram per liter [mg/L]). No other samples contained PCP or any other chlorophenols above laboratory detection limits (CH2M HILL, July 2002). Based on historic sampling results, additional soil sampling was recommended by TDEC in the vicinity of the former PCP Dip Vat.

### 1.3 Geology and Hydrogeology

The soil investigation will be conducted within the loess geologic unit, the uppermost geologic unit at or near ground surface in the Depot area. The loess-eolian deposits consist of silty clay, clayey silt, and fine sandy clayey silt. This unit is described as a continuous, brown to yellowish, low-plasticity clayey silt (ML) or low-plasticity silty clay (CL). On the MI, the unit ranges in thickness from 6 ft at MW-25 to about 43.5 ft at MW-38, with an average thickness of 28 ft. Four samples have been collected from this unit for an analysis of physical properties. Atterberg Limits analyses (liquid limit average = 35 and plasticity index average = 15) and grain size analysis (average 96.8 percent passing the No. 200 sieve) indicate a lean clay classification (Law, August 1990).

The loess deposits overlie the fluvial deposits, in which the fluvial aquifer exists under unconfined conditions. The average depth to the water table of the fluvial aquifer is 87 ft below land surface (bls) (CH2M HILL, January 2000). Aquifer thickness in the fluvial deposits ranges from less than 1 foot the northwest corner of the MI to as high as 57 ft in the west central portion of the MI Groundwater flow in this aquifer is variable but is primarily southwest, south, and southeast. Figure 1-7 presents the most recent interpretation of the potentiometric surface underlying the MI in July 2003.

The fluvial aquifer is typically underlain by a clay-rich unit that occurs beneath most of the MI. This upper clay of the Jackson Formation/Upper Claiborne Group does not appear to be present at the base of the fluvial deposits in the northwestern part of MI. The MI RI concluded that clay-rich units (clay or clayey sand) occur in the Jackson Formation/Upper Claiborne Group at variable elevations, and also are highly variable in thickness. The Memphis Sand aquifer is separated from the overlying fluvial aquifer by units of the Jackson Formation/Upper Claiborne Group. The Memphis Sand is the source of water supply for the City of Memphis.



## 1.4 Work Plan Organization

This Work Plan is organized into the following sections:

Section 1.0 Introduction includes a discussion of the Work Plan structure, project objectives, and site background.

Section 2.0 Sampling and Analysis provides the procedures and protocols which will be followed for collecting and analyzing soil samples, sets forth the data quality objectives (DQOs), and describes equipment and materials to be used. It also addresses all field sampling, waste characterization, and sampling and analysis activities.

Section 3.0 Data Analysis and Interpretation describes the procedures that will be used to analyze and interpret data. This section also includes a "decision tree" regarding the pathway from soil sampling and sample analysis to future decisions

Section 4.0 Health and Safety describes how the Health and Safety Plan will address the hazards associated with the soil investigation.

Section 5.0 Reporting and Schedule describes the preparation of a TM documenting the results of the soil investigation and data analysis The schedule indicates the planned starting and ending dates for the tasks outlined in the work assignment

Section 6.0 References lists the documents cited in this Plan

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## 2. Sampling and Analysis

The sampling and analysis procedures presented below outline required activities associated with the soil investigation for the former PCP Dip Vat area. In addition, the information below presents proposed locations and analyses for soil samples, as well as requirements for disposal of wastes generated during field activities.

## 2.1 Data Quality Objectives

#### 2.1.1 General Investigation Data Quality Objectives

The DQOs detailed below are established to achieve the objectives outlined in Section 1.1.

#### DQO No. 01—Define PCP Concentrations in Soils

**Qualitative DQO** Evaluate whether PCP and degradation products, which pose a threat to human health, are currently present in soils at the former PCP Dip Vat area and define their extent in the vertical soil horizon. The source of PCP in the former Dip Vat and UST area was removed in 1985. During the source removal, PCP was detected in subsurface soil at a concentration of 2,400 mg/kg at 20 ft bls. In 1998, PCP was detected at 470 mg/kg in site soil at 8 to 10 ft bls.

**Quantitative DQO** Advance up to seven soil borings in the former PCP Dip Vat area. Since the objective is to determine the presence of PCP and degradation products in soil, collect composite rather than discrete soil samples to ensure the entire vertical soil column is evaluated. Collect three to five composite soil samples within each boring. Analyze soil samples for SVOCs using SW-846 Method 8151 (to achieve low reporting limits for PCP, 2,4,6-TCP, and 2,4-DCP) and Method 8270C for other PCP degradation products. Compare soil concentrations to those previously reported and to EPA Region 9 PRGs. Figure 2-1 presents the proposed locations of the soil borings. Table 2-1 presents the DQOs for each soil boring location. A list of laboratory-provided method detection limits (MDLs) and method reporting limits (MRLs) is included as Appendix A.

**Methods to Obtain DQO** Advance boreholes with continuous sampling using direct push technology (DPT) probing methods from land surface to a maximum depth of 40 ft bls. Collect soil samples using the DPT Macro-Core® sampling system to characterize soil conditions and conduct laboratory analyses.

#### DQO No. 02—Assess Impact of PCP in Soil on Groundwater

**Qualitative DQO** Evaluate the threat to groundwater in the underlying fluvial aquifer through leaching of PCP from site soils Currently, neither PCP nor PCP degradation products have been detected in groundwater in any wells in the vicinity of the former PCP Dip Vat and Storage Tank





Source: On-Site Remedial Activities at the Defense Depot Memphis, OHM, 1986

Note: The sump associated with the former PCP Dip Vat was removed during the soil excavation in 1985. The sump associated with Building 737 was filled and abandoned in the early 1990's. The purpose of the Building 737 sump was to collect spilled material into the building for recoupment; however, no spills occurred and the pump was never utilized.

> Figure 2-1 Proposed Soil Boring Locations PCP Dip Vat Investigation Memphis Depot Main Installation



TABLE 2-1 Summary of Proposed Soil Boring Locations and Data Quality Objectives Memphis Depot, Memphis Tennessee

Qualitative DQO	Quantitative DQO *b	Soil Boring ID	Composite Sample Depths (ft bls)
Confirm PCP soil concentrations adjacent to histonic boring 25 A Boring 25 sample was collected and analyzed as part of the 1985 soil investigation and excavation, PCP concentrations were reported at 2,400 mg/kg Soil in this area was excavated from land surface to 10 ft bls and replaced with clean soil	Advance (1) one soil boring adjacent to historic Boring 25 from 10 ft bis to approximately 40 ft bis Collect (5) five composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-109	Samples will be collected at • 10-16 • 16-22 • 22-28 • 28-34 • 34-40
Define PCP soil concentrations in the location of the former drain pan, north of the former PCP Dip Vat During the 1985 soil investigation, soil in this area was defined as heavity contaminated based on soil concentrations reported in OHM's On-Site Remedial Activities Report (1986) and located where the deepest soil contamination was observed, approximately 25 ft bis Soil in this area was excavated from land surface to 10 ft bis and replaced with clean soil	Advance (1) one soil boring in the location of the former northern drain pan from 10 ft bls to approximately 40 ft bls. Collect (5) five composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-110	Samples will be collected at • 10-16 • 16-22 • 22-28 • 28-34 • 34-40
Confirm PCP soil concentrations adjacent to histonc boring 3 A Boring 3 sample was collected and analyzed as part of the 1985 soil investigation and excavation, PCP concentrations were reported at 2.400 mg/kg Soil in this area was excavated from land surface to 10 ft bis and replaced with clean soil Since the sample was collected at a depth of 10 feet, soil adjacent to this sample may have been removed during the excavation	Advance (1) one soil boring adjacent to historic Boring 3 from 10 ft bls to approximately 40 ft bis Collect (5) five composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-111	Samples will be collected at • 10-16 • 16-22 • 22-28 • 28-34 • 34-40
Define PCP soil concentrations beneath the former PCP UST Soil in this area was excavated from land surface to 14 ft bls and replaced with clean soil	Advance (1) one soil boring in the location of the former PCP tank from approximately 10 ft bis to approximately 40 ft bis Soil collection will begin when natural soils (rather than fill) are begin when natural soils (rather than fill) are boseved, based on field observations during dinling Collect (5) five composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-112	Samples will be collected at 10-16 16-22 22-28 28-34 34-40

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TABLE 2-1 Summary of Proposed Soil Boring Locations and Data Quality Objectives Memphis Depot, Memphis Tennessee

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Qualitative DQO	Quantitative DQO <sup>a,b</sup>	Soil Boring ID	Composite Sample Depths (ft bls)
Evaluate the potential for nsk to human health under industrial land use for shallow soil located adjacent to the building on-site Define PCP soil concentrations adjacent to the office/storage building, on the outside of the eastern wall to assess whether PCP-contaminated soil was removed up to the extent of the building	Advance (1) one soil boring along the outside of the eastern wall, from land surface to approximately 20 ft bis. The boring will be drilled at an angle so samples can be collected undermeath the building Collect (3) three composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-113	Samples wil be collected at • 0-6 • 6-13 • 13-20
Evaluate the potential for risk to human health under industrial land use for shallow soil located beneath the building on-site Define PCP soil concentrations beneath the storage building, along the eastern edge, to assess whether PCP, used at the Dip Vat, may have migrated beneath the building	Advance (1) one soil boring along the eastern wall of the storage building, from land surface to approximately 20 ft bls Collect (3) three composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts	SB-114	Samples will be collected at • 0-6 • 6-13 • 13-20
Evaluate the potential for risk to human health under industrial land use for shallow soil near the former pump house and UST Soil was not excavated in this location.	Advance (1) one soil boring in an area between the former pump house and UST from land surface to approximately 20 ft bls Collect (3) three composite soil samples at the boring and analyze soil samples for total and leachable PCP and degradation byproducts Additionally, TDEC will collect split soil samples for analysis of dioxons and furans	SB-115	Samples will be collected at • 0-6 • 6-13 • 13-20
Notes. <sup>•</sup> The method of installation for each soil boring will be DPT driling te <sup>•</sup> PCP, 2,4,6-TCP; and 2,4-DCP in soil samples will be analyzed usi	chinques Soil samples will be collected using the DPT Ma ig SW-846 Method 8151 to achieve low reporting limits C	acroCore sampling s Other applicable PCF	ystem 2 degradation products will be

analyzed using SW846 Method 8270C A list of laboratory-provided method detection limits (MDLs) and method reporting limits (MRLs) is included as Appendix A

- direct push technology feet below land surface micrograms per kilogram pentachlorophenol
- soil boring synthetic Preceptation Leaching Procedure semi-volatile organic compounds A bls PCP SPLP SPLP SPLP

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**Quantitative DQO** Analyze composite soil samples collected from up to six soil borings for SPLP SVOCs by SW-846 Methods 8151 and 8270C. Figure 2-1 and Table 2-1 present the proposed locations of the soil borings. Calculate a site-specific dilution attenuation factor (DAF). Using the SPLP data, calculate a site-specific SSL for PCP. Use fate and transport modeling to simulate the transport of PCP from site soils to groundwater A list of laboratory-provided MDLs and method reporting limits MRLs is included as Appendix A.

**Methods to Obtain DQO** Advance boreholes and collect soil samples using DPT techniques, as described in DQO No 01. Calculate the leachability potential of PCP in soil using methods outlined in the Soil Screening Guidance (EPA, July 1996). Obtain depth to water data from existing potentiometric maps. Simulate the transport of PCP leachate from soil to the water table in the fluvial aquifer using vadose zone -fate and transport modeling. Compare the model results to the Federal Maximum Contaminant Level (MCL) for PCP, which is 1 microgram per liter (µg/L).

#### 2.1.2 Soil Boring Selection Data Quality Objectives

As discussed above, a soil excavation and tank removal were conducted in 1985. Based on the extents of excavation, there may be six historic soil samples (from borings 3, 25 and 33, 126, 127, and 128) remaining after the soil and UST excavation, which were analyzed for PCP; these sampling locations are presented on Figure 1-3. PCP was not detected in soil samples collected in the former PCP UST area. Soil samples collected in the former PCP Dip Vat area, however, did contain detectable concentrations of PCP.

Seven soil borings will be completed during the field investigation. Since the primary objective of the soil investigation is to determine the presence or absence of PCP and applicable degradation products in soil, composite rather than discrete soil samples will be collected to ensure the entire vertical soil column is evaluated. Three to five composite soil samples will be collected from each boring. One of the soil borings will be advanced within the on-site garage/storage building. Soil samples will be collected from under the concrete slab at the base of the building to define if contamination has migrated from the adjacent, former PCP Dip Vat location.

The maximum depth that will be sampled during this investigation is 40 ft bls This is typically the depth at which the loess deposits transition to the fluvial deposits Any greater depth will require a larger drilling type vehicle than currently proposed because of DPT rod refusal from the geologic materials underlying the Memphis Depot.

DQOs were developed for each proposed soil boring location. The proposed boring locations are presented on Figure 2-1, though exact locations may vary slightly based on site access for drilling Table 2-1 summarizes the soil boring DQOs and describes sample locations.

## 2.2 Drilling and Soil Sampling

Drilling and soil sampling procedures presented herein will adhere as closely as possible to procedures described in the EPA Region 4 Science and Ecosystems Services Division *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* (EISOPQAM), dated November 2001 and the USACE's Engineer Manual (EM) 200-1-3,

dated February 2001; an excerpt of this manual is included in Appendix B. In addition, the following site-specific plans will be used for further reference on applicable methods and procedures:

- Operable Units 2, 3, and 4 and Screening Sites: Field Sampling Plan Addenda (CH2M HILL, September 1998)
- Operable Unit 4 Field Sampling Plan (CH2M HILL, September 1995)
- Screening Sites Field Sampling Plan (CH2M HILL, September 1995)
- Generic Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (CH2M HILL, August 1995)
- Hazardous and Toxic Waste Health and Safety Plan (CH2M HILL, August 1995)
- Generic Quality Assurance Project Plan (QAPP) (CH2M HILL, February 1995)

#### 2.2.1 Drilling and Soil Sampling Methodology

All boring activities will be conducted according to procedures described within the EISOPQAM. Prior to disturbance of the surface, each boring location must be thoroughly reviewed for utility locations by contacting the Tennessee Utilities Hotline (TN OneCall) at (800) 351-1111. This review must be accomplished at least 2 weeks prior to commencement of drilling.

Seven soil boreholes (SB-109 through SB-115) will be completed using DPT probing methods, which were selected based on the lack of soil cuttings, smaller-diameter boreholes, and the ability of the equipment to access and enter the storage/garage building to collect samples. Four borings (SB-109 through SB-112) will be advanced to approximately 40 ft bls or the bottom of the loess deposits, whichever is encountered first. During the installation of boring SB-105 in 2001, the bottom of the loess deposits was encountered at 38 ft bls. Three borings (SB-113 through SB-115) will be advanced to 20 ft bls to evaluate direct contact risk to human health from surface and shallow subsurface soil. Groundwater will not be encountered during the investigation.

Soil samples for chemical analysis will be collected using the DPT Macro-Core<sup>®</sup> sampling system. Soil sampling procedures will be performed in compliance with the USACE's Engineer Manual (EM) 200-1-3 (February 2001); an excerpt of this manual is included in Appendix B. Four-foot long, 1.5-inch diameter acetate-lined sample tubes will be used. A retractable tip will be used to enhance sample recovery and help prevent crosscontamination. All soil samples will be described by the field scientist or engineer for grain size, mineralogy, color, moisture content, and structure. Descriptions will be recorded in the field book. If, during the soil composite process, staining is observed or odors are detected anywhere along the length of a soil core, this will also be noted in the field book. Soil with any obvious staining or odors will be combined with other soil collected within the selected sample interval (i.e., 10 to 16 ft bls) for sample analysis.

Composite soil samples will be collected to guarantee that the entire vertical soil column within the loess deposits is evaluated for the presence of PCP and the applicable degradation products. Collecting composite samples may "dilute" the concentration reported in the sample interval; however, it will make sure that hot spots are not missed which may occur in discrete sampling. For borings SB-109 through SB-112, continuous soil

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samples will be collected from 10 ft bls to approximately 40 ft bls During the 1985 soil excavation, native, clean soil was used to backfill the excavation pit in the area of these borings to an average depth of 10 ft (OHM, February 1986); therefore, no samples will be collected above this depth. A sample from each foot of the soil core will be collected and will be used to form a composite sample on a 6-foot basis, for a total of five (5) composite samples from each boring. Even though the Macro-Core<sup>®</sup> sampler is four-foot long, it will be feasible to collect soil samples on a six-foot basis since continuous sampling is being conducted. Additional sample procedures are described in Section 2.4.

