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Jan - June 2000

Ms. Jane Hedges  
Perimeter Areas Section Manager  
Nuclear Waste Program  
State of Washington  
Department of Ecology  
1315 W. Fourth Avenue  
Kennewick, Washington 99336

RECEIVED  
JUL 14 2003  
EDMC

Dear Ms. Hedges:

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) FINAL STATUS  
CORRECTIVE ACTION SEMIANNUAL REPORTS

Please find attached the semiannual reports for two RCRA sites (the 183-H Solar Evaporation Basins and the 300 Area Process Trenches) where groundwater is monitored under Final Status/Corrective Action programs. These reports are submitted to fulfill the requirements of WAC 73-303-645(11)(g).

If you want to discuss this matter further or require additional information, please contact M. J. Furman at (509) 373-9630.

Sincerely,

John G. Morse, Program Manager  
Groundwater/Vadose Zone Project

GWVZ:MJF

Attachment

cc w/o attach:  
R. L. Biggerstaff, BHI  
R. J. Landon, BHI  
J. G. Woolard, BHI  
J. V. Borghese, CHI  
M. J. Hartman, PNNL  
J. W. Lindberg, PNNL  
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Results of Groundwater Monitoring for RCRA Corrective Action  
At The 300 Area Process Trenches  
January through June 2000

J.W. Lindberg  
October 2000

## INTRODUCTION

The 300 Area Process Trenches (316-5) were operated to receive effluent discharges of dangerous mixed waste from fuel fabrication laboratories in the 300 Area. This is the second 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. Results of monitoring have been reported previously in groundwater annual reports (e.g., Hartman et al. 2000). This report covers groundwater monitoring data collected during the period from January through June 2000.

## BACKGROUND

A RCRA interim-status groundwater quality assessment program began in June 1985 to monitor groundwater near the 300 Area Process Trenches and continued until December 1996. In December 1996, the interim-status assessment program was changed to a final-status compliance-monitoring program. The schedule for modifying the Hanford Site RCRA Permit (Ecology 1994) required that a modified closure plan and accompanying revised groundwater-monitoring plan be submitted. The documents were prepared, and the closure plan (DOE/RL-93-73) included the revised groundwater-monitoring plan (Lindberg et al. 1996). This documentation is referenced in the revised Hanford Site RCRA Permit (Ecology 1994) and became effective December 26, 1996.

As expected, groundwater samples from well 399-1-16B, a downgradient well sampling the base of the uppermost aquifer, showed that cis-1,2-dichloroethene (cis-DCE) and trichloroethene (TCE) were in concentrations higher than the specified concentration limits (70- $\mu\text{g/L}$  and 5- $\mu\text{g/L}$  MCLs, respectively). Similarly, the three downgradient wells monitoring the aquifer at the water table (399-1-10, -1-16A, and -1-17A) had concentrations of uranium that exceeded the 20- $\mu\text{g/L}$  EPA-proposed MCL. After the first four independent samples were collected in December 1996, and January, February, and March 1997, the exceedances of MCLs for cis-DCE, TCE, and uranium were confirmed and the regulator was notified. As required by WAC 173-303-645(2)(a)(ii), the monitoring plan was modified from a compliance-monitoring plan to a corrective action plan.

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 proposed groundwater-monitoring plan for corrective action utilizes the same well network that was being sampled during the compliance period but uses the combined Shewart-Cusum approach for

statistical evaluations. This approach can be implemented with a single observation (sample) at any monitoring event. The method could be applied to monitor each well individually and yet maintain desired site-wide false-positive and false-negative rates. Also, each well showing an exceedance of one of the constituents of interest (currently, four of eight wells) will be put on a quarterly sampling schedule to better follow the trends of contaminant concentration. The other wells in the network will continue to be sampled semiannually. The proposed plan is still being reviewed by the regulator.

## RCRA GROUNDWATER-MONITORING PROGRAM

Until the time that the proposed corrective action plan is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect. This current compliance-monitoring plan calls for four independent (time independent) groundwater samples from each network well (eight) be collected during each semiannual sampling period (i.e., 64 well trips/yr = 8 wells X 4 well trips/semiannual sampling period X 2 sampling periods/yr). The groundwater-monitoring well network is sampled in the following months: December, January, February, March (when the Columbia River stage is generally low), and June, July, August, and September (when the Columbia River is generally higher). The current reporting period includes January, February, March, and June. Time independence is accomplished by sampling at one-month intervals during each semiannual sampling period. An alternate final-status/corrective action-monitoring plan has been proposed that will accomplish the goals of the original final-status/compliance-monitoring program but with one independent sample collected during each semiannual sampling event.

The groundwater-monitoring well network for the 300 Area Process Trenches includes four well pairs (Figure 1). One pair is upgradient and three pairs are downgradient. Each well pair is composed of one well that monitors the upper portion of the uppermost aquifer near the water table (wells ending in "A"), and another well that monitors the base of the uppermost aquifer (wells ending in "B").

Wells in the network are monitored for constituents of interest including uranium and volatile organics. The concentration limits, as specified in Lindberg et al. (1996), are as follows:

- Uranium: 20 µg/L. Based on EPA-proposed MCL.
- Cis-1,2-dichloroethene: 70 µg/L. Based on MCL.
- Trichloroethene: 5 µg/L. Based on MCL.
- Any other volatile organic detected: MCL.

## CONTAMINANT TRENDS

This section discusses concentrations of uranium, cis-DCE, and TCE in groundwater near the 300 Area Process Trenches. Data for the reporting period (January through June 2000) are included in the attachment. Trends are compared to the concentration limits defined above. For more information on groundwater contamination near the 300 Area Process Trenches, as well as the whole 300 Area since December 1997, see Hartman and Dresel (1998), Hartman (1999), and Hartman et al. (2000).

## Uranium

Uranium-contaminated groundwater in the 300 Area occurs mostly near the top of the uppermost aquifer. The areal distribution (horizontal distribution) is illustrated in Figure 2. [Figure 2 is from Hartman et al. (2000) and is based on data collected prior to the current reporting period. Data collected during the reporting period is added to the figure but is not reflected in the contour lines.] Although uranium is distributed throughout much of the 300 Area, wells downgradient (southeast) of the southern end (the discharge end) of the 300 Area Process Trenches are associated with some of the highest concentrations of uranium in the 300 Area. Based on this distribution, the soil beneath (or near) the 300 Area Process Trenches continues to be one of the major sources of uranium contamination in groundwater.

The concentration of uranium remained above the concentration limit (20 µg/L) during the reporting period in the three downgradient wells of the well network (Figures 3, 4, and 5) that are screened in the upper portion of the uppermost aquifer (399-1-10A, -1-16A, and -1-17A). In the wells screened in the lower portion of the uppermost aquifer, uranium was not detected in wells 399-1-10B or 399-1-17B. In well 399-1-16B the concentration remained below the concentration limit.

The uranium concentration varied greatly in well 399-1-16A during the reporting period, but not in the other two downgradient wells screened in the upper portion of the aquifer (see Figures 3, 4, and 5). In well 399-1-16A the concentration varied from 87.8 to 131 µg/L during the reporting period with an overall steady trend since 1997. However, in wells 399-1-10A and 399-1-17A the concentrations varied only slightly during the reporting period (48-54 µg/L for 399-1-10A and 95 to 126 µg/L for 399-1-17A), but the overall trend since 1997 appears to be a slight decline in both wells.

## Chlorinated Hydrocarbons

None of the wells in the 300 Area Process Trenches well network had reported concentrations of TCE above the 5.0 µg/L MCL during the reporting period. The highest reported concentration was 3.5 µg/L in March of 2000 in well 399-1-16B (Figure 6). Other wells of the network occasionally have detectable concentrations of TCE, but none higher than 0.65 µg/L. Since March 1997 the reported concentrations of TCE have been slowly declining.

Cis-DCE is detected in several wells near the 300 Area Process Trenches, but only one well (399-1-16B) has reported concentrations above the MCL (70 µg/L) during the reporting period. The highest reported concentration during that time was 170 µg/L in June 2000 (Figure 7). As shown in Figure 7 the concentration of cis-DCE in well 399-1-16B remained fairly constant and is generally in the range of 140 to 180 µg/L during 1997 and 1998. During 1999, the concentration began to decline with one value as low as 110 µg/L, but during the reporting period the concentration of cis-DCE stopped declining and began to rise again to the concentrations of 1997 and 1998.

