PNNL-SA-49438

Results of Groundwater Monitoring for the 300 Area Process Trenches

Reporting Period: July–December 2005

A Letter Report Prepared by
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Richland, Washington

March 2006

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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This letter report has been prepared to provide the U.S. Department of Energy, U.S. Environmental Protection Agency, Washington State Department of Ecology, and Hanford Site contractors with updated groundwater monitoring information. It is not intended for general distribution beyond that audience.

INTRODUCTION

The 300 Area process trenches (316-5) are a *Resource Conservation and Recovery Act* (RCRA) treatment, storage, and/or disposal unit in the Hanford Facility RCRA Permit (Ecology 2004). From 1975 through 1994, the trenches received effluent discharges of dangerous mixed waste from fuel fabrication laboratories in the 300 Area. Groundwater monitoring at the 300 Area process trenches is conducted in accordance with Washington Administrative Code (WAC) 173-303-645(11), "Corrective Action Program," and Part VI, Chapter 1 of the Hanford Facility RCRA Permit (Ecology 2004). The modified closure plan (DOE 1995), portions of which are incorporated into the Hanford Facility RCRA Permit, indicates that groundwater remediation is deferred to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) 300-FF-5 groundwater operable unit.

This report is one of a series of semiannual groundwater-monitoring reports on the corrective action program at the 300 Area process trenches. It fulfills requirements of WAC 173-303-645(11)(g) to report on the effectiveness of the corrective action program. This report covers groundwater monitoring data collected during the period from July through December 2005.

OBJECTIVE

The objective of groundwater monitoring during the corrective action period is to demonstrate the effectiveness of the corrective action program by examining the trend of the constituents of interest to confirm that they are attenuating naturally, as expected by the CERCLA record of decision for the 300-FF-5 Operable Unit (ROD 1996). The 300 Area process trenches were closed under a modified closure/post-closure plan (DOE 1995) and continue to be in the groundwater corrective action program because groundwater contamination continues to exceed groundwater quality criteria (federal drinking water standards). Groundwater monitoring will continue for 30 years during the post-closure monitoring period.

RCRA GROUNDWATER-MONITORING PROGRAM

The groundwater-monitoring network for the 300 Area process trenches (Lindberg et al. 1995) includes four well pairs (see Figure 1). Each of the well pairs has one shallow and one deep well. The shallow wells are screened at the water table, and the deep wells are screened at the bottom of the unconfined aquifer (above the lacustrine and over-bank deposits of the Ringold Formation lower mud unit). One of the pairs is upgradient, and the other three pairs are downgradient. The constituents of interest are total uranium[1] and the volatile organic compounds cis-1,2-dichloroethene, trichloroethene, and tetrachloroethene. Sampling frequency is semiannual, but during each semiannual sampling period the wells are sampled four times (monthly intervals). As a result, the wells are sampled during the months of January, February, March, June, July, August, September, and December. Groundwater samples are analyzed for the contaminants of interest.

[1] Groundwater monitoring objectives of RCRA, CERCLA, and the *Atomic Energy Act* (AEA) often differ slightly and the contaminants monitored are not always the same. For RCRA regulated units, monitoring focuses on non-radioactive dangerous waste constituents. Radionuclides (source, special nuclear and by-product materials) may be monitored in some RCRA unit wells to support objectives of monitoring under the AEA and/or CERCLA. Please note that pursuant to RCRA, the source, special nuclear and by-product material component of radioactive mixed wastes, are not regulated under RCRA and are regulated by DOE acting pursuant to its AEA authority. Therefore, while this report may be used to satisfy RCRA reporting requirements, the inclusion of information on radionuclides in such a context is for information only and, may not be used to create conditions or other restrictions set forth in any RCRA permit.

GROUNDWATER FLOW DIRECTION

Measurements of depth to groundwater in each network well were collected when the wells were sampled. The water table during the July to December 2005 sampling events was predominately in its normal (low river stage) configuration except for early in the reporting period when higher river volumes (still high from the spring run-off) raised the river level. The river level may also be temporarily raised or lowered by Columbia River dams in order to respond to power needs or salmon recovery efforts. During periods of low river stage, the water table slopes to the southeast in the vicinity of the 300 Area process trenches; the result is that groundwater flows mainly to the southeast, discharging to the Columbia River. During high or rising river stages, the water table slope (or gradient) changes from its typical southeast direction to a south or southwest direction.