As agreed upon at the July 2003 BRAC meeting, composite soil samples will also be collected to evaluate the potential risk to human health under industrial land use. For borings SB-113, -114, and -115, continuous soil samples will be collected from land surface (just beneath the concrete slab) to approximately 20 ft bls. A sample from each foot of these soil cores will be collected and will be used to form a composite sample on a 6 to 7-foot basis, for a total of three (3) composite samples from each boring. In addition, soil samples collected at boring SB-115 will be split with TDEC for analysis of dioxins and furans.

Following collection of the soil samples, the borehole will be plugged and abandoned using procedures presented in Section 6.9 of the EISOPQAM. Disturbed areas will be returned to conditions that existed prior to the initiation of work.

The locations of the soil borings will be surveyed by a registered surveyor relative to local benchmarks that reference to North American Datum (NAD). Horizontal control surveying (X-, Y-coordinates) will be performed at the ground surface of each sampling location.

#### 2.2.2 Decontamination and Demobilization

Equipment will be properly decontaminated between installation of soil borings to prevent cross-contamination and prior to leaving the site. All decontamination activities will be performed within a concrete staging area. Decontamination procedures will be according to methods described in quality assurance plans as well as methods described in the November 2001 EISOPQAM

All downhole drilling equipment as well as other equipment will be decontaminated according to procedures presented in Appendix B of the EISOPQAM Decontamination of the DPT drive rods will be conducted between each borehole and when equipment enters and leaves site. Decontamination of metal sampling equipment (i.e, spoons and bowls) will be conducted between each sample. Decontamination will consist of the following procedures, where applicable:

- High pressure, low volume steam-cleaning
- Wash and scrub with non-phosphate detergent (Liquinox) and potable water
- Rinse with tap water
- Rinse with deionized (or analyte free) water
- Rinse with laboratory grade isopropyl alcohol (PVC or plastic material will not be rinsedwith solvent)
- Rinse with organic free water
- Air dry to the extent practical
- Wrap in plastic sheeting or aluminum foil

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#### 2.2.3 Investigation-Derived Waste (IDW)

Waste handling will be dealt with during the soil investigation. Waste may be classified as non-investigative waste or investigative/field-generated waste. Non-investigative waste, such as litter and household garbage, will be collected on an as needed basis to maintain the site in a clean and orderly manner. This waste will be containerized and transported to the designated sanitary landfill or collection bin. Acceptable containers will be sealed containers or plastic garbage bags.

Investigative/field-generated waste will be properly containerized and temporarily stored, prior to transportation. Soil cuttings generated from soil investigation procedures will be placed in drums or other appropriate storage devices and stored at the site. Minimal soil cuttings should be retrieved using DPT probing and sampling methods. Acceptable containers will be sealed, U.S. Department of Transportation-approved steel 55-gallon drums or roll-off box-type containers. Each container will be properly labeled with site identification, sampling point, depth, matrix, constituents of concern, and other pertinent information for handling.

Soil in the vicinity of the PCP Dip Vat has been previously characterized, as described in Section 1. Soil cuttings from this investigation will be sampled for final disposal purposes according to methods and analyses required by the accepting corporation, including toxicity characteristic leaching procedure (TCLP) parameters and Reactivity, Corrosivity & Ignitability (RCI). Once the soil analytical data have been obtained, the soil will be removed from the MI within 60 days and transported to an appropriate offsite facility. If the soil is determined to be nonhazardous, it will be disposed of at the Tunica County Landfill in Mississippi. If the waste is determined to be hazardous it will be disposed at an appropriate Subtile C landfill. The containers will be transported in a manner to prevent spillage or particulate loss to the atmosphere.

Wastewater generated from equipment decontamination activities will also be stored at the site prior to removal from the MI Decontamination water will be contained in 55-gallon drums During past investigation activities at the MI, IDW water was disposed of in the City of Memphis sewer system after a temporary permit had been obtained from the City of Memphis Public Works Department. The permit provided an explanation that the water contained concentrations of contaminants similar to the effluent from the operating Dunn Field groundwater extraction system, which discharges into the City's sewer system If required, representative samples of the IDW will be collected for chemical characterization of volatile organic compounds and semi-volatile organic compounds.

## 2.3 Laboratory Analysis

Soil samples will be submitted to an off-site laboratory for analysis. The USACE-certified lab, Columbia Analytical Services (CAS) in Kelso, Washington, will perform the laboratory analyses; The laboratory's USACE Missouri River District (MRD) certification is presented in Appendix C. For this investigation, the laboratory will be informed of the USACE's requirements under EM 200-1-3 (February 2001) and comply with them when performing the necessary analyses.

All samples will be analyzed for PCP by SW-846 Method 8151 (to achieve low reporting limits for PCP; 2,4,6-TCP, and 2,4-DCP), Method 8270C (to evaluate other applicable PCP degradation products; including, tetrachlorophenols, trichlorophenols, dichlorophenols, and phenol), and SPLP Method 1312 for leachable PCP and PCP degradation products. The reporting limit for the laboratory analysis of the soil will be as low as possible to comply with EPA Region 9 PRGs. Sample analytical methods are summarized in Table 2-2. A list of laboratory-provided MDLs and MRLs is included as Appendix A.

At stated in Section 11, dioxins and furans were not identified at COCs in soil at the site; therefore, the analysis of these compounds is not included in the general soil investigation. However, soil samples collected at soil boring SB-115 will be split with TDEC, who will analyze the soil samples for dioxins and furans.

Since soil pH and organic content have a significant impact on the leaching of PCP, one soil sample collected from each of the seven soil borings will also be analyzed for pH by SW-846 Method 9045C and total organic carbon (TOC) by SW-846 Method 9060. As stated in the EPA's technical fact sheet for PCP, the adsorption of PCP to soil is greater under low pH or acidic conditions Chlorophenols were documented by Okeke et al. (1996) to biodegrade more readily under initial low-pH soil conditions. One soil sample will be selected for pH and TOC analysis in each boring. A different sample depth will be selected at each boring in order to observe vertical changes in pH and TOC, sample depths are summarized in Table 2-1. Sample analytical methods, holding times, appropriate containers, and preservation requirements are summarized in Table 2-2.

Unless otherwise specified by the laboratory, soil samples will be collected in a clear glass wide-mouth jar with a Teflon® lined cap and preserved by cooling to 4 degrees Celsius. Samples will be placed in coolers with ice upon collection Soil samples will be delivered to the laboratory within the appropriate holding period, however, preferably within 24 hours. In addition, quality assurance/quality control (QA/QC) samples will be collected during the field effort. The quantity of QA/QC samples collected at the site will be in accordance with guidelines in Sections 5.13 11 and 5.13.12 of the EISOPQAM. QA samples will be collected on a ten percent basis. The QA/QC samples include 3 field duplicates 2 matrix spike/matrix spike duplicates, 1 ambient blank (for TOC and pH), and 3 equipment rinseate blanks; QA/QC samples are summarized in Table 2-3.

The analytical laboratory will provide the project data in both hard copy and in an electronic format, submitted to the database supervisor. The electronic data deliverable (EDD) from the lab will be in a comma-delimited ASCII file format that is compliant with CH2M HILL's EDD 4 0 specification, included as Appendix D. The database supervisor will provide the laboratory with any project specific valid values that are applicable and required for use in the EDD. The database supervisor then will process the electronic laboratory data deliverable, and upload the data from the lab into the current CH2M HILL Environmental Data Management System (EDMS) template that has been configured for supporting the project data management requirements.

Laboratory analytical data will be validated (including a review of the data to assess the accuracy, precision, and completeness) by a project chemist.

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## 2.4 Logistics

Equipment, supplies, and personnel required to complete the soil investigation at the former PCP Dip Vat will be mobilized after approval of this Work Plan.

A site coordination meeting will be held after the final Work Plan has been submitted and before mobilization of the field effort. Participation will include Depot, TDEC, CH2M HILL,USACE, Depot Redevelopment Corporation, and subcontractor personnel. The meeting will include discussions of Depot regulations, DQOs, field procedures, field schedules, and the Site Health and Safety Plan.

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#### TABLE 2-2 Sample Analytical Methods Memphis Depot, Memphis Tennessee

Prelim TAT/ Final TAT	Data Package Requirement	Required Analysis	Analyticai Methods	Holding Time	Sample Preservation	Containers
7 days/14 days	CLP-type full package	рH	SW-846 9045C	Upon receipt	Cool to 4°C	1 - 4oz glass- clear wide- mouth jar with Teflon® lined caps/lids
		SVOCs (total and leachable)	SW-846 8270	14 days to extraction and 40 days from extraction to analysis	Cool to 4°C	1 - 4oz or 8 oz glass-clear wide-mouth jar with Teflon® lined caps/lids
		SVOCs (total and leachable)	SW-846 8270 SIM	14 days to extraction and 40 days from extraction to analysis	Cool to 4°C	1 - 4oz or 8 oz glass-clear wide-mouth jar with Teflon® lined caps/lids
		SPLP	SW-846 1312	14 days to leach	Cool to 4°C	1 - 4oz or 8 oz glass-clear wide-mouth jar with Teflon® lined caps/lids
		тос	SW-846 9060	28 days	Cool to 4°C	1 - 4oz G-AWM

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Notes. TAT = turnaround time SVOCs = semi-volatile organic compounds CLP = EPA Contract Laboratory Program quality assurance control procedures SPLP = synthetic precipitation leaching procedure C = Celsius

TABLE 2-3 Summary of Quality Assurance/Quality Control Samples Memphis Depot, Memphis Tennessee

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Sample Point	Matrix	Sampling Frequency	Approx. Sample Number	Sampling Method	Sampling Equipment	Prelim TAT/ Final TAT	Data Package Require- ment	Required Analysis	Analytical Methods	Holding Time	Sample Preservation	Containers
WSDS**	Soil	1 per 20 samples	N	Prepared In Field	Same Equipment for Soil Samples	7 days/ 14 days	CLP-like full package	Selected by Personnel in Field	Appropnate Method	Corresponds to Method	Appropriate Measures	Appropriate Containers
Field Duplicates	Sol	1 per 10 samples	n	Prepared in Field	Same Equipment for Soil Samples	7 days/ 14 days	CLP-like full package	pH, total and leachable SVOCs, including SPLP, TOC	See Table 2-2	See Table 2-2	See Table 2-2	See Table 2-2
Ambient Blank	Sol	1 per event	-	Prepared In Field	Same Equipment for Soil Samples	7 days/ 14 days	CLP-like full package	pH, TOC	See Table 2-2	See Table 2-2	See Table 2-2	See Table 2-2
Equipment blank	Soil	1 per 10 samples	Ċ,	Prepared in Field	Same Equipment for Soil Samples	7 days/ 14 days	CLP-like full package	pH, total and leachable SVOCs, including SPLP, TOC	See Table 2-2	See Table 2-2	See Table 2-2	See Table 2-2
Mater												

Notes ••Matrix Spike(MS)/MS Duplicate Samples (MSDS) samples will be supplied to the laboratory as an extra bottle containing the sample and the analysis will be the responsibility of the alternatory. TAT = turnaround time CLP = EPA Contract Laboratory Program quality assurance control procedures SPLP = synthetic precipitation leaching procedure SPC = semi-volatile organic compounds C = degrees Celsius

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## 3. Data Analysis and Interpretation

All data and resulting interpretation will be presented and described in a technical memorandum (TM). The primary objective of this investigation is to determine the presence or absence of PCP and degradation products which pose a risk to human health and groundwater

### 3.1 Evaluation of Direct Contact Exposure Risk

To evaluate the potential risk to human health of PCP and degradation products in site soil, any detected concentrations will be screeened against the 2002 EPA Region 9 PRGs for residential and industrial soil, along with soil screeening levels, which are protective of groundwater. There are only six anaerobic degradation products and zero aerobic degradation products with listed RBCs (see Table 3-1). Therefore, aerobic biodegradation products (i e. tetrahydroquinone) will not be evaluated during this soil investigation. Furthermore, the aerobic biodegradation intermediates for PCP are considered to be unstable, short-lived, and less likely present in site soil.

The applicable PRGs for PCP and subsequent degradation products are listed in Table 3-1. The PRGs are generic, non site-specific, risk-based concentrations that correspond to fixed levels of risk (i.e. either a one-in-one million [10<sup>4</sup>] cancer risk or a non-carcinogenic hazard quotient [HQ] of 1). Carcinogenic risk is often evaluated over a range of values (from 10<sup>4</sup> to one-in-ten thousand [10<sup>4</sup>]), therefore the PRGs for PCP and subsequent degradation products were also calculated at a 10<sup>4</sup> cancer risk level. In addition, PRGs for noncarcinogenic compounds were also calculated at a HQ of 0 1 to take into account the possible presence of multiple chemicals. If the PRGs are updated during the time of this investigation, the most current PRGS will used in the evaluation.

## 3.2 Evaluation of Soil to Groundwater Pathway

If PCP and subsequent degradation products are detected in site soil, the migration of contamination from soil to groundwater will be evaluated. Using the EPA's Soil Screening Guidance (1996), a site-specific DAF and SSLs will be calculated based on the analytical SPLP results. The detected soil concentrations will then be compared directly to these site-specific SSLs.

Based on historic sampling investigations, soil contamination is expected to be fairly shallow (<25 ft bls). Since the depth to groundwater in this area (>100 ft bls) is much deeper thane the zone of contamination, fate and transport modeling will be performed to account for the attenuation of contaminants leaching through soil to the underlying groundwater aquifer. The goal of the modeling will be to define the potential for contaminants to leach into the underlying aquifer and reach downgradient receptor exposure points.

Since this is a preliminary investigation, a one-dimensional fate and transport model will be utilized to simulate the vertical leaching of PCP in soil to the groundwater table. PCP,

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TABLE 3-1 Applicable Soil Preliminary Remediation Goals (PRGs) Memphis Depot, Memphis Tennessee

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				Direct Conti	act Exposure				Migration to	Groundwater
	Υ.	esidential	Soil (mgikg)	-		ndustrial S	soil (mgikg)		Soil Screening	Level (mgikg)
ranew	10 <sup>6</sup> Cancer Risk	10 <sup>4</sup> Cancer Risk	HQ = 0.1	HQ = 1	10 <sup>°</sup> Cancer Risk	10 <sup>4</sup> Cancer Risk	HQ = 0.1	HQ = 1	DAF = 1	DAF = 20
Pentachlorophenol	e	300	140	1,400	6	006	1,200	12,000	0 001	0 03
2,3,4,6-Tetrachlorophenol	ł	I	180	1,800	1	ł	1,800	18,000	NL	NL
2,4,5-Tnchlorophenol	ł	I	610	6,100	I	I	6,200	62,000	14	270
2,4,6-Trichlorophenol	I	1	061	61	I	1	62	62	0 008	02
2,4-Dichlorophenol	I	1	18	180	I	1	180	1,800	0 05	10
2-Chlorophenol	I	I	63	63	1	1	24	240	02	4 0
Phenol	ł	I	3,700	37,000	ł	I	37,000	100,000	50	100
Notes										

1 All values taken from the EPA Region 9 PRG Table (EPA, October 2002)
2 For phenol, the industrial Soil direct contact exposure criteria is listed as a maximum of 100,000 mg/kg in the 2002 PRG table (HQ = 1), however the calculated Industrial Soil criteria, as listed in the interCalc Table for soils is 370,000 mg/kg Therefore, this later value was used to calculate the Industrial Soil PRG for phenol at a HQ of 01

= dilution attenuation factor
 = hazard quotient
 = milligrams per kilogram
 = not listed

DAF HQ NL

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which is leaching from contaminated soil in the vadose zone, is not assumed to move horizontally, only in one vertical downward direction. Due to the complexity of the site geology and hydrogeology at the site, a three-dimensional model would be difficult to create and calibrate. In addition, it would be highly time consuming and not cost-effective for this particular problem, especially since PCP transport in groundwater is not required for the evaluation.