## CONCLUSIONS

Concentrations of uranium and cis-DCE exceeded applicable concentration limits during the reporting period of January to June 2000. Uranium concentrations exceeded the concentration limit at all three downgradient wells that are completed in the upper portion of the uppermost aquifer. However, concentrations continue to decline slightly with time and vary with Columbia River stage. Cis-DCE exceeded applicable concentration limits in only one well (399-1-16B – screened in the lower portion of the uppermost aquifer. The trend was downward throughout 1999, but began to rise again during 2000. A “five-year review” is currently underway by the EPA to determine if the decline in concentrations of uranium and cis-DCE are adequate to meet the objectives of the current remedy (natural attenuation).

Until the proposed corrective action groundwater-monitoring plan is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect.

## REFERENCES

DOE/RL-93-73, 1994, *300 Area Process Trenches Closure Plan*. U.S. Department of Energy, Richland, Operations Office, Richland, Washington.

Ecology, 1994, *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Permit No. WA7890008967, effective September 28, 1994, Washington State Department of Ecology, Olympia, Washington.

Hartman, M.J., ed., 1999, *Hanford Site Groundwater Monitoring for Fiscal Year 1998*. PNNL-12086., Pacific Northwest National Laboratory, Richland, Washington.

Hartman, M.J. and P.E. Dresel, eds., (1998), *Hanford Site Groundwater Monitoring for Fiscal Year 1997*. PNNL-11793, Pacific Northwest National Laboratory, Richland, Washington.

Hartman, M.J., L.F. Morasch, and W.D. Webber, eds., 2000, *Hanford Site Groundwater Monitoring for Fiscal Year 1999*. PNNL-13116, Pacific Northwest National Laboratory, Richland, Washington.

Lindberg, J.W., C.J. Chou, and V.G. Johnson, 1996, *Groundwater Monitoring Plan for the 300 Area Process Trenches*. WHC-SD-EN-AP-185, Rev. 0A, Westinghouse Hanford Company, Richland, Washington.

Record of Decision (ROD), 1996, *Declaration of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units*. State of Washington Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland, Operations Office, Richland, Washington.

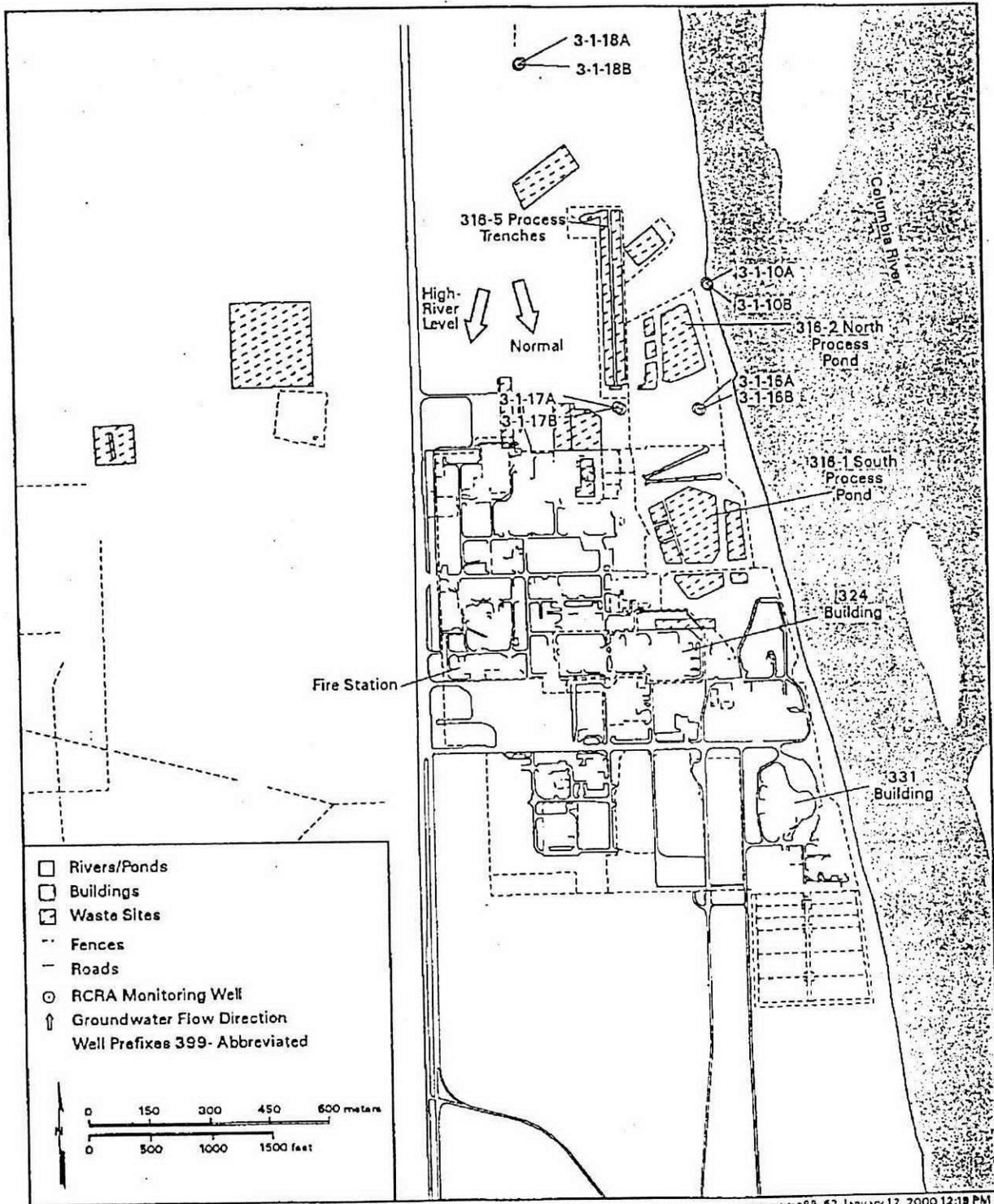


Figure 1. Monitoring Well Locations for the 300 Area Process Trenches.

