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Revision 0

200-UP-1 and 200-ZP-1 Pump and Treat Semi-Annual Technical Memorandum, Fiscal Year 2008

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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Fluor Hanford, Inc.

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LIST OF TERMS

bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
DWS	drinking water standard
Ecology	Washington State Department of Ecology
ESD	explanation of significant difference
ETF	Effluent Treatment Facility
FH	Fluor Hanford, Inc.
FY	fiscal year
GC/MS	gas chromatography/mass spectrometry
gpm	gallons per minute
HEIS	Hanford Environmental Information System
ID	identification
K_d	distribution coefficient
MCL	maximum contaminant level
NA	not available
NTU	nephelometric turbidity unit
OU	operable unit
PNNL	Pacific Northwest National Laboratory
QC	quality control
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
ROD	Record of Decision
RPD	relative percent difference
TCE	trichloroethene
VOA	volatile organic analysis
WAC	*Washington Administrative Code*
WMA	waste management area

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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	millibecquerels	millibecquerels	0.027	picocuries

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1.0 INTRODUCTION

This semi-annual technical memorandum is a mid-year progress report for fiscal year 2008 (FY08) groundwater remediation activities at the 200-UP-1 and the 200-ZP-1 Operable Units (OUs) in the 200 West Area of the Hanford Site. It addresses the operation of the two groundwater pump-and-treat systems during the period October 1, 2007, to March 31, 2008. The groundwater remediation activities are conducted under the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) for the U.S. Department of Energy, Richland Operations Office (RL). Background information and the operational history of the 200-UP-1 and 200-ZP-1 OU pump-and-treat systems are discussed in detail in *200-UP-1 and 200-ZP-1 Operable Units Pump and Treat System Annual Report for Fiscal Year 2007* (DOE/RL-2008-02). Information pertaining to the local hydrogeology and groundwater of the 200 West Area can be found in *Hanford Site Groundwater Monitoring for Fiscal Year 2007* (DOE/RL-2008-01).

The 200-UP-1 OU pump-and-treat system is intended to remove the primary contaminants of concern (COCs), uranium and technetium-99, from a groundwater contaminant plume in response to the *Record of Decision for the 200-UP-1 Interim Remedial Measure* (EPA et al. 1997). The interim Record of Decision (ROD) required remediation of the highest concentrations of these primary COCs in the "baseline target plumes." It identified the area of highest concentrations of uranium and technetium-99 as corresponding to the area where concentrations were >480 µg/L for uranium and 9,000 pCi/L for technetium-99 (i.e., 10 times the maximum contaminant levels [MCLs] in force at the time that the interim ROD was issued). Nitrate and carbon tetrachloride are recognized as secondary contaminants in the groundwater plume.

The remedial action objectives (RAOs) for the 200-UP-1 OU include the following:

- Reducing contamination in the area of highest concentrations of uranium and technetium-99 to below 10 times the cleanup level established in *Washington Administrative Code* (WAC) 173-340, "Model Toxics Control Act – Cleanup," and below 10 times the MCL for technetium-99
- Reducing potential adverse human health risks through reduction of contaminant mass
- Preventing further movement of these contaminants from the highest concentration area
- Providing information that will lead to development and implementation of a final remedy that will be protective of human health and the environment.

The 200-ZP-1 OU pump-and-treat system removes the primary COC, carbon tetrachloride, from groundwater beneath the 200 West Area. The system is also effective for removing the secondary contaminants trichloroethene (TCE) and chloroform from groundwater. This CERCLA remedial action is conducted to satisfy the *Declaration of the Interim Record of Decision for the 200-ZP-1 Operable Unit* (EPA et al. 1995), which requires remediation of the highest concentrations of carbon tetrachloride in the groundwater baseline target plumes. The 200-ZP-1 interim ROD identifies the area of highest concentration as corresponding to the area enclosed by the 2,000 to 3,000 µg/L carbon tetrachloride plume contour. The MCL for carbon tetrachloride is 5 µg/L.

The RAOs for the 200-ZP-1 OU include the following:

- Reducing contamination in the area of highest concentrations of carbon tetrachloride.
- Preventing further movement of these contaminants from the highest concentration area.
- Providing information that will lead to development of a final remedy that will be protective of human health and the environment.

The 200-ZP-1 OU pump-and-treat system operated during the reporting period under the technical direction of Fluor Hanford, Inc. (FH).

2.0 200-UP-1 OPERABLE UNIT INTRODUCTION

This section addresses the 200-UP-1 OU pump-and-treat system. Section 2.5 presents a summary of sampling activities and observations at wells 299-W23-19 and 299-W22-44, which are located within the OU to the southwest of the 200-UP-1 pump-and-treat extraction wells.

The 200-UP-1 OU pump-and-treat system operated during the reporting period. The 200-UP-1 OU pump-and-treat system was put into service in September 1995 and operated through January 2005 (Figure 2-1). During this period, the uranium and technetium-99 concentrations in the groundwater declined to levels below the RAOs. A rebound study was initiated in January 2005 to evaluate the effectiveness of the pump-and-treat system at remediating the aquifer. Groundwater sampling for the rebound study was completed in January 2006, and the *200-UP-1 Operable Unit Rebound Study Letter Report* (WMP-30847) evaluated options for future activities. The pump-and-treat system remained in hot-standby mode until April 19, 2007, when it was restarted at the direction of the U.S. Department of Energy (see *200 Areas Unit Managers' Meeting Minutes*, April 2007, FH0700949, Attachment 3 [FH 2007]).

At present, the 200-UP-1 pump-and-treat system operates to treat groundwater to meet interim RAOs for uranium and technetium of 480 µg/L (10 times the 48 µg/L *Model Toxics Control Act* standard) and 9,000 pCi/L (10 times the MCL), respectively, as set in 1997.

The results of a second 5-year CERCLA project review (*The Second CERCLA Five-Year Review Report for the Hanford Site* [DOE/RL-2006-20]) recommended that an explanation of significant difference (ESD) be prepared to address several issues within the 200-UP-1 Groundwater OU. The ESD will focus on revising the uranium cleanup levels to address the current 30 µg/L MCL. The ESD will also address the limited pumping capacity at well 299-W23-19, the reduced pumping capacity at the baseline pump-and-treat system, and the technetium-99 concentrations at other locations within the OU. The ESD is being prepared by the Washington State Department of Ecology (Ecology), which is currently collaborating with RL for specific content of the document.

Contaminant levels have remained below the interim ROD RAOs during the first half of FY08, with the exception of one measurement at extraction well 299-W19-36, where technetium-99 was above the RAO at 11,000 pCi/L in October 2007.

2.1 200-UP-1 OPERABLE UNIT SUMMARY

This section summarizes progress for the first half of FY08:

- Uranium levels dropped below 300 µg/L in the extraction wells and remained at that level during the period. Uranium concentrations have remained below 300 µg/L at all baseline monitoring wells, except monitoring well 299-W19-37 where concentrations ranged between 300 and 350 µg/L since August 2006.
- Technetium-99 concentrations have remained below 2,000 pCi/L at all monitoring and extraction wells, except extraction well 299-W19-36, where an increase to 13,000 pCi/L was previously observed in the July 2007 sample, following the April 2007 restart. Technetium-99 declined to 11,000 pCi/L in the October 2007 sample and subsequently to between 7,400 and 8,000 pCi/L for the remainder of the first half of FY08.

- Carbon tetrachloride concentrations were variable, with only extraction well 299-W19-36 exhibiting concentrations above 250 µg/L. Carbon tetrachloride concentrations in this well ranged from 240 to 300 µg/L during the first half of FY08.
- Two wells reported nitrate concentrations above 200 mg/L during the first half of FY08, including extraction wells 299-W19-43 and 299-W19-36. Nitrate concentrations in well 299-W19-36 have increased from 261 to 274 mg/L during the period and declined from 868 to 699 mg/L at well 299-W19-43.
- At the 241-SX Tank Farm, technetium-99 concentrations at well 299-W23-19 ranged between 46,000 and 57,000 pCi/L during the first half of FY08. This is well above the 200-UP-1 RAO of 9,000 pCi/L for this contaminant. Data from wells downgradient of the 241-SX Tank Farm indicate a more widespread >9,000 pCi/L technetium-99 plume, with concentrations up to 19,000 pCi/L in new well 299-W22-47, for instance. This well was intended to bound the southern margin of the contaminant plume, but these analytical results indicate that the plume is larger and is not well defined along its southern margin.
- At the 241-S Tank Farm, above-MCL concentrations of technetium-99 have been reported at wells 299-W22-44 and 299-W22-48. At well 299-W22-44, contaminant concentrations have risen from 1,010 pCi/L in July 2005 to 14,000 pCi/L in March 2008. Conversely, well 299-W22-48 has remained stable (between 1,100 and 1,370 pCi/L) between October 2005 and March 2008. A tank or pipeline leak within the 241-S Tank Farm is the presumed source for this emerging plume.
- Six new far-field monitoring wells were drilled in the 200-UP-1 OU in the first half of FY08 (see Figure 2-2). Three wells (699-33-75, 699-32-76, and 699-33-76) were drilled near the 216-S-10 *Resource Conservation and Recovery Act of 1976* (RCRA) facility. Well 699-33-74 was drilled just downgradient of the 216-S-14 Crib, and well 699-34-72 was drilled to the east of the 222-S Laboratory facility. Well 299-W22-88 was drilled approximately 500 m (1,640 ft) east southeast of the 216-U-12 Crib. All wells were drilled to at least approximately 36.5 m (120 ft) below the water table, and some were drilled to the top of the Ringold Lower Mud Unit. All five wells were screened in the upper portion of the unconfined aquifer. Vertical profile sampling indicated that only well 699-34-74 encountered significant concentrations of a target analyte, encountering technetium-99 concentrations between 701 and 958 pCi/L in March 2008 sampling.

2.2 EXTRACTION WELL DATA AND TREATMENT SYSTEM PERFORMANCE

Operations at the 200-UP-1 groundwater pump-and-treat system ceased with the onset of the rebound study and resumed on April 19, 2007. Through the end of the first half of FY08, nearly 865 million L (229 million gal) of groundwater have been pumped from extraction wells. During the first half of FY08, 8.9 million L (2.4 million gal) of groundwater were pumped from extraction wells 299-W19-36 and 299-W19-43 at a combined average rate of 34 L/min (9 gallons per minute [gpm]). The following table shows the cumulative mass of contaminants removed during the lifetime of the pump-and-treat operation to date, as well as their mean concentrations in the waste stream since initiation of pumping in 1994:

Contaminant	Cumulative Mass Removed	Mean Concentration in Waste Stream
Uranium	216.7 kg	250 µg/L
Technetium-99	0.123 kg	0.14 µg/L
Carbon tetrachloride	35.4 kg	41.µg/L
Nitrate	36,145 kg	48,700 µg/L

Table 2-1 lists the mass of each of the contaminants removed from the aquifer at the pump-and-treat site during each quarter since initiation of pumping in 1994, as well as the volume of water treated each quarter. Figures 2-3, 2-4, and 2-5 compare the volume of water treated versus the mass of contaminants extracted for uranium, technetium-99, carbon tetrachloride, and nitrate, respectively.

2.3 WATER-LEVEL MONITORING

Between June 1995 and September 2007, the direction of groundwater flow in the 200-UP-1 OU changed from southeast to eastward. During that period, the hydraulic gradient also changed, decreasing from approximately 0.0018 m/m to the current gradient of 0.0009 m/m, as calculated in the FY07 200-UP-1 annual report (DOE/RL-2008-02). The average water table elevation in the vicinity of the pump-and-treat system has decreased by approximately 5.0 m (16.4 ft) since 1995. These changes reflect the gradual dissipation of groundwater mounds produced by historic wastewater discharge from Hanford operations.

Figure 2-6 provides hydrographs for monitoring wells 299-W19-35 and 299-W19-48 for the period from October 1, 2007, to March 31, 2008. Well 299-W19-48 is located near the 200-UP-1 extraction wells, while well 299-W19-35 is more distal. The hydrographs reflect the current rate of the continuing regional water-level decline (0.299 and 0.292 m/yr [0.98 and 0.96 ft/yr], respectively). Table 2-2 provides an indication of how soon the monitoring wells around the 200-UP-1 pump-and-treat system are expected to go dry. Well 299-W19-40 is currently dry (i.e., the bottom of the screen is above the water table). Well 299-W19-37 is expected to be sample dry within 2 years. The only other well that will run dry in the relatively near future is 299-W19-35, where the bottom of the screen will be above the water table in 7 to 10 years if the present rate of decline of the water table continues. Due to their key locations, both wells should be replaced. Well 299-W19-37's replacement should also be considered as a possible extraction well and located slightly north of the current location if the uranium plume does not clear up with continued pumping.

The results of numerical modeling to calculate water heads and capture zones for 200-UP-1 wells is presented in the FY07 annual report (DOE/RL-2008-02). This modeling indicates that the 200-UP-1 extraction wells were effectively capturing contaminants in the central portion of the OU during the period from April to September 2007.

2.4 CONTAMINANT TRENDS

Monitoring of groundwater contaminants has continued in the first 6 months of FY08 at 9 of the 12 wells used during the rebound study. Of these, five wells were sampled once during the period, two wells were sampled twice, and three wells were sampled three times. Three wells were not sampled, including one well that is out of service (299-W19-39), one well that has gone

dry (299-W19-40), and one well that is sampled annually in August (299-W19-34A). The next full round of sampling is scheduled for August 2008.

Trends observed from the rebound study continued with little change at most wells in the FY08 semi-annual sampling. Key wells and analytes are discussed below:

- Uranium concentrations at extraction well 299-W19-36 remained below the interim RAO of 480 µg/L following a previous (April 2007) analysis was 613 µg/L. Uranium concentrations at all baseline wells (except 299-W19-37) sampled during the first half of FY08 appear to have stabilized at levels below the interim RAO (Figure 2-7). Well 299-W19-37 continued to trend above 300 µg/L for the reporting period.

- One extraction well (299-W19-36) had technetium-99 concentrations near or above the RAO of 9,000 pCi/L during the period. This well had a technetium-99 concentration of 11,000 pCi/L in October 2007. Concentrations exceeded 7,000 pCi/L during January and February 2008. Well 299-W19-43 declined from 2,100 to 1,500 pCi/L in the period, and all other wells were below the 900 pCi/L MCL.

  Extraction well 299-W19-36 has displayed an unpredictable response following startup and shutdown cycles of the pump, which is attributed to starting and stopping of pumping. Spikes in technetium-99 concentrations have been observed following either shutdown or startup of pumping (Figure 2-8). This is attributed to drainage collecting at the top of the aquifer.

- Carbon tetrachloride concentrations were below 300 µg/L for all eight wells that were sampled during the period (Figure 2-9). The highest concentrations of carbon tetrachloride was 300 µg/L in extraction well 299-W19-36 in October 2007. In general, carbon tetrachloride concentrations tend to fluctuate within fairly narrow ranges, with the greatest degree of fluctuation in wells 299-W19-36, 299-W19-48, and 299-W19-101. One well (299-W19-49) has trended upward from 37 to 71 µg/L between February 2007 and March 2008.

- Samples from nine wells were analyzed for nitrate during the first half of FY08 (Figure 2-10). Six wells showed all concentrations in excess of the MCL of 45 mg/L, one well showed one concentration just above the MCL and one just below the MCL, and two wells showed all concentrations below the MCL. The highest concentrations were seen in extraction well 299-W19-43, where concentrations remained above 700 mg/L, even though the overall trend of nitrate concentration in this well is steeply downward. Other wells with relatively elevated nitrate concentrations during the period include extraction well 299-W19-43 with an October 2007 concentration of 281 mg/L, and monitoring well 299-W19-37 with a March 2008 concentration of 197 mg/L.

Plume maps prepared for the FY07 annual report (DOE/RL-2008-02) are presented in Figure 2-11 and were not revised for this technical memorandum. Figure 2-11 shows the uranium groundwater plume and the modeled groundwater table for the fall of 2007. Figure 2-12 in DOE/RL-2008-02 shows the decline of the uranium plume on an annual basis from fall 1995 to fall 2007. These figures clearly show that the plume has decreased in area and concentration since initiation of the pump-and-treat operation in 1995. The plume shape and concentrations for the fall of 2006 (when the pump-and-treat was not running) are almost identical to those shown for the fall of 2007 (when the pump-and-treat was in operation), most likely related to the low pumping rate (34 L/min [9 gpm]).

Figure 2-12 shows the technetium-99 plume and the modeled groundwater table for the fall of 2007. Figure 2-13 in DOE/RL-2008-02 shows the shrinking of the technetium-99 plume since startup of the pump-and-treat system.

Potential sources for contaminants found in the 200-UP-1 OU include the 216-U-1 and 216-U-2 Cribs and the pipeline to the 216-U-8 and 216-U-12 Cribs. Other sources may include the 270-W neutralization tank and the 224-U Facility.

2.5 TECHNETIUM-99 MONITORING AND REMOVAL AT WELLS 299-W23-19 AND 299-W22-44

Well 299-W23-19 is located near the southwestern corner of the 241-SX Tank Farm, within Waste Management Area (WMA) S/SX. Figure 2-13 shows the location of the wells, the tank farm, and the groundwater plumes containing technetium-99. Quarterly sampling at well 299-W23-19 began in March 2000 following detection of high concentrations of technetium-99 in the groundwater. Starting in March 2003, each sampling event was accompanied by extended purging of at least 3,800 L (1,000 gal) of the technetium-99-contaminated groundwater, followed by treatment or storage. A possible source of technetium-99 is from leaking SX tanks.

Technetium-99 trends at well 299-W23-19 have exhibited two spike-and-decline episodes over the past 5 years. Figure 2-14 illustrates the technetium-99 trend through March 2008. In January 2003 and September 2005, technetium-99 concentrations peaked at 188,000 and 137,000 pCi/L, respectively, but subsequently declined to 40,000 to 46,000 pCi/L within 6 to 12 months, then remained stable for another 6 to 12 months. The technetium-99 concentrations were relatively low during the first half of FY08, although a modest upward trend is present. If the periodicity between the first two spikes is any indication, the technetium-99 concentration in the well may spike again in August or September 2008. As presented in the table below, through March 2008, an estimated total of 97,800 L (25,836 gal) has been purged from the well. This volume represents removal of 0.00579 Ci, or 0.340 g, of technetium-99.

Well 299-W23-19 Date of Sampling	Groundwater Pumped, L (gal)	Tc-99 Concentration (pCi/L)	Tc-99 (Ci)[a]	Tc-99 Mass (g)
03/12/03	2,722 (719)	133,000	0.00036	0.021
06/18/03	4,028 (1,064)	120,000	0.00048	0.028
09/23/03	4,013 (1,060)	74,300	0.00030	0.018
12/16/03	3,944 (1,042)	42,950	0.00017	0.010
03/22/04	4,845 (1,280)	42,200	0.00020	0.012
06/16/04	3,986 (1,053)	41,800	0.00017	0.010
08/29/04	4,111 (1,086)	46,100	0.00019	0.011
12/20/04	3,850 (1,017)	62,300	0.00024	0.014
03/09/05	3,789 (1,001)	69,400	0.00026	0.015
06/20/05	3,785 (1,000)	128,000	0.00048	0.028
09/27/05	3,785 (1,000)	137,000	0.00052	0.030
12/21/05	5,223 (1,380)	89,900	0.00047	0.028
03/29/06	6,284 (1,660)	47,100	0.00030	0.017

Well 299-W23-19 Date of Sampling	Groundwater Pumped, L (gal)	Tc-99 Concentration (pCi/L)	Tc-99 (Ci)[a]	Tc-99 Mass (g)
06/21/06	4,739 (1,252)	42,900	0.00020	0.012
09/28/06	5,450 (1,440)	43,200	0.00024	0.014
01/19/07	4,936 (1,304)	46,300	0.00023	0.013
03/30/07	5,451 (1,440)	40,800	0.00022	0.013
06/25/07	5,224 (1,380)	35,100	0.00018	0.011
10/01/07	4,315 (1,140)	46,000	0.00020	0.012
01/29/08	4,386 (1,148)	57,000	0.00025	0.015
03/17/08	5,441 (1,140)	52,000	0.00028	0.017
Totals	**97,800 (25,836)**	--	**0.00579**	**0.340**

[a] Specific activity of technetium-99 is 0.017 Ci/g, or 58.7 g/Ci.

Recent trends in technetium-99 activity for wells downgradient from 299-W23-19 suggest a broader technetium-99 plume. The trends at three wells were examined for sampling events from April 2005 through March 2008 (i.e., a 3-year period). Well 299-W22-50, located 150 m (492 ft) to the east, decreased from 9,400 pCi/L in June 2005 to 6,400 pCi/L in March 2008. At well 299-W22-83, located 270 m (approximately 890 ft) to the east-southeast, technetium-99 concentrations increased from 12,400 pCi/L in June 2005 to 18,000 pCi/L in January 2008. A recently installed well, 299-W22-47, located 180 m (590 ft) southeast of well 299-W23-19, increased slightly from 18,000 pCi/L in April 2005 to 19,000 pCi/L in January 2008. Technetium-99 at well 299-W22-86, located downgradient of the leading edge of the RAO plume contour, has also steadily increased. Following well construction, the technetium-99 concentration has risen from 1,950 pCi/L in June 2006 to 5,400 pCi/L in March 2008. Based on this data, a technetium-99 plume is depicted extending downgradient from well 299-W23-19 and encompassing these three wells (Figure 2-13). Results from well 299-W22-47 indicate that the plume is larger than anticipated, as this well was intended to bound the southern margin of the technetium-99 plume. The source is attributed to leaks from tank 15 in the 241-SX Tank Farm; however, leaks from 241-SX tank 6 or tank 7 may also be sources.

Wells 299-W22-80 and 299-W23-15 are located within 50 to 90 m (164 to 295 ft) of well 299-W23-19 but yielded concentrations of technetium-99 near or below detection levels during the period. Upwelling of less-contaminated groundwater is reported at these wells and may be responsible for the current low concentrations (DOE/RL-2008-01). However, during drilling at well 299-W22-47, technetium-99 concentrations exceeded the RAO for a 20.5-m (67.3-ft) interval immediately below the groundwater table. These wells and 299-W23-19 are all screened across similar intervals within the upper unconfined aquifer.

Above-MCL concentrations of technetium-99 have been reported at wells 299-W22-44 (Figure 2-13) and 299-W22-48, located approximately 375 m (1,230 ft) northeast of well 299-W23-19. At well 299-W22-44, the concentration has risen from 1,010 pCi/L in July 2005 to 14,000 pCi/L in March 2008, exceeding the RAO in September 2007. Conversely, well 299-W22-48 has ranged between 1,100 and 1,370 pCi/L between October 2005 and March 2008. The presumed source for this contamination is a tank leaking within the 241-S Tank Farm.

2.6 CONCLUSIONS

Throughout the period covered by this report, activity continued with the 200-UP-1 OU pump-and-treat system. In terms of the four RAOs, the following accomplishments are recognized:

- ***RAO #1: Reduce contamination in the area of highest concentrations of uranium and technetium-99 to below 10 times the cleanup level established in the "Model Toxics Control Act – Cleanup" (WAC 173-340) and 10 times the MCL for technetium-99.***

  Results: The objective of reducing contaminant concentrations below the RAOs for technetium-99 (9,000 pCi/L) and for uranium (480 µg/L) was met before initiation of the rebound study and continued through restart of the pump-and treat system in April 2007 and through the first half of FY08. Routine groundwater monitoring during the reporting period confirmed that the groundwater concentrations for these contaminants continued to be below the RAOs at nearly all wells. At extraction well 299-W19-36, while technetium-99 levels remain near the RAO, concentrations declined somewhat during the period.

- ***RAO #2: Reduce potential adverse human health risks through reduction of contaminant mass.***

  Results: Contaminant mass continued to be reduced as the pump-and-treat was operated during the period. Contaminant masses removed during the first half of FY08 include 4.4 g of technetium-99, 3,810 g of uranium, 480 g of carbon tetrachloride, and 673 kg of nitrate.

- ***RAO#3: Prevent further movement of these contaminants from the highest concentration area.***

  Results: Hydraulic containment of the contaminant plumes has not been lost since initiation of the rebound study and subsequent restart of the pump-and-treat system. Groundwater monitoring data indicates that uranium and technetium-99 concentrations diminish with distance from the extraction wells and the 216-U-1/U-2 Cribs. Continued groundwater monitoring will track changes in the plume and allow for reactions to unexpected increases.

- ***RAO#4: Provide information that will lead to development and implementation of a final remedy that will be protective of human health and the environment.***

  Results: Additional knowledge of the groundwater contamination continued to be gathered from the analysis of the rebound study data and from the drilling of the new groundwater wells. Regular groundwater sampling identified an area of potential concern from the technetium-99 and uranium peaks at well 299-W19-36.

2.7 RECOMMENDATIONS

Based on observations and developments during the reporting period, the following recommendation is proposed for the 200-UP-1 pump-and-treat operation:

- The behavior of uranium and technetium-99 in the groundwater relative to the waste sites is still poorly understood. A better understanding of the correlation of the 216-U-1/U-2 Cribs and the 200-W-42 pipeline and related features to groundwater trends would be

beneficial in anticipating and understanding changes in groundwater concentrations and would be useful in waste site remediation.

- Well 299-W19-37 will become sample dry in the near future and should quickly be replaced. This well is the only well that has trended above the proposed 300 μg/L RAO for the 200-UP-1 pump-and-treat system. In addition, it has consistently encountered some of the highest nitrate concentrations in the baseline plume area. Its replacement will provide another point to monitor the core part of the uranium and technetium-99 plumes. If installed, a replacement well could be added to the extraction well system in the vicinity of well 299-W19-36 and could hasten cleanup of the uranium plume.
- The 200-UP-1 OU pump-and-treat system has met the presumptive 300 μg/L interim RAO for uranium that becomes effective when the ESD is approved. After ESD approval, it is recommended that when the system has operated for one year at <300 μg/L uranium concentrations, the system should then be shut down for a one-year rebound test with monthly sampling. If the rebound test demonstrates that uranium concentrations do not increase above the 300 μg/L RAO for any continuous 3-month period, then the extraction system should remain shut down and quarterly sampling instituted to track contaminant trends. If, at any point after the rebound study, uranium concentrations exceed 300 μg/L for two consecutive quarters, the system should be restarted.
- A pump-and-treat system should be developed for the growing technetium-99 plumes associated with the 241-S/SX Tank Farms around wells 299-W23-19 and 299-W22-44. Several options are available:
    1. The *Proposed Plan for Remediation of the 200-ZP-1 Groundwater Operable Unit* (DOE/RL-2007-33) includes a large-scale pump-and-treat system that may be extended south into the 200-UP-1 OU. If this system is built, consideration should be given to tying in extraction wells in the two plumes to the treatment facility. Injection wells for the treated water may be needed to control plume movement toward the extraction well field. Wells located east of the 200 West Area fence line are considered as alternate but less desirable alternative due to the dilution of the contaminants.
    2. If the above system is not extended into the 200-UP-1 OU, then a stand-alone pump-and-treat system should be constructed to address the technetium plume. Previous testing of Purolite® resin at wells 299-W15-44 and 299-W15-765 successfully demonstrated technetium-99 removal from the groundwater. Alternately, other options may exist. Treatment system size should be based on the to-be-determined plume size. Injection wells can be used to help control the plumes' movements.

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Figure 2-1. 200-UP-1 Operable Unit Pump-and-Treat Site Showing Extraction and Monitoring Well Locations.

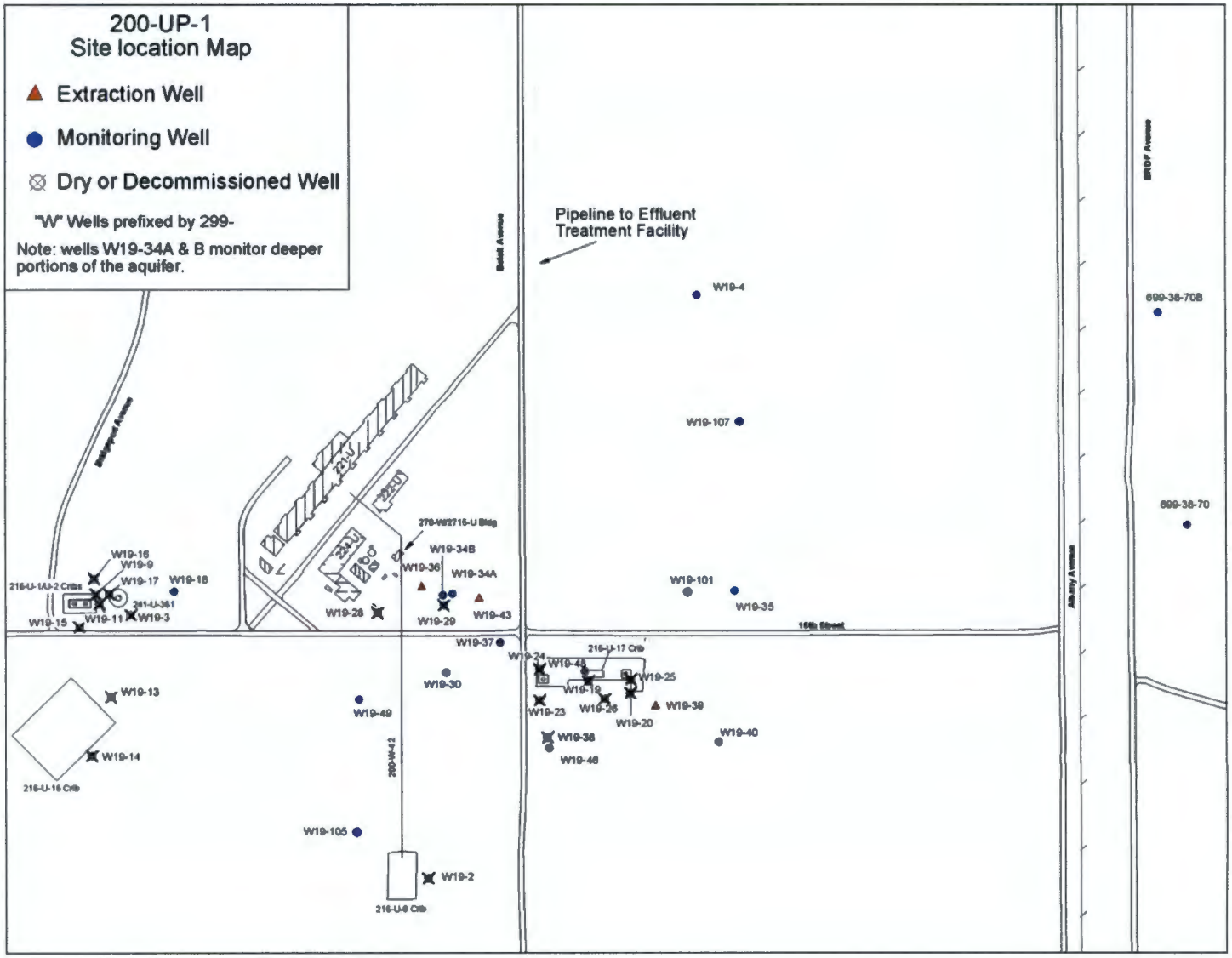


Figure 2-2. Monitoring Wells Installed at the 200-UP-1 Operable Unit in Fiscal Years 2007 and 2008.

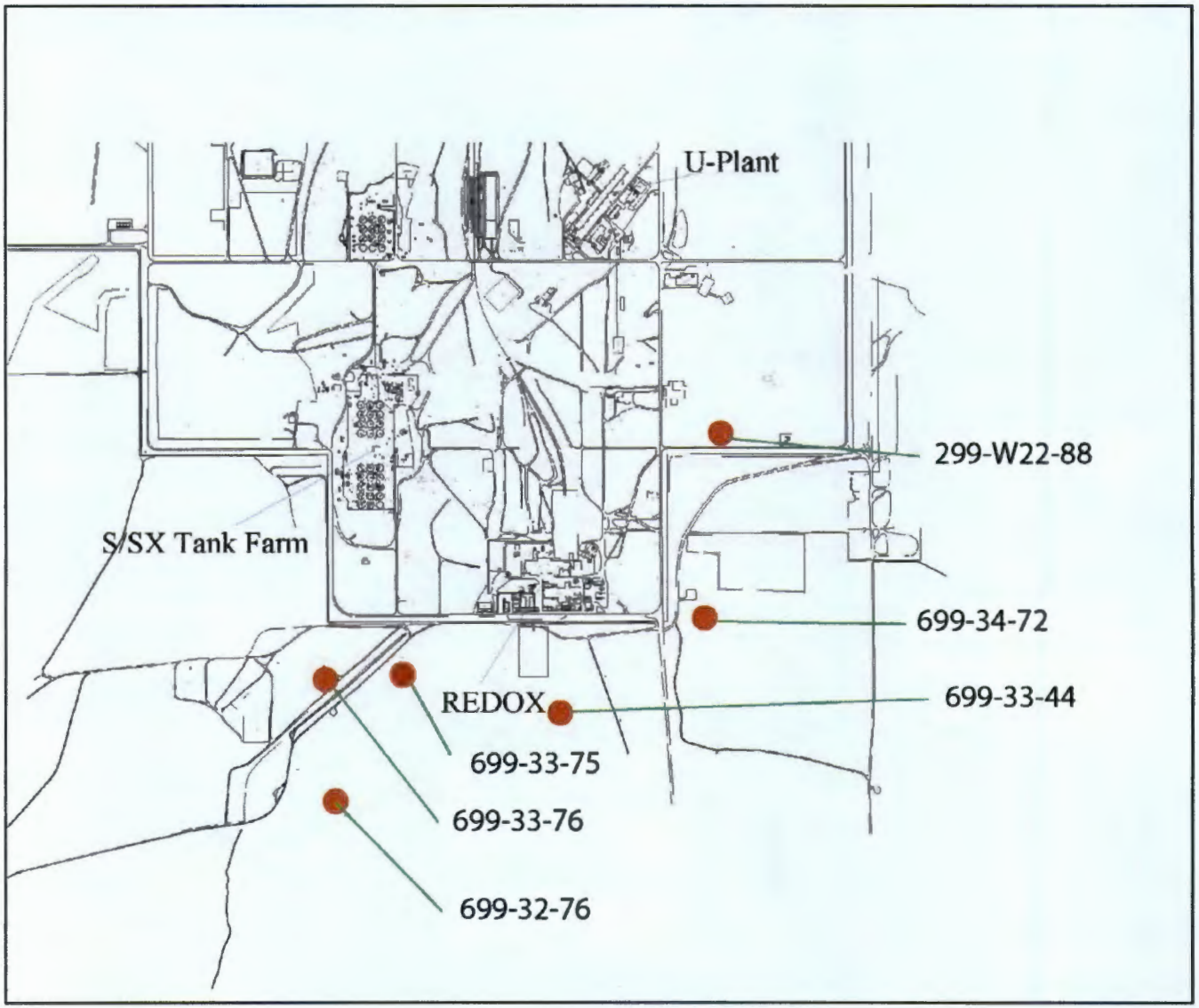


Figure 2-3. 200-UP-1 Operable Unit Cumulative Groundwater Treated Versus Uranium Extracted.