The vertical fate and transport modeling will be conducted using the software program, Multimedia Exposure Assessment Model (MUTIMED). MULTIMED is a one-dimensional model created to simulate the movement of contaminants leaching from a waste disposal facility. Transport in the model is based on one-dimensional, semi-analytical equations. The model simulates vertical flow of soil water, incorporating dispersion, adsorption, biodegradation, and volatilization in the saturated and unsaturated zones. Input parameters required to run the model are listed in Table 3-2. Site-specific input parameters will be used whenever possible. For parameters in which a site-specific value is not available, a conservative estimate will be used.

Using the maximum and average detected soil concentrations for PCP and applicable degradation products reported during this soil investigation, the MULTIMED model will be used to estimate the soil leachate concentrations at the depth of the water table. These calculated concentrations will be compared to the site-specific SSLs. All model results will be included in a TM, along with the analytical soil results.

### 3.3 Evaluation of PCP Natural Attenuation

In the soil matrix, biodegradation is the predominant transformation mechanism for PCP. In general, PCP has been observed to degrade more rapidly in anaerobic environments than in aerobic ones (ATSDR, 2001). Anaerobic degradation of PCP in soil occurs primarily via reductive dechlorination. During this process, the chlorinated compound is used as an electron acceptor by microorganisms and a chlorine atom is replaced by a hydrogen atom. The phenol ring is broken relative late in the degradation process. PCP is reductively broken down in the following general sequence:

PCP--- tetrachlorophenol (TeCP) --- trichlorophenol (TCP) --- dichlorophenol (DCP) --- chlorophenol (CP).

However, the pathway (or specific isomers created during the anaerobic degradation process) that is followed at a specific site is dependent on the type of microorganism present in the system (Mahaffey, 1997). Possible intermediate breakdown products include three isomers of TeCP, five isomers of TCP, six isomers of DCP, and three isomers of CP. The isomers of CP may dechlorinate to phenol or may mineralize to carbon dioxide and water, however, this is not prevalent. A possible pathway for reductive dechlorination of PCP is presented in Appendix E.

TABLE 3-2 Input Parameters for MULTIMED model Memphis Depot, Memphis Tennessee

	Unsaturate	d Zone	Parameters
٠	Saturated hydraulic conductivity	•	Biological decay coefficient
•	Thickness of each layer	•	Duration of pulse
٠	Reference temperature for air	•	Number of porous materials
٠	Diffusion	•	Acid, base, and neutral hydrolysis rates
٠	Porosity	•	Source decay constant
٠	Longitudinal dispersivity	•	Number of layers
٠	Molecular weight	•	Reference temperature
٠	Air entry pressure head	•	Initial concentration at landfill
٠	Percent organic matter	•	Alpha coefficient
٠	Infiltration rate	٠	Normalized distribution coefficient
٠	Depth of unsaturated zone	•	Particle diameter
٠	Soil bulk density	•	van Genuchten exponent
٠	Area of waste disposal unit	•	Air diffusion coefficient
•	Residual water content		
	Saturated	Zone P	arameters
•	Recharge rate	٠	Vertical dispersivity
٠	Longitudinal dispersivity	•	Angle off-center of well
٠	Organic carbon content	•	Aquifer thickness
٠	First-order decay coefficient	•	Temperature of aquifer
٠	Transverse dispersivity	•	Well vertical distance
٠	Well distance from site	•	Hydraulic gradient
•	Biodegradation coefficient	•	pH

In aerobic degradation, PCP is broken down by a series of pathways. The degradation process begins with oxidative dechlorination reactions, forming intermediate degradation products, which may include tetrachloroatechol, tetrachlorohydroquinone (TeCHQ), tetrachlorobenzoquinone (TeCBQ), trichlorohydroxylbenzoquinone (TCBHQ), trichlorohydroquinone (TCHQ), dichlorohydroquinone (DCHQ), and chlorohydroquinone (CHQ). These aerobic degradation products have fewer chloride atoms than does PCP and they degrade quickly by cleavage of the phenol ring Therefore, PCP does not fully break down to hydroquinone. The aerobic byproducts are considered to be short-lived and do not generally accumulate in the environment (Mahaffey, 1997). The final degradation products by mineralization are water, carbon dioxide, and chloride ions. The aerobic degradation pathway for PCP is presented in Appendix E.

Based on the EXTOXNET information profile (June 1996), PCP degradation is best under higher temperatures and in the presence of organic matter. PCP has been shown to degrade in soil, with reported half-lives of 45 days, (Extoxnet, 1996) and weeks to months (EPA Technical Fact Sheet - <u>http://www.epa.gov/OGWDW/dwh/t-soc/pentachl.html</u>, November 2002). However, based on a search on the BIODEG database (Syracuse Research Corporation-<u>http://esc.syrres.com/efdb/biodeg.htm</u>), only 67 to 99 percent of PCP degradation occurred in aerobic soils and 7 to 75 percent degradation of PCP occurred in anaerobic soils in grab soil sample tests.

Applicable anaerobic degradation products of PCP will be evaluated during this investigation. Since there are no aerobic degradation products with listed PRGs, they will not be analyzed. In addition, as stated above, the intermediate aerobic degradation products are not considered stable and are less likely to be present in site soil. The presence of anaerobic degradation byproducts will serve as indicators of the natural attenuation of PCP in the soil matrix. If natural attenuation is determined to be occurring at the site, a full-scale natural attenuation evaluation may be conducted to determine particular degradation mechanisms (i.e. methanogenesis).

### 3.4 Decision Tree Analysis

A detailed "decision tree" regarding the pathway from soil sampling and sample analysis (addressed in this Plan) to future decisions has been developed for the former PCP Dip Vat site. This is presented as Figure 3-1

At the conclusion of this soil investigation and analysis, if soil concentrations of PCP and subsequent degradation products are determined to be absent from site soil (not detected at acceptable laboratory limits) or detected below direct contact exposure PRGs and site-specific SSLs, no further action (NFA) will be requested for the site. If soil concentrations are reported above direct contact exposure PRGs, remedial action objectives (RAOs) will be developed. If soil concentrations are reported above site-specific SSLs, vadose zone fate and transport modeling will be performed to estimate the concentrations leaching into groundwater from the overlying soil contamination. If the modeling concludes that the concentration of soil leachate reaching groundwater is above the SSLs, then RAOs will be developed.

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If remedial action is deemed necessary by the RAOs, the natural attenuation of PCP will be evaluated. The presence of anaerobic degradation products will be used as indicators of biodegradation in the soil matrix. If natural attenuation is determined to be occurring at the site, a full natural attenuation evaluation will be performed to assess it's feasibility as a remedial alternative. If there are no degradation products present in site soil, it will be assumed that biodegradation is not readily occurring and a detailed analysis of remedial alternatives will be conducted to reduce soil concentrations to acceptable levels. The analysis will be performed in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, October 1998). A report will be submitted with conclusions of this analysis and recommendations for remedial action at the site.

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FIGURE 3-1 Decision Tree Analysis Memphis Depot, Main Installation



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### 4. Health and Safety

A Health and Safety Plan (HASP) was prepared by CH2M HILL for the MI and Dunn Field at the Memphis Depot (CH2M HILL, April 2002). This HASP was amended in August 2003 for the activities included in this Work Plan and will be kept on-site during field activities. This HASP includes company safety goals, objectives, and procedures. This HASP meets the requirements specified in the USACE Safety and Health Requirements Manual, EM 385-1-1 (USACE, September 1996); excerpts of this manual pertinent to the field tasks included in this Work Plan are located in the amended HASP and Appendix F of this document.

The following health and safety items are of particular concern for the field activities described in this Work Plan.

- Drilling The advancement of soil boreholes at the former PCP Dip Vat will require the use of a DPT drill rig. The use of this equipment involves inherent hazards, including moving equipment, noise, and potential slips, trips, and falls. Equipment will be inspected prior to use. Other possible hazards include underground utilities and aboveground power lines.
- Soil Sampling Soil from the former PCP Dip Vat area may contain levels of COCs. These potential contaminants will be considered when selecting the proper personal protective equipment (PPE).

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### 5. Schedule and Reporting

### 5.1 Reporting Requirements

A TM will be developed that presents the findings and conclusions of the soil investigation and data analysis for the former PCP Dip Vat, including recommendations and follow-up actions and issues. The TM will provide analytical results of all soil and QA samples, soil boring logs, any survey data, as well as soil leachability calculations. Analytical data will be validated by a project chemist for compliance with the analytical method requirements; a data quality evaluation which reviews the accuracy, precision, and completeness of the data will be included with the TM

The TM will also include results from the fate and transport modeling, along with conclusions on the potential risk to groundwater and downgradient receptors from soil contamination, and a preliminary natural attenuation evaluation. Maps of the soil boring locations with respect to the site layout will also be presented in the TM

The TM will be submitted to all pertinent stakeholders of the Memphis Depot for review and comment. The review comments, as well as responses to comments, will be attached to the revised document as part of the final report. Revisions 0, 1, and 2 (Final) will be prepared. Rev. 0 and Rev 1 will produced on CD ROM and Rev 2 (Final) will be produced on CD ROM and hard copy

### 5.2 Project Schedule

A preliminary schedule for the soil investigation at the former PCP Dip Vat area is presented as Appendix G. This schedule may be accelerated or delayed based on review times.

### 6. References

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### Appendix A

Columbia Analytical Services: List of Method Detection Limits (MDLs) and Method Reporting Limits (MRLs) **Report List Information** 

Product Matrix: Level:	: PCP-T-TRI SOLID LOW			Account: Project: Method:	MJ270				List Cur Exp	ID: LJ238 rent: Y ired:	1
Descript	iion: Includes breakdown products					Report	Title: Ch	lornated Ph	enols and Breakdo	wn Products	
Order	Analyte Name	Type	MDL	MRL	Surr/MS Limits	LCS Limits	Units	Spike Level	Analyte ID	Last User	Last Date & Time
180	2.3.4.5.6-Pentachloroanisole	TRG	2	5	26-140	50-115	ug/Kg		1825-21-4	MManthe	09/28/2001 11 23
150	2,3,4,5-Tetrachlorophenol	SW	ę	10	32-141	37-131	ug/Kg	50	4901-51-3	MManthe	09/28/2001 11.23
160	2,3,5,6-Tetrachlorophenol	SW	4	10	29-150	54-116	ug/Kg	50	935-95-5	MManthe	09/28/2001 11.23
130	2,4,6-Tnchlorophenol	SW	07	Ś	21-132	42-98	ug/Kg	50	88-06-2	MManthe	09/28/2001 11 23
140	3,4,5-Trichlorophenol	SW	m	10	70-130	70-130	ug/Kg	50	609-19-8	MManthe	09/28/2001 11 23
110	3,4-Dichlorophenol	SM	2	10	21-133	10-168	ug/Kg	50	95-77-2	MManthe	09/28/2001 11 23
120	3,5-Dichlorophenol	SW	ŝ	10	10-148	10-184	ug/Kg	50	591-35-5	MManthe	09/28/2001 11 23
190	4-Bromo-2,6-dichlorophenol	SURR			31-146	31-146	PERCENT	50	3217-15-0	MManthe	09/28/2001 11 23
170	Pentachlorophenol	SM	2	5	26-140	50-115	ug/Kg	50	87-86-5	MManthe	09/28/2001 11 23
145	Tetrachlorophenols, Total	SM			29-150	54-116	ug/Kg		25167-83-3	MManthe	09/28/2001 11 23

Italicized values are list specific

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Report List Information

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Method	Parameter	Water RL	Water MDL	Soil RL	Soil MDL
SW8270C	Phenol	10 ug/L	0 5 ug/L	0 3 mg/Kg	0.03 mg/Kg
SW8270C	2-Chlorophenol	10 ug/L	07 ug/L	0.3 mg/Kg	0.03 mg/Kg
SW8270C	Benzyl Alcohol	10 ug/L	0 7 ug/L	0 3 mg/Kg	0.05 mg/Kg
SW8270C	2-Methylphenol	10 ug/L	0.9 ug/L	0.3 mg/Kg	0.03 mg/Kg
SW8270C	3- and 4-Methylphenol	10 ug/L	0.5 ug/L	0 3 mg/Kg	0.04 mg/Kg
SW8270C	2-Nitrophenol	10 ug/L	08 ug/L	0.3 mg/Kg	0 03 mg/Kg
SW8270C	2,4-Dimethylphenol	10 ug/L	2 ug/L	0.3 mg/Kg	l mg/Kg
SW8270C	Benzoic Acid	25 ug/L	2 ug/L	2 mg/Kg	0 07 mg/Kg
SW8270C	2.4-Dichlorophenol	10 ug/L	0.9 ug/L	0 3 mg/Kg	0.03 mg/Kg
SW8270C	4-Chloro-3-methylphenol	10 ug/L	0 8 ug/L	0 3 mg/Kg	0 04 mg/Kg
SW8270C	2.4.6-Trichlorophenol	10 ug/L	0 7 ug/L	0.3 mg/Kg	0 03 mg/Kg
SW8270C	2.4.5-Trichlorophenol	10 ug/L	09 ug/L	0 3 mg/Kg	0 03 mg/Kg
SW8270C	2.4-Dinitrophenol	25 ug/L	6 ug/L	2 mg/Kg	0.2 mg/Kg
SW8270C	4-Nitronhenol	25 ug/L	2 ug/L	2 mg/Kg	0.06 mg/Kg
SW8270C	2-Methyl-4.6-dinitrophenol	25 ug/L	2 ug/L	2  mg/Kg	0.05 mg/Kg
SW8270C	Pentachlorophenol	25 ug/L	2 ug/L	2  mg/Kg	0 04 mg/Kg
	F				00
SW8270C SIM	2.4.5-Trichlorophenol	10 ug/L	0.02 ug/L		
SW8270C SIM	2.4.6-Trichlorophenol	1.0 ug/L	0.02 ug/L	160 ma/ka	53 mg/kg
SW8270C SIM	2.4-Dichlorophenol	1.0 ug/L	0 04 ug/L	160 ma/ka	55 ma/ka
SW8270C SIM	2-Chlorophenol	10  ug/L	0.02 ug/L	160 ma/ka	66 ma/ka
SW8270C SIM	Pentachlorophenol	10 ug/L	0.03  ug/L	640 ma/ka	90 ma/ka
SW8270C SIM	Phenol	10 ng/L	0.02 ug/L	160 ma/ka	77 ma/ka
SW8270C SIM	2.3.4.6-Tetrachlorophenol	10 ug/L	0.04 ug/L		-
	-,-, ,,				
EPA 1653	4-Chlorophenol	1 25 ug/L	0.03 ug/L		
EPA 1653	2,4-Dichlorophenol	2 5 ug/L	0 06 ug/L		
EPA 1653	2.6-Dichlorophenol	2 5 ug/L	0.03 ug/L		
EPA 1653	2.4.5-Trichlorophenol	2 5 ug/L	0.05 ug/L		
EPA 1653	2.4.6-Trichlorophenol	2 5 ug/L	0.04 ug/L		
EPA 1653	2.3.4.6-Tetrachlorophenol	2 5 ug/L	0.04 ug/L		
EPA 1653	Pentachlorophenol	5 ug/L	0.2 ug/L		
EPA 1653	4-Chloroguaiacol	1 25 ug/L	0 02 ug/L		
EPA 1653	3.4-Dichloroguaiacol	2.5 ug/L	0 02 ug/L		
EPA 1653	4,5-Dichloroguaiacol	2.5 ug/L	0 03 ug/L		
EPA 1653	4.6-Dichloroguaiacol	2 5 ug/L	0.03 ug/L		
EPA 1653	3.4.5-Trichloroguaiacol	2 5 ug/L	0.06 ug/L		
EPA 1653	3.4.6-Trichloroguaiacol	2.5 ug/L	0.03 ug/L		
EPA 1653	4.5.6-Trichloroguaiacol	2.5  ug/L	0.04 ug/L		
EPA 1653	Tetrachloroguaiacol	5 ug/L	0.05 µg/L		
EPA 1653	4-Chlorocatechol	1.25 µg/L	0.02 ug/L		
EPA 1653	3 4-Dichlorocatechol	2.5 µg/L	0.03 ug/L		
EPA 1653	3.6-Dichlorocatechol	2 5 ug/L	0.03 ug/L		
EPA 1653	4 5-Dichlorocatechol	25 ug/5 25 ug/1	0.02 ug/I		
EPA 1653	3 4 5-Trichlorocatechol	5 ng/I	0.02 ug/L 0.04 ug/I		
EPA 1653	3 4 6-Trichlorocatechol	5 ug/L 5 ug/I	0.07 110/1		
EPA 1653	Tetrachlorocatechol	5 ug/L 5 ug/l	0.07 ug/13 0.04 ug/1		
		- 4 <u>5</u> 76	VIOT UE/L		

### Appendix B

Excerpts from the USACE EM 200-1-3

When a hole is completed, a space block marked "Bottom of Hole," or "BOH" should be securely placed after the last core run. Appropriately marked space blocks should also be inserted in the core boxes to fill the spaces formerly occupied by core that has been removed for testing.