The water-table contours in June 2005, just prior to the reporting period, suggest a south to south-southwest groundwater flow direction in the vicinity of the process trenches (Figure 2; typical higher river stage configuration). In December 2005 (Figure 3) the water-table configuration, although overall lower in elevation in the vicinity of the process trenches compared to June 2005, also suggests a south to southwest groundwater flow direction. At the time water levels were measured in December 2005, the river stage was rising causing the water-table configuration to resemble the June 2005 configuration. Groundwater response to river stage is described in detail in previous semiannual reports on the RCRA 300 Area process trenches and in annual reports of the Groundwater Performance Assessment Project (e.g., Hartman et al. 2004, 2005, 2006).

GROUNDWATER CONTAMINANT TRENDS

This section discusses concentrations of uranium, cis-1,2-dichloroethene (cis-DCE), trichloroethene, and tetrachloroethene (the contaminants of interest) in the well network during the reporting period. Table 1 lists the analytical results for each contaminant of interest in each well of the monitoring network.

Uranium

The uranium plume continues to underlie a large portion of the 300 Area, and there was very little change throughout the reporting period (Figure 2 – June 2005, just prior to the reporting period and Figure 3 – December 2005, at the end of the reporting period). The maps include additional uranium data from wells sampled and analyzed for the 300-FF-5 Operable Unit. CERCLA and RCRA sampling and analysis are coordinated to avoid duplication of effort and to provide consistency for data interpretation purposes. The most concentrated portions of the plume continued to be downgradient (southeast) of the process trenches and along the shore of the river as far south as well 399-3-10. Another area of high uranium concentration is at well 399-3-11, which is downgradient from 307 trench, another known source of uranium contamination.

Uranium was detected in seven of the eight network wells during the reporting period. However, uranium concentrations exceeded the drinking water standard (30 ug/L) only at the three downgradient network wells that are screened at the water table. The highest concentration reported in the network wells was 62.1 ug/L at well 399-1-17A in a sample collected August 5, 2005. Concentrations of uranium at the three shallow, downgradient wells (wells 399-1-10A, -16A, and -17A; Figures 4, 5, and 6) remained relatively constant or decreased throughout the reporting period. Well 399-1-17A has a relatively steady trend, whereas the trends at wells 399-1-10A and 399-1-16A (Figure 5) have been decreasing since 2004.

Table 1. Results of Groundwater Analyses for 300 Area Process Trenches Contaminants of Interest During July to December 2005

Well	Sample Date	cis-1,2-DCE (ug/L)		Tetrachloroethene (ug/L)		Trichloroethene (ug/L)		Uranium (ug/L)	
399-1-10A	7/12/2005	0.27	U	0.1	U	0.13	U	42.8	
399-1-10A	8/2/2005	0.27	U	0.1	U	0.13	U	37.3	
399-1-10A	9/26/2005	0.27	U	0.1	U	0.13	U	31	
399-1-10A	12/22/2005	0.19	U	0.19	U	0.2	U	39.1	
399-1-10B	7/12/2005	0.27	U	0.1	U	0.13	U	0.197	
399-1-10B	8/2/2005	0.27	U	0.1	U	0.13	U	0.0305	U
399-1-10B	9/26/2005	0.27	U	0.1	U	0.13	U	0.34	
399-1-10B	12/22/2005	0.19	U	0.19	U	0.2	U	0.0417	U
399-1-16A	7/12/2005	0.27	U	0.1	U	0.46	J	52.5	
399-1-16A	8/1/2005	0.43	JN	0.1	U	0.54	J	47.8	
399-1-16A	9/26/2005	0.41	J	0.1	U	0.29	J	48.9	
399-1-16A	12/16/2005	0.38	J	0.19	U	0.43	J	38.7	
399-1-16B	7/12/2005	170	D	0.1	U	2.1		13.5	
399-1-16B	8/1/2005	170	D	0.1	U	2.2		14	
399-1-16B	9/26/2005	230	D	0.1	U	1.7		7.04	
399-1-16B	12/16/2005	120	D	0.19	U	2.1		7.56	
399-1-17A	7/12/2005	0.43	J	0.1	U	0.13	U	57.9	
399-1-17A	7/12/2005	0.27	U	0.1	U	0.13	U	53.2	
399-1-17A	8/5/2005	0.27	U	0.1	U	0.13	U	62.1	
399-1-17A	9/26/2005	0.27	U	0.1	U	0.13	U	47.3	
399-1-17A	12/16/2005	0.19	U	0.19	U	0.2	U	38.3	
399-1-17B	7/13/2005	3		0.1	U	0.13	U	0.00583	U
399-1-17B	8/2/2005	1.9		0.1	U	0.13	U	0	U
399-1-17B	8/2/2005	2		0.1	U	0.13	U	0	U
399-1-17B	9/26/2005	2.2		0.1	U	0.13	U	0.23	
399-1-18A	7/13/2005	0.27	U	0.1	U	0.13	U	6.06	
399-1-18A	8/2/2005	0.27	U	0.1	U	0.13	U	5.69	
399-1-18A	9/26/2005	0.27	U	0.1	U	0.13	U	5.52	
399-1-18A	9/26/2005	0.27	U	0.1	U	0.13	U	5.97	
399-1-18A	12/21/2005	0.19	U	0.19	U	0.2	U	4.98	
399-1-18B	7/13/2005	0.27	U	0.1	U	0.13	U	0	U
399-1-18B	8/2/2005	0.27	U	0.1	U	0.13	U	0.0365	U
399-1-18B	9/26/2005	0.27	U	0.1	U	0.13	U	0.0602	U
399-1-18B	12/21/2005	0.19	U	0.19	U	0.2	U	0.0116	U