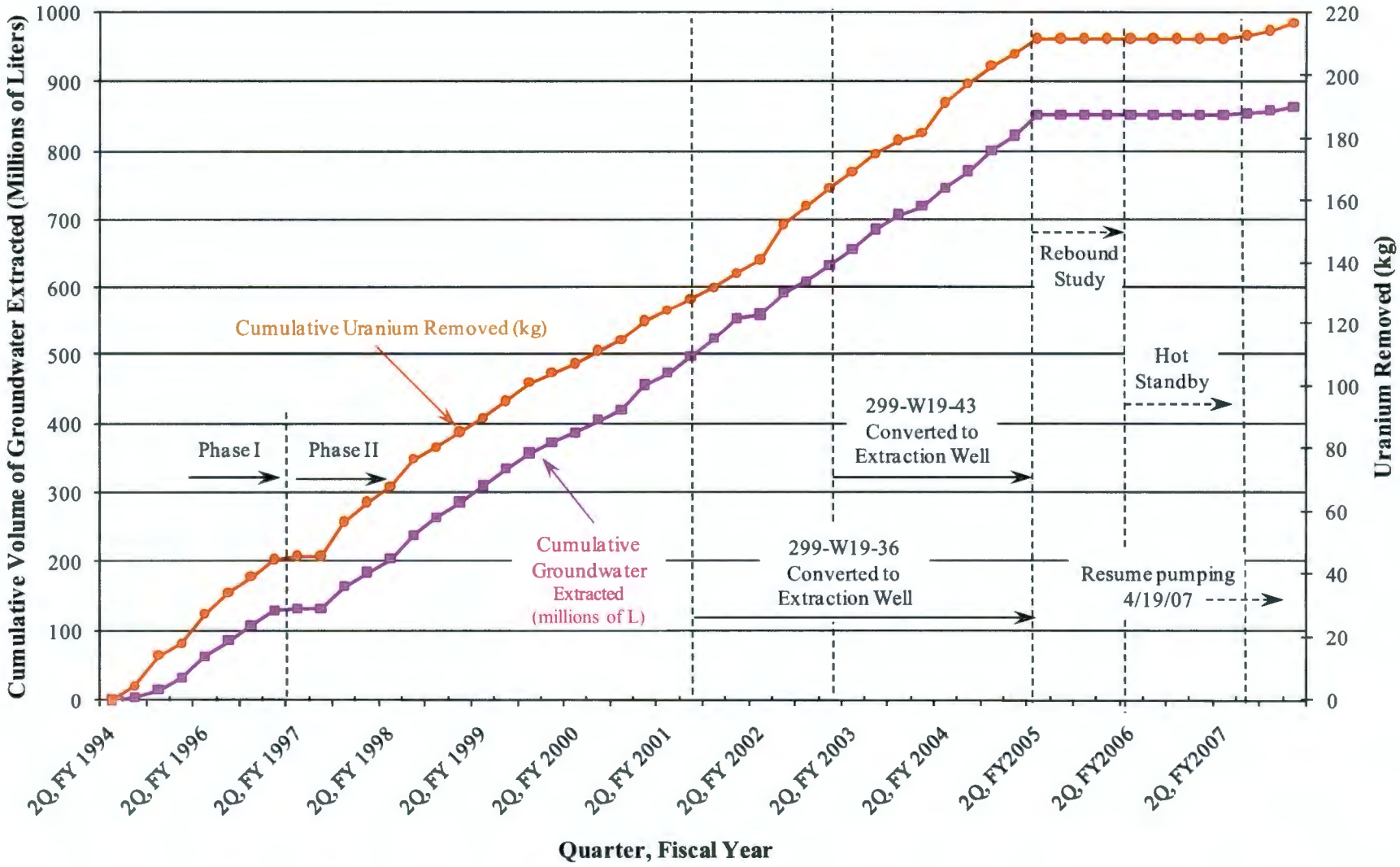


Figure 2-4. 200-UP-1 Operable Unit Cumulative Groundwater Treated Versus Technetium-99 Extracted.

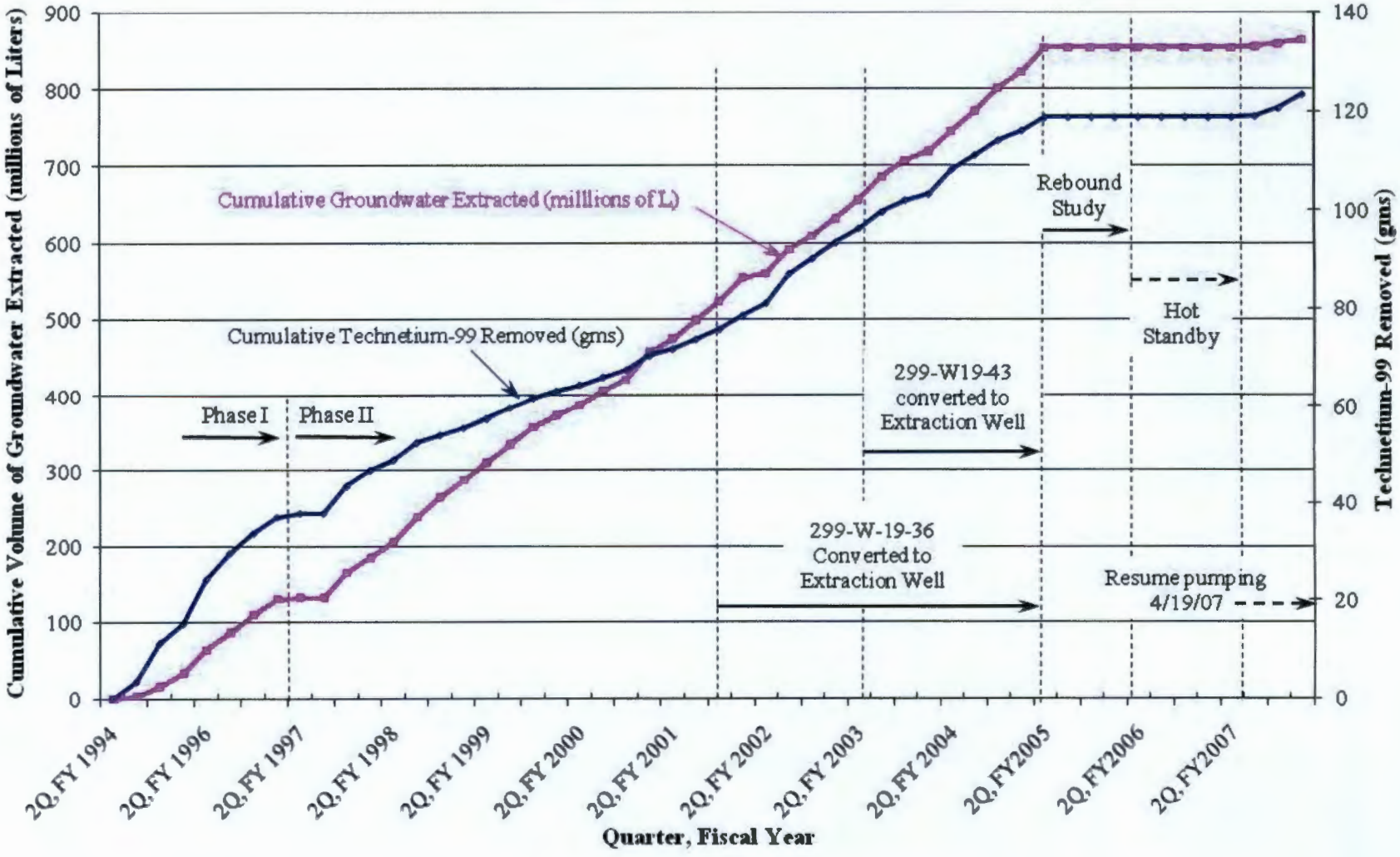


Figure 2-5. 200-UP-1 Operable Unit Cumulative Groundwater Treated Versus Carbon Tetrachloride and Nitrate Extracted.

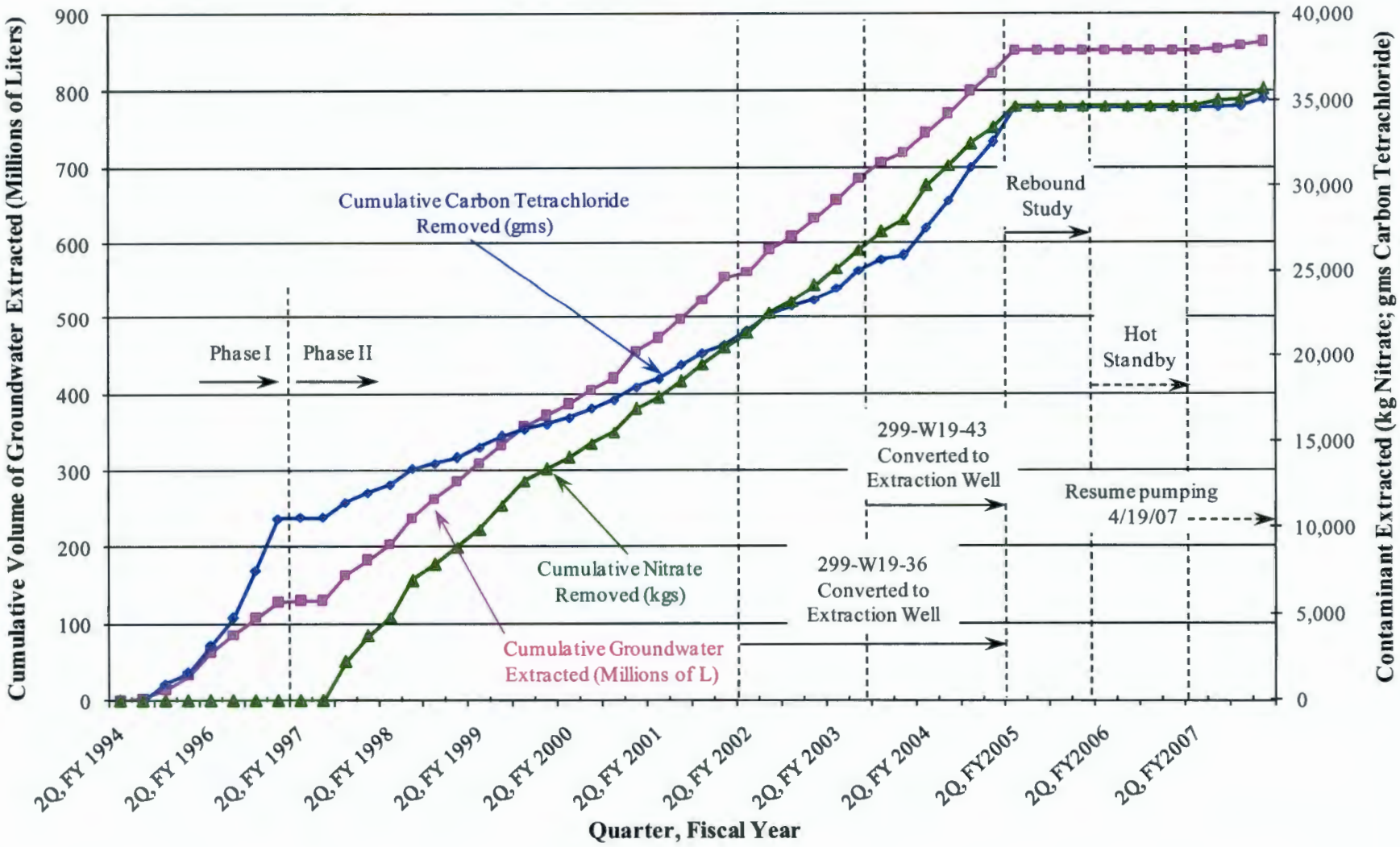


Figure 2-6. Hydrographs for Wells 299-W19-35 and 299-W19-48.

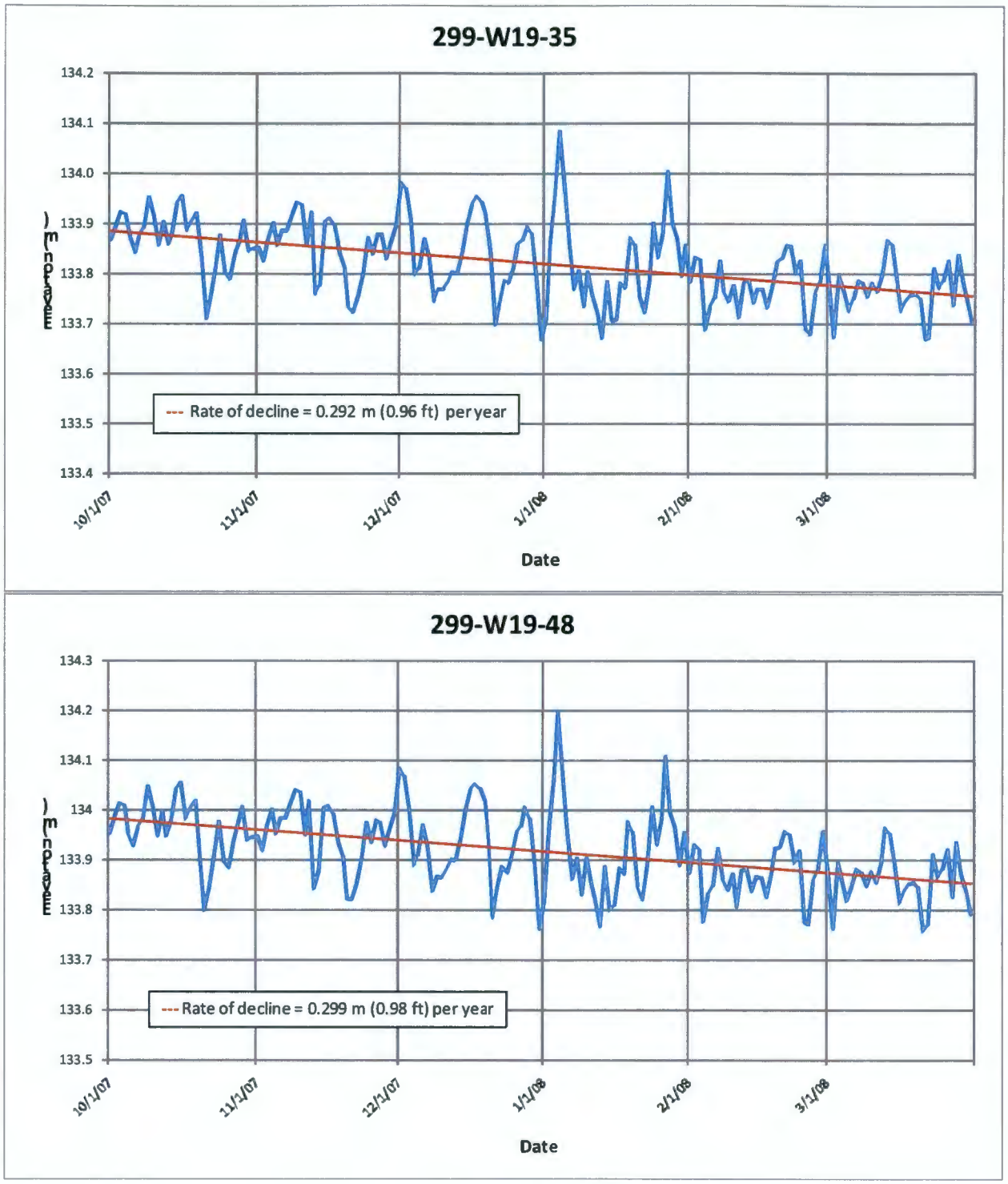


Figure 2-7. 200-UP-1 Operable Unit Uranium Concentrations through March 31, 2008.

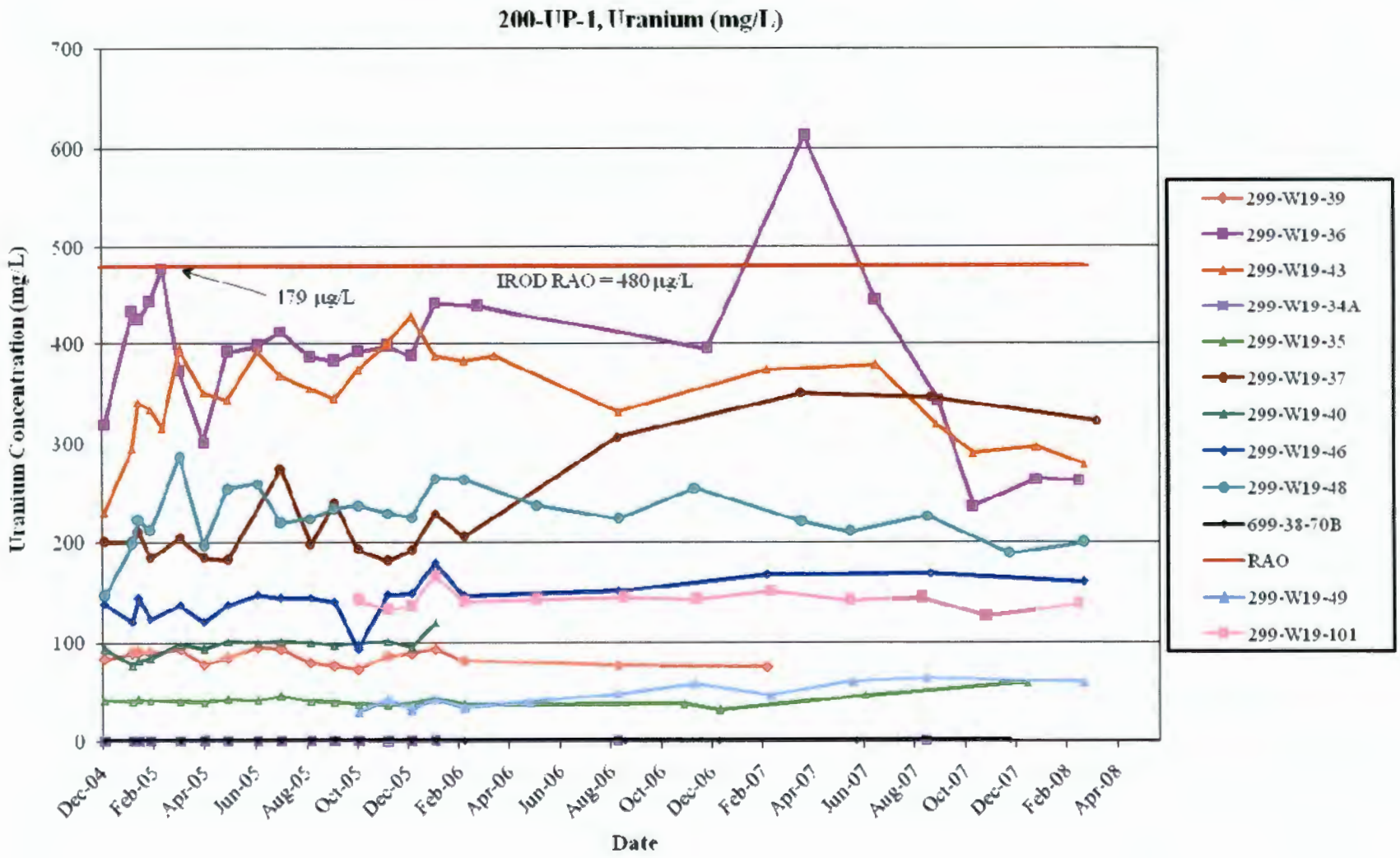


Figure 2-8. 200-UP-1 Operable Unit Technetium-99 Concentrations through March 31, 2008.

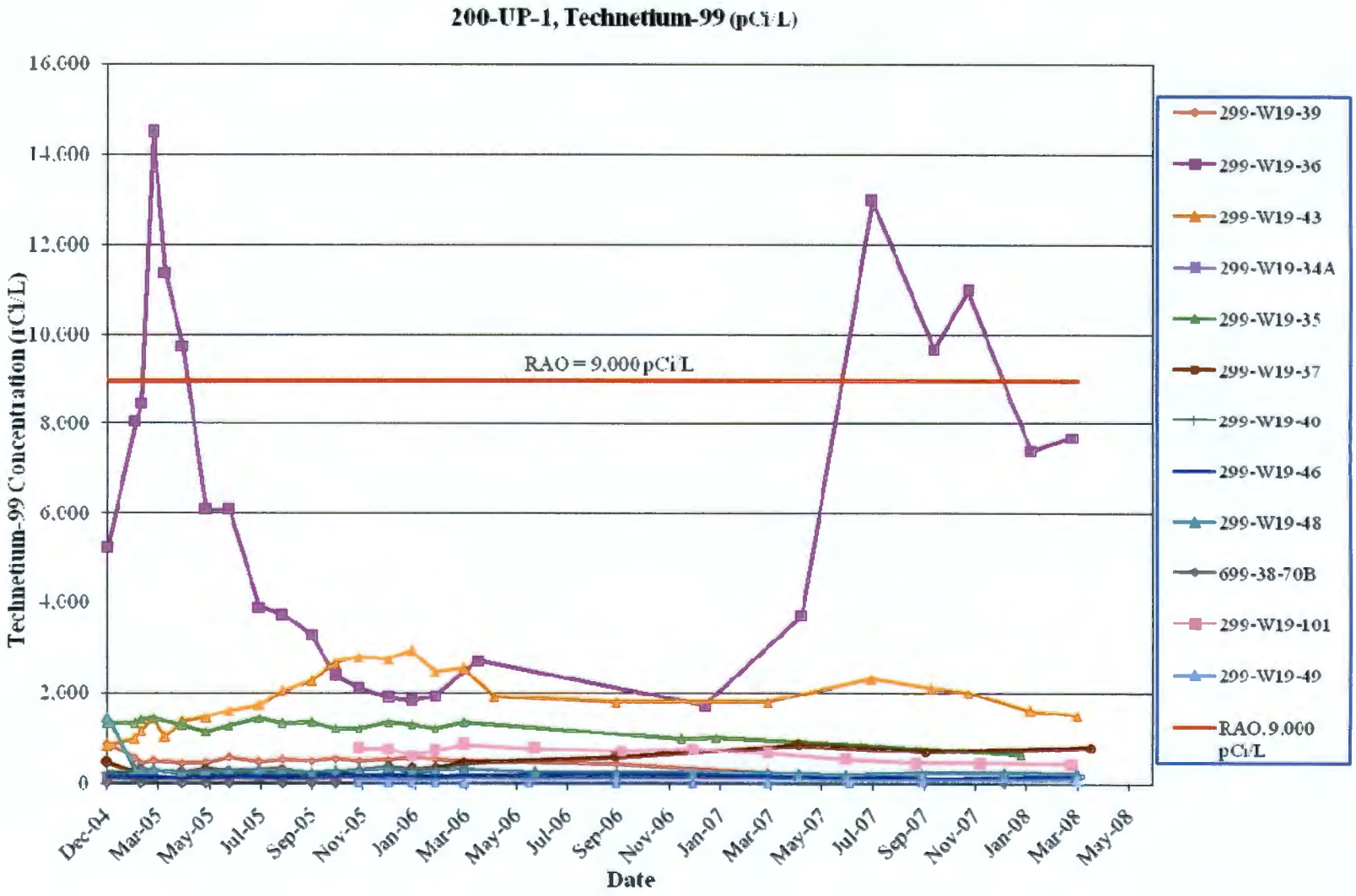


Figure 2-9. 200-UP-1 Operable Unit Carbon Tetrachloride Concentrations through March 31, 2008.

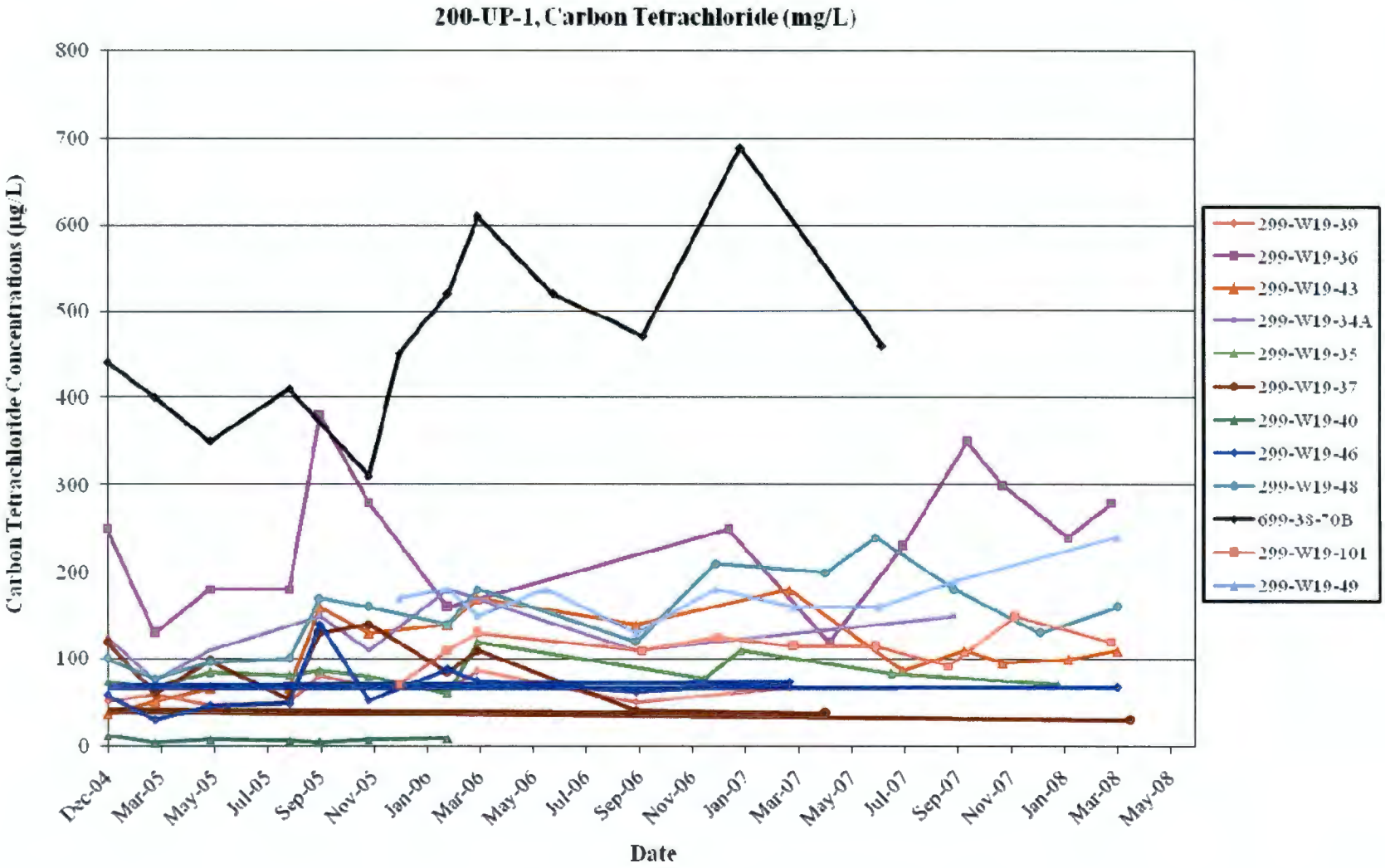


Figure 2-10. 200-UP-1 Operable Unit Nitrate Concentrations through March 31, 2008.

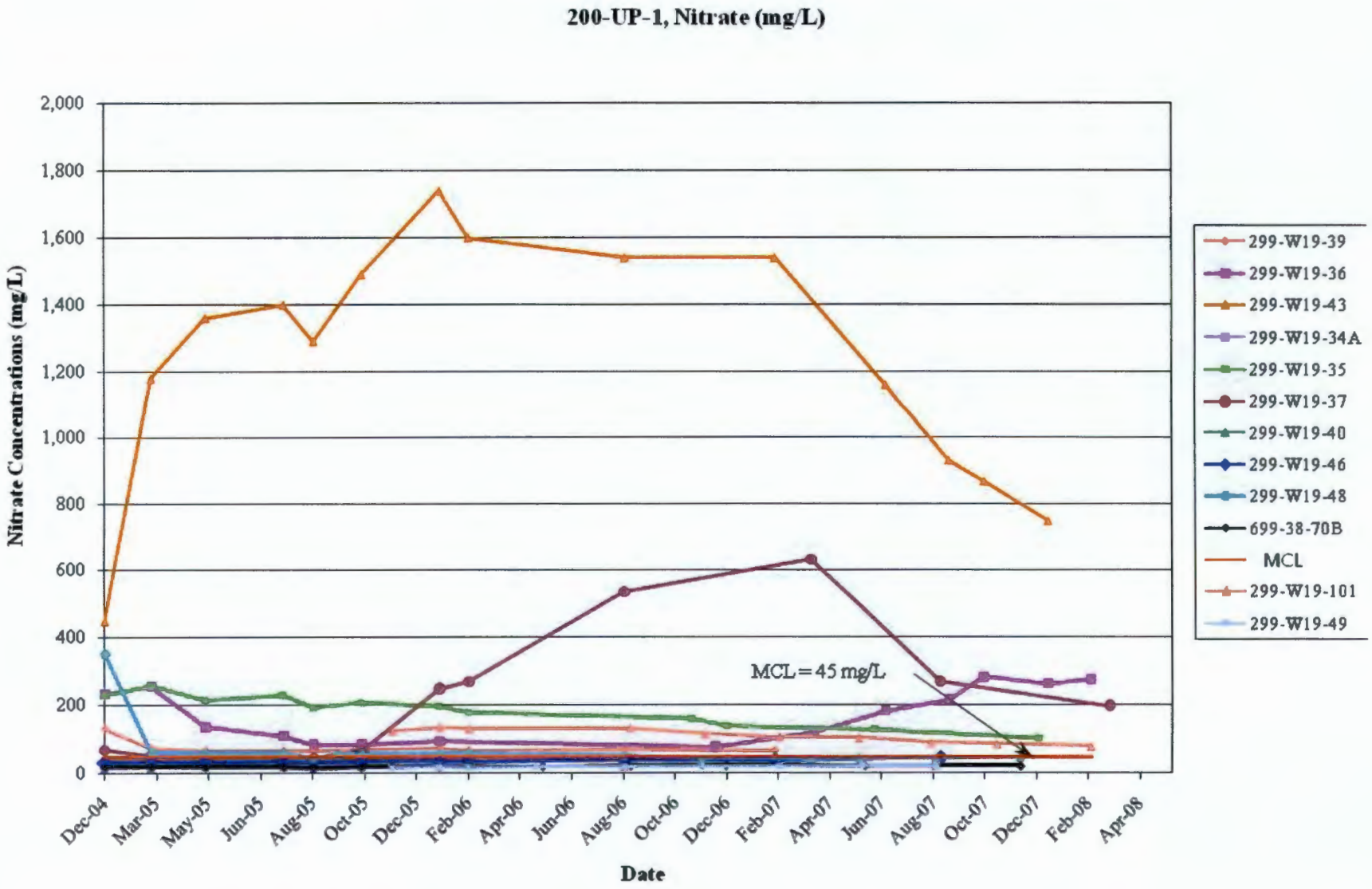


Figure 2-11. 200-UP-1 Operable Unit Uranium Contaminant Plume.

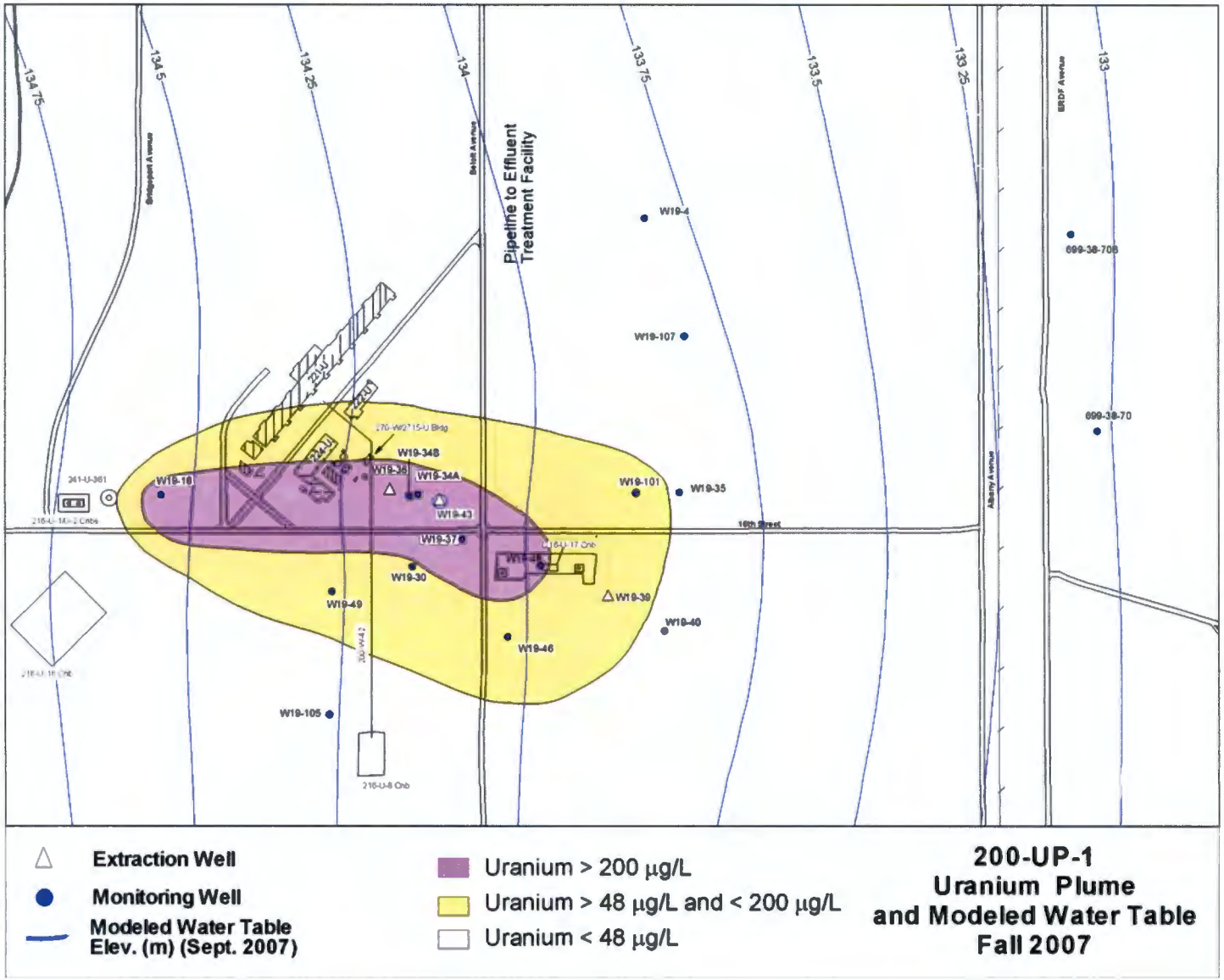


Figure 2-12. 200-UP-1 Operable Unit Technetium-99 Contaminant Plume.

