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200-ZP-1 IRM Implementation Description of Work

Author
M. E. Darrach

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Joseph Zoghbi — Signature

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ACRONYMS

ALARA	as low as reasonably achievable
BWIP	Basalt Waste Isolation Project
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DNAPL	dense non-aqueous phase liquid
DOE	U.S. Department of Energy
DOW	description of work
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
HEIS	Hanford Environmental Information System
IRM	interim remedial measure
PID	photoionization detector
NTU	nephalometric turbidity unit
RCRA	*Resource Conservation and Recovery Act of 1976*
TCE	trichloroethylene
WAC	Washington Administrative Code

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FIGURES

TABLES

1.0 SCOPE OF WORK

This description of work (DOW) details the field activities to be performed in support of implementation of the 200-ZP-1 interim remedial measure (IRM) groundwater pump-and-treat system. This DOW will serve as a field guide for those performing the work and will be used in conjunction with *Environmental Investigations Procedures* (BHI 1994a). Two extraction wells and one injection well will be drilled, sampled, and constructed to support an IRM groundwater pump-and-treat system that will be implemented to reduce further degradation of groundwater from elevated concentrations of carbon tetrachloride in the 200-ZP-1 Operable Unit. Specific project objectives are to (1) assist in containing the highly contaminated portion of the plume, (2) extract a significant mass of the contaminants, (3) reduce concentrations of contaminants in the groundwater, and (4) obtain vertical characterization data that help define contaminant distribution with depth. The locations of the proposed wells are presented in Figure 1.

The following sections supply the general criteria and activities for the proposed wells. Detailed data on waste volumes, contaminants, and system history are contained in the *Z Plant Aggregate Area Management Study Report* (DOE-RL 1992) and the *200 West Groundwater Aggregate Area Management Study Report* (DOE-RL 1993).

2.0 GENERAL BACKGROUND INFORMATION

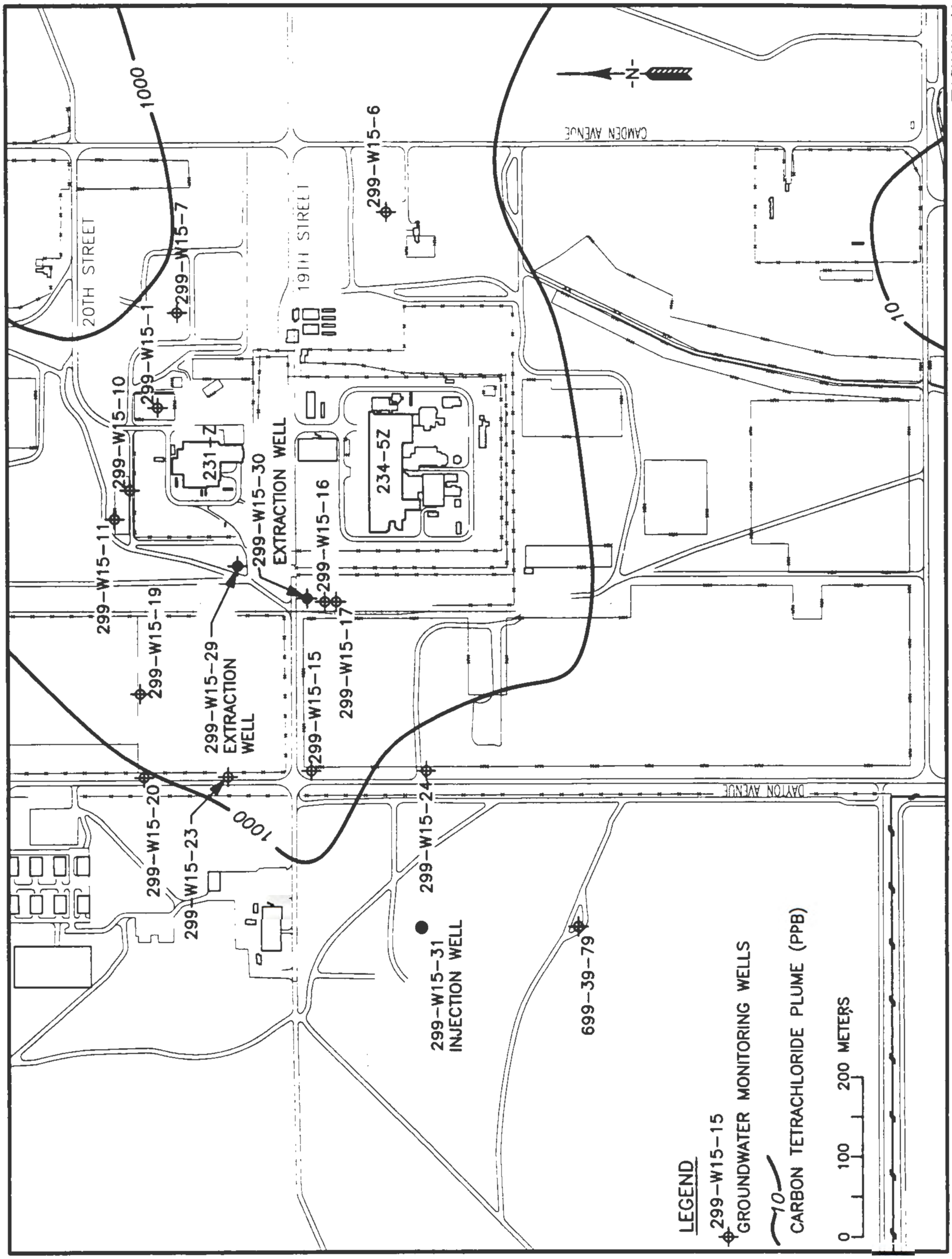
2.1 GENERAL HISTORICAL BACKGROUND

The 200 West Area is an operational area of approximately 3.2 mi^2 where spent nuclear fuel was processed in four main facilities: U Plant (primarily uranium recovery), Z Plant (primarily plutonium separation and recovery), and S and T Plants (primarily uranium and plutonium separation from irradiated fuel rods).