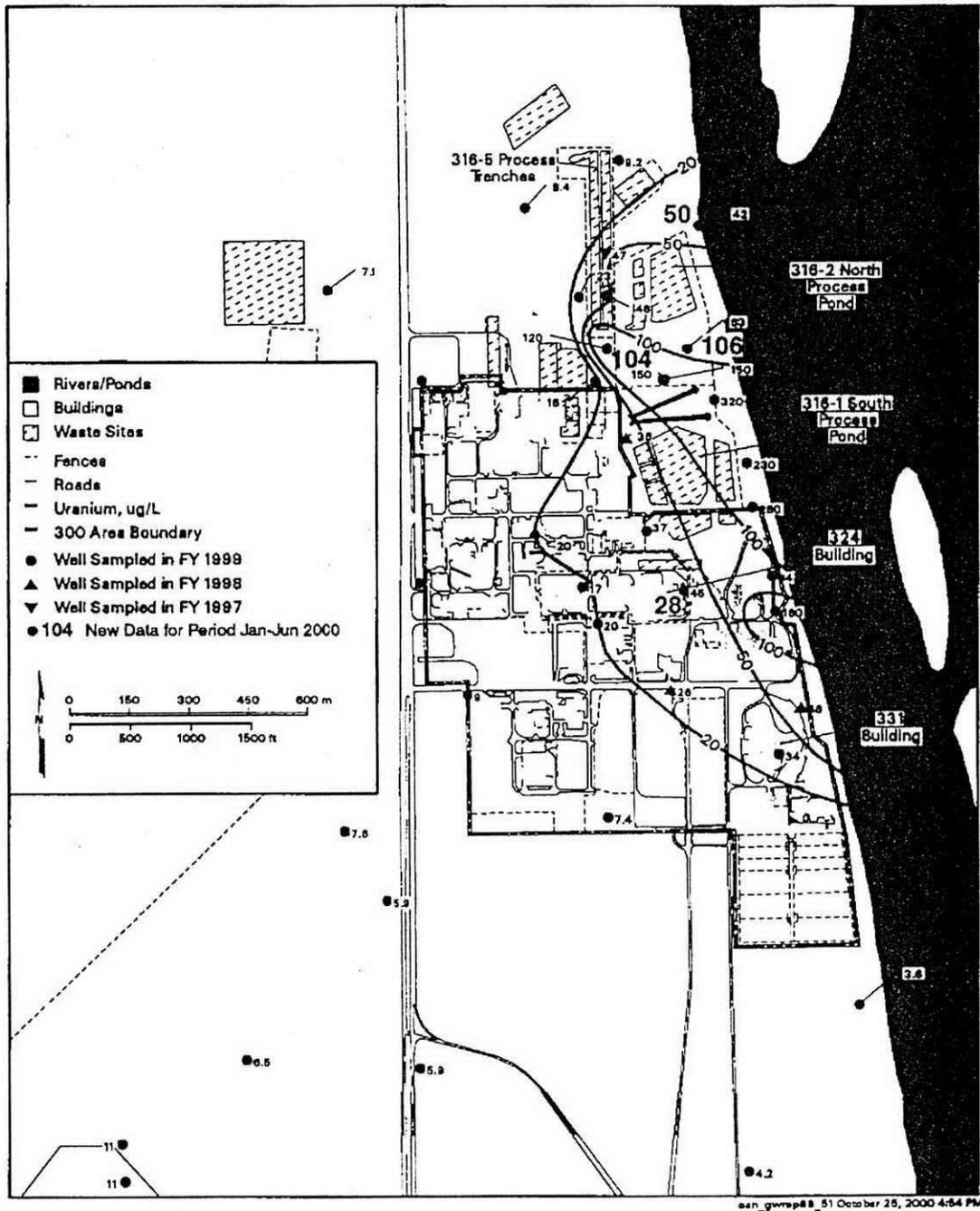


Figure 2. Average Uranium Concentrations at the 300 Area, Uppermost Portion of the Uppermost Aquifer, During FY-1999. [New data for Jan-Jun 2000 in large, bold numbers.]

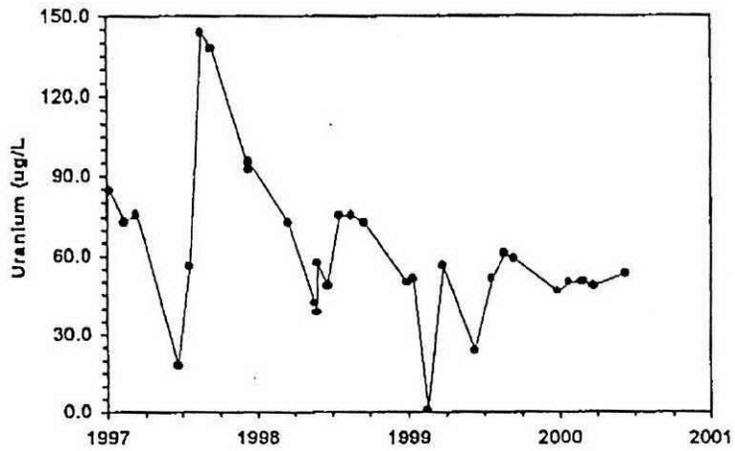


Figure 3. Uranium in Downgradient Well 399-1-10A.

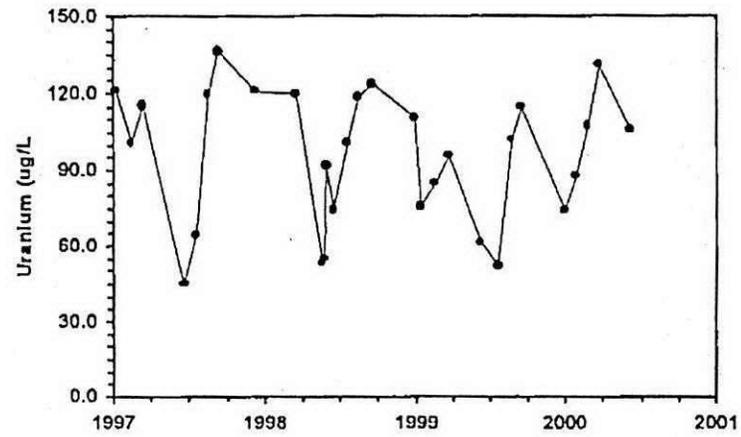


Figure 4. Uranium in Downgradient Well 399-1-16A.

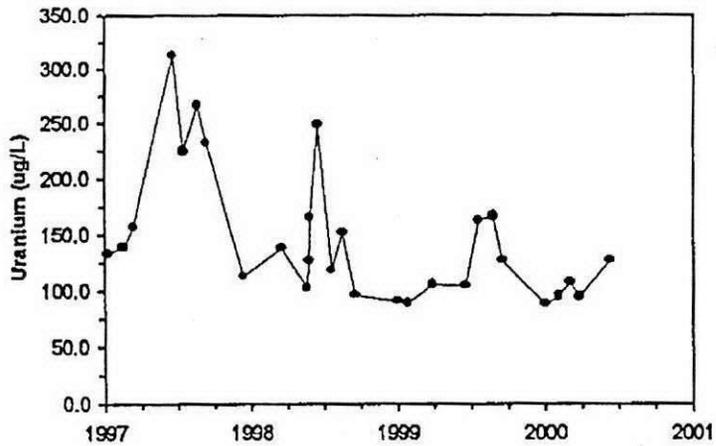


Figure 5. Uranium in Downgradient Well 399-1-17A.

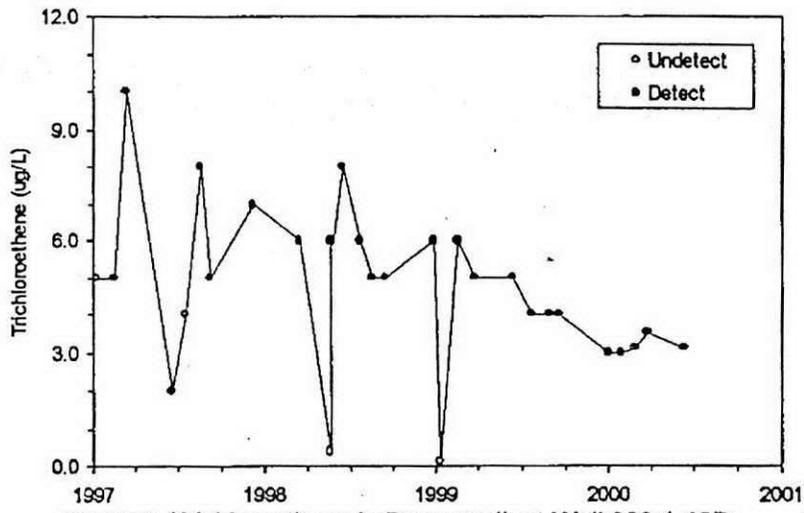


Figure 6. Trichloroethene in Downgradient Well 399-1-16B.

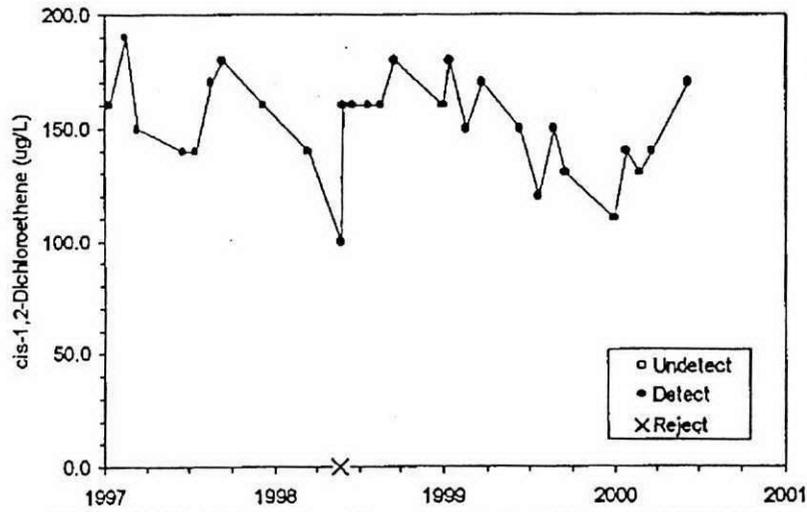


Figure 7. Cis-1,2-dichloroethene in Downgradient Well 399-1-16B.