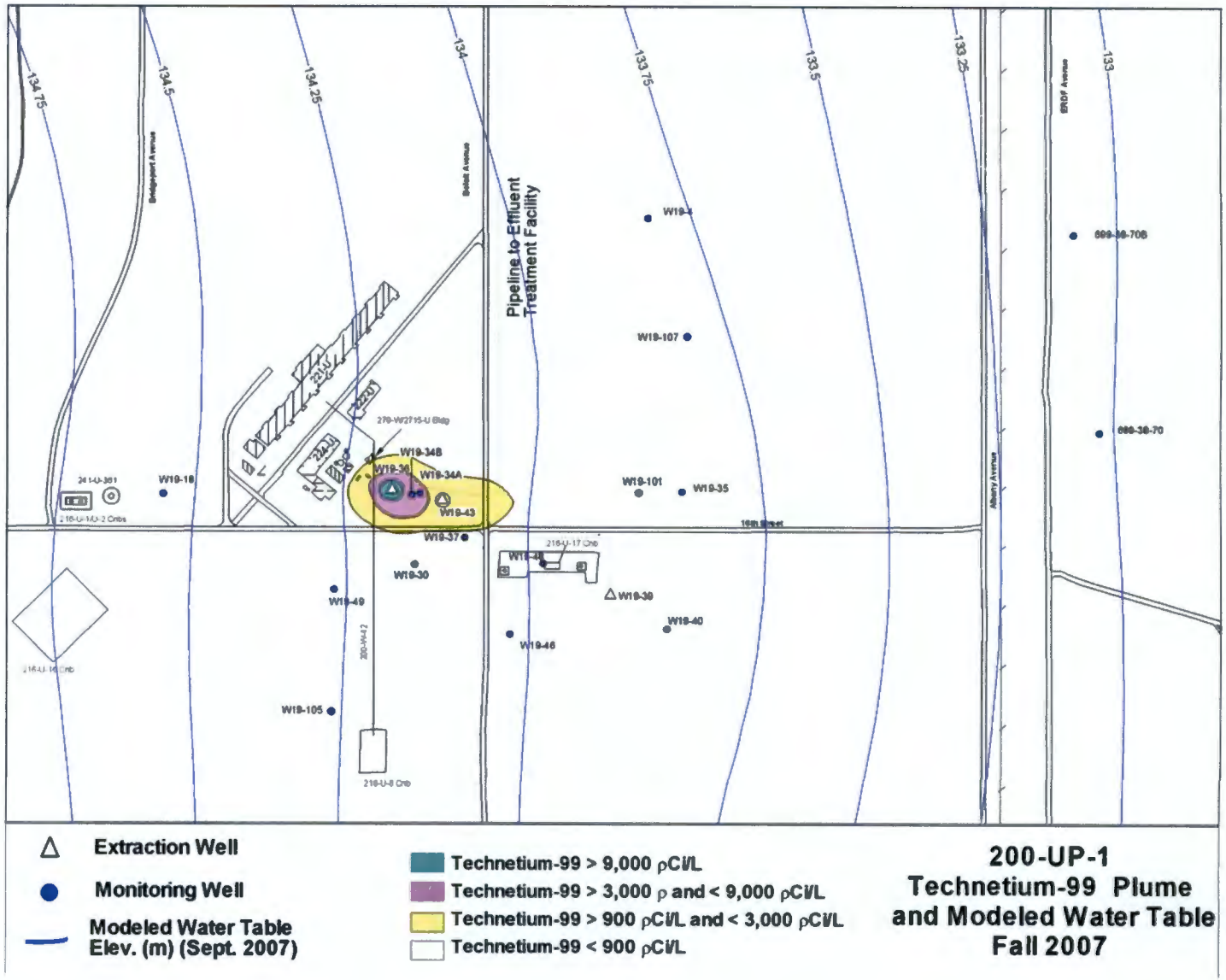
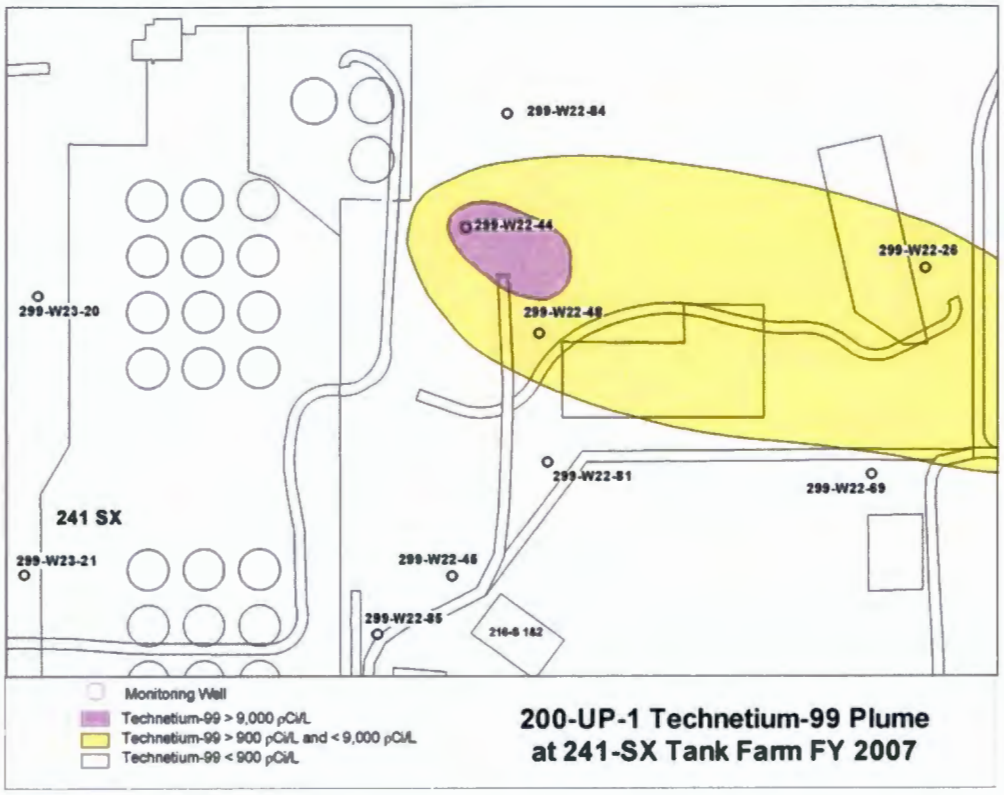


Figure 2-13. 200-UP-1 Operable Unit, Technetium-99 Plume at Wells 299-W23-19 and 299-W22-44.



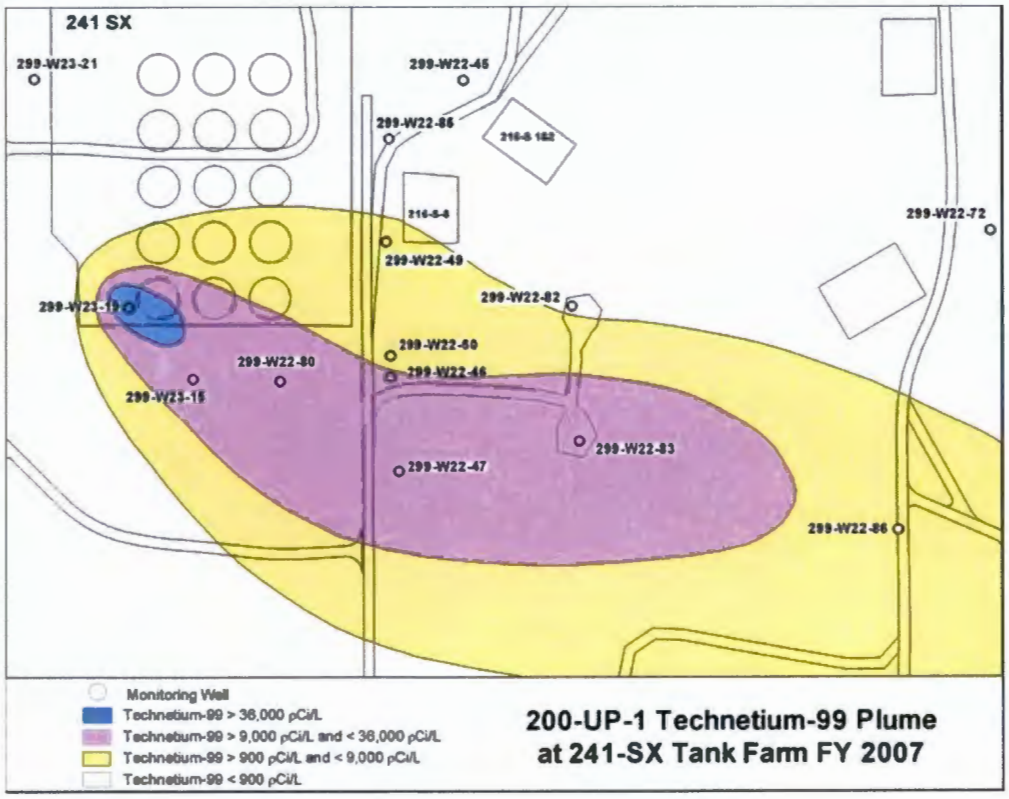


Figure 2-14. 200-UP-1 Operable Unit, Technetium-99 Trend Plot at Well 299-W23-19.

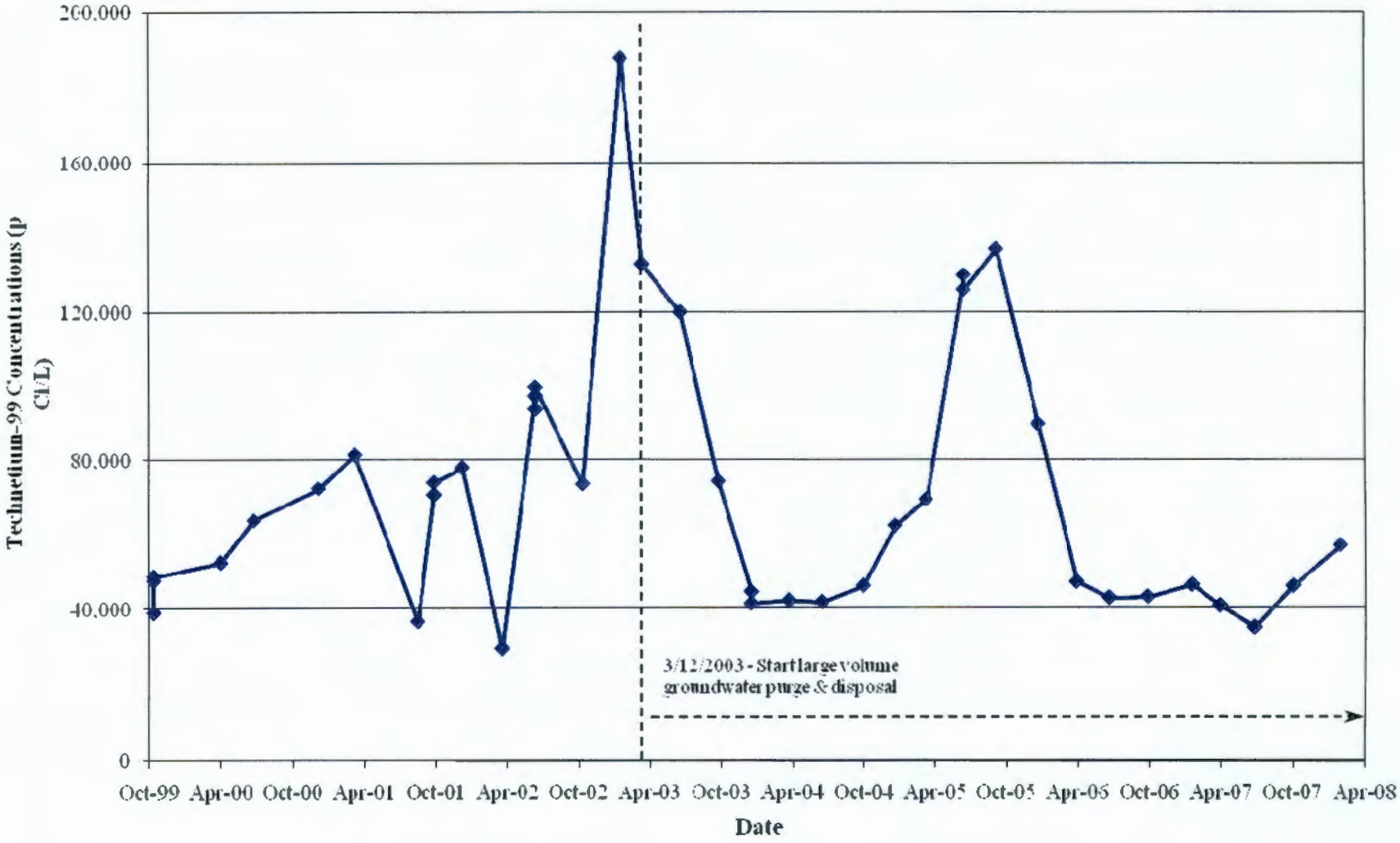


Table 2-1. Quarterly Treatment Volume and Quarterly Contaminant Mass Removal. (2 sheets))

Reporting Period	Liters Treated	Mass Technetium-99 Removed (g)	Mass Total Uranium Removed (g)	Mass Carbon Tetrachloride Removed (g)	Mass Nitrate Removed (kg)
Start	0	0	0	0	0
March 1994 - November 1994[a]	3,898,550	3.41	4,422	Not reported	N/A
December 1994 - August 1995	11,391,491	7.79	9,831	992	N/A
September 1995 - November 1995	17,198,571	3.95	3,895	630	N/A
December 1995 - March 1996	31,311,340	9.05	9,105	1,609	N/A
April 1996 - June 1996	22,459,108	5.4	6,845	1,569	N/A
July 1996 – September 1996	22,370,327	4.01	5,134	2,790	N/A
October 1996 - December 1996	20,300,000	3.33	5,607	2,980	N/A
January 1997 - February 1997[b]	2,667,600	0.83	963	73	N/A
February - March 30, 1997	--	--	--	--	--
March 31 - September 30, 1997	32,414,481	5.6	11,000	888	2,260
October 1 - December 31, 1997	20,390,054	3.31	6,300	572	1,530
January 1 - March 31, 1998	19,791,765	2.08	4,900	460	1,070
April 1 - June 30, 1998	33,538,750	3.58	8,680	907	2,150
July 1 - September 30, 1998	26,346,466	1.57	3,750	296	900
October 1 - December 31, 1998	22,174,396	1.49	4,910	341	979
January 1 - March 31, 1999	23,720,542	1.89	4,450	601	1,050
April 1 - June 30, 1999	24,369,400	2.29	5,400	600	1,400
July 1 - September 30, 1999	23,206,922	2.14	5,940	460	1,430
October 1 - December 31, 1999	14,858,190	1.25	3,080	286	681
January 1 - March 31, 2000	14,636,480	1.29	3,100	352	645
April 1 - June 30, 2000	18,295,080	1.63	4,050	527	806
July 1 - September 30, 2000	15,439,630	1.45	3,410	494	675
October 1 - December 31, 2000	35,538,203	2.93	6,475	781	1,371
January 1 - March 31, 2001	17,352,328	1.41	3,332	434	631
April 1 - June 30, 2001	24,300,159	2.01	3,798	833	955
July 1 - September 30, 2001	25,284,628	2.02	3,523	696	967
October 1 – December 31, 2001	31,276,969	2.8	4,840	444	987
January 1 – March 31, 2002	6,102,084	2.54	4,350	854	850

Table 2-1. Quarterly Treatment Volume and Quarterly Contaminant Mass Removal. (2 sheets))

Reporting Period	Liters Treated	Mass Technetium-99 Removed (g)	Mass Total Uranium Removed (g)	Mass Carbon Tetrachloride Removed (g)	Mass Nitrate Removed (kg)
April 1 – June 30, 2002	31,217,155	6.05	11,400	950	1,180
July 1 – September 30, 2002	17,290,247	3.11	5,830	499	669
October 1 - December 31, 2002	23,365,000	3.21	5,980	359	966
January 1 - March 31, 2003	24,550,000	2.91	5,210	699	991
April 1 - June 30, 2003	28,615,000	3.31	5,747	1,087	1,144
July 1 - Sept 30, 2003	21,813,000	2.39	4,238	654	1,056
October 1 - December 31, 2003	12,037,600	1.2	2,210	217	717
January 1 - March 31, 2004	26,497,900	4.94	9,840	1,670	2,010
April 1 - June 30, 2004	25,362,260	2.99	5,880	1,560	1,190
July 1 - September 30, 2004	29,866,899	2.97	5,610	2,000	1,290
October 1 - December 31, 2004	21,728,264	2	3,740	1,440	911
January 1 - March 31, 2005	30,396,859	2.68	4,987	2,004	1,255
April 1, 2005 - April 18, 2007	0	0	0	0	0
April 19 - September 30, 2007	2,227,336	0.21	1,129	53	359
October 1 - December 31, 2007	3,722,252	1.59	1,450	301	494
January 1 - March 1, 2008	5,252,293	2.82	2,360	445	576
Totals	**864,575,579**	**123.43**	**216,701**	**35,407**	**36,145**

Table 2-2. Existing Wells for 200-UP-1 Pump-and-Treat System.

Well ID	Well Name	Date Completed	Total Depth Drilled (ft bgs)	Water Level (ft bgs)/ Date Reported	Permanent Screen and Casing			Status
					Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Length (ft bgs)	
A9517	299-W19-34A	05/18/94	345.0	266.44 03/13/08	324.2	339.6	15.4	Declining water level
A9515	299-W19-35	04/20/94	273.8	261.82 03/13/08	239.9	270.0	30.1	Declining water level
A9513	299-W19-34B	11/09/94	556.5	267.45 03/31/08	411.6	421.3	9.7	Declining water level
B2461	299-W19-36	09/01/95	295.0	273.42 03/13/08	269.8	289.8	19.9	Extraction well; declining water level
B2465	299-W19-37	08/28/95	267.0	264.04 03/13/08	243.5	263.3	19.9	Declining water level, nearly dry
B2460	299-W19-39	09/11/95	287.5	NA NA	234.0	284.1	50.1	Well out of service
B2464	299-W19-40	09/14/95	258.5	248.29 03/16/06[a]	230.8	250.8	20.0	Dry
C3381	299-W19-43	08/02/01	296.3	NA NA	257.8	292.7	34.9	Extraction well; no water level data since 2003
C3958	299-W19-46	12/02/02	380.0	262.83 03/13/08	255.0	290.0	35.0	Declining water level
C4236	699-38-70B	03/15/04	478.5	299.73 03/14/08	406.7	421.7	15.0	Declining water level
C4300	299-W19-48	12/30/04	424.0	258.96 03/31/08	262.1	297.2	35.1	Declining water level
C4695	299-W19-49	09/14/05	380.0	261.91 03/13/08	259.5	294.5	35.0	Declining water level
C4966	299-W19-101	08/20/05	380.0	264.04 03/13/08	260.0	295.0	35	Declining water level
C4968	299-W19-105	01/25/06	293.33	260.99 03/13/08	255.2	290.3	35.1	Declining water level
C5183	299-W19-017	04/28/06	328.55	275.46 03/13/08	310.5	325.6	15.1	Declining water level

[a] Indicates water-level elevations recorded before the reporting period; best data found.
bgs = below ground surface
NA = not available

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3.0 200-ZP-1 OPERABLE UNIT SEMI-ANNUAL SUMMARY

In the first half of FY08, continued progress was made toward meeting the three RAOs for the 200-ZP-1 OU pump-and-treat system. Hydraulic capture of the baseline high-concentration portion of the contaminant plume was maintained, health risks were reduced through a lessening of contaminant mass, and information was collected to support development of a final remedy. The current treatment system consists of 10 active extraction wells, 5 injection wells, numerous monitoring wells, and a granular activated carbon system that captures vapor-phase carbon tetrachloride removed from groundwater by an air-stripping column that removes organic contaminants. During the reporting period, 2.29×10^8 L of groundwater were processed through the water treatment plant. Additionally, two wells located to the east of the 241-T Tank Farm were put into use as extraction wells. Technetium-99 was removed from the water pumped from these wells and sent to the Effluent Treatment Facility (ETF).

Carbon tetrachloride contaminant concentrations measured at the extraction wells during the first half of FY08 were very similar overall to the average concentrations measured in FY07, although the average concentrations measured at the influent tank was slightly lower during the first half of FY08 than during the first half of FY07. Increasing concentrations of technetium-99 were noted at one extraction well during the period.

A plan view of the 200-ZP-1 extraction and monitoring wells is presented in Figure 3-1, and the configuration of the pump-and-treat system is shown in Figure 3-2.

3.1 200-ZP-1 OPERABLE UNIT SUMMARY

This section summarizes progress for the first half of FY08. Contaminant concentration trends and groundwater conditions were identified and recorded as follows:

- Drilling at three RCRA program groundwater monitoring wells was carried out during the period (Figure 3-3). Well 699-45-69C was started in FY07 and completed during the first half of FY08. Well 299-W11-88 was started and completed during the first half of FY08, and well 699-43-69 was started during the first half of FY08 and completed during the third quarter of FY08. At well 699-43-69, a 10.2-m (35-ft) screen was installed in the semi-confined aquifer beneath the Ringold Lower Mud Unit. This well configuration was used because elevated levels of carbon tetrachloride were noted in the semi-confined aquifer during field screening tests.
- Technetium-99 concentration at extraction well 299-W15-765 has generally been increasing since the fourth quarter of FY07, peaking at 3,300 pCi/L in December 2007 and January 2008. Well 299-W15-44 appears to have generally stabilized, with most concentrations during the period slightly over 2,000 pCi/L. Monitoring well 299-W15-763 declined from a peak of 5,980 pCi/L in August 2006 to 1,800 pCi/L in March 2008.

- A treatability test for the removal of technetium-99 from groundwater was completed during the period. This test, using ion-exchange columns with Purolite resin to remove technetium-99 from groundwater extracted from wells 299-W15-44 and 299-W15-765, operated from the third quarter of FY07 to the end of the first quarter of FY08. Breakthrough, as defined in the test plan, was not achieved for either well during the treatability test. The test results were considered adequate to demonstrate that the Purolite resin was able to successfully remove technetium-99 from the groundwater.
- Monitoring wells 299-W11-45 and 299-W11-46 were converted into extraction wells in September 2007 to remediate and contain a technetium-99 plume. They are located on the east side of the 241-T Tank Farm. Extracted groundwater is pumped to a tie-in with the pipeline connecting the 200 West Area to the Liquid Effluent Retention Facility and is combined with the 200-UP-1 pump-and-treat water in Basin 43. The ETF processes the groundwater in batches of 1,900,000 to 2,600,000 L on an as-needed basis.
- Plans are underway to expand the 200-ZP-1 pump-and-treat system by converting four existing monitoring wells to extraction wells. The system will be upgraded to handle 1,893 L/min (500 gpm). The system will shut down for upgrades in the second half of FY09. The new extraction wells are 299-W15-1, 299-W15-7, 299-W15-11, and 299-W15-46.
- Deep aquifer concentrations of carbon tetrachloride from just above the top of the Ringold Lower Mud Unit in well 299-W13-1 averaged 2,450 µg/L during the period. Other significant deep aquifer average concentrations include 1,950 µg/L at well 299-W11-87 and 1,100 µg/L at well 299-W14-71.

3.2 EXTRACTION WELL DATA

Ten groundwater extraction wells operated at the 200-ZP-1 OU during the first half of FY08 (Figure 3-1). Groundwater extracted from these wells is air stripped to remove carbon tetrachloride, chloroform, and TCE, which are then trapped on activated carbon. Section 3.2.1 presents a summary of extraction flow rates, amount of carbon tetrachloride recovered, and concentrations for the air-stripped contaminants. These data reflect historical performance, as well as performance during the first half of FY08. It should be noted that extraction well 299-W15-6 is screened at a depth 52.6 m (172.5 ft) below the water table and is intended to extract water from the bottom portion of the unconfined aquifer. The other nine extraction wells are screened in the upper portion of the unconfined aquifer.

By September 2005, technetium-99 concentrations in several wells within the extraction well field had increased significantly. Trends for this contaminant, which is not removed by the air-stripping system, are discussed in Section 3.2.2.

Key points regarding extraction well performance during the period are as follows:

- Carbon tetrachloride concentrations at extraction wells were stable at eight extraction wells and increased at two extraction wells.

- The RAO for carbon tetrachloride (2,000 μg/L) was exceeded on average at 6 of 10 extraction wells during the first half of FY08. One well (299-W15-34) exceeded the RAO each time it was sampled; other wells that had average concentrations for the period above the RAO had individual concentrations that often, but not always, exceeded the RAO. Two wells (299-W15-44 and 299-W15-765) have analytical results that appear anomalously high and are undergoing laboratory review.
- Chloroform concentrations in extraction wells continued to be stable or are decreasing. None of these exceeded the drinking water standard (DWS) of 100 μg/L.
- The TCE concentrations in extraction wells continued to be stable or are decreasing. Five of these exceeded the DWS of 5 μg/L.
- Technetium-99 concentrations at the 10 extraction wells were generally stable. At well 299-W15-765, the technetium-99 concentration increased >30% during the period. Well 299-W15-45, which has a generally slightly increasing trend for some time, spiked to more than twice the usual concentration during November 2007 before returning to on trend values during the second quarter of FY08.
- Quality control (QC) data for the period showed good QC for carbon tetrachloride, chloroform, and TCE analyses (see Section 3.2.3 for additional details).

3.2.1 Treated Contaminants (Carbon Tetrachloride, Chloroform, and Trichloroethene)

Throughout the first two quarters of FY08, the 200-ZP-1 groundwater pump-and-treat system operated using the 10 extraction wells shown in Figure 3-1. Table 3-1 shows the volumes of groundwater extracted and treated on a quarterly basis since August 1994, as well as the estimated mass of carbon tetrachloride removed during each quarter. Table 3-2 shows pumping rates for each extraction well during each of the first two quarters of FY08. For comparison, Table 3-2 also shows the average annual pumping rates for the 10 wells that were active in FY07 and presents statistical comparisons. Historical contaminant concentration trends for the 10 extraction wells are illustrated in Figure 3-4 (carbon tetrachloride), Figure 3-5 (chloroform), and Figure 3-6 (TCE).

Carbon tetrachloride averaged 3,000 μg/L in one extraction well (299-W15-34) during the first half of FY08, while all other extraction wells had lower averages. The RAO of 2,000 μg/L for carbon tetrachloride is exceeded at wells 299-W15-34, 299-W15-35, 299-W15-6, 299-W15-40, 299-W15-44, and 299-W15-765. Carbon tetrachloride concentrations at the remaining four wells range from about 500 μg/L to about 1,350 μg/L and are generally stable, with the exception of well 299-W15-36, where the trend is increasing. Table 3-3 presents a comparison between carbon tetrachloride concentrations during the first half of FY08 and concentrations during FY07. This comparison shows that concentration trends in eight wells are stable (i.e., show changes in concentration of <20%) and are increasing (i.e., show changes in concentration of >20%) in two wells. The influent tank (T-01) also shows a stable carbon tetrachloride concentration trend for the period.

Chloroform concentration trends follow a stable or decreasing pattern. Table 3-4 presents a comparison between chloroform concentrations during the first half of FY08 and concentrations during FY07. This comparison shows that concentration trends are stable in seven wells and are decreasing in three wells. The influent tank (T-01) shows a stable chloroform concentration trend for the period. The MCL for chloroform is 100 μg/L.

The TCE concentration trends follow a stable or decreasing pattern. Table 3-5 presents a comparison between TCE concentrations during the first half of FY08 and concentrations during FY07. This comparison shows that concentration trends are stable in three wells and are decreasing in seven wells. The influent tank (T-01) shows a decreasing TCE concentration trend for the period. The MCL for TCE is 5 µg/L.

3.2.2 Technetium-99

Technetium-99 is not removed by the 200-ZP-1 treatment system and is returned to the aquifer at below MCL concentrations (900 pCi/L) at upgradient injection wells. As a result, technetium-99 can be used as a tracer for plume characterization, particularly in the area between the injection wells and the downgradient extraction wells. All extraction wells and many monitoring wells located in this area are routinely sampled and analyzed for technetium-99. Several of these wells show increasing technetium-99 trends, including wells 299-W18-23, 299-W15-152, 299-W15-94, 299-W15-30, 299-W15-31A, 299-W15-45, 299-W15-49, and 299-W15-11. Technetium-99 in these wells indicates that groundwater has moved from the area of injection, toward the baseline extraction wells in the area of the Plutonium Finishing Plant.

In general, technetium-99 concentrations measured in the first half of FY08 declined with increasing distance from the injection wells. For example, in well 299-W18-23, located a short distance to the east of the injection well array, the technetium-99 concentration was 440 pCi/L. In comparison, well 299-W15-11, located closer to the extraction wells, had a technetium-99 concentration of 52 pCi/L during the same period.

A well with the screen set near the bottom of the unconfined aquifer (299-W15-17) was compared with nearby well 299-W15-30 with the screen set near the top of the unconfined aquifer to see if vertical mixing of technetium-99 was occurring within the aquifer. Because the injection wells are screened near the top of the unconfined aquifer and are considered to be the source of technetium-99 in the vicinity of this well pair, increasing technetium-99 concentrations near the bottom of the aquifer might be indicative of vertical mixing.

Shallow/deep well pair 299-W15-30/299-W15-17 shows increasing concentrations of technetium-99 in the shallow well and stable low concentrations in the corresponding deep well. As a result, vertical mixing does not appear to be a significant factor in the area downgradient of the injection wells.

3.2.3 Extraction Well Analytical Quality Control

Laboratory replicates (i.e., separate samples collected at the same time, given different sample numbers, and sent to the same laboratory for analysis) were used to assess the precision of chemical analysis in the first half of FY08.

Establishing the precision of analyses consists of comparing analyses for replicates and splits through calculating the relative percent difference (RPD), as follows:

$$\text{RPD} = \frac{(c1 - c2)}{(c1 + c2)/2} \text{ x } 100\%$$

where $c1$ and $c2$ are replicate or split concentrations.

The RPD values that are <±20% are deemed acceptable in accordance with *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA 540/R-94/083).

3.2.3.1 Carbon Tetrachloride. Results of QC analyses performed for carbon tetrachloride during the first half of FY08 are shown in Table 3-6.

Four laboratory replicate samples were analyzed for carbon tetrachloride using method 8260_VOA_GCMS[1]. The RPD values for these sample pairs ranged from 0% to 10.8%, with all sample pairs less than ±20%.

3.2.3.2 Chloroform. Results of QC analyses performed for chloroform during the first half of FY08 are shown in Table 3-7.

Four laboratory replicate samples were analyzed for chloroform using method 8260_VOA_GCMS[1]. The RPD values for these sample pairs ranged from 0% to 4.4%, with all sample pairs less than±20%.

3.2.3.3 Trichloroethene. Results of QC analyses performed for TCE during the first half of FY08 are shown in Table 3-8.

Four laboratory replicate samples were analyzed for TCE using method 8260_VOA_GCMS[1]. The RPD values for these sample pairs ranged from 0% to 10.8%, with all sample pairs less than ±20%.

3.3 TREATMENT SYSTEM PERFORMANCE

This section describes performance of the 200-ZP-1 pump-and-treat operation.

3.3.1 Carbon Tetrachloride

Key elements of treatment system performance during the period include the following:

- 2.29×10^8 L of groundwater were extracted from 10 wells, which is an 11% decrease over the same period in FY07.
- 348.8 kg of carbon tetrachloride were recovered from treated groundwater (a 17% decrease from the same period in FY07). Concentrations of carbon tetrachloride are declining at the baseline extraction wells.
- The extraction system was on-line 94.1% of the time during the period.

During the reporting period, 2.29×10^8 L of groundwater (Table 3-1) from 10 extraction wells were processed through the water treatment plant (an 11% decrease in production compared to production from the ten pumped wells available during the first half of FY07). The mean concentrations of contaminants going into the treatment plant were 1,443 µg/L for carbon tetrachloride, 9.2 µg/L for chloroform, and 3 µg/L for TCE. Tables 3-3, 3-4, and 3-5 present historical average concentrations of carbon tetrachloride, chloroform, and TCE, respectively, in groundwater extracted from each of the pumping wells, as well as in influent tank T-01.

Removal efficiency for carbon tetrachloride was over 99.8%, and an estimated 348.8 kg of carbon tetrachloride were removed from the treated water during the first half of FY08 (a 17% decrease over the first half of FY07). The decrease in carbon tetrachloride recovery over that in the same period of FY07 reflects a general decrease in carbon tetrachloride concentration in the extraction wells, as well as a slightly lower pumping rate. The influent tank (T-01) reflects this

[1] Methods are taken from the Hanford Environmental Information System (HEIS) database.

general decrease in concentration, showing a 4% decrease between the concentration calculated for FY07 and that calculated for the first half of FY08.

A total of 4,382.6 operating hours were available during the reporting period (4,392 total hours available, less 9.4 hours planned down time). The system actually operated for 4,125.6 hours, or 94.1% of the time, with 257 hours of unplanned stoppages.

From August 1994 through March 2008, a total of 11,304.5 kg of carbon tetrachloride were removed from 3.92×10^9 L of groundwater. The average carbon tetrachloride concentration measured at the T-01 influent tank during the first half of FY08 was 1,443 μg/L. The chloroform concentration for the same period was 9.2 μg/L, and the TCE concentration was 3 μg/L.

Figure 3-7 shows cumulative liters of groundwater treated versus cumulative kilograms of carbon tetrachloride removed since initiation of the 200-ZP-1 pump-and-treat operation. Figure 3-8 shows the liters of groundwater treated versus kilograms of carbon tetrachloride removed on a quarter-by-quarter basis for the same period. It is evident from an inspection of these diagrams that, in general, increasing the pumping rate (and correspondingly increasing the amount of water treated) increases the amount of carbon tetrachloride removed each quarter by the extraction system. However, it is also evident that the amount of carbon tetrachloride removed each quarter has been generally decreasing since about the middle of FY00, even though the pumping rate has generally increased. This reflects removal of the high-concentration core of the carbon tetrachloride groundwater plume, and an overall reduction in mass of carbon tetrachloride in groundwater.

3.3.2 Technetium-99

Technetium-99 is most commonly found in the 200 West Area in groundwater downgradient of tank farms or liquid waste disposal sites associated with tank farm or evaporator processes. Significant levels of technetium-99 have been discovered in groundwater near the 241-TX, 241-TY, and 241-T Tank Farms (DOE/RL-2008-01, Section 2.8) and are further described below.

3.3.2.1 Technetium-99 Purolite Treatability Test (241-TX/TY Tank Farms). Elevated and increasing levels of technetium-99 were noted in 2004 in two monitoring wells (299-W15-44 and 299-W15-765) located along the west boundary of the 241-TX/TY Tank Farms (Figure 3-9). These wells displayed rapid increases in technetium-99 concentrations subsequent to their conversion to extraction wells in the fourth quarter of FY05. A Purolite A-530E, resin-based ion-exchange system was installed at the heads of both wells at a treatability test for removing technetium-99 from groundwater before transfer to the 200-ZP-1 pump-and-treat system. The treatability test operated from the third quarter of FY07 until the end of the first quarter of FY08. The results showed that the Purolite resin removed technetium-99 to below the DWS from 200-ZP-1 OU groundwater and selectively removed technetium-99 over other anions (i.e., nitrate and sulfate) in solution. It did not remove carbon tetrachloride. Breakthrough began approximately 6 to 7 months after the test began for the test columns for both wells but the test was terminated early with the onset of cold weather (breakthrough was defined in the test plan as the point at which the effluent concentration of technetium-99 equaled 50% of the influent concentration of technetium-99). Although breakthrough was not fully achieved for either well during the treatability test, the test results were considered adequate to characterize the suitability of Purolite resin for technetium-99 sequestration.

3.3.2.2 Technetium-99 in the Vicinity of the 241-T Tank Farm. A significant technetium-99 plume has been detected in groundwater on the east side of the 241-T Tank Farm, where elevated concentrations have been detected in a number of wells. For example, concentrations up to 181,900 pCi/L were found in well 299-W11-25B, located near the northeast corner of the tank farm. Monitoring wells 299-W11-45 and 299-W11-46 were converted to extraction wells in September 2007. The extracted groundwater is sent to ETF for treatment. During the first half of FY08, the system pumped 37,734,274 L of groundwater and recovered 180.4 g of technetium-99.

3.4 WATER-LEVEL MONITORING

A summary of water-level monitoring in the vicinity of the 200-ZP-1 OU is as follows:

- The average rate of decline calculated from data from three groundwater monitoring wells is 0.303 m/yr (1.01 ft/yr), which is about 30% lower than the rate calculated for the first half of FY07, which was 0.425 m/yr (1.39 ft/yr).
- For the first half of FY08, wells that were relatively distal to the pump-and-treat extraction and injection wells were selected in order to characterize the regional water table with fewer potential impacts from changes in pumping and injection rates.
- Water levels have been generally declining since at least FY98 in the vicinity of the 200-ZP-1 pump-and-treat operation. Groundwater elevation data collected from FY02 through FY04 show that the groundwater surface declined at a steady rate of 0.36 m/yr (1.18 ft/yr) over this period. A decrease in the rate of decline was evident in FY05 when groundwater declined at an average rate of 0.25 m/yr (0.82 ft/yr), although the rate increased in FY06 to 0.41 m/yr (1.35 ft/yr). The rate of decline was smaller in FY07, when the water level declined at a rate of 0.20 m/yr (0.65 ft/yr).

Starting with FY06, wells 299-W18-1 and 299-W18-24, previously used to monitor water levels for the 200-ZP-1 pump-and-treat operation, were replaced with wells 299-W10-4 and 299-W14-14 in an effort to eliminate or moderate the effects of increased discharges at the 200-ZP-1 injection wells. However, it has become evident that well 299-W10-4, in particular, is impacted by pump-and-treat activities. As a result, three more distal wells were selected in order to characterize the water table. Figure 3-10 shows that the rate of decline for well 299-W18-01 is 0.37 m/yr (1.21 ft/yr), the rate of decline for well 299-W15-37 is 0.32 m/yr (1.05 ft/yr), and the rate of decline for well 299-W13-01 is 0.22 m/yr (0.72 ft/yr), with an average rate of decline for the period of 0.30 m/yr (1.00 ft/yr).

Declining water levels have given rise to a number of issues. Several monitoring wells have gone dry over time (e.g., 299-W15-15 and 299-W15-39), and more wells will likely dry up over the next few years. The flow rates in extraction wells have also generally decreased due to falling water levels, leading to a reduction in size of capture zones at individual wells. Numerical modeling carried out in FY07 (DOE/RL-2008-02) indicates that the extraction wells are effectively capturing the contaminants in the baseline plume area.

3.5 CONTAMINANT MONITORING

This section presents a brief description of recent trends in the distribution of groundwater contaminants in the 200-ZP-1 Groundwater OU. The trends are the results of hydraulic stresses caused by operation of the pump-and-treat system and either contaminant mass removal or contaminant displacement by injected water (for technetium-99, in particular).