Mixtures of carbon tetrachloride containing other organic solvents were used at Z Plant to recover plutonium from processing waste streams. Spent carbon tetrachloride mixtures were disposed to the ground via waste management units in the 200-ZP-2 source operable unit overlying the 200-ZP-1 groundwater operable unit. These waste management units are the 216-Z-9 Trench, 216-Z-1A Tile Field, and the 216-Z-18 Crib. Approximately 600 to 1,000 metric tons of carbon tetrachloride waste were discharged to the ground between 1955 and 1973 (DOE-RL 1994). This resulted in extensive contamination of the soil and groundwater beneath the 200 West Area.

Some of the carbon tetrachloride, chloroform, and trichloroethylene (TCE) has migrated through the soil column and contaminated the groundwater underlying the 200 West Area. Groundwater occurs about 200 ft below the ground surface and generally flows from west to east beneath the 200 West Area. However, historic discharges of large volumes of water have created an artificial groundwater mound that causes groundwater contaminated with carbon tetrachloride, chloroform, and TCE to flow toward the north and northeast in the 200-ZP-1 Operable Unit. Carbon tetrachloride is distributed in a plume that extends under most of the 200 West Area, although the highest concentration areas of

Figure 1. Locations of the Extraction and Injection Wells to Support 200-ZP-1 Pump-and-Treat Activities.



the plume are located within the 200-ZP-1 Operable Unit. The maximum average concentration of carbon tetrachloride found in one well in 200-ZP-1 groundwater is approximately 7,000 ppb. Some of the carbon tetrachloride may be present in the aquifer as dense non-aqueous phase liquids (DNAPL). Chloroform is generally associated with the carbon tetrachloride in its areal distribution; its greatest measured average concentration in the groundwater is currently about 170 ppb. TCE is distributed in three smaller plumes that are not as clearly associated with the carbon tetrachloride plume; TCE is found in the groundwater at concentrations up to about 25 ppb.

Since late 1990, U.S. Department of Energy (DOE) has been conducting an expedited response action (ERA) at the 200-ZP-2 Operable Unit, which is located in the 200 West Area. The ERA involves the use of a vapor extraction system to remove carbon tetrachloride from the unsaturated soils between the ground surface and water table in an effort to minimize further movement of the carbon tetrachloride contamination to uncontaminated areas. The ERA is being conducted to ensure that the environment and public health are adequately protected and to reduce the threat of further groundwater contamination. This action has contributed significant information regarding the origin, nature, and extent of carbon tetrachloride and other site characteristics needed for evaluating remedial alternatives for both source and groundwater operable units in the 200 West Area.

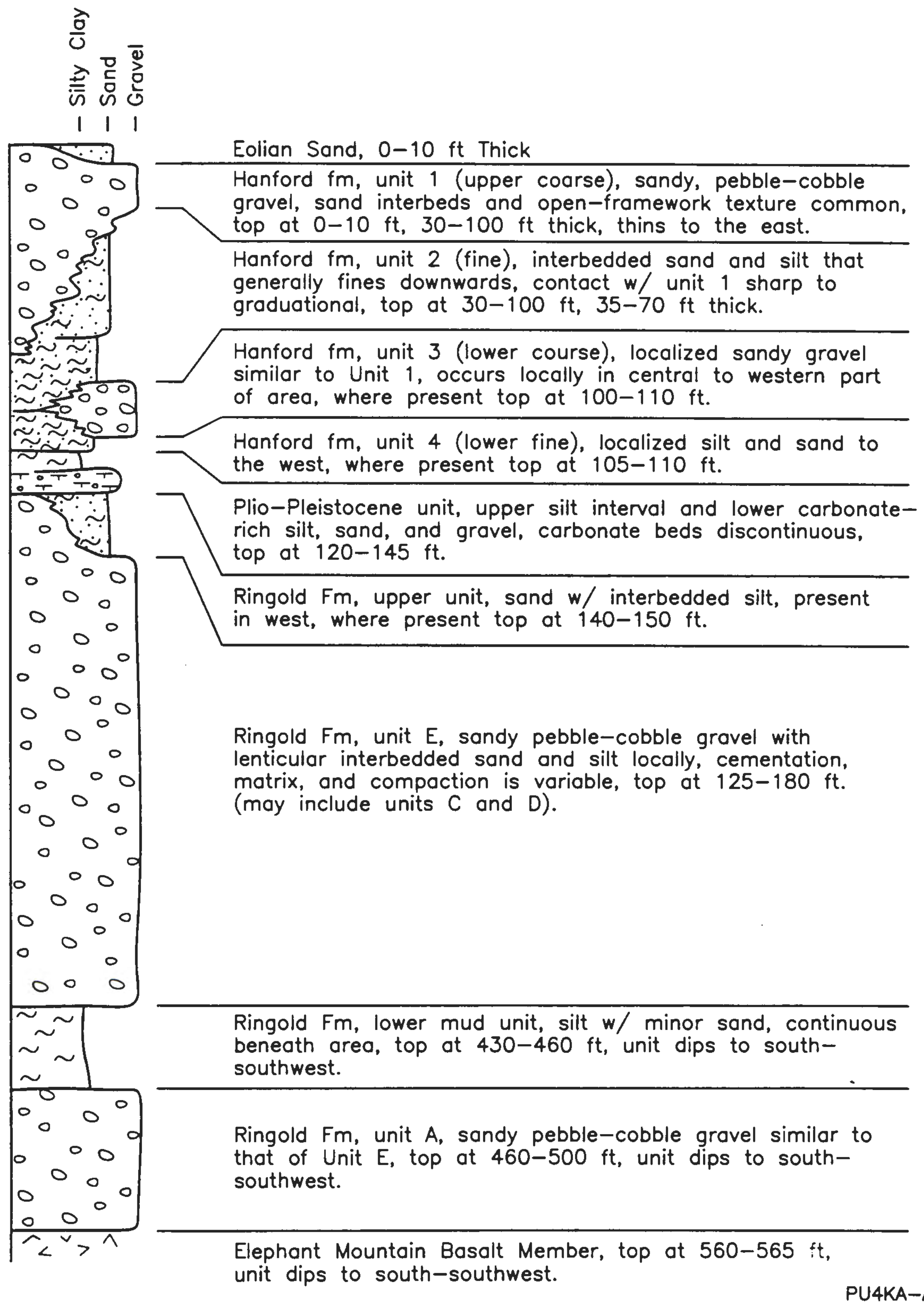
In early 1994 the U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), and DOE determined that the information and data gained through the 200 West Groundwater Aggregate Area Management Study and the carbon tetrachloride ERA were sufficient to warrant an interim pump-and-treat remedial action for the 200-ZP-1 Operable Unit.