J = Value is an estimate (close to detection limit)
N = Spike recovery was outside control limits
U = Below detection limit

Cis-1,2-Dichloroethene

Cis-1,2-dichloroethene (cis-DCE) was detected at four wells in the 300 Area process trenches network during the reporting period (399-1-16A and B, and 399-1-17A and B). The B wells are screened in the lower portion of the unconfined aquifer, and the A wells are screened at the water table. Only well 399-1-16B had concentrations of cis-DCE that exceeded the drinking water standard (70 ug/L). At well 399-1-16B the concentrations during the reporting period ranged from 120 to 230 ug/L. The trend at well 399-1-16B (Figure 7) is variable but overall appears to be neither decreasing or increasing. At the other three wells where cis-DCE was detected, the concentration never exceeded 3.0 ug/L during the reporting period.

Trichloroethene

Trichloroethene (drinking water standard 5 μg/L) was detected at two wells in the 300 Area process trenches network during the reporting period. The well with the highest reported concentration during the reporting period was well 399-1-16B with a value of 2.2 ug/L. This well is screened at the base of the unconfined aquifer, and the source was most likely the 300 Area process trenches. The historical trend at this well shows that trichloroethene concentrations decreased since 1997, but have remained relatively stable at levels below the drinking water standard since 2000. The source of trichloroethene at the other well (399-1-16A, screened at the water table) is most likely offsite to the southwest. Recent concentrations of trichloroethene from the offsite source to the southwest are all below 1.0 ug/L in 300 Area process trenches network wells (Hartman et al. 2006).

Tetrachloroethene

In recent years, tetrachloroethene (5 ug/L drinking water standard) has occasionally been detected in the well network downgradient of the 300 Area process trenches. During the reporting period it was not detected at levels above the method detection limit (0.1 ug/L).

CONCLUSIONS

The objective of the groundwater-monitoring plan is to examine the trend of the contaminants of interest to confirm that they are attenuating naturally. The overall concentration of uranium in network wells decreased during the years 1998 to 2001, but has been holding relatively stable since 2001 in most wells downgradient of the 300 Area process trenches. Two wells, 399-1-16A and 399-1-10A, have shown a decrease since 2004. However, rising water-table conditions during high river stages mobilizes vadose zone uranium and temporarily increases concentrations of uranium in the aquifer, as reported in earlier semiannual reports. The concentration of cis-DCE appears to be holding steady at levels above the drinking water standard (70 ug/L) in one well (399-1-16B) and is not affected by river stage.