Core boxes should be marked on the outside to indicate the top and bottom, and the inside upper left corner of the box should be permanently marked with the letters UL to indicate the upper left corner.

Soft or friable cores should be wrapped in plastic film or sealed in wax.

When samples are collected with a core barrel and placed into a core box, the core samples should be photographed in the core box as soon as possible after the core samples are retreived and the box is labeled.

The core box lid should be marked both inside and outside with the project name, hole number, location, surface elevation, box number, and depths for the beginning and end of core in the box. The ends of the core box should be marked with the project name, hole number and box number.

C.6.4.9 Direct Push Soil Sampling. Method Reference: ASTM D 6282.

C.6.4.9.1 Applicability. The direct push soil sampling method is widely used as a preliminary site characterization tool for the initial field activity of a site investigation. Direct push sampling is an economical and efficient method for obtaining discrete soil and water samples without the expense of drilling and its related waste cuttings disposal costs.

C 6.4.9.2 Method summary and equipment. The sampling method, known as the direct push method, involves sampling devices that are directly inserted into the soil to be sampled without drilling or borchole excavation. Direct push sampling consists of advancing a sampling device into the subsurface by applying static pressure, impacts, or vibration or any combination thereof to the aboveground portion of the sampler extensions until the sampler has been advanced its full length into the desired soil strata. No specific guidance or standards document the "direct push sampling method," but the guidance is a modification of standards from the Shelby tube, split spoon, piston, and penetrometer methods. The method is employed under various protocols by commercial entities and called by various proprietary names (i.e., Geoprobe). Direct push methods may be used to collect soil, and in some cases, the method may be combined with sampling devices capable of water and/or vapor sampling. The equipment generally used in direct push sampling is small and relatively compact allowing for better mobility around the site and access to confined areas. Direct push insertion methods include static push, impact, percussion, other vibratory driving, and combinations of these methods using direct push equipment adapted to drilling rigs, cone penetrometer units (the reference standard for which is ASTM D 5778-95, and specially designed percussion/direct push combination machines. Standard drilling rods used for rotary drilling are sometimes used when sampling is done at the base of drill holes. A direct push soil sampling system consists of a sample collection tool; hollow extension rods for advancement, retrieval, and transmission of energy to the sampler; and an energy source to force penetration by the sampler.

C.6.4.9.3 Sampling procedure. The sampling procedure is as follows:

Assemble decontaminated direct push sampling device that will be pushed into the ground to collect data or samples.

Advance the sampling device into subsurface soils by applying static pressure, impacts, or vibration or any combination thereof to the aboveground portion of the sampler extensions until the sampler has been advanced its full length into the desired soil strata.

Sampling can be continuous for full-depth borehole logging or incremental for specific strata sampling. Samplers used can be protected for controlled specimen gathering or unprotected for general data collection.

Recover the sampler from the borehole and remove the soil sample from the sampler.

Begin sampling with the acquisition of any VOC samples, conducting the sampling with as little disturbance as possible to the media. Refer to Instruction E-4 for additional information on the collection, handling, and storage of solid VOA samples.

If homogenization of the sample location is appropriate for the remaining analytical parameters or if compositing of a different location is desired, transfer the sample to a stainless steel bowl for mixing. Refer to Instructions E-2 and E-3, Appendix E, respectively.

Transfer sample into an appropriate sample bottle using a stainless steel spoon or equivalent.

Check that a PTFE liner is present in the cap. Secure the cap tightly.

Label the sample bottle. Complete the label completely and clearly, addressing all the categories and parameters.

Place filled sample containers on ice immediately.

Complete chain-of-custody documents and field sheets and record in the logbook (see Instruction F-1, "Documentation," Appendix F).

Prepare samples for shipment (see Instruction F-2, "Packaging and Shipping Procedures," Appendix F).

Decontaminate the equipment following each probe or sample.

C.6.4 10 Site Characterization and Analysis Penetrometer System (SCAPS).

C.6.4 10.1 Applicability. The SCAPS system provides the capability to conduct rapid site characterization and real-time analysis of contaminated soil and ground water in situ. SCAPS may be used to determine areas free of contamination, optimize the selection of monitoring well locations, and provide onsite three-dimensional visualization of soil stratigraphy and contaminant plumes. SCAPS site characterization may save from 25 to 30 percent of site characterization costs compared with those of conventional drill and sampling techniques. SCAPS sensors have the capability for determining soil classification/layering and detecting contaminants simultaneously. Geotechnical and contaminant sensing technologies currently available include soil classification; electrical resistivity; POL; explosives, VOCs; and gamma-emitting radionuclides. Regulatory certification has been granted for the SCAPS POL and is ongoing for VOCs, explosives, and metals sensors under the Environmental Security Technology Certification Program (ESTCP) and by the USEPA Consortium for Site Characterization Technologies, the California EPA Environmental Technology Certification Program, and reciprocity via the Interstate Technology Regulatory Cooperation

### E.2 Homogenizing Techniques

E.2.1 Scope and application. This instruction provides guidance for homogenizing samples. Proper homogenization is vital to accurately assessing the condition of a particular site. Correct homogenization techniques are also important for preparing the necessary quality control (QC) samples associated with a typical sampling event. Homogenization techniques should not be used when samples for volatile organic analyses (VOA) or other parameters that require undisturbed samples are collected.

E.2.2 Sample handling and mixing. An integral part of any sampling investigation is obtaining samples that truly represent the site under investigation. Therefore, applying proper homogenization techniques will help ensure that conditions are being accurately represented. Generation of field control samples (e.g., replicate samples) provides a means for evaluating matrix heterogeneity and the sampling and handling techniques of field personnel. However, for this evaluation to be meaningful, field sampling personnel must be able to properly homogenize and divide collected samples.

E.2.2.1 Sampling equipment composition. The composition of sampling equipment can affect sample analytical results. Sampling materials used must be properly decontaminated and must not contaminate the sample being collected. The standard materials for sampling equipment used to collect samples for trace organic compounds or metals analyses are given in Table E.1. This table may be used as a guide to select the proper sampling instruments.

Table E.1 Standard Materials for Sampling Equipment	
Analysis/Site Condition	Preferred Material
Metals	Glass or PTFE
Organics	Stainless steel, glass, or PTFE
Corrosive Soil/Waste	Glass or PTFE

E.2.2.2 Required sample volumes. The volume of sample obtained should be sufficient to perform all required analyses with an additional amount collected to provide for quality control needs, including any split or replicate samples. The volume of sample required by the laboratory depends on the analyses to be performed. Volumes and containers identified in Appendix B are sufficient volumes for the prescribed analysis. If deviations from these volumes are necessary due to low sample yields, the laboratory receiving the sample and conducting the analyses should be consulted for alternative volume requirements. The volumes of samples collected from waste sources at hazardous waste sites or samples from sources that are known to be toxic should be kept to an absolute minimum since disposal costs of excess sample material are high. The laboratory or project personnel may require that excess sample volume be returned to the site because of the hazardous nature of the samples or because of sensitive political issues surrounding the project. If samples are being collected for bench-scale or pilot-scale remediation studies, larger volumes may be necessary. This scenario normally involves sending large bulk volumes to a laboratory to undergo various applications/manipulations to identify the optimum conditions for remediation of a particular waste stream. The data user (i e., design engineer) or laboratory should be contacted to determine the volume of material required.

E.2.2.3 Aqueous samples. Aqueous samples are typically considered homogeneous because of the physical properties of water, such as diffusion and the ability to flow and freely mix. Therefore, aqueous samples do not require mixing. However, when solids are present within the aqueous samples, viscous or semisolid liquids are encountered, and the sample will require mixing. These samples can be shaken well

or stirred thoroughly with a tool of appropriate composition. The sampler may also encounter portions of the media that are immiscible with water and separate into distinct phases. In these situations, it is advisable to collect a sample from each layer/phase as well as a homogenized sample When multiple phases are sampled, the sample should be homogenized in the laboratory to achieve the most homogeneous sample. Water samples (potable well, monitoring well, surface water) should be obtained by alternately filling sample containers from the same sampling device for each parameter. Split and replicate samples will be collected simultaneously with the primary samples. Containers for VOA will be filled first, followed by containers for semivolatile organics, metals, cyanide, and water quality parameters. Each VOA container should be completely filled immediately, rather than splitting the water between bottles and filling the bottles incrementally. The containers will all be filled from the sampling device if possible. If this is not possible, a minimum of two containers (one for the primary sample and one for the split sample) will be filled from each sampling volume. If more than two containers can be filled from one sampling volume, the number of containers filled should be an even number (i.e., two or four) so that an equal number of containers for the primary and split samples are prepared. The remaining portions of the sample will then be prepared by splitting each sampling volume between containers for the primary and replicate samples.

E.2.2.4 Solid samples. Obtaining samples in a soil or sediment matrix requires homogenization of the sample aliquot prior to filling sample containers. However, volatile organic samples are the exception; samples being analyzed for volatile organic compounds (VOCs) must always be taken from discrete locations prior to mixing. Refer to Instruction E-4 for additional information on the collection, handling, and storage of solid VOC samples. This practice is necessary to prevent loss of volatile constituents and to preserve, to the extent practicable, the physical integrity of the volatile fraction. Homogenization of the sample for remaining parameters is necessary to create a representative sample media. Moisture content, sediments, and waste materials may inhibit the ability to achieve complete mixing prior to filling sample containers. Consequently, alternative procedures may need to be pursued, i.e., kneading, particle size reduction (PSR), or particle size separation (PSS). However, it is extremely important that solid samples be mixed as thoroughly as possible to ensure that the sample is as representative as possible of the sample location.

E.2.2.4.1 Before sample mixing is performed, instructions on the removal of extraneous sample materials (grass or materials in "root zone," leaves, sticks, rocks, etc.) should be given. This can be accomplished by the removal of material by a gloved hand, or through the use of PSS devices (i.e., sieves). Other procedures employed may include PSR techniques. This may be as simple as breaking up large material with a hammer, or may include more elaborate techniques (grinder or mill). However, many of these PSR devices are difficult to decontaminate, and may not be conducive to trace level chemical analyses.

E.2.2.4.2 Homogenization procedures may be accomplished by several methods. The method best suited for the media will depend on the physical characteristics of the solid material (e.g., heterogeneity of media, maximum particle size present, moisture content, etc.). In general, homogenization is accomplished by filling a properly decontaminated container with the sample and mixing it with a decontaminated implement. The container should be large enough to hold the sample volume and accommodate the procedures without spilling. In most cases, the method of choice for mixing is referred to as cone and quartering and can be performed in a bowl or tray of an appropriate material (depending on the analytical parameters to be performed). First all the soils will be disaggregated to less than 6-mm (1/4-in.) diameter as the sample is mixed. The soils are then gathered into a pile in the middle of the container and divided into quarters. Each quarter is mixed, then soils from opposite corners are mixed together again. Soils are then partitioned into quarters again, and this time adjacent corners are mixed together, then the whole combined again. The extent of mixing required will depend on the nature of the sample and should achieve a consistent physical appearance before sample containers are filled. The soils are then divided into final quarters, which are equally subsampled to fill the appropriate containers. If the soil medium is not amenable to cone and

quartering techniques due to the high moisture content or high cohesiveness of the waste, recommend kneading techniques be pursued. First place the sample into a clean noncontaminating bag, and knead materials thoroughly to mix the sample.

E.2.3 Potential problems.

E.2.3.1 The true homogenization of soil, sediment, or sludge samples may be difficult to accomplish under field conditions. However, the homogenizing techniques may be evaluated with the use of a noninterfering dye. The noninterfering dye should be added to the sample medium prior to homogenizing procedures. The resulting distribution of the dye throughout the sample medium during the mixing will indicate the effectiveness of the procedures and areas requiring further mixing.

E.2.3.2 Another important aspect of obtaining a representative sample is to employ proper subsampling techniques. Recommend as a final step of the mixing that the material as a whole be subsampled as equally as possible. This may be accomplished by the procedures already noted or as follows. Flatten the piled material into an oblong shape. Using a flat-bottomed scoop, collect a strip of material across the entire width of the short axis. Repeat this procedure at evenly spaced widths until the sample containers are filled If the material is cohesive, the solid medium may be flattened, and cut into cubes. Collect random cubes into a subsample, which will be rekneaded and placed into the appropriate sample containers.

### E.3 Compositing Samples

E.3.1 Scope and application This instruction provides information on the various types of composite sampling techniques and the proper procedures to obtain a composite sample. The technique of compositing discrete samples is typically employed when the site under investigation is quite large to improve the precision (lower the variance) of the estimated average contaminant concentrations, especially when contamination exhibits a short-range heterogeneity, and to decrease the probability of making a wrong decision based on limited data Consultation with data users should be done to determine the appropriateness of applying compositing schemes to meet project objectives. Compositing scenarios that employ a retesting scheme may also be effective in identifying hot spots if a majority of the discrete samples are anticipated to be nondetect and there is adequate sensitivity of the analyses. In this case, the maximum number of discrete samples composited should be determined based on the dilution factor imposed and the sensitivity of the analyses in relation to the project decision level. Compositing schemes are of most benefit when analytical costs are high or analysis is time-consuming relative to sampling costs. Composite sampling may also decrease overall sampling and analytical costs. Composite sampling is not specific to one matrix. Rather it can be utilized for solid, semisolid, liquid, and air matrices.

E.3.2 Compositing techniques. Composite samples consist of a series of discrete grab samples that are mixed together to characterize the average composition of a given material. The discrete samples used to make up a composite sample are typically of equal volume, but may be weighted to reflect an increased flow or volume. Regardless, all discrete samples must be collected in an identical fashion. Likewise, the number of grab samples forming a composite should remain consistent (i.e., a number and pattern for collection of grab samples within a grid should be selected and, for a given grid size, should not be changed). Five types of composite samples are discussed in the following sections.

E.3.2.1 Flow-proportioned composite. Flow-proportional composite samples are collected proportional to the flow rate during the compositing period by either a time-varying/constant volume or a time-constant/varying volume method. This type of sampling is usually associated with wastewater or storm water runoff sampling. To enhance the representativeness of the flow-proportioned composite sample, suggest collection using an automatic sampler that is paced by a flowmeter. Automatic samplers reduce human error, and can directly correlate flow with both sample size and time. Figure E-1a and c illustrate flow-proportioned composite sampling.

E.3.2.2 Time composite. A time composite sample is composed of a varying number of discrete samples collected at equal time intervals during the compositing period. The time composite sample is typically used to sample wastewater and streams, and in some air sampling applications. Time composite samples are typically obtained using automated programmable samplers. When a large number of locations must be sampled, automatic samplers may be set up to sample these locations simultaneously with minimal supervision and costs. In hazardous situations, use of automatic samplers can reduce personnel contact with hazardous waste streams or with potentially dangerous sampling environments. The disadvantages of automatic sampling equipment are its high cost and extensive maintenance requirements. These disadvantages can be offset by reduced labor requirements, proper maintenance, and the proper choice of equipment. When access to the waste stream is relatively easy and sufficient labor is available, manual methods are also quite effective. The most significant disadvantage of manual sampling is that it is labor-intensive, particularly with respect to long-term composite sampling. Figure E-1b illustrates equal time compositing.

E.3.2.3 Areal composite. Areal composite samples are samples collected from individual grab samples collected in an area or on a cross-sectional basis. Areal composites are made up of equal volumes of grab samples where all grabs are collected in an identical manner Areal composite sampling is typically used for estimating average contaminant concentrations in surface soils or sediments. This is especially

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Figure E-1. Composite sampling methods

useful when contaminants are present in a nugget form (i.e., TNT chunks, lead shot, etc.), exhibiting large differences in concentration in a small area (short-range heterogeneity). Grid sizes should be kept moderate (1.5 to 3 m (<5 to 10 ft) in diameter), if project objectives and intended use of the data are to maintain aspects of a "discrete" sample while providing better overall coverage. Reference Jenkins et al. (1996a) for additional details on the use of short range areal composite sampling techniques.