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
cis-1,2-dichloroethene			
399-1-10A	24-Jan-00	0.18	U
399-1-10A	24-Feb-00	0.18	U
399-1-10A	21-Mar-00	0.18	U
399-1-10A	06-Jun-00	0.18	U
399-1-10B	24-Jan-00	0.18	U
399-1-10B	24-Feb-00	0.25	J
399-1-10B	21-Mar-00	0.18	U
399-1-10B	06-Jun-00	0.18	U
399-1-10B	06-Jun-00	0.18	U
399-1-16A	25-Jan-00	0.18	U
399-1-16A	24-Feb-00	0.26	J
399-1-16A	21-Mar-00	0.6	J
399-1-16A	07-Jun-00	0.31	J
399-1-16B	25-Jan-00	140	D
399-1-16B	24-Feb-00	130	D
399-1-16B	21-Mar-00	140	D
399-1-16B	07-Jun-00	170	D
399-1-17A	01-Feb-00	0.18	U
399-1-17A	01-Feb-00	0.18	U
399-1-17A	28-Feb-00	0.18	U
399-1-17A	22-Mar-00	0.18	U
399-1-17A	07-Jun-00	0.18	U
399-1-17B	25-Jan-00	3.5	J
399-1-17B	28-Feb-00	3.9	J
399-1-17B	21-Mar-00	4.7	J
399-1-17B	07-Jun-00	3.5	J
399-1-18A	24-Jan-00	0.18	U
399-1-18A	24-Feb-00	0.18	U
399-1-18A	21-Mar-00	0.18	U
399-1-18A	06-Jun-00	0.18	U
399-1-18B	24-Jan-00	0.18	U
399-1-18B	24-Feb-00	0.18	U
399-1-18B	21-Mar-00	0.18	U
399-1-18B	06-Jun-00	0.18	U
Trichloroethene			
399-1-10A	24-Jan-00	0.16	U
399-1-10A	24-Feb-00	0.16	U
399-1-10A	21-Mar-00	0.16	U
399-1-10A	06-Jun-00	0.16	U
399-1-10B	24-Jan-00	0.16	U
399-1-10B	24-Feb-00	0.16	U
399-1-10B	21-Mar-00	0.16	U
399-1-10B	06-Jun-00	0.16	U
399-1-10B	06-Jun-00	0.16	U
399-1-16A	25-Jan-00	0.49	J
399-1-16A	24-Feb-00	0.49	J
399-1-16A	21-Mar-00	0.65	J
399-1-16A	07-Jun-00	0.4	J
399-1-16B	25-Jan-00	3	J

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
399-1-16B	24-Feb-00	3.1	J
399-1-16B	21-Mar-00	3.5	J
399-1-16B	07-Jun-00	3.1	J
399-1-17A	01-Feb-00	0.16	U
399-1-17A	01-Feb-00	0.27	J
399-1-17A	28-Feb-00	0.28	J
399-1-17A	22-Mar-00	0.33	J
399-1-17A	07-Jun-00	0.22	J
399-1-17B	25-Jan-00	0.16	U
399-1-17B	28-Feb-00	0.16	U
399-1-17B	21-Mar-00	0.16	U
399-1-17B	07-Jun-00	0.16	U
399-1-18A	24-Jan-00	0.16	U
399-1-18A	24-Feb-00	0.16	U
399-1-18A	21-Mar-00	0.16	U
399-1-18A	06-Jun-00	0.16	U
399-1-18B	24-Jan-00	0.16	U
399-1-18B	24-Feb-00	0.16	U
399-1-18B	21-Mar-00	0.16	U
399-1-18B	06-Jun-00	0.16	U

Uranium

399-1-10A	24-Jan-00	49.4	
399-1-10A	24-Feb-00	49.8	
399-1-10A	21-Mar-00	48.4	
399-1-10A	06-Jun-00	53.4	
399-1-10B	24-Jan-00	0.0274	U
399-1-10B	24-Feb-00	0.0819	J
399-1-10B	21-Mar-00	0.0316	U
399-1-10B	06-Jun-00	0.197	
399-1-10B	06-Jun-00	0.37	
399-1-16A	25-Jan-00	87.8	
399-1-16A	24-Feb-00	108	
399-1-16A	21-Mar-00	131	
399-1-16A	07-Jun-00	106	
399-1-16B	25-Jan-00	8.19	
399-1-16B	24-Feb-00	12.7	
399-1-16B	21-Mar-00	12.7	
399-1-16B	07-Jun-00	11.2	
399-1-17A	01-Feb-00	96.1	
399-1-17A	01-Feb-00	95	
399-1-17A	28-Feb-00	107	
399-1-17A	22-Mar-00	94	
399-1-17A	07-Jun-00	126	
399-1-17B	25-Jan-00	0.0236	U
399-1-17B	28-Feb-00	0.0475	U
399-1-17B	21-Mar-00	0.067	U
399-1-17B	07-Jun-00	0.0192	U
399-1-18A	24-Jan-00	5.63	
399-1-18A	24-Feb-00	5.78	
399-1-18A	21-Mar-00	5.98	

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
399-1-18A	06-Jun-00	5.97	
399-1-18B	24-Jan-00	0.00802	U
399-1-18B	24-Feb-00	0.00851	U
399-1-18B	21-Mar-00	0.0773	J
399-1-18B	06-Jun-00	0.367	

Results of Groundwater Monitoring for RCRA Corrective Action  
at the 183-H Solar Evaporation Basins  
January 2000 through August 2000

M.J. Hartman  
October, 2000

## INTRODUCTION

The 183-H solar evaporation basins were a treatment, storage, or disposal facility that was regulated under the *Resource Conservation and Recovery Act of 1976* (RCRA). The waste discharged to the basins originated in the 300 Area fuel fabrication facility and included solutions of chromic, hydrofluoric, nitric, and sulfuric acids that had been neutralized. The waste solutions contained various metallic and radioactive constituents (e.g., chromium, technetium-99, uranium). Between 1985 and 1996, remaining waste was removed, the facility was demolished, and the underlying contaminated soil was removed and replaced with clean fill.

This is the second of a series of reports on corrective action monitoring at the 183-H Solar Evaporation Basins. It addresses requirement of WAC 173-303-645(11)(g) to report twice each year on the effectiveness of the corrective action program. This report covers the period from January through August 2000.

The Washington State Department of Ecology issued a RCRA Permit for the Hanford Site in 1994 (Ecology 1994). The 183-H Basins were included in Part V of the Permit, which contains requirements specifically applicable to those treatment, storage, and disposal units that are undergoing closure. A final-status, compliance monitoring program was proposed in 1995 (Hartman and Chou, 1995) to comply with the groundwater monitoring requirements of WAC 173-303-645.

The first sample set collected during compliance monitoring showed that downgradient concentrations of the contaminants of concern exceeded concentration limits defined in the monitoring plan. The regulations require corrective action activities to reduce contaminant concentrations in groundwater. The Postclosure Plan, which was incorporated into Part V of the Hanford Site RCRA Permit in February 1998, deferred corrective action to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) interim action for in the 100-HR-3 Operable Unit. The Postclosure Plan also required monitoring to be conducted as described in the revised RCRA groundwater monitoring plan (Hartman 1997).

The objective of RCRA groundwater monitoring during the period of interim remediation is to track trends in chromium, nitrate, uranium, and technetium-99, and fluoride. DOE, the regulators, and members of the public will determine methods for final remediation of 100-H Area groundwater some time in the future. At that time, the RCRA monitoring program will be revised to meet the requirements of final remedial measures.

## INTERIM REMEDIAL MEASURE

The interim remedial measure applies to the 100-HR-3 groundwater operable unit, which is under the authority of a CERCLA record of decision. Groundwater is pumped from five extraction wells, located west, north, and east of the 183-H Basins (Figure 1). The effluent is treated to remove chromium and injected back into the aquifer in upgradient wells. The objective of the interim remedial measure is to reduce the amount of chromium entering the Columbia River, where it is a potential hazard to the ecosystem.

Groundwater is sampled to monitor the effectiveness of the interim remedial measure and to monitor the entire 100-HR-3 Operable Unit (DOE-RL 1996; Peterson and Raidl, 1996). This CERCLA monitoring is coordinated with RCRA monitoring.

The pump-and-treat system may be shut down when concentrations of hexavalent chromium are below 22 µg/L in wells specified in the ROD and data indicate that the concentration will remain below that value. The system may also be shut down if the system proves ineffective or if a better treatment technique is found. The most recent operable unit report, covering calendar year 1999, concluded that chromium concentrations in groundwater were declining but are not consistently below 22 µg/L in compliance wells (DOE-RL, 2000).