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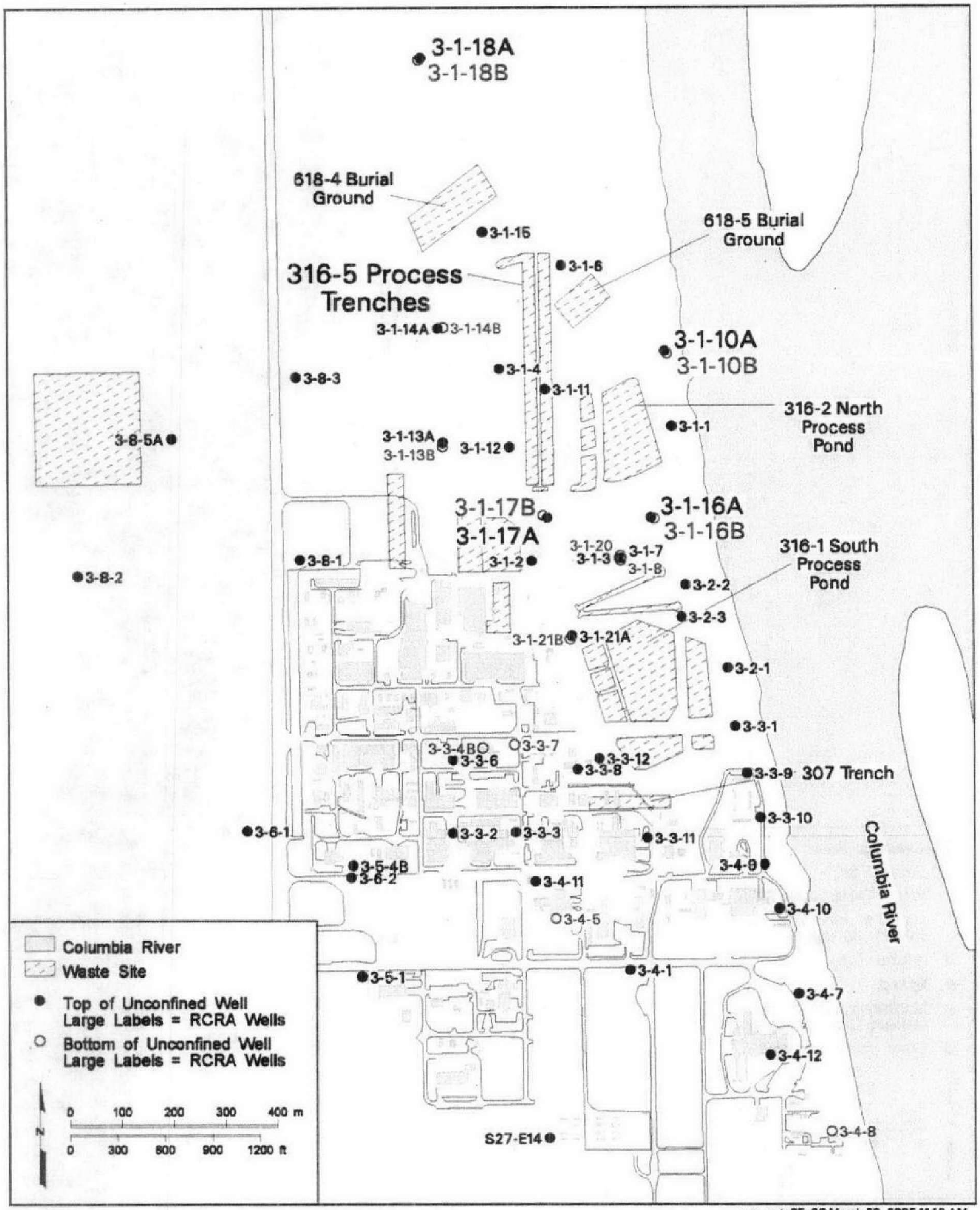

Figure 1. Locations of Wells in the 300 Area Process Trenches Monitoring Networks (from Lindberg et al. 1995). The four well pairs of the 300 Area process trenches network have larger labels