E.3.2.4 Vertical composite. Vertical composite samples are also collected from individual grab samples but taken from a vertical cross section. Vertical composites are also made up of equal volumes of grab samples where all grab samples are collected in an identical manner. Vertical profiles of a soil borehole or sediment columns are examples of vertical compositing.

E.3.2.5 Volume composite. Volume composite samples are collected from discrete samples whose aliquot volumes are proportional to the volume of sampled material. This type of composite is usually

associated with hazardous waste bulking operations, where the composite sample is intended to represent the combined or bulked waste. Discrete samples are typically combined within a group of compatible wastes to undergo physical and chemical testing to define disposal options or determine acceptability at a treatment, storage, and disposal facility.

E.3 3 Compositing grab samples. In general, compositing grab samples lends itself to lowering analytical costs because it reduces the number of analyses Collecting composite samples also requires project-specific decisions for several key points, including the type of composite sampling technique that will meet the project needs (i.e., time composite, areal composite, etc.); the total number of composite samples needed; the number of grab samples in each composite; and the size and pattern of the sampling grid. These issues may depend on the size of the area under investigation, the nature of the contaminants, and the position of the regulators. Good documentation of sampling locations is also essential in all field sampling, particularly when several grab samples are being homogenized to form a composite should be analyzed individually to determine the actual distribution of the contamination. Procedures should be established between the project manager and the laboratory to ensure that holding times for the discrete grab samples are not exceeded. However, caution should be exercised when reviewing this type of confirmatory analysis due to the lag time between sample analyses and expiration of the holding times of the samples.

E.3.3.1 Solid matrix. Composite samples should be prepared as follows:

- Collect discrete grab samples using the appropriate instructions as outlined in Appendices C and D. To obtain a representative composite sample, it is important that all grab samples are collected in identical fashion.
- Homogenize the individual discrete samples as outlined in Instruction E-2, and place them into properly labeled sample containers.
- Assemble the sample containers that contain the grab samples that will make up a specific composite sample.
- Remove an appropriate volume of discrete sample (aliquot) from each sample container and place it into a clean stainless steel mixing bowl. Each aliquot amount should be taken in an identical fashion to facilitate representativeness. Avoid generating excess contaminated soil when possible.
- Homogenize the aliquots as described in Instruction E-2.
- Remove sample amounts from the homogenized composite sample and place them into the proper containers for shipment to the laboratory.
- Place the individual homogenized discrete samples in proper storage conditions after aliquots are
  removed for compositing, when a retesting scheme is employed, or if it is of benefit to the project.
  If the composite sample results do not appear to be accurate or if evidence of contamination exists,
  subsequent analyses of the individual grab samples that composed the composite may confirm the
  results and provide discrete information.

E 3.3.2 Liquid matrix. The proparation of liquid matrix composite samples is typically easier than that of solid matrices due to the tendency of liquids to homogenize easily. Also, it is common practice to send liquid grab samples to the laboratory for compositing because of the difficulties in handling larger sample volumes (4 to 16 L (1 to 4 gal) for a typical wastewater sampling event) and to minimize the potential

to introduce contaminants. When liquid composite samples are to be generated in the field, the following procedure should be used:

- Assemble all sample containers that contain the grab samples that will make up a specific composite sample.
- Shake or stir the individual containers to homogenize.
- Using clean glass or disposable pipets, deliver aliquots of the homogenized grab samples directly
  into a sample container to be sent to the laboratory. (It will require five 200-mL (7-fl-oz) aliquots
  from five discrete grab samples to generate a 1,000-mL (33-fl-oz) composite sample).
- Seal the container and shake well to mix. Avoid stirring samples if possible to lower the potential of introducing contaminants.
- At some sites it may be beneficial to save and store the individual homogenized grab samples after aliquots are removed for compositing. If the composite sample results do not appear to be accurate, subsequent analyses of the individual grab samples that composed the composite may confirm the results. Confirmatory analyses of these samples would likely be for informational purposes only since the holding times of the samples may have expired.

E.3.4 Potential problems.

E.3.4.1 Compositing does not allow the spatial variability of contamination or discrete information to be determined. Additional analyses of the individual grab samples are required.

E.3.4.2 Low concentrations of contaminants in individual grab samples may be diluted so that the total composite concentration is below the detection limit. In this case, the existence of the contamination in individual samples would go unnoticed. Therefore, the maximum number of discrete samples composited should be based on the dilution factor from the compositing and the analytical sensitivity in comparison to the project decision level and sensitivity requirements.

E.3.4.3 When the sampled medium is not amenable to mixing techniques (samples are moist and clayey), it may be very difficult to create a homogeneous sample mixture. Consequently, the resulting composite may not represent an average of all the grabs.

E.3.4.4 Compositing techniques should not be employed when chemical interactions may diminish the integrity of the sample (i.e., VOC samples).

E.3.4.5 Compositing schemes are not efficient when the goal is to identify hot spots and there is a high probability that the discrete samples contain detectable concentrations. The amount of retesting may be significant to achieve the objectives.

E.3.4.6 Compositing schemes are not efficient if analytical costs are low.

E 3.4.7 Obtaining samples by an automatic sampling device is typically difficult for the first-time user. However, after the sampler has become familiar with the sampling device and any problems have been addressed, these devices prove to be quite reliable.

### Appendix C

Columbia Analytical Services USACE MRD HTRW Laboratory Certification



### DEPARTMENT OF THE ARMY CORPS OF ENGINEERS HTWO CENTER OF EXPERTINE 12365 WEST CENTER OND OWARD NEBFORM 88164-1889

### March 21, 2002

Hazardous, Toxic and Radioactive Waste Center of Expertise

Columbia Analytical Services ATTN: Lee E. Wolf 1317 South 13th Avenue Kelso, WA 98626

Gentlemen.

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This correspondence addresses the recent evaluation of Columbia Analytical Services of Kelso, WA, by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below-

METHOD	PARAMETERS	MATRIX <sup>(1)</sup>
300 Series	Anions <sup>(4)</sup>	Water <sup>(2)</sup>
9010B/9012A	Cyanide	Water <sup>(2)</sup>
9013/9012A	Cyanide	Solids
8330	Explosives	Water <sup>(2)</sup>
8330	Explosives	Solids <sup>(2)</sup>
8151A	Herbicides	Water <sup>(2)</sup>
8151A	Herbicides	Solids
6010B/7000A	TAL Metals <sup>(3)</sup>	Water <sup>(2)</sup>
6010B/7000A	TAL Metals <sup>(3)</sup>	Solids <sup>(2)</sup>
6020/7470A	TAL Metals <sup>(3)</sup>	Water <sup>(2)</sup>
6020/7471A	TAL Metals <sup>(3)</sup>	Solids <sup>(2)</sup>
8081A	Organochlorine Pesticides	Water <sup>(2)</sup>
8081A	Organochlorine Pesticides	Solids
8082	Polychlorinated Biphenyls	Water <sup>(2)</sup>
8082	Polychlorinated Biphenyls	Solids <sup>(2)</sup>
8310	PAHs	Water <sup>(2)</sup>
8310	PAHs	Solids
8270C-SIM	PAH-SIM	Water

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8270C-SIM	PAH-SIM	Solids
314.0	Perchlorates	Water <sup>(2)</sup>
314.0	Perchlorates	Solids
8270C	Semivolatile Organics	Water <sup>(2)</sup>
8270C	Semivolatile Organics	Solids <sup>(2)</sup>
9060	TOC	Water <sup>(2)</sup>
9060M	TOC	Solids
AK 101, 102, 103	TPH - GRO/DRO/RRO	Water <sup>(5)</sup>
AK 101, 102, 103	TPH - GRO/DRO/RRO	Solids <sup>(5)</sup>
8021B	Volatile Organics	Water <sup>(2)</sup>
8021B	Volatile Organics	Solids
8260B	Volatile Organics	. Water <sup>(2)</sup>
<u>8260B</u>	Volatile Organics	Solids

Remarks:

1)

'Solids' includes soils, sediments, and solid waste.

- 2) The laboratory has successfully analyzed a performance evaluation sample for this method/matrix.
- TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.
- 4) Amons: nitrate, ortho-phosphate, chloride, sulfate, and fluoride.
- 5) Approval for this parameter is based on review of SOPs only

Based on the successful analysis of the performance evaluation samples and the outcome of the laboratory audit conducted by the Navy on June 13, 14 & 15 June, 2001, your laboratory will be validated for sample analysis by the methods listed above. Note that any corrective action committed to by your laboratory as a result of the Navy inspection will also apply to this USACE validation. The period of validation is 24 months and expires on March 21, 2004.

The USACE reserves the right to conduct additional laboratory inspection or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

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Any questions of comments can be directed to Richard Kissinger at (402) 697-2569. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

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Sincerely,

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Director, USACE Hazardous, Toxic and Radioactive Waste Center of Expertise

### Appendix D

**Electronic Data Deliverable Specification** 

# Electronic Data Deliverable Format for CH2M HILL

The electronic data deliverable (EDD) file from the laboratory will be a comma-delimited ASCII (CDA) file in the format listed below. There will be one file per hard copy report and the filename of the EDD file will be in the format REPORTID.txt or REPORTID.csv, where REPORTID is the hard copy report identifier of sample delivery group.

The first row of the EDD will contain the 47 field name values as listed in the EDD Specification Table

The EDD Specification Table lists the attributes of the columns for each row of the CDA file. The fields should be reported in the order indicated.

mm/dd/yyyy), or time (24-hour format hh:mm). If the field is conditional or optional and there is no value to be reported, report a The Data Type column describes the value in the field as either text (alphanumeric), number (numeric only), date (format: null (i.e., no) value. For a text field, do not report a zero-length string (i.e., "").

The Data Length column contains the maximum length of a text value for the particular data field.

The Rqmt column contains a code indicating whether the value is required (R) for all rows, optional (O) for all rows, or conditional (C) and depends on the type of result reported.

Laboratory Electronic Deliverable Format for CH2M HILL, version 4.00 Sources: Vito D'Aurora/RDD, Ed Svastits/GNV March 6, 2000 Revision

### Modification Notes:

## Changes to February 9, 2000 Revision:

- Change the description of the QAQCType field (Field No. 6) to clarify how diluted samples should be reported. Ŀ,
- Change the description of the LRType field (Field No. 7) to allow for multiple dilutions, re-analyses, and confirmation sample analyses. Also change the example values to reflect this change. N
  - Change the description of the AnalysisMethod field (Field No. 10) to correct grammatical error. ĉ
- Minor typographical/grammatical changes in the descriptions of the ExtractDate and ExtractTime fields (Field Nos. 15 and 16). 4
- Change requirement of the LabLotCtINum field (Field No. 20) from Required to Conditional. If there is no preparation, then the value in this field should be blank. ഗ
  - Change data type of the Result field (Field No. 24) from Number to Text, length of 10. Clarify the requirement of a text value in the field description. ó.
    - Change the description of the MDL field (Field No. 28) to clarify the contents of the field.
    - Change the description for the UpperControlLimit and LowerControlLimit fields (Field Nos. 35 and 36) to explain when a value is required in those fields. r, ∞
      - Change the description of the MDLAdjusted field (Field No. 39) to clarify the contents of the field 6.
- Change the requirement of the SampleDescription field (Field No. 41) from Required to Conditional. Lab QC samples method blanks, blank spike, blank spike duplicates) do not appear on the COC 10.
  - Change the description of the CalRefID field (Field No. 47) to clarify the contents of the field 11.

		:		EDD Speci	fication Table
Field	Field	Data	Data	Rqmt	Description and
Number	Name	Type	Length		Comments
1	VersionCode	text	15	R	Code identifying the version of the EDD deliverable.
2	LabName	text	10	R	Identification code for the laboratory performing the work. This
					value is used to distinguish among different facilities.
3	SDG	text	8	R	Sample delivery group designation. Always populated for all
					samples, including QC.
4	FieldID	text	13	R	Client sample ID as appears on COC with optional lab-assigned
					suffixes and/or prefixes to make it unique. If the sample identifier
					on the COC and the prefix/suffix is greater than 13 characters,
					abbreviate the value but make it unique. For laboratory QC samples
					(i.e., method blanks, lab control samples), use a unique lab sample
					identifier.
ъ	NativeID	text	13	R	Client sample ID, exactly as on the COC. No prefix or suffix
					allowed. Used to identify the native sample from which other
					samples are derived (e.g., QAQCType = "LR", "MS", or "SD"). For
					laboratory QC samples (i.e., method blanks, lab control samples),
					use a unique lab sample identifier. For lab blank spike (and blank
					spike duplicate) samples, use the FieldID value that was assigned to
					the associated method blank.

				EDD Speci	fication Table
Field Number	Field Name	Data Tvpe	Data Length	Rqmt	Description and Comments
φ	QAQCType	text	77	Х	This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of "N" (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines). Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of "LR" and a LRType value of "DL" (see LRType, below).
2	LRType	text	n	U	This is the code for laboratory replicate sample type. Values are: blank (if QAQCType value is not "LR"), "DL" (dilution), "RE" (re-analysis), "D" (inorganic duplicate), "CF" (confirmation). For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (i e., "RE", "RE2", "RE3", etc.).
œ	Matrix	text	പ	R	Sample matrix code. Valid values are as follows: "AIR", "WATER", "SOIL", unless otherwise provided by the project data manager and marked on the COC. The use of "liquid", "solid", etc. for lab QC is not allowed.
6	LabSampleID	text	20	R	Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: "D97-1111RE" is acceptable.
10	AnalysisMethod	text	20	R	Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as "EPA" should not be used.

				EDD Speci	fication Table
Field	Field	Data	Data	Rqmt	Description and
Number	Name	Type	Length		Comments
11	ExtractionMethod	text	20	R	Preparation method code. A value in this field is required. If the preparation is described in the method, use "METHOD". If there is
					no separate preparation required, use "NONE" Note that Total and
					Dissolved metal analyses are differentiated by the value in this
					column. Note that Total, TCLP, and SPLP analyses are now
					differentiated by the value in the LeachMethod column (see below).
12	SampleDate	date		ပ	Date of sample collection. Value is required for all samples sent to
					the laboratory and samples derived from those samples. Format:
					mm/ dd/ yyyy
13	SampleTime	time		υ	Time of sample collection. Value is required for all samples sent to
					the laboratory and samples derived from those samples. 24-hour
					format: hh:mm
14	ReceiveDate	date		υ	Date of sample receipt in the lab. Value is required for all samples
					sent to the laboratory and samples derived from those samples.
					Format: mm/dd/yyyy
15	ExtractDate	date		υ	Date of sample preparation (extraction or digestion). Value is
					required if the ExtractionMethod field value is other than "NONE".
					Format: mm/dd/yyyy
16	ExtractTime	time		ပ	Time of sample preparation. Value is required if the
					ExtractionMethod field value is other than "NONE". 24-hour
					format: hh:mm
17	AnalysisDate	date		R	Date of sample analysis. Value is required for all records. Format:
					mm/dd/yyyy
18	AnalysisTime	time		R	Time of sample analysis. Value is required for all records. 24-hour
					format: hh:mm
19	PercentSolids	number		R	Percent solids within the sample. Should be zero for water samples.

				EDD Speci	ification Table
Field Number	Field Name	Data Type	Data Length	Rqmt	Description and Comments
50	LabLotCtINum	text	10	U	Identifier of an autonomous group of environmental samples and associated QC samples <b>prepared</b> together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank.
21	CAS	text	20	С	CAS number of analyte, if available.
ក	ParamID	text	12	R	Parameter identifier code for the parameter listed in the Analyte field.
33	Analyte	text	60	R	Name of analyte, chemical name.
24	Result	text	10	R	Result of the analysis. Surrogate analytes will be reported in units of
					percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending
					on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	number		υ	"100" for surrogates; "0" (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc.
26	Units	text	10	R	Units of measure used in the analysis. Report "PERCENT" for surrogate analytes and concentration units for all others.
27	Dilution	number		R	Total dilution reported in the analysis. Default value should be 1
					oute). This value should reneat changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis).
28	MDL	number		υ	Minimum detection limit adjusted for preparation and dilution.
					Note that this value may be the intention detection intuit of the instrument detection limit, depending on the method and the project requirements. This value is <u>not</u> adjusted for percent moisture.
29	RL	number		C	Reporting limit adjusted for preparation and dilution. Value is <u>not</u> adjusted for percent moisture. Equivalent to PQL.
30	LabQualifier	text	6	R	Lab qualifier for the results, as reported on the hard copy. Use "=" as first (or only) qualifier value for detected results.