2.2 GENERAL SITE GEOLOGY AND HYDROLOGY

Suprabasalt sediments underlying the central 200-ZP-1 area include, from the ground surface down, Holocene eolian sand, the Hanford formation, silt and sand, gravel, and the carbonate of the redefined Plio-Pleistocene unit, and the Ringold Formation. These strata overlie basalts of the Columbia River Basalt Group. More detailed discussions of Hanford Site and 200 West Area geology can be found in Myers et al. (1979), Tallman et al. (1979, 1981), Reidel and Fecht (1981), DOE (1988), Delaney et al. (1991), Lindsey (1991), Lindsey et al. (1992, 1994), and Connelly et al. (1992). More detailed discussions of the geology in the immediate vicinity can be found in Rohay et al. (1992, 1993), Last and Rohay (1992, 1993), and Lindsey et al. 1994).

Holocene-aged deposits form the uppermost unit in the vicinity of the proposed borehole. These deposits consist of eolian silt and sand that form a thin (< 15 ft), discontinuous sheet across the site. The uppermost laterally continuous unit in the area is the Hanford formation. At the locations of the boreholes, gravelly and slightly gravelly sands extend from approximately 10 to 25 ft (Figure 2). Underlying these strata are generally open-framework gravels and minor interbedded sands typical of the gravel-dominated facies. These gravelly deposits comprise unit 1 (upper coarse unit), which extends to a depth of 30 to 100 ft. Well-stratified sand and minor gravel of the sand-dominated or transitional facies comprises unit 2 (fine unit), which is 35 to 70 ft thick. Up to 50 ft of gravelly strata (unit 3) and silt and sand-rich strata (unit 4) locally underlie unit 2 in the central to western part of the area. The silt and sand of unit 4 have been correlated to the early Palouse soil in the past (Tallman et al. 1979, DOE-RL 1988, Last et al. 1989). However, the presence of interbedded silt and sand is more typical of the sand-dominated and silt-dominated facies of the Hanford formation rather than the massive, bedded, less-dominated early Palouse soil.

Figure 2. Conceptual Stratigraphic Column for the Area Near the Extraction and Injection Wells.



The base of the Hanford formation occurs at the top of the Plio-Pleistocene unit, which is at approximately 120 to 145 ft. The upper half of the Plio-Pleistocene unit consists of laminated silty deposits (also previously referred to as early Palouse soil) while the lower half is predominately carbonate-rich silt, sand, and gravel. Carbonate horizons within the unit are discontinuous. The low-permeability carbonate horizons can form local perching layers.

The top of the Ringold Formation is situated approximately 125 to 150 ft below the surface. In the western part of the area the uppermost Ringold strata are the sand and minor interbedded silt of the upper unit. This unit pinches out in the central to eastern part of the area where uppermost Ringold strata are assigned to unit E. The upper unit can be as much as 30 ft thick.

Unit E extends to an approximate depth of 430 to 460 ft. The saturated thickness of unit E near the proposed boreholes is approximately 230 ft. Static water level is approximately 210 ft, 60 to 80 ft below the top of the Ringold Formation, at the locations of the proposed boreholes. Partially cemented fluvial gravels containing minor intercalated sandy and silty zones are essentially the same as those found in the unit above the water table. Well-indurated and silt-rich zones that generate locally confined aquifer conditions have been encountered in unit E in the northern 200 West Area and the 200-UP-1 Operable Unit, southeast of the 200-ZP-1 Operable Unit. The presence of cemented zones in Basalt Waste Isolation Project (BWIP) coreholes DH-7 (W19-10), DH-12 (W14-7), and DH-13A (W14-8A) suggests similar conditions may occur in the southern half of the 200 West Area. However, if locally confined conditions occur, it is not clear how laterally extensive they are. Lacustrine strata of the Ringold Formation lower mud unit underlie Ringold unit E throughout the 200-ZP-1 area. The top of the lower mud unit occurs at approximately 430 ft (132.3 m) below ground surface, and the unit is approximately 50 ft thick in the vicinity of the proposed boreholes at this location. The lower mud unit forms the base of the unconfined aquifer zone in the 200 West Area and it continues beneath the entire study area. The lower mud unit dips to the south-southwest.

Ringold Formation unit A fluvial gravels underlie the lower mud unit at approximately 460 to 500 ft below ground surface in this area. Intercalated fluvial sand and mud-rich zones can be found in unit A. Unit A is present beneath the entire site, dips to the south-southwest, and directly overlies basalt. It marks the transition to confined conditions within the sitewide hydrologic architecture and the base of the upper aquifer system. The top of basalt is at a depth of 560 to 565 ft.