Figure 3-11 presents the groundwater concentration of carbon tetrachloride for August 2007. Figures 3-12 and 3-13 show the groundwater concentrations of chloroform and TCE, respectively, for August 2007. Table 3-9 presents the FY08 results for carbon tetrachloride, chloroform, and TCE at 200-ZP-1 monitoring wells. These contaminants are discussed in the following subsections, as well as the trends for technetium-99.

Key elements of contaminant monitoring during the period include the following:

- The carbon tetrachloride plume continues to be reduced in extent and concentration.
- The chloroform plume has decreased somewhat in extent to the south when compared to the plume from the first half of FY07. However, the 2007 plume has a significantly larger central core of material at a concentration of >20 μg/L, but this is still below the MCL of 100 μg/L.
- Few changes are noted in the TCE plume when compared to the plume from the first half of FY07.
- Deep aquifer contamination continued to be evident in well 299-W13-1, located approximately 2.4 km (1.5 mi) east of the 200-ZP-1 OU baseline plume area, with carbon tetrachloride concentrations during the first half of FY08 averaging 2,450 μg/L, which is above the RAO of 2,000 μg/L carbon tetrachloride. This concentration is well above the FY07 average concentration of 1,650 μg/L. Well 299-W13-1 is screened near the bottom of the unconfined aquifer.
- Deep aquifer monitoring well 299-W11-87, located approximately 550 m (1,800 ft) north of well 299-W13-1, had an average carbon tetrachloride concentration of 1,950 μg/L during the first half of FY08. This concentration is similar to concentrations from the second half of FY07, when the well was put in service. Well 299-W11-87 is screened near the bottom of the unconfined aquifer

3.5.1 Carbon Tetrachloride

Figure 3-11 shows carbon tetrachloride plume concentration contours for August 2007, and Figure 3-12 in DOE/RL-2008-02 shows the configuration of the carbon tetrachloride plume between 1995 and 2007. This figure shows that the area encompassed by the 1,000 μg/L isopleth was generally reduced in width and length (toward the south) between 2006 and 2007. Concentrations in a number of wells fell below 1,000 μg/L over the period, including monitoring wells 299-W15-11, 299-W10-5, 299-W15-38, and 299-W15-46, as well as at extraction well 299-W15-47. However, three of these wells (299-W10-5, 299-W15-38, and 299-W15-47) had concentrations slightly >1,000 μg/L during the first half of FY08. The footprint of the higher concentration core of the plume (i.e., >2,000 μg/L) was reduced somewhat between 2006 and 2007.

Table 3-9 shows that carbon tetrachloride concentrations increased in four monitoring wells, decreased in seven wells and were stable in nine wells when concentrations from the first half of

FY08 are compared with concentrations from FY07. Wells with increasing concentrations are located near the southern portion of the contaminant plume in the vicinity of the 216-Z-9 Crib, near the northern portion of the contaminant plume west of the 241-TX Tank Farm, and in a far-field location to the east-northeast of the 216-Z-9 Crib. Wells with decreasing concentrations are mostly located in the area between the injection wells and the extraction wells. One well with a decreasing location is located to the southwest of the 216-Z-9 Crib, and one well is located to the immediate south of the 241-T Tank Farm.

Monitoring well 699-48-71, located approximately 2 km (1.2 mi) northeast of WMA T, has been monitored for carbon tetrachloride since the second quarter of FY02 in order to identify potential northeast migration of the carbon tetrachloride plume. Carbon tetrachloride concentrations in this well have gradually increased from 7.4 µg/L in the second quarter of FY02 to the current level of 62 µg/L in the second quarter of FY08.

3.5.2 Deep Aquifer Carbon Tetrachloride Concentrations

Starting in the fourth quarter of FY05, carbon tetrachloride concentrations at or slightly exceeding the RAO (2,000 µg/L) have been detected in deep monitoring well 299-W13-1 (Figure 3-3). This well, located near the eastern boundary of the 200 West Area, is screened near the bottom of the unconfined aquifer, just above the Ringold Lower Mud Unit. The carbon tetrachloride concentration during the first half of FY08 averaged 2,450 µg/L, considerably above the FY07 average of 1,650 µg/L.

Nine wells are presently screened near the bottom of the unconfined aquifer, including three new wells drilled or completed in FY08. One of these wells was screened below the confining Ringold Lower Mud Unit. Carbon tetrachloride analyses for the first half of FY08 are available for seven of these wells and are shown in Figure 3-14. The carbon tetrachloride concentration at well 299-W13-1 at 2,450 µg/L is above the 200-ZP-1 RAO of 2,000 µg/L, and the concentration at well 299-W11-87 at 1,950 µg/L approaches the RAO.

Concentrations in other wells range from 1 to 1,100 µg/L. The highest concentrations are found in wells located to the east and northeast of the 216-Z-9 Crib. Well 699-43-69 is screened below the Ringold Lower Mud Unit. A concentration of 240 µg/L was measured during the first half of FY08. Trends have not been established in most of the deep wells installed within the last year or two because of the small data set. Even the trend in well 299-W13-1, installed in FY05, has a degree of uncertainty due to variability in the data.

3.5.3 Chloroform

All chloroform concentrations during the first half of FY08 were well below the DWS of 100 µg/L for total trihalomethanes. The highest concentration seen during the period was 15 µg/L at well 299-W15-34, located to the southwest of the 241-TX Tank Farm. Slightly lower concentrations (13 µg/L) were present at wells 299-W15-765, 299-W15-40, and 299-W15-6. Figure 3-12 shows chloroform plume concentration contours for August 2007. When compared with chloroform contours from August 2006 (*200-UP-1 and 200-ZP-1 Pump-and-Treat Semi-Annual Technical Memorandum, Fiscal Year 2007* [SGW-34328]), the extent of chloroform concentration towards the south was smaller during the period and the 20 µg/L isopleth was smaller than that that present in FY06.

Table 3-9 shows that chloroform concentrations increased in 2 wells, decreased in 14 wells, and were stable in 4 wells when concentrations from the first half of FY08 are compared with

concentrations from FY07. This table also indicates that chloroform concentrations have further declined since contours were last generated in August 2007. Specifically, none of the monitoring wells exceeded 20 μg/L in the first half of FY08. The two wells with increasing chloroform concentrations are located between the injection wells and the extraction wells.

3.5.4 Trichloroethene

The TCE concentrations in excess of the MCL (5 μg/L) are found over a large area extending from well 299-W15-50, located north of the 216-Z-9 Trench to the 241-T Tank Farm. Figure 3-13 shows the TCE plume concentration contours for August 2007. When compared with TCE contours from August 2006 (SGW-34328), few significant changes are evident.

Table 3-9 shows that TCE concentrations increased in 4 wells, decreased in 12 wells, and were stable in 4 wells when concentrations from the first half of FY08 are compared with concentrations from FY07. Wells with increasing concentrations of TCE are located between the injection and extraction wells and near the 216-Z-9 Crib.

3.5.5 Technetium-99

Technetium-99 plumes are found in three general areas in the 200-ZP-1 OU:

- 241-T Tank Farm (most significant plume)
- 241-TX Tank Farm
- Near the Plutonium Finishing Plant (least significant plume, with concentrations below the 900 pCi/L MCL).

Technetium-99 concentrations in monitoring wells 299-W15-765 and 299-W15-44, located along the west boundary of the 241-TX/TY Tank Farms (Figure 3-1), remained elevated during FY08, following an increasing trend that began during the fourth quarter of FY04. Following conversion of these wells to extraction wells in the fourth quarter of FY05, rapid increases in technetium-99 concentrations were noted. During the first half of FY08, concentrations continued to increase at well 299-W15-765, increasing from approximately 2,500 pCi/L at the beginning of the period to approximately 3,500 pCi/L by the end of the period (Figure 3-15). Concentrations at well 299-W15-44 were stable during the first half of FY08, with concentrations of around 2,100 pCi/L.

Extraction well 299-W15-40, located approximately midway between the two extraction wells noted above (299-W15-44 and 299-W15-765), continues to show only modest evidence of elevated technetium-99, suggesting that two separate sources may be present. The 241-TX and 241-TY Tank Farms contain single-shell tanks that are confirmed or suspected to have leaked as a potential source for technetium-99 contamination. The 216-T-19 tile field (located south of the tank farms) and the 216-T-26, 216-T-27, and 216-T-28 Cribs (located to the east of the tank farms) are also potential sources. Concentrations in extraction well 299-W15-6, which is screened near the bottom of the unconfined aquifer, appear to have stabilized during the first half of FY08 at slightly >40 μg/L, indicating that the technetium-99 is largely confined to the upper portion of the unconfined aquifer.

3.6 NEW MONITORING WELLS

As previously noted, three new monitoring wells were completed within the 200-ZP-1 OU during the period (well development at one well was deferred until the third quarter of FY08).

All three wells were drilled to investigate carbon tetrachloride in groundwater, although well 299-W11-88 was also intended to investigate the downgradient extent of a uranium groundwater plume found near the 221-T Building. Brief descriptions are presented in this section, and more detailed information is available in the *Borehole Summary Report for the Installation of Wells 299-W11-88 (C5572), 6999-43-69 (C5573), and 699-45-69C (C5574) for the 200-ZP-1 Operable Unit, FY 2007* (SGW-37703). The well locations are shown in Figure 3-3.

3.6.1 Well 699-45-69C (C5574)

Well 699-45-69C (C5574) is located east of the Hanford Meteorological Station. Drilling, well construction, and well development activities took place between July 13, 2007, and February 20, 2008. The borehole was drilled to a total depth of 138.7 m (455 ft) below ground surface (bgs), and groundwater was encountered at 89.8 m (294.5 ft) bgs (Figure 3-16). One split-spoon sediment sample was collected for sieve analysis and one was collected for solubility tests. Six groundwater samples were also collected for analysis. Gravel-dominated, sand-dominated, and silt-sand-dominated sediments of the Hanford formation extend from surface to 32.0 m (105 ft) bgs, while silt and caliche overlying gravels, sands, and silts of the Cold Creek unit extend from 32.0 to 61.0 m (105 to 200 ft) bgs. It should be noted that the Cold Creek unit in this borehole consists of an upper caliche layer (upper Cold Creek unit) and a relatively thick underlying section of strongly calcareous sands (lower Cold Creek unit). This interpretation is consistent with recent work by Pacific Northwest National Laboratory (PNNL) (e.g., *Vadose Zone Hydrogeology Data Package for Hanford Assessments* [PNNL-14702, Rev. 1]) where two lithofacies of the Cold Creek unit have been identified, including an upper coarse to fine-grained, carbonate-cemented facies and a lower fine-grained, laminated to massive facies.

Silty sandy gravels of the upper Ringold Formation (member of Taylor Flat) extend from 61.0 to 97.5 m (200 to 320 ft) bgs; silty sandy gravels, gravelly sandy silts, gravelly silty sands, and silty gravels of the Ringold Unit E (member of Wooded Island) extend from 97.5 to 138.7 m (320 to 455 ft) bgs. Basalt of Elephant Mountain Member of the Columbia River Basalt Group was encountered at 138.7 m (455 ft) bgs.

Well 699-45-69C was constructed as a groundwater monitoring well, with a 6-in. stainless-steel, 20-slot screen set from 111.9 to 116.4 m (367 to 382 ft) bgs. A 6–in.-diameter completion was chosen for this well (and the other two new wells) because, if needed, the 6-in. completion would be more suitable for a pump-and-treat extraction well than the more typical 4-in. completion. Two 2.3-m (7.5-ft) intervals were developed by pumping until turbidity was less than 5 nephelometric turbidity units (NTU), and other water parameters (including pH and conductivity) had stabilized. Pumping rates during final well development were 27.3 to 29.5 L/min (7.2 to 7.8 gpm) for both intervals. The lower interval was pumped for 46 minutes and the upper interval was pumped for 45 minutes. The observed drawdown ranged from 0.5 to 0.6 m (1.6 to 1.9 ft). A Grundfos® Redi-Flo3 10SQE-340 NE permanent sampling pump was installed with the intake at 113.6 m (372.8 ft) bgs, which is equivalent to 23.2 m (76.3 ft) below the static water level.

Carbon tetrachloride, chloroform, and TCE contaminant distributions in groundwater samples are shown in Figure 3-17. The highest concentration of carbon tetrachloride (22 μg/L) was found in a sample collected at a depth of 116.4 to 117.7 m (382 to 386 ft) bgs. Chloroform and technetium-99 were present at very low levels.

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3.6.2 Well 299-W11-88 (C5572)

Well 299-W11-88 (C5572) is located northeast of T Plant, within the 200-ZP-1 OU. Drilling, well construction, and well development activities took place between October 4, 2008, and April 9, 2008. The borehole was drilled to a total depth of 149.4 m (490.2 ft) bgs, and groundwater was encountered at 87.8 m (288.1 ft) bgs (Figure 3-18). Seven groundwater samples were collected for analysis. Gravel-dominated, sand-dominated, and silt-sand-dominated sediments of the Hanford formation extend from surface to 36.6 m (120 ft) bgs, while silt and caliche overlying gravels, sands, and silts of the Cold Creek unit extend from 36.6 to 64.0 m (120 to 210 ft) bgs. Silty sandy gravels and sandy gravels of Ringold Unit E extend from 64.0 to 149.4 m (210 to 490.2 ft) bgs. Basalt of the Elephant Mountain Member was encountered at 149.4 m (490.2 ft) bgs.

Well 299-11-88 was constructed as a groundwater monitoring well with a 6-in. stainless-steel screen set from 135.7 to 147.9 m (445.1 to 485.1 ft) bgs. Two 6.1-m (20-ft) intervals were developed by pumping until turbidity was less than 5 NTU and other water parameters (including pH and conductivity) had stabilized. Pumping rates during final well development was 125 L/min (33 gpm) for both intervals. The lower interval was pumped for 78 minutes and the upper interval was pumped for 83 minutes at this rate. The observed drawdown ranged from 1.5 to 1.9 m (15.9 to 17.9 ft). A Grundfos Redi-Flo3 10SQE-340 NE permanent sampling pump was installed with the intake at 141.2 m (463.1 ft) bgs, which is equivalent to 53.3 m (175.0 ft) below the static water level.

Carbon tetrachloride, chloroform, and TCE contaminant distributions in groundwater samples are shown in Figure 3-19. The highest concentration of carbon tetrachloride (1,700 µg/L) was found in a sample collected at a depth of 108.5 to 111.6 m (356 to 366 ft) bgs. Chloroform and technetium-99 were present at very low levels.

3.6.3 Well 699-43-69 (C5573)

Well 699-43-69 (C5573) is located near the northeast corner of the Waste Sampling and Characterization Facility. Drilling, well construction, well development, and decommissioning activities took place between December 12, 2007, and May 6, 2008. The borehole was drilled to a total depth of 152.9 m (501.5 ft) bgs, and groundwater was encountered at 94.4 m (309.7 ft) bgs (Figure 3-20). Two split-spoon samples for sieve analysis were collected, in addition to eight groundwater samples. Gravel-dominated and sand-dominated sediments of the Hanford formation extend from surface to 32 m (105 ft) bgs, while silt and caliche of the Cold Creek unit extend from 32 to 36.6 m (105 to 120 ft) bgs. Silty sandy gravels and sandy gravels of the Ringold Unit E extend from 36.6 to 110.9 m (120 to 364 ft) bgs. Silts of the Ringold Lower Mud Unit extend from 110.9 to 120.7 m (364 to 396 ft) bgs. Silty sandy gravels and sandy gravels of the Ringold Unit E extend from 120.7 to 145.4 m (364 to 477 ft) bgs. Silty sandy gravel of the Ringold Unit A extends from 145.4 to 152.4 m (477 to 500 ft) bgs. Basalt of the Elephant Mountain Member was encountered at 152.4 m (500 ft) bgs.

Well 699-45-69C was constructed as a groundwater monitoring well, with a 6-in. stainless-steel, 20-slot screen set from 122.0 to 132.6 m (400.2 to 435.2 ft) bgs. Two 4.6-m (15-ft) intervals were developed by pumping until turbidity was less than 5 NTU and other water parameters (including pH and conductivity) had stabilized. Pumping rates during final well development was 71.0 L/min (18.75 gpm) for both intervals. The lower interval was pumped for 60 minutes and the upper interval was pumped for 134 minutes at this rate. The observed drawdown ranged

from 1.5 to 1.9 m (5.0 to 6.2 ft). A Grundfos Redi-Flo3 10SQE-340 NE permanent sampling pump was installed with the intake at 127.0 m (416.8 ft) bgs, which is equivalent to 32.6 m (107.1 ft) below the static water level.

Vertical profiles were not prepared for this borehole as the data are not currently available.

3.7 CONCLUSIONS

Throughout the period covered by this report, activities continued at the 200-ZP-1 OU pump-and-treat system. In terms of the three RAOs, the following accomplishments are recognized:

- ***RAO #1: Prevent further movement of contaminants from the highest concentration area of the baseline plume.***

  Results: The pump-and-treat system continues to capture carbon tetrachloride in the baseline high-concentration areas of the plume. Based on current extraction and monitoring well data, the highest concentration portion of the contaminant plume (>3,000 μg/L) has been nearly eliminated, with only one well having a concentration slightly above 3,000 μg/L. The 2,000 μg/L plume also continued to shrink in the baseline target area under the combined influence of extraction and injection pumping. Continued monitoring will allow tracking of carbon tetrachloride concentrations and will provide information about the conformation and movement of the baseline 2,000 μg/L plume.

- ***RAO #2: Reduce contamination in the areas of highest concentration of carbon tetrachloride.***

  Results: During the first half of FY08, 2.29 x 10^8 L of groundwater from 10 extraction wells were processed through the water treatment plant (an 11% decrease in production compared to the ten pumped wells available during the first half of FY07). The mean concentrations of contaminants going into the treatment plant were 1,443 μg/L for carbon tetrachloride, 9.2 μg/L for chloroform, and 3 μg/L for TCE. The removal efficiency for carbon tetrachloride was >99.8%, and an estimated 348.8 kg of carbon tetrachloride was removed from the treated water during the first half of FY08 (a 17% decrease over the first half of FY07, reflecting a general decrease in carbon tetrachloride concentration in the contaminant plume, as well as a lower pumping rate). Over the longer period, reduction in both the extent and level of carbon tetrachloride contamination within the highest concentration portion of the contaminant plume is clearly demonstrated by the contours plotted in Figure 3-11, which shows carbon tetrachloride contours from June 1996 and August 2007.

- ***RAO #3: Provide information that will lead to development of a final remedy that will be protective of human health and the environment.***

  Results: Programmed data collection continues to help refine the conceptual model for the carbon tetrachloride plume. Construction of three new monitoring wells was completed in the OU in FY07 and FY08. Depth-specific sampling provided valuable information on the vertical distribution of carbon tetrachloride, as well as better definition of the extent of carbon tetrachloride in the deeper portion of the unconfined aquifer.

  The baseline carbon tetrachloride plume is being captured and controlled by the pump-and-treat system. Contaminant mass is being steadily removed from the groundwater, and additional data (including the distribution of contaminants within the plume) are

being gathered to lead to the development of a final remedy. The enlarged extraction well network increased the system extraction rate and provides more rapid remediation of the baseline carbon tetrachloride plume.

3.8 RECOMMENDATIONS

The following recommendations are made for the 200-ZP-1 pump-and-treat system:

- An evaluation of the number of wells that are monitored, as well as the frequency of sampling, should be undertaken. Some areas where concentrations are rapidly changing may need to be sampled more often, while areas where concentrations are well established and stable may warrant less frequent sampling.
- Well 299-W15-15, which became sample dry after July 2007, should be replaced. This well monitored groundwater flow between injection and extraction wells within the 200-ZP-1 treatment system. Over time, the well showed evidence of decreasing carbon tetrachloride and increasing technetium-99 concentrations. The carbon tetrachloride trend can be used to infer that the treatment system has been effective in cleaning up the aquifer. Well 299-W15-15 is the well nearest to the most regularly used injection and extraction wells and has yielded the highest concentrations of technetium-99. Since technetium-99 acts as a tracer, it provides a relative sense of how high technetium-99 concentrations were at the point of injection. A new well should be installed near the existing well and screened deep enough in the unconfined aquifer to continue monitoring aquifer response to treatment and injection. This replacement well should be coordinated with the 200-ZP-1 Proposed Plan (DOE/RL-2007-33) and design documents to maximize the benefit.
- Consideration should be given to drilling two new monitoring wells to help with characterizing the deep aquifer carbon tetrachloride plume. A potential data gap may exist in the area to the southwest of T Plant and a well located approximately midway between the 216-Z-9 Trench and well 299-W11-87 would provide additional information about the nature and extent of the deep plume. As well, the leading edge (i.e., toward the northeast) of the deep plume is not well constrained by the current well array. A new well located between well 299-W11-87 and well 699-45-69C would provide useful information about the plume margin. Well locations should be coordinated with the 200-ZP-1 Proposed Plan (DOE/RL-2007-33) and design documents to maximize the benefit.

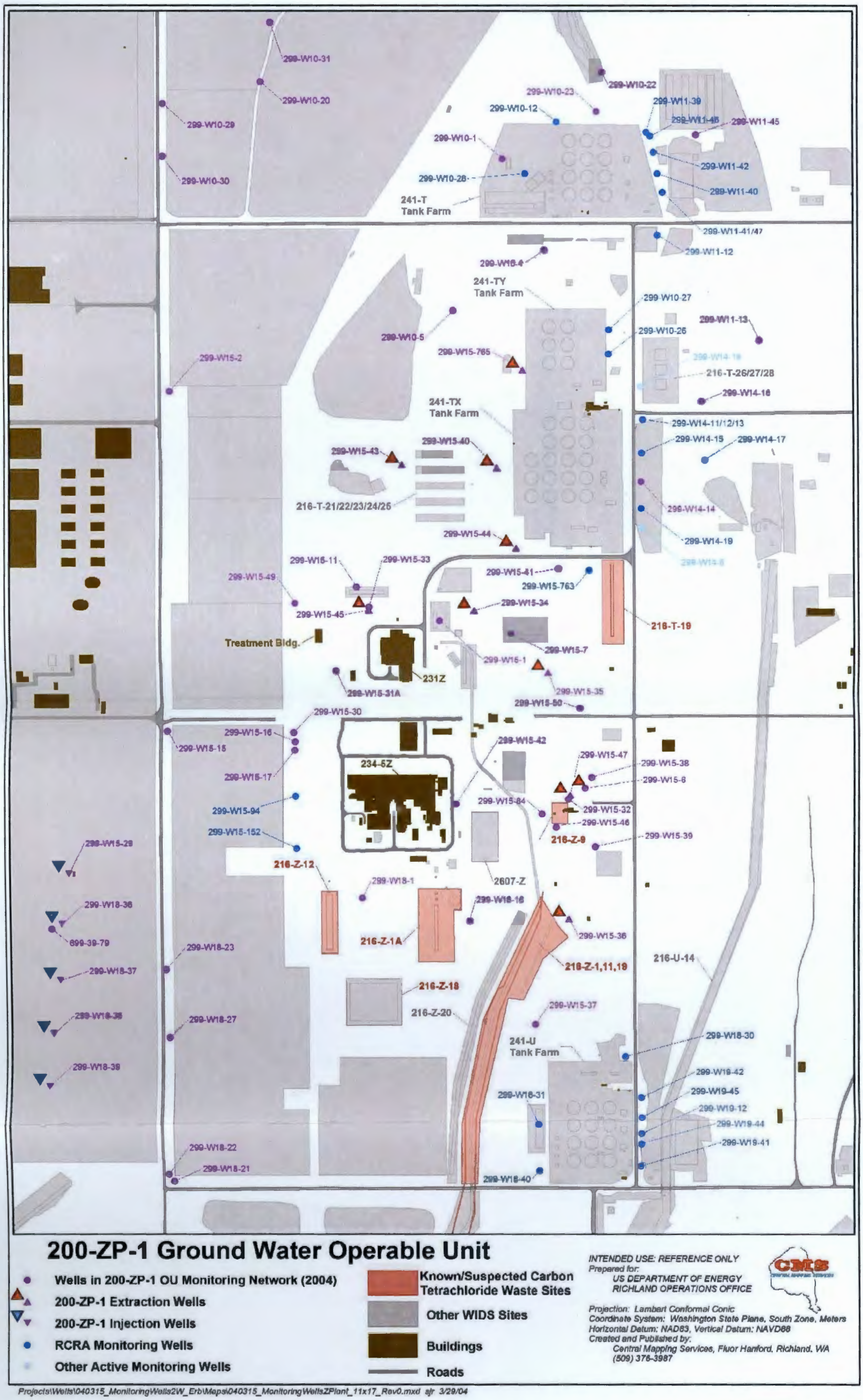


Figure 3-1. 200-ZP-1 Operable Unit Pump-and-Treat Site Showing Extraction and Monitoring Well Locations.

Figure 3-2. 200-ZP-1 Operable Unit Pump-and-Treat Process Flow Diagram.

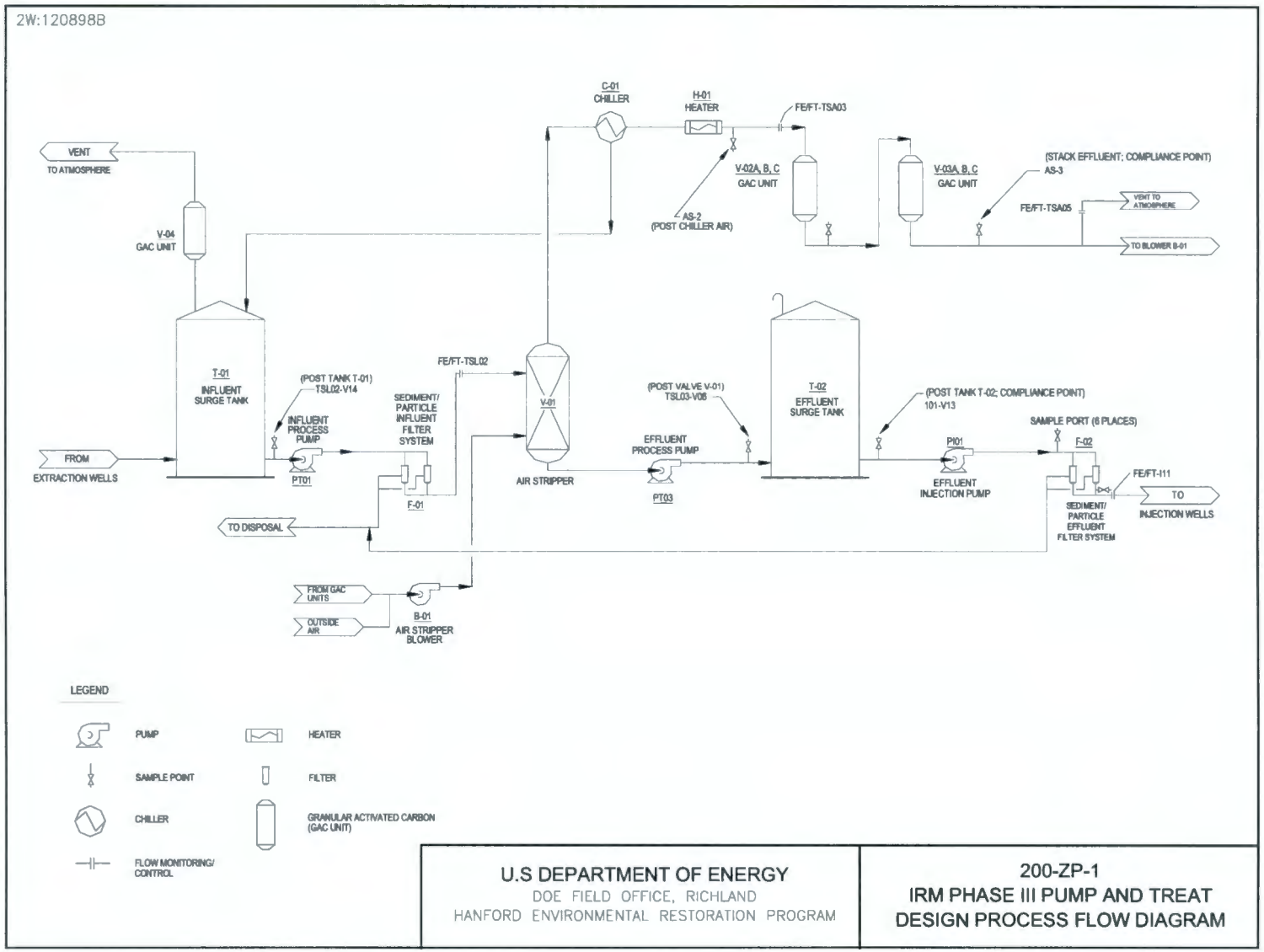


Figure 3-3. New Wells Installed During Fiscal Year 2007 and Fiscal Year 2008.

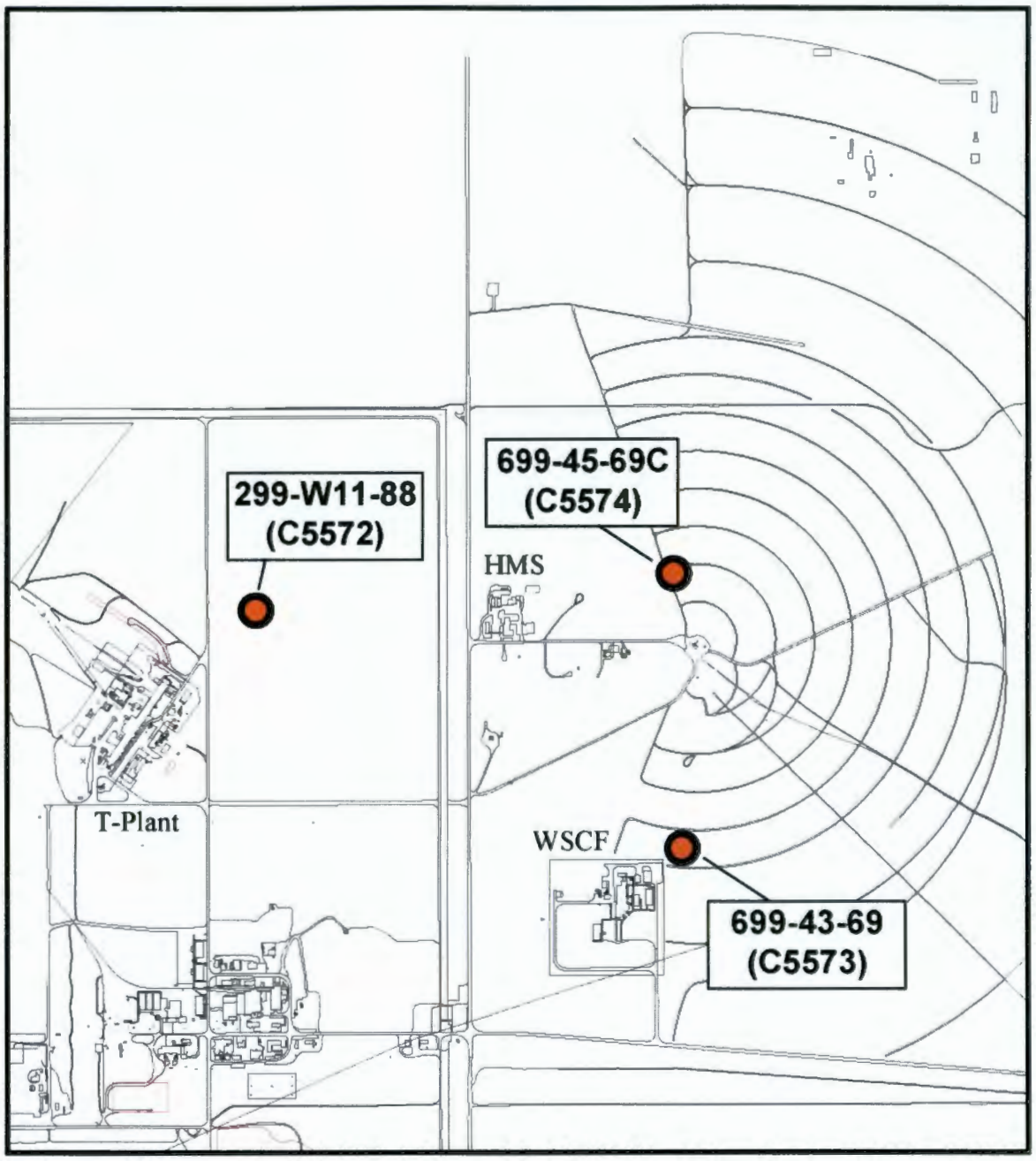
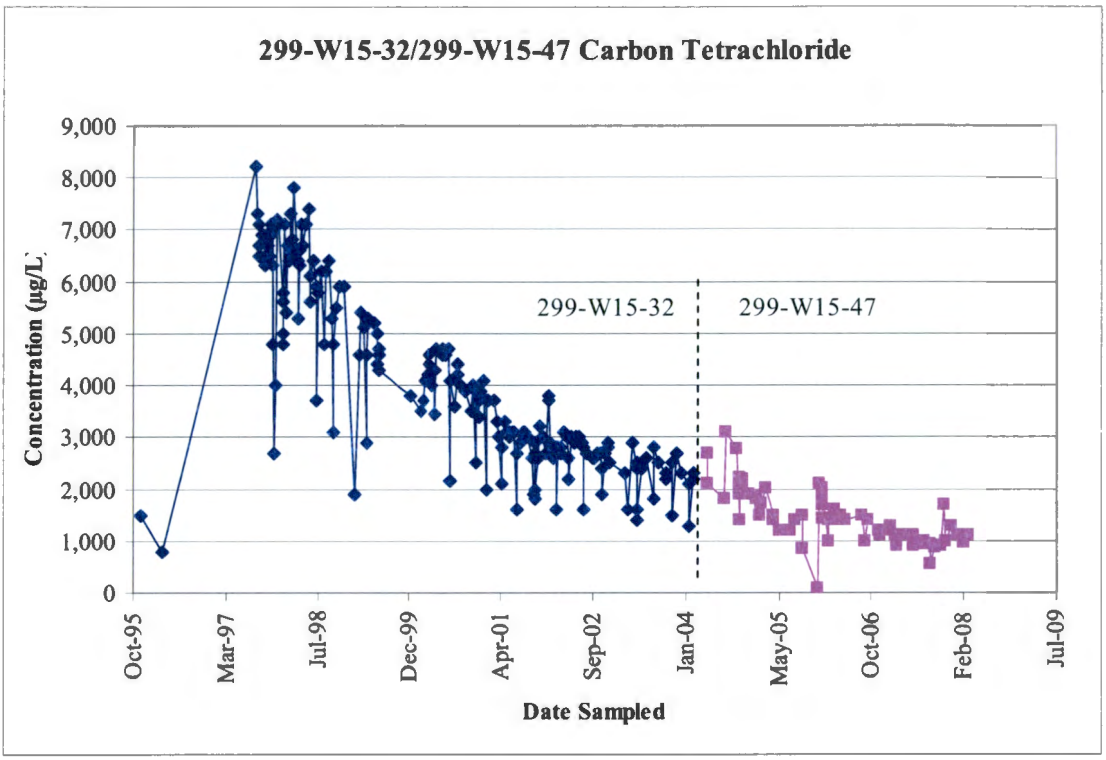


Figure 3-4. 200-ZP-1 Operable Unit Carbon Tetrachloride Extraction Well Trend Plots. (5 sheets)