## RCRA GROUNDWATER MONITORING PROGRAM

Four wells located in the 183-H chromium plume are monitored for RCRA requirements during pump-and-treat activities (see Figure 1). Three of the wells are completed at the top of the uppermost aquifer (Hanford formation): wells 199-H4-7 and 199-H4-12A are extraction wells, and well 199-H4-3 is a monitoring well that has historically shown the highest levels of chromium, nitrate, technetium-99, and uranium from the 183-H Basins. Well 199-H4-12C is located adjacent to 199-H4-12A and is completed in a confined aquifer in the Ringold Formation. This well consistently has elevated concentrations of chromium, though the contaminant source is unknown. This well is monitored to help determine whether pumping the shallow aquifer affects chromium concentrations deeper in the Ringold sediments.

Wells are sampled annually for RCRA, generally in November. This is typically a period when river stage is low and the samples reflect nearly pure groundwater instead of a mixture of groundwater and river water held in bank storage. Therefore, contaminant concentrations in November are usually among the highest of the year.

Hartman and Chou (1995) listed the following concentration limits for the 183-H Basins constituents of concern:

- Chromium: 122 µg/L. This limit was derived based on background concentrations from upgradient wells 199-H3-2A and 199-H4-6, which were formerly monitored for RCRA.
- Nitrate: 45 mg/L (as NO<sub>3</sub>). Based on final maximum contaminant level (56 FR, January 30, 1991).
- Uranium: 20 µg/L. Based on EPA proposed changes to 40 CFR 141.
- Technetium-99: 900 pCi/L. Interim drinking-water standard, based on national primary drinking water standards (40 CFR 141).

Hartman and Chou (1995) did not identify fluoride as a groundwater contaminant of concern, but it was detected in the vadose zone beneath the former basins and so it is monitored under RCRA (DOE-RL, 1997).

The concentration limits listed above were applied during compliance monitoring to determine whether corrective action was necessary as required under WAC 173-303-645. Because the CERCLA pump-and-treat system is not the final corrective action for the site, the current objective of RCRA monitoring is simply to track trends, not to determine the effectiveness of the corrective action. After completion of the interim remedial measure and future phases of corrective action, the RCRA monitoring program will be revised and contaminant concentrations will be compared to the limits listed above or alternative limits to determine whether the corrective action was successful.

## CONTAMINANT TRENDS

This section discusses concentrations of chromium, nitrate, technetium-99, uranium, and fluoride in groundwater. Data for the reporting period (January through August 2000) are included in the appendix. The 183-H wells were not sampled for RCRA during the reporting period, but some constituents were analyzed for CERCLA. All available data are presented and discussed below.

Concentrations of groundwater contaminants fluctuate seasonally, especially in wells 199-H4-3 and 199-H4-12A. These two wells are directly in the contaminant plume from the 183-H basins and are relatively near the Columbia River. Changing river stage causes the water table to rise and fall. In general, a low water table is associated with higher concentrations of contaminants. Seasonal variations in the water table also cause changes in the direction of groundwater flow. Since 1998, overall contaminant trends have been downward, as shown in Figures 2 and 3.

### Chromium

Chromium concentrations in the four RCRA monitoring wells are illustrated in Figure 2. Two types of analyses are represented: total chromium and hexavalent chromium. Total chromium may include the relatively insoluble, nontoxic trivalent

chromium and the soluble, more toxic hexavalent form. Filtered samples represent dissolved chromium, which is assumed to be hexavalent. Samples analyzed for hexavalent chromium may be filtered or unfiltered. The data table in Appendix A indicates which types of analyses were run and which samples were filtered.

Well 199-H4-3 detected the highest chromium concentration (152  $\mu\text{g/L}$ ) during the reporting period, which is typical for this well. The concentration in July 2000 was lower than in the summer of 1998 or 1999, and appears to fit the pattern of an overall decline. Chromium concentrations in wells 199-H4-7 and 199-H4-12A are typically lower, and declined during the reporting period.

Well 199-H4-12C is completed in a confined aquifer in the Ringold formation. Chromium concentrations are consistently  $>100 \mu\text{g/L}$ . The source of the chromium in this deeper aquifer is unknown, but is probably not the 183-H basins because concentrations of technetium-99, uranium, and nitrate are low. Chromium levels have been declining since 1996 (i.e., before the pump-and-treat system began to operate).

#### Nitrate

Nitrate data are only available for extraction wells 199-H4-7 and 199-H4-12A during the reporting period (Figure 3). The concentration has been fairly steady in 199-H4-7 during the past 3 years, and measured 52.6 mg/L in May 2000. In well 199-H4-12A, nitrate was 14.2 mg/L in May 2000, continuing a three-year decline.

Historical data for well 199-H4-3 show nitrate above 100 mg/L. Nitrate levels in deeper well 199-H4-12C are consistently low ( $<6 \text{ mg/L}$ ).

#### Technetium-99

Technetium-99 data are only available for extraction wells 199-H4-7 and 199-H4-12A during the reporting period (see Figure 3). These wells have historically had very low technetium-99 concentrations. The concentration in well 199-H4-7 increased to 65 pCi/L in May 2000.

Historical data for well 199-H4-3 show technetium-99 concentrations mostly between 1,000 and 5,000 pCi/L. Concentrations in well 199-H4-12C are usually below analytical detection limits.

#### Uranium

No uranium data are available for the reporting period. Historically, levels fluctuate in wells 199-H4-3 and 199-H4-12A, ranging from below the detection limit to over 100  $\mu\text{g/L}$ . Levels in wells 199-H4-7 and 199-H4-12C are consistently much lower, except for a single spike in extraction well 199-H4-7 in 1997.

## Fluoride

No fluoride data are available for the reporting period. Historical levels in 183-H monitoring wells are below the 2,000-ug/L secondary drinking water standard, and are about the same as in wells upgradient of the basins.

## CONCLUSIONS

Contaminant concentrations continued the overall decline of the past 3 years during the reporting period January through August 2000. Specific observations include the following:

- Chromium concentrations continued their general decline in all four monitoring wells. The highest value was 152 µg /L in well 199-H4-3.
- Nitrate continued its decline in well 199-H4-12A (14.2 mg/L) and remained steady in well 199-H4-7 (52.6 mg/L). There were no new data for wells 199-H4-3 or 199-H4-12C.
- Technetium-99 concentrations remained low in wells 199-H4-7 and 199-H4-12A (65 and 43 pCi/L, respectively). There were no new data for wells 199-H4-3 or 199-H4-12C.
- There were no new uranium or fluoride data.

The four RCRA wells will be sampled for all of the constituents of interest in November 2000. The current RCRA monitoring plan (Hartman 1997) remains adequate for the objective of tracking trends during the period of the interim remedial action.