3.0 GENERAL REQUIREMENTS

3.1 HEALTH AND SAFETY

All personnel working to this DOW will have completed the 40-Hour Hazardous Waste Site Worker Training Program and will perform all work in accordance with the following:

- BHI-EE-01, *Environmental Investigations Procedures* (BHI 1994a)
- BHI-EE-02, *Environmental Requirements* (BHI 1995a)
- HSCRM-1, *Hanford Site Radiological Control Manual* (BHI 1994b)

- *Quality Management Plan* (BHI 1994c)
- BHI-SH-02, *Safety and Health Procedures* (BHI 1994d)
- Site-specific health and safety plan/radiation work permits/job safety analysis - as applicable

3.2 TECHNICAL PROCEDURES/SPECIFICATIONS

This section identifies technical procedures/specifications applicable to the 200-ZP-1 Operable Unit field activities.

- BHI-SH-01, *Hanford ERC Environmental Safety and Health Program* (BHI 1995c)
- BHI-FS-01, *Field Support Administration*, Section 4.0, "Waste Management" (BHI 1995b)
- BHI-EE-01, *Environmental Investigations Procedures* (BHI 1994a)
  - EIP 1.5, "Field Logbooks"
  - EIP 1.8, "Well Characterization and Evaluation"
  - EIP 3.0, "Chain of Custody"
  - EIP 3.1, "Sample Packaging and Shipping"
  - EIP 4.0, "Soil and Sediment Sampling"
  - EIP 4.0, Appendix B, "Split-Spoon Sampling"
  - EIP 6.0, "Decontamination of Well Drilling and Completion Operations"
  - EIP 6.2, "Field Decontamination"
  - EIP 7.0, "Geologic Logging."

Each item on the checklist for tasks requiring no readiness review will be signed and dated by the cognizant engineer or field team leader prior to the start of work.

4.0 FIELD ACTIVITIES

The following subsections detail the activities to be conducted for the drilling, sampling, and construction of two groundwater extraction wells and one injection well in the 200-ZP-1 Operable Unit.

4.1 FIELD SCREENING ACTIVITIES

All samples and cuttings will be field screened for volatile organics. Soil screening for carbon tetrachloride will be conducted using a photoionization detector (PID) equipped with an 11.7-eV lamp. Field screening will be performed in accordance with the Waste Control Plan. The field geologist will record screening results on the borehole log per EIP 7.0, "Geologic Logging" (BHI 1994a).

4.2 GENERAL DRILLING ACTIVITIES

The following describes the general drilling activities that will be conducted at the drill sites. All drilling will be conducted utilizing the specifications and guidance presented in the *Washington Administrative Code* (WAC) 173-160, Part Three, "Resource Protection Wells." All drilling activities will be performed in accordance with the *Technical Specification for Environmental Drilling Services*, BHI-SPEC-00008 (BHI 1994e), except where stated in this DOW. Drilling operations will also conform to EIP 6.0, "Documentation of Well Drilling and Completion Operations," and EIP 6.2, "Field Decontamination" (BHI 1994a). All waste will be handled according to BHI-FS-01, Section 4.0, "Waste Management" (BHI 1995b), and/or the Waste Control Plan.

In support of the 200-ZP-1 Operable Unit pump-and-treat IRM, three wells will be drilled (Figure 1). Two of these wells will be extraction wells and the third will be an injection well. The two extraction wells (299-W15-29 and 299-W15-30) will be located in highly contaminated portions of the carbon tetrachloride plume (Figure 1). They will be placed near existing monitoring wells to facilitate adequate long-term observation of local hydrologic and geochemical variables.

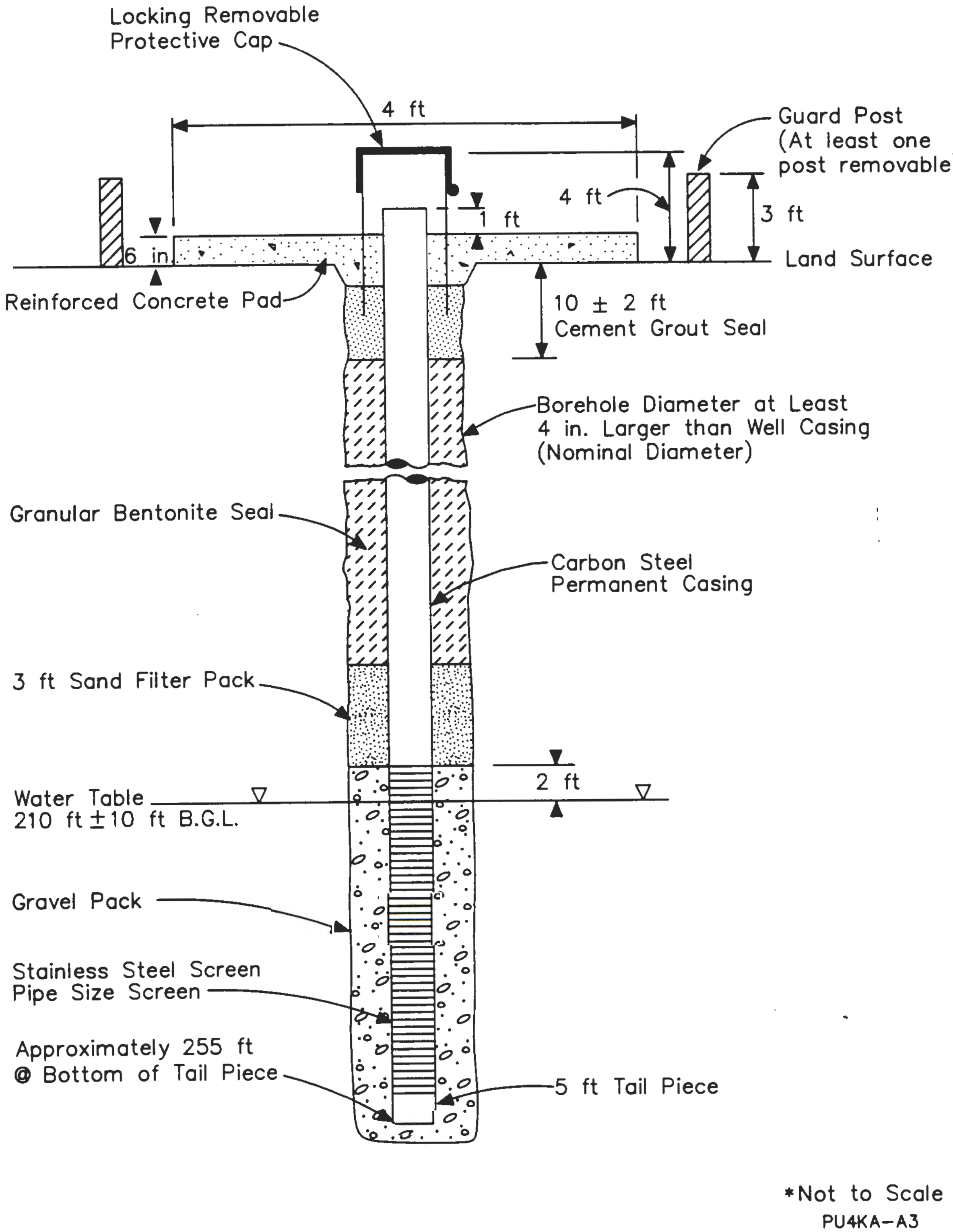
Both of the extraction wells will be drilled and sampled to obtain vertical characterization profiles of both groundwater (i.e., carbon tetrachloride, chloroform, TCE) contamination levels and geologic materials properties. These wells will be drilled to approximately 40 ft below the water table in the E unit of the Ringold Formation (Figure 3). Upon reaching final depth these wells will be completed as deemed appropriate based upon the obtained characterization data.