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				EDD Speci	fication Table
Field	Field	Data	Data	Rqmt	Description and
Number	Name	Type	Length		Comments
31	Surrogate	text	1	R	Is the chemical a surrogate? Report " $Y$ " for yes or "N" for no.
32	Comments	text	240	0	Comment field
33	ParValUncert	text	16	J	Radiological parameter value uncertainty.
34	Recovery	number		ပ ပ	Percent recovery for MS, SD, LCS, and surrogate compounds.
35	LowerControlLimit	number		J	Lower control limit value for spiked compounds, expressed in units
				·	of Percent. A value in this field is required if there is a value in the
					Recovery field (Field No. 34).
36	UpperControlLimit	number		C	Upper control limit value for spiked compounds, expressed in units
					of Percent. A value in this field is required if there is a value in the
					Recovery field (Field No. 34).
37	Basis	text	1	R	Weight basis for soil (or solid) sample analysis. Use "D" for dry-
					weight basis, "W" for wet-weight basis, or "X" if not applicable.
38	ConcQual	text	1	R	Concentration qualifier. Use "=" for detects, "J" for estimated value
					(value between detection limit and reporting limit), "U" for
					undetected result, or "E" for exceeded result.
39	MDLAdjusted	number	-	υ	Minimum detection limit adjusted for preparation, dilution and
					percent moisture. See the description of the MDL field (Field
			_		No. 28) for an explanation of the contents of this field.
40	RLAdjusted	number		C	Reporting limit adjusted for preparation, dilution and percent
					moisture. Equivalent to PQL
41	SampleDescription	text	20	с U	Full sample identifier value as it appears on the COC. In some cases,
	•				this may be the name of the sampling location instead of the sample.
					Required for all samples that are either collected in the field and
			•••••		specified on the COC, or derived from samples that are collected in
					the field and specified on the COC.
42	LeachMethod	text	20	R	Analytical method used for leaching the sample. This applies to
					TCLP, SPLP, or other leaching or pre-extraction leaching
					procedures. Use "NONE" if the sample was not leached.

				EDD Speci	ification Table
Field	Field	Data	Data	Rqmt	Description and
Number	Name	Type	Length		Comments
43	LeachDate	date		υ	Date that the leaching method was performed (start date for multi-
					date leaching procedures). Value is required if the LeachMethod field value is other then "NONE". Format: mm/dd/vvvv.
44	LeachTime	time		U	Time that the leaching procedure started. Value is required if the
					LeachMethod field value is other then "NONE". 24-hour format:
					hh:mm.
45	LeachLot	text	20	υ	Identifier of an autonomous group of environmental samples and
					associated QC samples leached at the same time. If the sample was
					not leached, leave this field blank.
46	AnalysisLot	text	20	R	Identifier of an autonomous group of environmental samples and
					associated QC samples analyzed together. A value in this field is
					mandatory (i.e., it should not be blank).
47	CalRefID	text	20	υ	Identifier of a group of environmental and QC samples linked by a
					common set of calibration records. All results with the same
					CalRefID value will have had the same initial calibration run.

Each row is uniquely identified by the values in the following fields:

- FieldID
- AnalysisMethod
- ExtractionMethod
  - LeachMethodParamID

If an analytical sample must be diluted or reanalyzed and reported in addition to the original analytical sample, the diluted or reanalyzed sample should have a FieldID value that is different that that of the original sample. This can be accomplished through the addition of a suffix to the original FieldID that establishes a new and unique FieldID for the associated records.

## **Example Valid Values**

The project data manager will provide the laboratory with a list of valid values that the laboratory will use in constructing the EDD. Listed below are some example valid values.

Field Name	Valid Value	Meaning
VersionCode	4.00AFCEE3	Format 4.00, AFCEE data values. LabQualifier field contains the laboratory qualifier values defined in the AFCEE QAPP, version 3.0.
VersionCode	4.00EPACLP	Format 4.00, EPA data values. LabQualifier field contains the standard EPA CLP lab qualifiers.
QAQCType	Z	Normal, environmental sample
QAQCType	LB	Laboratory method blank
QAQCType	WS	Laboratory matrix spike sample
QAQCType	SD	Laboratory matrix spike duplicate
QAQCType	LR	Laboratory replicate (dilution, re-analysis, duplicate)
QAQCType	BS	Laboratory method blank spike
QAQCType	BD	Laboratory method blank spike duplicate
LRType	DL	First dilution sample
LRType	DL2	Second dilution sample
LRType	DL3	Third dilution sample
LRType	RE	First re-analysis/re-extraction sample
LRType	RE2	Second re-analysis/re-extraction sample

LK1ype LRType LRType LRType LRType LRType AnalysisMethod AnalysisMethod AnalysisMethod AnalysisMethod ExtractionMethod ExtractionMethod ExtractionMethod ExtractionMethod ExtractionMethod ExtractionMethod ExtractionMethod	kes D CF CF2 CF3 CF3 SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW8260A SW1311 DISWAT SW3510 SW3540 SW3540	Intra re-analysis/re-extraction sample Inorganic duplicate sample First confirmation analysis sample Second confirmation analysis sample Second confirmation analysis sample Third confirmation analysis sample Volatiles by method 8260A in EPA SW846. Semivolatiles by method 8270 in EPA SW846. ICP metals by method 6010 in EPA SW846. ICP metals by method 7060 in EPA SW846. Field filtration for dissolved metals analysis Field filtration for dissolved metals analysis of samples. TCLP extraction TCLP extraction Distilled water extraction for analytes in soil samples. Soxhlet extraction Soxhlet extraction
ExtractionMethod	TOTAL	Digestion of unfiltered waters for total metals analysis Actione
ParamID	ACE	Arsenic

Field Name	Valid Value	Meaning
ParamID	BHCGAMMA	gamma-BHC (Lindane)
ParamID	BZ	Benzene
ParamID	CDS	Carbon disulfide
ParamID	PB	Lead
ParamID	PHENOL	Phenol
ParamID	SE	Selenium
ParamID	TCE	Trichloroethene

### Appendix E

### **Example Degradation Pathways of PCP**

FIGURE B-1 Potential Reductive Dechlorination Pathway for PCP



Fig. 5 Proposed a pathway for anaerobic dechlorination and degradation by the PCP-degrading granules. Part of the PCP was dechlornated through 2,4,6-trichlorophenol (TCP), 2,4-dichlorophenol (DCP), and 2-chlorophenol (CP) or 4-CP to phenol and phenol was further degraded to methane and CO<sub>2</sub> (*o ortho* dechlorination; *m meta* dechlorination; *p para* dechlornation)

**Source:** Kennes, C., W M. Wu, L. Bhatnager, and J.G. Zeikus. 1996. Anaerobic dechlorination and mineralization of pentachlorophenol and 2,4,6-trichlorophenol by methanogenic pentachlorophenol-degrading granules Applied Microbiology and Biotechnology, Volume 44, p. 805.

FIGURE B-2 Aerobic Degradation Pathway for PCP



**Source:** Zeng, Yuemo 2003. University of Minnesota. <u>http://umbbd.ahc.umn.edu/pcp/pcp\_map.html</u>
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#### Appendix F

#### Excerpts from the USACE EM385-1-1

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b The operating deck of floating piledrivers shall be so guarded as to prevent piles which are being hoisted into driving position from swinging in over the deck.

16 L 08 Hoisting and moving pile.

 All employees shall be kept clear when pliing is being hoisted into the leads.

b. Hoisting of steel piling shall be done by use of a closed shackle or other positive attachment that will prevent accidental disengagement.

 c. Taglines shall be used for controlling unguided piles and free-hanging (flying) hammers. d. Hammers shall be lowered to the bottom of the leads while the piledriver is being moved 16 L.09 When driving jacked piles, all access pits shall be provided with ladders and bulkheaded curbs to prevent material from falling into the pit.

16.L 10 When it is necessary to cut off the tops of driven piles, piledriving operations shall be suspended except where the cutting operations are located at least twice the length of the longest pile from the driver.

16.L 11 Pile extraction.

 If pulling cannot be pulled without exceeding the load rating of equipment, a pile extractor shall be used.

b. When pulling pilling, crane booms shall not be raised more than 60° above the horizontal. c. Piling shall not be pulled by tipping the crane, releasing the load brake momentarily, and catching the load before the crane

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has settled

## **16.M DRILLING EQUIPMENT**

<u>16.M.01</u> Applicability: the requirements of this Section (16 M) are applicable to rock, soil, and concrete drilling operations.

16.M.02 Earth drilling equipment shall be operated, inspected, and maintained as specified in the manufacturer's operating manual: a copy of the manual will be available at the job site. 16.M.03 Prior to bringing earth drilling equipment on the job site, a survey shall be conducted to identify overhead electrical hazards and potential ground hazards, such as contact with unexploded ordnance, hazardous agents in the soil, or underground utilities.

a. The location of any overhead or ground hazards shall be identified on a site layout plan.

b. The findings of this survey and the controls for all potential hazards shall become a part of the hazard analysis for the activity. 16.M.03 The hazard analysis for an earth drilling activity will not be accepted unless:

 a. It contains a copy of the MSDS for the drilling fluids, if equired.

b. It meets the requirements of 01 A.09, and

c. It indicates that the site layout plan specified in 16 M 02 will become a part of the analysis, and will be covered at the preparatory inspection (pre-activity safety briefing), when the plan has been completed.

6.M.04 Training.

a. All members of drilling crews shall be trained in:

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 the operation, inspection, and maintenance of the equipment,
 the safety features and procedures to be used during

operation, inspection, and maintenance of the equipment, and (3) overhead electrical line and underground hazards.

b. This training will be based on the equipment operating manual and the hazard analysis for the activity. 16.M.05 Earth driling equipment shall be equipped with two easily-accessible emergency shutdown devices, one for the operator and one for the helper. 16.M 06 Clearance from electrical sources shall be as specified in 11.E 05.

 Driling equipment shall be posted with signs warning the operator of electrical hazards b. The equipment operator shall ascertain proper clearance before moving equipment. Clearance shall be monitored by a spotter or by an electrical proximity warning device.

16.M.07 Moving equipment.

 Before earth drilling equipment is moved the travel route shall be surveyed for overhead and terrain hazards, particularly overhead electrical hazards. b Earth driling equipment shall not be transported with the mast up. The exception is movement of the equipment required in drilling a series of holes, such as in blasting, if the following conditions are satisfied:

 movement is over level, smooth terrain,
 the path of travel has been inspected for stability and the absence of holes, other ground hazards, and electrical hazards; and

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(3) the travel distance is limited to short, safe distances.

16.M.08 Equipment set-up.

 Equipment shall be set-up on stable ground and maintained level: cribbing shall be used when necessary.

b. Outriggers shall be extended per the manufacturer's specifications. c When drilling equipment is operated in areas with the potential for classification as a confined space, the requirements of Section 6.1 shall be followed.

6.M.09 Equipment operation.

 Weather conditions shall be monitored: operations shall cease during electrical storms or when electrical storms are imminent. b. Drill crew members shall not wear loose clothing, jewelry, or equipment which might become caught in moving machinery.

c. Auger guides shall be used on hard surfaces

d. The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment before starting or engaging equipment.  The discharge of drilling fluids shall be channeled away from the work area to prevent the ponding of water.

 Hoists shall be used only for their designed intent and shall not be loaded beyond their rated capacity. Steps shall be taken to prevent two-blocking of hoists. g. The equipment manufacturer's procedures shall be followed if rope becomes caught in, or objects pulled into, a cathead.

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h. Drill rods shall be neither run nor be rotated through rod slipping devices: no more than 0.3 m (1 ft) of drill rod column shall be hoisted above the top of the drill mast. Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a <u>rod</u> slipping device.

 Dust shall be controlled. <u>When there is potential for silica</u> <u>exposure, the requirements contained in Appendix C shall be</u> <u>implemented.</u>  Augers shall be cleaned only when the rotating mechanism is in neutral and the auger stopped: long-handled shovels shall be used to move cutting from the auger

k. Open boreholes shall be capped and flagged; open excavations shall be barricaded. I. Means (e.g., guard around the auger; barricade around the perimeter of the auger, electronic brake activated by a presence-sensing device) shall be provided to guard against employee contact with the auger.

m. The use of side-feed swivels collars on drill rods are restricted to those collars which are retained by either a manufacturer-design stabilizer or a stabilizer approved by a professional engineer.

### DEFINITIONS

Altered: any change to the original manufacturer's design configuration. These are (1) replacement of weight-handling equipment parts and components with parts or components not identical with the original (i.e., change in material, dimensions, or design configuration); (2) the addition of parts or components not previously a part of the equipment; (3) the removal of components which were previously a part of the load handling equipment; and (4) rearrangement of original parts or components.

Anti-two block (upper limit) device: a device which is activated by two-blocking and disengages the particular function whose movement is causing the two-blocking.

Articulating boom crane: a crane consisting of a <u>mainframe or</u> base, rotating mast, boom, and one or more operator's stations. The crane can be stationary or mounted on a vehicle, track, locomotive, etc., and is used to lift, swing, and lower loads.

Boom stop: a device used to limit the angle of the boom at the highest recommended position. Bridge: that part of a gantry or overhead crane which carries the trolley(s).

Cathead: a spool shaped attachment on a winch around which rope is wound for hoisting and pulling

Crane operator alds: devices which are used to assist a crane operator in the safe operation of the crane, including: two-block warning devices, two-block prevention devices, load and load moment indicator devices, boom angle and radius indicators, boom and jib stops, boom hoist disengaging devices, limit switches, drum rotation indicators, etc. Cribbing: a system of timbers, arranged in a rectangular pattern, used to support and distribute the weight of equipment.

Critical lift: a non-routine crane lift required detail planning and additional or unusual safety precautions. Critical lifts include lifts made when the load weight is 75% of the rated capacity of the crane; lifts which require the load will be lifted, swung, or placed out of the operator's view; of lifts made with more than one crane; lifts involving non-routine or technically difficult rigging arrangement; hosting personnel with a crane or derrick, or any lift which the lift or crane operator believe should be considered critical.

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cured prior to final placement in a structure.

Reshoring: the construction operation in which shoring equipment (also called reshores or reshoring equipment) is placed, as the original forms and shores are removed, in order to support partially cured concrete and construction loads. Ridge pole: the longitudinal board, set on end, which is tied to the upper ends of roof trusses

Roofing bracket: a bracket fastened to the roof or supported by ropes fastened over the ridge of the roof and secured to a suitable structural member,

Safety monitoring system: a safety system in which a competent person monitors the safety of all employees in a roofing crew and warms them when it appears to the monitor that they are unaware of the hazard or are acting in an unsafe manner. This competent person must be on the same roof as and within visual sighting distance of the employees and must be close enough to verbally communicate with the workers.

Shoring. a supporting member that resists a compressive force imposed by a load. Shore head a honzontal member fastened atop vertical shoring

Sill: a horizontal member placed on the foundation and upon which shores are supported. Tremie a pipe or tube through which concrete is placed under water.

Troweling machine: a device utilizing rotating trowels on radial arms and used in concrete finishing operations. Vertical slip forms: forms which are jacked vertically during the placement of concrete.

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### **SECTION 28**

## HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE (HTRW) AND <u>UNDERGROUND STORAGE TANK (UST)</u> ACTIVITIES

### 28.A GENERAL

28.A 01 The requirements in this section apply to:

 a. Clean-up operations, including initial investigations and assessments and underground tank removal, involving hazardous, toxic, and radioactive waste (HTRW) activities, and b. emergency operations in response to releases of hazardous substances at HTRW sites.

28.A.02 Hazard evaluation and control.

 HTRW activities shall be evaluated to identify hazards specific to the activity and to determine procedures appropriate for controlling employee exposure to those hazards. > See Section 28.C

b. Control procedures shall be implemented prior to initiating site activities

28.A.03 Employees who will be working on an HTRW activity shall be informed of any risks that have been identified.

a. Any information concerning the chemical, physical, or toxicological properties of each substance known or suspected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform, shall be made available to the affected employees prior to the commencement of their work activities Any MSDS developed for hazard communication may also be used.