## REFERENCES

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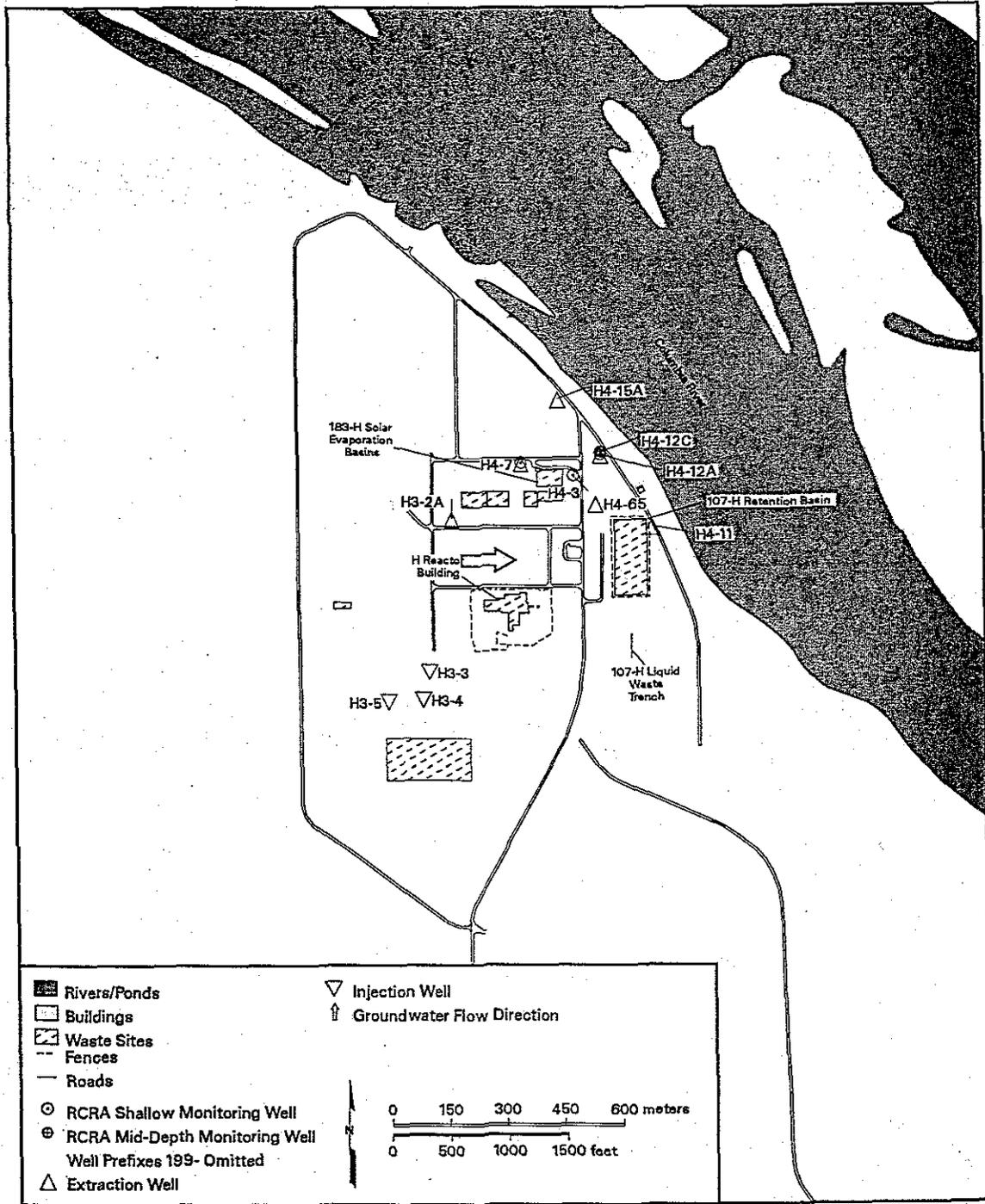


Figure 1. Monitoring Well Locations for 183-H Solar Evaporation Basins.

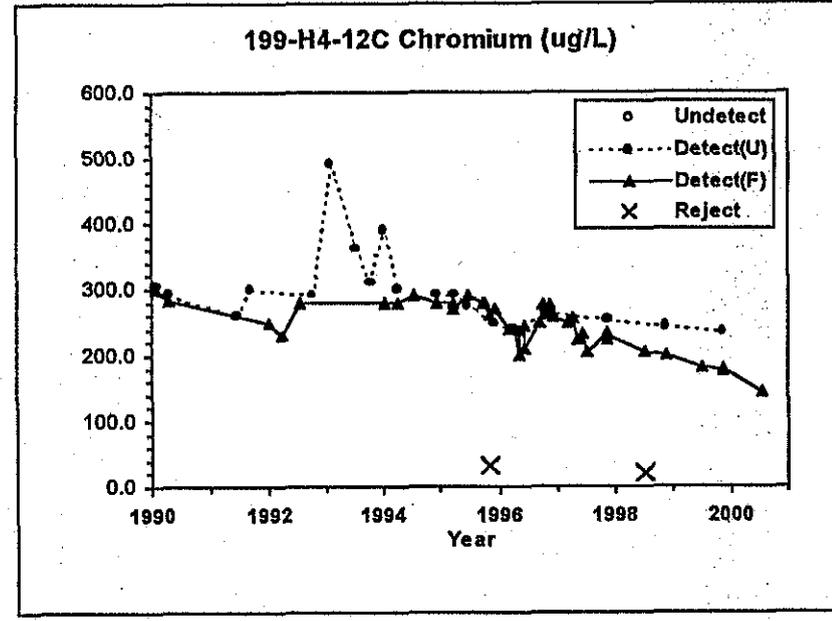
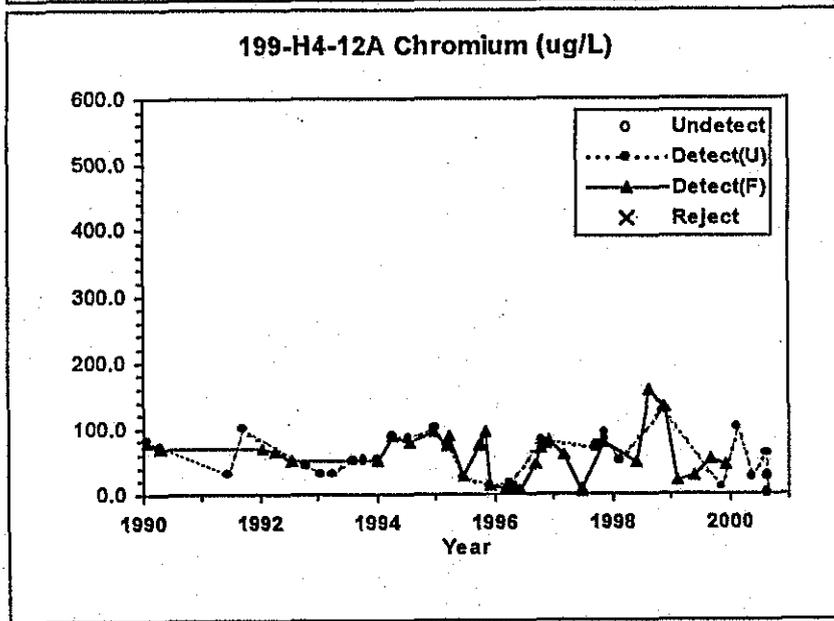
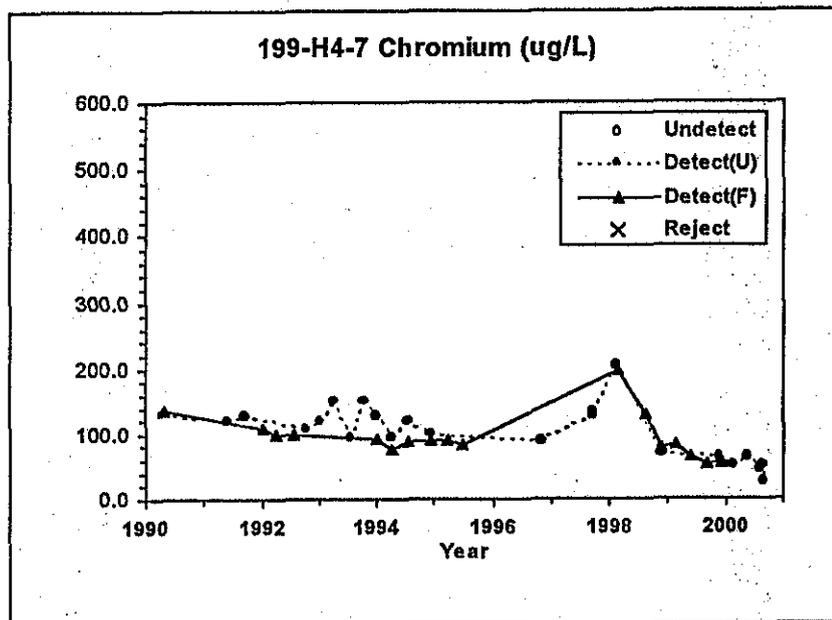
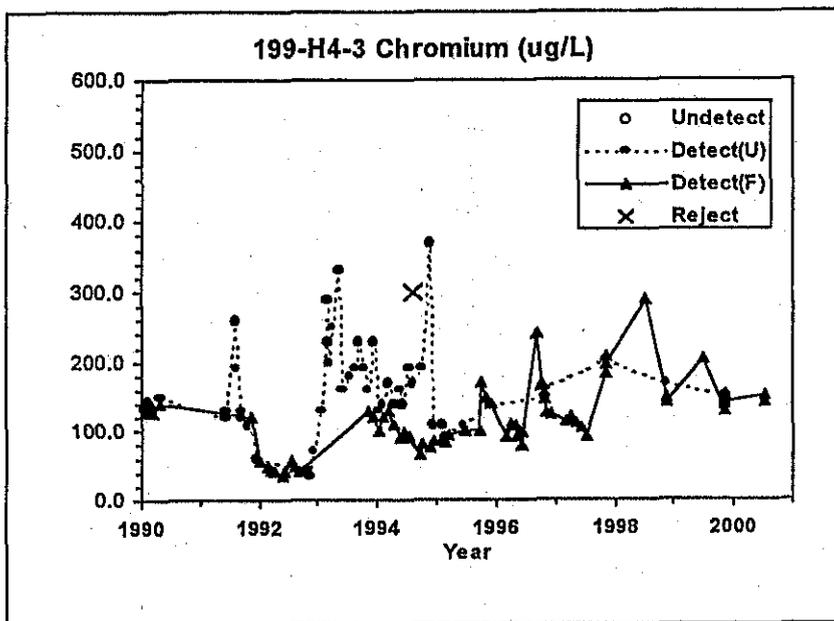


Figure 2. Chromium in 183-H Wells. Both total and hexavalent data are plotted. Dashed line indicates unfiltered samples (U); solid line indicates filtered samples (F).