The injection well (299-W15-31) will be drilled below the water table (Figure 1) and will be screened across the saturated zone and up into the vadose zone. Limited characterization activities in this boring shall include obtaining instantaneous slug test data and a water sample. The water sample data are deemed necessary to ensure that injected waters do not compromise the chemical integrity of the existing aquifer waters at the injection site and to provide a baseline chemical concentration of carbon tetrachloride.

The borings may in general be advanced using any approved drilling/sampling method or combination of methods. However, it is anticipated that data quality and cost control considerations will place some restrictions on the technology(ies) employed. It is imperative that drilling through the vadose zone be achieved in as timely a fashion as possible in all three wells. In advancing the wells, it is critical that high-quality chemical and physical data be obtained from the geologic horizons of interest.

If perched water above the carbonate-rich Plio-Pleistocene unit is reported during drilling, it should be noted that the requirements presented in WAC Section 173-160-500, Item 2, "No resource protection well shall interconnect saturated formations or aquifers," are not being violated when casing is carried through them. Previous studies conducted in the area and the site conceptual model have shown that perched layers above the carbonate-rich Plio-Pleistocene unit are discontinuous, and any water encountered can be treated as a single hydrologic unit. No technical purpose would be served by attempting to seal individual clay or silt beds that occur in the lower fine-grained unit of the Hanford formation (Touchet-like beds). The perching units expected are typically several centimeters to no more than 0.305 m (1 ft) thick and are laterally discontinuous. Layers thicker than 1.5 m are not expected. However, if they occur and perched water is encountered, Ecology will be informed

Figure 3. Well Design for the 200-ZP-1 Extraction Wells.



and an evaluation will be performed to determine the appropriate course of action. If perched water is encountered along the calichefied Plio-Pleistocene unit, drilling will stop and the amount of perched water will be determined using an electric measuring tape. The temporary casing will be backpulled from the top of the caliche layer at least 0.305 m (1 ft) to ensure that water can enter the casing. The borehole will then be allowed to equilibrate and a baseline water level will be established. A water sample will then be obtained.

Downhole gross gamma geophysical logging will be conducted on casing only if radiation levels above background are detected during field screening by Health Physics personnel. If geophysical logging is performed, it will be conducted in accordance with EIP 7.0, "Geologic Logging" (BHI 1994a).

The site geologist will record all important activities on the field activity report per EIP 6.0, "Documentation of Well Drilling and Completion Operations" (BHI 1994a). Items for entry will include such items as the borehole number, site location drawings, drawing of downhole tool strings, site personnel, sampling types and intervals, and specific information regarding well completion activities.

The borehole will be logged according to EIP 7.0, "Geologic Logging" (BHI 1994a). The geologic log will include lithologic descriptions, a record of significant water-producing intervals, sample codes, Hanford Environmental Information System (HEIS) numbers with depth intervals, screening results, and any general information the site geologist believes is pertinent to the characterization of subsurface conditions (e.g., heaving sand horizons, etc.). Each log sheet should contain no more than 20 ft of stratigraphic information.

5.0 WELL DESIGNS

The design criteria for both the injection and extraction wells are based on the following criteria: (1) maximization of open area of the screens, (2) inside diameters must be large enough to install packers and instruments, (3) minimization of turbulence in the wells while maximizing well efficiency, (4) minimize particulate inflow into the wells, (5) ensure a useable lifetime for these wells of approximately 30 years, and (6) ensure for the ease of maintenance for these wells.

It is stressed that special attention be addressed to carefully develop the wells in order to seat the gravel packs properly, prevent uncontrolled infiltration of fines, and maximize well production and injection rates. In this regard it is also requested that check valves be installed above the pumps to minimize downhole surging that may compromise gravel pack integrity over a well lifetime.

5.1 EXTRACTION WELLS

The extraction wells (299-W15-29 and 299-W15-30) will be completed with nominal carbon steel permanent casing and continuous-slot stainless steel screens of the same diameter. The well screens shall be either welded or threaded onto the permanent casing. The carbon steel permanent casing shall be seated above the water table to preclude any potential problems with oxidation or future iron bacteria growth. The permanent casing and screens shall be of sufficient diameter (6- or 8-in.

diameters are anticipated) to allow space for packer and pump assemblies. Figure 3 illustrates the general design proposed for these wells. Gravel packs shall be installed around the screens in these wells. Gravel packs allow for maximizing well efficiency in a cost effective manner and maximizing water producing surface area while minimizing entrance velocities. Screen slot sizes and gravel packs shall be chosen as a function of particle size analyses (procedure GEL-07) performed on lithologic samples obtained from the proposed screened intervals. The screened intervals will be as closely matched as possible to the water-producing interval(s) of interest. The lengths of screen chosen should provide for adequate production volumes. Pumping rates of approximately 75 gal/min will be required for each well, while entrance velocities into the wells should be restricted to a maximum of 0.1 ft/sec in order to minimize turbulence and attendant mobilization of fines (Driscoll 1986). Five-foot-long tailpieces without a base plate and with about 1 ft of bentonite will be added to the screens to allow for accumulation of fines without impairing well operations.

