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Revision 0

Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Operable Unit Carbon Tetrachloride Site, Fiscal Year 2006

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland, Washington

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V. J. Rohay
Fluor Hanford, Inc.

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EXECUTIVE SUMMARY

Soil vapor extraction (SVE) is being used to remove carbon tetrachloride from the vadose zone at the 200-PW-1 Operable Unit (OU) (formerly designated as the 200-ZP-2 OU). The purpose of this document is to report the SVE system operating data and the effectiveness of SVE in remediating carbon tetrachloride contamination based on the existing remedial design. This report covers operations for fiscal year 2006 (FY06) (the period of October 1, 2005, through September 30, 2006) and provides a general overview of the entire operating period from February 25, 1992, through September 30, 2006. The scope of the report includes the following:

- Summary of the history of SVE operations at the 200-PW-1 OU
- Evaluation of the efficiency of operations over time
- Estimated volume of soil vapor treated
- Measured changes in carbon tetrachloride concentrations
- Calculated mass of carbon tetrachloride removed
- Recommendations for future operations and evaluations
- SVE operations cost data.

Carbon tetrachloride was found in the unconfined aquifer beneath the 200 West Area at the Hanford Site in the mid-1980s. During this time, groundwater monitoring results indicated that the carbon tetrachloride plume was widespread and that concentrations were increasing. In response to this contamination, removal of carbon tetrachloride from the vadose zone in the 200 West Area was initiated in 1992, using SVE with aboveground vapor treatment using granular activated carbon.

By March 1993, three SVE systems (located near the three primary carbon tetrachloride disposal sites) were in operation with a total capacity of 85 m^3/min. The three primary carbon tetrachloride disposal sites were the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 Crib (216-Z-9, 216-Z-1A, and 216-Z-18 sites, respectively). These three sites were the subsurface infiltration facilities used from 1955 through 1973 for soil column disposal of aqueous and organic liquid wastes containing carbon tetrachloride. The SVE using wells at the 216-Z-12 Crib (216-Z-12 site) was initiated in 1995. The 216-Z-1A, 216-Z-18, and 216-Z-12 sites are discussed together because the well fields at these sites overlap.

The operating strategy was modified in FY98, based on the results documented in the *Rebound Study Report for the Carbon Tetrachloride Soil Vapor Extraction Site, Fiscal Year 1997* (BHI-01105) and the declining rate of carbon tetrachloride removal during continuous extraction operations. Rather than operating all three SVE systems continuously, only the 14.2-m^3/min system was used for carbon tetrachloride removal during FY98, FY99, and FY01 through FY06. During each of these FYs, the system typically operated from April through September, alternately between the 216-Z-9 and the 216-Z-1A/Z-18 sites (approximately 3-month periods for each site); however, the system was maintained in standby mode from October through March to allow time for carbon tetrachloride vapor concentrations to rebound. Operation was temporarily suspended during the entire period of FY00 as a result of higher priority remediation activities competing for limited funding. Beginning in FY03, maintenance of the 28.3-m^3/min and 42.5-m^3/min SVE systems was discontinued; surplus of these systems is pending.

The 14.2-m^3/min SVE system was operated at the 216-Z-1A/Z-18 well field from April through July 2006 and at the 216-Z-9 well field from August through September 2006. Operation of the SVE system at the 216-Z-1A/Z-18 well field was limited to three wells in the 216-Z-1A waste site as a result of access restrictions. Operation of the SVE system at the 216-Z-9 well field included use of the slant well (well 299-W15-48) that was drilled beneath the 216-Z-9 Trench and completed as a vapor extraction well in FY06.

Carbon tetrachloride concentrations in the extracted soil vapor have decreased significantly at all three sites since initial operation of the SVE systems. Initial carbon tetrachloride concentrations in extracted soil vapor were approximately 30,000 parts per million by volume (ppmv) at the 216-Z-9 well field and 1,500 ppmv at the 216-Z-1A/Z-18 well field. In contrast, concentrations in extracted soil vapor were approximately 10 ppmv at the 216-Z-1A/Z-18 well field and 21 ppmv at the 216-Z-9 well field when active SVE was last used at these sites in FY06.

The primary source of the remaining carbon tetrachloride appears to be the relatively low-permeability zones within and overlying the Cold Creek unit (CCU). As carbon tetrachloride from these lower permeability zones migrates into the overlying and underlying higher permeability zones, it can be removed using SVE. However, the rate of removal will be controlled by the rates of carbon tetrachloride desorption and diffusion. At many monitoring locations, including locations within the higher permeability zones, the relatively low carbon

tetrachloride rebound concentrations indicate that the readily available mass (i.e., carbon tetrachloride already in the vapor phase or volatizing directly from residual nonaqueous phase liquid) has been removed. At these locations, availability of additional mass for removal is controlled by the desorption and diffusion kinetics of carbon tetrachloride adsorbed within soil particle micropores and within soil moisture.

The SVE system was operated with an average availability of 88% from April through September 2006 and extracted 173 kg (381 lb) of carbon tetrachloride. Between April 1991 (when the pilot test was conducted) and September 2006, approximately 78,884 kg (173,908 lb) of carbon tetrachloride were removed from the vadose zone. Of this total, 54,280 kg (119,666 lb) were removed from the 216-Z-9 well field and 24,604 kg (54,242 lb) from the 216-Z-1A/Z-18/Z-12 well field.

From 1991 through 1997, approximately 74,851 kg (165,017 lb) of carbon tetrachloride were removed from the vadose zone. In comparison, approximately 4,033 kg (8,891 lb) of carbon tetrachloride were removed from the vadose zone between FY98 and FY06.

Passive SVE systems were installed on eight wells in FY99 and operated from FY00 through FY06 to remove carbon tetrachloride from the vadose zone. Passive SVE is a naturally occurring process driven by barometric pressure fluctuations and is often referred to as "barometric pumping." The eight wells are located in the 216-Z-1A/Z-18 well field. Approximately 5 kg (11 lb) of carbon tetrachloride were removed from the vadose zone using passive SVE in FY06. Between October 1999 and September 2006, approximately 80 kg (176 lb) of carbon tetrachloride have been removed using passive SVE.

An updated conceptual model of the carbon tetrachloride contamination in the vadose zone has been developed as part of the remedial investigation of the 200-PW-1 Operable Unit. In general, the highest concentrations of carbon tetrachloride detected in the vadose zone have been in fine-grained layers within and overlying the Cold Creek unit. For example, samples of soil from a silt lens approximately 19.8 m (65 ft) below ground surface south of the 216-Z-9 Trench contained relatively high concentrations of carbon tetrachloride (380,000 to 390,000 μg/kg) indicative of a dense, nonaqueous-phase liquid (DNAPL). The regions of residual carbon tetrachloride are generally limited in area, are located near the 216-Z-9 Trench and 216-Z-1A Tile Field, and are not considered to be a significant current source of groundwater contamination.

Depth-discrete groundwater sampling and analysis results (2005 and 2006) for dissolved carbon tetrachloride suggest that as a result of past transport conditions, a significantly higher percent of the mass may be present throughout the unconfined aquifer (in dissolved and sorbed phases) than previously estimated. The current estimate is that approximately 100,000 kg (220,460 lb) of carbon tetrachloride may exist within the groundwater system. However, the lateral extent and maximum concentrations of the higher concentration carbon tetrachloride contamination in the top 10 m (33 ft) of the aquifer have been diminishing from 2000 to 2006, indicating that a significant continuing source in the deep vadose zone or top of the aquifer is not likely.

Recommendations for SVE operations include (1) continuing operation of active and passive extraction systems, and (2) continuing development of a final remedial action determined through the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* remedial investigation/feasibility study process for the 200-PW-1 OU, which began in FY02.

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LIST OF TERMS

B&K	Brüel & Kjaer™ (trademark of Brüel & Kjaer North America, Inc.)
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CCU	Cold Creek unit
DNAPL	dense nonaqueous phase liquid
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
FY	fiscal year
GAC	granular activated carbon
OU	operable unit
PFP	Plutonium Finishing Plant
ppmv	parts per million by volume
PRF	Plutonium Reclamation Facility
RAO	remedial action objective
RECUPLEX	Recovery of Uranium and Plutonium by Extraction
RI Report	*Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (DOE/RL-2006-51)
RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office
SVE	soil vapor extraction

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METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerels	0.027	picocuries

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1.0 INTRODUCTION

Carbon tetrachloride was found in the unconfined aquifer beneath the 200 West Area at the Hanford Site in the mid-1980s. During this time, groundwater monitoring results indicated that the carbon tetrachloride plume was widespread and that concentrations were increasing. On December 20, 1990, the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) requested that the U.S. Department of Energy (DOE), Richland Operations Office (RL) proceed with detailed planning, including non-intrusive field work, required to implement an expedited response action (ERA) for removing carbon tetrachloride contamination from the unsaturated soils in the 200 West Area. The request was based on concerns that carbon tetrachloride residing in the soils was continuing to spread to the groundwater and, if left unchecked, would significantly increase the lateral extent of groundwater contamination. The purpose of the ERA was to minimize carbon tetrachloride migration within the vadose zone and away from the carbon tetrachloride disposal sites in the 200 West Area.

The objective of the ERA, as stated in the action memorandum issued in January 1992 by EPA and Ecology (*Action Memorandum: Expedited Response Action Proposal for 200 West Area Carbon Tetrachloride Plume* [EPA and Ecology 1992]), is to mitigate the threat to site workers, public health, and the environment caused by the migration of carbon tetrachloride vapors through the soil column and into the groundwater. The ERA is an interim action taken to reduce the mass of carbon tetrachloride in the soil column beneath the 200 West Area pending final cleanup activities.

Based on the initial investigations and an engineering evaluation/cost analysis, the preferred alternative for removal of the carbon tetrachloride from the vadose zone was soil vapor extraction (SVE) followed by aboveground vapor treatment using granular activated carbon (GAC) ("Site Evaluation," in *Expedited Response Action Proposal (EE/CA & EA) for 200 West Area Carbon Tetrachloride Plume* [DOE/RL-91-32]). The SVE pilot test was conducted in 1991, and the first SVE system began full-scale operations in February 1992.

The final cleanup activities will be determined as part of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial investigation/feasibility study (RI/FS) process for the 200-PW-1 Operable Unit (OU). The RI for this OU was initiated in fiscal year 2002 (FY02) and was completed in FY06 (*Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* [DOE/RL-2006-51] [hereinafter referred to as the RI report). The FS and proposed plan for this OU will be submitted to EPA in FY07.

1.1 REPORT PURPOSE

The purpose of this report is to evaluate the SVE system operating data and the effectiveness of the SVE in remediating the carbon tetrachloride contamination based on the existing remedial design. This report covers operations for FY06 (the time period of October 1, 2005, through September 30, 2006) and provides a general overview of the operating period from February 25, 1992, through September 30, 2006. The scope of the report includes the following:

- Summary of the history of SVE operations at the 200-PW-1 OU
- Evaluation of the efficiency of operations over time
- Estimated volume of soil vapor treated
- Measured changes in carbon tetrachloride concentrations
- Calculated mass of carbon tetrachloride removed
- Recommendations for future operations and evaluations
- SVE operations cost data.

1.2 REPORT ORGANIZATION

Detailed information on previous operating periods, and characterization data collected during the remedial investigation, can be obtained from the following reports:

- FY92 through FY01: *Performance Evaluation Report for Soil Vapor Extraction Operations at the Carbon Tetrachloride Site, February 1992 – September 2001* (BHI-00720)
- FY02: *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Carbon Tetrachloride Site, Fiscal Year 2002* (WMP-17869)
- FY03: *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Carbon Tetrachloride Site, Fiscal Year 2003* (WMP-21327)
- FY04: *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Carbon Tetrachloride Site, Fiscal Year 2004* (WMP-26178).
- FY05: *Performance Evaluation Report for Soil Vapor Extraction Operations at the 200-PW-1 Carbon Tetrachloride Site, Fiscal Year 2005* (WMP-30426).
- *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (DOE/RL-2006-51)
- *Carbon Tetrachloride Dense Non-Aqueous Phase Liquid (DNAPL) Source Term Interim Characterization Report* (DOE/RL-2006-58)
- *Carbon Tetrachloride Dense Non-Aqueous Phase Liquid (DNAPL) Source Term Interim Characterization Report Addendum* (DOE/RL-2007-22).

In this FY06 report, data from previous years are used for comparison and trending purposes. This FY06 report is divided into the following sections:

- Section 1.0: Provides introductory information and describes the purpose of this SVE report.
- Section 2.0: Includes information on the design and location of the SVE systems, history of operations, and SVE system performance.
- Section 3.0: Discusses soil vapor monitoring during FY06 and provides information on historical monitoring activities.
- Section 4.0: Presents information on the contaminant inventory of carbon tetrachloride discharged to the soil column.
- Section 5.0: Includes information on the status of the ERA.

- Section 6.0: Presents conclusions and recommendations.
- Section 7.0: Presents costs for SVE operations in FY04 through FY06
- Section 8.0: Provides a list of the references cited in this report.

Appendices A through D provide the data collected during operations and monitoring in FY06.

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2.0 200-PW-1 OPERABLE UNIT SOIL VAPOR EXTRACTION SYSTEM

The purpose of the ERA, as described in the action memorandum (EPA and Ecology 1992), can be summarized by four remedial action objectives (RAOs):

- Mitigate the threat to site workers.
- Mitigate the threat to public health.
- Mitigate the threat to the environment caused by the migration of contaminants from soil into groundwater.
- Reduce the mass of carbon tetrachloride in the soil.

To meet these RAOs, the action memorandum authorized the installation and operation of SVE systems. These systems are described below.

2.1 SOIL VAPOR EXTRACTION SYSTEM DESCRIPTION

The primary active SVE system uses an applied vacuum to extract carbon tetrachloride vapor from the vadose zone. This system extracts vapor through multiple vadose zone borings at the three primary carbon tetrachloride disposal sites:

- 216-Z-9 Trench
- 216-Z-1A tile field
- 216-Z-18 Crib.

The SVE system also is used to extract vapor through wells at the 216-Z-12 Crib (216-Z-12 site). Hereinafter in this report, these sites will be referred to as the 216-Z-9, 216-Z-1A, 216-Z-18, and 216-Z-12 sites. The 216-Z-1A, 216-Z-18, and 216-Z-12 sites are discussed together because the well fields at these sites overlap.

The SVE system was operated at the 216-Z-1A site from April through July 2006 and at the 216-Z-9 site from August through September 2006. Passive SVE systems that use naturally occurring changes in barometric pressure to drive the extraction of vapor were installed at eight vadose zone borings and operated throughout FY06. Detailed information for both the active and passive systems is presented in the following subsections.

2.1.1 Active Soil Vapor Extraction

The active SVE system consists of the following:

- A water knockout tank to remove entrained water droplets
- A high-efficiency particulate air filter to remove entrained particulate matter, including radionuclides
- A blower to extract the soil vapor
- An air-to-air heat exchanger to cool the vapor between the blower and the GAC canisters
- A secondary water knockout tank to remove entrained water condensate from the air cooler

- GAC-filled canisters for adsorbing carbon tetrachloride
- A stack for venting the treated vapor to the atmosphere.

Following overheating of a GAC canister in June 1993, a Brüel & Kjaer™ (B&K) Type 1302 multi-gas analyzer was purchased, and manual sampling was performed to test the performance of the instrument. The B&K instrument proved to be accurate and reliable, with the added features of being able to measure several other targeted volatile organic compounds and being readily adaptable to automated operation. The B&K instrument has since been used to support 24-hour/day SVE system operations, providing automated sampling and analysis at the SVE system inlet, between GAC canisters, and at the post-treatment vent stack. The vapor flow rate also is measured at these locations.

2.1.2 Passive Soil Vapor Extraction

Passive SVE uses naturally induced pressure gradients between the subsurface and the surface to drive soil vapor to the surface. The presence of a borehole screened in the vadose zone provides a preferential pathway for flow. In general, falling atmospheric pressure causes subsurface vapor to move to the atmosphere through wells, while rising atmospheric pressure causes atmospheric air to move into the subsurface. At the carbon tetrachloride site, passive SVE systems are installed on the following selected wells: wells 299-W18-6L, 299-W18-7, 299-W18-10L, 299-W18-11L, 299-W18-12, 299-W18-246L, 299-W18-247L, and 299-W18-252L.

The minimum component for a passive SVE system is a well to provide the preferential pathway from the subsurface zone to the surface. On the systems designed for use at the carbon tetrachloride site, additional components include:

- An aboveground canister of GAC to collect the venting carbon tetrachloride;
- Hoses to connect the well to the canister; and
- A one-way, flow-activated valve that lets soil vapor flow out through the well but prevents atmospheric air from flowing in through the well.

2.2 HISTORY OF OPERATIONS

2.2.1 Carbon Tetrachloride Waste Disposal

Carbon tetrachloride contained in aqueous and organic liquid wastes generated during plutonium-processing operations at Z Plant (currently called the Plutonium Finishing Plant [PFP]) was discharged primarily to three subsurface infiltration facilities:

- 216-Z-9 Trench from 1955 to 1962
- 216-Z-1A tile field from 1964 to 1969
- 216-Z-18 Crib from 1969 to 1973.

The Recovery of Uranium and Plutonium by Extraction (RECUPLEX) plutonium-processing operation was discontinued after a criticality incident in April 1962 and was replaced in May 1964 by the Plutonium Reclamation Facility (PRF). No liquid organic waste associated with these operations was discharged to cribs between April 1962 and May 1964. No liquid

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organic waste was discharged to the cribs after 1973. An estimated total of 570,000 to 920,000 kg (1,257,000 to 2,028,000 lb) of carbon tetrachloride may have been discharged to soil through these three waste sites between 1955 and 1973 (Table 2-1) (DOE/RL-91-32).

The 216-Z-12 Crib received analytical and development laboratory waste from Z Plant from 1959 to 1973 and is estimated to have received a small volume of organics, which included carbon tetrachloride (*216-Z-12 Transuranic Crib Characterization: Operational History and Distribution of Plutonium and Americium* [RHO-ST-44]).

2.2.2 Carbon Tetrachloride Well Field

The vadose zone underlying the primary carbon tetrachloride disposal sites consists of approximately 70 m (230 ft) of relatively permeable sand and gravel. This section is interrupted from 38 to 45 m (125 to 148 ft) depth by a less-permeable interval composed of 4 m (13 ft) of silt and sand and 3 m (10 ft) of carbonate-rich silt and sand. Because it constitutes a relatively low-flow zone, this less-permeable interval effectively divides the subsurface into two distinct zones:

- An upper zone from the ground surface to the top of the less-permeable layer
- A lower zone from the bottom of the less-permeable layer to the water table (>70 m [230 ft] below ground surface [bgs]).

Because of its higher concentration of calcium carbonate, the less-permeable CCU (formerly called the Plio-Pleistocene unit) is informally referred to as the "caliche layer." Vapor extraction wells are screened or perforated in both the upper and lower zones, with some wells screened in the low-flow CCU interval, 38 to 45 m (125 to 148 ft) bgs.

Currently, 47 drilled wells are available for SVE (Figure 2-1). Thirteen of these wells were drilled or deepened in 1992 and 1993 and were completed as vapor extraction wells with stainless-steel casings and screens; one well (well 299-W15-223) at the north end of the 216-Z-9 site was drilled at a 45-degree incline (slant). Thirty-three existing wells, drilled between 1954 and 1978 and completed with carbon-steel casing, were adapted for vapor extraction by perforating the well casing using mechanical or jet perforators. Two of these wells at the 216-Z-9 site (wells 299-W15-84 and 299-W15-95) were deepened in 2001 and completed with stainless-steel screens and casing that extend below the perforated intervals (*Borehole Completion Report – 216-Z-9 Trench Vadose Well Deepening and Characterization* [BHI-01552]). A new well (well 299-W15-48), drilled at a 32-degree incline underneath the 216-Z-9 Trench, was completed as a vapor extraction well in 2006 (*Borehole Summary Report for Slant Well 299-W15-48 [Borehole C3427] Drilled at the 216-Z-9 Trench* [WMP-30566]).

Nineteen of the 47 wells have two screened or perforated open intervals; within each of these 19 wells, the two open intervals are isolated by downhole packers. Twenty-one well intervals are available at the 216-Z-18/Z-12 well field, 21 well intervals are available at the 216-Z-1A well field, and 24 well intervals are available at the 216-Z-9 well field. Eighteen of these 66 intervals are open below the CCU layer (six at 216-Z-18/Z-12, two at 216-Z-1A, and ten at 216-Z-9). Well diameters range from 5 to 20 cm (2 to 8 in.). The SVE system extracts simultaneously from multiple wells that are open above and/or below the CCU layer. Cross-sections through the 216-Z-18/Z-12, 216-Z-1A, and 216-Z-9 well fields are shown in Figures 2-2, 2-3, and 2-4, respectively.

Currently, 126 subsurface vapor monitoring probes are installed within the vadose zone around the carbon tetrachloride sites at a depth of >2 m (6.6 ft) (Figures 2-1 through 2-4). These probes are as follows (note that one cone penetrometer well was decommissioned and is not counted):

- In 1993, a cone penetrometer was used to install 11 small-diameter extraction or vapor-monitoring wells. The deepest open interval ends 34 m (112 ft) bgs. In April 1997, one of these wells was decommissioned.
- Between 1991 and 1994, a cone penetrometer was used to install 106 subsurface vapor-monitoring probes at 35 locations at the carbon tetrachloride site (Figures 2-1 through 2-4). The deepest monitoring probe installed at the vapor extraction sites using the cone penetrometer is 36 m (118 ft) bgs.
- In 1993, 10 stainless-steel tubes were strapped to the outside of the casing of four wells during well completion to enable monitoring above and below the screened intervals.

2.2.3 Carbon Tetrachloride Soil Vapor Extraction, Fiscal Years 1992 Through 2005

In April 1991, a pilot SVE system was tested at the 216-Z-1A tile field (DOE/RL-91-32). In February 1992, based on the results of this testing and as part of the ERA, a full-scale SVE system was installed and began extracting from wells at the 216-Z-1A tile field. In May 1992, two of the 216-Z-18 Crib wells were added to the system. This system originally had a design capacity of 14.2 m^3/min but was upgraded to 28.3 m^3/min in March 1993. Two additional SVE systems, one with 42.5-m^3/min capacity and the other with 14.2-m^3/min capacity began operating in March 1993 at the 216-Z-9 Trench.

Operation of the three systems (14.2-m^3/min, 28.3-m^3/min, and 42.5-m^3/min) was temporarily suspended in June 1993 because a GAC canister overheated at 216-Z-9 (*Summary of Canister Overheating Incident at the Carbon Tetrachloride Expedited Response Action Site* [WHC-SD-EN-TI-203]). The 28.3-m^3/min system resumed operation at the 216-Z-1A/Z-18 well field in November 1993. The 42.5-m^3/min system resumed operation at the 216-Z-9 well field in February 1994. The 14.2-m^3/min system was moved to the 216-Z-18 well field and resumed operation in June 1994. In August 1995, SVE operations using the 14.2-m^3/min SVE system were expanded to include the 216-Z-12 site.

In FY97, a rebound study was conducted throughout the carbon tetrachloride SVE sites (BHI-01105). The purpose of the study was to determine the increase in carbon tetrachloride vapor concentrations following temporary system shutdown. Operation of all three SVE systems (14.2-m^3/min, 28.3-m^3/min, and 42.5-m^3/min) was temporarily suspended in November 1996 and then restarted in July 1997. All three SVE systems continued to operate through September 1997.

The operating strategy was modified in FY98 based on the results of the FY97 rebound study and the declining rate of carbon tetrachloride removal during continuous extraction operations. Rather than operating all three SVE systems continuously, only the 14.2-m^3/min system was used for carbon tetrachloride removal during FY98, FY99, and FY01 through FY06. Operation was temporarily suspended during FY00 as a result of higher priority remediation activities competing for limited funding.

During each of the operational FYs, the 14.2-m^3/min system typically operated from April through September alternately between the 216-Z-9 and the 216-Z-1A/Z-18 sites (for approximately 3 months at each site). The systems were maintained in standby mode from October through March to allow time for carbon tetrachloride vapor concentrations to rebound. Beginning in FY03, maintenance of the 28.3-m^3/min and 42.5-m^3/min SVE systems was discontinued; surplus of these systems is pending.

The masses of carbon tetrachloride removed by year, by waste site, and cumulatively are summarized in Table 2-2.

2.2.4 Carbon Tetrachloride Soil Vapor Extraction in Fiscal Year 2006

The 14.2-m^3/min SVE system was operated at two locations in FY06. The 14.2-m^3/min SVE system was operated at the 216-Z-1A/Z-18 well field from April through July 2006 and at the 216-Z-9 well field from August through September 2006. Operation of the SVE system at the 216-Z-1A/Z-18 well field was limited to three wells (299-W18-165, 299-W18-166, and 266-W18-174) in the 216-Z-1A waste site as a result of access restrictions. Operation of the SVE system at the 216-Z-9 well field included use of the slant well (299-W15-48) that was completed as a vapor extraction well beneath the 216-Z-9 Trench in FY06.

2.3 SOIL VAPOR EXTRACTION SYSTEM PERFORMANCE

The operating data that are routinely recorded for the SVE system include carbon tetrachloride concentrations, hours of operation, applied vacuums, and system flow rates (Appendix A). These parameters are monitored at the inlet to the SVE system to represent the combined contribution of all extraction wells currently online. In addition, samples are periodically collected at individual wells to obtain well-specific data (Appendix B). All instruments (i.e., flow meters, vacuum gauges, and volatile organic monitors) are calibrated, and the calibration data for each instrument are retained and available for review. The volatile organic compound monitoring instruments are checked periodically with gas standards. The detection limit for carbon tetrachloride using this instrumentation is 1 part per million by volume (ppmv).

2.3.1 Concentration Changes Over Time

Carbon tetrachloride concentrations in the extracted soil vapor have decreased significantly at both the 216-Z-9 and 216-Z-1A/Z-18/Z-12 well fields during operation of SVE. This is typical of SVE operations and represents removal of the volatile contaminant readily available in the swept pore spaces. Extracted contaminant vapor concentration approaches an asymptotic level as the supply of volatile contaminant to the high-flow zone becomes limited by desorption and diffusion of carbon tetrachloride from sediment particles and soil moisture. Diffusion also controls contaminant migration from the pore spaces between sediment particles in the lower permeability/lower flow zones to pore spaces in the higher permeability/higher flow zones.

Carbon tetrachloride concentrations in soil vapor extracted from the 216-Z-1A/Z-18/Z-12 well field using the SVE systems have declined from approximately 1,500 ppmv at startup in February 1992 to 10 ppmv in July 2006. Carbon tetrachloride concentrations in soil vapor extracted from the 216-Z-9 well field using the SVE systems have declined from approximately 30,000 ppmv at startup in March 1993 to 21 ppmv in September 2006.

In FY06, SVE resumed on April 3, 2006, at the 216-Z-1A/Z-18 well field using the 14.2-m^3/min SVE system. Following an extraction strategy similar to that used in previous years, extraction wells open near the depth of the CCU within the 216-Z-1A tile field were selected to optimize mass removal. The initial wells were wells 299-W18-165, 299-W18-166, and 299-W18-174 (Figure 2-1). The other two wells planned for initial startup (299-W18-167 and 299-W18-168) were not available because Vista Engineering Technologies, LLC, planned to use them for testing to support the carbon tetrachloride dense nonaqueous phase liquid (DNAPL) source-term characterization project. As a result of access restrictions in the vicinity of the 216-Z-1A tile field during the operating period, these were the only three wells used during the entire period of FY06 operations at the 216-Z-1A/Z-18 well field; no other wells were added online during this time. The passive SVE systems were maintained on eight wells open near the groundwater in the 216-Z-1A/Z-18 well field.

During FY06, carbon tetrachloride concentrations extracted from the 216-Z-1A/Z-18/Z-12 well field using the active SVE system showed only a slight decrease in concentration between April and July 2006 (Figure 2-5). These trends are similar to trends from previous years, as shown in Figure 2-6, but with lower concentrations due most likely to an overall reduced mass of carbon tetrachloride vapor to be extracted from these locations. The three locations used in FY06 are ones that typically have the highest carbon tetrachloride vapor concentrations. It should also be noted that rebound period from FY05 was only 6 months long, which is a relatively short rebound period under the current operating scenario.

The SVE operations at the 216-Z-9 well field resumed on July 31, 2006, using the 14.2-m^3/min SVE system. Following an extraction strategy similar to that used in previous years, initial on-line wells were selected close to the 216-Z-9 Trench, and wells farther away from the trench were brought on-line as extraction continued. The four initial wells, used as planned, were wells 299-W15-82, 299-W15-9U, 299-W15-9L, and 299-15-217 (Figure 2-1). Well 299-W15-48, the new slant well drilled underneath the waste site, was prioritized for early addition to the mixture of on-line wells at 216-Z-9. This well was used as the only on-line well between August 1 and August 7, 2006, to allow it to be characterized. Operations were not conducted during the weekend of August 4 to 6, 2006, to let concentrations at this well rebound and to minimize the potential for the system to overheat as a result of having only one well on-line. These five wells (299-W15-9L, 299-W15-9U, 299-W15-48, 299-W15-82, and 299-W15-217), plus five additional wells (299-W15-8L, 299-W15-8U, 299-W15-86, 299-W15-95L, and 299-W15-95U), were used from August 9 through September 29, 2006.

During FY06, carbon tetrachloride concentrations extracted from the 216-Z-9 well field appeared to initially increase and then to decrease with continued extraction (Figure 2-5). These trends are similar to trends from previous years, as shown in Figure 2-7, but with lower concentrations due most likely to an overall reduced mass of carbon tetrachloride vapor to be extracted from these locations.

Although the initial (1992 through 1993) carbon tetrachloride concentrations were an order of magnitude higher at the 216-Z-9 site (30,000 ppmv) than at the 216-Z-1A site (1,500 ppmv), concentrations at the two sites are now similar. Operation of the SVE system at the 216-Z-9 site reduced the inlet concentrations to approximately 20 to 40 ppmv each year of operation from FY97 through FY06 (Figure 2-7). At the 216-Z-1A site, operation of the SVE system appears to have reduced the inlet concentrations to approximately 10 to 25 ppmv each year of operation from FY97 through FY06 (Figure 2-6).