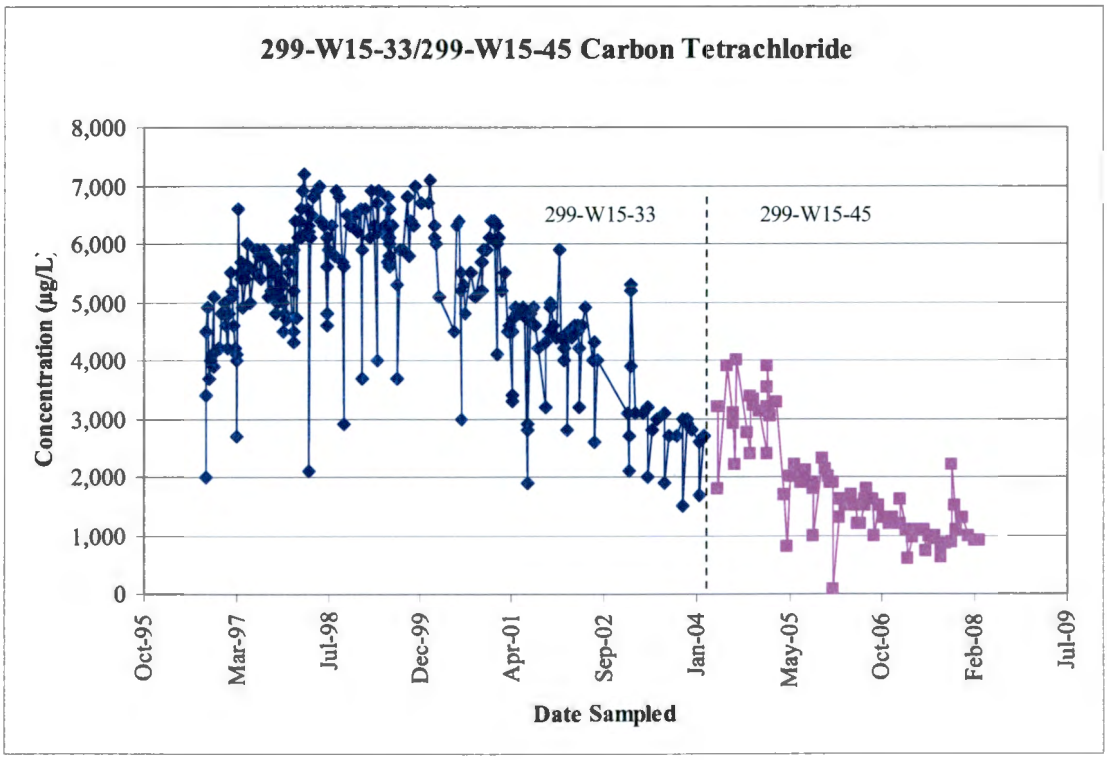
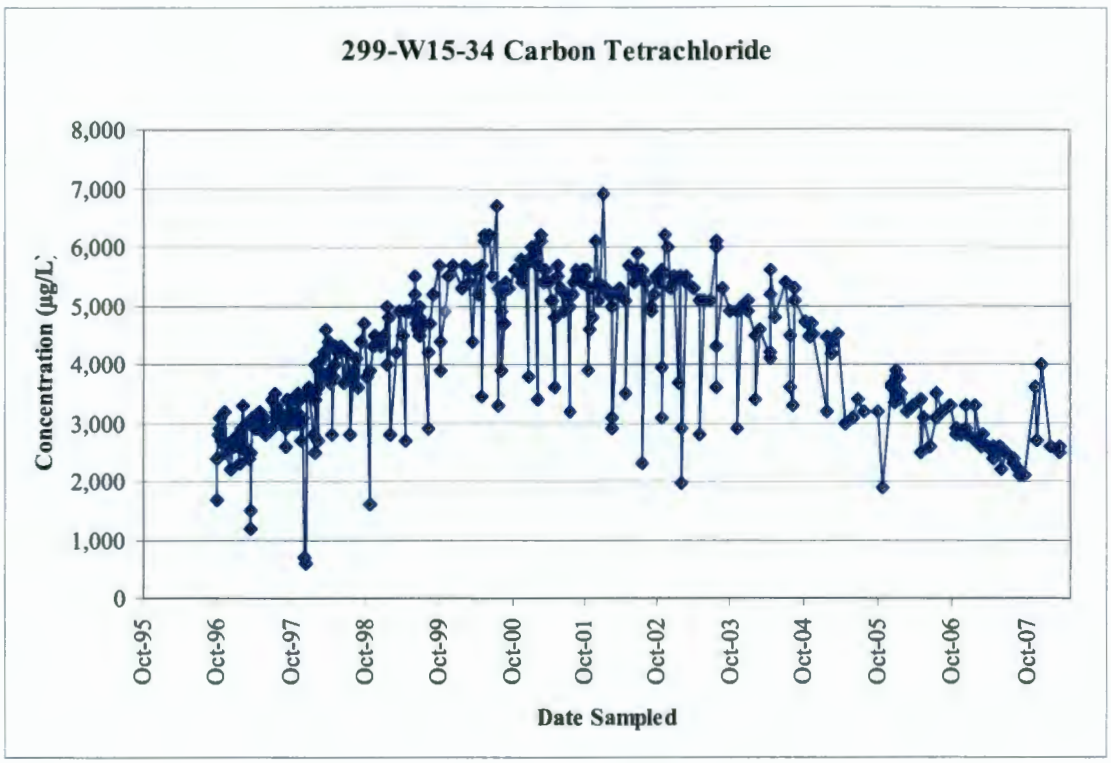


Figure 3-4. 200-ZP-1 Operable Unit Carbon Tetrachloride Extraction Well Trend Plots. (5 sheets)



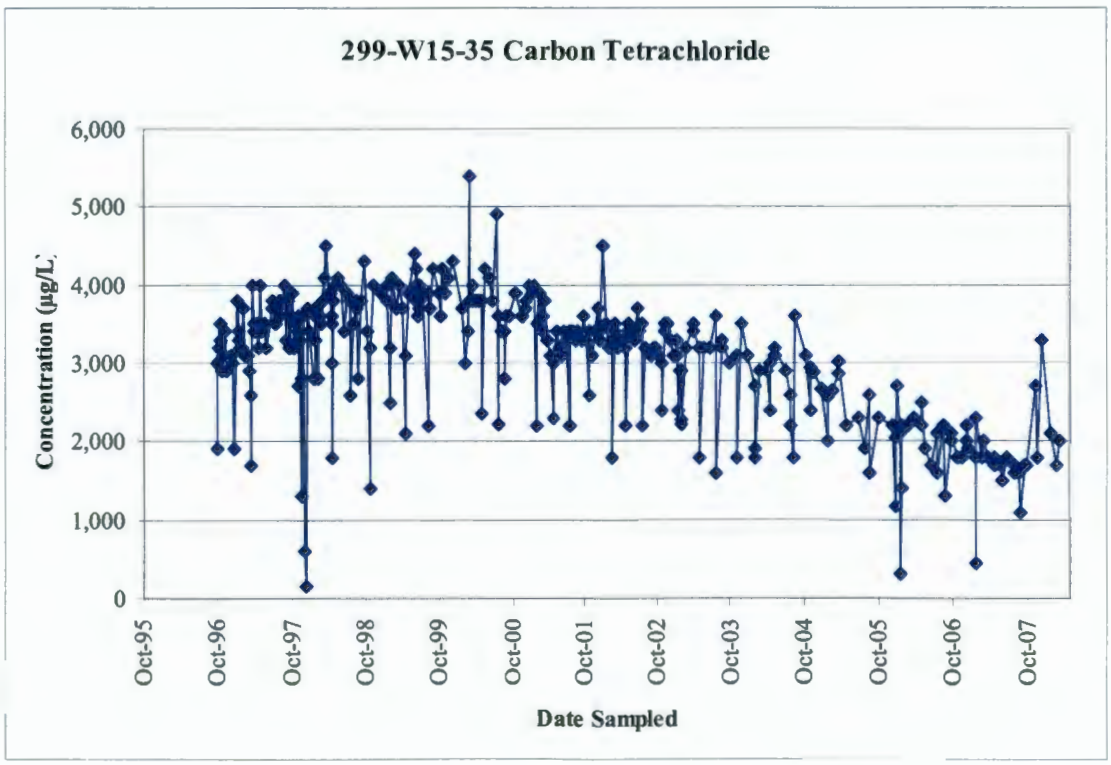
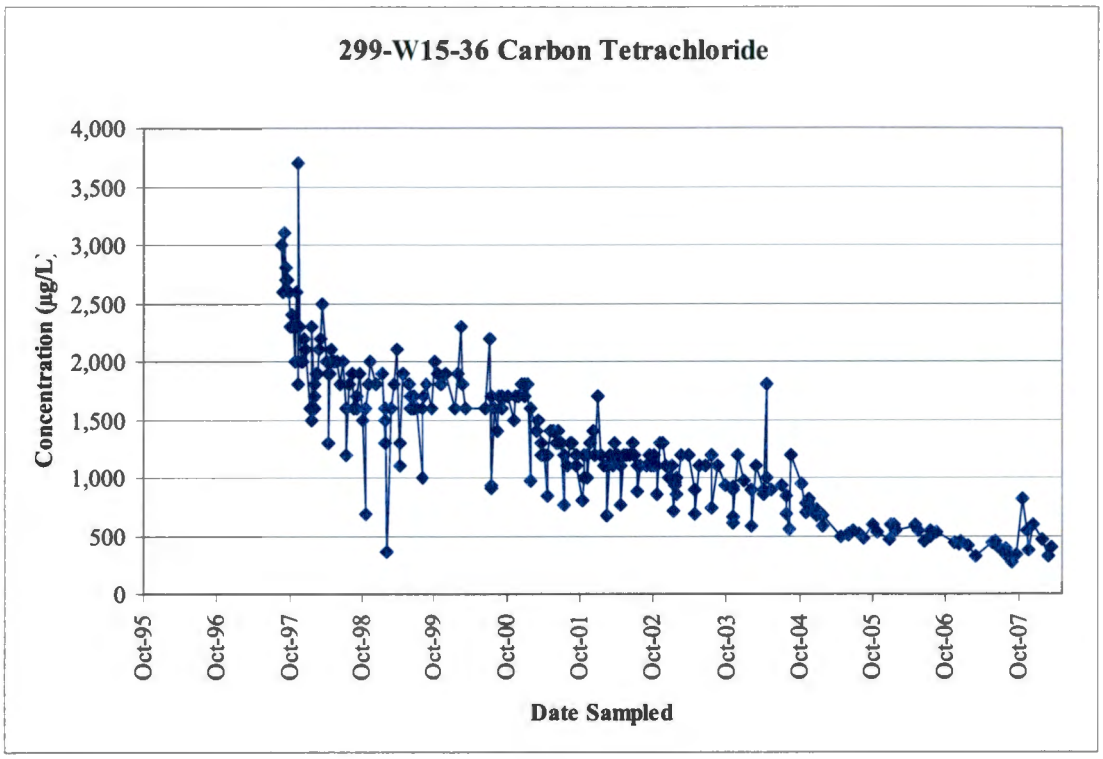


Figure 3-4. 200-ZP-1 Operable Unit Carbon Tetrachloride Extraction Well Trend Plots. (5 sheets)



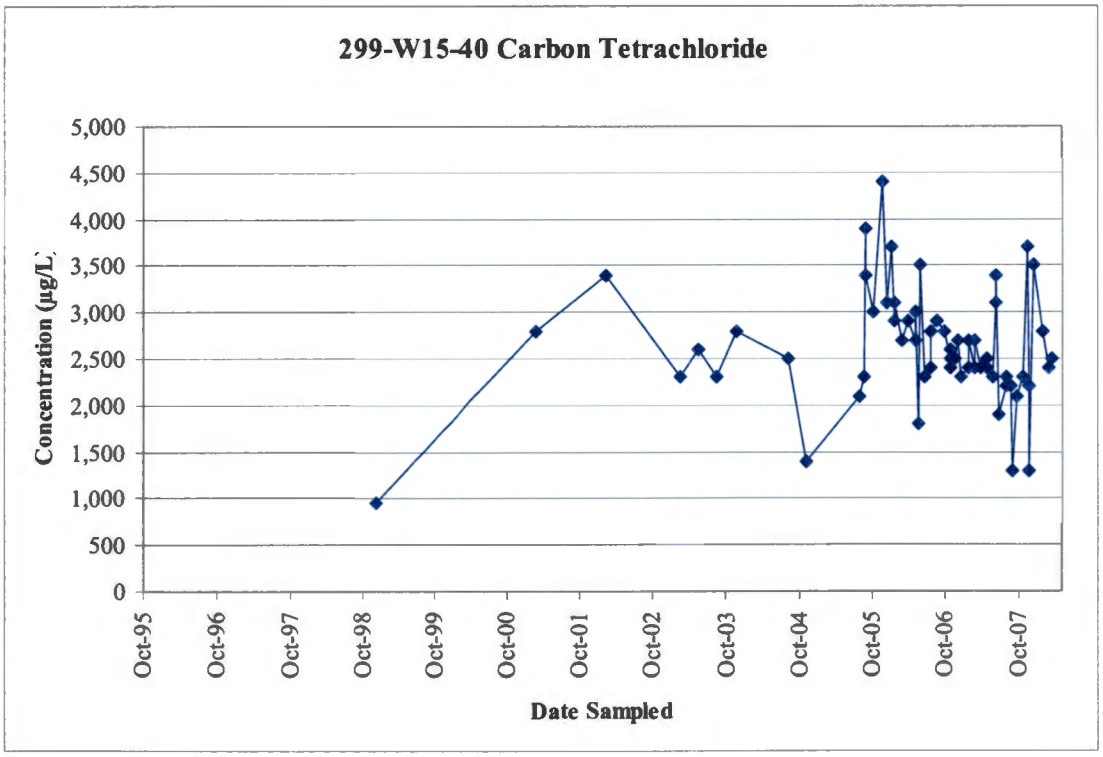
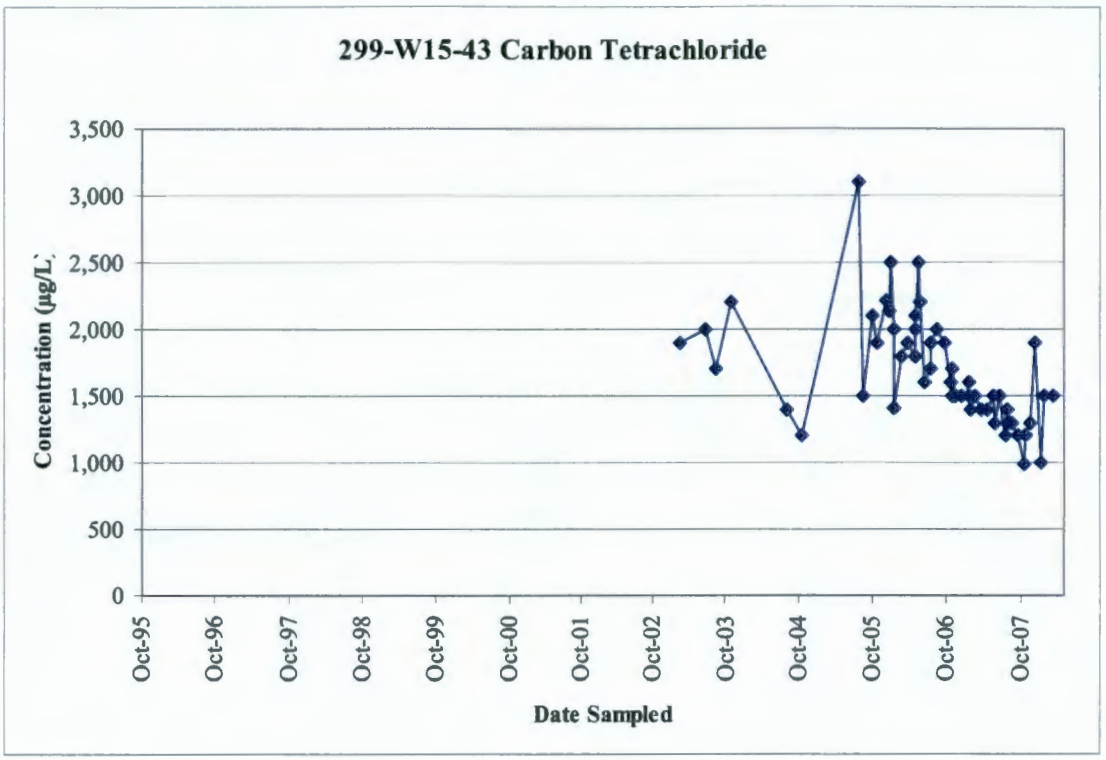


Figure 3-4. 200-ZP-1 Operable Unit Carbon Tetrachloride Extraction Well Trend Plots. (5 sheets)



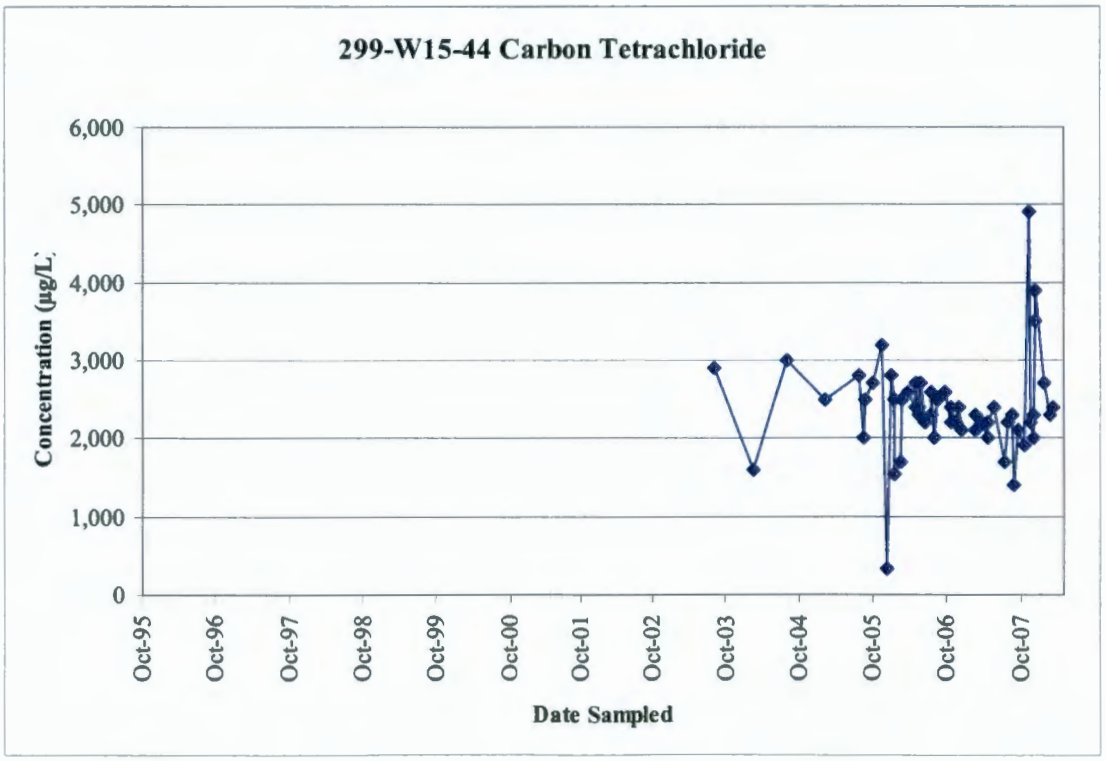


Figure 3-4. 200-ZP-1 Operable Unit Carbon Tetrachloride Extraction Well Trend Plots. (5 sheets)

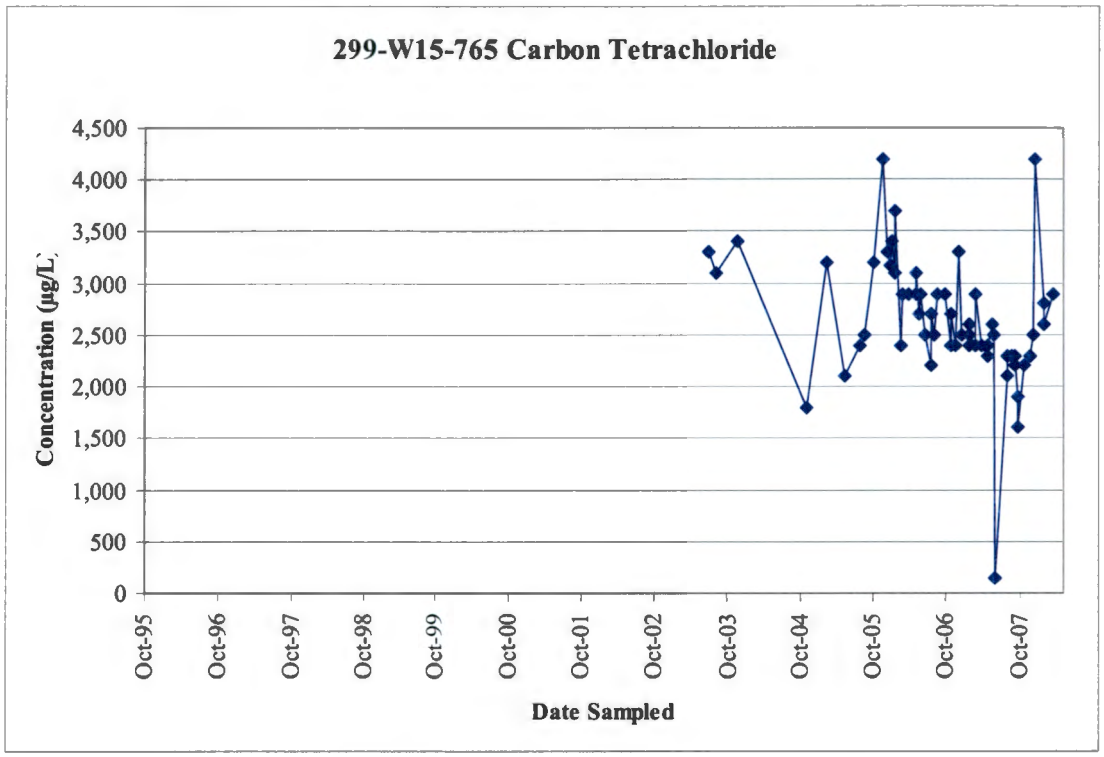
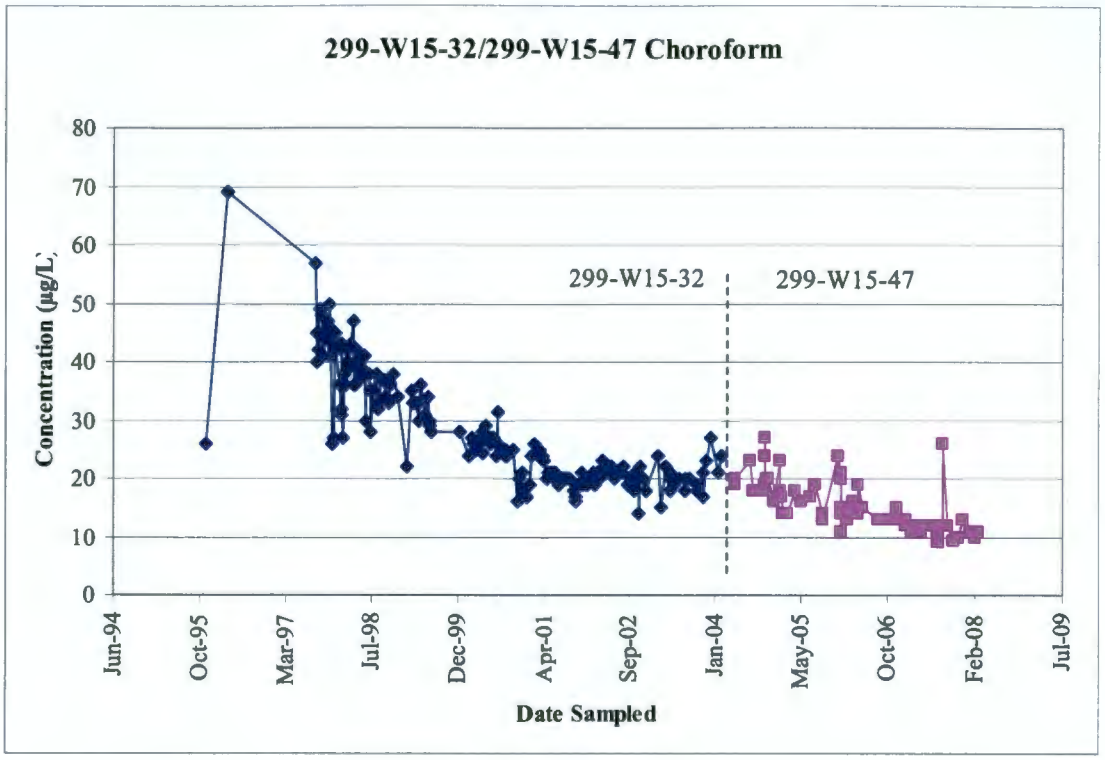


Figure 3-5. 200-ZP-1 Operable Unit Chloroform Extraction Well Trend Plots. (5 sheets)



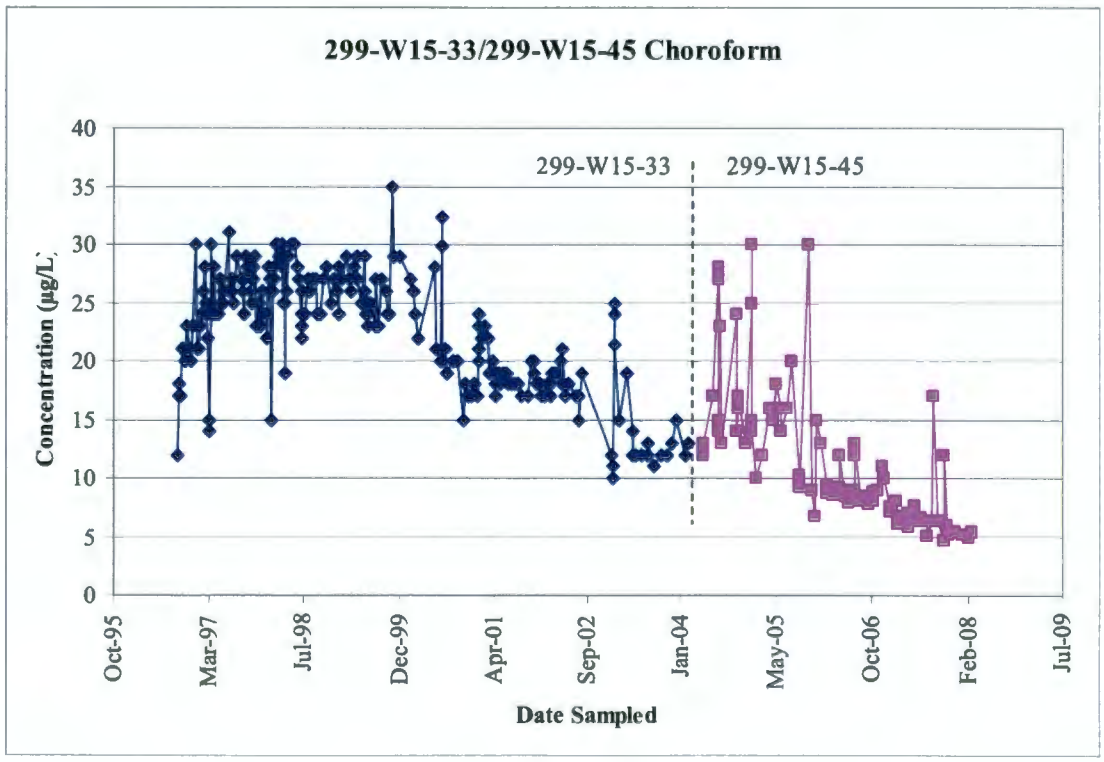
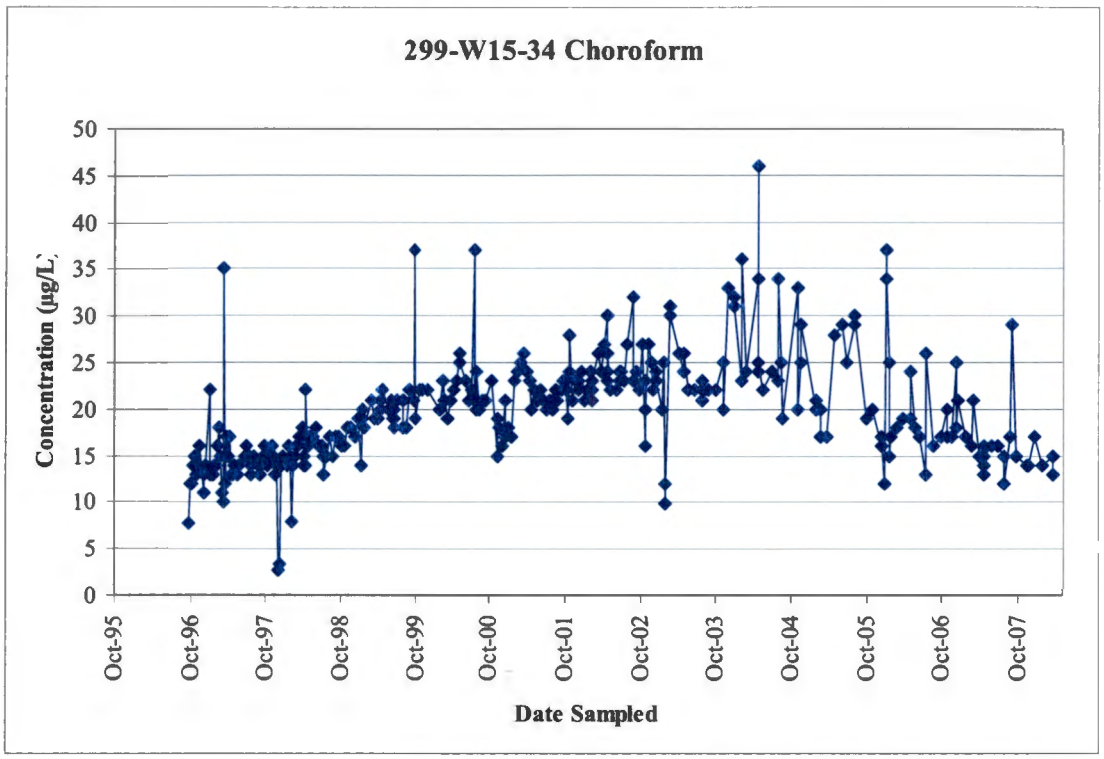


Figure 3-5. 200-ZP-1 Operable Unit Chloroform Extraction Well Trend Plots. (5 sheets)



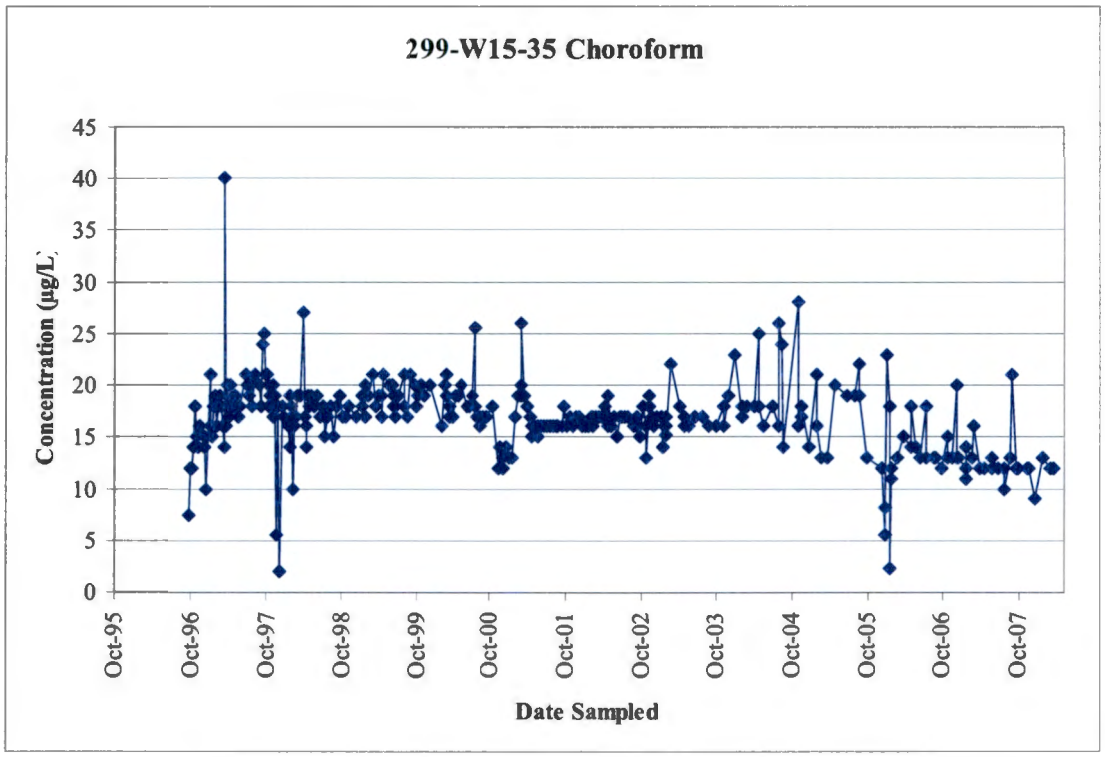
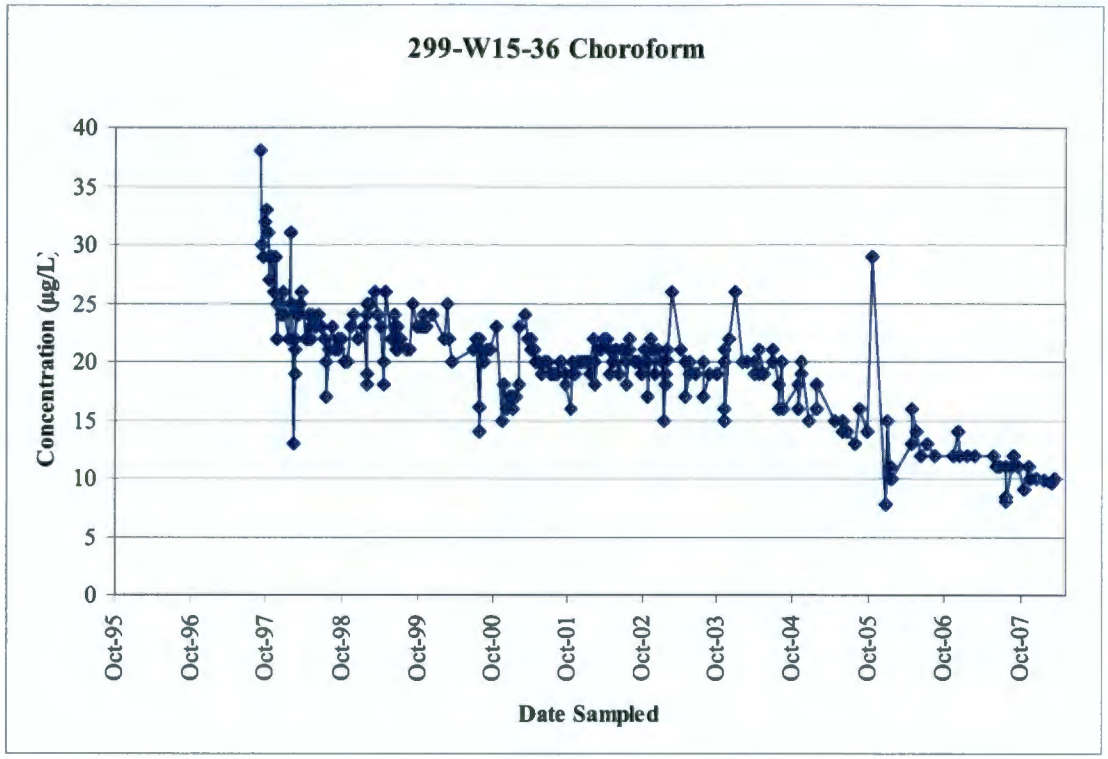


Figure 3-5. 200-ZP-1 Operable Unit Chloroform Extraction Well Trend Plots. (5 sheets)