5.2 INJECTION WELL

The injection well (299-W15-31) will be completed using 8-in.-diameter nominal carbon steel casing and a casing-size louvered/vertical bridge slot screen. The proposed design for this well is illustrated in Figure 4. The louvered screen will extend up into the vadose zone and downward into the unconfined aquifer. The total screen length and slot size shall be determined as a function of particle size analyses performed on lithologic samples collected. However, it is anticipated that the screen length will be significantly longer than those employed in the extraction wells in order to maintain optimal exit velocities at approximately 0.05 ft/sec (Driscoll 1986).

Design considerations for the injection well will include a 15-ft-thick cement seal emplaced above a sandpack. This cement plug should ensure protection against washout around the casing in the event of elevated water pressures during injection.

6.0 SAMPLING STRATEGY

The sampling regimen for the 200-ZP-1 extraction and injection wells will be conducted to obtain data that optimize their efficiency and long-term utilization.

6.1 FIELD SCREENING ACTIVITIES

As specified in the Waste Control Plan, all samples and cuttings will be screened for radionuclides. Representative samples will be collected at 5-ft intervals in the vadose zone and on a per drum basis below the water table. These samples will be field screened by Radiological Control Technicians on a twice-a-day basis for radionuclides with Geiger-Mueller and portable alpha meter field instruments. The action levels for radiological monitoring will be the minimum detectable activities of the field instruments. Soil screening for carbon tetrachloride will be conducted using a PID equipped with an 11.7-eV lamp. The field geologist will record screening results on the borehole log per EIP 7.0, "Geologic Logging" (BHI 1994a).

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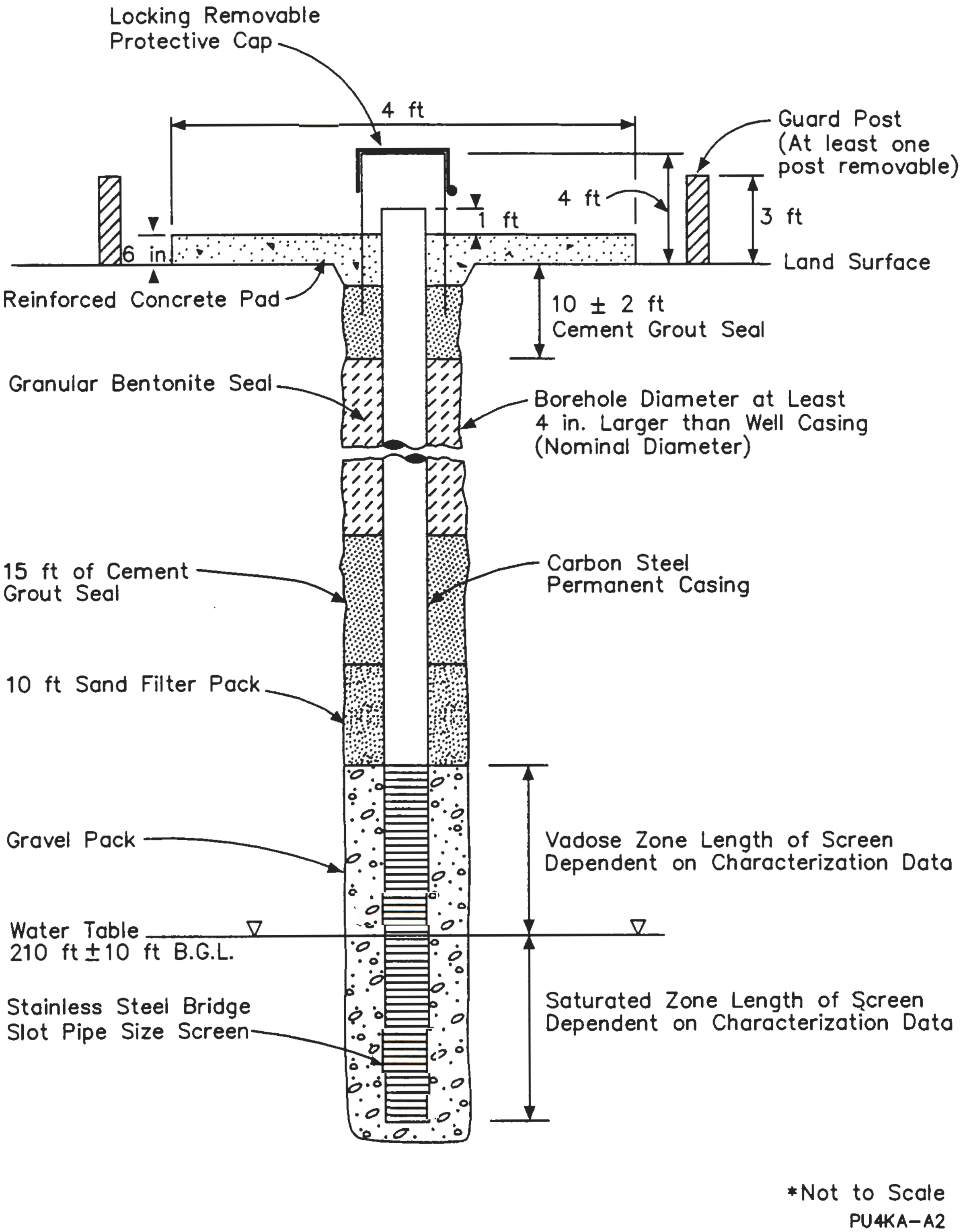
Figure 4. Well Design for the 200-ZP-1 Injection Well.