Slant well 299-W15-48, which is screened from 34 to 43 m (111 to 141 ft) downhole (i.e., along the inclined borehole) (29 to 37 m [95 to 121 ft] vertical bgs) beneath the 216-Z-9 Trench, was placed on-line on August 1, 2006, and was monitored at 2-hour intervals from August 1 through 3, 2006. During the first 23.3 hours of operation, carbon tetrachloride concentrations detected in vapor extracted from well 299-W15-48 decreased from 74 to 26 ppmv (Appendix B). By the end of the operational period (August 29, 2006) carbon tetrachloride concentrations in vapor extracted from this well had reduced to 5 ppmv.

2.3.2 Volume of Soil Vapor Treated

For each SVE system, the volume of soil vapor processed was calculated using the hours that the system operated and the measured flow rate of soil vapor exiting the system. The flow rate measured at the SVE system represents the combined flow from all on-line wells and may change as the selection of on-line wells changes. For a given applied vacuum, the flow produced from each well is a function of the air permeability of the soil, the open area of the screened or perforated interval, the well diameter, and the radius of influence of the well.

During FY06 operations, 1.8 million m^3 of extracted vapor was treated. Between April 1991 (pilot testing) and September 2006, 99.3 million m^3 of soil vapor were extracted and treated using the three SVE systems. This volume was extracted from two well fields, with 43.5 million m^3 extracted from the 216-Z-9 well field and 55.8 million m^3 extracted from the 216-Z-1A/Z-18/Z-12 well field.

The flow rates at individual extraction wells were estimated by apportioning the flow rates measured at the SVE systems among the on-line wells (Appendix A of BHI-00720). To estimate the flow rate at each well on each day of operation, the system flow rate was multiplied by the ratio of the well's open area to the sum of the open areas for all of the wells in operation on that system on that particular day. The daily flow rates and the number of operating hours were then used to estimate the cumulative flow from each extraction well. At the 216-Z-9 well field, an estimated 27.7 million m^3 of soil vapor were extracted from wells open above the CCU (Table 2-3), and 15.8 million m^3 of soil vapor were extracted from wells open below the CCU (Table 2-4). For the 216-Z-1A/Z-18/Z-12 well field, an estimated 35.3 million m^3 of soil vapor were extracted from wells open above the CCU (Table 2-3), and 20.5 million m^3 were extracted from wells open below the CCU (Table 2-4).

Since system startup, 66 pore volumes of soil vapor have been extracted by the SVE systems above the CCU in the 216-Z-9 area, based on an average lateral zone of influence of 55,000 m^2 (592,000 ft^2) above the CCU in the 216-Z-9 area, an average Hanford formation thickness of 38 m (125 ft), an average porosity of 20%, and assuming a uniform distribution of flow. Similarly, for the 216-Z-1A/Z-18/Z-12 area, based on an average lateral zone of influence of 155,000 m^2 (1,668,000 ft^2), 30 pore volumes of soil vapor have been extracted by the SVE systems above the CCU.

Based on an average lateral zone of influence of 40,000 m^2 (431,000 ft^2) below the CCU in the 216-Z-9 area, an average Ringold Unit E thickness of 21 m (69 ft) in the unsaturated zone, an average porosity of 20%, and an assumed uniform distribution of flow, 94 pore volumes of soil vapor have been extracted by the SVE systems below the CCU. Similarly, for the 216-Z-1A/Z-18/Z-12 area, based on an average lateral zone of influence of 100,000 m^2 (1,076,000 ft^2), 49 pore volumes of soil vapor have been extracted by the SVE systems below the CCU.

2.3.3 Carbon Tetrachloride Mass Removed

The mass of carbon tetrachloride removed from each well field was calculated using the measured flow, concentration, and hours of operation data (Appendix A). In FY06, approximately 76 kg (166 lb) of carbon tetrachloride were removed from the 216-Z-1A/Z-18/Z-12 well field, and 97 kg (214 lb) were removed from 216-Z-9 well field (Table 2-2). Between April 1991 (when the pilot test was conducted) and July 2006, approximately 24,604 kg (54,242 lb) of carbon tetrachloride were removed from the 216-Z-1A/Z-18/Z-12 well field. Between March 1993 and September 2006, approximately 54,280 kg (119,666 lb) of carbon tetrachloride were removed from 216-Z-9 well field (Table 2-2). By the end of FY06, the total mass of carbon tetrachloride removed from all sites was 78,884 kg (173,908 lb) (Table 2-2).

Carbon tetrachloride removal rates have decreased significantly from SVE startup to FY06 (Figure 2-8). The decline in mass removed in FY03 and FY04 may have resulted, in part, because the SVE system operated primarily at the 216-Z-1A well field, where less mass typically is extracted (Figure 2-9 and Table 2-2). The decline in mass removed in FY05 resulted, in part, because the SVE system was not operated, or operated on dayshift only, for approximately 77 days while the automated concentration monitoring equipment was being repaired. However, relatively high removal rates were noted during short periods in FY05. The ratio of mass removed per volume of vapor extracted from the vadose zone is shown in Figure 2-10.

The mass removed from the 216-Z-1A/Z-18/Z-12 well field in FY06 (76 kg [166 lb]) is comparable to the mass removed in FY05 (67 kg [148 lb]) (Table 2-2) but is less than the masses removed in FY03 and FY04. The relatively low rate of removal in FY05 may have been partly attributed to a reduced number of operating hours. The relatively low rate of removal in FY06, relative to FY03 and FY04, partly may have been a result of operations being limited to the same three wells (299-W18-165, 299-W18-166, and 266-W18-167) for the duration of extraction operations. However, these wells typically have the highest carbon tetrachloride concentrations.

The mass removed from the 216-Z-9 well field in FY06 (97 kg [214 lb]) was less than the mass removed in FY05 (295 kg [650 lb]). The higher mass removal in FY05 resulted, in part, because operations continued longer at the high-production area around 216-Z-9 in FY05 than in FY06. Further, concentrations in extracted soil vapor were higher in FY05 than in FY06.

The SVE system efficiencies were evaluated for FY98 through FY06 by comparing the mass of carbon tetrachloride removed per volume of vapor extracted from the vadose zone (Table 2-2). As shown in Figure 2-10, SVE system efficiencies for the 216-Z-9 well field are relatively inconsistent but have declined overall from FY98 to FY06. The two significant increases both occurred during extraction following extended periods of rebound. In contrast, SVE system efficiencies for the 216-Z-1A/Z-18/Z-12 well fields have consistently decreased between FY99 and FY06.

Carbon tetrachloride concentrations were monitored at the passive wells in FY06 (Appendix C). These monthly concentrations were used to calculate the mass removed from each well. This calculation assumes the following:

- The wells exhale 50% of the time.
- During outflow, the average flow rate is one-half the maximum flow rate.
- During outflow, the average concentration is one-half of the maximum concentration.
- The concentrations measured each month were maximum values.
- The maximum flow values were the same as used in FY01 (BHI-00720).

In FY06, the mass of carbon tetrachloride removed using the eight passive SVE wells is estimated to be approximately 5 kg (11 lb). In FY05, the passive SVE wells were estimated to have removed 10 kg (22 lb). The decline in mass removed in FY06 is a result, in part, of having three of the wells disconnected for 11 to 12 months in FY06 for use in support of the carbon tetrachloride DNAPL source-term characterization project.

2.3.4 System Operation Downtime

The availability of each SVE system is evaluated by comparing the amount of actual operating time to the potential amount of operating time (scheduled outages are excluded from this calculation). Because operation of the systems is most difficult to maintain during the winter months (i.e., with the need to drain water from the extraction hoses and water knockout tanks during cold weather and potential freezing of water in the hoses), temporary suspension of operation has continued each winter since 1998. This practice also allows a rebound period each year for concentrations to increase in the vapor phase.

In FY06, the total availability of the system was 88%. Between November 1994 and September 2006, the monthly availability for all three systems averaged 87%, which is slightly less than the objective of 90% availability. Figure 2-11 shows operational availability for FY06 and since 1994.

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Figure 2-1. Extraction and Monitoring Wells and Deep (>2 m [>6.6 ft]) Soil Vapor Probes at the Carbon Tetrachloride Soil Vapor Extraction Sites.

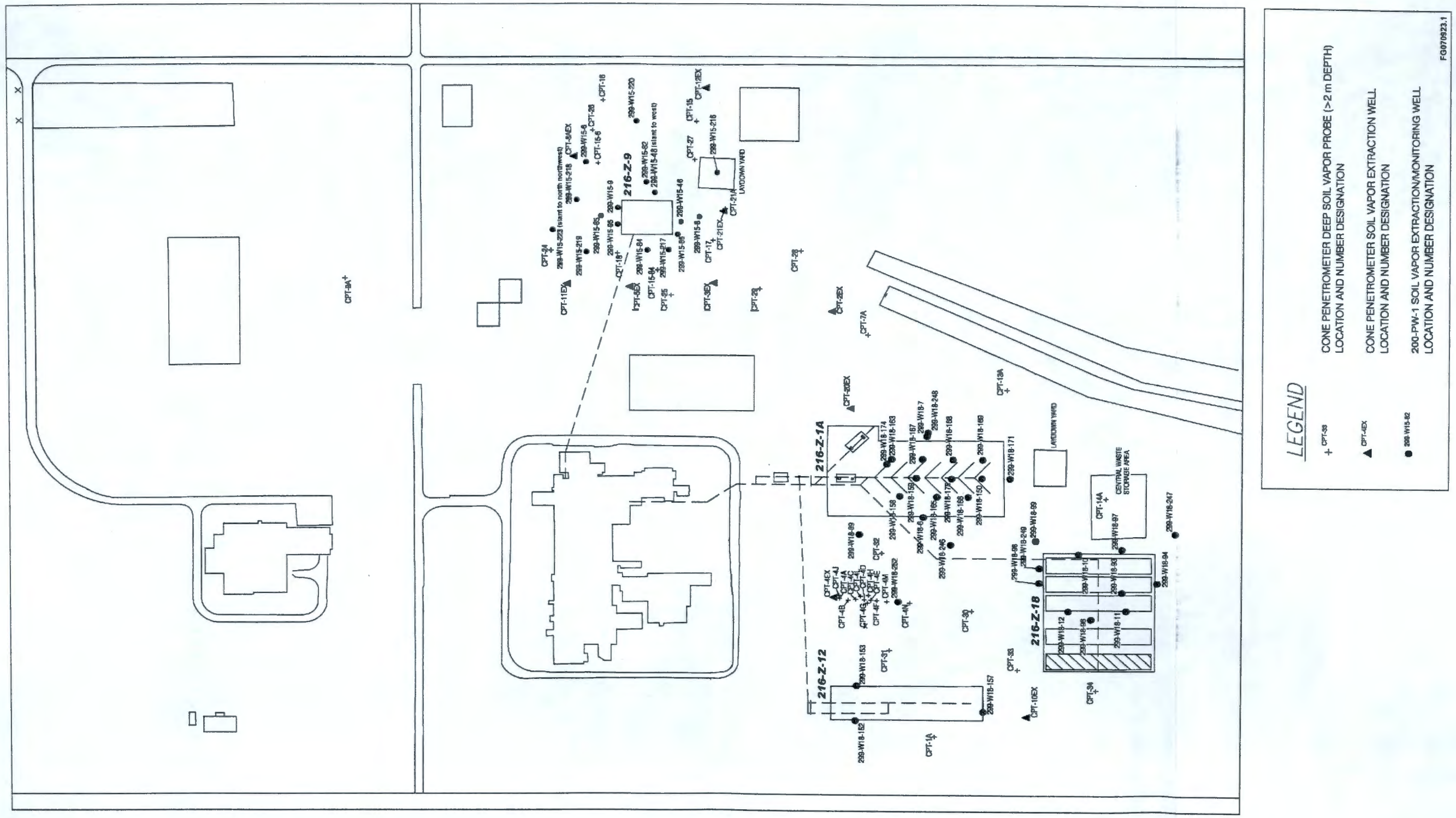


Figure 2-2. Cross-Section Through the 216-Z-18/Z-12 Well Field.

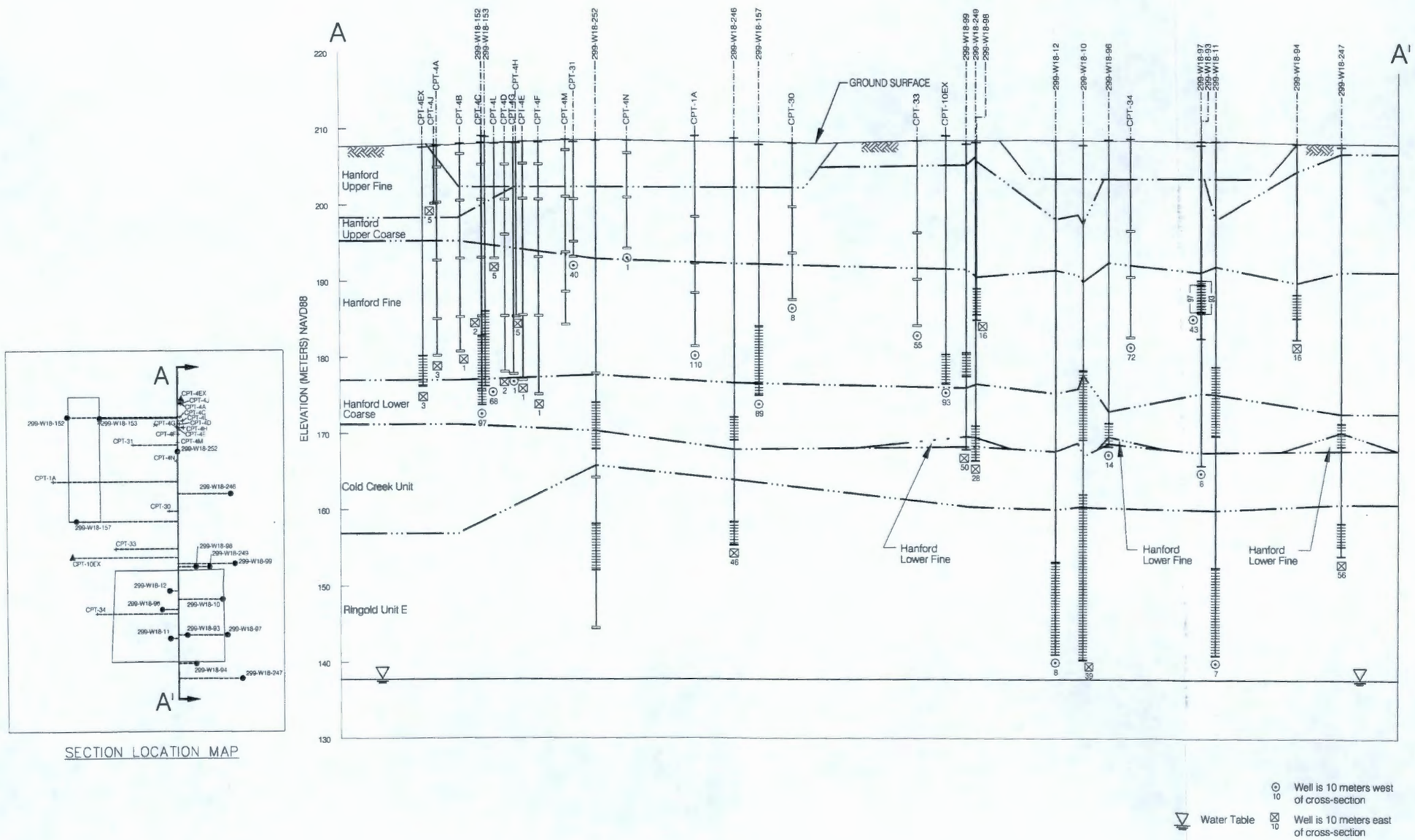


Figure 2-3. Cross-Section Through the 216-Z-1A Well Field.

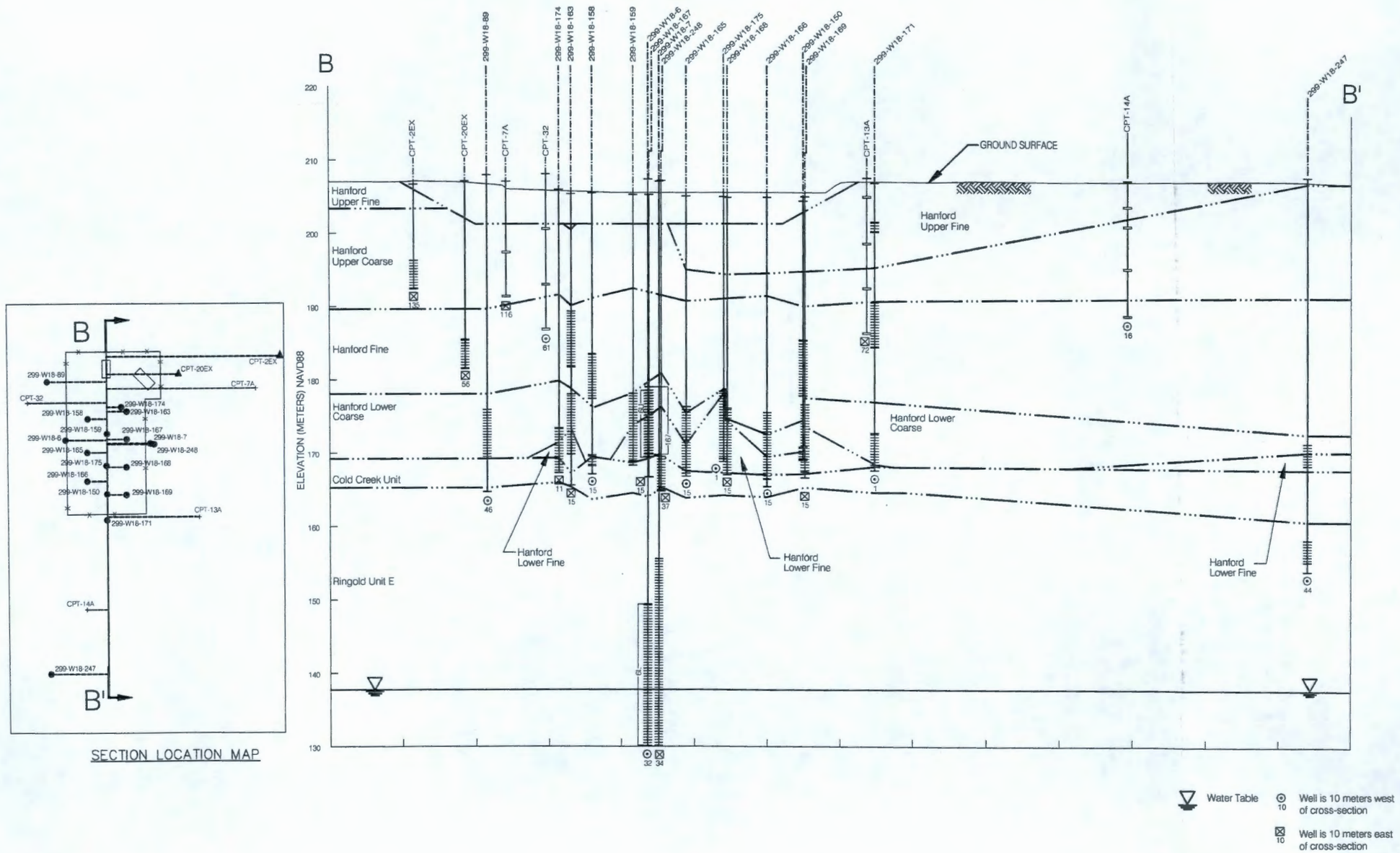


Figure 2-4. Cross-Section Through the 216-Z-9 Well Field.

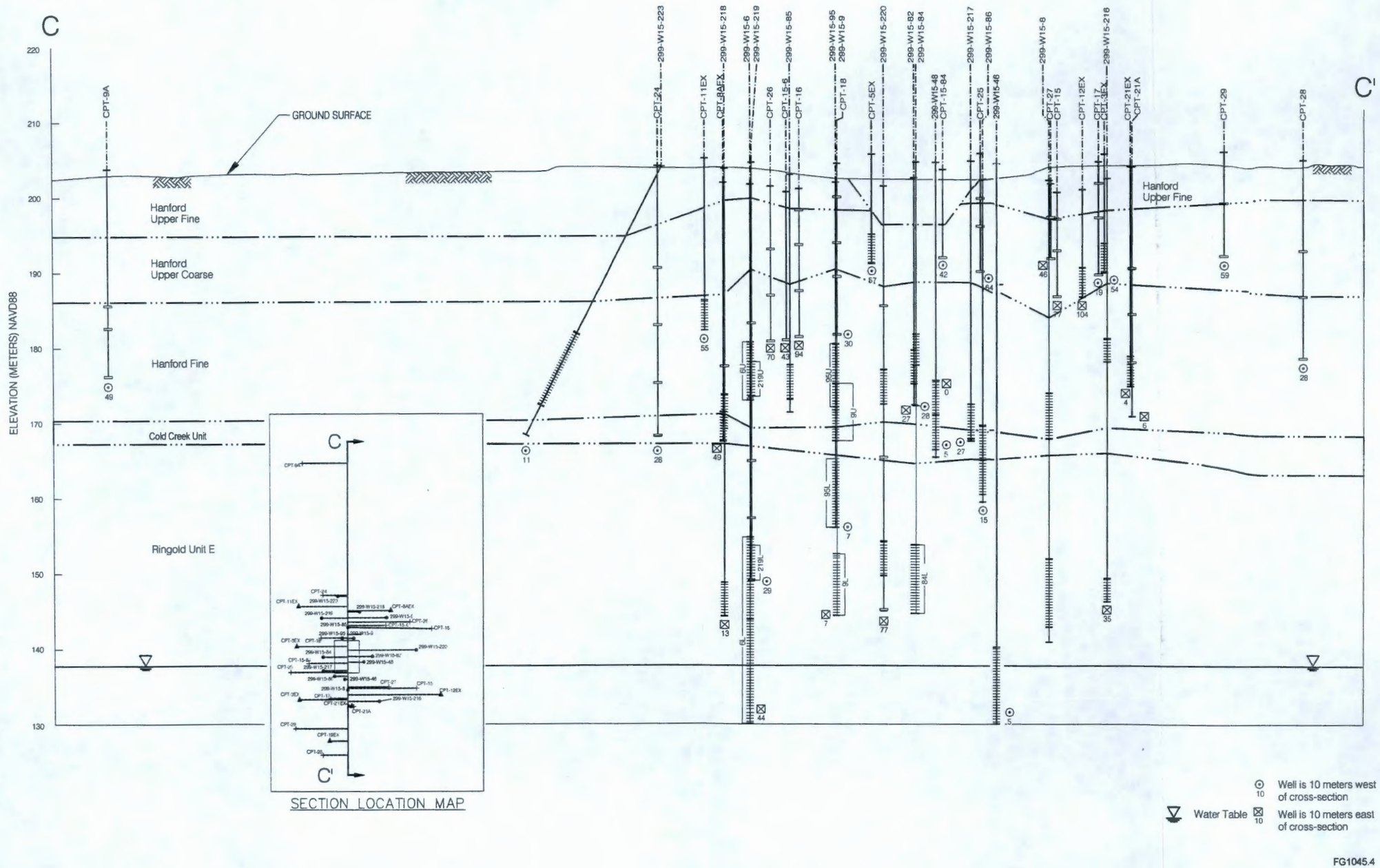


Figure 2-5. Daily Carbon Tetrachloride Concentrations and Mass Removed, Fiscal Year 2006.

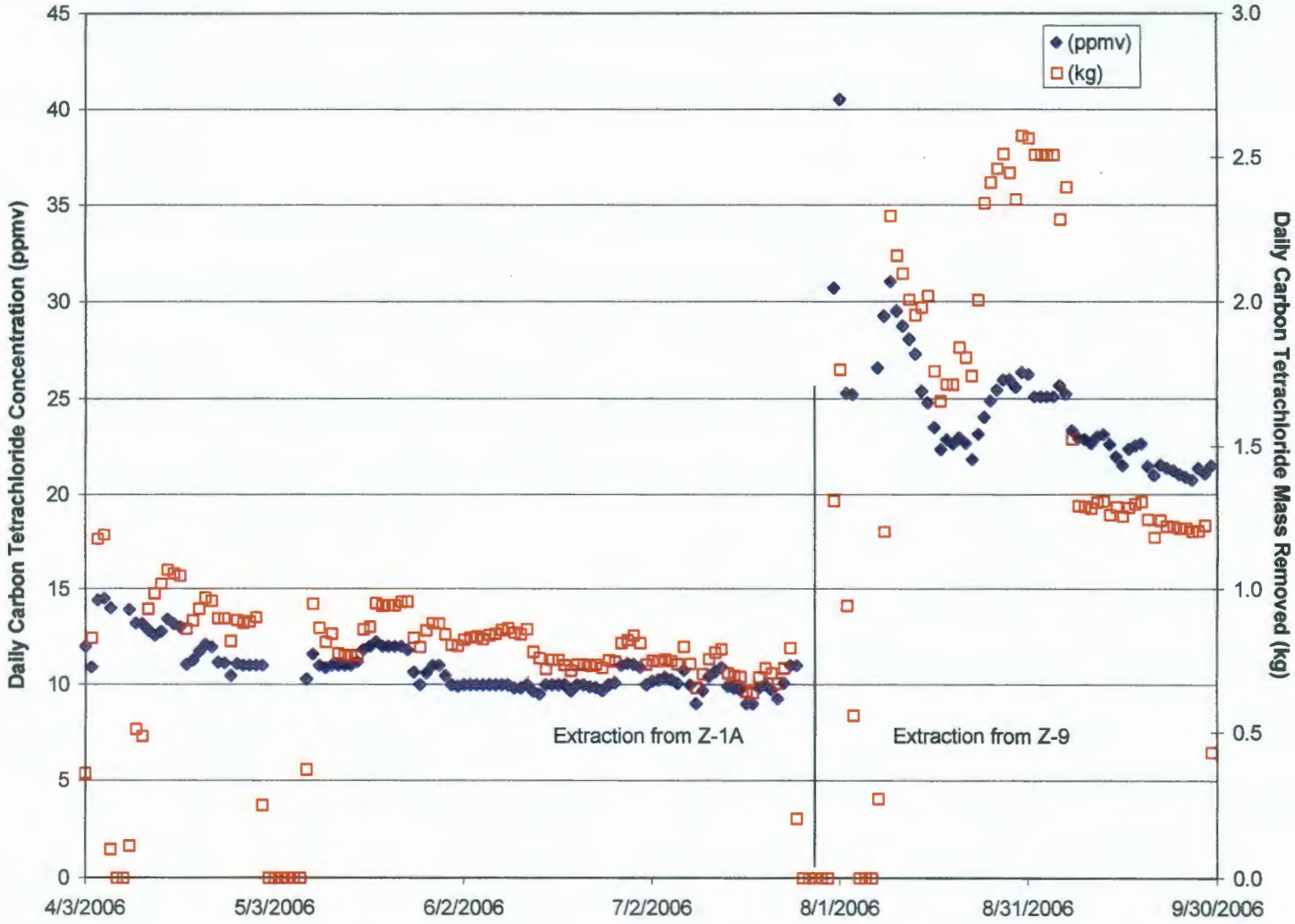


Figure 2-6. Carbon Tetrachloride Concentrations in Vapor Extracted from the 216-Z-1A Site, 1997 Through 2006.

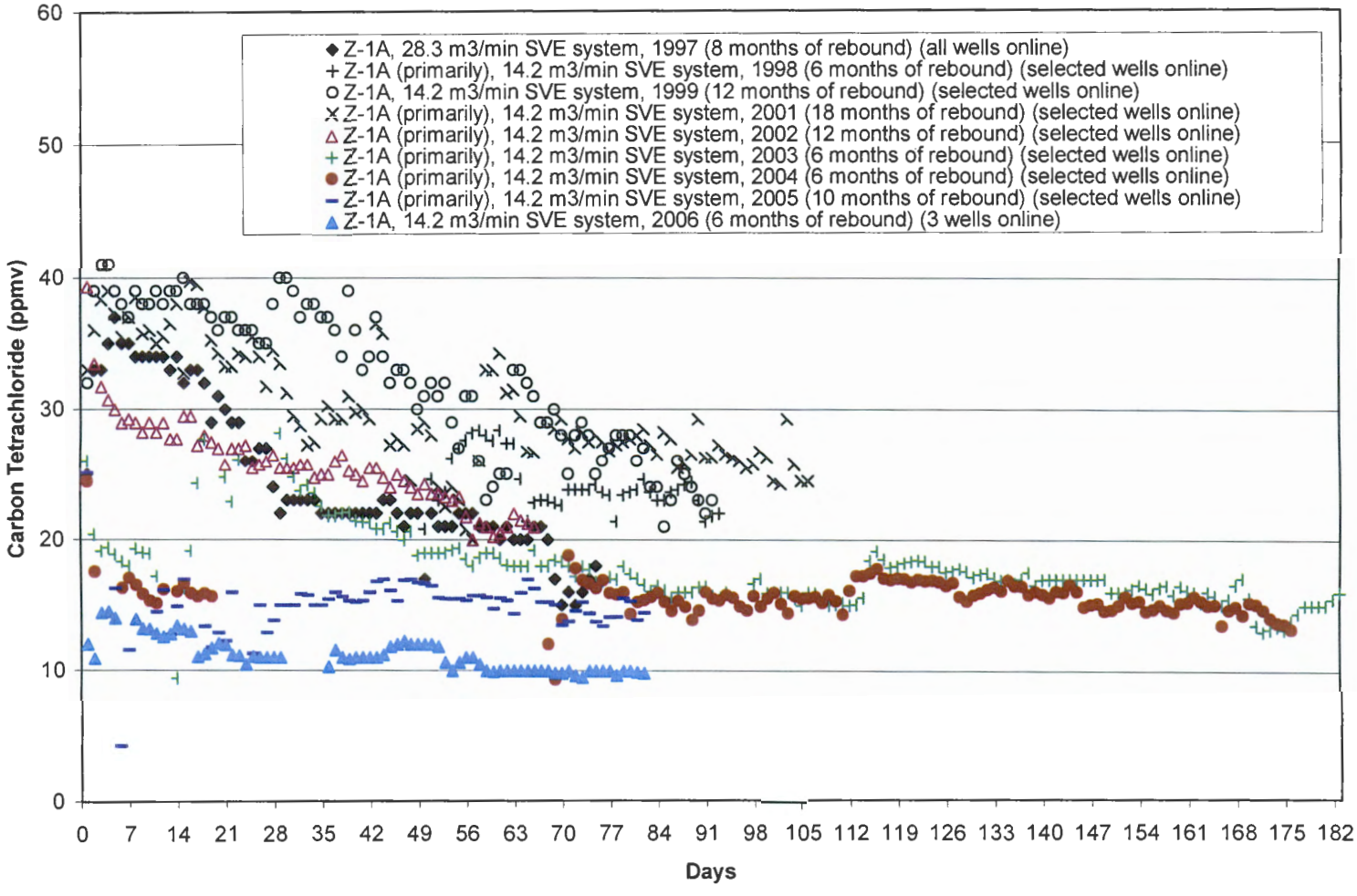


Figure 2-7. Carbon Tetrachloride Concentrations in Vapor Extracted from the 216-Z-9 Trench Site, 1997 Through 2006.