 An information program shall be developed and implemented to inform personnel engaged in hazardous

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waste activities of the nature, level, and degree of exposure likely because of participation in such activities and the hazards of, and controls for, those exposures. This information program shall be part of the safety and health program (<u>SHP</u>).

 c. Contractors and subcontractors shall inform all employees engaged in HTRW activities of  any potential safety, health, fire, explosion, or other hazard of he activity:

(2) applicable requirements of the safety and health program; and

emergency response procedures.

28 A.04 Training > See Section 28.D

a. All employees working on an HTRW activity, and their supervisors and management responsible for the activity, shall receive training before they are allowed to engage in HTRW activities that could expose them to hazardous substances or safety or health hazards.

b. Personnel are prohibited from participating in, or <u>in the</u> <u>on-site supervision of</u>, HTRW activities unless they have been certified as having successfully completed the training to a level required by their <u>position</u> function and responsibilities. 28 A 05 Pre-entry brnefings shall be held for employees pror to their initiating any new or differing site activity and at such other times as necessary to ensure that employees are knowledgeable of the site-specific safety and health plan (SSHP) and activity hazard analysis and that the plan and analysis are being followed. > Briefings shall be documented per 01.B.03b

28.A.06 Medical surveillance shall be conducted in accordance with the requirements delineated in Appendix K; <u>employees</u> included in medical surveillance shall maintain documentation, in their possession or otherwise on site, of current medical status

## while they are engaged in site activities.

28.A.07 Inspections.

a. Inspections shall be conducted by the Site Safety and Health Supervisor or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health, acting on the behalf of the employer as necessary to determine the effectiveness of the SSHP. > See Section 01.A for inspection requirements

b. Deficiencies in the implementation or effectiveness of the SSHP shall be brought to the attention of the employer for correction. 28.A.08 Pror to initiating excavation, subsurface exploration shall be used to determine the location and depth of drums. Subsurface exploration shall not create additional hazards nor present a hazard to subsurface drums: the use of non-intrusive techniques shall be taken into consideration.

28 A.09 Drums and containers used during hazardous waste clean-up shall meet the appropriate DOT, OSHA, and EPA requirements.

28.A.10 Emergency operations.

 Emergency operations involving hazardous, toxic, or radioactive waste conducted at USACE facilities shall be conducted in accordance with 29 CFR 1910.120(q). b. Prior to performing emergency operations, all persons shall have successfully completed training specified in 29 CFR 1910.120(q)(6) to a level required by their <u>position</u> functions and responsibilities.

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## 28.B SAFETY AND HEALTH PROGRAM

28.B.01 When employees are engaged in HTRW activities (including preliminary assessments and underground tank work) a safety and health program shall be developed <u>and implemented</u>: existing written SHPs are acceptable if they are modified to cover the criteria in Table 28-1. **> See Table 28-1** 

a The SHP shall cover the items listed in Table 28-1 and provide for the identification, evaluation, and control of safety and health hazards and provide for emergency response for HTRW activities.

b. SHPs and SSHPs shall have a cover sheet for the names, titles, and signatures of the <u>qualified competent persons</u> <u>assigned by the employer to develop and review them</u>: a SHP or SSHP will not be considered to have been reviewed or accepted unless this cover sheet has all of the necessary signatures.

c. For government operations, the <u>SSHP</u> shall be made available to all contractor and subcontractor employees.

d. For contract activities, <u>the prime contractor shall integrate all</u> <u>subcontractor work activities into the SSHP, make the SSHP</u> <u>available to all contractor and subcontractor employees, and</u> <u>ensure</u> all subcontractors integrate provisions of the <u>SSHP</u> in their work activities.

 The <u>SSHP</u> shall be reviewed and updated as necessary in order to keep it current and effective. f. A project <u>SSHP</u> may be considered to satisfy the requirement for an accident prevention plan if the SHP covers all of the elements required of an accident prevention plan > See Section 01.A 28 B 02 A site control program (included in the SSHP portion of

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### **TABLE 28-1**

# SAFETY AND HEALTH PROGRAM OUTLINE REQUIREMENTS

3 Site-specific safety and health plan (SSHP) Addresses the safety and health b The site safety and health officer who has the responsibility and authority to a The general supervisor who has the responsibility and authority to direct all c Other personnel needed for the safety and health of HTRW operations and hazards of each phase of site activity and the procedures for their control The SSHP is developed from information obtained during site characterization and a Sefety and health risk or hazard analysis for each site task and operation environmental samping techniques and instrumentation to be used, including activities; identifies the methods, logistics, and resources for accomplishing c Personnel protective equipment program (including personal protective equipment requirements for site activities) and decontamination procedures. Organizational structure Establishes the safety and health policy for the emergency response, specifying their general functions and responsibilities procedures for communication, outlines requirements for safety and health enspections, safety and health meetings, and accident investigating and Comprehensive workplan Defines work tasks and objectives of the site employees, management, and supervisors, details the means, lines, and develop and implement the site-specific safety and health plan and verify project: specifies the lines of authority and the overall responsibilities of those tasks and objectives, and establishes personnel requirements for Emergency response plan, including necessary personal protective e. Frequency and type of air monitoring, personnel monitoring, and implementing the comprehensive workplan. methods of maintenance and calibration. Medical surveillance requirements, Confined space entry procedures
 h. Spill containment program, and analysis and addresses the following Employee training assignments, reporting in addition, identifies hazardous waste operations, defineated in the workplan, compliance, and equipment

control program

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the SHP) shall be developed during the planning stages of HTRW information becomes available. As a minimum, the site control dean-up activities and modified as necessary when new program shall include:

- a a site map and site work zones;
- requirements for use of the buddy system.
- c. requirements for site communications, including alert means for emergencies;

d. standing operating procedures and safe work practices (safe work practices shall be in the form of an activity hazard analysis); identification and phone numbers of the nearest emergency

assistance; and

site security procedures.

## 28.C. SITE CHARACTERIZATION AND ANALYSIS AND INITIAL SITE ENTRY

28.C.01 Preliminary evaluation.

nazards shall be conducted by a qualified person prior to site entry in order to determine the appropriate safety and health A preliminary evaluation of a site's characteristics and controis.

obtained prior to allowing employees to enter a site and shall be b. The following information, to the extent available, shall be included in this evaluation;

 location and approximate size of the site;
 description of the response activities and/or <u>position</u> tasks to be performed and the duration of planned employee activities; (3) site topography and accessibility by air and roads;

(4) safety and health hazards anticipated at the site and their chemical and physical properties;

(6) present status and capabilities of emergency response (5) pathways for hazardous substance dispersion; and

eams that would provide assistance to HTRW site employees.

the names and responsibilities of team members and leaders, and the procedures for contacting the team.

28.C.02 Detailed evaluation.

a. Immediately following initial site entry, a detailed evaluation of the site-specific hazards shall be performed by a qualified person.

verify the preliminary evaluation, to further identify existing site b. The results of the detailed evaluation shall be used to hazards, and to determine appropriate safety and health controls for the activities to be performed.

28.C.03 Hazard Identification.

could cause death of serious harm, shall be identified during the absorption hazards that are iDLH, and any other condition that All suspected conditions that may pose inhalation or skin preliminary survey and analyzed in the detailed evaluations.

established, the risks associated with these substances shall be identified and controls appropriate for the hazards shall be hazardous substances and health hazards have been Dnce the presence and concentrations of specific determined and implemented. > See 28.A.03

28.C.04 PPE shall be provided and used during initial site entry.

level, other published guidelines and information may be used a. Personal protective equipment shall provide protection to a published exposure levels for known or suspected hazardous identified during the preliminary evaluation. (If a hazard does not have a permissible exposure limit or published exposure as a guide to appropriate personal protective equipment.) evel of exposure below permissible exposure limits and protection against other known and suspected hazards substances and health hazards, and which will provide

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b If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary evaluation, an escape self-contained breathing apparatus of at least five minutes duration shall be carried by each employee during initial site entry.

c If the preliminary evaluation does not produce sufficient information to identify the hazards or suspected hazards at the site, an ensemble providing protection equivalent to Level B personal protective equipment shall be used for minimum protection and direct reading instruments shall be used as appropriate for identifying IDLH conditions.

### 28 C 05 Monitoring.

a. During initial site entry, the following monitoring shall be conducted when the preliminary evaluation indicates the potential for ionizing radiation or IDLH conditions or when the preliminary evaluation does not produce sufficient information to reasonably eliminate the possibility of these conditions:

 montoring with direct reading instruments for hazardous evels of ionizing radiation.

(2) air monitoring with appropriate direct reading test equipment or IDLH conditions, or

(3) visually observing for signs of actual or potential IDLH or other hazardous conditions. b. An on-going air monitoring program shall be implemented after site characterization has determined the site is safe for start up of activities. > See Section 28.F

### **28.D TRAINING**

28.D.01 All personnel performing on-site work activities in which they may be exposed to safety or health hazards resulting from hazardous waste operations shall have completed applicable

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training in compliance with 29 CFR 1910.120(e).

 a. Training shall be conducted by instructors who meet trainer qualifications of 1910.120(e)(5) b. Each employee successfully completing their training and field experience specified shall be certified as having successfully completed the necessary training and shall maintain a copy of the written certification at the project site. 28.D.02 Prior to conducting on-site HTRW activities, all USACE and contractor personnel shall successfully complete a 40-hour HTRW safety and health training course to be followed by an 8-hour annual refresher and/or 8-hour supervisors course as mandated in 29 CFR 1910.120(e). 28 D.03 Site-specific training. Employees shall be trained in the following:

 names of personnel and alternates responsible for site safety and health;

b. safety, health, and other hazards present on site;

c. use of personal protective equipment;

 work practices by which the employee can minimize risks from hazards;

e. safe use of engineering controls and equipment on the site;
 f. medical surveillance requirements, including recognition of

symptoms and signs indicative of overexposure to hazards;

decontamination procedures;
 h. emergency response plan, including the necessary personal protective equipment and other equipment;

I confined space entry procedures; and

j spill containment program.

28.D.04 Employees who are engaged in responding to hazardous emergency situations at HTRW sites that may expose them to hazardous substances shall be trained and drilled in responding to such emergencies. The frequency of training and

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drills shall be such that the employees maintain knowledge of and proficiency in the emergency response procedures.

# 28.E PERSONAL PROTECTIVE EQUIPMENT

28.E.01 A personal protective equipment program shall be developed as part of the SSHP. The program shall address:

 a. personal protective equipment selection based on site-specific hazards, b. the use and limitations of personal protective equipment,
 c. HTRW activity duration,

d. maintenance and storage of personal protective equipment

 decontamination and disposal of personal protective equipment,

f. personal protective equipment training and fitting.

equipment donning and doffing procedures.

h procedures for inspecting equipment before, during, and after use.

 evaluation of the effectiveness of the personal protective equipment program, and

 medical considerations, including work limitations due to temperature extremes. 28.E.02 Personal protective equipment selection shall be based on the performance characteristics of the equipment relative to:

a. the requirements and limitations of the site,

b the task-specific conditions and duration, and

c. the hazards and potential hazards identified at the site.

> See Section 5.E personal protective equipment requirements and Appendix L for description of levels of protection 28.E.03 The level of protection provided by personal protective equipment shall be increased when additional information on site conditions indicates that increased protection is necessary to

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reduce exposure below permissible exposure limits or published exposure levels for hazardous substances and health hazards

## 28.F MONITORING AND SAMPLING

28.F.01 A monitoring and sampling program shall be established as part of the SSHP. The program shall identify:

 a. the frequency and types of personnel and air monitoring and environmental sampling techniques and instrumentation to be used, and

b. methods of maintenance and calibration of monitoring and sampling equipment.

28.F 02 Initial and periodic monitoring.

a. Upon initial site entry, representative air monitoring shall be conducted to identify any IDLH condition, exposure above permissible exposure limits or published exposure levels, exposure over a radioactive material's dose limits, or other dangerous conditions. b. Perodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed, there is indication that exposure may have risen above permissible exposure limits or published exposure levels since prior monitoring, or for the following situations'

when work begins on a different portion of the site,
 when contaminants other than those previously identified are

being handled, (3) when a different type of activity is initiated, or

(4) when employees are handling leaking drums or containers

or working in areas with obvious liquid contamination.

28.F.03 Monitoring high-nsk employees.

a. After commencement of HTRW activities, the employer shall

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monitor those employees likely to have the highest exposures to hazardous substances and health hazards likely to be present above permissible exposure levels by using personal sampling frequently enough to characterize employee exposures. b. If the employees likely to have the highest exposure are over permissible exposure limits or published exposure limits, then monitoring shall continue to determine all employees likely to be above those limits.

c. The employer may use a representative sampling approach by documenting that the employees and chemicals chosen for monitoring are based on the criteria stated above. This requirement does not apply to employees engaged in site characterization activities covered by Section 28.C.

# 28.G UNDERGROUND STORAGE TANK REMOVAL

28 G 01 Prior to initiating the removal or disposal of an underground storage tank (UST) system, information required by 28 A 03 shall be provided to employees. Such information shall be used to select sampling techniques to verify the contents of the tank.

28.G 02 Sampling data shall be used to assess the hazards of the contents and determine controls appropriate for those hazards.

28.G.03 The removal or disposal of UST systems which contained petroleum or other hazardous substances shall be in accordance with the procedures of American Petroleum Institute (API) Recommended Practice 1604, Removal and Disposal of Used Underground Petroleum Storage Tanks. A copy of this publication will be used in developing the hazard analyses for UST system removal/disposal activities and shall be available at the job site.

28.G.04 Hazard analyses for the removal or disposal of an

underground storage tank (UST) system shall address the following:

 a. hazards of UST system contents and procedures for hazard control, to include explosion prevention;

- b. monitoring requirements and procedures;
- UST system draining, purging, and cleaning procedures,
   excavation safety requirements and procedures for blocking

free-standing tanks; e. procedures and safety precautions for disassembly, removal, and disposal of system; and

f. spill contingency planning.

# 28.H HANDLING DRUMS AND CONTAINERS

28.H.01 The handling of HTRW drums and containers shall be kept to the minimum necessary for. a. responding to problems which may affect safety and health,
 b. unstacking and orienting drums and containers for sampling.

 organizing drums and containers in staging areas to facilitate characterization and remedial actions.

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28.H.02 Site activities shall be organized to minimize the amount of drums or container movement.

28.H.03 Identification and inspection.

 Prior to handling or opening a drum or other container, efforts shall be made to identify their contents  Drums and containers shall be inspected and their integrity shall be assured prior to being moved. c. Drums or containers that cannot be inspected before being moved because of storage conditions (e.g., buried beneath the earth, stacked behind other drums, stacked several tiers high in

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a pile, etc.) shall be moved to an accessible location and inspected prior to further handling. d. Unlabeled drums and containers shall be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

28 H.04 Handling requirements.

a. Prior to movement of drums or containers, all employees exposed to the transfer operation shall be warned of the potential hazards associated with the contents of the drums or containers and their handling and instructed to minimize handling as much as possible. b. Where major spills may occur, a spill containment program shall be implemented to contain and isolate the entire volume of the hazardous substance being transferred: USDOT specified salvage drums or containers and suitable quantitues of proper absorbent shall be kept available and used in areas where spills, leaks, or ruptures may occur.

c Drums and containers that cannot be moved without rupture, leakage, or splitage shall be emptied into a sound container using a device classified for the material being transferred. d. Subsurface exploration shall be used to estimate the location and depth of buried drums or containers; soil or covering material shall be removed with caution to prevent drum or container rupture. > See 28.A.08

28.H 05 Opening drums or containers.

a. Where an airline respirator system is used, connections to the source of air supply shall be protected from contamination and the entire system protected from physical damage.

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b. Employees not involved in opening drums or containers shall be kept a safe distance from the drums or containers being opened.

c. If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation shall be placed between the employee and the drums or containers being opened to protect the employees in case of an accidental explosion. d. Controls for drum or container opening equipment, monitoring equipment, and fire suppression equipment shall be located behind the explosion-resistant barrier.  When there is a reasonable possibility of flammable atmospheres being present, material handling equipment and hand tools shall be of a type to prevent sources of ignition (e.g, non-sparking tools). f. Drums and containers shall be opened in such a manner that excess interior pressure will be safely relieved, if pressure cannot be relieved from a remote location, appropriate shielding shall be placed between the employee and the drums or containers to reduce the risk of employee injury.