6.2 GENERAL SAMPLING REQUIREMENTS

The characterization goals for this DOW are (1) determining vertical extent and distribution of carbon tetrachloride and chlorinated solvent co-contaminants in groundwater, and (2) obtaining representative physical samples from significant water-producing zones in order to facilitate optimal screen and gravel pack designs.

Table 1 lists analytical parameters of interest, holding times, and bottle and preservation requirements.

Table 1. Analytical Methods for Target Analytes.

Analyte	General Analytical Technique	Water Analysis Method	Container and Volume	Comments
CCl_4, CCl_3, C_2Cl_3	GC; GC/MS	SW846 method 8240	40-mL VOA vial with septum Gs* 3 x 40 mL, HCl to pH <2, cool 4 °C	GC technique pertains to mobile field laboratory trailer and GC/MS pertains to EAL. Store sample on ice.
Dissolved Oxygen	YSI Portable Probe/HACH Portable Spectrophotometer	HACH method 8316	NA	Spectrophotometer will be used only for low-range readings.
Eh	ORION Eh Probe	NA	NA	Will be measured at the wellhead.
pH	HACH field probe	NA	NA	
Redox Couples	HACH Spectrophotometer	HACH Procedures 8146, 8008, 8039, 8153	NA	Redox Couples

EAL = Environmental Analytical Laboratory
GC = gas chromatograph
GC/MS = gas chromatograph/mass spectrometer
Gs* = glass septum with zero headspace

6.3 PHYSICAL SOIL SAMPLES

Once the water table has been encountered (approximately 210 ft below ground surface) in the extraction and injection wells, sampling should be conducted so that representative geologic material is obtained. Samples for sieve analysis will be retrieved from the producing zone. These samples are the primary driver for the physical sampling program as they will directly dictate gravel pack and screen designs. The samples will be sieved (GEL-07 test) in the 300 Area geotechnical laboratory. Total activity splits will be collected for radiological analysis at the 222-S Laboratory. Chain of custody of all samples will be maintained and documented in accordance with EIP 3.0, "Chain of Custody" (BHI 1994a).

6.4 GROUNDWATER SAMPLING

Groundwater samples will be obtained from all major water-producing zones as determined by the wellsite geologist. These samples will be obtained in accordance with EIP 4.1, "Groundwater Sampling" (BHI 1994a). If more than one water-producing zone is encountered, temporary telescoping screens will be installed and the casing backpulled to expose the screen to the formation. Then a submersible pump with supporting output volume control electronics will be utilized to develop the well to a permissible sampling nephelometric turbidity unit (NTU) value range. When acceptable turbidity levels are achieved, the volume control electronics will be utilized to produce the lowest output volume possible to facilitate sample collection and accurate volatile organic analyses.

The groundwater sampling at the extraction wells will focus on establishing the vertical extent of volatile organic compounds in order to optimize the placement of the well screens for plume remediation. Volatile organic analyses shall be conducted with gas chromatography equipment in a mobile laboratory operated by the Environmental Restoration Contractor. This will facilitate quick turnaround time. Splits of every other sample are to be shipped to an offsite laboratory for volatile organic analysis as an independent cross check of the onsite analysis. The high percentage of splits is justified as a function of low sample density. However, the number of splits is not expected to exceed two per borehole. The suite of information obtained from every onsite sample retrieved shall include the following information:

- Volatile organic analysis for carbon tetrachloride, chloroform, and TCE
- Dissolved oxygen
- Eh/pH
- Redox couples

6.5 PERCHED WATER SAMPLING

If encountered, a perched water sample will be collected per EIP 4.1, "Groundwater Sampling" (BHI 1994a), and will be analyzed for the data presented directly above in Section 6.4.

7.0 QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Internal quality control samples shall be collected by the sampling scientist as outlined below. The sampling shall be documented in the sampling logbook per EIP 1.5, "Field Logbooks" (BHI 1994a).

- Field Duplicate Samples. A minimum of one duplicate for every other groundwater sample shall be collected. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique and shall be placed in two sets of identically prepared and preserved containers. All field duplicates shall be analyzed independently to provide an indication of the reproducibility of sampling and/or analysis techniques.

- Equipment Rinsate Blanks. Equipment rinsate blanks consist of pure deionized distilled water that is run through decontaminated sampling equipment and placed in clean sample containers. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected at the same frequency as field duplicate samples where applicable.

8.0 SCHEDULE

Drilling of the 200-ZP-1 extraction and injection wells should commence within 3 months of Regulatory and Quality Assurance approval of this DOW. This schedule is subject to change, and the operable unit coordinator should be contacted for the current status. An Agreement Activity Notification form will be issued at least 5 days before the start of field work.

9.0 ALARA CONSIDERATIONS AND CHANGES TO THE DESCRIPTION OF WORK

All boreholes will be drilled utilizing the guidance of the As Low As Reasonably Achievable (ALARA) program.

Field changes to this DOW, such as a changing sampling methods, analyzing different parameters, using different analytical methods, or significantly changing the sampling guidelines, will be submitted on the attached form (Attachment 1) and kept on file with the operable unit coordinator. Copies will be submitted to DOE, regulatory agencies, and the appropriate Bechtel Hanford, Inc. personnel within 10 working days of the occurrence.

10.0 REFERENCES

BHI, 1994a, *Environmental Investigations Procedures*, BHI-EE-01, Vol. 1, Bechtel Hanford Inc., Richland, Washington.