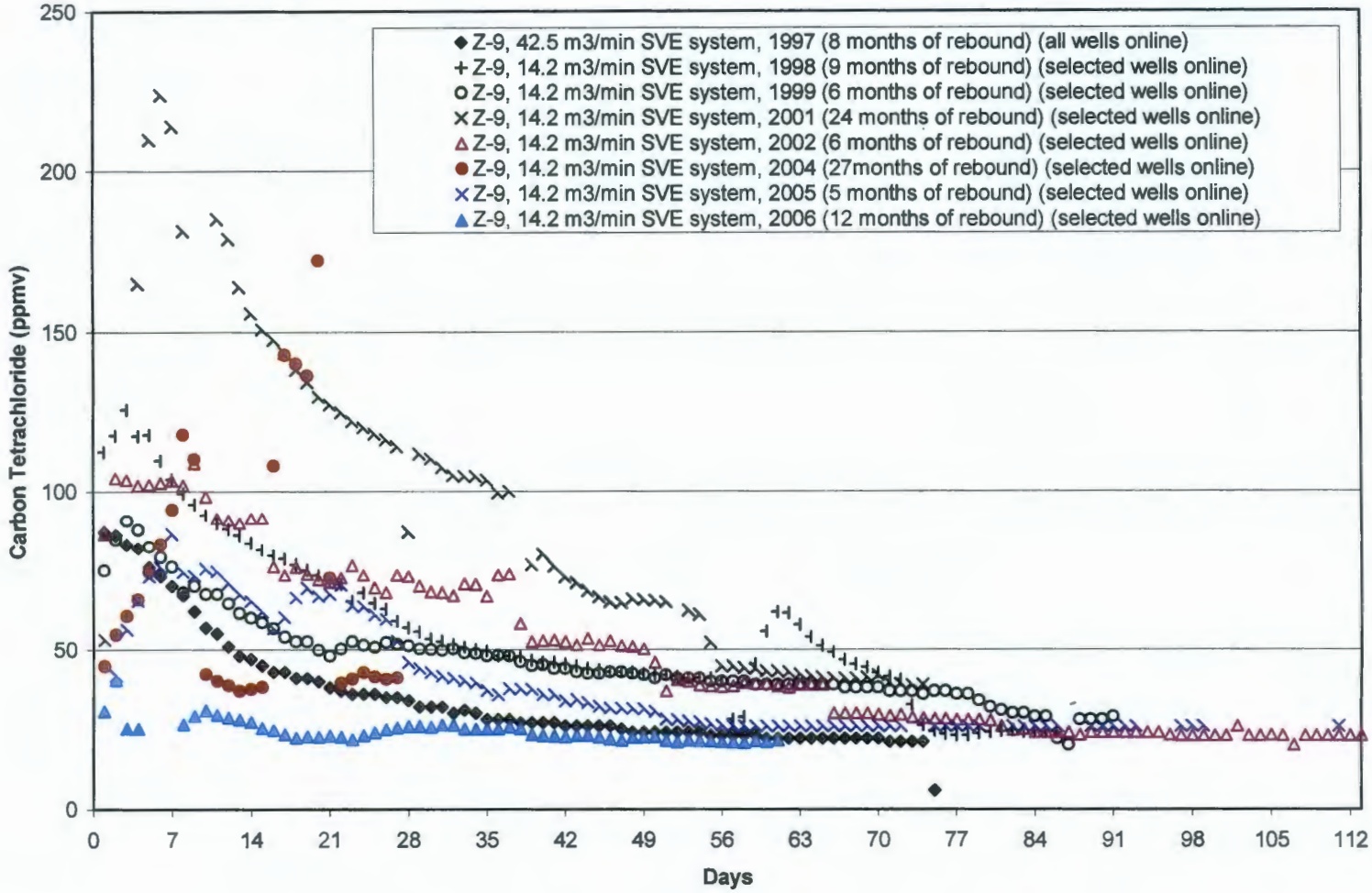


Figure 2-8. Daily Carbon Tetrachloride Mass Extracted, 1992 Through 2006.

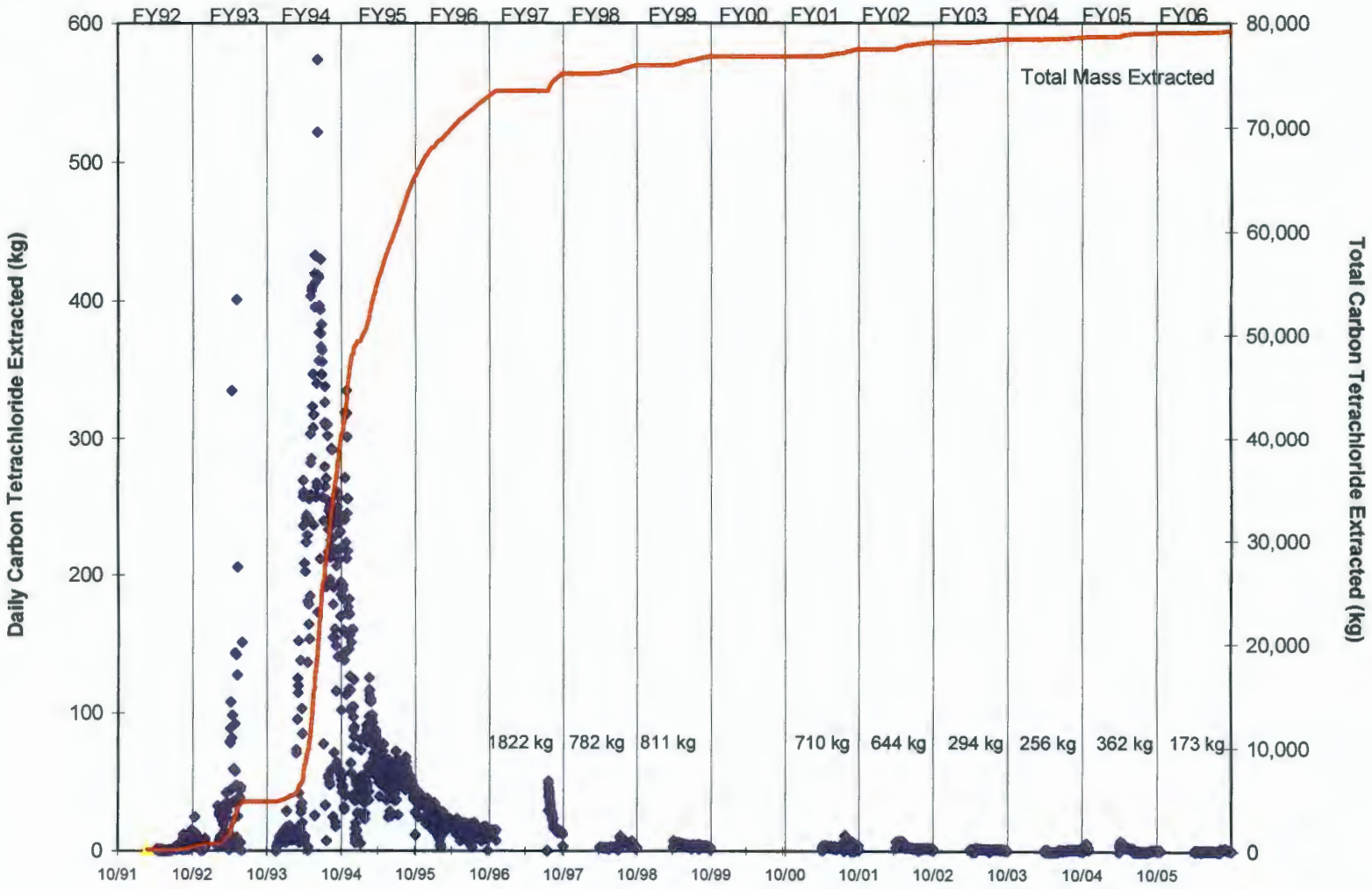


Figure 2-9. Daily Carbon Tetrachloride Mass Extracted, 2001 Through 2006.

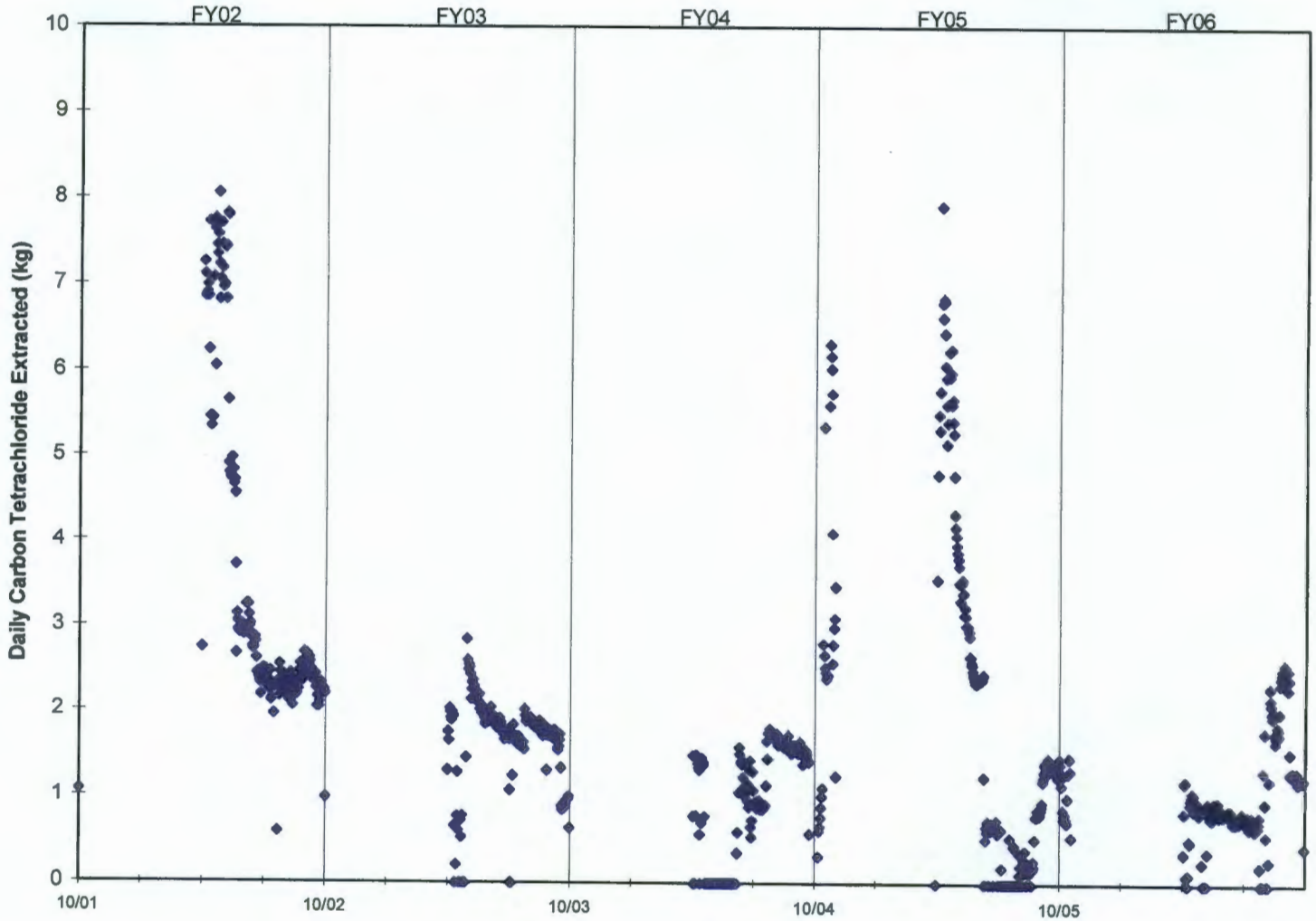
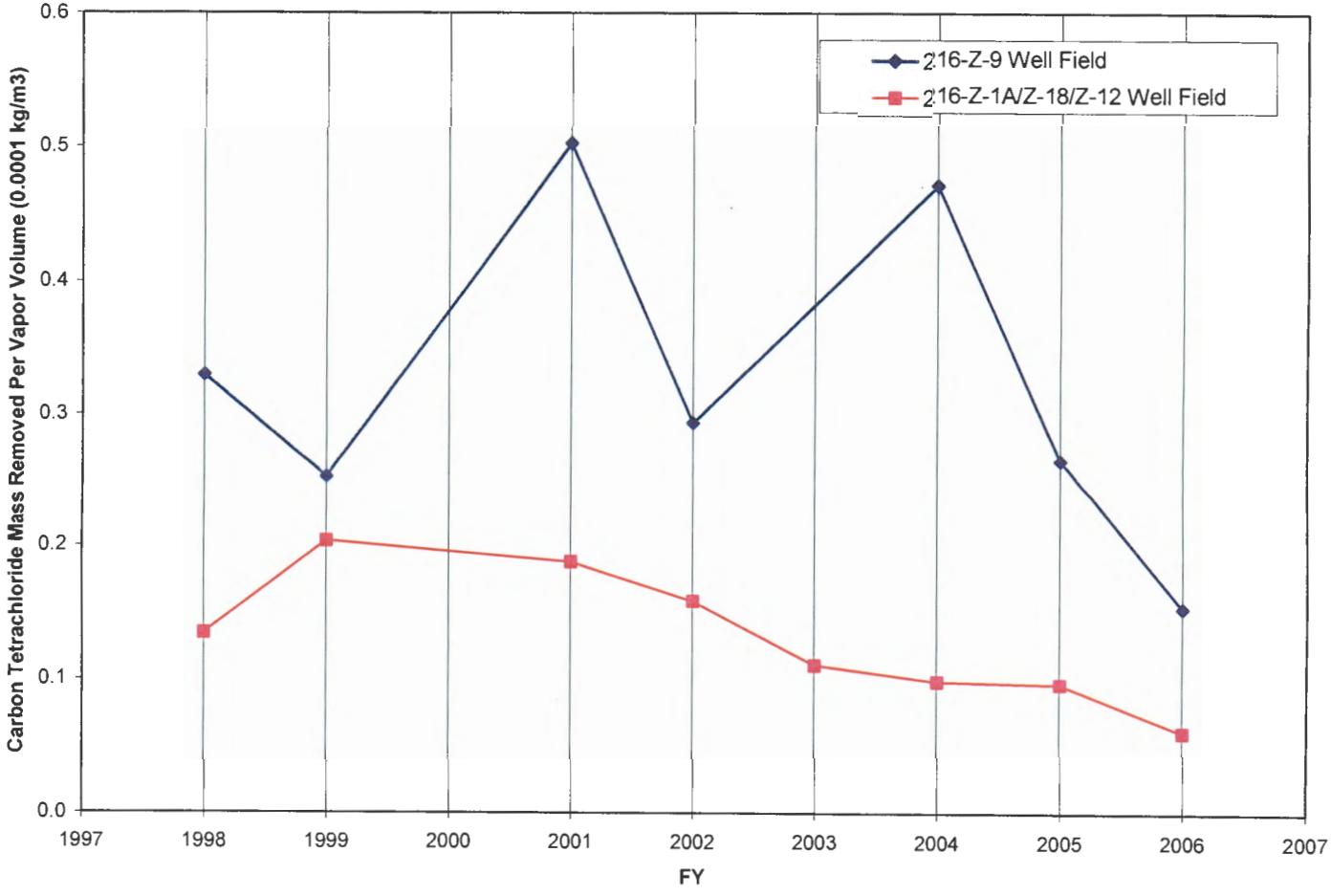


Figure 2-10. Ratio of Carbon Tetrachloride Mass Removed Per Volume of Vapor Recovered from the Vadose Zone, Fiscal Year 1998 Through Fiscal Year 2006.



NOTES: The SVE system was off-line in fiscal year 2000.
Extraction was not conducted at the 216-Z-9 well field in 2003 due to site characterization activities.

Figure 2-11. Soil Vapor Extraction System Availability.

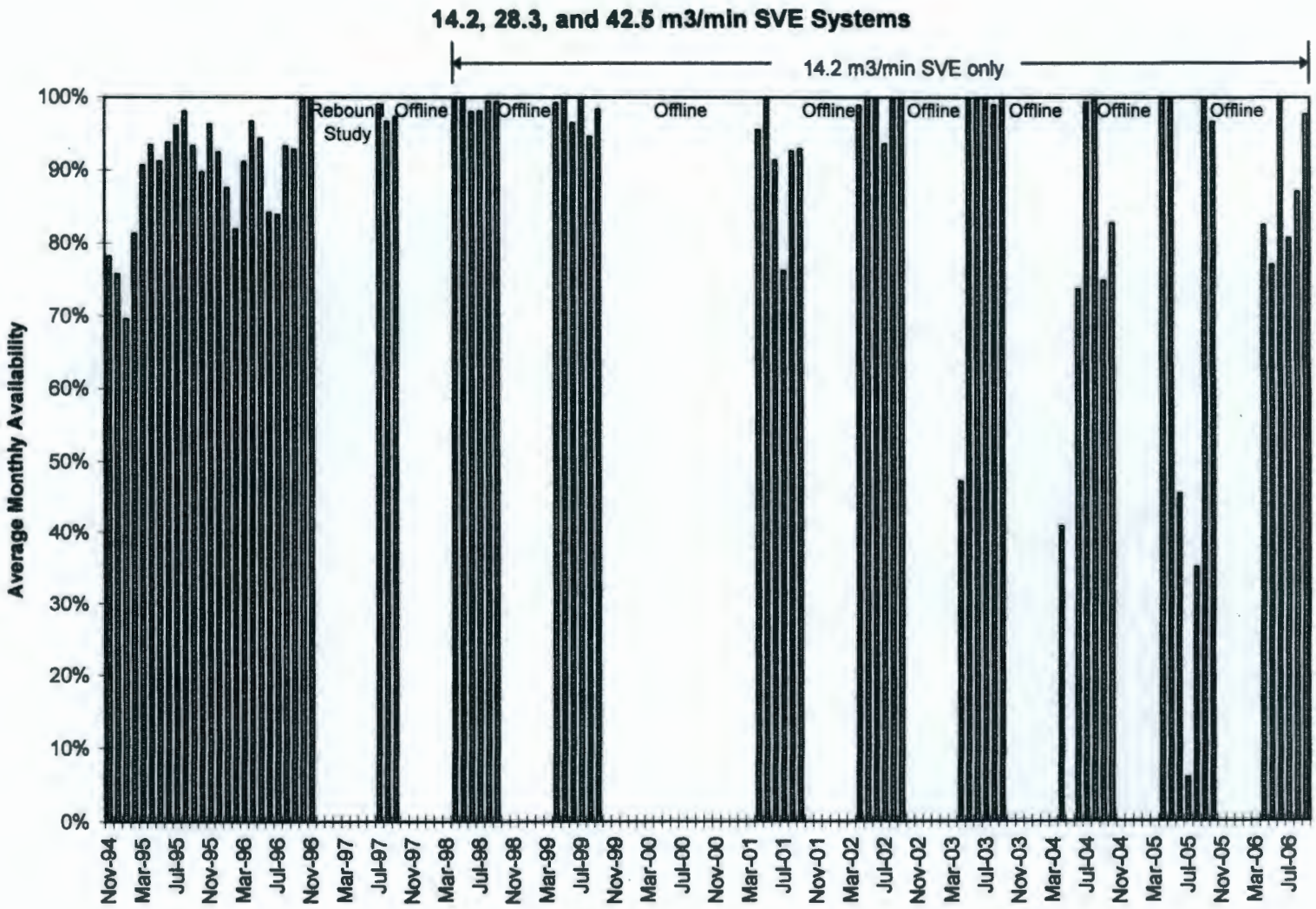


Table 2-1. Contaminant Inventory Discharged to Carbon Tetrachloride Disposal Sites.

Site	Carbon Tetrachloride (kg)	Plutonium (kg)	Americium (kg)	Carbon Tetrachloride (L)	Total Liquid (Aqueous and Organic) (L)	Operating Dates
216-Z-9	130,000 to 480,000	106[a]	2.5	83,000 to 300,000	4,090,000	1955 to 1962
216-Z-1A	270,000	57	1	170,000	5,200,000	1964 to 1969
216-Z-18	170,000	23	0.4	110,000	3,860,000	1969 to 1973
Totals	**570,000 to 920,000**	**186**	**3.9**	**363,000 to 580,000**	**13,150,000**	**1955 to 1973**

[a] 58 kg have been removed.

Table 2-2. Carbon Tetrachloride Mass Removed Using Soil Vapor Extraction.

Site	Carbon Tetrachloride Removed Each Calendar Year (kg)																
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Total**
216-Z-9	--	--	1,065	35,029	11,500	3,150	1,239	524	436	0	375	480	0	90	295	97	54,280
216-Z-1A/ Z-18/Z-12	140	959	2,541	8,757	7,307	2,581	583	258	375	0	335	164	294	167	67	76	24,604
Yearly Total	**140**	**959**	**3,606**	**43,786**	**18,807**	**5,731**	**1,822**	**782**	**811**	**0**	**710**	**644**	**294**	**256**	**362**	**173**	**78,884**
Cumulative Total	**140**	**1,099**	**4,705**	**48,491**	**67,298**	**73,029**	**74,851**	**75,633**	**76,444**	**76,444**	**77,154**	**77,798**	**78,092**	**78,348**	**78,710**	**78,883**	
Volume of vapor recovered per year of system operation (1000 m^3).																	
216-Z-9	--	--	--	--	--	--	--	1,585	1,719	0	745	1,632	0	190	1,109	634	**7,613**
216-Z-1A/ Z-18/Z-12	--	--	--	--	--	--	--	1,907	1,837	0	1,776	1,030	2,637	1,678	688	1,228	**12,780**
Ratio of carbon tetrachloride removed per cubic meter of vapor recovered from vadose zone (kg/[1000 m^3]).																	
216-Z-9 Totals	--	--	--	--	--	--	--	**0.33**	**0.25**	**0.00**	**0.50**	**0.29**	**0.00**	**0.47**	**0.27**	**0.15**	
216-Z-1A/ Z-18/Z-12 Totals	--	--	--	--	--	--	--	**0.14**	**0.20**	**0.00**	**0.19**	**0.16**	**0.11**	**0.10**	**0.10**	**0.06**	
Weeks that the 14.2-m^3/min soil vapor extraction system operated each year.																	
216-Z-9	--	--	--	--	--	--	--	13	13	0	11	16	0	4	17	9	83
216-Z-1A/ Z-18/Z-12	--	--	--	--	--	--	--	13	13	0	15	10	26	18	12	16	123

Table 2-3. Volume of Vapor Extracted from Each Extraction Well Above the Cold Creek Unit Between April 1991 and September 2006.

Z-9 Wells, March 1993-September 2006	Extracted Vapor (1,000 m^3)	Z-18/Z-12 Wells, February 1992-September 2006	Extracted Vapor (1,000 m^3)	Z-1A Wells April 1991-September 2006	Extracted Vapor (1,000 m^3)
W15-6U	150	W18-10U	660	W18-6U	190
W15-8U	40	W18-93	10	W18-87L	40
W15-9U	920	W18-94	0	W18-87M	20
W15-48	110	W18-96	450	W18-87U	40
W15-82	5,390	W18-97	230	W18-89	8,450
W15-84U	2,510	W18-98	0	W18-150L	240
W15-85	2,650	W18-99	160	W18-150M	40
W15-95U	850	W18-152	1,770	W18-150U	60
W15-216U	570	W18-153	480	W18-158L	230
W15-217	4,850	W18-246U	780	W18-158M	0
W15-218U	3,410	W18-249	800	W18-158U	900
W15-219U	2,790	W18-252U	1,290	W18-159	980
W15-220U	2,040			W18-163L	240
W15-223	1,420			W18-163M	60
				W18-163U	520
				W18-165	2,450
				W18-166	1,310
				W18-167	1,810
				W18-168	1,910
				W18-169	150
				W18-171L	500
				W18-171M	390
				W18-171U	460
				W18-174	4,280
				W18-175	350
				W18-248	3,050
Total	**27,700**	**Total**	**6,640**	**Total**	**28,670**

Table 2-4. Volume of Vapor Extracted from Each Extraction Well Below the Cold Creek Unit Between April 1991 and September 2006.*

Z-9 Wells, March 1993-September 2006	Extracted Vapor (1,000 m^3)	Z-18/Z-12 Wells, February 1992-September 2006	Extracted Vapor (1,000 m^3)	Z-1A Wells April 1991-September 2006	Extracted Vapor (1,000 m^3)
W15-6L	2,400	W18-10L	2,720	W18-6L	2,360
W15-8L	60	W18-11L	240	W18-7	8,880
W15-9L	980	W18-12	1,040		
W15-84L	700	W18-246L	1,650		
W15-86	780	W18-252L	3,650		
W15-95L	1,810				
W15-216L	1,170				
W15-218L	3,630				
W15-219L	2,820				
W15-220L	1,470				
Total	**15,820**	**Total**	**9,290**	**Total**	**11,240**

* based on soil vapor extraction using the active soil vapor extraction systems.

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3.0 SOIL VAPOR MONITORING

Non-operational soil vapor monitoring data are collected at wells and probes that are not on-line to the SVE system. The objectives of monitoring the non-operational wells and probes are as follows:

- To measure carbon tetrachloride concentrations and trends near the vadose/atmosphere and vadose/groundwater interfaces to evaluate whether non-operation of the SVE system is negatively impacting the atmosphere or groundwater
- To be cognizant of carbon tetrachloride concentrations and trends near the CCU to provide an indication of concentrations that can be expected during restart of SVE operations and to support selection of on-line wells.

For each well field, the period of rebound begins when SVE operations are temporarily suspended.

Carbon tetrachloride concentrations rebound during periods of non-operation as a result of carbon tetrachloride accumulating in the pore spaces after apparent diffusion from sediment micropores, soil moisture, residual DNAPL, and/or low-permeability zones. When operations resume, initial extracted carbon tetrachloride concentrations are higher than the carbon tetrachloride concentrations at the previous shutdown. These initial concentrations will generally be lower than the initial concentrations following previous periods of rebound. However, the non-operational duration for each well field varies from year to year, which also affects the rebound concentrations.

3.1 FISCAL YEAR 2006 MONITORING

Soil vapor monitoring at off-line wells and probes was conducted in FY06 using the sampling methods developed for the rebound study in FY97 (BHI-01105). A low-flow (0.8-L/min) sampling pump was used to draw soil vapor samples from wells and probes into a 1-L Tedlar bag for analysis using a B&K multi-gas monitor. Two purge volumes were drawn before the representative sample was collected. At the wells, a tube was lowered to the target depth where the casing is perforated to minimize the volume of air to be purged. A metal filter attached to the end of the tube also served as a weight. Each well equipped with a sampling tube remained sealed at the well head throughout the monitoring period and allowed access to the sampling tubes in the wells.

Soil vapor samples were collected from approximately 30 off-line wells and probes approximately once each month. The soil vapor monitoring data for FY06 are included in Appendix D. As in previous years, soil vapor samples were analyzed primarily to monitor for carbon tetrachloride. However, samples were also analyzed for chloroform, methylene chloride, methyl ethyl ketone, and water vapor because the B&K multi-gas analyzer has been configured to monitor these constituents in support of routine operations.

Passive SVE systems are operating on eight wells in the 216-Z-1A/Z-18 well field. The eight wells are wells 299-W18-6L, 299-W18-7, 299-W18-10L, 299-W18-11L, 299-W18-12, 299-W18-246L, 299-W18-247L, and 299-W18-252L (Figure 2-1). All of the passive SVE systems are open below the CCU. During FY06, soil vapor was sampled at passive SVE wells and analyzed for carbon tetrachloride, chloroform, methylene chloride, methyl ethyl ketone, and

water vapor using a B&K multi-gas analyzer. The FY06 passive monitoring data are included in Appendix C. These data are included in the evaluation of FY06 rebound data below.

Soil vapor concentrations near the groundwater and ground surface were monitored to assess whether non-operation of the SVE system was allowing carbon tetrachloride to migrate out of the vadose zone to the atmosphere and/or to the groundwater. Monitoring was also conducted at locations near the lower permeability CCU to provide an indication of concentrations that could be expected during restart of SVE operation.

The maximum concentration detected near the ground surface (between 2 and 10 m [7 and 33 ft] bgs) was 6.4 ppmv at a depth of 7.6 m (25 ft) in the 216-Z-1A/Z-18 well field (at probe cone penetrometer [CPT]-32). At the 216-Z-9 well field, the maximum concentration detected near the ground surface was 1.6 ppmv at a depth of 7.6 m (25 ft) (probe CPT-16). Near the groundwater (between 40 and 70 m [131 and 230 ft] bgs), the maximum concentration was 25.7 ppmv at a depth of 43.9 m (144 ft) bgs at the 216-Z-9 site (well 299-W15-95L). At the 216-Z-1A well field, the maximum concentration detected near groundwater was 33.8 ppmv at a depth of 60 m (197 ft) bgs (well 299-W18-7) (Appendix C). Near the CCU, at depths ranging from 25 to 40 m (82 to 131 ft) bgs, the maximum concentration detected was 394 ppmv at a depth of 33.2 m (108.9 ft) in the 216-Z-1A well field (well 299-W18-165). At the 216-Z-9 well field, the maximum concentration detected was 245 ppmv at a depth of 26.5 m (87 ft) bgs (probe CPT-28).

For each period of rebound monitoring since FY97, the maximum rebound concentrations have occurred near the CCU (Figure 3-1). With the exception of FY02 and FY06, the maximum carbon tetrachloride rebound concentration has been measured at well 299-W15-217.

Because carbon tetrachloride concentrations did not increase significantly at the near-surface probes, temporarily suspending operation of the SVE system appears to have caused minimal detectable vertical transport of carbon tetrachloride through the soil surface to the atmosphere. Because carbon tetrachloride concentrations did not increase significantly near the water table during this time, temporarily suspending operation of the SVE systems appears to have had no negative impact on groundwater quality. As in previous years, soil vapor monitoring results for FY06 suggest that the CCU is the most likely source zone for the observed carbon tetrachloride vapor.