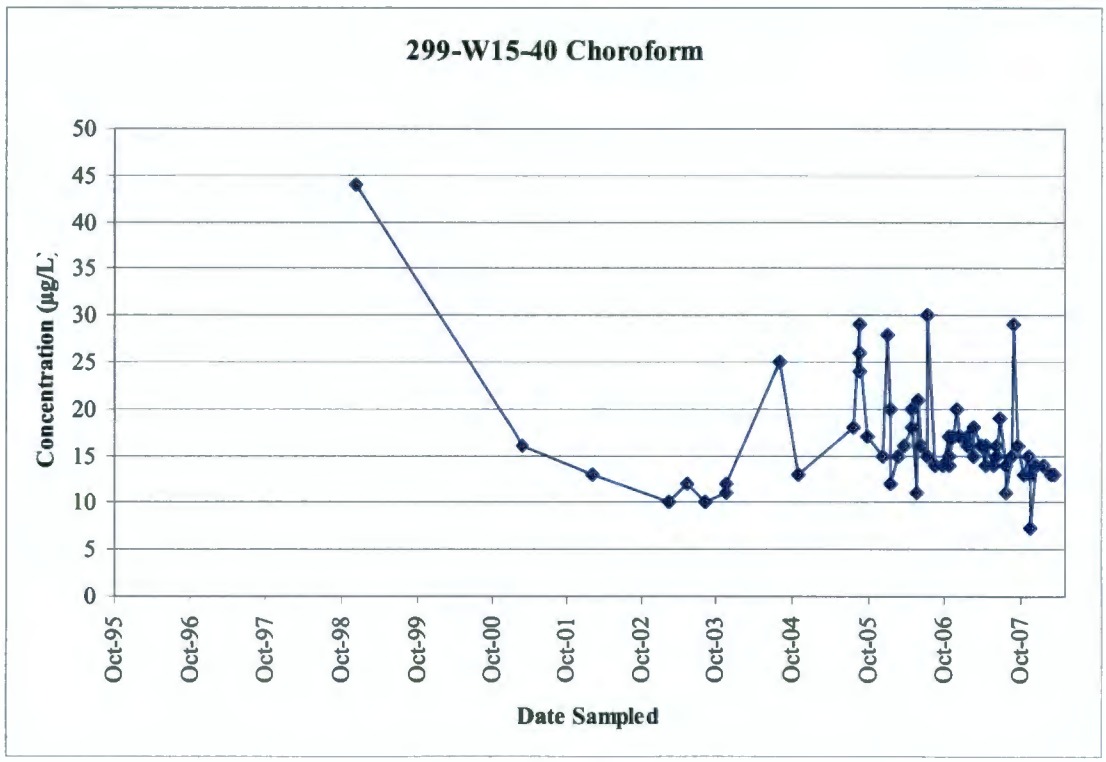
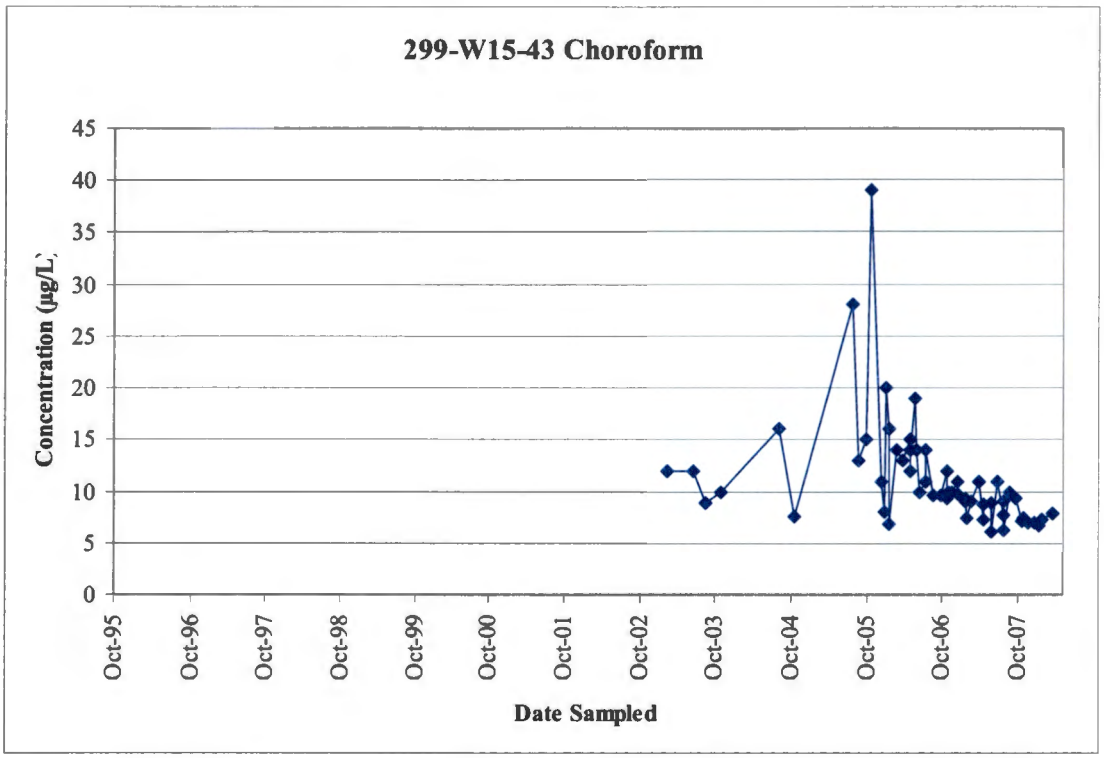


Figure 3-5. 200-ZP-1 Operable Unit Chloroform Extraction Well Trend Plots. (5 sheets)



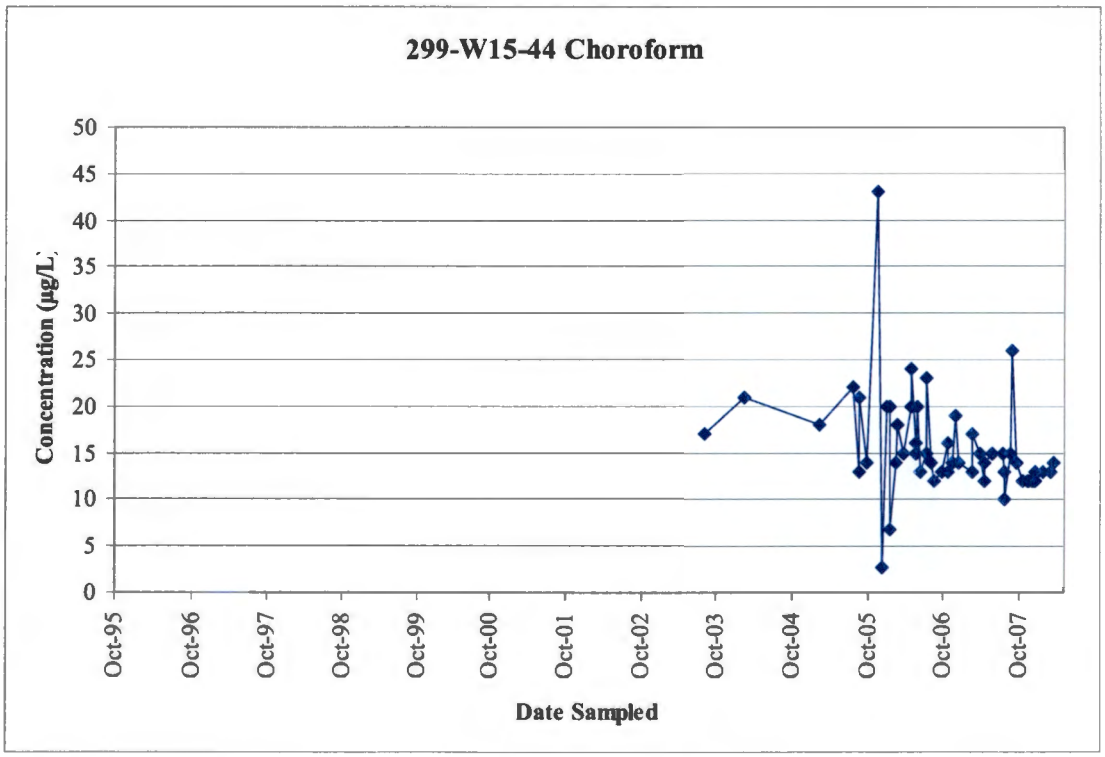


Figure 3-5. 200-ZP-1 Operable Unit Chloroform Extraction Well Trend Plots. (5 sheets)

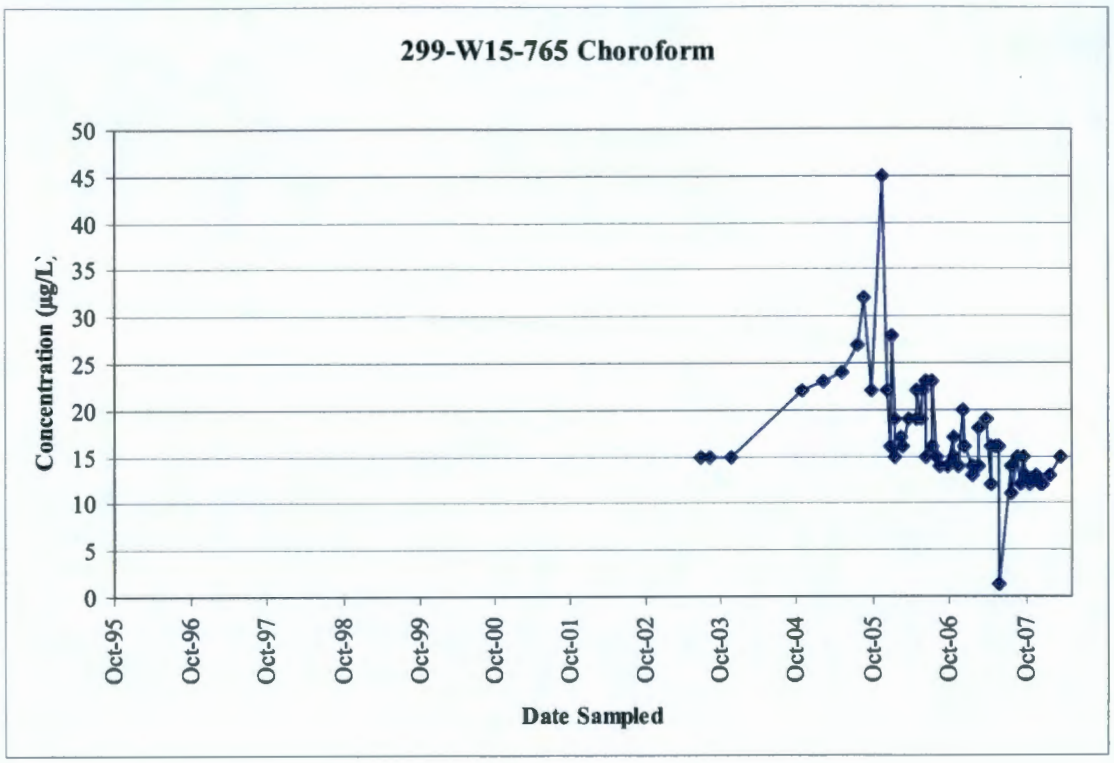
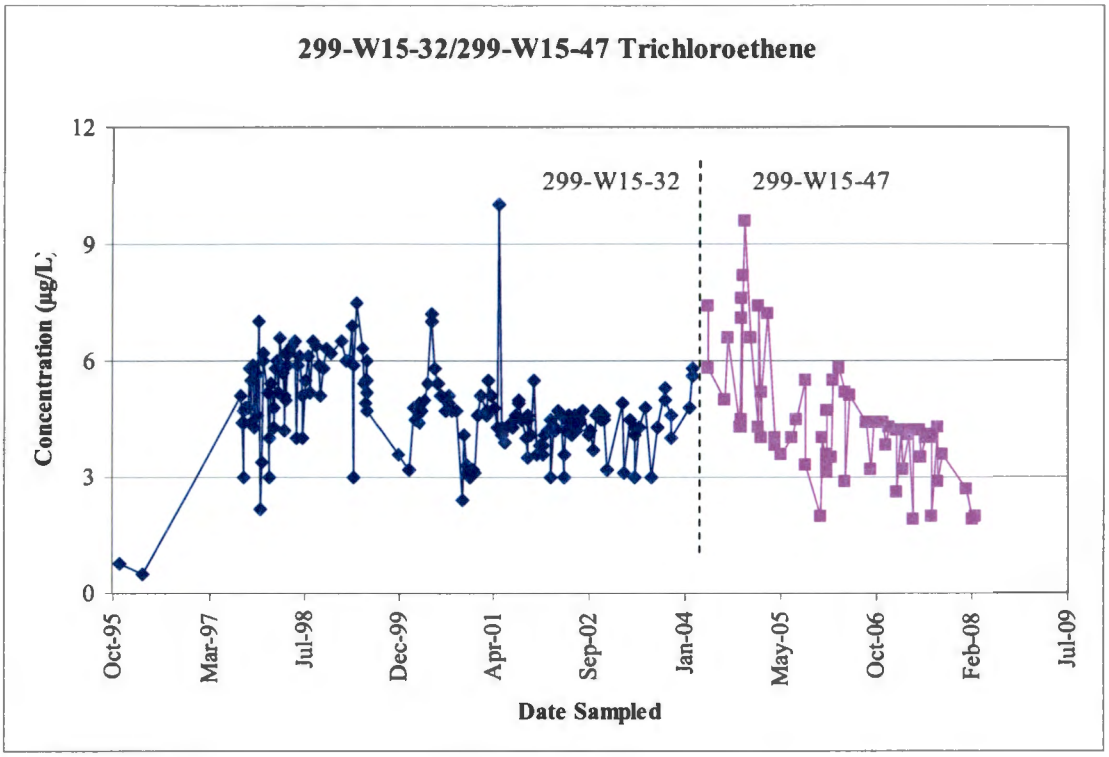


Figure 3-6. 200-ZP-1 Operable Unit Trichloroethene Extraction Well Trend Plots. (5 sheets)



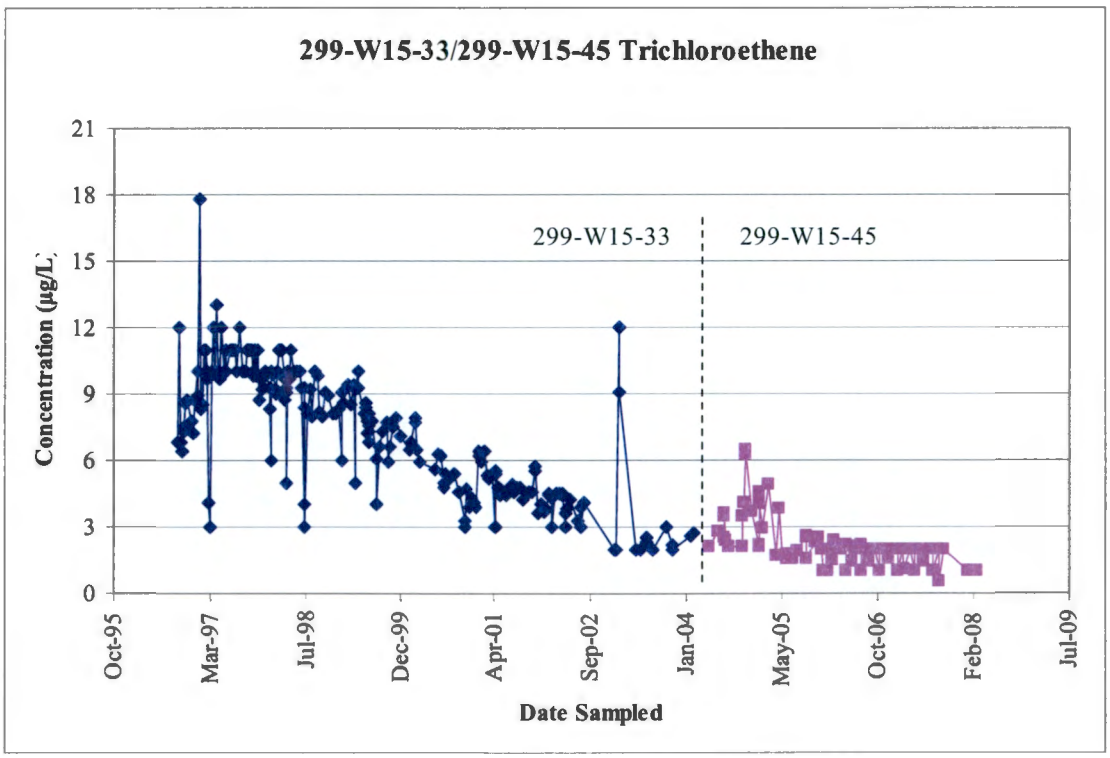
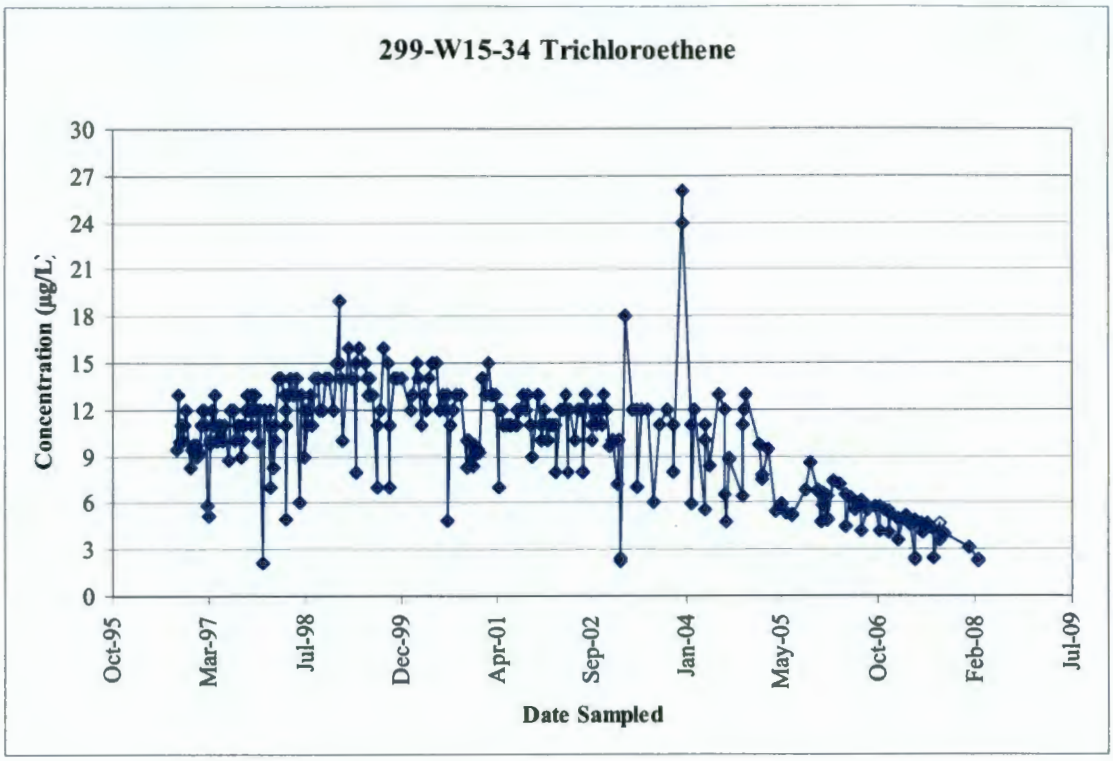


Figure 3-6. 200-ZP-1 Operable Unit Trichloroethene Extraction Well Trend Plots. (5 sheets)



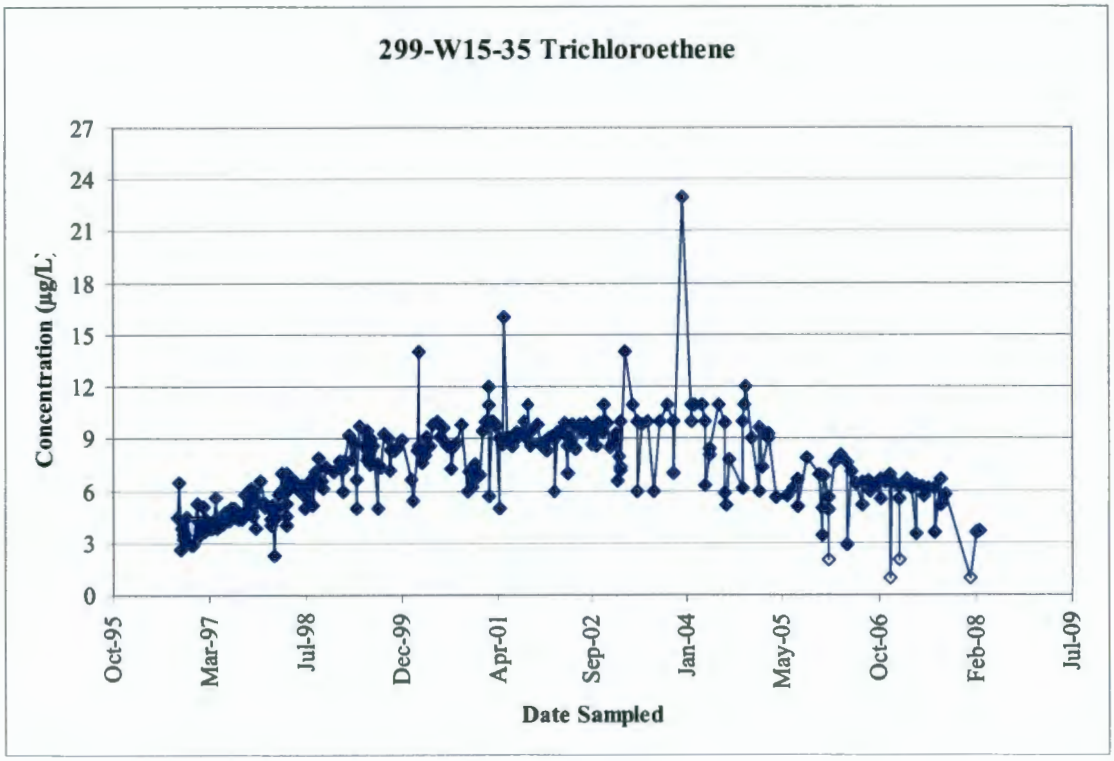
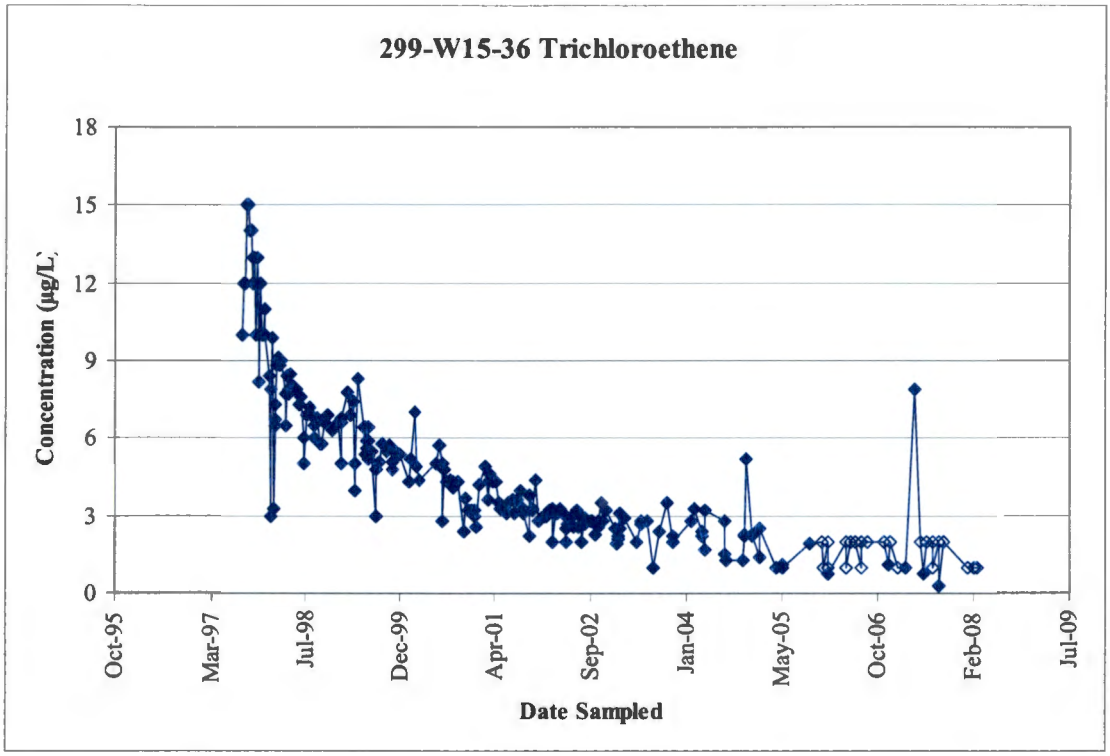


Figure 3-6. 200-ZP-1 Operable Unit Trichloroethene Extraction Well Trend Plots. (5 sheets)



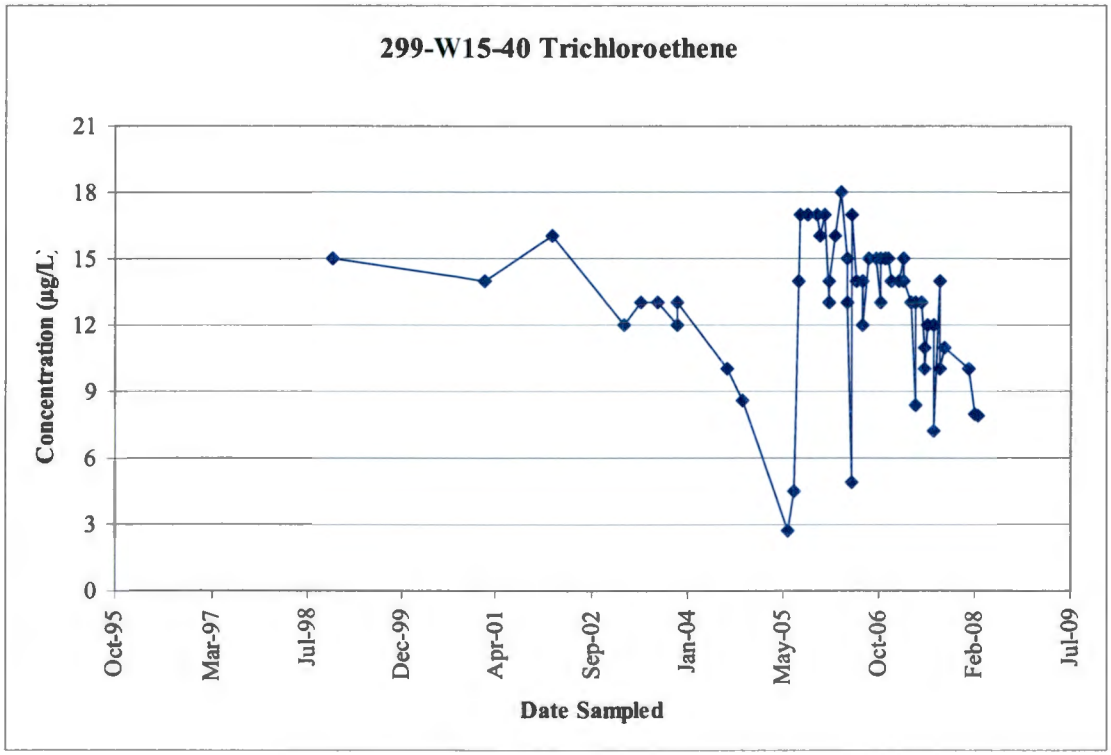
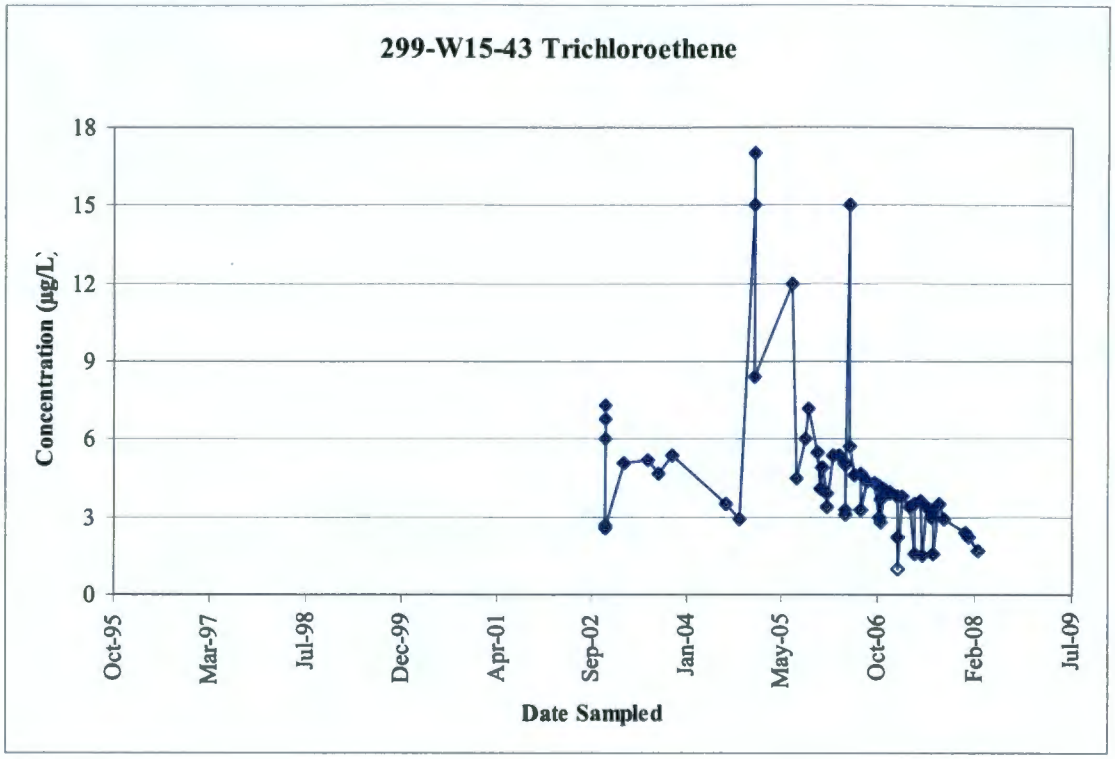


Figure 3-6. 200-ZP-1 Operable Unit Trichloroethene Extraction Well Trend Plots. (5 sheets)



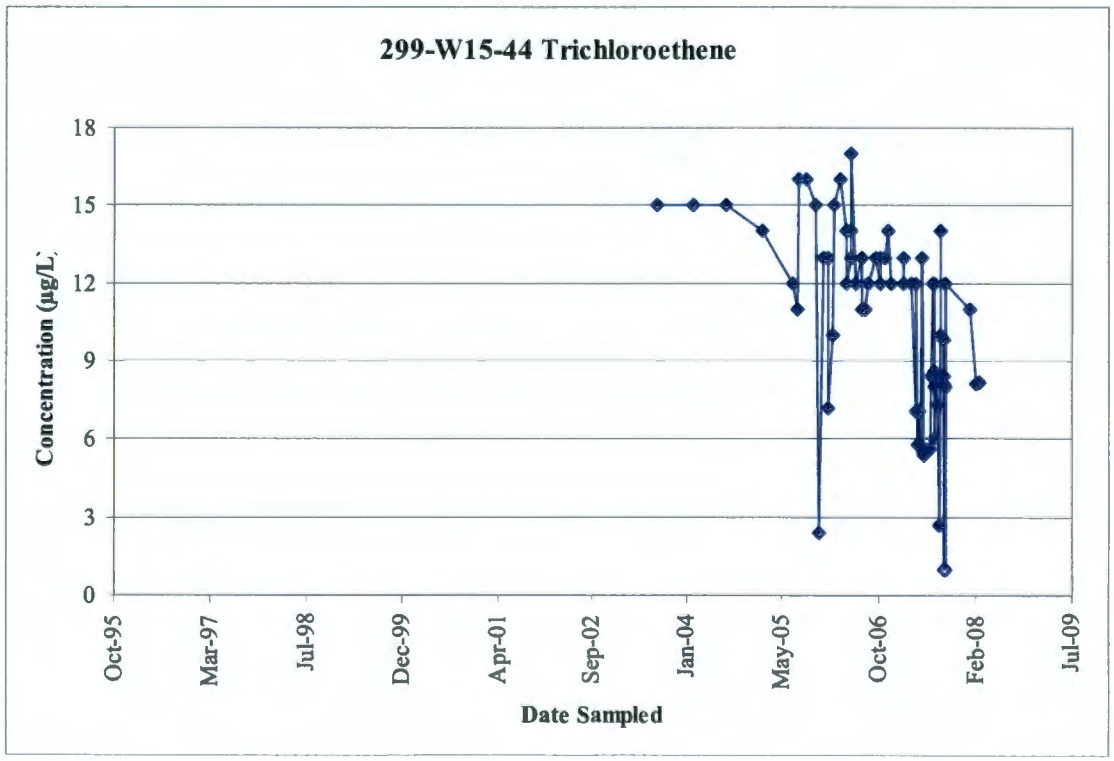


Figure 3-6. 200-ZP-1 Operable Unit Trichloroethene Extraction Well Trend Plots. (5 sheets)

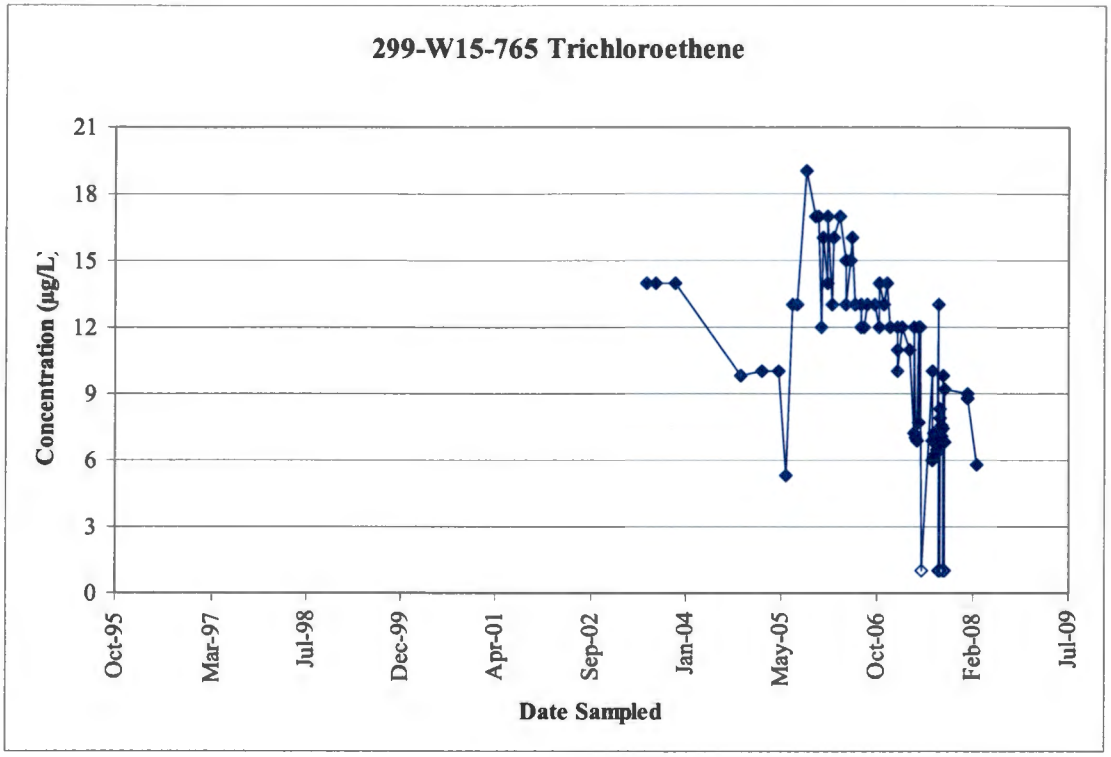


Figure 3-7. Carbon Tetrachloride Removed Versus Groundwater Treated.