BHI, 1994b, *Hanford Site Radiological Control Manual*, HSCRM-1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1994c, *Quality Management Plan*, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1994d, *Safety and Health Procedures*, BHI-SH-02, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1994e, *Technical Specification for Environmental Drilling Services*, BHI-SPEC-00008, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995a, *Environmental Requirements*, BHI-EE-02, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995b, *Field Support Administration*, BHI-FS-01, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1995c, *Hanford ERC Environmental Safety and Health Program*, BHI-SH-01, Bechtel Hanford, Inc., Richland, Washington.

Bjornstad, B. N., 1984, *Suprabasalt Stratigraphy Within and Adjacent to the Reference Repository Location,* SD-BWI-DP-039, Rockwell Hanford Operations, Richland, Washington.

Connelly, M. P., B. H. Ford, J. W. Lindberg, S. J. Trent, C. D. Delaney, and J. V. Borghese (PNL), 1992, *Hydrogeologic Model for the 200 East Groundwater Aggregate Area,* WHC-SD-EN-TI-019, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Delaney, C. D., K. A. Lindsey, and S. P. Reidel, 1991, *Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports,* WHC-SD-ER-TI-003, Westinghouse Hanford Company, Richland, Washington.

DOE, 1988, *Site Characterization Plan, Reference Repository Location, Hanford Site, Washington, Consultation Draft*, DOE/RW-0164, U.S. Department of Energy, Washington, D.C.

DOE-RL 1992, *Z Plant Aggregate Area Management Study Report*, DOE/RL-91-58, Rev. 0, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE-RL, 1993, *200 West Groundwater Aggregate Area Management Study Report*, DOE-RL-92-16, Rev. 0, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE-RL, 1994, *Interim Remedial Measure Proposed Plan for the 200-ZP-1 Operable Unit, Hanford, Washington*, Hanford, Washington, DOE/RL-93-68, Rev 3, U.S. Department of Energy, Richland Field Office, Richland, Washington.

Driscoll, F. G., 1986, *Groundwater and Wells,* Second Edition, Johnson Filtration Systems Inc., St. Paul, Minnesota, 1108 p.

Last, G. V., B. N. Bjornstad, M. P. Bergeron, D. W. Wallace, D. R. Newcomer, J. A. Schramke, M. A. Chamness, C. S. Cline, S. P. Airhart, and J. S. Wilbur, 1989, *Hydrogeology of the 200 Areas Low-Level Burial Grounds - An Interim Report,* PNL-6820, Pacific Northwest Laboratory, Richland, Washington.

Last, G. V. and V. J. Rohay, 1993, *Refined Conceptual Model for the Volatile Organic Compounds - Arid Integrated Demonstration and the 200 West Area Carbon Tetrachloride Expedited Response Action,* PNL-8597, prepared by G. V. Last, Pacific Northwest Laboratory, and V. J. Rohay, Westinghouse Hanford Company, for Pacific Northwest Laboratory, Richland, Washington.

Lindsey, K. A., 1991, *Revised Stratigraphy for the Ringold Formation, Hanford Site, South-Central Washington,* WHC-SD-EN-EE-004, Westinghouse Hanford Company, Richland, Washington.

Lindsey, K. A., M. P. Connelly, and B. N. Bjornstad, 1992, *Geologic Setting of the 200 West Area: An Update,* WHC-SD-EN-TI-008, Westinghouse Hanford Company, Richland, Washington.

Myers, C. W., S. M. Price, J. A. Caggiano, M. P. Cochran, W. J. Czimer, N. J. Davidson, R. C. Edwards, K. R. Fecht, G. E. Holmes, M. G. Jones, J. R. Kunk, R. D. Landon, R. K. Ledgerwood, J. T. Lillie, P. E. Long, T. H. Mitchell, E. H. Price, S. P. Reidel, and A. M. Tallman, 1979, *Geologic Studies of the Columbia Plateau--A Status Report: Richland, Washington,* RHO-BWI-ST-4, Rockwell Hanford Operations, Richland, Washington.

Reidel, S. P. and K. R. Fecht, 1981, "Wanapum and Saddle Mountains Basalts of the Cold Creek Syncline Area," *Subsurface Geology of the Cold Creek Syncline,* RHO-BWI-ST-14, C.W. Myers and S.M. Price (eds.), Rockwell Hanford Operations, Richland, Washington.

Rohay, V. J., G. V. Last, V. L. King, and L. A. Doremus, 1992, *FY92 Site Characterization Status Report and Data Package for the Carbon Tetrachloride Site,* WHC-SD-EN-TI-063, Rev. 0, prepared by V. J. Rohay and V. L. King, Westinghouse Hanford Company, and G. V. Last and L. A. Doremus, Pacific Northwest Laboratory, for Westinghouse Hanford Company, Richland, Washington.

Rohay, V. J., K, J. Swett, V. M. Johnson, G. V. Last, D. C. Lanigan, and L. A. Doremus, 1993, *FY93 Site Characterization Status Report and Data Package for the Carbon Tetrachloride Site,* WHC-SD-EN-TI-202, Rev. 0, prepared by V. J. Rohay, K. J. Swett, and V. M. Johnson, Westinghouse Hanford Company, and G. V. Last, D. C. Lanigan, and L. A. Doremus, Pacific Northwest Laboratory, for Westinghouse Hanford Company, Richland, Washington.

Tallman, A. M., K. R. Fecht, M. J. Marratt, and G. V. Last, 1979, *Geology of the Separations Areas, Hanford Site, South-Central Washington,* RHO-ST-23, Rockwell Hanford Operations, Richland, Washington.

Tallman, A. M., J. T. Lillie, and K. R. Fecht, 1981, "Suprabasalt Sediments of the Cold Creek Syncline Area," in *Subsurface Geology of the Cold Creek Syncline,* C.W. Myers and S.M. Price (eds), RHO-BWI-ST-14, Rockwell Hanford Operations, Richland, Washington.

ATTACHMENT 1
200-ZP-1 Description of Work

PROJECT CHANGE FORM

Date:

Person Initiating Change:

Change Description:

Reason for Change:

APPROVALS

Field Team Leader:

Operable Unit Coordinator:

Quality Assurance:

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