4.0 CONCEPTUAL MODEL

This section summarizes the environmental setting and the conceptual models at the primary disposal sites. Additional details are available in the following documents:

- *Performance Evaluation Report for Soil Vapor Extraction Operations at the Carbon Tetrachloride Site, February 1992 - September 2001* (BHI-00720)
- *Carbon Tetrachloride Flow and Transport in the Subsurface of the 216-Z-9 Trench at the Hanford Site: Heterogeneous Model Development and Soil Vapor Extraction Modeling* (PNNL-15914)
- *Carbon Tetrachloride Flow and Transport in the Subsurface of the 216-Z-18 Crib and 216-Z-1A Tile Field at the Hanford Site: Multifluid Flow Simulations and Conceptual Model Update* (PNNL-16198)
- *Remedial Investigation Report for the Plutonium/Organic-Rich Process Condensate/ Process Waste Group Operable Unit: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units* (DOE/RL-2006-51)
- *Carbon Tetrachloride Dense Non-Aqueous Phase Liquid (DNAPL) Source Term Interim Characterization Report* (DOE/RL-2006-58)
- *Carbon-Tetrachloride Dense Non-Aqueous Phase Liquid (DNAPL) Source Term Interim Characterization Report* Addendum (DOE/RL-2007-22).

4.1 ENVIRONMENTAL SETTING

The approximately 70-m (230-ft)-thick vadose zone can be broadly divided into an upper gravel and sand interval (Hanford formation) and a lower gravel and sand interval (Ringold Formation Unit E), separated by a finer grained, carbonate-cemented CCU at approximately 38 m (125 ft) bgs. Based on characterization results, the CCU appears to have been an accumulation zone for carbon tetrachloride. Numerical simulation results indicate that the CCU accumulated carbon tetrachloride and had a large impact on DNAPL movement and the resulting distribution of carbon tetrachloride in the subsurface (PNNL-15914). Other fine-grained zones in both the upper and lower gravel and sand intervals may also be accumulation zones. For example, high carbon tetrachloride concentrations were observed in a silt layer 19.8 m (65 ft) bgs during drilling of well 299-W15-46 on the south side of the 216-Z-9 Trench in FY04. Carbon tetrachloride may be in non-equilibrium sorption sites within intra-particle sediment pore spaces in these fine-grained units (*Hanford Soil Partitioning and Vapor Extraction Study* [BHI-00861]).

4.2 216-Z-9 CONCEPTUAL MODEL

The 216-Z-9 Trench is located in the 200 West Area, about 213 m (700 ft) east of the 234-5Z Building (Figure 2-1). The surface elevation of this site is approximately 201 m (660 ft). The groundwater beneath the 216-Z-9 Trench is approximately 68 m (223 ft) bgs, based on nearby well 299-W15-46 in April 2005.

The 216-Z-9 Trench consists of a 6-m (20-ft)-deep excavation with a 37-m by 27-m (120-ft by 90-ft) concrete cover. The walls of the trench slope inward and downward to the 18-m by 9-m (60-ft by 30-ft) floor space, which had a slight slope to the south. The underside of the concrete cover was paved with acid-resistant brick/tiles. The cover of the trench is supported by six concrete columns.

From July 1955 through June 1962, the 216-Z-9 Trench received all solvent and aqueous wastes from the RECUPLEX process that operated in the 234-5Z Building. The 216-Z-9 Trench received approximately 4.1 million L (1.1 million gal) of high-salt, acidic, aqueous, and organic liquid waste from the RECUPLEX process. The organic inventory discharged to the trench included 130,000 to 480,000 kg (286,600 to 1,058,219 lb) of carbon tetrachloride; 27,900 L of tributyl phosphate; 46,500 L of dibutyl butyl phosphonate; and 9,300 L of lard oil (Figure 4-1). The carbon tetrachloride, which was mixed with the other organics, was discharged to the 216-Z-9 Trench as a small entrained fraction of process aqueous wastes and as DNAPL.

The RI report for the 200-PW-1 OU (DOE/RL-2006-51) provides details of past investigations and the RI results, including soil, soil vapor, borehole geophysical logging, and other investigations. The significant RI findings for the 216-Z-9 Trench in relation to carbon tetrachloride are summarized below:

- Soil vapor samples collected from boreholes drilled in the vicinity of the trench revealed carbon tetrachloride at concentrations up to 28,500 ppmv in 1993. This is approximately 23% of the maximum soil vapor concentration, indicating carbon tetrachloride saturation in the vadose zone.
- Soil samples from boreholes near the 216-Z-9 Trench revealed carbon tetrachloride DNAPL in soil of up to 380,000 μg/kg in well 299-W15-46 from 19.4 to 20.1 m (63.5 to 66 ft) bgs. At adjacent direct-push location C5336 (P66), the maximum carbon tetrachloride detected in soil was 390,000 μg/kg in the same silt lens. These represent the first detections of DNAPL at any location in the subsurface of the 200 West Area since the beginning of the carbon tetrachloride contamination investigation in the early 1990s.
- An SVE system has been operating near the 216-Z-9 Trench as an ERA. Between April 1991 and September 2006, 54,280 kg (119,667 lb) of carbon tetrachloride were removed by the SVE system.
- In general, the highest concentrations of carbon tetrachloride detected in the vadose zone soils have been in fine-grained layers (i.e., silts and the CCU).
- A higher percentage of the carbon tetrachloride inventory than previously estimated was likely lost to the atmosphere through evaporation during disposal. A higher percentage of the carbon tetrachloride inventory than previously estimated is present in the unconfined aquifer.
- At the 216-Z-9 Trench, the discharged effluent volume was greater than the soil-column pore volume, which indicates that the volume of effluent released was sufficient to reach the unconfined aquifer during operation of this waste site. However, based on currently available site data, including soil-moisture content measurements, the 216-Z-9 Trench is not considered to be a significant current source of groundwater contamination.

The contaminant distribution model for the 216-Z-9 Trench is presented in Figure 4-1.

4.3 216-Z-1A TILE FIELD CONCEPTUAL MODEL

The 216-Z-1A tile field is located in the 200 West Area about 153 m (500 ft) south of the 234-5Z Building, immediately south of the 216-Z-1 and 216-Z-2 Cribs and adjacent to the 216-Z-3 Crib (Figure 2-1). The surface elevation around this site is approximately 207 m (679 ft). The groundwater beneath the 216-Z-1A tile field is approximately 71 m (234 ft) bgs, based on nearby well 299-W18-16 on March 20, 2005.

The tile field's piping consists of 20-cm (8 in.)-diameter perforated vitrified clay pipe placed on a 1.5-m (5-ft)-deep gravel bed. The piping consists of a 79-m (260-ft)-long, north-south trunk or main pipeline with seven pairs of 21-m (70-ft) laterals spaced at 11-m (35-ft) intervals in a centered herringbone pattern. The piping system was overlaid with 15 cm (6 in.) of cobbles and 1.5 m (5 ft) of sand and gravel.

The tile field was used in this configuration from 1949 to 1959. The waste stream discharged to the adjacent 216-Z-1 and 216-Z-2 Cribs (1949 to 1952) and the 216-Z-3 Crib (1952 to 1959) overflowed to the tile field and consisted of neutral to basic (pH of 8 to 10) process waste and analytical and development laboratory waste from the Z Plant via the 241-Z-361 settling tank. The total volume of waste discharged from 1949 to 1959 was approximately 1 million L (264,000 gal.).

Before the 216-Z-1A tile field was reactivated in 1964, a sheet of 0.05-cm (0.02-in.)-thick polyethylene and a 30-cm (1-ft)-thick layer of sand and gravel were added, and the liquid waste discharge piping was routed directly to the central distributor pipe in the tile field. Between 1964 and 1969, a 5-cm (2-in.)-diameter, stainless-steel pipe was progressively inserted inside the central distributor pipe to divide the tile field into three operational sections (216-Z-1AA, 216-Z-1AB, and 216-Z-1AC) (*Existing Data on 216-Z Liquid Waste Sites* [RHO-LD-114]).

From 1964 to 1969, the 216-Z-1A tile field received approximately 5.2 million L (1.4 million gal) of liquid waste from 234-5Z (PFP), 236-Z PRF, 242-Z Waste Treatment Facility, and miscellaneous laboratory waste. The organic inventory discharged to the tile field included 270,000 kg (594,000 lb) of carbon tetrachloride; 23,900 L of tributyl phosphate; 27,500 L of dibutyl butyl phosphonate; and 11,000 L of lard oil (Figure 4-2). The carbon tetrachloride, which was mixed with the other organics, was discharged to the 216-Z-1A tile field as a small entrained fraction of process aqueous wastes and as DNAPL.

The RI report (DOE/RL-2006-51) provides details of past investigations and RI results, including soil, soil vapor, borehole geophysical logging, and other investigations. The significant RI findings for the 216-Z-1A tile field in relation to carbon tetrachloride are summarized below:

- Soil samples from the tile field area revealed a maximum carbon tetrachloride concentration of 6,561 μg/kg in the CCU in 1993.
- A SVE system has been operating near the tile field. Between April 1991 and September 2006, 24,604 kg (54,242 lb) of carbon tetrachloride were removed by the SVE system.

- The 216-Z-1A tile field has not been considered to be a past source of groundwater contamination because the effluent volume discharged at this site was much less than the soil-column pore volume. However, based on the dispersed carbon tetrachloride vadose zone plume data presented in the RI, there are significant concentrations of carbon tetrachloride in the vadose zone adjacent to this site, so it is possible that this site was a past source of groundwater contamination; however, it is not a significant current source.

The refinements to the 216-Z-9 Trench contaminant distribution model regarding the presence of discontinuous silt layers apply to the 216-Z-1A tile field contaminant distribution model as well.

The contaminant distribution model for the 216-Z-1A tile field is presented in Figure 4-2.

4.4 216-Z-18 CRIB CONCEPTUAL MODEL

The 216-Z-18 Crib is located in the 200 West Area, southwest of the 216-Z-1A tile field (Figure 2-1). The groundwater beneath the 216-Z-18 Crib is approximately 72 m (236 ft) bgs, based on nearby well 299-W18-2 in July 2003.

The 216-Z-18 Crib consists of five separate, parallel, north/south-running trenches, each 63 m by 3 m (207 ft by 10 ft) and 5.5 m (18 ft) deep. Each crib structure has two 8-cm (3-in.)-diameter distribution pipes placed on a 0.3-m (1-ft)-thick bed of gravel at 5.2 m (17 ft) bgs, buried under an additional 0.3 m (1 ft) of gravel, covered with a membrane and sand, and then backfilled to grade. Crib piping was fed by the primary steel distribution pipe that bisected each crib. The individual trenches were operated for approximately 1 year, each beginning with Trench 3, followed by Trenches 2, 1, and 4 (in that order) (Figure 4-3).

The 216-Z-18 Crib was used as a replacement for the 216-Z-1A tile field to receive high-salt, acidic (pH of 1 to 2.5) aqueous liquid waste and organic liquid waste from the PFP from 1969 to 1973. The organic inventory discharged to the crib included 175,000 kg (386,000 lb) of carbon tetrachloride; 16,400 L of tributyl phosphate; and 19,100 L of dibutyl butyl phosphonate (Figure 4-3). The carbon tetrachloride, which was mixed with the other organics, was discharged to the 216-Z-18 Crib as a small entrained fraction of process aqueous wastes and as DNAPL.

The RI report (DOE/RL-2006-51) provides details of past investigations, including soil, soil vapor, borehole geophysical logging, and other investigations. The 216-Z-18 Crib conceptual site model is based on all available existing data for this waste site. The contaminant distribution model for the 216-Z-18 Crib is presented in Figure 4-3.

Figure 4-1. Contaminant Distribution Model, 216-Z-9 Trench.

200-PW-1 Operable Unit
Waste Type: Process Waste

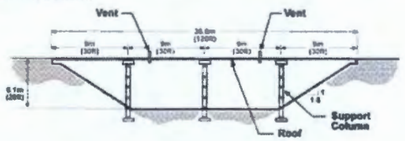
216-Z-9 Trench

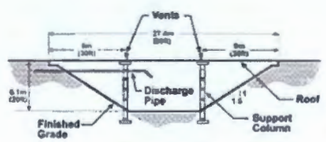
PFP Zone

History

The 216-Z-9 Trench is an enclosed, below-grade trench that was used from 1955 to 1962 for disposal of Z Plant RECUPLEX aqueous and organic liquid waste. Carbon tetrachloride was received in the aqueous phase liquid and, mixed with other organics, as a dense, non-aqueous phase liquid (DNAPL). In 1976 and 1977, the upper 0.3 m (1 ft) of the trench floor was mined to reduce the amount of plutonium in the trench; after mining, 38 to 48 kilograms (84 to 106 pounds) of plutonium were estimated to remain in the soils beneath the trench. Soil vapor extraction has been ongoing at the 216-Z-9 Trench since 1993 to remove carbon tetrachloride from the vadose zone.

CONSTRUCTION: The site is a rectangular, enclosed trench with a concrete cover supported by six columns. The trench is 18 by 9 m (60 by 30 ft) at the bottom and 6 m (21 ft) deep. The underside of the concrete cover was lined with acid resistant bricks. Two stainless steel pipes discharged effluent above the trench bottom.





WASTE VOLUME: 4,090,000 L (1,081,000 gal) (RHO-LD-114)

DURATION: 1955 to 1962

DISCHARGED INVENTORY:

Plutonium	38-48 kg (remaining) (RHO-ST-21)
Americium-241	2.5 kg (RHO-LD-114)
Carbon tetrachloride	83,000 to 300,000 L (DOE/RL-91-32)
Tributyl phosphate	27,900 L (WHC-SD-EN-TI-248)
Dibutylbutyl phosphonate	46,500 L (WHC-SD-EN-TI-248)
Lard oil	9,300 L (WHC-SD-EN-TI-248)
Nitrate	1,361,000 kg (HNF-31792)

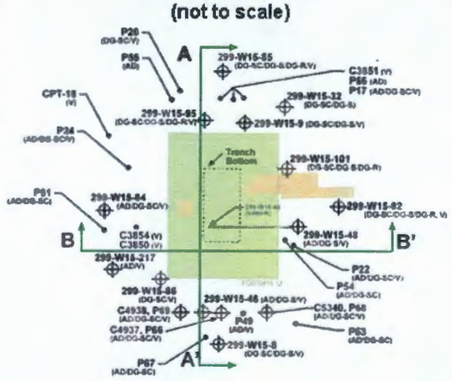
REFERENCES:

WIDS general summary reports
ARH-2915
RHO-ST-21
RHO-LD-114
PNNL-16103
PNNL-11978
DOE/RL-91-32
WHC-SD-EN-TI-248
BHI-00431
SGW-33746
HNF-31792

Basis of Knowledge (Data Types)

- Process History (PH)
- Downhole Geophysics - Spectral (DG-S)
- Downhole Geophysics - Scintillation (DG-SC)
- Downhole Geophysics - Radionuclide Logging System (DG-R)
- Soil Sampling Analytical Data (AD)
- Vapor Sampling Data (V)

Site Plan View
(not to scale)



Characterization Summary

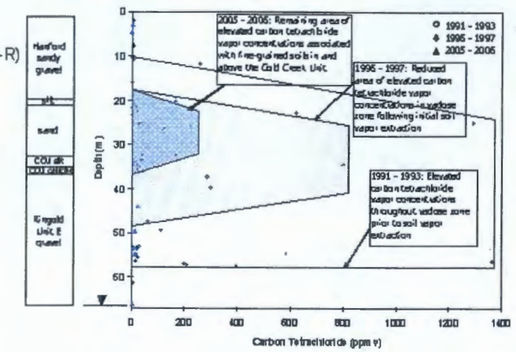
Wells were installed around the 216-Z-9 Trench beginning in the 1950s to monitor contaminant migration. Many of these wells have been geophysically logged. Characterization was conducted in 1961, 1963, and 1973 to evaluate the plutonium and americium in the trench (ARH-2915). Characterization was conducted in 1991 to 1993 to support soil vapor extraction activities. A DNAPL investigation conducted on the northeast corner of the 216-Z-9 Trench in 1995 detected no DNAPL in well 299-W15-32 (BHI-00431). Remedial investigation activities conducted at the trench included sampling from one deep well (299-W15-46) and one slant well (299-W15-48) and a phased carbon tetrachloride investigation. DNAPL was identified in a silt lens 20 m (65 ft) bgs south of the trench.

LEGEND

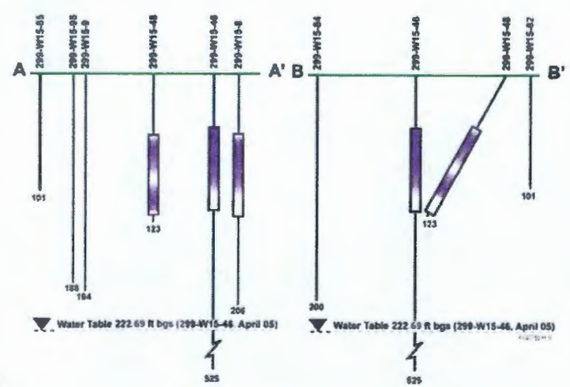
- Existing Borehole (data type)
- Water Table
- bgs = below ground surface

Site Section View Scale. Concentrations of plutonium; no color bar on Site Section View indicates no contamination was identified in available data.

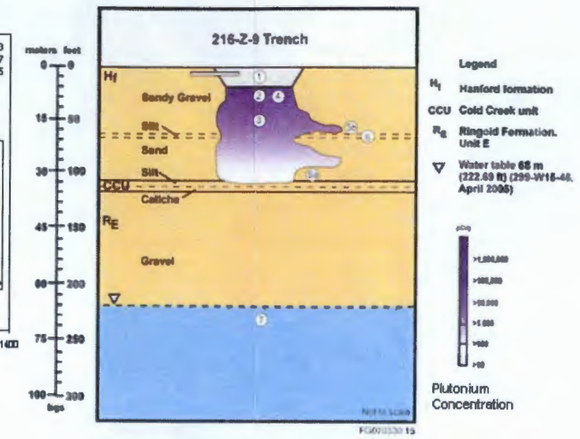
Carbon Tetrachloride Vapor Distribution



Site Section Views
(not to scale, units in feet bgs)



Contaminant Distribution Model



1. At the 216-Z-9 Trench, more than 4 million liters of plutonium/organic-rich process wastes were discharged between 1955 and 1962.
2. Effluent containing contaminants was discharged at the bottom of the unlined 216-Z-9 Trench. The trench floor slopes slightly to the south.
3. The wetting front and contaminants moved vertically beneath the trench. Lateral spreading of liquids is associated mainly with the Hanford gravel and sand contact, the Cold Creek unit, or fine-grained lenses in the Hanford or Ringold formations. In addition, vapor phase carbon tetrachloride migrated vertically and laterally beneath and around the trench, but has been considerably reduced by soil vapor extraction operations started in 1993 (see vapor distribution chart at left).
4. Constituents with large distribution coefficients, such as americium and plutonium, sorb to soils resulting in higher concentrations near the bottom of the trench. Concentrations generally decrease with depth. However, these contaminants were detected to depths up to 36.9 m (121 ft) bgs beneath the trench, indicating that plutonium and americium mobility was enhanced in the presence of the organic and acidic liquid wastes.
5. Carbon tetrachloride is present throughout the vadose zone beneath the 216-Z-9 Trench. As determined from sample data, carbon tetrachloride exists as vapor (5A), as a DNAPL near the Hanford gravel/sand contact on the south side (5B), and as a dissolved aqueous phase and/or sorbed phase in soil.
6. The highest concentrations of detected carbon tetrachloride are associated with silts in a thin lens at 20 m (65 ft) bgs.
7. Carbon tetrachloride has impacted the groundwater; impacts may have been associated with vapor, aqueous liquid, and/or organic liquid phases. In addition, carbon tetrachloride may have been dissolved in aqueous waste effluent from nearby facilities and subsequently been transported to groundwater. Plutonium and americium have been detected at low concentrations in the groundwater collected from one well near the trench. Older boreholes, and possibly clastic dikes, may have provided preferential pathways through the vadose zone.

200-PW-1FS.216-Z-9.08/28/07

Figure 4-2. Contaminant Distribution Model, 216-Z-1A Tile Field.

200-PW-1 Operable Unit
Waste Type: Process Waste

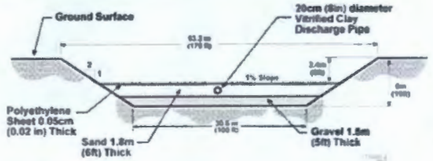
216-Z-1A Tile Field

PFP Zone

History

The 216-Z-1A Tile Field was a liquid waste site that was used to dispose of aqueous and organic liquid waste generated at the Plutonium Finishing Plant. The waste streams included overflow from the 216-Z-1, 216-Z-2, and 216-Z-3 Cribs, which received process and laboratory waste from 1949 to 1959, and 236-Z plutonium recovery waste and 242-Z americium recovery waste discharged directly to the tile field from 1964 to 1969. Carbon tetrachloride was received in the aqueous phase liquid and, mixed with other organics, as a dense, non-aqueous phase liquid (DNAPL) from 1964 to 1969. The site was deactivated in 1969 by plugging facility discharge piping to the tile field when plutonium recovery waste was diverted to the 216-Z-18 Crib. Soil vapor extraction has been ongoing at the site since 1992 to remove carbon tetrachloride from the vadose zone.

CONSTRUCTION: The 216-Z-1A Tile Field consists of a 30 m (100 ft) wide, 79 m (260 ft) long, and 5.8 m (19 ft) deep excavation. The 20-cm (8-in) diameter vitrified clay distribution pipes lie on a 1.5-m (5-ft) thick gravel bed, 4.3 m (14 ft) bgs. The distribution pipes are covered with a 1.8-m (6-ft) thick sand layer. The central distribution pipe is a continuous line without perforations; the seven pairs of lateral pipes are divided into 0.3-m (1-ft) long segments.



WASTE VOLUME: 6,200,000 L (1,600,000 gal) (RHO-LD-114)

DURATION: 1949 to 1969

ESTIMATED DISCHARGED INVENTORY:

Plutonium	57 kg (RHO-LD-114)
Americium-241	1 kg (RHO-ST-17)
Carbon tetrachloride	270,000 kg (WHC-SD-EN-TI-248)
Tributyl phosphate	23,900 L (WHC-SD-EN-TI-248)
Dibutylbutyl phosphonate	27,500 L (WHC-SD-EN-TI-248)
Lard oil	11,000 L (WHC-SD-EN-TI-248)
Nitrate	3,000 kg (DOE/RL-91-58)

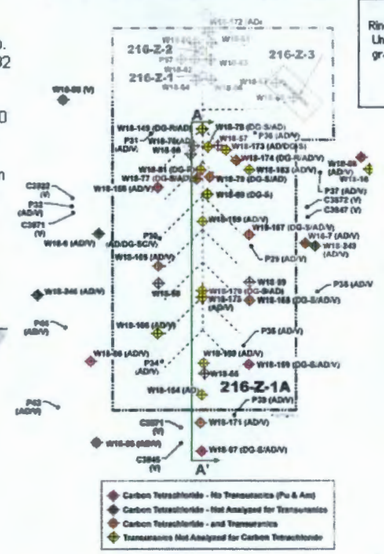
REFERENCES:
WIDS general summary reports
RHO-ST-17
RHO-LD-114
DOE/RL-91-32
WHC-SD-EN-TI-248
DOE/RL-91-58
SGW-33746
SGW-33829

Basis of Knowledge (Data Types)

- Process History (PH)
- Downhole Geophysics - Spectral (DG-S)
- Downhole Geophysics – Scintillation (DG-SC)
- Geologic Logs (GL)
- Soil Sampling Analytical Data (AD)
- Vapor Sampling Data (V)

Site Plan View

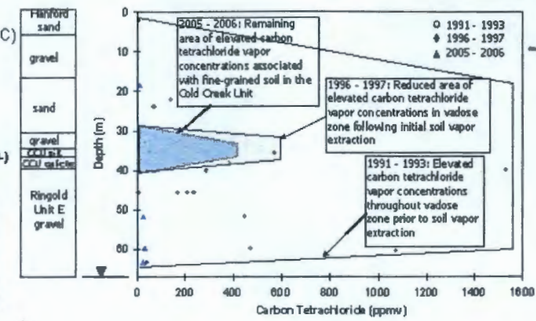
(not to scale; all well numbers prefixed with 299-)



Characterization Summary

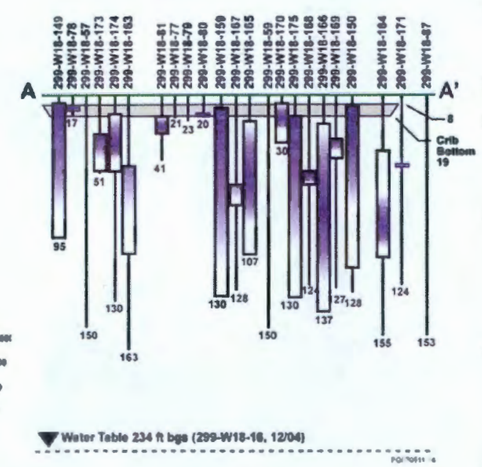
Data collection activities have been ongoing at the 216-Z-1A Tile Field since early operations. The distribution of plutonium and americium was characterized at 16 wells at this site in the 1970s (RHO-ST-17). Also, many of the wells in and around the tile field have been geophysically logged (ARH-ST-156, SGW-33829). Characterization was conducted in 1991-1993 to support soil vapor extraction, which has been ongoing at this site since 1992. As part of the remedial investigation, information from additional characterization boreholes was used to evaluate the distribution of carbon tetrachloride and other organic contaminants.

Carbon Tetrachloride Vapor Distribution



Site Section View

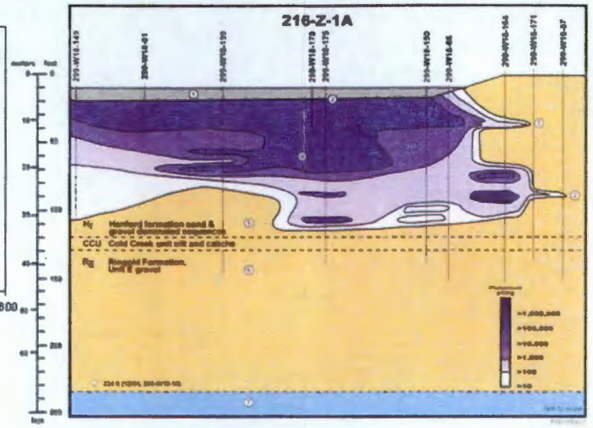
(not to scale; units in feet bgs)



Site Section View Scale. Concentrations of plutonium; no color bar on Site Section View indicates no contamination was identified in available data.

LEGEND
- Existing Borehole (data type)
- Water Table
- bgs = below ground surface

Contaminant Distribution Model



1. Between 1964 and 1969, the 216-Z-1A Tile Field received 5.2 million liters of high-salt, acidic liquid waste containing significant inventories of plutonium and carbon tetrachloride. From 1949 to 1959, the 216-Z-1A Tile Field received 1.0 million liters of slightly basic, aqueous waste.
2. Effluent and contaminants were released to the soil at the bottom of the tile field through a herringbone arrangement of pipes.
3. The wetting front and contaminants moved vertically beneath the tile field. Lateral spreading is mainly attributed to contact with the Cold Creek unit or fine-grained lenses in the Hanford or Ringold formations. Vapor phase carbon tetrachloride exists throughout the vadose zone in the source area.
4. Constituents such as plutonium (Pu) and americium (Am), which are generally immobile in soils, sorb readily to soils, resulting in higher concentrations directly beneath the tile field. The Am and Pu concentrations generally decrease with depth. However, radionuclides were detected to depths up to 37 m, indicating that Pu and Am mobility was enhanced in the presence of carbon tetrachloride, tributyl phosphate and derivatives, and acidic liquid wastes.
5. Carbon tetrachloride initially spread throughout the vadose zone beneath and around the 216-Z-1A Tile Field. However, soil vapor extraction operations started at the site in 1992 have considerably reduced the vadose zone carbon tetrachloride inventory (see vapor distribution chart at left). Dense non-aqueous phase liquid carbon tetrachloride was not identified during the remedial investigation.
6. The highest concentration of carbon tetrachloride is associated with the fine-grained sediments of the Cold Creek unit.
7. The effluent volume discharged to the tile field suggests that groundwater may not have been directly impacted by the wetting front unless a preferential pathway is present. Carbon tetrachloride in the soil vapor phase may have reached groundwater.

200-PW-1FS.216-Z-1A.08/30/07

Figure 4-3. Contaminant Distribution Model, 216-Z-18 Crib.

200-PW-1 Operable Unit
Waste Type: Process Waste

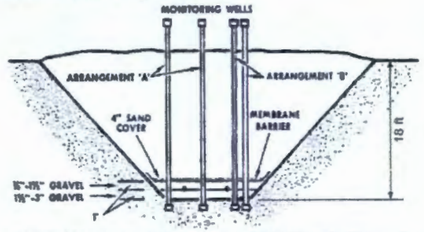
216-Z-18 Crib

PFP Zone

History

The 216-Z-18 Crib was used, as a replacement for the 216-Z-1A Tile Field, to receive high salt, acidic (pH 1 to 2.5) aqueous liquid waste and organic liquid waste from the Plutonium Finishing Plant. The waste streams included plutonium recovery waste from the 236-Z Building and americium recovery waste from the 242-Z Building. Carbon tetrachloride was received in the aqueous phase liquid and, mixed with other organics, as a dense, non-aqueous phase liquid (DNAPL). Crib structures 1 through 4 (shown numbered east to west) received waste; crib structure 5 was not used. The individual crib structures were operated for approximately 1 year each beginning with crib structure 3, followed by crib structures 2, 1, and 4, in that order. The 216-Z-18 Crib was retired in 1973 and deactivated by blanking pipelines in the 236-Z and 242-Z Buildings. Soil vapor extraction has been ongoing at the crib since 1992 to remove carbon tetrachloride from the vadose zone.

CONSTRUCTION: The 95 by 79 m (311 by 259 ft) site consists of 5 separate, parallel crib structures, each 63 m by 3 m (207 ft by 10 ft), and 5.5 m (18 ft) deep. Each crib structure has two 8-cm (3-in) diameter distribution pipes placed on a 0.3-m (1-ft) thick bed of gravel at 5.2 m (17 ft) bgs, buried under an additional 0.3 m (1 ft) of gravel, covered with a membrane and sand, and then backfilled to grade. Crib piping was fed by the primary steel distribution pipe that bisected each crib.