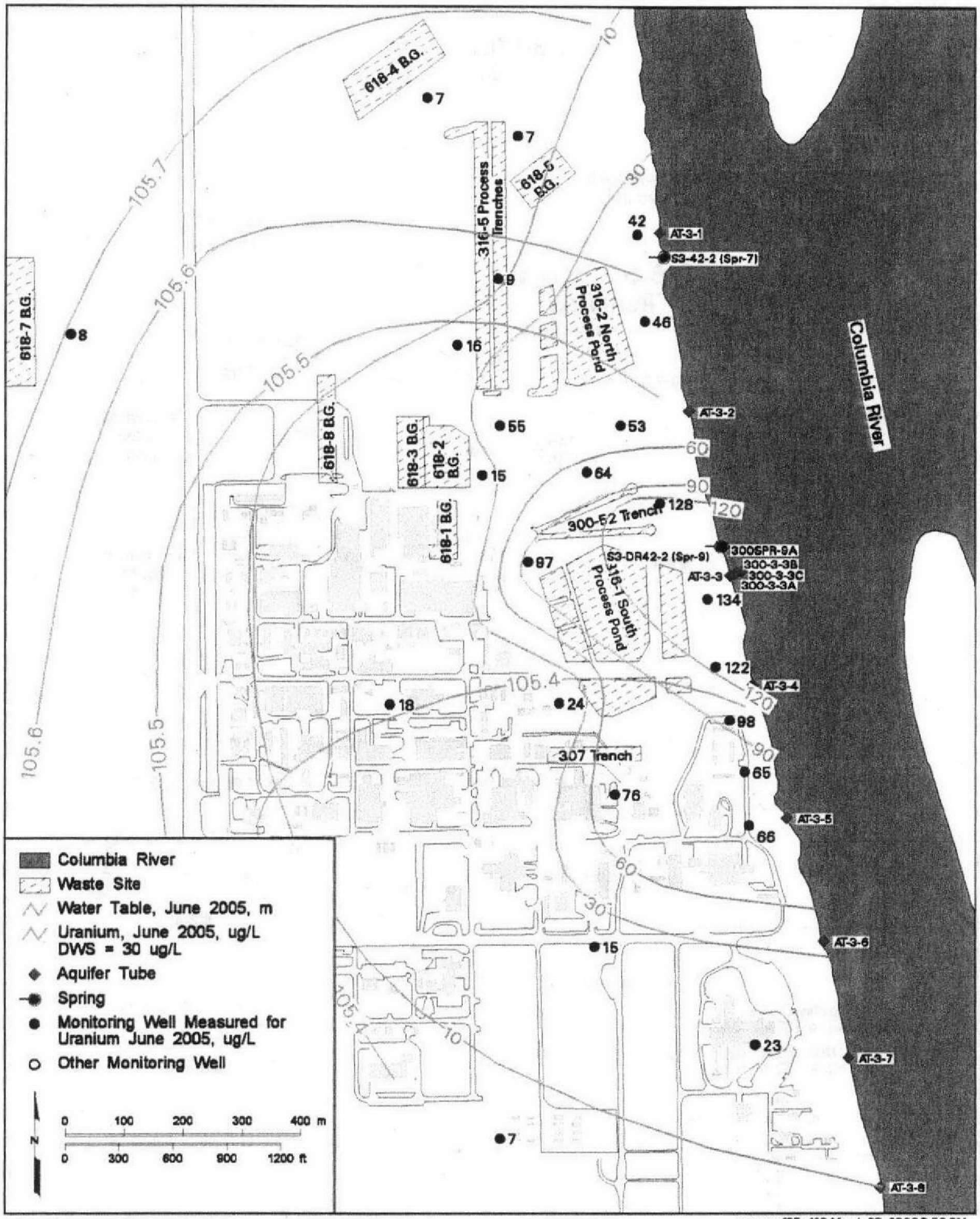

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Figure 2. Uranium Concentrations in the Upper Portion of the Unconfined Aquifer, June 2005 (Hartman et al. 2006).