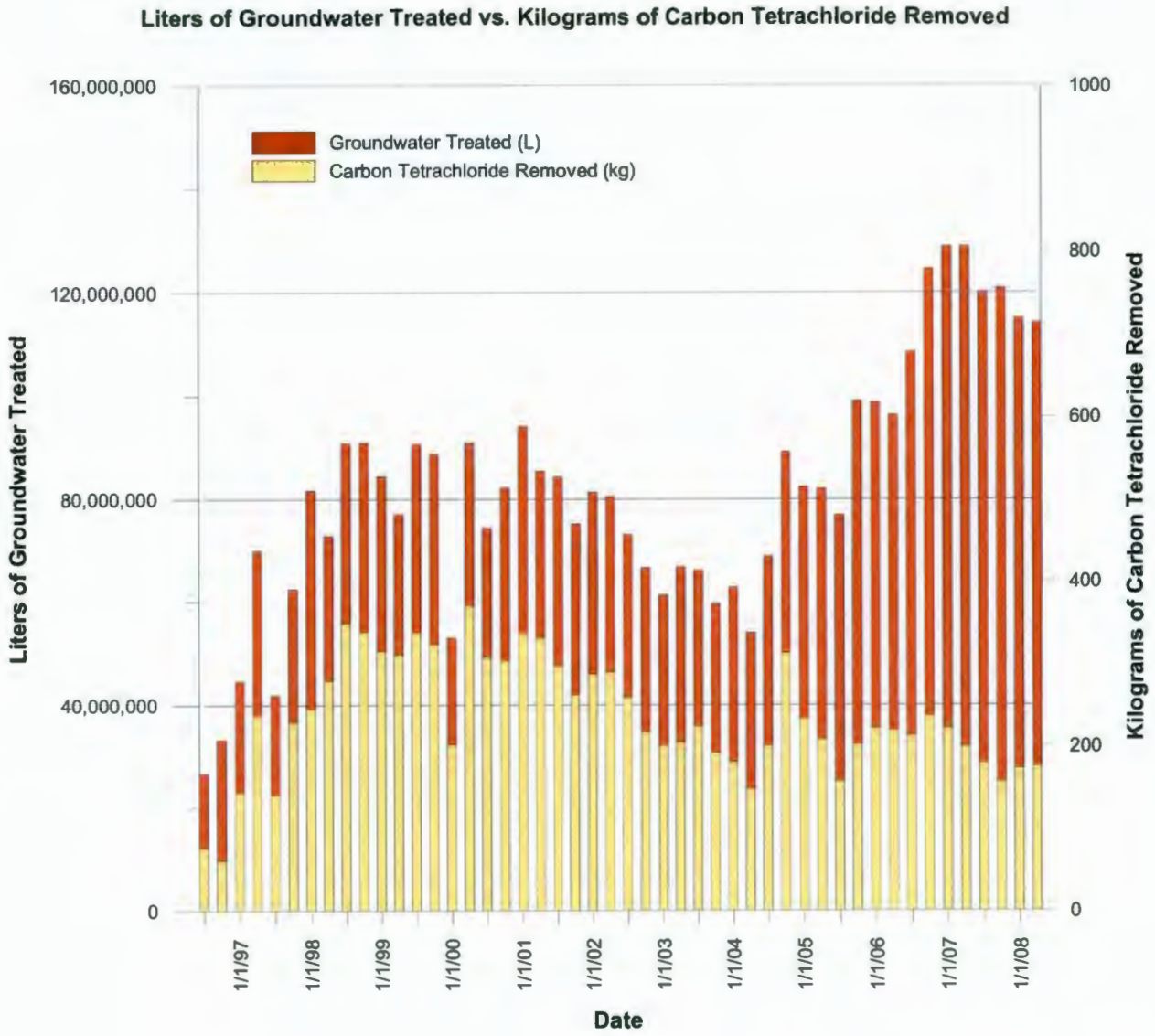


Figure 3-8. Cumulative Carbon Tetrachloride Removed Versus Cumulative Groundwater Treated.

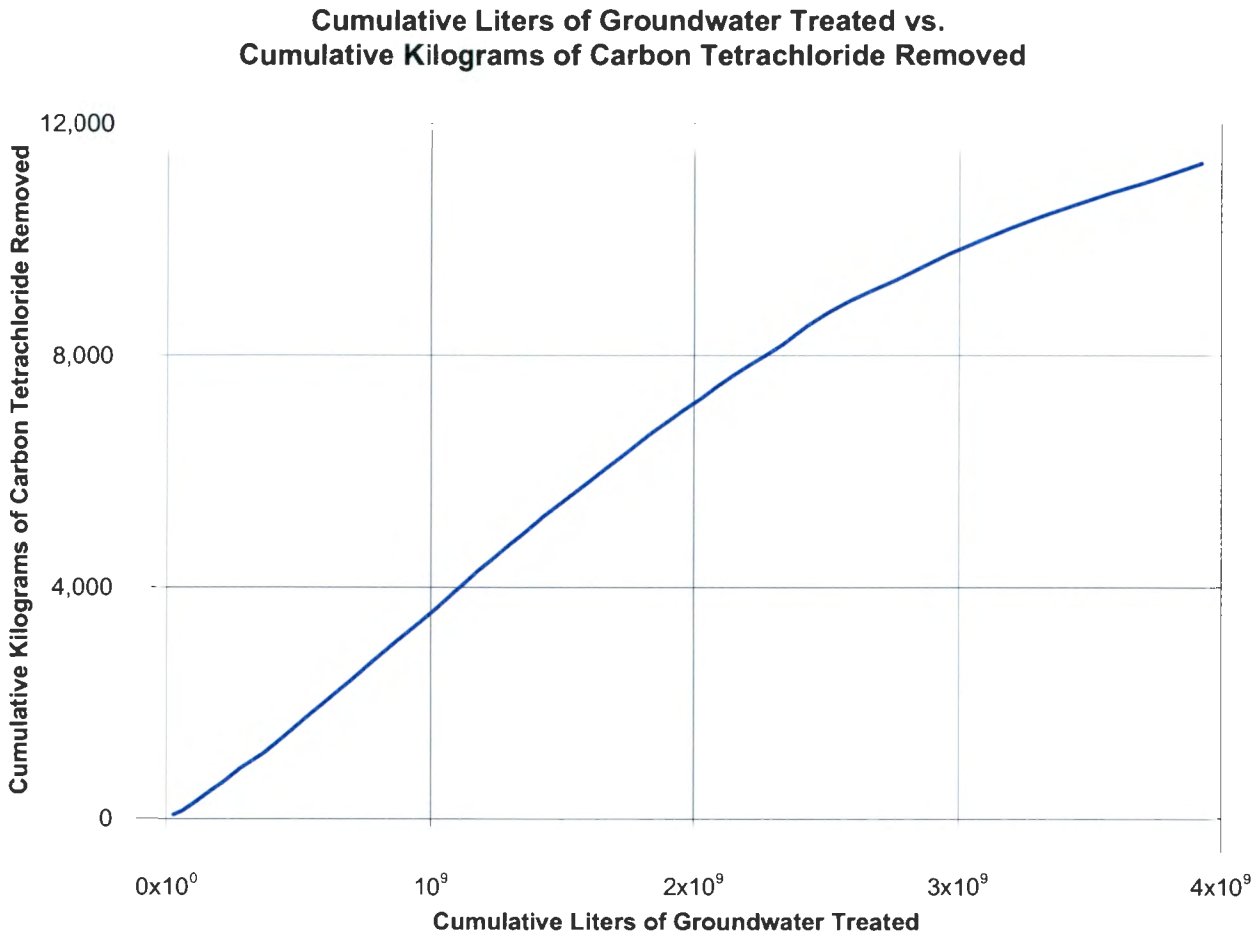


Figure 3-9. 241-T and TX/TY Tank Farms Technetium-99 Plume Map, Fiscal Year 2007.

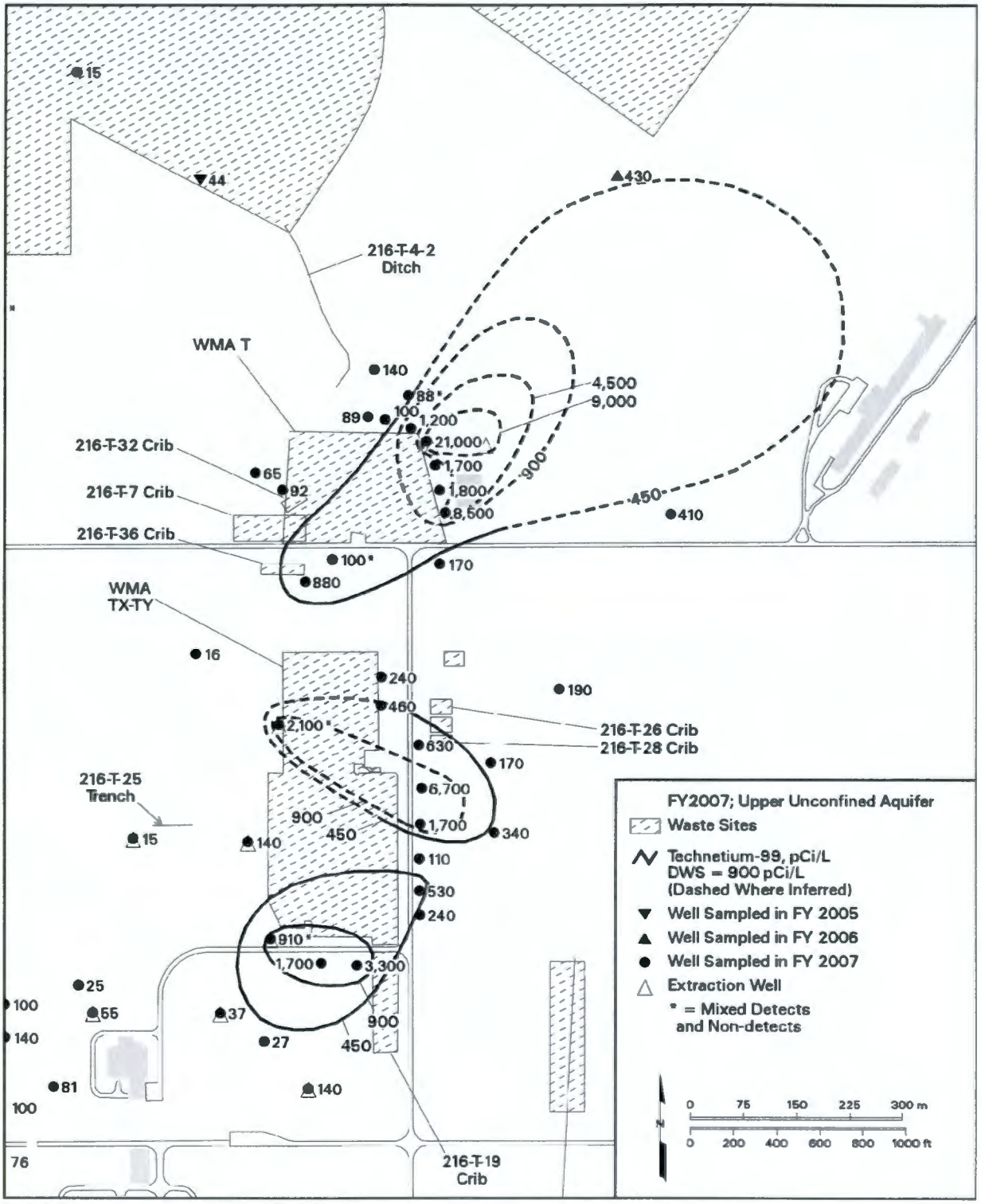
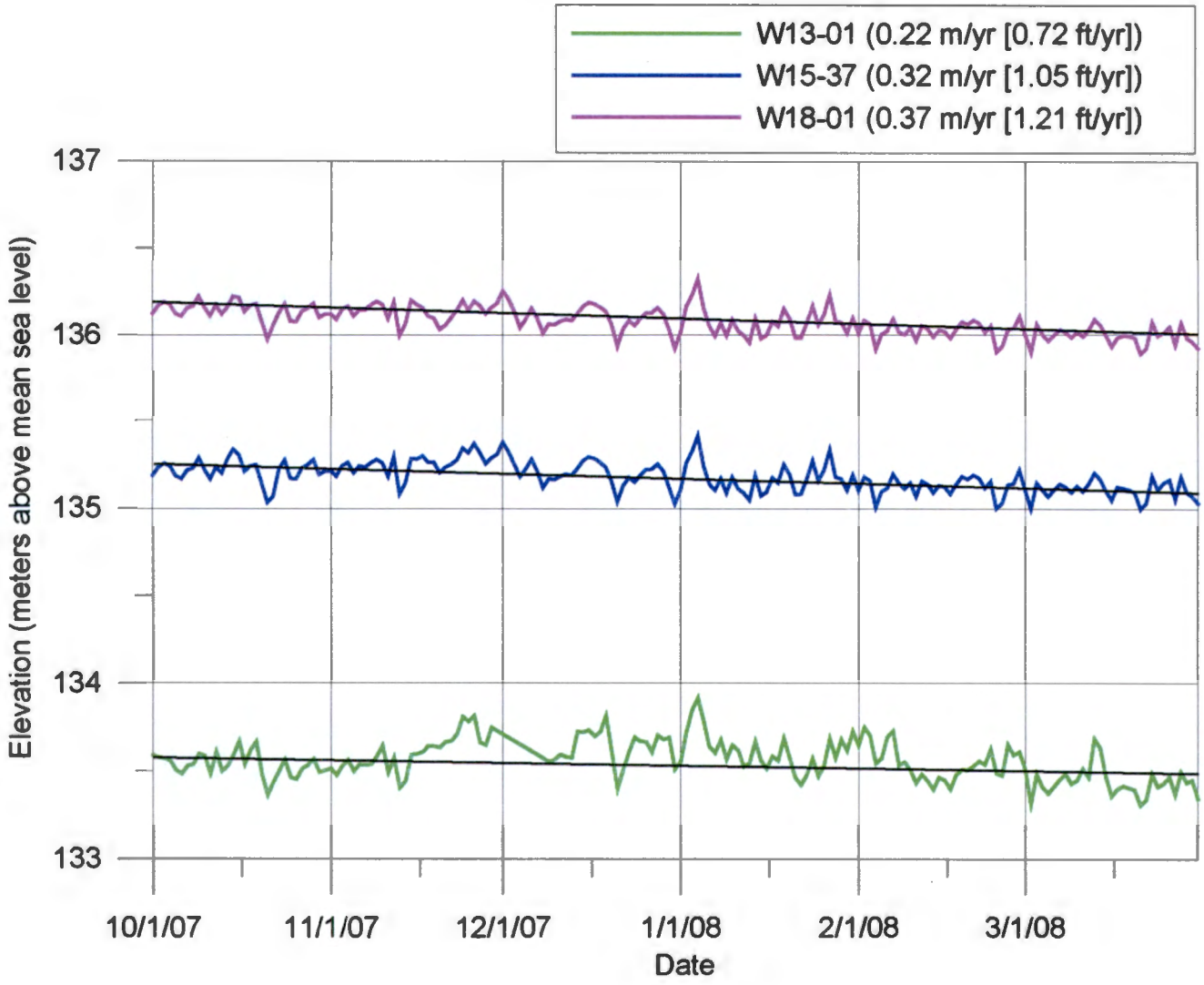


Figure 3-10. Hydrographs for Wells 299-13-1, 299-W15-37, and 299-W18-1 (First Half of Fiscal Year 2008).



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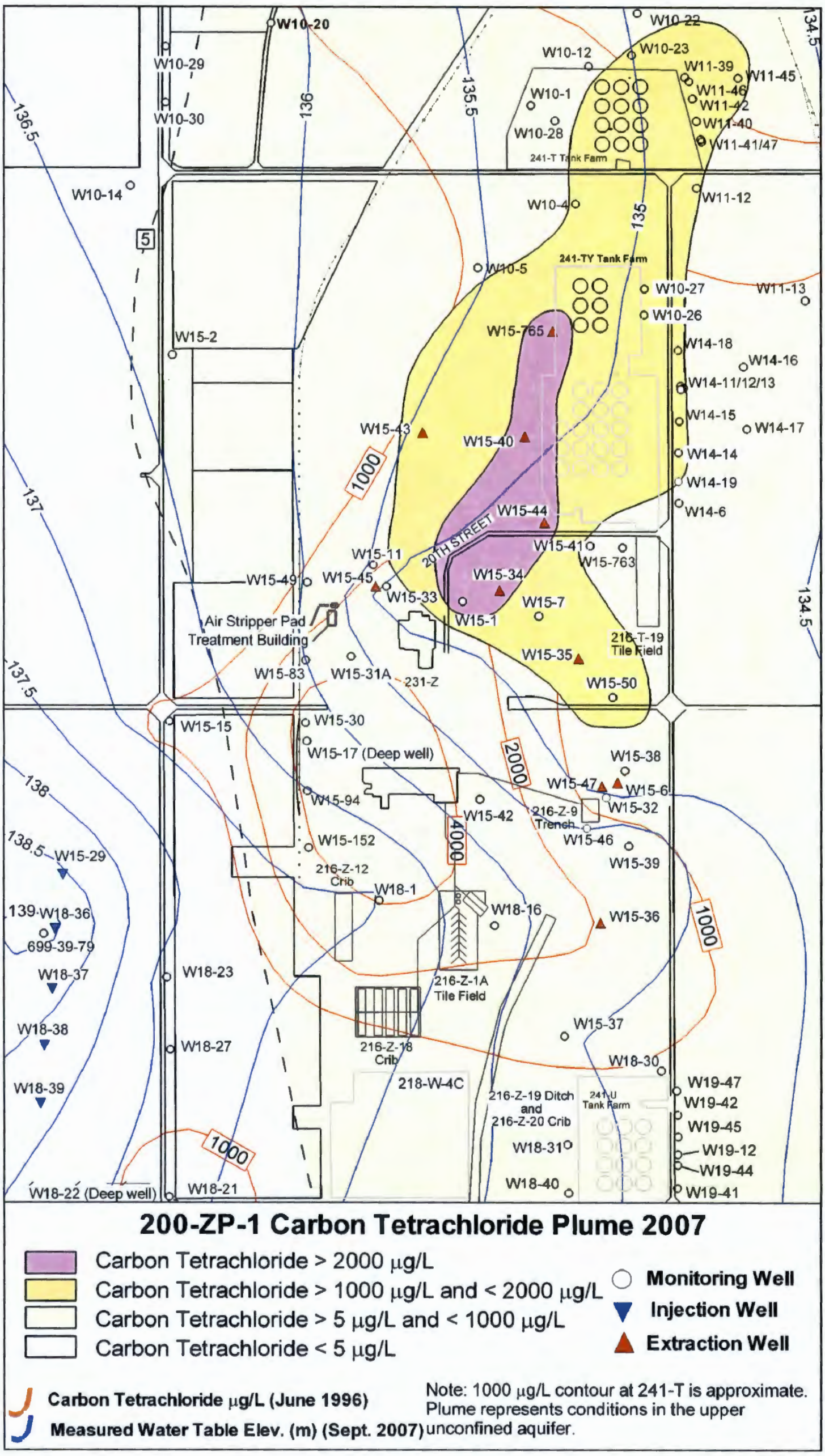

Figure 3-11. 200-ZP-1 Operable Unit Carbon Tetrachloride Plume Map Showing June 1996 and August 2007 Plumes.

NOTE: From DOE/RL-2008-02, *200-UP-1 and 200-ZP-1 Operable Units Pump-and-Treat System Annual Report for Fiscal Year 2007.*

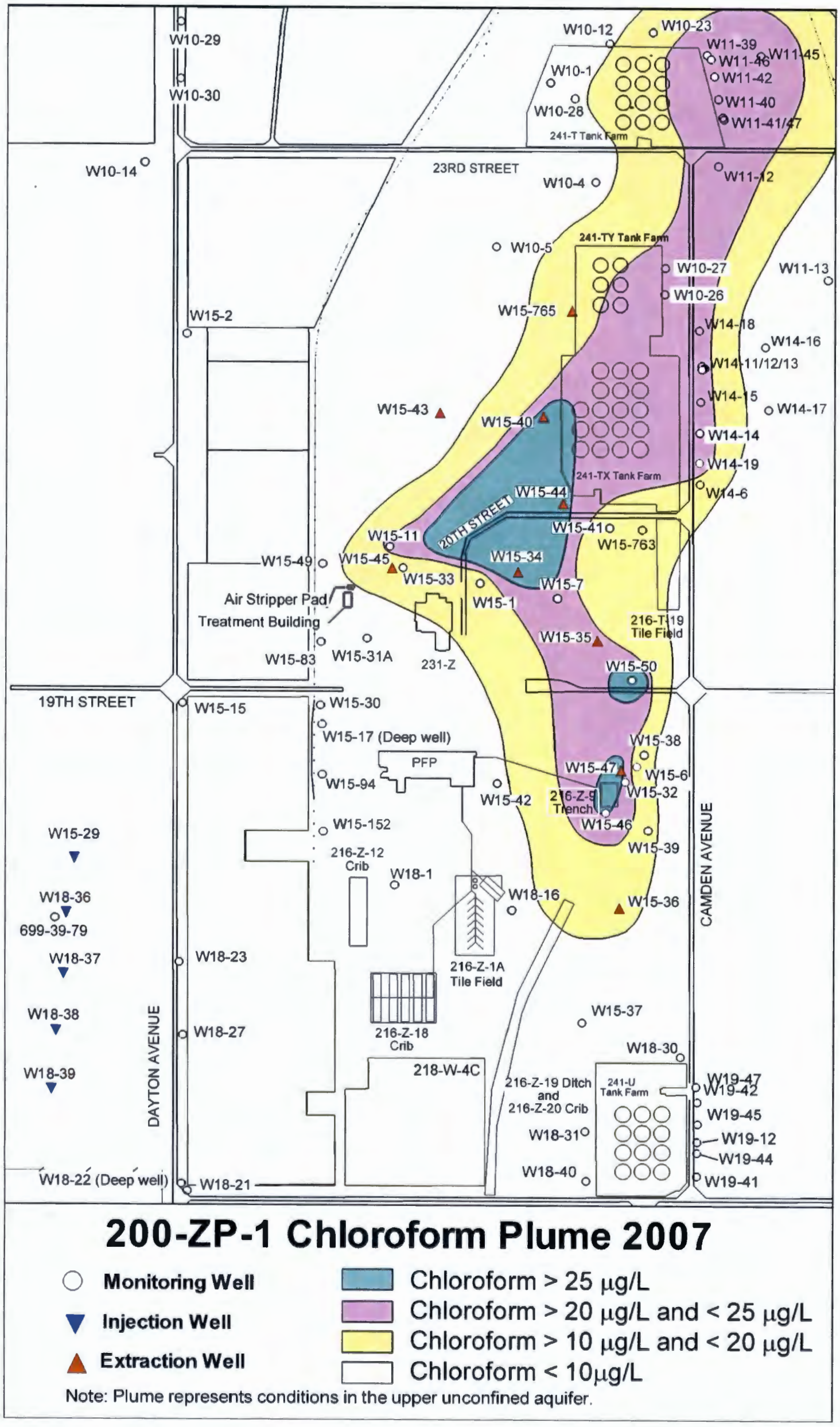

Figure 3-122. 200-ZP-1 Operable Unit Chloroform Plume Map.

NOTE: From DOE/RL-2008-02, *200-UP-1 and 200-ZP-1 Operable Units Pump-and-Treat System Annual Report for Fiscal Year 2007.*

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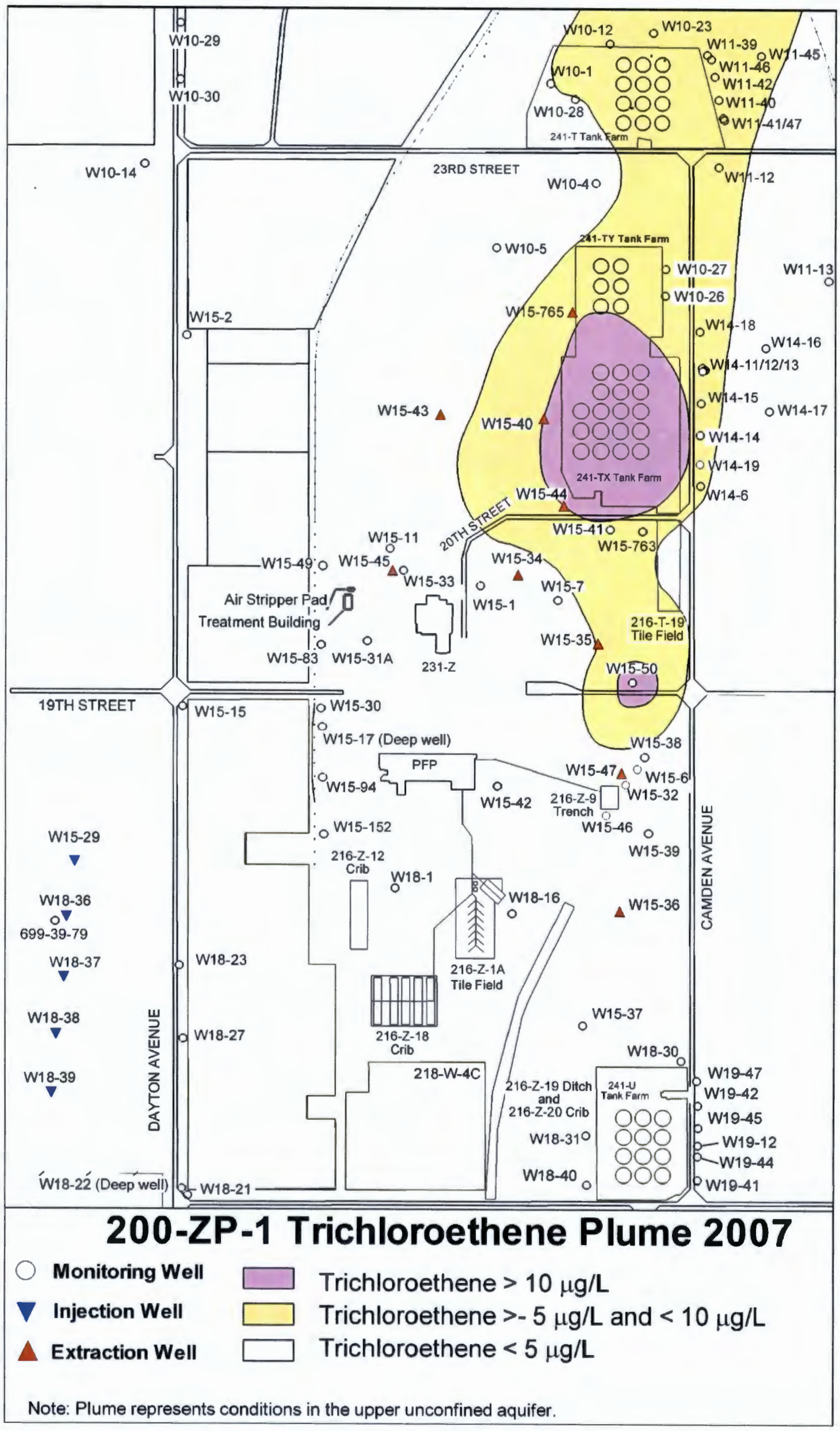

Figure 3-13. 200-ZP-1 Operable Unit Trichloroethene Plume.

NOTE: From DOE/RL-2008-02, *200-UP-1 and 200-ZP-1 Operable Units Pump-and-Treat System Annual Report for Fiscal Year 2007.*

Figure 3-14. Carbon Tetrachloride in Deep Wells (First Half of Fiscal Year 2008).

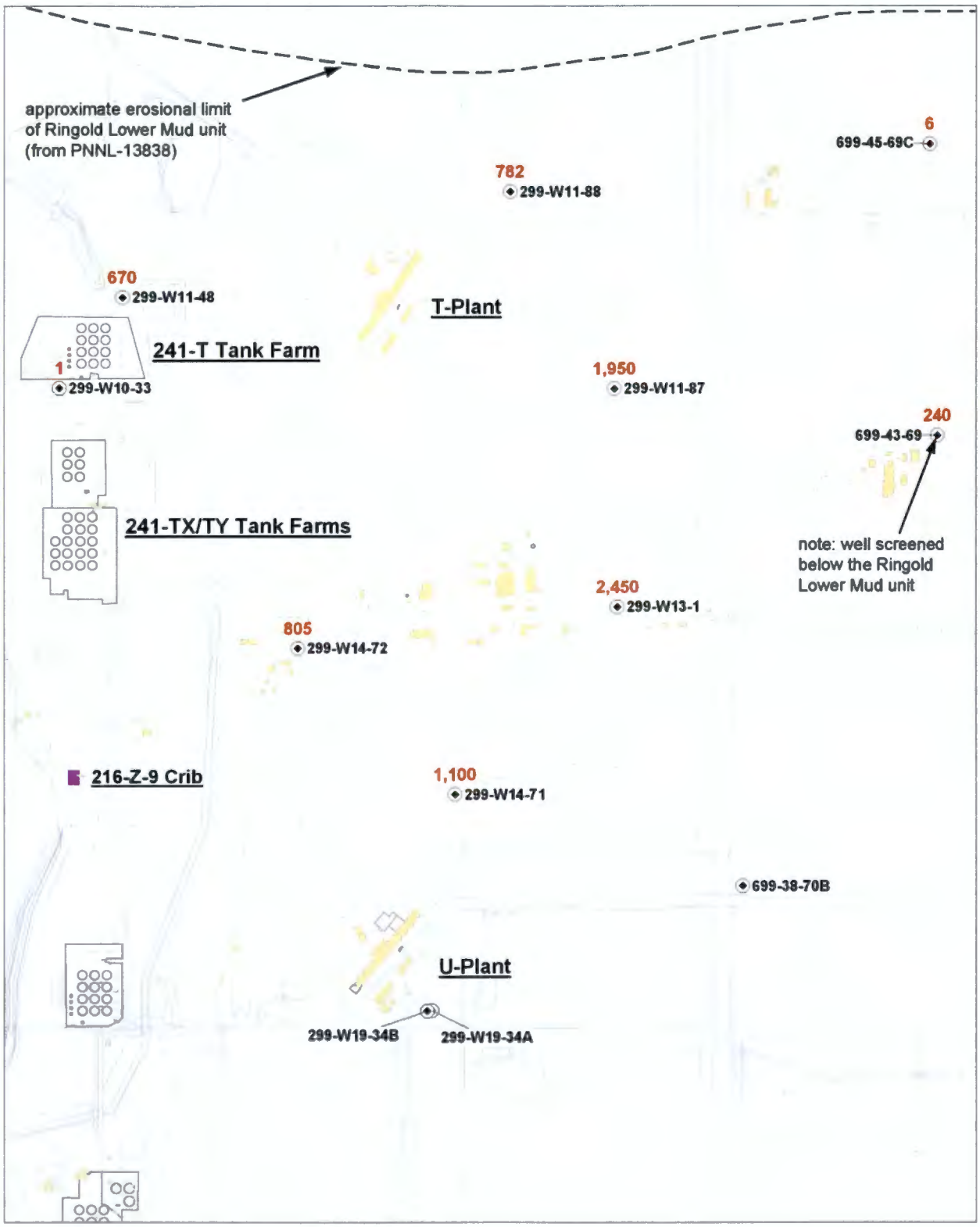

Figure 3-15. Technetium-99 Concentrations in Extraction Wells 299-W-15-44 and 299-W15-765 and Monitoring Well 299-W15-763.

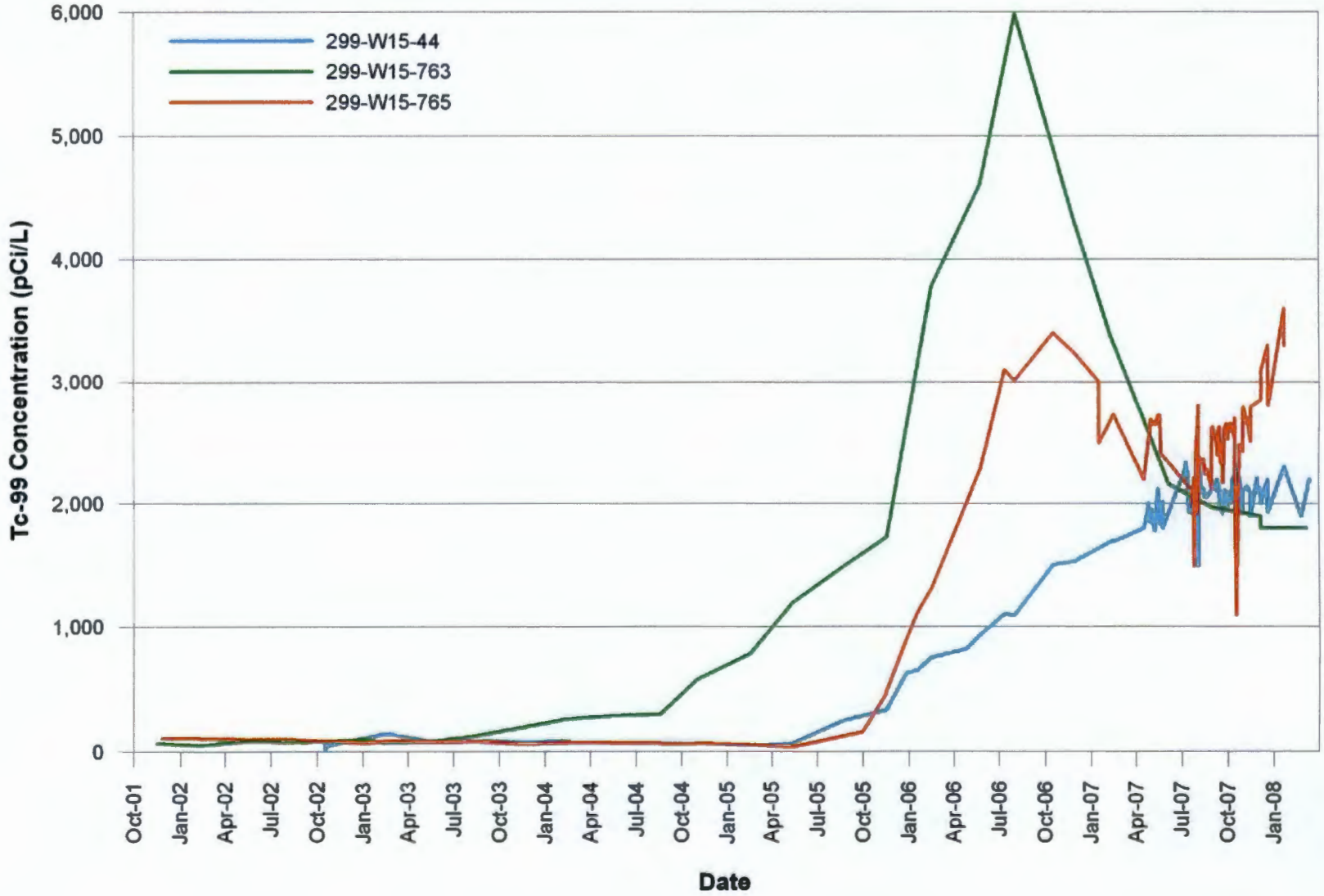

Figure 3-16. Borehole Geology and Sample Locations for Well 699-45-69C (C5574).

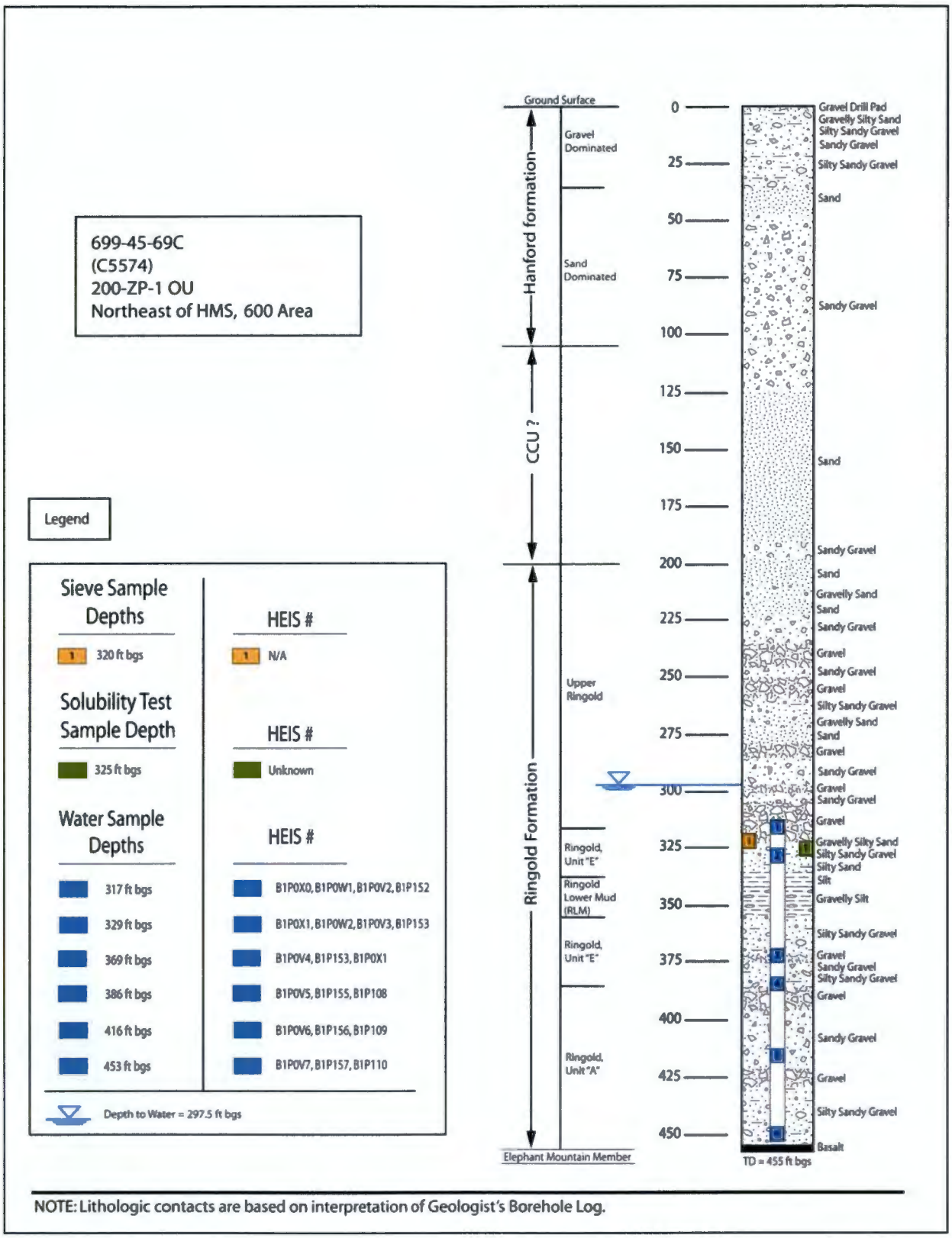

Figure 3-17. Vertical Profile of Carbon Tetrachloride, Chloroform, and Trichloroethene for Well 699-45-69C (C5574).