Appendix A. Constituents of Interest for RCRA Groundwater Monitoring at 183-H Solar Evaporation Basins,  
January through August, 2000.

Well	Date	Result	Filtered	Analysis
Hexavalent Chromium, ug/L				
199-H4-12A	14-Feb-00	99	N	Hexavalent
199-H4-12A	15-May-00	25	N	Hexavalent
199-H4-12A	07-Aug-00	60	N	Hexavalent
199-H4-12A	16-Aug-00	28	N	Hexavalent
199-H4-12A	23-Aug-00	2.6	N	Hexavalent
199-H4-12C	19-Jul-00	145	Y	Hexavalent
199-H4-3	13-Jul-00	143	Y	Hexavalent
199-H4-3	13-Jul-00	152	Y	Total
199-H4-7	14-Feb-00	50	N	Hexavalent
199-H4-7	15-May-00	63	N	Hexavalent
199-H4-7	15-May-00	66	N	Hexavalent
199-H4-7	07-Aug-00	47	N	Hexavalent
199-H4-7	16-Aug-00	50	N	Hexavalent
199-H4-7	23-Aug-00	28	N	Hexavalent
Nitrate, ug/L				
199-H4-12A	15-May-00	14200	N	
199-H4-7	15-May-00	52600	N	
Technetium-99, pCi/L				
199-H4-7	15-May-00	65	N	
199-H4-12A	15-May-00	43.3	N	

Results of Groundwater Monitoring for RCRA Corrective Action  
At The 300 Area Process Trenches  
January through June 2000

J.W. Lindberg  
October 2000

## INTRODUCTION

The 300 Area Process Trenches (316-5) were operated to receive effluent discharges of dangerous mixed waste from fuel fabrication laboratories in the 300 Area. This is the second 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. Results of monitoring have been reported previously in groundwater annual reports (e.g., Hartman et al. 2000). This report covers groundwater monitoring data collected during the period from January through June 2000.

## BACKGROUND

A RCRA interim-status groundwater quality assessment program began in June 1985 to monitor groundwater near the 300 Area Process Trenches and continued until December 1996. In December 1996, the interim-status assessment program was changed to a final-status compliance-monitoring program. The schedule for modifying the Hanford Site RCRA Permit (Ecology 1994) required that a modified closure plan and accompanying revised groundwater-monitoring plan be submitted. The documents were prepared, and the closure plan (DOE/RL-93-73) included the revised groundwater-monitoring plan (Lindberg et al. 1996). This documentation is referenced in the revised Hanford Site RCRA Permit (Ecology 1994) and became effective December 26, 1996.

As expected, groundwater samples from well 399-1-16B, a downgradient well sampling the base of the uppermost aquifer, showed that cis-1,2-dichloroethene (cis-DCE) and trichloroethene (TCE) were in concentrations higher than the specified concentration limits (70- $\mu\text{g/L}$  and 5- $\mu\text{g/L}$  MCLs, respectively). Similarly, the three downgradient wells monitoring the aquifer at the water table (399-1-10, -1-16A, and -1-17A) had concentrations of uranium that exceeded the 20- $\mu\text{g/L}$  EPA-proposed MCL. After the first four independent samples were collected in December 1996, and January, February, and March 1997, the exceedances of MCLs for cis-DCE, TCE, and uranium were confirmed and the regulator was notified. As required by WAC 173-303-645(2)(a)(ii), the monitoring plan was modified to change from a compliance-monitoring plan to a corrective action plan.

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 proposed groundwater-monitoring plan for corrective action utilizes the same well network that was being sampled during the compliance period but uses the combined Shewart-Cusum approach for

statistical evaluations. This approach can be implemented with a single observation (sample) at any monitoring event. The method could be applied to monitor each well individually and yet maintain desired site-wide false-positive and false-negative rates. Also, each well showing an exceedance of one of the constituents of interest (currently, four of eight wells) will be put on a quarterly sampling schedule to better follow the trends of contaminant concentration. The other wells in the network will continue to be sampled semiannually. The proposed plan is still being reviewed by the regulator.

## RCRA GROUNDWATER-MONITORING PROGRAM

Until the time that the proposed corrective action plan is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect. This current compliance-monitoring plan calls for four independent (time independent) groundwater samples from each network well (eight) be collected during each semiannual sampling period (i.e., 64 well trips/yr = 8 wells X 4 well trips/semiannual sampling period X 2 sampling periods/yr). The groundwater-monitoring well network is sampled in the following months: December, January, February, March (when the Columbia River stage is generally low), and June, July, August, and September (when the Columbia River is generally higher). The current reporting period includes January, February, March, and June. Time independence is accomplished by sampling at one-month intervals during each semiannual sampling period. An alternate final-status/corrective action-monitoring plan has been proposed that will accomplish the goals of the original final-status/compliance-monitoring program but with one independent sample collected during each semiannual sampling event.

The groundwater-monitoring well network for the 300 Area Process Trenches includes four well pairs (Figure 1). One pair is upgradient and three pairs are downgradient. Each well pair is composed of one well that monitors the upper portion of the uppermost aquifer near the water table (wells ending in "A"), and another well that monitors the base of the uppermost aquifer (wells ending in "B").

Wells in the network are monitored for constituents of interest including uranium and volatile organics. The concentration limits, as specified in Lindberg et al. (1996), are as follows:

- Uranium: 20 µg/L. Based on EPA-proposed MCL.
- Cis-1,2-dichloroethene: 70 µg/L. Based on MCL.
- Trichloroethene: 5 µg/L. Based on MCL.
- Any other volatile organic detected: MCL.

## CONTAMINANT TRENDS

This section discusses concentrations of uranium, cis-DCE, and TCE in groundwater near the 300 Area Process Trenches. Data for the reporting period (January through June 2000) are included in the attachment. Trends are compared to the concentration limits defined above. For more information on groundwater contamination near the 300 Area Process Trenches, as well as the whole 300 Area since December 1997, see Hartman and Dresel (1998), Hartman (1999), and Hartman et al. (2000).

## Uranium

Uranium-contaminated groundwater in the 300 Area occurs mostly near the top of the uppermost aquifer. The areal distribution (horizontal distribution) is illustrated in Figure 2. [Figure 2 is from Hartman et al. (2000) and is based on data collected prior to the current reporting period. Data collected during the reporting period is added to the figure but is not reflected in the contour lines.] Although uranium is distributed throughout much of the 300 Area, wells downgradient (southeast) of the southern end (the discharge end) of the 300 Area Process Trenches are associated with some of the highest concentrations of uranium in the 300 Area. Based on this distribution, the soil beneath (or near) the 300 Area Process Trenches continues to be one of the major sources of uranium contamination in groundwater.

The concentration of uranium remained above the concentration limit (20 µg/L) during the reporting period in the three downgradient wells of the well network (Figures 3, 4, and 5) that are screened in the upper portion of the uppermost aquifer (399-1-10A, -1-16A, and -1-17A). In the wells screened in the lower portion of the uppermost aquifer, uranium was not detected in wells 399-1-10B or 399-1-17B. In well 399-1-16B the concentration remained below the concentration limit.

The uranium concentration varied greatly in well 399-1-16A during the reporting period, but not in the other two downgradient wells screened in the upper portion of the aquifer (see Figures 3, 4, and 5). In well 399-1-16A the concentration varied from 87.8 to 131 µg/L during the reporting period with an overall steady trend since 1997. However, in wells 399-1-10A and 399-1-17A the concentrations varied only slightly during the reporting period (48-54 µg/L for 399-1-10A and 95 to 126 µg/L for 399-1-17A), but the overall trend since 1997 appears to be a slight decline in both wells.