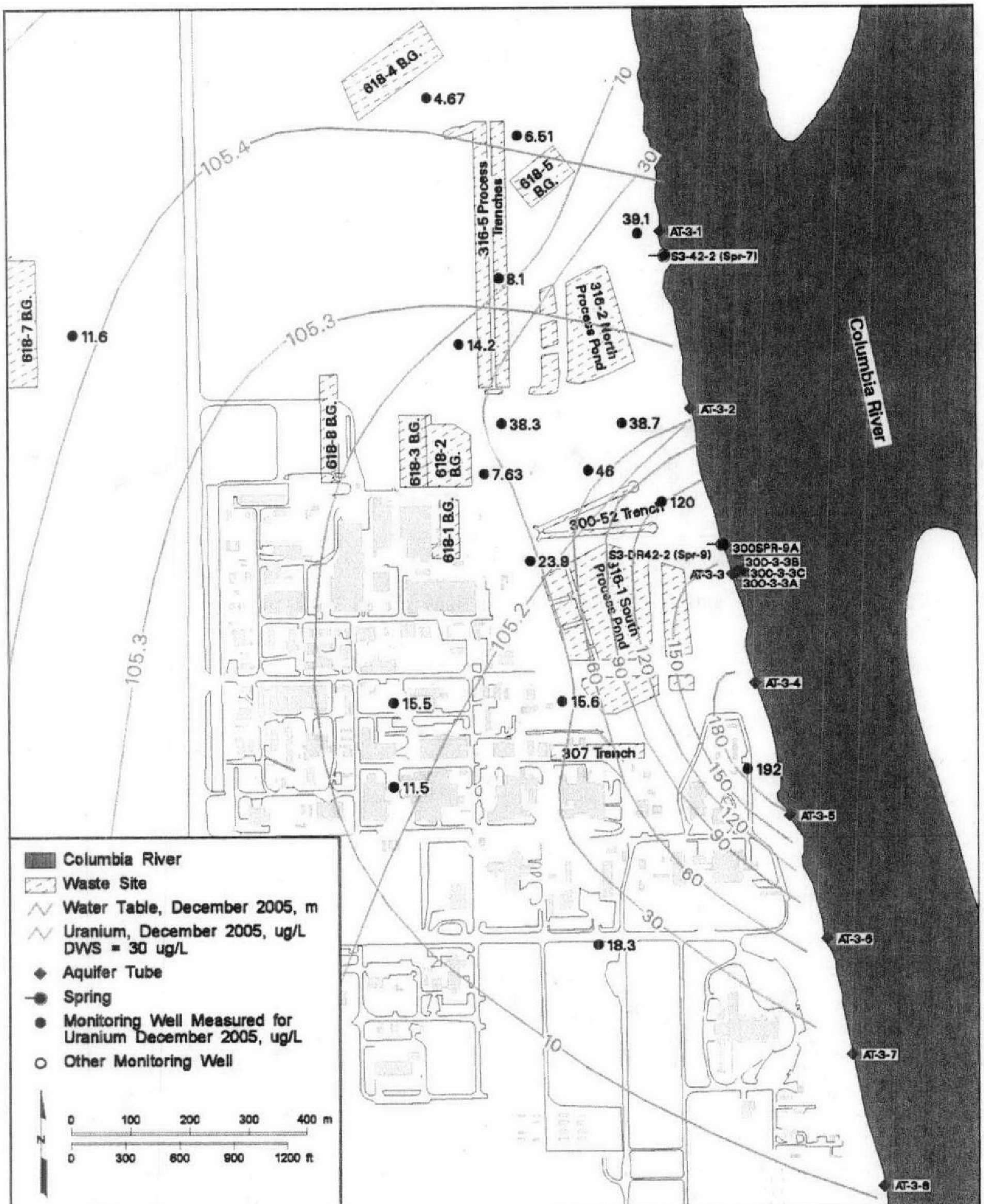

Figure 3. Uranium Concentrations in the Upper Portion of the Unconfined Aquifer, December 2005