 Employees shall not stand upon or work from drums or containers. 28.H.06 Material handling equipment used to transfer drums and containers shall be selected, positioned, and operated to minimize sources of ignition related to the equipment from igniting vapors released from drums or containers.

28 H.07 The following precautions shall be taken when drums or containers containing, or suspected of containing, shock sensitive waste are handled.

a. All non-essential employees shall be kept a safe distance

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from the area of transfer.

b. Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

c. An employee alarm system, capable of being perceived above surrounding light and noise conditions, shall be used to signal the commencement and completion of explosive waste handling activities. d. Continuous communications shall be maintained between the employee in charge of the immediate handling area and both the site safety and health supervisor and the command post until the handling operation in completed. Communication equipment or methods which could cause shock sensitive materials to explode shall not be used. e. Drums and containers under pressure, as evidenced by buiging or swelling, shall not be moved until the cause for excess pressure is determined and appropriate containment procedures have been implemented to protect employees from explosive relief of the drum.

f Drums and containers containing packaged laboratory wastes shall be considered to contain shock-sensitive or explosive materials until they have been characterized 28 H.08 When handling laboratory waste packs, the following precautions shall be taken in addition to the requirements of paragraph 28.H.07f.

a. Lab packs shall be opened only when necessary and then only by an individual knowledgeable in the inspection, classification, and segregation of the containers within the pack according to the hazards of the wastes. b. If crystalline material is noted on any container, the contents

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shall be handled as a shock sensitive waste until the contents are identified.

28.H.09 Sampling of drum and container contents shall be done in accordance with a sampling procedure which is part of the site-<u>specific</u> safety and health plan.

28.H.10 Shipping and transport.

 Drums and containers shall be identified and classified prior to packaging for shipment.

b. Drum or container staging areas shall be kept to the minimum number necessary to identify and classify materials safety and prepare them for transport. c. Bulking of hazardous wastes shall be permitted only after a thorough characterization of the materials has been completed.

28.H.11 Tank and vault procedures.

a. Tanks and vauts containing hazardous <u>substances</u> shall be handled in a manner similar to that for drums and containers, taking into consideration the size of the tank or vault.

b. Entry into tanks or vaults shall be avoided if possible. When entry is required, appropriate tank or vault entry procedures as described by the <u>site-specific</u> safety and health plan shall be followed.

## 28.1 DECONTAMINATION

28.1.01 Procedures for all phases of decontamination shall be developed, communicated to all employees, and implemented before any employee or equipment may enter areas on a site where potential exposure to hazardous substances exists. Decontamination procedures shall specify

EM 385-1-1 3 Sep 96  a. decontamination methods and procedures for testing and evaluating their effectiveness,

 b. the number and layout of decontamination stations and the decontamination equipment needed,

 c. procedures to prevent contamination of clean areas and to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances, d. procedures to be taken if the non-impermeable clothing of

an employee becomes wetted with hazardous substances, e. methods for disposing of clothing and equipment that are

not completely decontaminated, and f. methods for disposing of decontamination water and waste. 28.1.02 All employees leaving a contaminated area shall be decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated. 28.1.03 Decontamination procedures shall be monitored by the site safety and health coordinator to determine their effectiveness: when such procedures are found to be ineffective, site work shall immediately cease and remain shut down until the situation is correct.

28.1.04 Decontamination shall be conducted in geographical areas that will minimize the exposure of uncontaminated employees and equipment to contaminated employees or equipment. 28.1.05 All equipment and solvents used for decontamination shall be decontaminated or disposed of property.

28.1.06 Personal protective equipment.

 Personal protective equipment shall be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness

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 b. Unauthorized employees shall not remove protective equipment from change rooms. c. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potential harmful effects of exposures to hazardous substances. 28 1.07 Where the decontamination procedure indicates the need for regular showers and change rooms outside a contaminated area, or if clean-up or removal operations will require six months or more to complete, showers and change rooms shall be provided and meet the requirements of Section 2: if temperature effects prevent the use of water, then other effective means for cleansing shall be provided and used

## 28.J EMERGENCY RESPONSE

28.J.01 Emergency response plan.

 An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of hazardous waste activities.

 The plan shall be in writing and shall be available for inspection and copying. c. If the employees on a hazardous waste site are to be evacuated from the danger zone when an emergency occurs and are not permitted to assist in handling the emergency, an emergency plan, meeting the requirements of Section 01.E, may be used in lieu of an emergency response plan

28.J.02 The emergency response plan shalf address, as a minimum, the following:

a. pre-emergency planning,
 b. personnel roles, lines of auti

. personnel roles, lines of authority, and communication,

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safe distances and staging areas (safety zones) emergency recognition and prevention. ర

e. site security and control.

evacuation routes and procedures,

g decontamination procedures which are not covered by the site-specific safety and health plan,

h emergency medical treatment and first aid,

emergency alerting and response procedures,

. critique of response and follow-up, and

k. personal protective and emergency equipment,

m. procedures for reporting incidents to federal, state, and local . site topography, layout, and prevailing wind conditions, and

governments.

28 J 03 The emergency response plan shall be a separate section of the SSHP. 28.J.04 The emergency response plan shall be compatible and integrated with the disaster, fire, and emergency response plans of local, state, and federal agencies or, for work conducted on DOD installations, the installation.

regularly as part of the overall training program for site operations 28 J.05 The emergency response plan shalf be rehearsed > See 28.D.04

periodically and, as necessary, amended to keep it current with 28.J.06 The emergency response plan shall be reviewed new or changing site conditions or operations.

employees of an emergency condition, to stop work activities - if 28 J.07 An employee alarm system shall be installed to notify necessary, to lower background noise in order to speed communications, and to begin emergency procedures

be evaluated and appropriate steps taken to implement the site emergency, the incident and the site response capabilities shall 28.J.08 Based on the information available at the time of the

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emergency response plan.

## 28.K RESOURCE CONSERVATION AND RECOVERY ACT OPERATIONS

28.K.01 When Resource Conservation and Recovery Act (RCRA) (TSD) facility, the following programs shall be developed and operations are conducted at a treatment, storage, or disposal implemented

a safety and health program, designed to identify, evaluate, and control safety and health hazards, per Section 28.B,

- b. a hazard communication program per 29 CFR 1910.1200,
  - a medical surveillance program, per Appendix K,
    - a decontamination program, per Section 28 I, and σ
- a safety and health training program, per paragraph 28.K.02. σ

successful completion of all required training and shall maintain a perform their assigned duties and function in a safe and healthful substances at TSD operations shall be trained to enable them to manner: employees shall receive certificates documenting their 28.K.02 Employees exposed to health hazard or hazardous copy of this certification at the TSD.

received a 24-hour initial training program covering the items a. All employees engaged in TSD operations shall have delineated in paragraph 28.E.01.

b. All employees shall receive an 8-hour refresher training program annually. c. All employees who assist in handling emergencies at the TSD shall receive annual training sufficient to certify the employees as knowledgeable of and proficient in the following:

the recognition of safety and health hazards,
 safety and health control methods and equipment,

EM 385-1-1 3 Sep 96 the selection and use of personal protective equipment ତ୍ର

the emergency response plan,

the activity hazard analyses for the emergency operations,

(5) the activity hazard analyses for the emergency opera
 (6) coordination and communication procedures,
 (7) the appropriate response in over-exposure to health

(8) the recognition of symptoms which may result from over-exposures to health hazards. nazards or injury, and

28 K.03 Drums and containers shall be handled in accordance with the requirements of Section 28.H.

28.K.04 Emergency response plans.

handling an emergency at the TSD: if employees are to be handling emergencies, the emergency response plan is not evacuated from the worksite and not permitted to assist in a An emergency response plan shall be developed and implemented when employees are allowed to assist In required.

b. The emergency response plan shall cover those items specified in Section 28.J

### DEFINITIONS

assessment, or clean-up of HTRW or the emergency response to Hazardous. Toxic. Radioactive Waste (HTRW) activity: refers to HTRW actions associated with Civil Works projects, and HTRW 926 65, at an HTRW site. Includes those activities undertaken orojects of other government agencies. Such activities include, but are not limited to, preliminary assessments/site inspections; or the EPA's Superfund program, the Defense Environmental Defense Sites and Installation Restoration Program activities) nazardous material as defined by 29 CFR 1910.120(a)(3) or Restoration Program (which also includes Formerly Used he overall project or worksite involving the investigation, releases of hazardous substances, <u>hazardous waste, or</u>

remedial design, or remedial construction at known, suspected, or containenized HTRW sites (leaking PCB transformers and leaking evaluations/cost analyses; RCRA facility investigations/corrective measures studies/corrective measures implementations/closure or suspected leaking underground storage tanks that contain potential HTRW sites. Also includes activities conducted at plans/Part B permits; or any other predesign investigations, remedial investigations; feasibility studies; engineering hazardous substances).

Hazardous, Toxic, Radioactive Waste (HTRW) operation. refers to a specific function on an HTRW site, such as sampling. monitoring, excavation, drum removal, etc. Hazardous, Toxic, Radioactive Waste (HTRW) site: any facility or location which (1) requires the planned or emergency clean-up of hazardous, toxic, radioactive waste, and (2) is designated as an uncontrolled hazardous waste site or covered by the Resource Conservation and Recovery Act. Laboratory waste pack: a drum containing individual containers of laboratory materials normally surrounded by cushioning absorbent material

evels of protection. see Appendix L.

permissible exposure limits or, if there is no permissible exposure Overexposure: exposure to a safety or health hazard above the imit, above the published exposure levels for the hazard. Pre-entry briefings: an information briefing given by the site safety and health supervisor to employees before their entry to an HTRW site and instructing employees in the contents of the site-specific safety and health plan

the worksite; the work activities; the hazards associated with the work activities and the means for their control; and the structure, Safety and health program: a written program which describes

EM 385-1-1 3 Sep 96	SECTION 29	29.A. GENERAL 29.A.01 Prerequisites.	<ul> <li>a. Permission in writing shall be obtained from the <u>Government's</u> designated authority before explosive materials are brought on the job <u>site</u>; periodic replenishment of approved supplies does not require written approval</li> <li>b. Prior to bringing explosives on site, the contractor shall</li> </ul>	develop a blasting safety plan. As a minimum, this plan shall <u>be</u> accepted by the <u>Government's designated authority and include</u> the following:	<ul> <li>(1) instructiones, quantational explosives, and personnel involved with explosives, and</li> <li>(2) defineate the contractor's requirements for handling, transportation, and storage of explosives; loading procedures; safety signals; danger area clearance; methods for securing the site; vibration and damage control; post-blast inspection and misfire procedures; and post-blast ventilation requirements.</li> <li>29.A.02 The transporting, handling, storage, and use of explosives, blasting agents, and blasting equipment shall be directed and supervised by a person of proven expenence and ability in blasting operations: these activities shall be in accordance with the requirements of the manufacturers, the linstitute of Makers of Explosives, and, where applicable, DOD explosives safety standards. &gt; See Section 26.J</li> <li>29.A.03 All persons working with explosives shall be in good physical condition and be able to understand and give written and verbal orders</li> </ul>	523
EM 385-1-1 3 Sep 96	policies, and procedures of the organizations involved in the HTRW activities.	Site control procedures: procedures delineated in the site control program which will be used to minimize any potential contamination of workers, protect members of the public from the site's hazards, and prevent vandalism.	Site Safety and Health Supervisor: that Individual on an HTRW site who is responsible to the employer and has the authority and knowledge necessary to implement the site-specific safety and health plan and verify compliance with safety and health requirements.	Site-specific safety and health plan (SSHP): a written plan which establishes policies and procedures for protecting workers and members of the public from the specific hazards of the HTRW site for which the plan was developed.	Site work zones: zones of differing work activities and hazards established to reduce the accidental spread of hazardous substances from a contaminated to an uncontaminated area and to control exposure of personnel to HTRW hazards. There are generally three categories of site work zones - (1) exclusion zones, where contamination does or could occur, (2) contamination-reduction zones, which are transition areas between contaminated areas and clean areas and where decontaminated areas where administrative and support functions are located.	522

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physician by the employer (with the exception of the copy of 29 CFR 1910.120 and its appendices).

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### **APPENDIX L**

# LEVELS OF PROTECTION FOR HTRW ACTIVITIES

#### Level A

respiratory, and eye protection is required. Level A protection Level A is to be selected when the greatest level of skin, should be used when:

concentration of atmospheric vapors, gases, or particulates; or the splash, immersion, or exposure to unexpected vapors, gases, or the highest level of protection for skin, eyes, and the respiratory a. the hazardous substance has been identified and requires particulates of materials that are harmful to skin or capable of site operations and work functions involve a high potential for system based on either the measured (or potential for) high being absorbed through the skin;

known or suspected to be present, and skin contact is possible, or operations must be conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not b. substances with a high degree of hazard to the skin are yet been determined. 2. The following constitute Level A equipment (italics indicate use is optional):

apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA, approved by the National Institute for Occupational a. positive pressure, full face-piece self-contained breathing Safety and Health (NIOSH);

b. totally-encapsulating chemical-protective suit:

- c. coveralls;
- d. long underwear,
- e. gloves, outer, chemical-resistant;
  - gloves, inner, chemical-resistant;
- boots, chemical-resistant, steel toe and shank; g boots, chemical-resistant, h. hard hat (under suit); and

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 disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit).

Level B

 Level B is used when the highest level of respiratory protection is necessary but a lesser level of skin protection is needed. Level B protection should be used when:

 the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;

but vapors and gases are not suspected of containing high levels indicated by a direct-reading organic vapor detection instrument, c. the presence of incompletely identified vapors or gases is of chemicals harmful to skin or capable of being absorbed b. the atmosphere contains less than 19.5% oxygen; or through the skin

specific substances that present severe inhalation hazards and that do not represent a severe skin hazard; or that do not meet Note: this involves atmospheres with IDLH concentrations of the criteria for use of air-punitying respirators. The following constitute Level B equipment (<u>italics</u> indicate use is optional):

apparatus (SCBA), or positive pressure supplied air respirator with a. positive pressure, full-facepiece self-contained breathing escape SCBA (NIOSH approved);

long-sleeved jacket; coveralls; one or two-piece chemical-splash b. hooded chemical-resistant clothing (overalls and suit; disposable chemical-resistant overalis);

coveralls;

- gloves, outer, chemical-resistant; ÷
- gloves, inner, chemical-resistant; ġ
- boots, outer, chemical-resistant steel toe and shank;
  - boot-covers, outer, chemical-resistant (disposable); ക്മ
    - hard hat; and

l. face shield.

Level C

punifying respirators are met. Level C protection should be used Level C is used when the concentration(s) and type(s) of airbome substance(s) is known and the criteria for using air when:

direct contact will not adversely affect or be absorbed through any a. the atmospheric contaminants, liquid splashes, or other exposed skin;

concentrations measured, and an air-purifying respirator is b. the types of air contaminants have been identified, available that can remove the contaminants, and

c. all criteria for the use of air-purifying respirators are met.

2. The following constitute Level C equipment (itelics indicate use is optional):

a. full-face or half-mask, air purifying respirators (NIOSH approved);

chemical-splash suit; disposable chemical-resistant overalls); b. hooded chemical-resistant clothing (overalls; two-piece c. coveralls;

- gloves, outer, chemical-resistant; ÷
  - gloves, inner, chemical-resistant; ė
- boots, (outer), chemical-resistant steel toe and shank;
- boot-covers, outer, chemical-resistant (disposable);
- h. hard hat
- l. escape mask; and
  - face shield

Level D

1. Level D is a work uniform affording minimal protection. used for nuisance contamination only. Level D protection

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should be used when:	APPENDIX M	
<ul> <li>a. the atmosphere contains no known hazard; and</li> <li>b. work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.</li> </ul>		
<ol><li>The following constitute Level D equipment (<u>italics</u> indicate use is optional):</li></ol>		
<ul> <li>a coveralls,</li> <li>b. gloves;</li> <li>c. boots/shoes, chemical-resistant steel toe and shank;</li> <li>d. boots, outer, chemical-resistant (disposable);</li> <li>e. safety glasses or chemical splash goggles;</li> <li>f. hard hat,</li> <li>g escape mask; and</li> <li>h. face shield.</li> </ul>	(Reserved for future use)	
Note. combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.		
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#### Appendix G

PCP Dip Vat Investigation Schedule of Activities