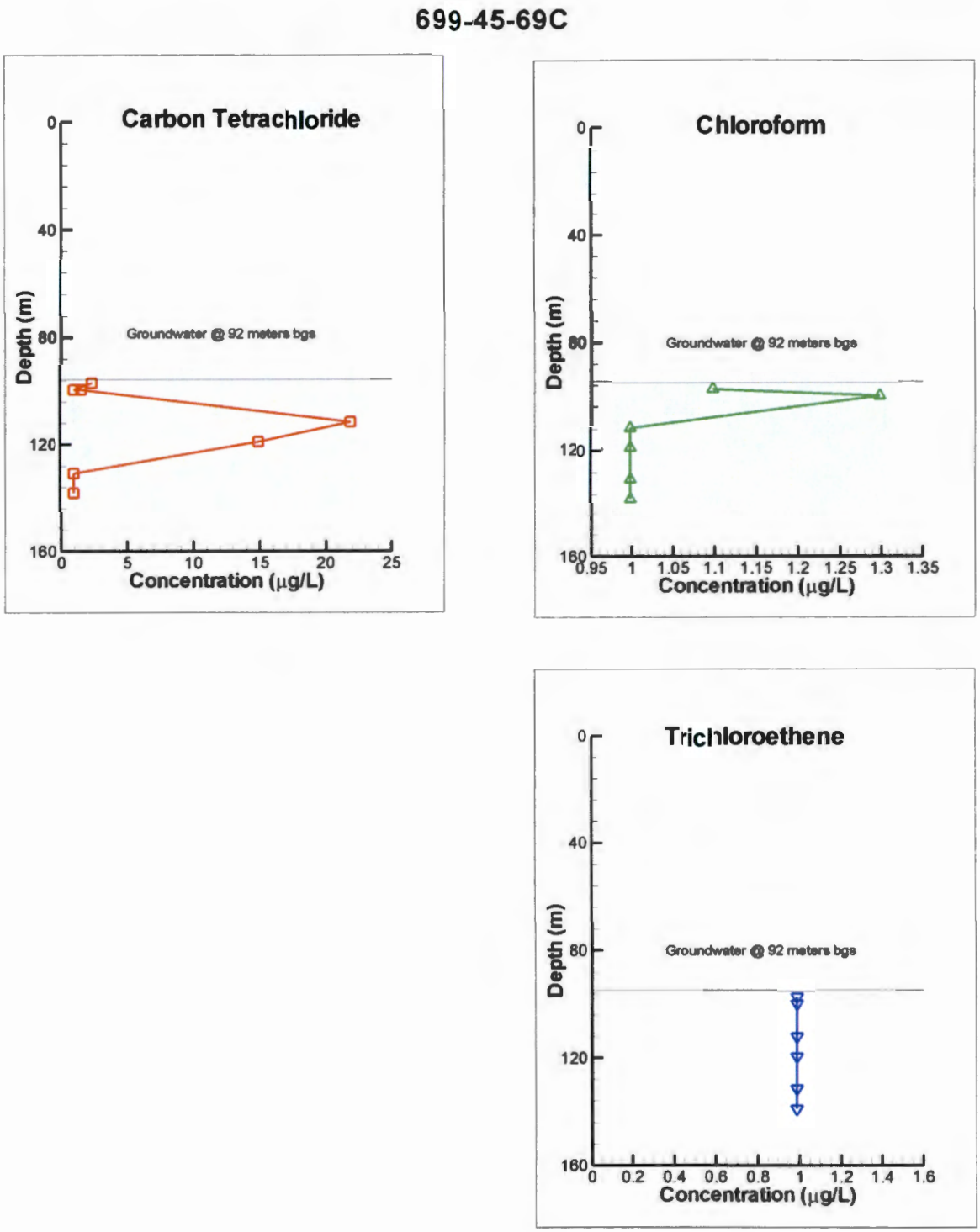

Figure 3-18. Borehole Geology and Sample Locations for Well 299-W11-88 (C5572).

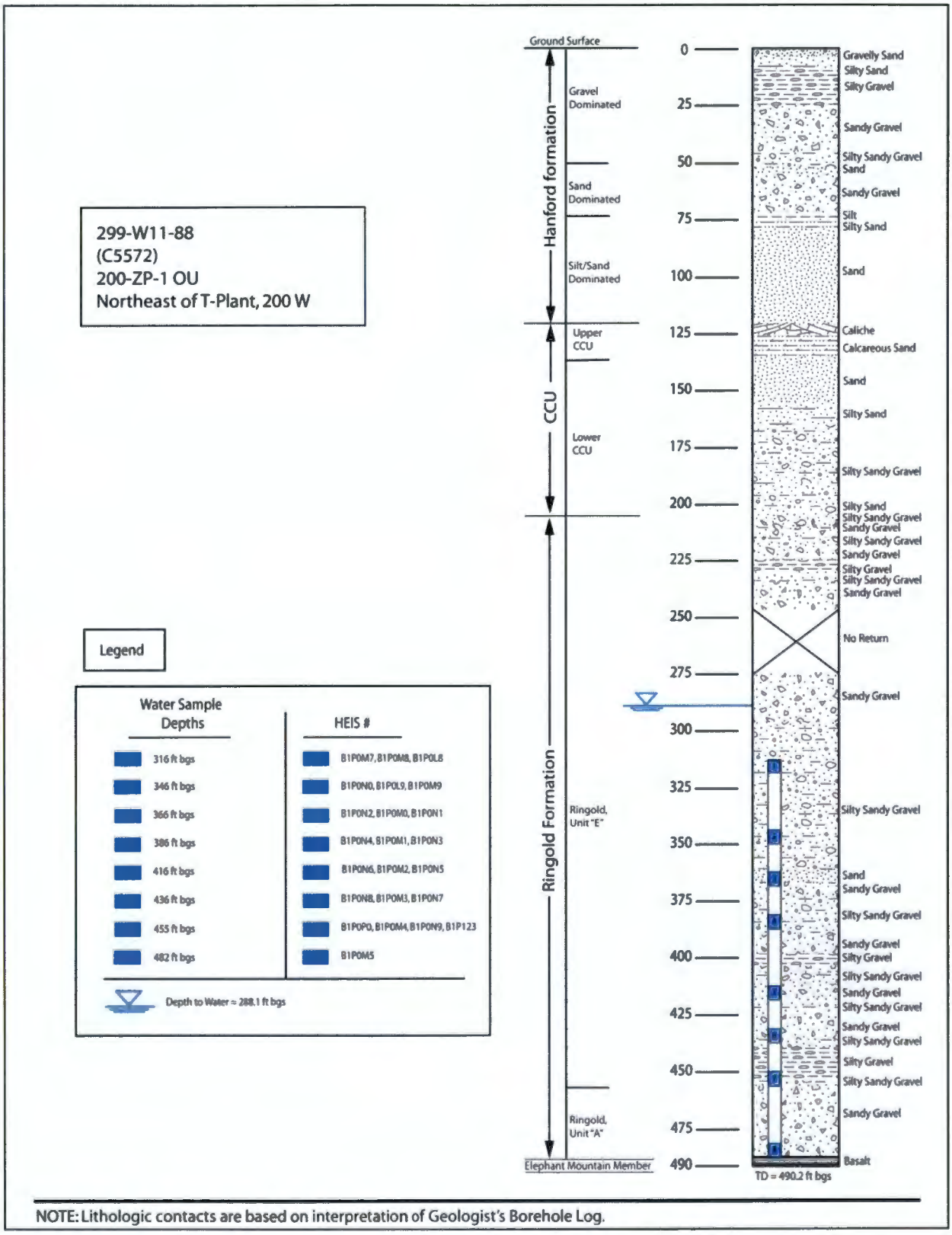

Figure 3-19. Vertical Profile of Carbon Tetrachloride, Chloroform, and Trichloroethene for Well 299-W11-88 (C5572).

299-W11-88

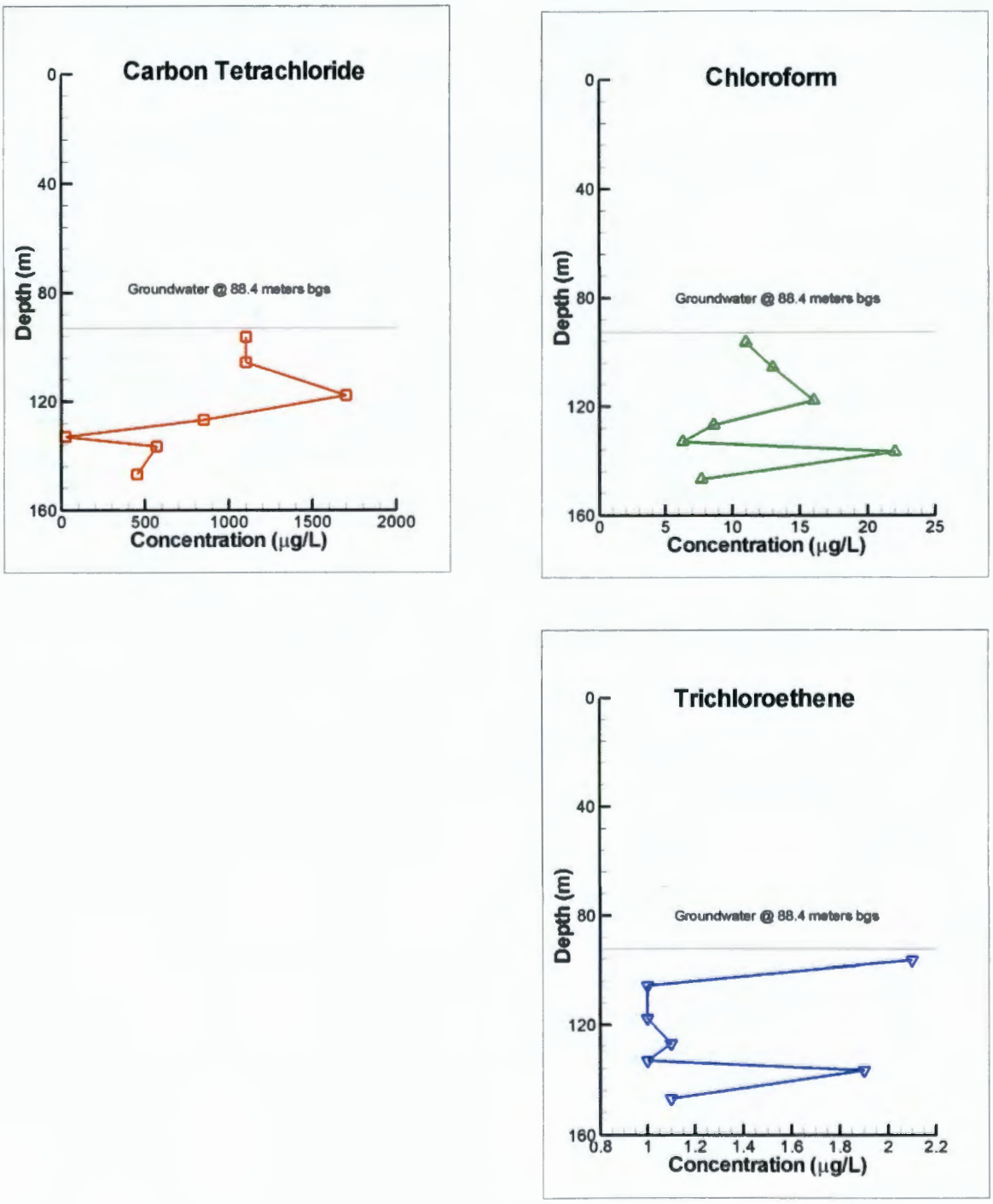

Figure 3-20. Borehole Geology and Sample Locations for Well 699-43-69 (C5573).

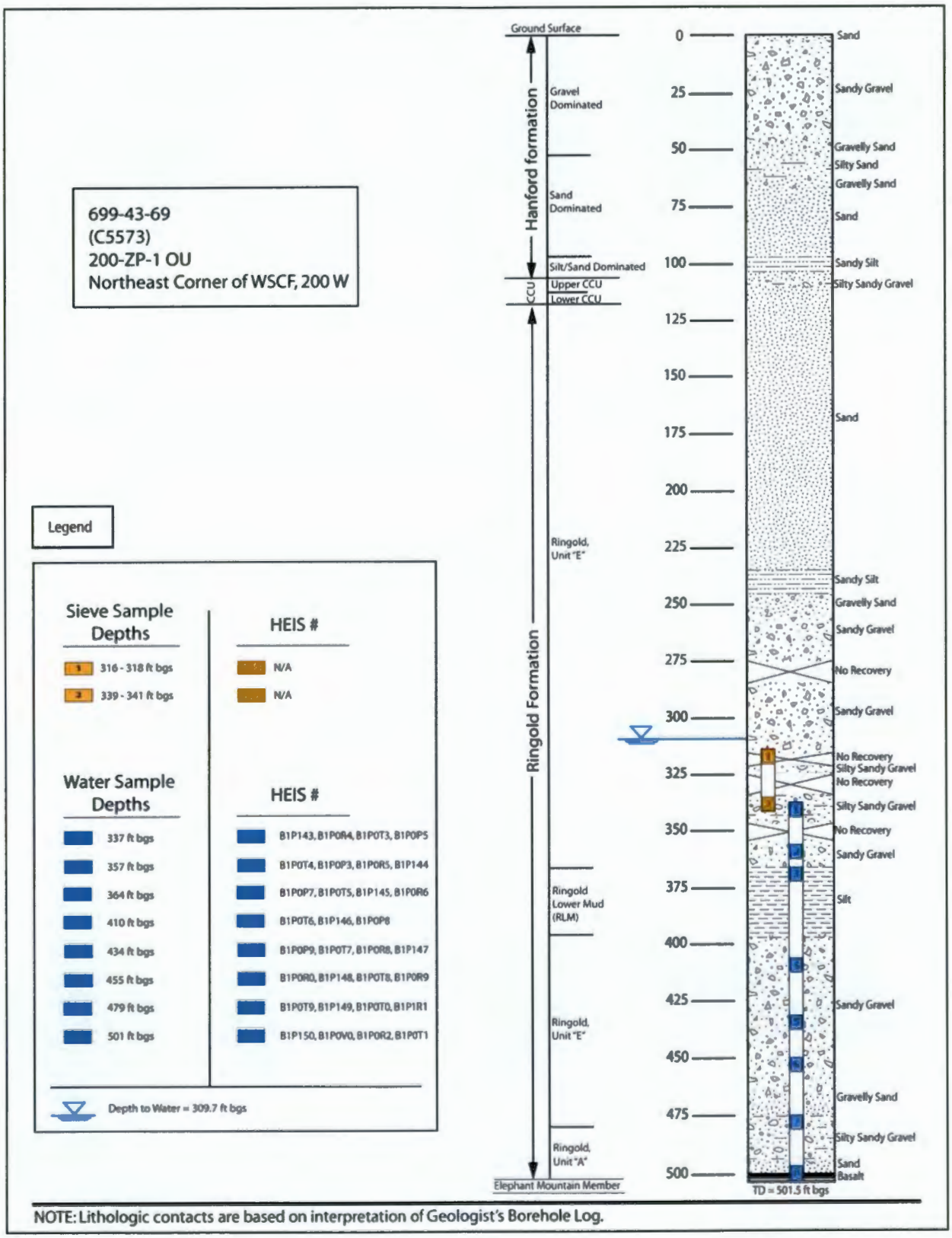

Table 3-1. Volumes of Groundwater Extracted and Treated, and Estimated Mass of Carbon Tetrachloride Removed by Quarter Since August 1994. (2 sheets)

Reporting Period	Liters Treated	Mass of Carbon Tetrachloride Removed (kg)
August 1994 – July 1996	26,676,000	75.9
August 1996 – September 1996	33,232,327	61
October 1996 – December 1996	44,583,715	143.5
January 1997 – March 1997	69,869,903	237.2
April 1997 – June 1997	41,877,094	140.8
July 1997 – September 1997	62,469,305	228.8
October 1997 – December 1997	81,629,000	245.7
January 1998 – March 1998	72,791,000	279.5
April 1998 – June 1998	90,842,900	348.9
July 1998 – September 1998	90,899,200	338.1
October 1998 – December 1998	84,386,385	315.6
January 1999 – March 1999	77,079,401	310.2
April 1999 – June 1999	90,657,483	337.8
July 1999 – September 1999	88,657,767	323.7
October 1999 – December 1999	53,073,892	201.8
January 2000 – March 2000	90,920,220	370
April 2000 – June 2000	74,312,943	307.8
July 2000 – September 2000	82,096,586	303.7
October 2000 – December 2000	94,110,990	336.8
January 2001 – March 2001	85,367,099	330.5
April 2001 – June 2001	84,283,176	297.1
July 2001 – September 2001	75,085,163	261.9
October 2001 – December 2001	81,274,965	287.3
January 2002 – March 2002	80,386,480	289.9
April 2002 – June 2002	73,058,873	258.9
July 2002 – September 2002	66,562,164	216.6
October 2002 – December 2002	61,253,813	200.4
January 2003 – March 2003	66,707,490	204.2
April 2003 – June 2003	66,077,797	223.2
July 2003 – September 2003	59,562,556	191.5
October 2003 – December 2003	62,687,970	180.1
January 2004 – March 2004	53,962,259	147.1
April 2004 – June 2004	68,812,409	200.3
July 2004 – September 2004	89,041,628	312.9
October 2004 – December 2004	82,302,725	233.4
January 2005 – March 2005	81,987,726	207.7
April 2005 – June 2005	76,756,518	157.1

Table 3-1. Volumes of Groundwater Extracted and Treated, and Estimated Mass of Carbon Tetrachloride Removed by Quarter Since August 1994. (2 sheets)

Reporting Period	Liters Treated	Mass of Carbon Tetrachloride Removed (kg)
July 2005 – September 2005	98,957,402	201.5
October 2005 – December 2005	96,920,611	221.3
January 2006 – March 2006	96,189,164	219.1
April 2005 – June 2006	108,452,847	212.3
July 2005 – September 2006	124,466,684	237
October 2006 – December 2006	128,813,214	221.7
January 2007 – March 2007	128,886,968	199.2
April 2007 - June 2007	120,178,892	179.7
July 2007 - September 2007	120,870,402	156.9
October 2007 - December 2007	114,991,190	173.1
January 2008 - March 2008	114,197,397	175.7
Totals	**3,919,946,595**	**11,304.52**

Table 3-2. Extraction Rates at 200-ZP-1 Operable Unit Extraction Wells for First and Second Quarters, Fiscal Year 2008.

Well Name[a]	1st/2nd Qtr. FY07 Min. Flow Rate (L/min)	1st/2nd Qtr. FY07 Max. Flow Rate (L/min)	FY06 Mean Flow Rate (L/min)	1st/2nd Qtr. FY07 Mean Flow Rate (L/min)	Quarter to Annual Comparison[b]
299-W15-34	66.1	71.6	72	68.5	Stable
299-W15-35	169.4	210.8	183	179.3	Stable
299-W15-36	67.0	75.6	37[d]	72.3	Increasing
299-W15-45	114.7	146.7	137	127.6	Stable
299-W15-47	97.2	235.6	125[d]	221.8	Increasing
299-W15-6	27.7	52.1	--	31.9	[c]
299-W15-40	22.5	27.9	27	25.2	Stable
299-W15-43	176.4	202.6	198	181.6	Stable
299-W15-44	21.1	33.0	33	26.2	Decreasing
299-W15-765	78.4	113.1	106	93.0	Stable

[a] Wells are listed from north to south.
[b] Quarterly to annual comparison is calculated by the following equation: (quarter FY07 – FY06)/FY06 x 100%. Wells are considered stable if the change in extraction rate is less than 20%.
[c] Comparison not possible.
[d] Well experienced significant downtime during FY06.
-- = data not available
FY = fiscal year

Table 3-3. Average Carbon Tetrachloride Concentrations for 200-ZP-1 Extraction Wells and Influent Tank During First and Second Quarters, Fiscal Year 2008.

Well Name[a]	1st/2nd Qtr. Min. Value (µg/L)	1st/2nd Qtr. Max. Value (µg/L)	Mean Concentration Carbon Tetrachloride (µg/L)								Mean Flow Rate (L/min)	Quarter to Annual Comparison[a]
			FY01	FY02	FY03	FY04	FY05	FY06	FY07	1st/2nd Qtr. FY08[b]		
299-W15-34	2,500	4,000	5,355	5,333	5,355	4,942	3,858	3,247	2,596	3,000	68.7	Stable
299-W15-35	1,700	3,300	3,413	3,344	3,233	3,045	2,563	1,928	1,697	2,267	172.7	Increasing
299-W15-36	320	820	1,377	1,195	1,097	965	655	545	389	506	67.1	Increasing
299-W15-33/45[c]	880	2,200	4,865	4,413	3,308	4,012	2,766	1,548	1,040	1,224	97.6	Stable
299-W15-32/47[c]	910	1,700	3,255	2,778	2,556	3,014	1,908	1,433	1,032	1,154	215.8	Stable
299-W15-6	1,300	3,700	--	--	--	--	2,760	2,938	1,810	2,040	22.3	Stable
299-W15-40	990	1,900	--	--	--	--	2,233	1,976	2,392	2,256	157.3	Stable
299-W15-43	870	4,900	--	--	--	--	2,650	2,309	1,428	1,341	23.0	Stable
299-W15-44	1,400	4,600	--	--	--	--	2,700	2,943	2,112	2,384	97.2	Stable
299-W15-765	1,600	3,100	--	--	--	--	--	--	2,233	2,569	22.8	Stable
Influent tank (T-01)	1,300	2,000	3,600	3,356	3,212	2,927	2,017	2,100	1,500	1,443	--	Stable

[a] Quarterly to annual comparison is calculated by the following equation: (quarter FY08- FY07)/FY07 x 100%. Wells are considered stable if concentration change is less than 20%.
[b] Average of all values for 1st and 2nd quarters of FY08.
[c] Wells 299-W15-45 and 299-W15-47 replaced wells 299-W15-33 and 299-W15-32 in FY04.
FY = fiscal year

Table 3-4. Average Chloroform Concentrations for 200-ZP-1 Extraction Wells and Influent Tank During First and Second Quarters, Fiscal Year 2008.

Well Name[a]	1st/2nd Qtr. Min. Value (µg/L)	1st/2nd Qtr, Max. Value (µg/L)	Mean Concentration Chloroform (µg/L)								Quarter to Annual Comparison[a]
			FY01	FY02	FY03	FY04	FY05	FY06	FY07	1st/2nd Qtr. FY08[b]	
299-W15-34	13	17	23.4	23.4	23.8	27	21.6	20	18	15	Stable
299-W15-35	9.1	13	18.6	16.6	17.2	18.8	17.3	14	13	12	Stable
299-W15-36	9.1	11	23.9	20.1	20.2	19.3	15.8	14	12	10	Stable
299-W15-33/45[c]	4.7	12	25.9	18.2	14.7	16.0	15.5	10	8	6	Decreasing
299-W15-32/47[c]	9.3	13	26.8	20.2	20.3	20.0	17.5	15	13	11	Stable
299-W15-6	7.3	15	--	--	--	--	22.3	--	13	13	Stable
299-W15-40	6.7	7.9	--	--	--	--	18.7	18	17	12	Decreasing
299-W15-43	10	14	--	--	--	--	17.5	14	9	7	Decreasing
299-W15-44	12	15	--	--	--	--	27	17	12	12	Stable
299-W15-765	11	14	--	--	--	--	--	20	13	13	Stable
Influent tank (T-01)	4.6	11	21.1	18.3	18.6	18.8	16.5	11	11.2	9.2	Stable

[a] Quarterly to annual comparison is calculated by the following equation: (quarter FY08- FY07)/FY07 x 100%. Wells are considered stable if concentration change is less than 20%.
[b] Average of all values for 1st and 2nd quarters FY08.
[c] Wells 299-W15-45 and 299-W15-47 replaced wells 299-W15-33 and 299-W15-32 in FY04.
Wells 299-W15-45 and 299-W15-47 replaced wells 299-W15-33 and 299-W15-32 in FY04.
FY = fiscal year

Table 3-5. Average Trichloroethene Concentrations for 200-ZP-1 Extraction Wells and Influent Tank During First and Second Quarters, Fiscal Year 2008.

Well Name[a]	1st/2nd Qtr. Min. Value (µg/L)	1st/2nd Qtr. Max. Value (µg/L)	Mean Concentration, Trichloroethene (µg/L)								Quarter to Annual Comparison[a]
			FY01	FY02	FY03	FY04	FY05	FY06	FY07	1st/2nd Qtr. FY08[b]	
299-W15-34	2.2	3.1	11.4	11.2	11.7	10.7	8.1	6	4	2	Decreasing
299-W15-35	3.3	3.8	9	9.1	10.1	9.7	8	6	6	3	Decreasing
299-W15-36			3.5	2.9	2.6	2.3	2.2	1	1	1	Stable
299-W15-33/45[c]	2.2	2.2	4.6	4.1	3.7	2.4	3.1	1	1	1	Stable
299-W15-32/47[c]	1.8	2.7	4.5	4.2	4.6	1.6	5.5	4	4	2	Decreasing
299-W15-6	1.6	10	--	--	--	--	13.1	--	7	4	Decreasing
299-W15-40	1.2	2.4	--	--	--	--	7.5	14	13	7	Decreasing
299-W15-43	6.4	14	--	--	--	--	13.8	5	3	2	Stable
299-W15-44	5.8	11	--	--	--	--	15	12	9	8	Decreasing
299-W15-765	4	6.1	--	--	--	--	--	14	9	7	Decreasing
Influent tank (T-01)	2.2	4.3	7.4	7.9	8.7	8.6	5.9	6.3	4.8	3	Decreasing

[a] Quarterly to annual comparison is calculated by the following equation: (quarter FY08- FY07)/FY07 x 100%. Wells are considered stable if concentration change is less than 20%.
[b] Average of all values for 1st and 2nd quarters of FY08.
[c] Wells 299-W15-45 and 299-W15-47 replaced wells 299-W15-33 and 299-W15-32 in FY04.
FY = fiscal year

Table 3-6. Carbon Tetrachloride Extraction Well Quality Control Results, First Half of Fiscal Year 2008.

Well Name	Sample Date	Constituent	Reported Value *c1* (µg/L)	Sample Number	Reported Value *c2* (µg/L)	Sample Number	RPD (%)
Laboratory Replicates (8260_VOA_GCMS)							
299-W15-34	03/12/08	Carbon tetrachloride	2,600	B1TTW9	2,500	B1TTX0	3.9
299-W15-40	10/18/07	Carbon tetrachloride	2300	B1R2K4	2300	B1R2K5	0
299-W15-44	12/12/07	Carbon tetrachloride	3900	B1RR70	3500	B1RR69	10.8
299-W15-765	01/21/08	Carbon tetrachloride	2800	B1T7V7	2600	B1T7V8	7.4

GC/MS = gas chromatography/mass spectrometry
RPD = relative percent difference
VOA = volatile organic analysis

Table 3-7. Chloroform Extraction Well Quality Control Results, First Half of Fiscal Year 2008.

Well Name	Sample Date	Constituent	Reported Value c1 (µg/L)	Sample Number	Reported Value c2 (µg/L)	Sample Number	RPD (%)
Laboratory Replicates (8260_VOA_GCMS)							
299-W15-34	03/12/08	Chloroform	15	B1TTW9	13	B1TTX0	14.3
299-W15-40	10/18/07	Chloroform	13	B1R2K4	13	B1R2K5	0
299-W15-44	12/12/07	Chloroform	13	B1RR69	12	B1RR70	8
299-W15-765	01/21/08	Chloroform	13	B1T7V7	13	B1T7V8	0

GC/MS = gas chromatography/mass spectrometry
RPD = relative percent difference
VOA = volatile organic analysis

Table 3-8. Trichloroethene Extraction Well Quality Control Results, First Half of Fiscal Year 2008.

Well Name	Sample Date	Constituent	Reported Value c1 (µg/L)	Sample Number	Reported Value c2 (µg/L)	Sample Number	RPD (%)
Laboratory Replicates (8260_VOA_GCMS)							
299-W15-34	03/12/08	TCE	2.3	B1TTW9	2.2	B1TTX0	4.4
299-W15-40	10/18/07	TCE	8.1	B1R2K4	7.9	B1R2K5	2.5
299-W15-44	12/12/07	TCE	1	B1RR69	1	B1RR70	0
299-W15-765	01/21/08	TCE	9	B1T7V7	8.8	B1T7V8	2.2

GC/MS = gas chromatography/mass spectrometry
RPD = relative percent difference
VOA = volatile organic analysis

Table 3-9. First Half Fiscal Year 2008 Versus Fiscal Year Contaminant Concentrations in 200-ZP-1 Monitoring Wells. (3 sheets)

Well ID	Well Name	FY06	FY07	1st Qtr.	2nd Qtr.	1st / 2nd Qtr.	FY08 Quarter and FY07 Annual Comparison[a]
Carbon Tetrachloride (µg/L)							
A7137	299-W10-4	1,008	1,150	0	850	850	Decreasing
A4898	299-W10-5	--	805	1,300	0	1,300	Increasing
C4694	299-W11-43	880	832	920	960	940	Stable
C4948	299-W11-45	657	1220	0	1,300	1,300	Stable
C4990	299-W11-47	548	1267	1,700	1,100	1,400	Stable
C4238	299-W13-1	1,775	1,575	2,900	2,000	2,450	Increasing
A7348	299-W15-1	2,500	2,500	0	2300	2,300	Stable
A5476	299-W15-7	1,667	1,700	--	--	--	[b]
A5474	299-W15-11	1,300	1,360	0	820	820	Decreasing
A4919	299-W15-15	4	2.3	--	--	--	[b]
A4921	299-W15-17	15	8.6	0	6.7	6.7	Decreasing
B2410	299-W15-30	960	533	0	370	370	Decreasing
B2471	299-W15-31A	610	450	260	0	260	Decreasing
B2754	299-W15-38	--	330	1,700	0	1,700	Increasing
B2755	299-W15-39	210	257	--	--	--	[b]
B8815	299-W15-41	1,453	1,130	0	1,200	1,200	Stable
C3426	299-W15-46	2,274	1,105	1,700	1,000	1,350	Increasing
C4301	299-W15-49	295	213	220	150	185	Stable
C4302	299-W15-50	1,725	2,125	2,000	2,200	2,100	Stable
C4684	299-W15-94	1,100	830	0	310	310	Decreasing
C4685	299-W15-152	34	21	0	18	18	Stable
C3339	299-W15-763	698	645	665	710	688	Stable
C4303	299-W18-16	520	315	150	280	215	Decreasing
Chloroform (µg/L)							
A7137	299-W10-4	10	14	0	10	10	Decreasing
A4898	299-W10-5	--	8.2	1	0	1(U)	Decreasing
C4694	299-W11-43	8.5	10	7.1	7.8	7.5	Decreasing
C4948	299-W11-45	24	22	11	11	11	Decreasing
C4990	299-W11-47	--	33	16	15	16	Decreasing
C4238	299-W13-1	14	18	11	12	11	Decreasing
A7348	299-W15-1	16	17	0	12	12	Decreasing
A5476	299-W15-7	16	18	--	--	--	[b]
A5474	299-W15-11	12	17	0	4.5	4.5	Decreasing

Table 3-9. First Half Fiscal Year 2008 Versus Fiscal Year Contaminant Concentrations in 200-ZP-1 Monitoring Wells. (3 sheets)

Well ID	Well Name	FY06	FY07	1st Qtr.	2nd Qtr.	1st / 2nd Qtr.	FY08 Quarter and FY07 Annual Comparison[a]
A4919	299-W15-15	0.1	0	--	--	--	[b]
A4921	299-W15-17	2	1.5	0	1.5	1.5	Stable
B2410	299-W15-30	9	3.6	0	3.1	3.1	Stable
B2471	299-W15-31A	7	3.4	2.3	0	2.3	Decreasing
B2754	299-W15-38	--	12	10	0	10	Stable
B2755	299-W15-39	10	11	--	--	--	[b]
B8815	299-W15-41	13	14	0	8.1	8.1	Decreasing
C3426	299-W15-46	25	17	11	10	10	Decreasing
C4301	299-W15-49	3	1	1.2	1.1	1.2	Increasing
C4302	299-W15-50	24	20	13	14	14	Decreasing
C4684	299-W15-94	10.5	5.7	0	2.2	2.2	Decreasing
C4685	299-W15-152	0.34	0	0	1	1(U)	Increasing
C3339	299-W15-763	12	11	8	8	8	Decreasing
C4303	299-W18-16	9	6.6	8.2	4.6	6.4	Stable
Trichloroethene (µg/L)							
A7137	299-W10-4	5.3	4.4	0	2.5	2.5	Decreasing
A4898	299-W10-5	--	2.8	1	0	1(U)	Decreasing
C4694	299-W11-43	10	10	7.5	8.4	8	Decreasing
C4948	299-W11-45	6	10	5.3	8.1	7.2	Decreasing
C4990	299-W11-47	6	10	5.2	5.7	5.5	Decreasing
C4238	299-W13-1	8.2	8	7.1	7.1	7.1	Stable
A7348	299-W15-1	3.4	3.5	0	1.6	1.6	Decreasing
A5476	299-W15-7	3.8	3.4	--	--	--	[b]
A5474	299-W15-11	1.7	2	0	1	1(U)	Decreasing
A4919	299-W15-15	0.1	0	--	--	--	[b]
A4921	299-W15-17	1	1	0	1	1(U)	Stable
B2410	299-W15-30	1	1	0	1	1(U)	Stable
B2471	299-W15-31A	0.71	0.52	0.36	0	0.36	Decreasing
B2754	299-W15-38	2.3	1	3.3	0	3.3	Increasing
B2755	299-W15-39	0.1	0.74	--	--	--	[b]
B8815	299-W15-41	10	8.8	0	5.9	5.9	Decreasing
C3426	299-W15-46	6	2	1	1	1(U)	Decreasing
C4301	299-W15-49	0.3	0.24	1	1	1(U)	Increasing
C4302	299-W15-50	24	17	9.9	9.8	9.9	Decreasing

Table 3-9. First Half Fiscal Year 2008 Versus Fiscal Year Contaminant Concentrations in 200-ZP-1 Monitoring Wells. (3 sheets)

Well ID	Well Name	FY06	FY07	1st Qtr.	2nd Qtr.	1st/ / 2nd Qtr.	FY08 Quarter and FY07 Annual Comparison[a]
C4684	299-W15-94	1	0.77	0	1	1(U)	Increasing
C4685	299-W15-152	0.1	0	0	1	1(U)	Increasing
C3339	299-W15-763	4	4.8	3.4	2.2	2.8	Decreasing
C4303	299-W18-16	0.8	1	1	1	1(U)	Stable

[a] Quarterly to annual comparison is calculated by the following equation: (quarter FY07- FY06)/FY06 x 100%. Wells are considered stable if concentration change is less than 20%.
[b] No comparison possible.
[c] Data from Hanford Environmental Information System database, with averages calculated using ARTDAT application.
[d] FY05 and FY06 data taken from *200-UP-1 and 200-ZP-1 Pump-and-Treat Semi-Annual Technical Memorandum, FY 2006* (WMP-30130). For new wells added since FY05, average FY05 and FY06 data are calculated from quarterly averaged data for each year

-- = data not available
FY = fiscal year
ID = identification
U = less than detection

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