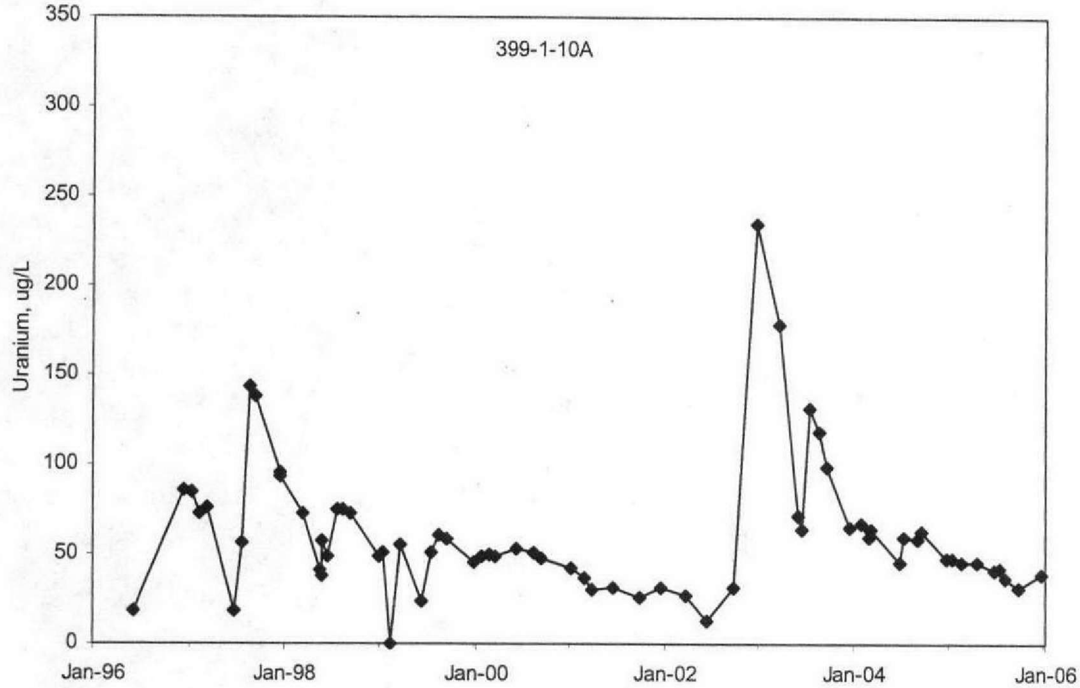

Figure 4. Uranium Concentrations in Well 399-1-10A

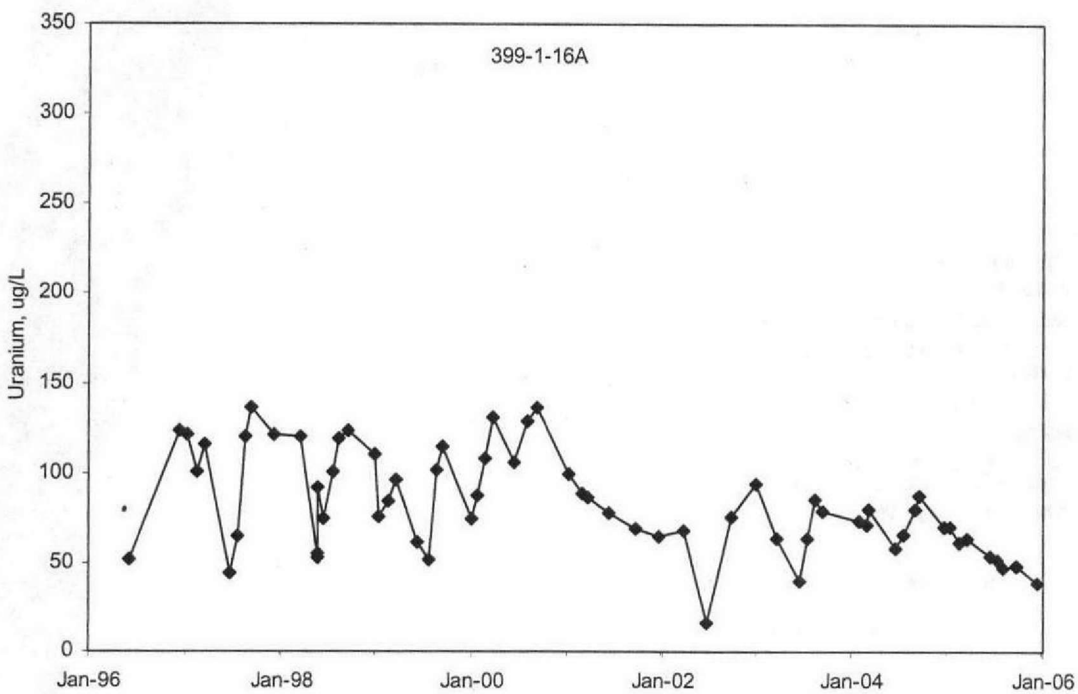

Figure 5. Uranium Concentrations in Well 399-1-16A