WASTE VOLUME: 3,860,000 L (1,020,000 gal) (RHO-LD-114)

DURATION: 1969 to 1973

ESTIMATED DISCHARGED INVENTORY:

Plutonium	23 kg (RHO-LD-114)
Americium-241	0.4 kg (DOE/RL-91-32)
Carbon tetrachloride	175,000 kg (WCH-SD-EN-TI-248)
Tributyl phosphate	16,400 kg (WCH-SD-EN-TI-248)
Dibutylbutyl phosphonate	19,100 kg (WCH-SD-EN-TI-248)
Nitrate	500,000 kg (DOE/RL-91-58)

REFERENCES:
WIDS general summary reports
RHO-LD-114
SGW-33746
WHC-SD-EN-TI-248
DOE/RL-91-32
DOE/RL-91-58

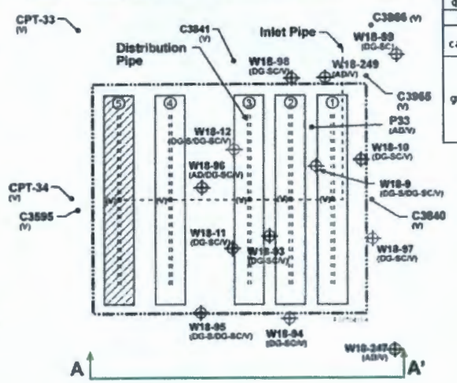
LEGEND
- Existing Borehole (data type)
- Water Table
- bgs = below ground surface

Basis of Knowledge (Data Types)

- Process History (PH)
- Downhole Geophysics - Spectral (DG-S)
- Downhole Geophysics – Scintillation (DG-SC)
- Soil Sampling Analytical Data (AD)
- Vapor Sampling Data (V)

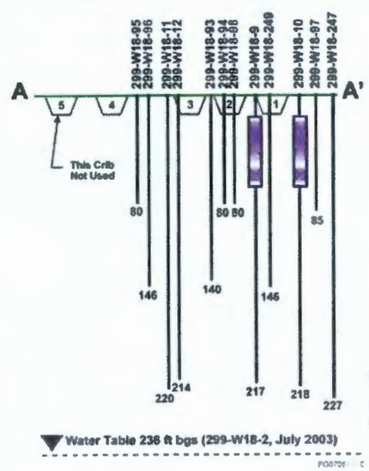
Site Plan View

(not to scale; all W18 well numbers prefixed by 299-)



Site Section View

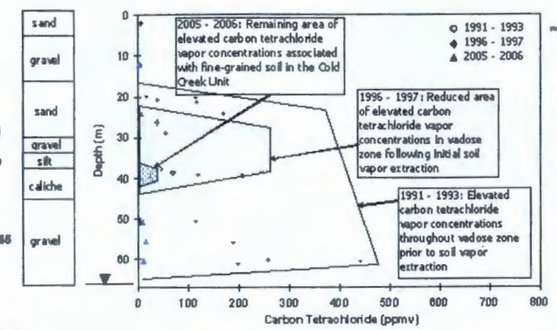
(not to scale, units in feet bgs)



Note: Concentration profile for 299-W18-10 derived from comparison with 299-W18-9 scintillation and logging data.

Site Section View Scale. Concentrations of plutonium; no color bar on Site Section View indicates no contamination was identified in available data.

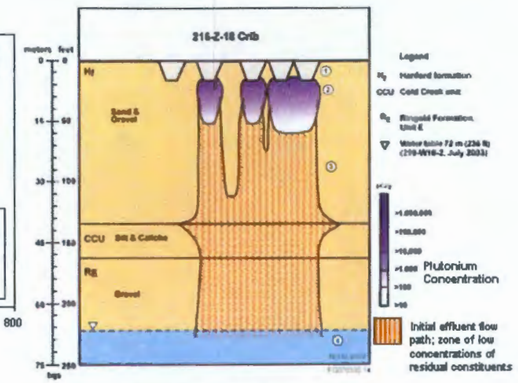
Carbon Tetrachloride Vapor Distribution



Characterization Summary

Characterization activities have been conducted at 216-Z-18 since the 1960s. Scintillation logging of site monitoring wells was conducted in 1968, 1973 and 1976. Wells 299-W18-9 and 299-W18-10 were the only wells that showed contamination above background levels; contamination was identified at about 8 to 17 m (26 to 55 ft) bgs (ARH-ST-156). Characterization was also conducted in 1992 and 1993 in support of soil vapor extraction activities. Spectral gamma logging and neutron moisture logging were conducted in 2006 at wells 299-W18-9, 299-W18-12, and 299-W18-95. Well 299-W18-9 identified plutonium and americium-241 from 7.6 to 18 m (25 to 60 ft) bgs with a maximum concentration of 400,000 pCi/g at 8.2 m (27 ft) bgs. Concentrations decreased with depth to 18 m (60 ft) bgs, where they increased to 250,000 pCi/g. Concentrations decreased to the tool detection limits below about 21 m (70 ft) bgs. Analytical soil data obtained from wells 299-W18-96, 299-W18-247, and 299-W18-249 in 1992 and 1993 did not identify significant organic chemical contamination (e.g., carbon tetrachloride was < 2 ppm). Nitrate was identified in well 299-W18-96 at 4,400 mg/kg at 25.6 m (84 ft) bgs decreasing to < 10 mg/kg at 38.1 m (125 ft) bgs. No significant concentrations of carbon tetrachloride or other volatile organic compounds were identified during soil vapor sampling conducted for the remedial investigation or soil vapor extraction operations in 2005 or 2006.

Contaminant Distribution Model



1. From 1969 to 1973, about 4 million liters of liquid waste were discharged to the 216-Z-18 Crib at a depth of about 5.2 m (17 ft) bgs. Crib operations were controlled so effluent was discharged evenly over the 4 (of 5) crib structures that received waste.
2. Liquid waste and contaminants moved through the gravel bed where the immobile radionuclides (plutonium and americium) sorbed to soils directly below the crib. Site-specific data show crib contamination extending from about 7.6 to 21 m (25 to 70 ft) bgs. Analytical sampling to date did not identify the presence of organics in soil in significant quantities. Any remaining carbon tetrachloride or other organic contaminants are likely associated with, or are directly above, the Cold Creek unit.
3. As the liquid waste continued to migrate downward, more mobile contaminants (e.g., nitrate) moved toward the groundwater. Because of the proximity of the individual crib structures to one another, subsurface intermingling of the waste streams has likely occurred. Fine-grained soils in the vadose zone slowed water movement and allowed mobile contaminants to concentrate and, to a minor extent, move laterally along the interfaces between fine-grained and coarser-grained sediments.
4. Although the overall effluent volume to each crib structure within the site was relatively low and evenly distributed throughout the crib structures, nitrate inventory was reportedly high. Analytical sample results for nitrate and soil moisture demonstrate a potential for past and/or future groundwater impacts from this site. Impacts to groundwater from organic constituents are not expected from this crib.

200-PW-1RIR.216-Z-18.08/30/07

5.0 EXPEDITED RESPONSE ACTION STATUS

The action memorandum (EPA and Ecology, 1992) described the purpose of the ERA as follows:

> *The purpose of this action is to mitigate the threat to site workers, public health, and the environment caused by the migration of carbon tetrachloride vapors through the soil column and into the groundwater. The action is an interim action taken to reduce the mass of carbon tetrachloride in the soil column beneath the 200 West Area pending the final cleanup activities associated with the 200-ZP-1 and 200-ZP-2 Operable Units.*

The purpose statement above can be formulated as four RAOs:

- Mitigate the threat to site workers.
- Mitigate the threat to public health.
- Mitigate the threat to the environment caused by the migration of contaminants from the soil into groundwater.
- Reduce the mass of carbon tetrachloride in the soil.

5.1 MITIGATE THREAT TO SITE WORKERS

In the area remediated using SVE, concentrations of carbon tetrachloride vapor in the vadose zone have been significantly reduced, as measured at the SVE system inlet and at individual extraction wells and monitoring probes. However, carbon tetrachloride is still present in the vadose zone. Concentrations are typically higher in the fine-grained layers where the use of SVE has been less successful at removing carbon tetrachloride. Concentrations may also be higher in the coarse-grained layers in areas that have not been swept by the airflow pathways established through use of the existing well network. As observed during drilling of well 299-W15-46 very close to the 216-Z-9 Trench in 2003 and 2004, carbon tetrachloride vapors still may be encountered during characterization activities such as well drilling. Site workers have been protected before and during the ERA and will also be protected after the ERA through proper conduct of operations, monitoring, and the use of engineering controls and personal protective equipment. Further evaluation of risks to site workers will be addressed in the risk assessment being conducted as part of the 200-PW-1 OU FS in 2007.

5.2 MITIGATE THREAT TO PUBLIC HEALTH

Public health is protected by the use of institutional controls that prevent public access to contaminated areas and by continued environmental monitoring of those areas. The action memorandum (EPA and Ecology 1992) also identified a concern that carbon tetrachloride vapors could migrate offsite in an independent direction from groundwater flow. The primary concern was related to vapor migration to wells and agricultural areas in the Cold Creek Valley, which is west of the 200 West Area.

None of the groundwater samples collected from wells located west of the 200 West Area indicate that carbon tetrachloride vapor is migrating westward offsite. All analytical results to date have yielded nondetect results. In addition, the 200-PW-1 OU RI found that the carbon tetrachloride vapor plume in the vadose zone was located within about 75 to 150 m (250 to 500 ft) of the three primary waste disposal sites (DOE/RL-2006-51). Based on the groundwater and RI vapor data, there is no indication that carbon tetrachloride vapor is posing a threat to the public.

Use of institutional controls to limit direct public access to the site and continued monitoring of contaminated areas are still needed to ensure protection of the public health. This RAO will continue until both the vadose zone and the groundwater have been remediated.

5.3 MITIGATE THREAT TO THE ENVIRONMENT CAUSED BY MIGRATION OF CONTAMINANTS FROM THE SOIL INTO GROUNDWATER

Initiation of the ERA was based on the assumption that contamination in the vadose zone posed a continuing threat to groundwater and that if no expedited action were taken, the groundwater quality would continue to degrade. The success of the remedial action can be evaluated by comparing the potential for transport of carbon tetrachloride between the soil vapor and the groundwater before and during the remedial action using Henry's Law as a guideline. Henry's Law describes the equilibrium partitioning of a compound between the aqueous and vapor phases.

5.3.1 During Initiation of Soil Vapor Extraction

The in situ carbon tetrachloride soil vapor concentration measured near the water table during installation of well 299-W15-218 at the 216-Z-9 site in 1993 was 10,400 ppmv. The carbon tetrachloride groundwater concentration measured at the same time at well 299-W15-218 was 6,500 μg/L. At this well in 1993, the measured vapor concentration was an order of magnitude higher than the equilibrium vapor concentration (approximately 1,000 ppmv) predicted using Henry's Law and the measured groundwater concentration. In 1994, carbon tetrachloride vapor concentrations ranging from approximately 100 to 2,400 ppmv were measured during SVE operations in 216-Z-9 Trench wells with open intervals near the groundwater.

In 1994, carbon tetrachloride vapor concentrations ranging from 150 to 600 ppmv were measured during SVE operations in 216-Z-1A wells with open intervals near the groundwater. At that time, the carbon tetrachloride groundwater concentration was approximately 2,100 μg/L in well 299-W18-1. In some locations, the measured vapor concentrations were higher than the equilibrium vapor concentration (approximately 300 ppmv) predicted using Henry's Law and the measured groundwater concentration.

These evaluations using measurements made during initiation of SVE suggest that the carbon tetrachloride concentration gradient at some locations would drive carbon tetrachloride from the vadose zone to the groundwater.

5.3.2 Following Initial Soil Vapor Extraction

Carbon tetrachloride vapor concentrations measured near the groundwater during the 1996-1997 rebound study were compared to groundwater concentration data collected from nearby groundwater wells as apart of the 200-ZP-1 OU groundwater pump-and-treat project. At both

the 216-Z-9 Trench and the 216-Z-1A tile field, the measured vapor concentrations were an order of magnitude less than the equilibrium vapor concentrations predicted using Henry's Law and site groundwater concentrations. Based on this comparison, the carbon tetrachloride concentration gradient in 1997 would drive carbon tetrachloride from the groundwater to the vadose zone.

5.3.3 2005-2006 Evaluation of Interim Actions

Between 1990 and 2006, the carbon tetrachloride concentrations at the top of the unconfined aquifer underlying the primary carbon tetrachloride source waste sites have been reduced (Figure 5-1). This reduction likely has resulted from the dual application of SVE remediation in the vadose zone and pump-and-treat remediation in the groundwater in the vicinity of the source waste sites.

One objective for the pump-and-treat interim remediation is the reduction of the carbon tetrachloride groundwater concentration below 2,000 µg/L. This goal for groundwater has been met in the 216-Z-1A area and nearly achieved in the 216-Z-9 area. Concentrations in groundwater extraction well 299-W15-32 (and replacement well 299-W15-47) near the 216-Z-9 Trench have declined from approximately 8,000 µg/L in 1997 to concentrations of 1,000 to 2,100 µg/L in 2006 (*Fiscal Year 2006 Annual Summary Report for 200-UP-1 and 200-ZP-1 Pump-and-Treat Operations* [DOE/RL-2006-73]). Concentrations in groundwater monitoring well 299-W18-1 (west of the 216-Z-1A tile field) have declined from approximately 1,700 µg/L in 1997 to 50 µg/L in 2005. (Well 299-W18-1 was not monitored in FY06.) A new groundwater monitoring well, 299-W18-16, was installed east of the 216-Z-1A tile field in FY05. The average carbon tetrachloride concentration in groundwater from this well was 520 µg/L in 2006.

Maximum carbon tetrachloride vapor concentrations measured near the groundwater during FY06 rebound monitoring and the SVE restart at the 216-Z-9 Trench ranged from 8 to 26 ppmv. These measured concentrations, which were similar to the deep vapor concentrations measured in this area in the 1996-1997 rebound study (5 to 60 ppmv), are still an order of magnitude less than the equilibrium vapor concentration (150 to 330 ppmv) predicted using Henry's Law and the 216-Z-9 Trench groundwater concentration measured in FY06.

Maximum carbon tetrachloride vapor concentrations measured near the groundwater during FY06 at the 216-Z-1A tile field were 34 ppmv. These measured concentrations are similar to the deep vapor concentrations measured in this area during the 1996-1997 rebound study (10 to 50 ppmv). The FY06 concentrations are slightly higher than the equilibrium vapor concentration (10 ppmv) predicted using Henry's Law and the 216-Z-1A tile field groundwater concentration measured at well 299-W18-1 in FY05. A vapor concentration of 34 ppmv would be in equilibrium with a groundwater concentration of approximately 220 µg/L, which is an order of magnitude below the objective for the pump-and-treat interim remediation. The relatively low carbon tetrachloride concentration in groundwater west of the 216-Z-1A tile field may be the result, at least in part, of ingress of cleaner, treated water injected upgradient of this site as part of the pump-and-treat operations for the 200-ZP-1 OU. The FY06 vapor concentration is lower than the equilibrium vapor concentration (approximately 80 ppmv) predicted using Henry's Law and the 216-Z-1A tile field groundwater concentration measured at well 299-W18-16 in FY06.

The reduction of carbon tetrachloride vapor concentrations in the area remediated using SVE has reduced the threat to groundwater, based on the calculation using Henry's Law. However, as carbon tetrachloride concentrations in both groundwater and the vadose zone change, the direction of contaminant movement between these media may change based on the concentration gradients.

Depth-discrete groundwater sampling and analysis results (2005 and 2006) for dissolved carbon tetrachloride suggest that a significantly higher percent of the mass may be present throughout the unconfined aquifer (in dissolved and sorbed phases) than previously estimated. The current estimate is that approximately 100,000 kg (220,460 lb) of carbon tetrachloride may exist within the groundwater system. However, the lateral extent and maximum concentrations of the higher concentration carbon tetrachloride contamination in the top 10 m (33 ft) of the aquifer have been diminishing from 2000 to 2006, indicating that a significant continuing source in the deep vadose zone or top of the aquifer is not likely.

5.4 REDUCE MASS OF CARBON TETRACHLORIDE IN THE SOIL

Two distinct phases are commonly observed during in situ remediation projects. The first phase is generally characterized by higher rates of mass removal while the readily available volatile contaminant is being removed from the higher permeability zones. With continued extraction, concentrations decrease more slowly as the supply of volatile contaminant becomes limited by desorption and diffusion of the contaminant from micropores and/or lower permeability soil. In this second phase, diffusion controls contaminant migration. The history of mass recovery using SVE at the carbon tetrachloride source cribs reflects these two phases typical to SVE operations (Figure 2-8).

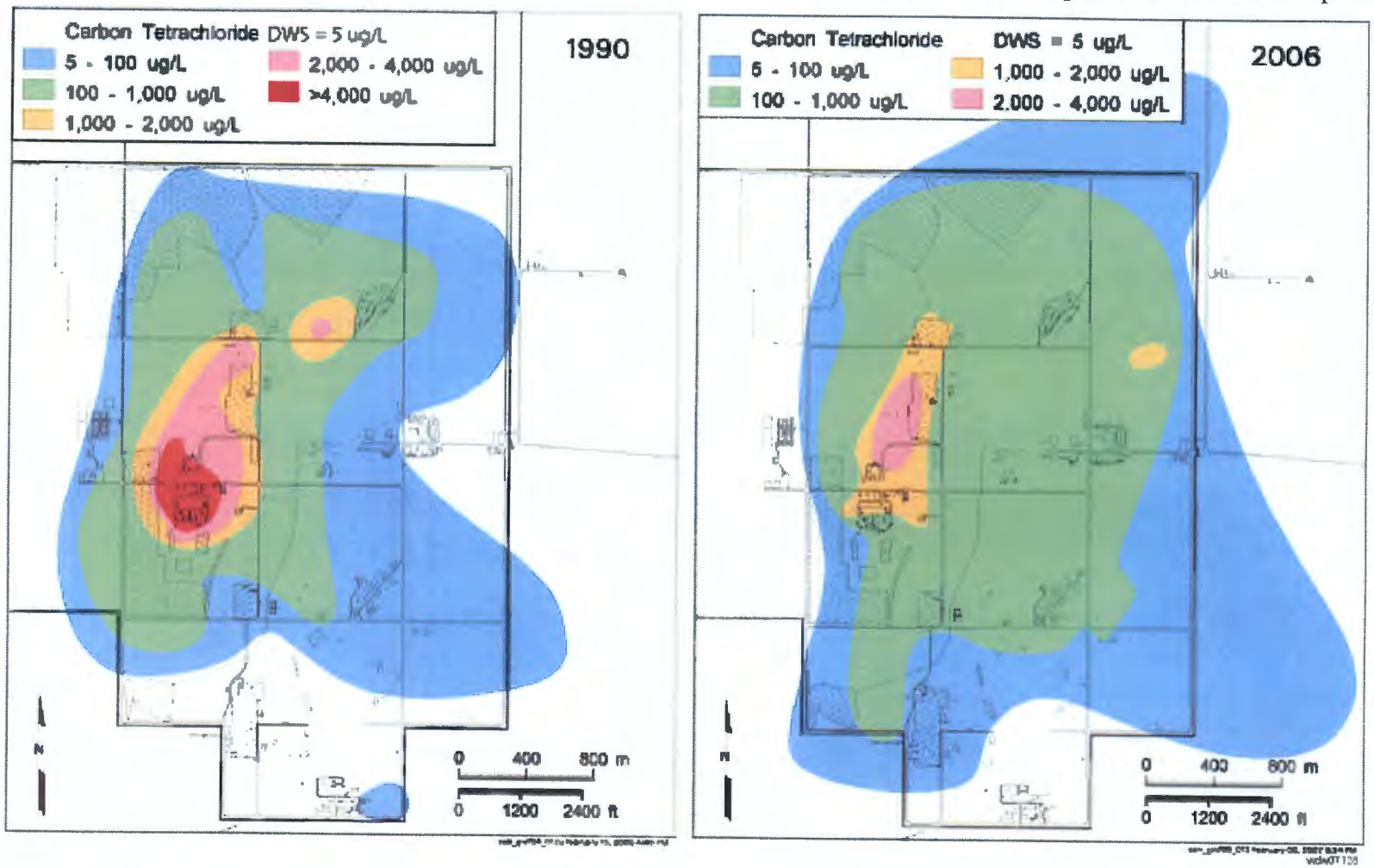
Although additional carbon tetrachloride can be recovered using SVE, the rate of removal has been decreasing. The decline in the rate of removal can be attributed primarily to the following:

- Diffusion-dominated extraction
- Reduction in SVE system capacity (i.e., from a total of 85 m^3/min to 14.2 m^3/min)
- Reduction in the yearly duration of extraction operations (i.e., from 12 months each year to 6 months each year)
- Potentially the continued use of the same airflow pathways established by using the same set of extraction wells.

When removal efficiency is considered, the mass removed per volume of vapor extracted likewise also decreases (Figure 2-10). However, only diffusion-dominated extraction is applicable to removal efficiency because the air volumes are normalized in the removal efficiency calculations. For this reason, the performance metric of kilograms of carbon tetrachloride removed per 1,000 cubic meters of vapor extracted is a good measure for the evaluation of the SVE operations. As shown in Figure 2-10, the value of this measure has been decreasing at both the 216-Z-9 and 216-Z-1A/Z-18/Z-12 carbon tetrachloride sites.

Because of the reduction of carbon tetrachloride mass in the soil, it is reasonable to conclude that the much higher percentage of extracted mass has been removed from the larger pore spaces and that the carbon tetrachloride that remains is in fine-grained layers. The characterization data support this conclusion.

Figure 5-1. Comparison of the Carbon Tetrachloride Plume Beneath the 200 West Area at the Top of the Unconfined Aquifer.[a]



[a] From *Summary of Hanford Site Groundwater Monitoring for Fiscal Year 2006* (PNNL-16346).

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6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

Operation of the SVE systems between 1991 and 2006 has resulted in the removal of 78,884 kg (173,909 lb) of carbon tetrachloride from the vadose zone underlying the primary carbon tetrachloride disposal sites.

The SVE system has been operated for approximately 6 months each year since 1998 (with the exception of 2000, when it was not operated). Operations during each of these years have continued to remove carbon tetrachloride from the vadose zone. Although removal rates have decreased in recent years, use of SVE still results in an annual average extraction of approximately 170 kg (375 lb) of carbon tetrachloride from the vadose zone per year. With the readily accessible carbon tetrachloride removed, mass removal (in terms of mass removed per operation time) is more efficient with intermittent SVE operation, which allows the carbon tetrachloride vapor concentration in the higher flow zone to increase while the system is not operating.

The passive SVE systems have removed approximately 80 kg (176 lb) of carbon tetrachloride from the vadose zone between October 1999 and September 2006. Mass removal per year using the passive systems has remained fairly constant at 5 to 10 kg (11 to 22 lb).

Reduction in vapor concentrations and carbon tetrachloride mass during SVE operations has contributed to progress in achieving the ERA objectives of mitigating the threat to site workers, public health, and the environment caused by the migration of carbon tetrachloride vapors through the soil column and into the groundwater. Monitoring data indicate that carbon tetrachloride vapor concentrations have decreased significantly in the deep vadose zone overlying groundwater in the areas of the disposal sites. However, as carbon tetrachloride concentrations in both the deep vadose zone and the groundwater change, the direction of carbon tetrachloride movement between these media may change based on the concentration gradients. Monitoring data near the vadose zone/groundwater interface are relatively sparse.

6.2 RECOMMENDATIONS

The following recommendations are made to maximize the effectiveness of SVE operations and monitoring and to provide information to support a final Record of Decision:

- Continue operation of the active SVE system in a cyclic manner to remove carbon tetrachloride from the vadose zone. Cyclic operations (i.e., alternating operations between the 216-Z-9 and 216-Z-1A sites) are recommended because mass removal (in terms of mass removed per operation time) is more efficient with intermittent SVE operation. However, longer operating time will result in the removal of additional mass; therefore, consider operating the system for a longer duration each year to maximize the mass removal.
- Evaluate the overall condition and limitations of the existing SVE system. The SVE system currently being used is more than 10 years old. Because of the time and effort required to maintain the aging components of this system and the likelihood that SVE operations will continue, the purchase of selected new components or a new system is recommended.

- Continue operation of the passive SVE systems.
- Continue monthly monitoring.
- Convert the three narrow-diameter wells on the south side of 216-Z-9 for use as vapor extraction wells and place them on-line. The narrow-diameter wells were installed in FY07 by Vista Engineering Technologies, LLC, as part of the alternatives for carbon tetrachloride source-term location (DNAPL) investigation (DOE/RL-2007-22). These three wells are screened in the silt layer identified at a depth of 19.8 m (65 ft) during the drilling of well 299-W15-46. The use of additional extraction points will alter the subsurface airflow pathways. Carbon tetrachloride concentrations extracted using these new airflow pathways can be used to evaluate carbon tetrachloride remediation using SVE.
- Consider adding additional extraction points in the source crib area. For example, extraction rods that were installed in 1993 using a cone penetrometer could be tested for use with the SVE system.

A remediation system evaluation of the SVE system at the 200-PW-1 OU was conducted in 2006, at the request of DOE-Headquarters Office of Environmental Management. The recommendation for the SVE system in the final remediation system evaluation report will be reviewed and considered in the FY07 SVE annual report.

7.0 SOIL VAPOR EXTRACTION SYSTEM COST DATA

Actual project costs for the 200-PW-1 OU SVE system can be used to determine the labor costs associated with each specific activity over a given period of time. Table 7-1 provides the burdened costs, by activity, for the 200-PW-1 OU SVE system for FY06. Specific activities are described below:

- **Design:** Includes environmental and operations engineering support to design activities required to support SVE system upgrades, modifications, and other design documentation.
- **Operations and maintenance:** Represents facility supplies, labor, and craft supervision costs associated with operating and maintaining the equipment. It also includes costs associated with routine characterization of online wells and engineering support as required during the course of SVE system operations and periodic maintenance.
- **Performance monitoring:** Includes monthly soil vapor sampling, analysis, and reporting, as required by the annual SVE system operating plan. It also includes preparation of this annual performance evaluation report.
- **Project support:** Includes project management, planning, and other administrative support required during the course of SVE operations during FY06.
- **Waste management:** Represents the estimated cost for the management of GAC at the 200-PW-1 OU in accordance with applicable laws for suspect hazardous, toxic, and regulated wastes. It includes waste designation sampling and analysis.

These project costs for operation of the 200-PW-1 OU SVE system in FY06 are displayed by percent of total costs in the pie chart in Figure 7-1. Based on the FY06 costs and yearly production rates of 1.8 billion L (1.8 million m^3) of vapor treated and 173 kg (381 lb) of carbon tetrachloride removed (Table 2-2), the FY06 treatment costs equate to \$0.00033/L (\$0.33/m^3) of vapor treated and \$3.48/g (\$3,477/kg) of carbon tetrachloride removed (Figure 7-2).

Figure 7-1. Cost Breakdown for 200-PW-1 Operable Unit Soil Vapor Extraction Operations in Fiscal Year 2006.

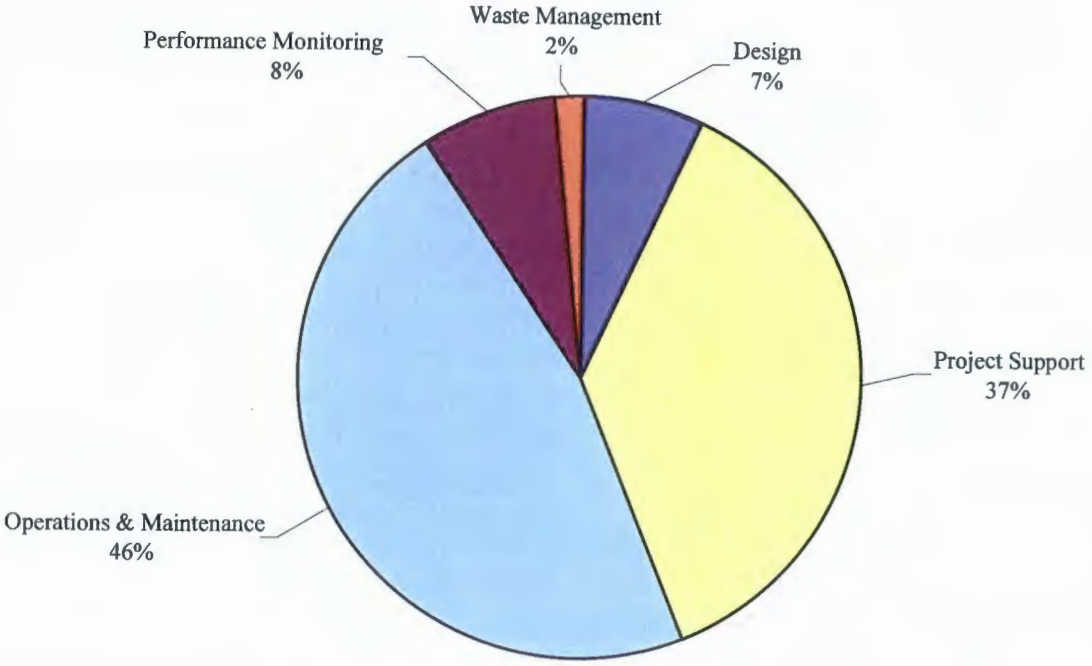

Figure 7-2. Cost for Soil Vapor Extraction Removal of Carbon Tetrachloride in Fiscal Year 2006.

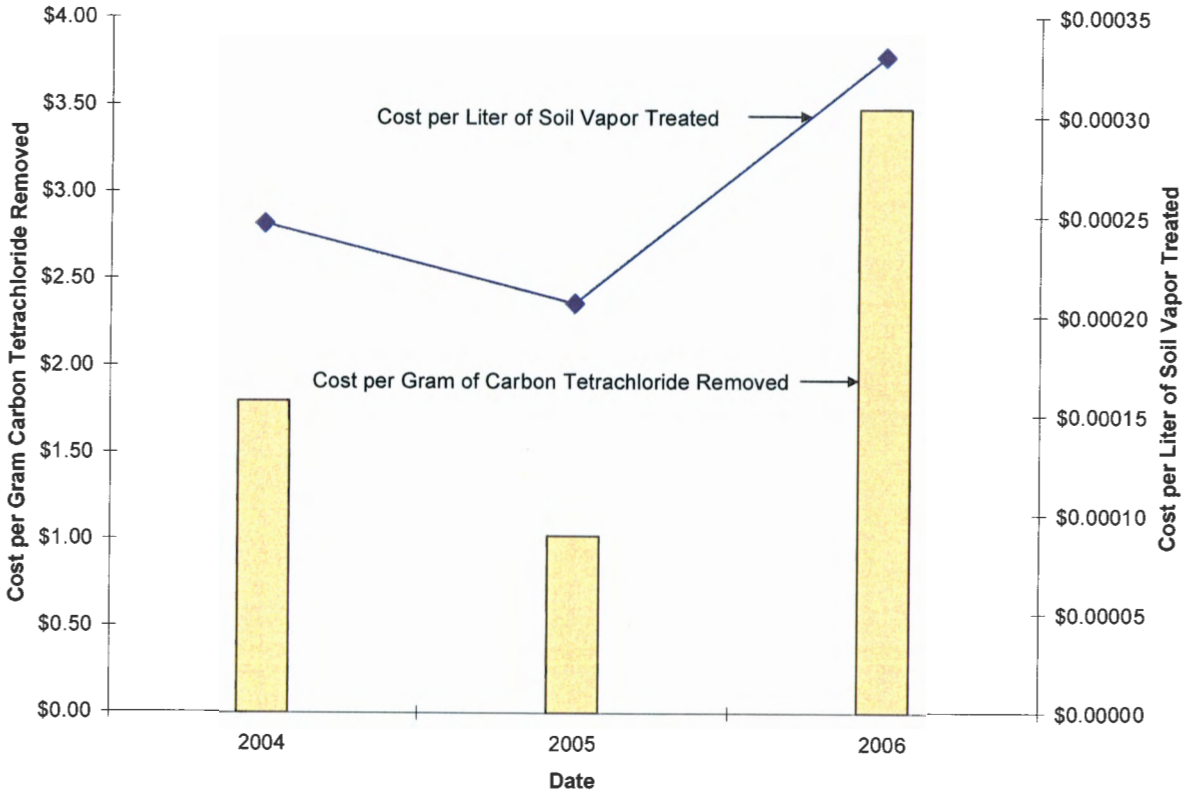

Table 7-1. Costs for Operation of 200-PW-1 Operable Unit Soil Vapor Extraction System.

Activity	Actual Costs ($1,000)		
	FY04	**FY05**	**FY06**
Design	78.9	50.9	41.7
Operations and maintenance	188.2	183.8	280.7
Performance monitoring	44.9	55.6	47.0
Project support	121.5	72.1	221.8
Waste management	27.2	7.9	10.5
Totals	**460.7**	**370.4**	**601.6**

FY = fiscal year

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APPENDIX A

FISCAL YEAR 2006
DAILY SOIL VAPOR EXTRACTION DATA

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Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
04/03/06	12.0	13.5	13.5	13.5	5,850.3	4.7	4.7	0.4	0.4
04/04/06	10.9	24.0	24.0	37.5	8,379.4	12.1	16.8	0.8	1.2
04/05/06	14.4	24.0	24.0	61.5	9,014.2	13.0	29.8	1.2	2.4
04/06/06	14.5	24.0	24.0	85.5	9,073.8	13.1	42.9	1.2	3.6
04/07/06	14.0	2.0	24.0	87.5	9,237.0	1.1	44.0	0.1	3.7
04/08/06	--	0.0	24.0	87.5	0.0	0.0	44.0	0.0	3.7
04/09/06	--	0.0	24.0	87.5	0.0	0.0	44.0	0.0	3.7
04/10/06	13.9	2.3	24.0	89.8	9,361.6	1.3	45.2	0.1	3.8
04/11/06	13.2	12.0	24.0	101.8	8,547.0	6.2	51.4	0.5	4.3
04/12/06	13.2	12.0	24.0	113.8	8,140.0	5.9	57.2	0.5	4.8
04/13/06	12.8	23.3	24.0	137.0	8,251.8	11.5	68.7	0.9	5.7
04/14/06	12.6	24.0	24.0	161.0	8,640.8	12.4	81.2	1.0	6.7
04/15/06	12.8	24.0	24.0	185.0	8,789.5	12.7	93.8	1.0	7.7
04/16/06	13.4	24.0	24.0	209.0	8,778.5	12.6	106.5	1.1	8.8
04/17/06	13.2	24.0	24.0	233.0	8,837.5	12.7	119.2	1.1	9.8
04/18/06	13.0	24.0	24.0	257.0	8,885.8	12.8	132.0	1.0	10.9
04/19/06	11.0	24.0	24.0	281.0	8,596.8	12.4	144.4	0.9	11.7
04/20/06	11.3	24.0	24.0	305.0	8,699.2	12.5	156.9	0.9	12.6
04/21/06	11.7	24.0	24.0	329.0	8,753.8	12.6	169.5	0.9	13.5
04/22/06	12.1	24.0	24.0	353.0	8,838.1	12.7	182.3	1.0	14.5
04/23/06	12.0	24.0	24.0	377.0	8,835.0	12.7	195.0	1.0	15.5

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
04/24/06	11.2	24.0	24.0	401.0	8,863.8	12.8	207.7	0.9	16.4
04/25/06	11.1	24.0	24.0	425.0	8,891.8	12.8	220.5	0.9	17.3
04/26/06	10.5	24.0	24.0	449.0	8,625.2	12.4	233.0	0.8	18.1
04/27/06	11.1	24.0	24.0	473.0	8,864.1	12.8	245.7	0.9	19.0
04/28/06	11.0	24.0	24.0	497.0	8,842.7	12.7	258.5	0.9	19.8
04/29/06	11.0	24.0	24.0	521.0	8,879.3	12.8	271.2	0.9	20.7
04/30/06	11.0	24.0	24.0	545.0	9,028.9	13.0	284.2	0.9	21.6
05/01/06	11.0	6.5	24.0	551.5	9,238.0	3.6	287.8	0.2	21.9
05/02/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/03/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/04/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/05/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/06/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/07/06	--	0.0	24.0	551.5	0.0	0.0	287.8	0.0	21.9
05/08/06	10.3	15.8	24.0	567.3	6,049.4	5.7	293.6	0.4	22.2
05/09/06	11.6	24.0	24.0	591.3	9,039.2	13.0	306.6	0.9	23.2
05/10/06	11.0	24.0	24.0	615.3	8,659.6	12.5	319.1	0.9	24.1
05/11/06	10.9	24.0	24.0	639.3	8,256.8	11.9	330.9	0.8	24.9
05/12/06	11.0	24.0	24.0	663.3	8,457.8	12.2	343.1	0.8	25.7
05/13/06	11.0	24.0	24.0	687.3	7,763.1	11.2	354.3	0.8	26.5
05/14/06	11.0	24.0	24.0	711.3	7,698.9	11.1	365.4	0.8	27.3
05/15/06	11.0	24.0	24.0	735.3	7,675.6	11.1	376.4	0.8	28.0

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
05/16/06	11.2	24.0	24.0	759.3	7,571.1	10.9	387.3	0.8	28.8
05/17/06	11.8	24.0	24.0	783.3	8,001.7	11.5	398.9	0.9	29.6
05/18/06	12.0	22.5	24.0	805.8	8,501.6	11.5	410.3	0.9	30.5
05/19/06	12.3	24.0	24.0	829.8	8,553.8	12.3	422.7	0.9	31.5
05/20/06	12.0	24.0	24.0	853.8	8,643.6	12.4	435.1	0.9	32.4
05/21/06	12.0	24.0	24.0	877.8	8,674.0	12.5	447.6	0.9	33.3
05/22/06	12.0	24.0	24.0	901.8	8,674.3	12.5	460.1	0.9	34.3
05/23/06	12.0	24.0	24.0	925.8	8,774.5	12.6	472.7	1.0	35.2
05/24/06	11.8	24.0	24.0	949.8	8,923.4	12.8	485.6	1.0	36.2
05/25/06	10.6	23.5	24.0	973.3	8,785.0	12.4	498.0	0.8	37.0
05/26/06	10.0	24.0	24.0	997.3	8,792.9	12.7	510.6	0.8	37.8
05/27/06	10.6	24.0	24.0	1,021.3	8,881.3	12.8	523.4	0.9	38.7
05/28/06	11.0	24.0	24.0	1,045.3	8,832.6	12.7	536.1	0.9	39.6
05/29/06	11.0	24.0	24.0	1,069.3	8,819.3	12.7	548.8	0.9	40.4
05/30/06	10.5	24.0	24.0	1,093.3	8,863.2	12.8	561.6	0.8	41.3
05/31/06	10.0	24.0	24.0	1,117.3	8,869.8	12.8	574.4	0.8	42.1
06/01/06	9.9	24.0	24.0	1,141.3	8,912.2	12.8	587.2	0.8	42.9
06/02/06	10.0	24.0	24.0	1,165.3	9,073.0	13.1	600.3	0.8	43.7
06/03/06	10.0	24.0	24.0	1,189.3	9,166.8	13.2	613.5	0.8	44.5
06/04/06	10.0	24.0	24.0	1,213.3	9,196.6	13.2	626.7	0.8	45.4
06/05/06	10.0	23.8	24.0	1,237.0	9,198.0	13.1	639.8	0.8	46.2
06/06/06	10.0	24.0	24.0	1,261.0	9,251.8	13.3	653.1	0.8	47.0

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
06/07/06	10.0	24.0	24.0	1,285.0	9,295.5	13.4	666.5	0.8	47.9
06/08/06	10.0	24.0	24.0	1,309.0	9,439.7	13.6	680.1	0.9	48.7
06/09/06	10.0	24.0	24.0	1,333.0	9,509.7	13.7	693.8	0.9	49.6
06/10/06	9.8	24.0	24.0	1,357.0	9,507.0	13.7	707.5	0.8	50.4
06/11/06	9.8	24.0	24.0	1,381.0	9,435.0	13.6	721.1	0.8	51.3
06/12/06	10.0	24.0	24.0	1,405.0	9,484.8	13.7	734.7	0.9	52.1
06/13/06	9.7	22.0	24.0	1,427.0	9,727.9	12.8	747.6	0.8	52.9
06/14/06	9.5	23.7	24.0	1,450.7	8,926.0	12.7	760.3	0.8	53.7
06/15/06	10.0	24.0	24.0	1,474.7	7,939.2	11.4	771.7	0.7	54.4
06/16/06	10.0	24.0	24.0	1,498.7	8,295.7	11.9	783.6	0.8	55.1
06/17/06	10.0	24.0	24.0	1,522.7	8,304.0	12.0	795.6	0.8	55.9
06/18/06	10.0	24.0	24.0	1,546.7	8,095.8	11.7	807.2	0.7	56.6
06/19/06	9.7	24.0	24.0	1,570.7	8,158.7	11.7	819.0	0.7	57.3
06/20/06	10.0	24.0	24.0	1,594.7	8,117.2	11.7	830.7	0.7	58.1
06/21/06	10.0	24.0	24.0	1,618.7	8,121.8	11.7	842.4	0.7	58.8
06/22/06	9.9	24.0	24.0	1,642.7	8,166.1	11.8	854.1	0.7	59.6
06/23/06	9.8	24.0	24.0	1,666.7	8,245.8	11.9	866.0	0.7	60.3
06/24/06	9.7	24.0	24.0	1,690.7	8,242.1	11.9	877.9	0.7	61.0
06/25/06	10.0	24.0	24.0	1,714.7	8,290.2	11.9	889.8	0.8	61.8
06/26/06	10.1	24.0	24.0	1,738.7	8,150.8	11.7	901.6	0.7	62.5
06/27/06	11.0	24.0	24.0	1,762.7	8,140.7	11.7	913.3	0.8	63.3
06/28/06	11.1	24.0	24.0	1,786.7	8,156.7	11.7	925.0	0.8	64.1

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
06/29/06	11.1	24.0	24.0	1,810.7	8,354.8	12.0	937.1	0.8	65.0
06/30/06	10.9	24.0	24.0	1,834.7	8,216.9	11.8	948.9	0.8	65.8
07/01/06	10.0	24.0	24.0	1,858.7	8,129.5	11.7	960.6	0.7	66.5
07/02/06	10.2	24.0	24.0	1,882.7	8,120.6	11.7	972.3	0.7	67.3
07/03/06	10.2	24.0	24.0	1,906.7	8,049.7	11.6	983.9	0.7	68.0
07/04/06	10.4	24.0	24.0	1,930.7	8,008.8	11.5	995.4	0.8	68.8
07/05/06	10.3	24.0	24.0	1,954.7	8,044.4	11.6	1,007.0	0.7	69.5
07/06/06	10.1	24.0	24.0	1,978.7	8,086.8	11.6	1,018.6	0.7	70.3
07/07/06	10.8	24.0	24.0	2,002.7	8,187.6	11.8	1,030.4	0.8	71.1
07/08/06	10.0	24.0	24.0	2,026.7	8,161.0	11.8	1,042.2	0.7	71.8
07/09/06	9.0	24.0	24.0	2,050.7	8,039.0	11.6	1,053.8	0.7	72.5
07/10/06	9.7	24.0	24.0	2,074.7	7,999.4	11.5	1,065.3	0.7	73.2
07/11/06	10.4	24.0	24.0	2,098.7	7,987.3	11.5	1,076.8	0.8	73.9
07/12/06	10.7	24.0	24.0	2,122.7	8,053.1	11.6	1,088.4	0.8	74.7
07/13/06	10.9	24.0	24.0	2,146.7	7,989.1	11.5	1,099.9	0.8	75.5
07/14/06	9.9	24.0	24.0	2,170.7	7,853.4	11.3	1,111.2	0.7	76.2
07/15/06	9.8	24.0	24.0	2,194.7	7,815.3	11.3	1,122.4	0.7	76.9
07/16/06	9.7	24.0	24.0	2,218.7	7,862.4	11.3	1,133.8	0.7	77.6
07/17/06	9.0	24.0	24.0	2,242.7	7,860.4	11.3	1,145.1	0.6	78.2
07/18/06	9.0	24.0	24.0	2,266.7	7,816.5	11.3	1,156.3	0.6	78.8
07/19/06	9.8	24.0	24.0	2,290.7	7,758.4	11.2	1,167.5	0.7	79.5
07/20/06	10.0	24.0	24.0	2,314.7	7,978.5	11.5	1,179.0	0.7	80.3

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
07/21/06	9.7	24.0	24.0	2,338.7	7,996.9	11.5	1,190.5	0.7	81.0
07/22/06	9.3	24.0	24.0	2,362.7	7,986.2	11.5	1,202.0	0.7	81.6
07/23/06	10.1	24.0	24.0	2,386.7	7,905.4	11.4	1,213.4	0.7	82.4
07/24/06	11.0	24.0	24.0	2,410.7	7,959.9	11.5	1,224.9	0.8	83.2
07/25/06	11.0	6.0	24.0	2,416.7	8,168.5	2.9	1,227.8	0.2	83.4
07/26/06	--	0.0	24.0	2,416.7	0.0	0.0	1,227.8	0.0	83.4
07/27/06	--	0.0	24.0	2,416.7	0.0	0.0	1,227.8	0.0	83.4
07/28/06	--	0.0	24.0	2,416.7	0.0	0.0	1,227.8	0.0	83.4
07/29/06	--	0.0	24.0	2,416.7	0.0	0.0	1,227.8	0.0	83.4
07/30/06	--	0.0	24.0	2,416.7	0.0	0.0	1,227.8	0.0	83.4
07/31/06	30.7	17.5	24.0	2,434.2	6,452.2	6.8	1,234.6	1.3	84.7
08/01/06	40.5	24.0	24.0	2,458.2	4,815.1	6.9	1,241.5	1.8	86.4
08/02/06	25.3	24.0	24.0	2,482.2	4,103.0	5.9	1,247.4	0.9	87.4
08/03/06	25.2	14.5	24.0	2,496.7	4,048.3	3.5	1,250.9	0.6	87.9
08/04/06	--	0.0	24.0	2,496.7	0.0	0.0	1,250.9	0.0	87.9
08/05/06	--	0.0	24.0	2,496.7	0.0	0.0	1,250.9	0.0	87.9
08/06/06	--	0.0	24.0	2,496.7	0.0	0.0	1,250.9	0.0	87.9
08/07/06	26.6	17.5	24.0	2,514.2	1,539.2	1.6	1,252.6	0.3	88.2
08/08/06	29.3	15.3	24.0	2,529.4	7,145.7	6.5	1,259.1	1.2	89.4
08/09/06	31.1	24.0	24.0	2,553.4	8,154.1	11.7	1,270.8	2.3	91.7
08/10/06	29.5	24.0	24.0	2,577.4	8,074.0	11.6	1,282.5	2.2	93.9
08/11/06	28.8	24.0	24.0	2,601.4	8,049.5	11.6	1,294.1	2.1	96.0

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
08/12/06	28.1	24.0	24.0	2,625.4	7,890.0	11.4	1,305.4	2.0	98.0
08/13/06	27.3	24.0	24.0	2,649.4	7,892.7	11.4	1,316.8	2.0	99.9
08/14/06	25.4	24.0	24.0	2,673.4	8,604.0	12.4	1,329.2	2.0	101.9
08/15/06	24.8	24.0	24.0	2,697.4	8,992.2	12.9	1,342.1	2.0	103.9
08/16/06	23.5	24.0	24.0	2,721.4	8,275.0	11.9	1,354.0	1.8	105.7
08/17/06	22.4	24.0	24.0	2,745.4	8,187.1	11.8	1,365.8	1.7	107.4
08/18/06	22.9	24.0	24.0	2,769.4	8,288.1	11.9	1,377.8	1.7	109.1
08/19/06	22.6	24.0	24.0	2,793.4	8,362.5	12.0	1,389.8	1.7	110.8
08/20/06	23.0	24.0	24.0	2,817.4	8,855.2	12.8	1,402.6	1.8	112.6
08/21/06	22.7	24.0	24.0	2,841.4	8,811.3	12.7	1,415.2	1.8	114.4
08/22/06	21.8	24.0	24.0	2,865.4	8,828.8	12.7	1,428.0	1.7	116.2
08/23/06	23.2	24.0	24.0	2,889.4	9,562.1	13.8	1,441.7	2.0	118.2
08/24/06	24.1	24.0	24.0	2,913.4	10,740.1	15.5	1,457.2	2.3	120.5
08/25/06	24.9	24.0	24.0	2,937.4	10,682.3	15.4	1,472.6	2.4	122.9
08/26/06	25.5	24.0	24.0	2,961.4	10,658.0	15.3	1,487.9	2.5	125.4
08/27/06	26.0	24.0	24.0	2,985.4	10,657.8	15.3	1,503.3	2.5	127.9
08/28/06	26.0	24.0	24.0	3,009.4	10,377.3	14.9	1,518.2	2.4	130.4
08/29/06	25.6	24.0	24.0	3,033.4	10,137.3	14.6	1,532.8	2.4	132.7
08/30/06	26.4	24.0	24.0	3,057.4	10,770.9	15.5	1,548.3	2.6	135.3
08/31/06	26.3	24.0	24.0	3,081.4	10,773.4	15.5	1,563.8	2.6	137.8
09/01/06	25.1	24.0	24.0	3,105.4	11,018.7	15.9	1,579.7	2.5	140.4
09/02/06	25.1	24.0	24.0	3,129.4	11,018.7	15.9	1,595.6	2.5	142.9

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
09/03/06	25.1	24.0	24.0	3,153.4	11,018.7	15.9	1,611.4	2.5	145.4
09/04/06	25.1	24.0	24.0	3,177.4	11,018.7	15.9	1,627.3	2.5	147.9
09/05/06	25.7	24.0	24.0	3,201.4	9,810.9	14.1	1,641.4	2.3	150.2
09/06/06	25.3	24.0	24.0	3,225.4	10,467.8	15.1	1,656.5	2.4	152.6
09/07/06	23.4	24.0	24.0	3,249.4	7,211.9	10.4	1,666.9	1.5	154.1
09/08/06	22.9	24.0	24.0	3,273.4	6,217.4	9.0	1,675.8	1.3	155.4
09/09/06	22.9	24.0	24.0	3,297.4	6,226.7	9.0	1,684.8	1.3	156.7
09/10/06	22.7	24.0	24.0	3,321.4	6,254.9	9.0	1,693.8	1.3	158.0
09/11/06	23.0	24.0	24.0	3,345.4	6,255.2	9.0	1,702.8	1.3	159.3
09/12/06	23.1	24.0	24.0	3,369.4	6,249.4	9.0	1,711.8	1.3	160.6
09/13/06	22.6	24.0	24.0	3,393.4	6,162.7	8.9	1,720.7	1.3	161.8
09/14/06	22.0	24.0	24.0	3,417.4	6,481.7	9.3	1,730.0	1.3	163.1
09/15/06	21.5	24.0	24.0	3,441.4	6,451.9	9.3	1,739.3	1.3	164.4
09/16/06	22.4	24.0	24.0	3,465.4	6,347.0	9.1	1,748.5	1.3	165.7
09/17/06	22.6	24.0	24.0	3,489.4	6,354.4	9.2	1,757.6	1.3	167.0
09/18/06	22.7	24.0	24.0	3,513.4	6,367.6	9.2	1,766.8	1.3	168.3
09/19/06	21.5	24.0	24.0	3,537.4	6,406.7	9.2	1,776.0	1.2	169.5
09/20/06	21.0	24.0	24.0	3,561.4	6,226.1	9.0	1,785.0	1.2	170.7
09/21/06	21.5	24.0	24.0	3,585.4	6,370.0	9.2	1,794.1	1.2	171.9
09/22/06	21.4	24.0	24.0	3,609.4	6,311.2	9.1	1,803.2	1.2	173.2
09/23/06	21.3	24.0	24.0	3,633.4	6,342.5	9.1	1,812.4	1.2	174.4
09/24/06	21.0	24.0	24.0	3,657.4	6,374.7	9.2	1,821.5	1.2	175.6

Table A-1. Daily Soil Vapor Extraction Data. (9 sheets)

Date	Carbon Tetrachloride (ppmv)	Daily Operating Hours (hrs)	Daily Operating Hours Available (hrs)	Year-to-Date Operating Hours (hrs)	Daily Flow Rate (L/min)	Daily Volume Treated (million L)	Year-to-Date Volume Treated (million L)	Daily Mass Extracted (kg)	Year-to-Date Mass Extracted[a] (kg)
09/25/06	20.9	24.0	24.0	3,681.4	6,416.1	9.2	1,830.8	1.2	176.8
09/26/06	20.7	24.0	24.0	3,705.4	6,409.5	9.2	1,840.0	1.2	178.0
09/27/06	21.4	24.0	24.0	3,729.4	6,233.9	9.0	1,849.0	1.2	179.2
09/28/06	21.1	24.0	24.0	3,753.4	6,420.7	9.2	1,858.2	1.2	180.5
09/29/06	21.5	8.0	24.0	3,761.4	6,630.2	3.2	1,861.4	0.4	180.9

[a] The record quantity of mass extracted is provided by project engineering and is the mass reported in this document. The data maintained by the project scientist, including the data provided in this table, are used in this document to illustrate operating trends. It has previously been documented that the project engineering and project scientist total mass removed calculations differ by less than 0.5% (Calculation No. 0200W-CA-V0019).

ppmv = parts per million by volume

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APPENDIX B

FISCAL YEAR 2006 SOIL VAPOR EXTRACTION WELL CHARACTERIZATION DATA

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Table B-1. 216-Z-1A Site Soil Vapor Extraction Well Characterization Data, Fiscal Year 2006.

216-Z-1A Well/ Interval	Date	Vacuum (kPa)	Flow (m^3/min)	Carbon Tetrachloride (ppmv)	Carbon Tetrachloride Flux (kg/day)	Chloroform (ppmv)	Methylene Chloride (ppmv)	Methyl Ethyl Ketone (ppmv)
299-W18-165	04/04/06	--	3.3	17.2	0.508	--	--	--
299-W18-166	04/04/06	--	3.3	16.4	0.484	--	--	--
299-W18-174	04/04/06	--	1.9	14.5	0.249	--	--	--

ppmv = parts per million by volume

Table B-2. 216-Z-9 Site Soil Vapor Extraction Well Characterization Data, Fiscal Year 2006. (2 sheets)

216-Z-9 Well/ Interval	Date	Vacuum (kPa)	Flow (m^3/min)	Carbon Tetrachloride (ppmv)	Carbon Tetrachloride Flux (kg/day)	Chloroform (ppmv)	Methylene Chloride (ppmv)	Methyl Ethyl Ketone (ppmv)
299-W15-8L	08/29/06	17.9	2.5	12.0	0.3	0	0	0
299-W15-8L	09/07/06	17.9	2.5	12.0	0.3	0	0	0
299-W15-8U	08/29/06	16.4	3.0	55.0	1.5	0	0	0
299-W15-8U	09/07/06	16.4	3.0	50.0	1.4	0	0	0
299-W15-9L	07/31/06	19.4	1.9	7.9	0.1	0.591	0.505	0.182
299-W15-9L	08/29/06	20.4	1.8	8.0	0.1	0	0	0
299-W15-9L	09/07/06	20.2	1.9	8.0	0.1	0	0	0
299-W15-9U	07/31/06	14.9	2.5	7.9	0.2	0.656	0.490	0.242
299-W15-9U	08/29/06	18.7	2.5	8.0	0.2	0	0	0
299-W15-9U	09/07/06	16.4	2.7	9.0	0.2	0	0	0
299-W15-48	08/01/06 07:45	28.1	4.0	74.0	2.7	0	0	0
299-W15-48	08/01/06 09:45	28.1	4.0	64.0	2.3	0	0	0
299-W15-48	08/01/06 11:45	30.6	4.1	52.0	1.9	0	0	0
299-W15-48	08/01/06 13:45	30.6	4.1	43.0	1.6	0	0	0
299-W15-48	08/01/06 15:45	29.9	4.1	40.0	1.5	0	0	0
299-W15-48	08/02/06 07:00	30.9	4.2	26.0	1.0	0	0	0
299-W15-48	08/02/06 09:00	29.6	4.0	25.0	0.9	0	0	0
299-W15-48	08/02/06 11:00	29.4	4.0	25.0	0.9	0	0	0
299-W15-48	08/02/06 13:00	28.9	4.0	25.0	0.9	0	0	0
299-W15-48	08/02/06 15:00	28.9	4.0	23.0	0.8	0	0	0

Table B-2. 216-Z-9 Site Soil Vapor Extraction Well Characterization Data, Fiscal Year 2006. (2 sheets)

216-Z-9 Well/ Interval	Date	Vacuum (kPa)	Flow (m^3/min)	Carbon Tetrachloride (ppmv)	Carbon Tetrachloride Flux (kg/day)	Chloroform (ppmv)	Methylene Chloride (ppmv)	Methyl Ethyl Ketone (ppmv)
299-W15-48	08/03/06 07:00	29.4	4.0	23.0	0.8	0	0	0
299-W15-48	08/03/06 09:00	29.6	4.0	25.0	0.9	0	0	0
299-W15-48	08/03/06 11:00	28.9	4.0	25.0	0.9	0	0	0
299-W15-48	08/03/06 13:00	28.9	4.0	25.0	0.9	0	0	0
299-W15-48	08/03/06 15:00	28.9	4.0	26.0	0.9	0	0	0
299-W15-48	08/29/06	16.7	2.9	5.0	0.1	0	0	0
299-W15-48	09/07/06	26.9	4.0	3.0	0.1	0	0	0
299-W15-82	07/31/06	21.4	1.0	0.5	0.0	0.478	0.057	0.101
299-W15-82	08/29/06	23.2	1.0	14.0	0.1	0	0	0
299-W15-82	09/07/06	27.9	1.1	19.0	0.2	0	0	0
299-W15-86	08/29/06	13.9	3.7	28.0	0.9	0	0	0
299-W15-86	09/07/06	13.9	3.8	27.0	0.9	0	0	0
299-W15-95L	08/29/06	13.0	4.0	11.0	0.4	0	0	0
299-W15-95L	09/07/06	13.2	4.0	12.0	0.4	0	0	0
299-W15-95U	08/29/06	13.0	4.0	4.0	0.1	0	0	0
299-W15-95U	09/07/06	19.2	5.9	3.0	0.2	0	0	0
299-W15-217	07/31/06	14.9	2.7	77.2	1.9	1.90	3.03	0.574
299-W15-217	08/29/06	13.0	4.0	28.0	1.0	0	0	0
299-W15-217	09/07/06	12.5	4.1	30.0	1.1	0	0	0

ppmv = parts per million by volume

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APPENDIX C

FISCAL YEAR 2006
PASSIVE SOIL VAPOR EXTRACTION DATA

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Table C-1. Passive Soil Vapor Extraction Well Monitoring Data. (4 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Carbon Tetrachloride (ppmv)	$CHCl_3$ (ppmv)	MEK (ppmv)	CH_2Cl_2 (ppmv)	Water (ppmv)	Comment
299-W18-6L	63	6	10/19/05 10:28	19.8	1.0 U	1.0 U	2.50	13,400	
299-W18-6L	63	6	10/19/05 10:28	19.90	1.0 U	1.0 U	2.74	13,600	Duplicate.
299-W18-6L	63	6	09/26/06 11:16	15.8	1.27	1.0 U	1.0 U	11,200	
299-W18-7	60	6	10/19/05 10:16	1.0 U	1.0 U	1.0 U	1.0 U	12,700	
299-W18-7	60	6	11/23/05 11:39	9.19	1.0 U	1.0 U	1.03	7,530	
299-W18-7	60	6	12/15/05 08:43	11.7	1.0 U	1.0 U	1.0 U	5,080	
299-W18-7	60	6	01/27/06 10:17	15.8	1.0 U	1.0 U	1.31	4,290	Well was open to the atmosphere; closed the well head and monitored as usual.
299-W18-7	60	6	02/28/06 10:00	16.2	1.0 U	1.0 U	1.46	a	
299-W18-7	60	6	03/27/06 13:37	15.3	1.04	1.0 U	1.0 U	a	
299-W18-7	60	6	03/27/06 13:37	15.3	1.0 U	1.0 U	1.13	a	Duplicate.
299-W18-7	60	6	04/28/06 12:38	33.8	1.0 U	1.0 U	1.25	a	
299-W18-7	60	6	04/28/06 12:38	33.8	1.0 U	1.0 U	1.92	a	Duplicate.
299-W18-7	60	6	05/26/06 11:46	20.3	1.0 U	1.0 U	1.72	8,890	
299-W18-7	60	6	06/29/06 10:28	5.87	1.0 U	1.0 U	1.19	13,200	
299-W18-7	60	6	07/26/06 08:43	11.0	1.0 U	1.0 U	1.55	9,770	
299-W18-7	60	6	08/29/06 13:02	15.3	1.0 U	1.0 U	2.24	9,620	
299-W18-7	60	6	09/26/06 10:25	1.0 U	1.0 U	1.0 U	1.25	10,900	
299-W18-7	60	6	09/26/06 10:25	1.0 U	1.0 U	1.0 U	1.11	10,600	Duplicate.
299-W18-10L	56	6	10/19/05 11:22	8.36	1.0 U	1.0 U	1.70	15,700	
299-W18-10L	56	6	11/23/05 13:44	11.6	1.0 U	1.0 U	2.64	8,640	
299-W18-10L	56	6	11/23/05 12:47	11.6	1.0 U	1.0 U	3.09	8,830	Duplicate.