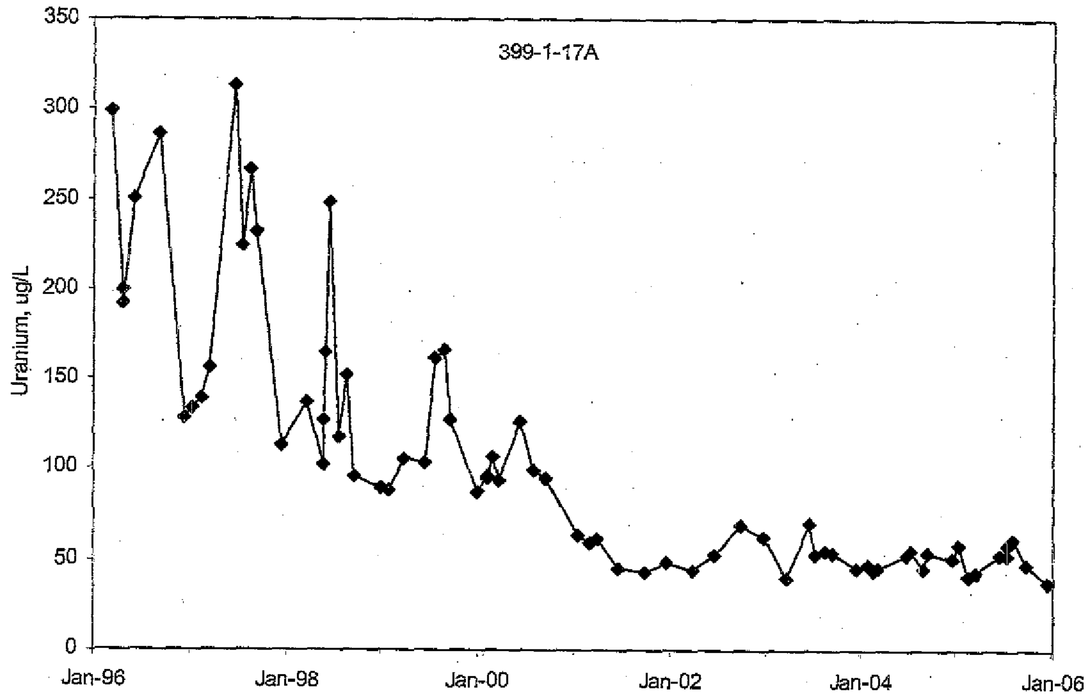

Figure 6. Uranium Concentrations in Well 399-1-17A

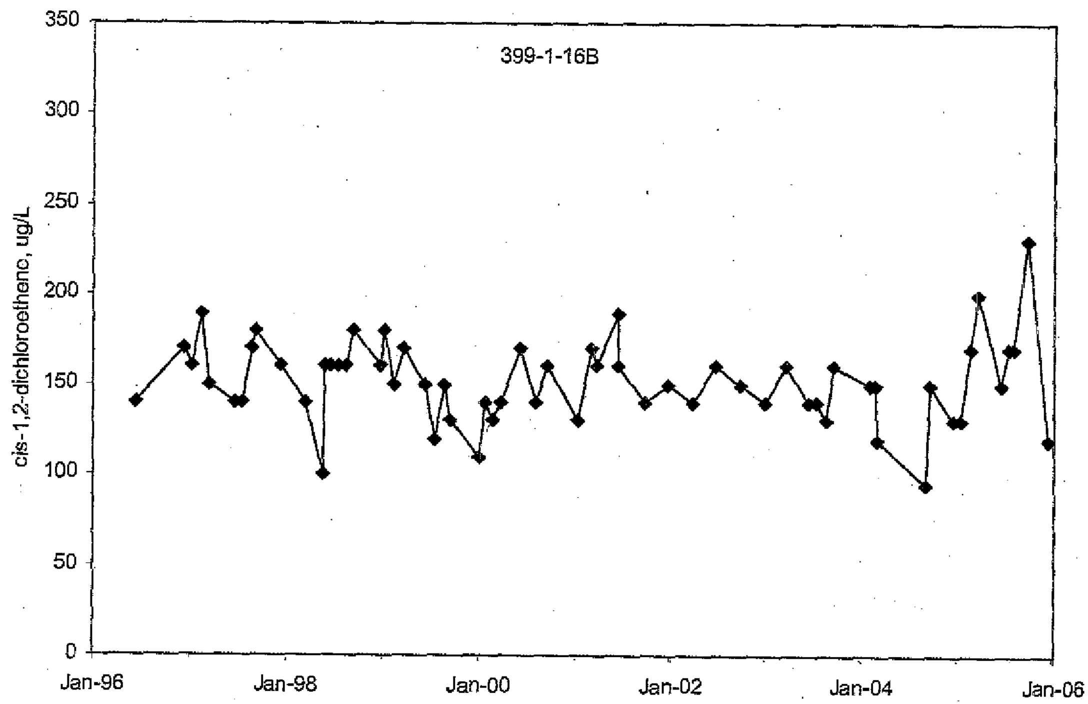

Figure 7. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B