Table C-1. Passive Soil Vapor Extraction Well Monitoring Data. (4 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Carbon Tetrachloride (ppmv)	$CHCl_3$ (ppmv)	MEK (ppmv)	CH_2Cl_2 (ppmv)	Water (ppmv)	Comment
299-W18-10L	56	6	12/15/05 09:05	4.01	1.0 U	1.0 U	1.0 U	5,410	
299-W18-10L	56	6	01/27/06 10:42	12.1	1.0 U	1.0 U	1.0 U	8,010	
299-W18-10L	56	6	02/28/06 10:40	13.0	1.0 U	1.0 U	1.0 U	a	
299-W18-10L	56	6	03/27/06 13:58	3.94	1.0 U	1.0 U	1.0 U	a	
299-W18-10L	56	6	04/28/06 16:04	14.1	1.0 U	1.0 U	1.58	a	
299-W18-10L	56	6	05/26/06 14:41	11.4	1.0 U	1.0 U	1.94	10,800	
299-W18-10L	56	6	05/26/06 14:41	11.4	1.0 U	1.0 U	2.32	11,000	
299-W18-10L	56	6	06/29/06 14:30	11.20	1.0 U	1.0 U	1.82	14,500	
299-W18-10L	56	6	07/26/06 13:07	10.0	1.0 U	1.0 U	2.30	12,300	
299-W18-10L	56	6	08/29/06 13:25	12.7	1.0 U	1.0 U	1.82	11,100	
299-W18-10L	56	6	09/26/06 14:35	11.7	1.0 U	1.14	3.33	19,700	
299-W18-11L	61	6	10/19/05 11:28	1.0 U	1.0 U	1.0 U	1.09	12,300	
299-W18-11L	61	6	11/23/05 13:03	5.85	1.0 U	1.0 U	1.0 U	8,140	
299-W18-11L	61	6	12/15/05 09:12	1.0 U	1.0 U	1.0 U	1.0 U	5,190	
299-W18-11L	61	6	12/15/05 09:09	1.0 U	1.0 U	1.0 U	1.0 U	5,230	Duplicate.
299-W18-11L	61	6	01/27/06 10:48	7.6	1.0 U	1.0 U	1.0 U	8,680	
299-W18-11L	61	6	02/28/06 10:47	8.98	1.0 U	1.0 U	1.0 U	a	
299-W18-11L	61	6	03/27/06 14:03	1.0 U	1.0 U	1.0 U	1.0 U	a	
299-W18-11L	61	6	04/28/06 16:10	5.42	1.0 U	1.0 U	1.39	a	
299-W18-11L	61	6	05/26/06 14:47	7.18	1.0 U	1.0 U	1.01	10,600	
299-W18-11L	61	6	06/29/06 14:22	1.75	1.0 U	1.0 U	1.17	13,500	
299-W18-11L	61	6	06/29/06 14:22	1.75	1.0 U	1.0 U	1.28	13,600	Duplicate.
299-W18-11L	61	6	07/26/06 13:16	3.03	1.0 U	1.08	2.56	13,300	

Table C-1. Passive Soil Vapor Extraction Well Monitoring Data. (4 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Carbon Tetrachloride (ppmv)	$CHCl_3$ (ppmv)	MEK (ppmv)	CH_2Cl_2 (ppmv)	Water (ppmv)	Comment
299-W18-11L	61	6	08/29/06 13:33	8.39	1.0 U	1.0 U	1.33	10,100	
299-W18-11L	61	6	09/26/06 14:58	1.30	1.0 U	1.0 U	1.86	12,700	
299-W18-12	60	6	10/19/05 11:35	1.0 U	1.0 U	1.0 U	1.45	14,500	
299-W18-12	60	6	11/23/05 13:09	1.60	1.0 U	1.0 U	1.0 U	10,000	
299-W18-12	60	6	12/15/05 09:28	1.0 U	1.0 U	1.0 U	1.0 U	5,410	Barely blowing; able to get only a small amount of sample.
299-W18-12	60	6	01/27/06 11:07	4.86	1.0 U	1.0 U	1.0 U	8,180	
299-W18-12	60	6	01/27/06 11:07	4.90	1.0 U	1.0 U	1.0 U	8,410	Duplicate.
299-W18-12	60	6	02/28/06 10:57	9.43	1.0 U	1.0 U	1.0 U	a	
299-W18-12	60	6	03/27/06 14:09	1.34	1.0 U	1.0 U	1.0 U	a	
299-W18-12	60	6	04/28/06 16:16	1.0 U	1.0 U	1.0 U	1.30	a	
299-W18-12	60	6	05/26/06 14:54	2.38	1.0 U	1.0 U	1.0 U	10,900	
299-W18-12	60	6	06/29/06 14:14	1.0 U	1.0 U	1.0 U	1.69	14,300	
299-W18-12	60	6	07/26/06 13:28	1.0 U	1.0 U	1.0 U	2.09	11,500	
299-W18-12	60	6	07/26/06 13:30	1.0 U	1.0 U	1.0 U	1.98	11,500	Duplicate.
299-W18-12	60	6	08/29/06 13:40	4.75	1.0 U	1.0 U	1.07	11,000	
299-W18-12	60	6	09/26/06 15:05	1.0 U	1.0 U	1.0 U	2.07	14,500	
299-W18-246L	52	6	10/19/05 10:40	13.0	1.0 U	1.0 U	1.56	14,400	
299-W18-246L	52	6	09/26/06 11:37	3.70	1.0 U	1.0 U	1.20	11,400	
299-W18-247L	51	6	10/19/05 11:43	1.0 U	1.0 U	1.0 U	1.47	14,600	
299-W18-247L	51	6	11/23/05 13:16	1.0 U	1.0 U	1.0 U	1.0 U	8,670	
299-W18-247L	51	6	12/15/05 09:38	2.39	1.0 U	1.0 U	1.0 U	4,940	
299-W18-247L	51	6	01/27/06 11:14	5.05	1.0 U	1.0 U	1.0 U	8,640	

Table C-1. Passive Soil Vapor Extraction Well Monitoring Data. (4 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Carbon Tetrachloride (ppmv)	$CHCl_3$ (ppmv)	MEK (ppmv)	CH_2Cl_2 (ppmv)	Water (ppmv)	Comment
299-W18-247L	51	6	02/28/06 11:03	7.59	1.0 U	1.0 U	1.30	a	
299-W18-247L	51	6	02/28/06 11:03	7.64	1.0 U	1.0 U	1.0 U	a	Duplicate.
299-W18-247L	51	6	03/27/06 14:14	1.0 U	1.0 U	1.0 U	1.0 U	a	
299-W18-247L	51	6	04/28/06 15:56	3.01	1.0 U	1.0 U	1.71	a	
299-W18-247L	51	6	05/26/06 14:59	1.82	1.0 U	1.0 U	1.34	10,800	
299-W18-247L	51	6	06/29/06 14:00	1.32	1.0 U	1.0 U	1.57	14,400	
299-W18-247L	51	6	07/26/06 13:53	1.0 U	1.0 U	1.0 U	2.23	12,100	
299-W18-247L	51	6	08/29/06 13:47	5.66	1.0 U	1.0 U	1.82	11,300	
299-W18-247L	51	6	08/29/06 13:47	5.66	1.0 U	1.0 U	1.83	11,300	Duplicate.
299-W18-247L	51	6	09/26/06 15:24	1.02	1.05	1.0 U	2.54	24,400	
299-W18-252L	53	6	10/19/05 10:47	1.0 U	1.0 U	1.0 U	1.31	14,100	

[a] Water vapor measured in units of degrees Celsius; result rejected in Hanford Environmental Information System database.
bgs = below ground surface
ppmv = parts per million by volume

Table C-2. Carbon Tetrachloride Concentration Standard Analyses.

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.37	22.1	10/19/05	12:09	1715232
25.37	21.9	10/19/05	13:01	1715232
25.37	22.9	11/23/05	13:38	1715232
25.37	22.8	11/23/05	14:10	1715232
25.37	21.7	12/15/05	10:07	1715232
25.37	22.0	12/15/05	10:41	1715232
25.37	22.2	01/27/06	11:38	1715232
25.37	22.2	01/27/06	12:12	1715232
25.37	21.3	02/28/06	11:20	1715232
25.37	21.3	02/28/06	11:56	1715232
25.37	20.9	03/27/06	14:32	1715232
25.37	21.0	03/27/06	15:06	1715232
25.37	20.4	04/28/06	16:41	1715232
25.37	20.3	04/28/06	18:17	1715232
25.37	24.6	05/26/06	16:39	1715232
25.37	24.5	05/26/06	17:17	1715232
25.37	21.5	06/29/06	16:02	1715232
25.37	22.0	06/29/06	17:55	1715232
25.37	21.7	07/26/06	14:08	1715232
25.37	22.3	07/26/06	16:04	1715232
25.37	22.2	08/29/06	15:40	1715232
25.37	22.1	08/29/06	16:12	1715232
25.37	22.6	09/26/06	14:38	1715232
25.37	22.8	09/26/06	16:55	1715232

ppmv = parts per million by volume

Table C-3. Blank Analyses.

Sample Location	Sample Date	Sample Time	Carbon Tetrachloride (ppmv)	$CHCl_3$ (ppmv)	MEK (ppmv)	CH_2Cl_2 (ppmv)	Water (ppmv)
Blank	10/19/05	12:07	1.0 U	1.0 U	1.0 U	1.0 U	9,660
Blank	10/19/05	13:03	1.0 U	1.0 U	1.0 U	1.0 U	10,700
Blank	11/23/05	13:34	1.0 U	1.0 U	1.0 U	1.0 U	6,600
Blank	11/23/05	14:12	1.0 U	1.0 U	1.0 U	1.0 U	6,490
Blank	12/15/05	10:05	1.0 U	1.0 U	1.0 U	1.0 U	2,050
Blank	12/15/05	10:43	1.0 U	1.0 U	1.0 U	1.0 U	2,620
Blank	01/27/06	11:36	1.0 U	1.0 U	1.0 U	1.0 U	1,200
Blank	01/27/06	12:14	1.0 U	1.0 U	1.0 U	1.0 U	1,640
Blank	02/28/06	11:19	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	02/28/06	11:58	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	03/27/06	14:30	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	03/27/06	15:08	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	04/28/06	16:39	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	04/28/06	18:19	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	05/26/06	16:37	1.0 U	1.0 U	1.0 U	1.0 U	8,670
Blank	05/26/06	17:19	1.0 U	1.0 U	1.0 U	1.0 U	9,320
Blank	06/29/06	16:00	1.0 U	1.0 U	1.0 U	1.0 U	3,210
Blank	06/29/06	17:57	1.0 U	1.0 U	1.0 U	1.0 U	6,920
Blank	07/26/06	14:04	1.0 U	1.02	1.0 U	1.0 U	10,400
Blank	07/26/06	16:06	1.0 U	1.0 U	1.0 U	1.0 U	12,000
Blank	08/29/06	15:36	1.0 U	1.0 U	1.0 U	1.0 U	7,060
Blank	08/29/06	16:16	1.0 U	1.0 U	1.0 U	1.0 U	7,290
Blank	09/26/06	14:34	1.0 U	1.0 U	1.0 U	1.0 U	2,790
Blank	09/26/06	16:58	1.0 U	1.0 U	1.0 U	1.0 U	7,110

[a] Water vapor measured in units of degrees Celsius; result rejected.
ppmv = parts per million by volume

APPENDIX D

FISCAL YEAR 2006 SOIL VAPOR MONITORING DATA

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Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-4E / 25 ft	8	2	04/28/06 12:59	-0.035	2.37	1.0 U	1.0 U	1.86	a	
CPT-4E / 25 ft	8	2	05/26/06 11:55	0.020	1.71	1.0 U	1.0 U	1.31	8,300	
CPT-4E / 25 ft	8	2	06/29/06 10:44	-0.015	1.0 U	1.0 U	1.0 U	1.0 U	14,700	
CPT-4E / 25 ft	8	2	07/26/06 09:58	0.015	1.0 U	1.0 U	1.0 U	1.33	11,500	
CPT-4E / 25 ft	8	2	08/30/06 15:06	0.002	1.0 U	1.0 U	1.0 U	1.06	15,400	
CPT-4E / 25 ft	8	2	09/26/06 11:58	0.015	1.0 U	1.0 U	1.0 U	1.71	11,500	
CPT-32 / 25 ft	8	2	11/28/05 11:48	0.025	1.14	1.0 U	1.0 U	1.0 U	6,620	
CPT-32 / 25 ft	8	2	12/20/05 10:03	0.005	3.36	1.0 U	1.0 U	1.0 U	8,390	
CPT-32 / 25 ft	8	2	01/26/06 10:27	-0.002	3.97	1.0 U	1.0 U	1.0 U	3,710	
CPT-32 / 25 ft	8	2	02/23/06 11:39	0.030	4.77	1.0 U	1.0 U	1.59	a	
CPT-32 / 25 ft	8	2	03/28/06 12:18	0.070	6.35	1.0 U	1.0 U	2.12	a	
CPT-32 / 25 ft	8	2	07/26/06 08:58	0.000	1.0 U	1.0 U	1.0 U	1.0 U	11,300	
CPT-32 / 25 ft	8	2	08/30/06 14:43	0.000	1.0 U	1.0 U	1.0 U	1.0 U	13,600	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-32 / 25 ft	8	2	09/26/06 11:24	0.002	1.0 U	1.0 U	1.0 U	1.45	11,500	
CPT-30 / 28 ft	9	2	10/25/05 09:50	0.012	1.21	1.0 U	1.0 U	1.81	11,500	
CPT-30 / 28 ft	9	2	11/28/05 11:53	0.037	1.0 U	1.0 U	1.0 U	1.0 U	6,480	
CPT-30 / 28 ft	9	2	12/20/05 10:08	0.022	1.11	1.0 U	1.0 U	1.0 U	8,370	
CPT-30 / 28 ft	9	2	01/26/06 10:32	-0.002	1.0 U	1.0 U	1.0 U	1.0 U	3,600	
CPT-30 / 28 ft	9	2	02/23/06 11:45	0.027	1.0 U	1.0 U	1.0 U	1.0 U	a	
CPT-30 / 28 ft	9	2	03/28/06 12:23	0.075	1.0 U	1.0 U	1.0 U	1.58	a	
CPT-30 / 28 ft	9	2	07/26/06 09:17	0.002	1.0 U	1.0 U	1.0 U	1.61	12,500	
CPT-30 / 28 ft	9	2	08/30/06 14:50	0.005	1.0 U	1.0 U	1.0 U	1.0 U	14,800	
CPT-30 / 28 ft	9	2	09/26/06 11:44	0.012	1.0 U	1.0 U	1.0 U	1.42	11,500	
CPT-30 / 28 ft	9	2	09/26/06 11:44	0.012	1.0 U	1.0 U	1.0 U	1.34	11,800	Duplicate.
CPT-13A / 30 ft	9	2	10/25/05 13:00	0.045	3.61	1.0 U	1.0 U	1.47	15,000	
CPT-13A / 30 ft	9	2	11/28/05 14:26	0.042	4.05	1.0 U	1.0 U	1.0 U	7,430	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-13A / 30 ft	9	2	11/28/05 14:26	0.042	3.37	1.0 U	1.0 U	1.0 U	7,460	Duplicate.
CPT-13A / 30 ft	9	2	12/20/05 12:53	0.042	3.92	1.0 U	1.0 U	1.0 U	9,040	
CPT-13A / 30 ft	9	2	01/26/06 12:54	0.030	3.56	1.0 U	1.0 U	1.0 U	5,190	
CPT-13A / 30 ft	9	2	02/23/06 13:24	0.055	3.51	1.0 U	1.0 U	1.0 U	a	
CPT-13A / 30 ft	9	2	03/28/06 14:09	0.177	3.32	1.0 U	1.0 U	1.0 U	a	
CPT-13A / 30 ft	9	2	04/28/06 15:50	0.032	3.59	1.0 U	1.0 U	1.11	a	
CPT-13A / 30 ft	9	2	05/26/06 14:27	0.022	3.79	1.0 U	1.0 U	1.0 U	10,900	
CPT-13A / 30 ft	9	2	06/29/06 13:54	-0.005	3.31	1.0 U	1.0 U	1.62	15,400	
CPT-13A / 30 ft	9	2	07/26/06 11:36	0.020	2.39	1.0 U	1.0 U	1.16	10,800	
CPT-13A / 30 ft	9	2	08/30/06 10:51	-0.007	2.45	1.0 U	1.0 U	1.0 U	14,100	
CPT-13A / 30 ft	9	2	09/26/06 14:30	0.022	2.37	1.0 U	1.0 U	1.20	14,300	
CPT-7A / 32 ft	10	2	10/25/05 10:29	0.015	2.31	1.0 U	1.0 U	1.53	11,900	
CPT-7A / 32 ft	10	2	11/28/05 11:21	0.035	2.68	1.0 U	1.0 U	1.0 U	6,340	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-7A / 32 ft	10	2	12/20/05 10:27	0.045	2.22	1.0 U	1.0 U	1.0 U	8,360	
CPT-7A / 32 ft	10	2	01/26/06 09:52	0.010	2.76	1.0 U	1.0 U	1.0 U	3,650	
CPT-7A / 32 ft	10	2	02/23/06 11:07	0.060	3.27	1.0 U	1.0 U	1.0 U	a	
CPT-7A / 32 ft	10	2	03/28/06 11:52	0.087	3.77	1.0 U	1.0 U	1.0 U	a	
CPT-7A / 32 ft	10	2	04/28/06 12:33	0.020	2.38	1.0 U	1.0 U	1.50	a	
CPT-7A / 32 ft	10	2	05/26/06 11:42	0.027	2.40	1.0 U	1.0 U	1.0 U	8,230	
CPT-7A / 32 ft	10	2	06/29/06 10:15	-0.015	1.83	1.0 U	1.0 U	1.10	14,800	
CPT-7A / 32 ft	10	2	07/26/06 08:28	-0.015	2.04	1.0 U	1.47	1.0 U	11,000	
CPT-7A / 32 ft	10	2	08/30/06 13:58	0.002	1.89	1.0 U	1.0 U	1.0 U	12,500	
CPT-7A / 32 ft	10	2	09/26/06 10:13	-0.007	1.17	1.0 U	1.0 U	1.36	10,600	
CPT-1A / 35 ft	11	2	10/25/05 09:57	0.010	17.2	1.41	1.0 U	2.19	11,700	
CPT-1A / 35 ft	11	2	11/28/05 11:59	0.042	9.11	1.0 U	1.0 U	1.0 U	6,150	
CPT-1A / 35 ft	11	2	12/20/05 10:14	0.030	3.60	1.0 U	1.0 U	1.0 U	8,150	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-1A / 35 ft	11	2	01/26/06 10:38	-0.010	7.70	1.0 U	1.0 U	1.0 U	3,740	
CPT-1A / 35 ft	11	2	02/23/06 11:51	0.052	6.00	1.0 U	1.0 U	1.00	a	
CPT-1A / 35 ft	11	2	03/28/06 12:32	0.082	7.35	1.0 U	1.0 U	2.11	a	
CPT-1A / 35 ft	11	2	04/28/06 13:04	0.030	6.24	1.0 U	1.0 U	2.01	a	
CPT-1A / 35 ft	11	2	05/26/06 12:01	0.032	8.94	1.0 U	1.0 U	1.32	7,740	
CPT-1A / 35 ft	11	2	06/29/06 10:57	-0.017	13.2	1.31	1.0 U	1.72	14,800	
CPT-1A / 35 ft	11	2	07/26/06 10:04	0.020	11.0	1.03	1.08	1.82	11,400	
CPT-1A / 35 ft	11	2	08/30/06 15:10	0.002	13.4	1.0 U	1.0 U	1.63	15,200	
CPT-1A / 35 ft	11	2	09/26/06 12:05	0.012	10.2	1.0 U	1.0 U	2.57	10,300	
CPT-33 / 40 ft	12	2	07/26/06 13:42	0.127	1.0 U	1.0 U	1.0 U	2.57	13,100	
CPT-33 / 40 ft	12	2	08/30/06 11:12	-0.002	1.31	1.0 U	1.0 U	1.31	15,400	
CPT-33 / 40 ft	12	2	09/26/06 15:15	0.025	1.57	1.0 U	1.0 U	3.39	15,000	
CPT-34 / 40 ft	12	2	10/25/05 13:10	0.035	1.80	1.0 U	1.0 U	1.02	14,900	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-34 / 40 ft	12	2	04/28/06 16:24	0.042	1.28	1.0 U	1.0 U	1.01	a	
CPT-34 / 40 ft	12	2	05/26/06 14:35	0.027	1.73	1.0 U	1.0 U	1.0 U	11,100	
CPT-34 / 40 ft	12	2	06/29/06 15:03	-0.005	1.16	1.0 U	1.0 U	1.47	16,400	
CPT-34 / 40 ft	12	2	07/26/06 13:47	0.030	1.0 U	1.0 U	1.12	2.02	15,100	
CPT-34 / 40 ft	12	2	08/30/06 11:16	-0.002	1.30	1.0 U	1.0 U	1.0 U	15,800	
CPT-34 / 40 ft	12	2	09/26/06 15:20	0.027	1.28	1.0 U	1.0 U	1.70	14,800	
CPT-3872 / 61 ft	19	2	10/25/05 10:18	0.050	4.01	1.0 U	1.0 U	1.69	11,600	
CPT-3872 / 61 ft	19	2	11/28/05 11:27	0.132	4.32	1.0 U	1.0 U	1.0 U	6,460	
CPT-3872 / 61 ft	19	2	12/20/05 09:47	0.072	3.74	1.0 U	1.0 U	1.0 U	7,980	
CPT-3872 / 61 ft	19	2	01/26/06 10:03	0.000	5.11	1.0 U	1.0 U	1.0 U	3,370	
CPT-3872 / 61 ft	19	2	02/23/06 11:18	0.115	6.29	1.0 U	1.0 U	1.48	a	
CPT-3872 / 61 ft	19	2	03/28/06 12:13	0.065	9.85	1.0 U	1.0 U	2.07	a	
CPT-3872 / 61 ft	19	2	07/26/06 08:37	-0.092	2.12	1.0 U	1.09	1.16	11,200	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
CPT-3872 / 61 ft	19	2	08/30/06 14:10	-0.022	2.17	1.0 U	1.0 U	1.27	13,000	
CPT-3872 / 61 ft	19	2	09/26/06 10:21	-0.045	2.38	1.0 U	1.0 U	1.94	11,200	
CPT-1A / 68 ft	21	2	07/26/06 10:09	0.012	13.2	1.00	1.0 U	2.59	11,900	
CPT-1A / 68 ft	21	2	08/30/06 15:15	-0.002	12.5	1.0 U	1.0 U	2.27	17,600	
CPT-1A / 68 ft	21	2	09/26/06 12:07	0.015	5.58	1.0 U	1.0 U	2.43	11,200	
CPT-32 / 70 ft	21	2	07/26/06 09:02	-0.072	4.21	1.0 U	1.16	2.22	11,700	
CPT-32 / 70 ft	21	2	08/30/06 14:45	-0.045	4.26	1.0 U	1.0 U	2.44	16,000	
CPT-32 / 70 ft	21	2	09/26/06 11:26	-0.027	3.50	1.0 U	1.0 U	2.45	11,800	
299-W18-152 / 101 ft	31	2	10/25/05 10:05	0.067	12.7	1.0 U	1.0 U	2.55	11,900	
299-W18-152 / 101 ft	31	2	11/28/05 12:04	0.276	14.2	1.0 U	1.0 U	1.46	6,640	
299-W18-152 / 101 ft	31	2	12/20/05 10:19	0.184	14.5	1.0 U	1.0 U	1.14	8,160	
299-W18-152 / 101 ft	31	2	01/26/06 10:42	-0.022	15.4	1.0 U	1.0 U	1.10	3,980	
299-W18-152 / 101 ft	31	2	02/23/06 11:57	0.259	15.2	1.0 U	1.0 U	2.18	a	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
299-W18-152 / 101 ft	31	2	03/28/06 12:40	0.047	16.2	1.0 U	1.0 U	2.37	a	
299-W18-152 / 101 ft	31	2	07/26/06 10:18	-0.080	10.8	1.0 U	1.53	2.02	12,100	
299-W18-152 / 101 ft	31	2	08/30/06 15:21	-0.060	12.5	1.0 U	1.02	2.28	18,700	
299-W18-152 / 101 ft	31	2	09/26/06 12:13	-0.017	13.3	1.0 U	1.64	2.94	12,800	
299-W18-167 / 106 ft	32	3	10/25/05 09:39	0.082	63.1	1.0 U	1.0 U	3.42	11,400	
299-W18-167 / 106 ft	32	3	11/28/05 10:46	0.122	174	1.08	1.0 U	4.04	6,210	
299-W18-167 / 106 ft	32	2	07/26/06 09:10	-0.110	1.0 U	1.12	1.26	1.0 U	10,800	
299-W18-167 / 106 ft	32	2	08/30/06 14:35	-0.070	1.0 U	1.0 U	1.0 U	1.12	7,800	
299-W18-167 / 106 ft	32	3	09/26/06 10:56	-0.047	1.0 U	1.0 U	1.0 U	1.71	10,600	
CPT-4F / 109 ft	33	3	07/26/06 09:48	-0.082	1.18	1.0 U	1.17	1.83	11,800	
CPT-4F / 109 ft	33	3	08/30/06 15:01	-0.062	2.85	1.0 U	1.0 U	1.91	14,500	
CPT-4F / 109 ft	33	3	09/26/06 11:55	-0.770	1.0 U	1.0 U	1.0 U	2.10	11,100	
299-W18-165 / 109 ft	33	3	10/25/05 09:33	0.097	65.1	7.41	1.0 U	7.25	11,500	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
299-W18-165 / 109 ft	33	3	11/28/05 10:41	0.115	394	3.75	1.0 U	9.37	5,910	
299-W18-165 / 109 ft	33	3	12/20/05 09:55	0.105	220	4.17	1.0 U	8.31	8,380	
299-W18-165 / 109 ft	33	3	01/26/06 10:10	0.010	161	5.77	1.0 U	8.53	3,640	
299-W18-165 / 109 ft	33	3	02/23/06 11:30	0.199	160	7.22	1.0 U	10.1	a	
299-W18-165 / 109 ft	33	3	03/28/06 12:03	0.027	164	5.28	1.0 U	10.1	a	
299-W18-165 / 109 ft	33	3	08/30/06 14:28	-0.020	1.0 U	1.0 U	1.0 U	1.0 U	8,150	
299-W18-165 / 109 ft	33	3	09/26/06 10:50	-0.015	1.0 U	1.0 U	1.0 U	1.36	11,100	
299-W18-165 / 109 ft	33	3	09/26/06 10:50	-0.015	1.0 U	1.0 U	1.0 U	1.36	11,100	
299-W18-249 / 130 ft	40	3	10/25/05 13:06	0.204	22.5	1.0 U	1.0 U	2.14	14,700	
299-W18-249 / 130 ft	40	3	11/28/05 14:34	0.346	22.0	1.0 U	1.0 U	1.33	7,580	
299-W18-249 / 130 ft	40	3	12/20/05 13:00	0.142	12.2	1.0 U	1.0 U	1.25	9,920	
299-W18-249 / 130 ft	40	3	01/26/06 13:02	0.112	12.4	1.0 U	1.0 U	1.17	5,580	

Table D-1. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-1A/216-Z-18/216-Z-12 Site. (10 sheets)

Sample Location	Depth (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)	Comment
299-W18-249 / 130 ft	40	3	02/23/06 13:30	0.249	17.1	1.0 U	1.0 U	1.98	a	
299-W18-249 / 130 ft	40	3	03/28/06 14:23	0.154	24.1	1.0 U	1.0 U	2.31	a	
299-W18-249 / 130 ft	40	3	07/26/06 11:45	-0.010	4.61	1.0 U	1.05	2.44	12,500	
299-W18-249 / 130 ft	40	3	08/30/06 11:08	-0.184	19.4	1.0 U	1.0 U	1.96	16,200	
299-W18-249 / 130 ft	40	3	09/26/06 14:54	0.095	18.1	1.0 U	1.05	3.34	14,400	
299-W18-248 / 131 ft	40	3	10/25/05 10:23	0.144	67.0	1.0 U	1.0 U	1.97	12,200	
299-W18-248 / 131 ft	40	3	11/28/05 11:34	0.219	23.1	1.0 U	1.0 U	1.11	6,530	
299-W18-248 / 131 ft	40	3	08/30/06 14:21	-0.147	27.2	1.0 U	1.0 U	1.85	12,900	
299-W18-248 / 131 ft	40	3	09/26/06 10:41	-0.090	43.0	1.0 U	1.0 U	1.84	11,400	

[a] Water vapor measured in units of degrees Celsius; result was given review qualifier of "R "(rejected) in the Hanford Environmental Information System database.
bgs = below ground surface
ppmv = parts per million by volume

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-17 / 10 ft	3	2	10/25/05 14:12	0.005	1.35	1.0 U	1.0 U	1.0 U	11,500	
CPT-17 / 10 ft	3	2	11/28/05 14:02	0.015	1.17	1.0 U	1.0 U	1.0 U	7,270	
CPT-17 / 10 ft	3	2	12/20/05 12:15	0.012	1.18	1.0 U	1.0 U	1.0 U	7,950	
CPT-17 / 10 ft	3	2	01/26/06 12:32	0.005	1.28	1.0 U	1.0 U	1.0 U	5,190	
CPT-17 / 10 ft	3	2	01/26/06 12:32	0.005	1.28	1.0 U	1.0 U	1.0 U	5,150	Duplicate.
CPT-17 / 10 ft	3	2	02/23/06 13:03	0.030	1.53	1.0 U	1.0 U	1.90	a	
CPT-17 / 10 ft	3	2	03/28/06 13:51	0.120	1.73	1.0 U	1.0 U	2.65	a	
CPT-17 / 10 ft	3	2	04/28/06 15:28	0.022	1.96	1.0 U	1.0 U	2.46	a	
CPT-17 / 10 ft	3	2	05/26/06 14:07	0.012	2.20	1.0 U	1.0 U	2.52	12,200	
CPT-17 / 10 ft	3	2	06/29/06 13:28	0.002	2.27	1.0 U	1.0 U	2.64	16,700	
CPT-18 / 15 ft	5	2	10/25/05 12:38	0.025	1.0 U	1.0 U	1.0 U	1.68	13,700	
CPT-18 / 15 ft	5	2	11/28/05 13:57	0.030	1.0 U	1.0 U	1.0 U	1.0 U	7,440	
CPT-18 / 15 ft	5	2	12/20/05 12:09	0.017	1.0 U	1.0 U	1.0 U	1.0 U	7,860	
CPT-18 / 15 ft	5	2	01/26/06 12:26	0.012	1.0 U	1.0 U	1.0 U	1.0 U	5,290	
CPT-18 / 15 ft	5	2	02/23/06 12:57	0.032	1.0 U	1.0 U	1.0 U	1.0 U	a	Duplicate.
CPT-18 / 15 ft	5	2	02/23/06 12:57	0.032	1.0 U	1.0 U	1.0 U	1.0 U	a	
CPT-18 / 15 ft	5	2	03/28/06 13:46	0.127	1.0 U	1.0 U	1.0 U	1.60	a	
CPT-18 / 15 ft	5	2	04/28/06 15:02	0.027	1.0 U	1.0 U	1.0 U	1.35	a	
CPT-18 / 15 ft	5	2	05/26/06 13:36	0.017	1.0 U	1.0 U	1.0 U	1.01	10,100	
CPT-18 / 15 ft	5	2	06/29/06 12:48	-0.002	1.0 U	1.0 U	1.0 U	1.44	15,800	
CPT-16 / 25 ft	8	2	10/25/05 11:05	0.015	1.64	1.0 U	1.0 U	1.16	12,200	
CPT-16 / 25 ft	8	2	11/28/05 12:16	0.030	1.16	1.0 U	1.0 U	1.0 U	6,370	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-16 / 25 ft	8	2	12/20/05 11:04	0.002	1.28	1.0 U	1.0 U	1.0 U	7,370	Duplicate.
CPT-16 / 25 ft	8	2	12/20/05 11:04	0.002	1.43	1.0 U	1.0 U	1.0 U	7,290	
CPT-16 / 25 ft	8	2	01/26/06 11:20	0.035	1.12	1.0 U	1.0 U	1.0 U	4,590	
CPT-16 / 25 ft	8	2	02/23/06 12:09	0.042	1.10	1.0 U	1.0 U	1.0 U	a	
CPT-16 / 25 ft	8	2	03/28/06 12:53	0.062	1.12	1.0 U	1.0 U	1.20	a	
CPT-16 / 25 ft	8	2	04/28/06 13:19	0.027	1.03	1.0 U	1.0 U	1.50	a	
CPT-16 / 25 ft	8	2	05/26/06 12:13	0.027	1.0 U	1.0 U	1.0 U	1.04	8,530	
CPT-16 / 25 ft	8	2	06/29/06 11:10	0.002	1.0 U	1.0 U	1.0 U	1.20	15,000	
CPT-27 / 33 ft	10	2	10/25/05 11:37	0.015	1.82	1.0 U	1.0 U	1.21	12,700	
CPT-27 / 33 ft	10	2	11/28/05 12:52	0.017	1.0 U	1.0 U	1.0 U	1.0 U	6,770	
CPT-27 / 33 ft	10	2	12/20/05 11:30	0.015	1.0 U	1.0 U	1.0 U	1.0 U	7,370	
CPT-27 / 33 ft	10	2	01/26/06 11:40	0.010	1.0 U	1.0 U	1.0 U	1.11	4,690	
CPT-27 / 33 ft	10	2	02/23/06 12:30	0.040	1.0 U	1.0 U	1.0 U	1.66	a	
CPT-27 / 33 ft	10	2	03/28/06 13:13	0.408	1.0 U	1.0 U	1.0 U	1.0 U	a	
CPT-27 / 33 ft	10	2	04/28/06 14:07	0.027	1.0 U	1.0 U	1.0 U	1.66	a	
CPT-27 / 33 ft	10	2	05/26/06 13:05	0.022	1.0 U	1.0 U	1.0 U	1.07	9,570	
CPT-27 / 33 ft	10	2	06/29/06 12:03	-0.007	1.0 U	1.0 U	1.0 U	1.0 U	15,700	
CPT-28 / 40 ft	12	2	07/26/06 11:23	0.017	5.50	1.0 U	1.0 U	1.31	11,400	
CPT-28 / 40 ft	12	2	07/26/06 11:23	0.017	4.66	1.0 U	1.0 U	1.33	11,700	
CPT-28 / 40 ft	12	2	08/30/06 10:36	-0.015	4.27	1.0 U	1.0 U	1.0 U	14,000	
CPT-28 / 40 ft	12	2	09/26/06 14:19	0.022	4.84	1.0 U	1.0 U	1.11	13,400	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-9A / 50 ft	15	2	10/25/05 10:49	0.075	52.8	1.0 U	1.0 U	5.29	12,300	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	11/28/05 11:07	0.222	50.9	1.0 U	1.0 U	3.64	6,290	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	12/20/05 10:40	0.110	50.6	1.0 U	1.0 U	3.70	8,360	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	01/26/06 09:39	-0.010	48.1	1.0 U	1.0 U	3.41	3,130	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	02/23/06 10:56	0.264	50.4	1.0 U	1.0 U	4.55	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	03/28/06 11:41	0.037	46.1	1.0 U	1.0 U	4.60	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	04/28/06 12:16	0.082	46.9	1.0 U	1.14	4.69	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	05/26/06 11:27	0.159	49.0	1.0 U	1.0 U	4.63	8,380	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	06/29/06 10:01	-0.137	39.1	1.0 U	1.0 U	3.45	15,000	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	07/26/06 08:11	-0.189	32.8	1.00	1.06	3.16	10,800	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-9A / 50 ft	15	2	08/30/06 13:46	-0.082	40.7	1.0 U	1.0 U	4.40	13,400	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 50 ft	15	2	09/26/06 10:01	-0.102	43.3	1.0 U	1.04	5.17	10,700	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 50 ft and sampled.
CPT-9A / 60 ft	18	2	10/25/05 10:39	0.022	25.5	1.0 U	1.0 U	3.34	12,000	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	10/25/05 10:39	0.022	25.5	1.0 U	1.0 U	3.16	12,100	Duplicate; CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	11/28/05 11:03	0.050	21.2	1.0 U	1.0 U	1.62	5,820	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	12/20/05 10:37	0.012	18.6	1.0 U	1.0 U	1.14	8,240	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	01/26/06 09:36	-0.002	17.4	1.0 U	1.0 U	1.0 U	3,170	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	02/23/06 10:47	0.085	11.4	1.0 U	1.0 U	1.47	a	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	03/28/06 11:37	0.045	16.0	1.0 U	1.0 U	2.03	a	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-9A / 60 ft	18	2	04/28/06 12:11	0.037	17.3	1.0 U	1.0 U	2.52	a	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	05/26/06 11:23	0.040	24.4	1.0 U	1.0 U	2.68	8,380	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	06/29/06 09:55	-0.012	13.3	1.0 U	1.0 U	1.0 U	14,100	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	07/26/06 08:05	-0.027	12.8	1.0 U	1.0 U	1.38	10,600	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	08/30/06 13:43	-0.002	9.82	1.0 U	1.0 U	1.21	9,440	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 60 ft	18	2	09/26/06 09:57	0.007	15.70	1.0 U	1.0 U	3.05	11,100	CPT-9A tubing (all three depths) cut off by construction vehicle. CPT-9A / 60 ft tube depth confirmed and sampled.
CPT-9A / 64 ft	20	2	10/25/05 10:45	0.050	38.6	1.0 U	1.0 U	4.18	12,200	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	11/28/05 11:10	0.157	36.9	1.0 U	1.0 U	2.83	6,340	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	12/20/05 10:45	0.090	36.9	1.0 U	1.0 U	2.30	8,130	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	01/26/06 09:45	-0.005	33.4	1.0 U	1.0 U	2.15	3,130	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-9A / 64 ft	20	2	02/23/06 10:52	0.192	36.2	1.0 U	1.0 U	3.35	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	03/28/06 11:45	0.050	36.6	1.0 U	1.0 U	4.03	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	04/28/06 12:21	0.072	33.1	1.0 U	1.06	4.07	a	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	05/26/06 11:33	0.117	36.4	1.0 U	1.0 U	3.80	8,500	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	06/29/06 10:05	-0.085	33.1	1.0 U	1.0 U	3.27	14,900	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	07/26/06 08:19	-0.122	33.8	1.0 U	1.84	3.93	11,300	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	08/30/06 13:50	-0.045	33.8	1.0 U	1.02	3.59	13,000	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-9A / 64 ft	20	2	09/26/06 10:04	-0.065	33.9	1.0 U	1.0 U	4.12	18,700	CPT-9A tubing (all three depths) cut off by construction vehicle. One tube measured to depth of 64 ft and sampled.
CPT-16 / 65 ft	20	2	04/28/06 13:22	0.107	5.34	1.0 U	1.0 U	1.22	a	
CPT-16 / 65 ft	20	2	05/26/06 12:15	0.162	5.61	1.0 U	1.0 U	1.0 U	10,200	
CPT-16 / 65 ft	20	2	06/29/06 11:14	-0.095	4.62	1.0 U	1.0 U	1.0 U	15,300	
CPT-21A / 65 ft	20	2	10/25/05 12:48	0.122	151	1.0 U	1.0 U	3.63	14,900	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-21A / 65 ft	20	2	11/28/05 14:09	0.199	137	1.0 U	1.0 U	2.33	7,320	
CPT-21A / 65 ft	20	2	12/20/05 12:21	0.105	140	1.0 U	1.0 U	1.86	7,950	
CPT-21A / 65 ft	20	2	01/26/06 12:39	0.042	139	1.0 U	1.0 U	3.38	5,500	
CPT-21A / 65 ft	20	2	02/23/06 13:10	0.122	146	1.0 U	1.0 U	3.83	a	
CPT-21A / 65 ft	20	2	03/28/06 13:56	0.157	145	1.0 U	1.0 U	4.32	a	
CPT-21A / 65 ft	20	2	03/28/06 13:56	0.157	151	1.0 U	1.0 U	4.85	a	
CPT-21A / 65 ft	20	2	04/28/06 15:34	0.122	139	1.0 U	1.0 U	4.76	a	
CPT-21A / 65 ft	20	2	05/26/06 14:13	0.092	160	1.0 U	1.0 U	4.64	11,000	
CPT-21A / 65 ft	20	2	06/29/06 13:36	-0.062	137	1.0 U	1.0 U	4.69	16,900	
CPT-21A / 65 ft	20	2	07/26/06 11:10	-0.007	153	1.0 U	1.48	5.22	11,600	
CPT-21A / 65 ft	20	2	08/30/06 10:25	-0.107	132	1.0 U	1.0 U	3.54	14,100	
CPT-21A / 65 ft	20	2	09/26/06 14:06	0.047	137	1.0 U	1.05	4.61	13,500	
CPT-24 / 70 ft	21	2	04/28/06 15:19	0.149	4.43	1.0 U	1.02	3.77	a	
CPT-24 / 70 ft	21	2	05/26/06 13:52	0.102	5.23	1.0 U	1.14	4.38	10,700	
CPT-24 / 70 ft	21	2	05/26/06 13:52	0.102	5.27	1.0 U	1.0 U	3.94	10,400	Duplicate.
CPT-24 / 70 ft	21	2	06/29/06 13:10	-0.077	4.32	1.0 U	1.08	4.01	16,600	
CPT-18 / 75 ft	23	2	04/28/06 15:06	0.085	3.42	1.0 U	1.0 U	2.59	a	
CPT-18 / 75 ft	23	2	05/26/06 13:39	0.065	3.69	1.0 U	1.0 U	2.48	10,600	
CPT-18 / 75 ft	23	2	06/29/06 12:54	-0.037	4.33	1.0 U	1.0 U	2.90	15,400	
299-W15-82 / 83 ft	25	2	10/25/05 11:29	0.085	8.07	1.0 U	1.0 U	7.24	12,800	
299-W15-82 / 83 ft	25	2	11/28/05 12:41	0.262	1.38	1.0 U	1.0 U	17.9	7,300	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
299-W15-82 / 83 ft	25	2	04/28/06 13:59	0.022	2.23	1.0 U	1.0 U	1.89	a	
299-W15-82 / 83 ft	25	2	05/26/06 12:59	0.010	6.83	1.0 U	1.0 U	3.03	9,610	
299-W15-82 / 83 ft	25	2	06/29/06 12:04	0.002	1.0 U	1.0 U	1.0 U	1.01	15,100	
CPT-21A / 86 ft	26	2	10/25/05 12:45	0.174	208	1.03	1.0 U	4.52	15,000	
CPT-21A / 86 ft	26	2	11/28/05 14:14	0.361	196	1.0 U	1.0 U	3.27	7,450	
CPT-21A / 86 ft	26	2	12/20/05 12:32	-0.015	(20.4)	(1.0 U)	(1.0 U)	(1.0 U)	(8,040)	Very difficult to collect sample. Was able to draw less than one-third of a liter of sample. Sample results are most likely not representative and were given review qualifier of "R" (rejected) in the HEIS database.
CPT-21A / 86 ft	26	2	01/26/06 12:43	0.062	186	1.0 U	1.0 U	4.37	5,130	
CPT-21A / 86 ft	26	2	02/23/06 13:15	0.199	194	1.0 U	1.0 U	4.48	a	
CPT-21A / 86 ft	26	2	03/28/06 13:59	0.187	201	1.0 U	1.0 U	4.70	a	
CPT-21A / 86 ft	26	2	04/28/06 15:38	0.202	192	1.0 U	1.0 U	5.20	a	
CPT-21A / 86 ft	26	2	04/28/06 15:38	0.202	194	1.0 U	1.0 U	5.33	a	Duplicate.
CPT-21A / 86 ft	26	2	05/26/06 14:16	0.177	204	1.0 U	1.0 U	5.19	10,800	
CPT-21A / 86 ft	26	2	06/29/06 13:39	-0.127	165	1.0 U	1.0 U	5.13	16,200	
CPT-21A / 86 ft	26	2	07/26/06 11:15	-0.060	179	1.0 U	1.42	5.25	11,300	
CPT-21A / 86 ft	26	2	08/30/06 10:29	-0.209	171	1.0 U	1.01	4.03	14,500	
CPT-21A / 86 ft	26	2	09/26/06 14:10	0.052	194	1.0 U	1.46	5.50	14,400	
CPT-28 / 87 ft	27	2	10/25/05 12:54	0.192	241	1.16	1.0 U	4.65	16,300	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
CPT-28 / 87 ft	27	2	11/28/05 14:20	0.379	219	1.0 U	1.0 U	2.97	7,590	
CPT-28 / 87 ft	27	2	12/20/05 12:42	-0.132	224	1.0 U	1.0 U	2.88	8,040	
CPT-28 / 87 ft	27	2	01/26/06 12:49	0.080	213	1.0 U	1.0 U	3.94	5,580	
CPT-28 / 87 ft	27	2	02/23/06 13:18	0.254	226	1.0 U	1.0 U	4.82	a	
CPT-28 / 87 ft	27	2	03/28/06 14:03	0.212	217	1.0 U	1.0 U	4.80	a	
CPT-28 / 87 ft	27	2	04/28/06 15:45	0.209	217	1.0 U	1.0 U	5.25	a	
CPT-28 / 87 ft	27	2	05/26/06 14:22	0.179	223	1.0 U	1.0 U	4.54	11,400	
CPT-28 / 87 ft	27	2	06/29/06 13:48	-0.130	174	1.0 U	1.0 U	4.61	16,400	
CPT-28 / 87 ft	27	2	07/26/06 11:29	-0.052	180	1.0 U	1.26	4.80	11,900	
CPT-28 / 87 ft	27	2	08/30/06 10:45	-0.212	185	1.0 U	1.12	3.97	15,300	
CPT-28 / 87 ft	27	2	08/30/06 10:45	-0.212	185	1.0 U	4.00	4.07	15,500	Duplicate.
CPT-28 / 87 ft	27	2	09/26/06 14:24	0.065	216	1.0 U	1.06	5.54	14,200	
299-W15-8U / 103 ft	31	2	10/25/05 12:26	0.374	10.4	1.0 U	1.0 U	4.30	13,000	
299-W15-8U / 103 ft	31	2	11/28/05 13:33	0.349	2.58	1.0 U	1.0 U	1.0 U	7,350	
299-W15-8U / 103 ft	31	2	12/20/05 11:59	0.217	5.14	1.0 U	1.0 U	7.21	7,800	
299-W15-8U / 103 ft	31	2	01/26/06 11:57	0.369	3.13	1.0 U	1.0 U	3.22	4,960	
299-W15-8U / 103 ft	31	2	02/23/06 12:44	0.635	4.47	1.0 U	1.0 U	5.31	a	
299-W15-8U / 103 ft	31	2	03/28/06 13:31	0.194	1.25	1.0 U	1.0 U	1.23	a	
299-W15-8U / 103 ft	31	2	04/28/06 14:32	0.042	1.53	1.0 U	1.0 U	1.36	a	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
299-W15-8U / 103 ft	31	2	05/26/06 13:21	0.635	2.75	1.0 U	1.0 U	1.48	10,100	
299-W15-8U / 103 ft	31	2	06/29/06 12:30	-0.371	5.54	1.0 U	1.0 U	14.9	14,800	
299-W15-217 / 114 ft	35	3	10/25/05 12:32	0.112	16.1	1.0 U	1.0 U	2.04	13,800	
299-W15-217 / 114 ft	35	3	11/28/05 13:53	0.247	1.68	1.0 U	1.0 U	1.0 U	7,500	
299-W15-217 / 114 ft	35	3	12/20/05 12:05	0.075	8.40	1.0 U	1.0 U	1.0 U	7,660	
299-W15-217 / 114 ft	35	3	01/26/06 12:23	0.092	11.5	1.0 U	1.0 U	1.0 U	5,360	
299-W15-217 / 114 ft	35	3	02/23/06 12:52	0.125	19.7	1.0 U	1.0 U	1.67	a	
299-W15-217 / 114 ft	35	3	03/28/06 13:41	0.179	12.1	1.0 U	1.0 U	1.72	a	
299-W15-217 / 114 ft	35	3	04/28/06 14:53	0.062	1.00	1.0 U	1.0 U	1.69	a	
299-W15-217 / 114 ft	35	3	05/26/06 13:25	0.122	8.60	1.0 U	1.0 U	1.62	10,600	
299-W15-217 / 114 ft	35	3	06/29/06 12:34	-0.050	1.0 U	1.0 U	1.0 U	1.55	15,100	
CPT-24 / 118 ft	36	3	04/28/06 15:23	0.259	22.9	1.0 U	1.0 U	4.77	a	
CPT-24 / 118 ft	36	3	05/26/06 13:57	0.257	23.9	1.0 U	1.0 U	4.79	11,000	
CPT-24 / 118 ft	36	3	06/29/06 13:14	-0.192	16.0	1.0 U	1.0 U	4.14	16,600	
CPT-24 / 118 ft	36	3	06/29/06 13:14	-0.192	19.4	1.0 U	1.0 U	4.8	16,500	Duplicate.

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
299-W15-220SST / 118 ft	36	3	04/28/06 13:34	-0.022	17.9	1.0 U	1.0 U	2.39	a	
299-W15-220SST / 118 ft	36	3	05/26/06 12:38	0.605	22.0	1.0 U	1.0 U	2.38	9,500	
299-W15-220SST / 118 ft	36	3	06/29/06 11:31	-0.359	21.5	1.0 U	1.0 U	2.22	14,900	
299-W15-95L / 144 ft	44	4	10/25/05 11:14	0.314	15.8	1.0 U	1.0 U	5.43	12,500	
299-W15-95L / 144 ft	44	4	11/28/05 12:26	0.202	16.7	1.0 U	1.0 U	4.85	6,780	
299-W15-95L / 144 ft	44	4	12/20/05 11:17	0.219	19.0	1.0 U	1.0 U	5.04	7,820	
299-W15-95L / 144 ft	44	4	01/26/06 11:29	0.346	19.9	1.0 U	1.0 U	5.10	4,470	
299-W15-95L / 144 ft	44	4	02/23/06 12:18	0.578	22.6	1.0 U	1.0 U	6.47	a	
299-W15-95L / 144 ft	44	4	03/28/06 13:02	0.344	20.6	1.0 U	1.0 U	5.61	a	
299-W15-95L / 144 ft	44	4	04/28/06 13:45	-0.005	17.8	1.0 U	1.0 U	5.45	a	
299-W15-95L / 144 ft	44	4	05/26/06 12:46	0.615	17.8	1.0 U	1.0 U	5.15	9,800	
299-W15-95L / 144 ft	44	4	06/29/06 11:49	-0.379	25.7	1.0 U	1.0 U	5.65	15,600	
299-W15-220 / 163 ft	50	5	04/28/06 13:28	-0.027	2.39	1.0 U	1.0 U	1.32	a	
299-W15-220 / 163 ft	50	5	05/26/06 12:34	0.506	9.29	1.0 U	1.0 U	1.58	9,240	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
299-W15-220 / 163 ft	50	5	06/29/06 11:25	-0.306	7.31	1.0 U	1.0 U	1.65	14,900	
299-W15-219L / 175 ft	53	5	04/28/06 15:13	0.137	4.45	1.0 U	1.22	4.55	a	
299-W15-219L / 175 ft	53	5	05/26/06 13:44	0.396	12.2	1.0 U	1.0 U	3.95	10,700	
299-W15-219L / 175 ft	53	5	06/29/06 13:03	-0.244	11.7	1.0 U	1.0 U	4.12	15,200	
299-W15-9L / 176 ft	54	6	10/25/05 11:21	0.067	3.97	1.0 U	1.0 U	2.07	12,800	
299-W15-9L / 176 ft	54	6	11/28/05 12:34	0.065	1.0 U	1.0 U	1.0 U	1.0 U	6,840	
299-W15-9L / 176 ft	54	6	12/20/05 11:24	0.072	1.0 U	1.0 U	1.0 U	1.0 U	7,710	
299-W15-9L / 176 ft	54	6	01/26/06 11:34	0.080	4.01	1.0 U	1.0 U	1.0 U	4,740	
299-W15-9L / 176 ft	54	6	02/23/06 12:24	0.164	5.37	1.0 U	1.0 U	1.96	a	
299-W15-9L / 176 ft	54	6	03/28/06 13:08	0.493	3.54	1.0 U	1.0 U	1.64	a	
299-W15-9L / 176 ft	54	6	04/28/06 13:51	-0.017	1.48	1.0 U	1.0 U	1.51	a	
299-W15-9L / 176 ft	54	6	05/26/06 12:51	0.212	2.44	1.0 U	1.0 U	1.46	9,840	
299-W15-9L / 176 ft	54	6	06/29/06 11:54	-0.112	1.0 U	1.0 U	1.0 U	1.15	15,100	
299-W15-84L / 180 ft	55	6	04/28/06 14:59	0.080	4.22	1.0 U	1.0 U	2.92	a	
299-W15-84L / 180 ft	55	6	05/26/06 13:30	0.625	14.0	1.0 U	1.0 U	4.21	10,400	

Table D-2. Monitoring Data for Non-Operational Wells and Probes at the 216-Z-9 Site. (13 sheets)

216-Z-9 Site Sample Location	Dept (m bgs)	Zone	Sample Date/Time	Differential Pressure (kPa)	Carbon Tetrachlorid (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Wate (ppmv)	Comment
299-W15-84L / 180 ft	55	6	06/29/06 12:44	-0.376	4.08	1.0 U	1.0 U	2.15	14,900	
299-W15-46 / 217 ft	66	6	10/25/05 12:05	0.005	2.98	1.0 U	1.0 U	1.43	13,700	
299-W15-46 / 217 ft	66	6	11/28/05 13:17	-0.002	1.0 U	1.0 U	1.0 U	1.0 U	7,160	
299-W15-46 / 217 ft	66	6	12/20/05 11:49	0.012	1.0 U	1.0 U	1.0 U	1.0 U	7,730	
299-W15-46 / 217 ft	66	6	01/26/06 12:04	0.214	4.73	1.0 U	1.0 U	1.0 U	4,950	
299-W15-46 / 217 ft	66	6	03/28/06 13:26	0.294	2.07	1.0 U	1.0 U	1.38	a	
299-W15-46 / 217 ft	66	6	04/28/06 14:39	0.010	1.0 U	1.0 U	1.0 U	1.41	a	
299-W15-46 / 217 ft	66	6	05/26/06 13:13	0.162	2.60	1.0 U	1.0 U	1.35	9,970	
299-W15-46 / 217 ft	66	6	06/29/06 12:16	-0.047	1.0 U	1.0 U	1.0 U	1.13	14,700	

[a] Water vapor measured in units of degrees Celsiuss; result was given review qualifier of "R" (rejected) in the Hanford Environmental Information System (HEIS) database.
ppmv = parts per million by volume

Table D-3. Carbon Tetrachloride Concentration Standard Analyses. (2 sheets)

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.37	21	01/26/06	14:19	1715232
25.37	21.6	01/26/06	15:12	1715232
200.00	181	01/26/06	15:18	1715232
25.37	21.7	02/23/06	13:48	1715232
25.37	21.9	02/23/06	14:39	1715232
200.00	182	02/23/06	14:42	1715232
25.37	20.9	03/28/06	14:41	1715232
25.37	21.1	03/28/06	15:33	1715232
200.00	180	03/28/06	15:39	1715232
25.37	20.4	04/28/06	16:41	1715232
25.37	20.3	04/28/06	18:17	1715232
200.00	178	04/28/06	18:21	1715232
25.37	24.5	05/26/06	15:24	1715232
25.37	24.8	05/26/06	16:35	1715232
200.00	186	05/26/06	16:26	1715232
25.37	21.5	06/29/06	16:02	1715232
25.37	22	06/29/06	17:55	1715232
200.00	182	06/29/06	17:10	1715232
25.37	21.7	07/26/06	14:08	1715232
25.37	22.3	07/26/06	16:04	1715232
200.00	188.0	07/26/06	15:31	1715232
25.37	21.5	08/30/06	11:14	1715232
25.37	21.8	08/30/06	16:14	1715232
200.00	184.0	08/30/06	12:05	1715232
25.37	22.6	09/26/06	14:38	1715232
25.37	22.6	09/26/06	16:55	1715232
200.00	193.0	09/26/06	15:38	1715232
25.50	22.3	10/25/05	13:56	1715232
25.50	22.1	10/25/05	14:52	1715232
200.00	194.0	10/25/05	14:59	1715232
25.50	22.3	11/28/05	14:54	1715232

Table D-3. Carbon Tetrachloride Concentration Standard Analyses. (2 sheets)

Carbon Tetrachloride Concentration Standard (ppmv)	Carbon Tetrachloride Concentration Analyzed (ppmv)	Date Analyzed	Time Analyzed	B&K Serial Number
25.50	22.3	11/28/05	15:52	1715232
200.00	191	11/28/05	15:57	1715232
25.5	22	12/20/05	13:25	1715232
25.5	22.5	12/20/05	14:17	1715232
200.0	NR	12/20/05	14:21	1715232

ppmv = parts per million by volume
NR = not recorded

Table D-4. Blank Analyses.

Sample Location	Sample Date	Sample Time	Carbon Tetrachloride (ppmv)	Chloroform (ppmv)	MEK (ppmv)	Methylene Chloride (ppmv)	Water (ppmv)
Blank	10/25/05	13:54	1.0 U	1.0 U	1.0 U	1.0 U	5,680
Blank	10/25/05	14:54	1.0 U	1.0 U	1.0 U	1.0 U	7,880
Blank	11/28/05	14:52	1.0 U	1.0 U	1.0 U	1.0 U	5,150
Blank	11/28/05	15:54	1.0 U	1.0 U	1.0 U	1.0 U	5,390
Blank	12/20/05	13:23	1.0 U	1.0 U	1.0 U	1.0 U	5,280
Blank	12/20/05	14:19	1.0 U	1.0 U	1.0 U	1.0 U	5,470
Blank	01/26/06	14:17	1.0 U	1.0 U	1.0 U	1.0 U	2,280
Blank	01/26/06	15:14	1.0 U	1.0 U	1.0 U	1.0 U	2,130
Blank	02/23/06	13:46	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	02/23/06	14:41	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	03/28/06	14:39	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	03/28/06	15:35	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	04/28/06	16:39	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	04/28/06	18:19	1.0 U	1.0 U	1.0 U	1.0 U	a
Blank	05/26/06	15:19	1.0 U	1.0 U	1.0 U	1.0 U	8,930
Blank	05/26/06	16:37	1.0 U	1.0 U	1.0 U	1.0 U	8,670
Blank	06/29/06	16:00	1.0 U	1.0 U	1.0 U	1.0 U	3,210
Blank	06/29/06	17:57	1.0 U	1.0 U	1.0 U	1.0 U	6,920
Blank	07/26/06	14:04	1.0 U	1.02	1.0 U	1.0 U	10,400
Blank	07/26/06	16:06	1.0 U	1.0 U	1.0 U	1.0 U	12,000
Blank	08/30/06	11:10	1.0 U	1.0 U	1.0 U	1.0 U	1,960
Blank	08/30/06	16:16	1.0 U	1.0 U	1.0 U	1.0 U	7,540
Blank	09/26/06	14:34	1.0 U	1.0 U	1.0 U	1.0 U	2,790
Blank	09/26/06	16:58	1.0 U	1.0 U	1.0 U	1.0 U	7,110

[a] Water vapor measured in units of degrees Celsius; result was given review qualifier of "R" (rejected) in the Hanford Environmental Information System database.

ppmv = parts per million by volume

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