## Chlorinated Hydrocarbons

None of the wells in the 300 Area Process Trenches well network had reported concentrations of TCE above the 5.0 µg/L MCL during the reporting period. The highest reported concentration was 3.5 µg/L in March of 2000 in well 399-1-16B (Figure 6). Other wells of the network occasionally have detectable concentrations of TCE, but none higher than 0.65 µg/L. Since March 1997 the reported concentrations of TCE have been slowly declining.

Cis-DCE is detected in several wells near the 300 Area Process Trenches, but only one well (399-1-16B) has reported concentrations above the MCL (70 µg/L) during the reporting period. The highest reported concentration during that time was 170 µg/L in June 2000 (Figure 7). As shown in Figure 7 the concentration of cis-DCE in well 399-1-16B remained fairly constant and is generally in the range of 140 to 180 µg/L during 1997 and 1998. During 1999, the concentration began to decline with one value as low as 110 µg/L, but during the reporting period the concentration of cis-DCE stopped declining and began to rise again to the concentrations of 1997 and 1998.

## CONCLUSIONS

Concentrations of uranium and cis-DCE exceeded applicable concentration limits during the reporting period of January to June 2000. Uranium concentrations exceeded the concentration limit at all three downgradient wells that are completed in the upper portion of the uppermost aquifer. However, concentrations continue to decline slightly with time and vary with Columbia River stage. Cis-DCE exceeded applicable concentration limits in only one well (399-1-16B – screened in the lower portion of the uppermost aquifer. The trend was downward throughout 1999, but began to rise again during 2000. A “five-year review” is currently underway by the EPA to determine if the decline in concentrations of uranium and cis-DCE are adequate to meet the objectives of the current remedy (natural attenuation).

Until the proposed corrective action groundwater-monitoring plan is approved by the regulator, the current final-status compliance-monitoring program (Lindberg et al. 1996) will remain in effect.

## REFERENCES

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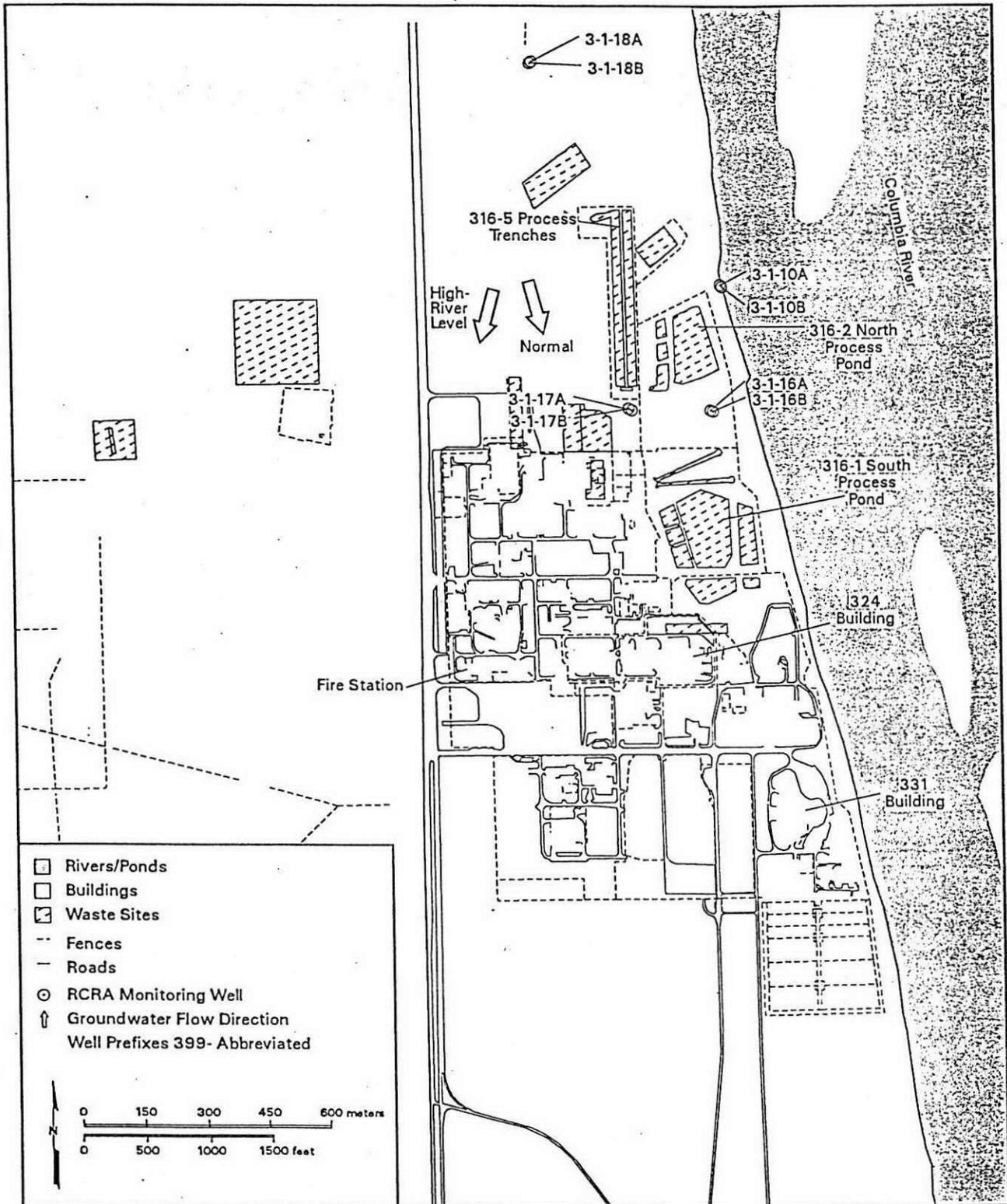
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Figure 1. Monitoring Well Locations for the 300 Area Process Trenches.



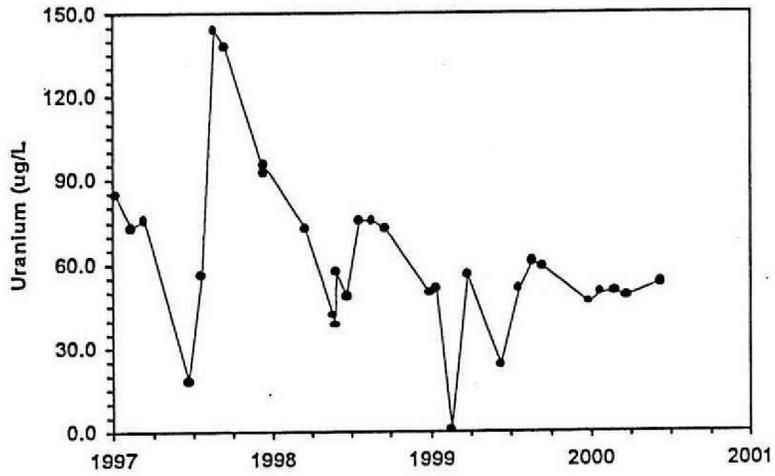


Figure 3. Uranium in Downgradient Well 399-1-10A.

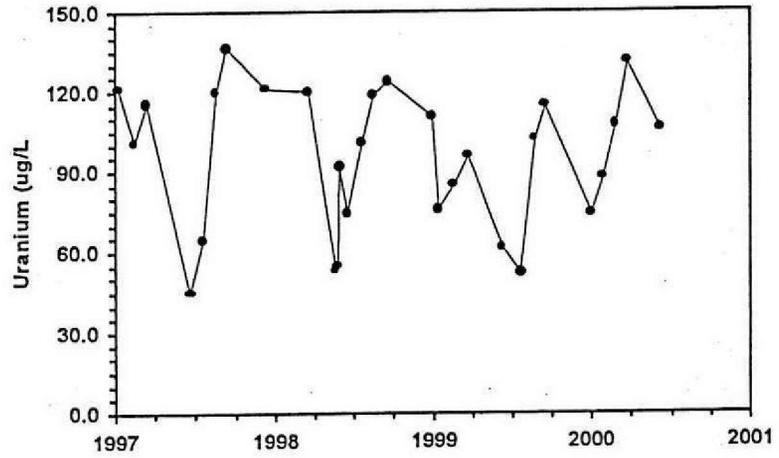


Figure 4. Uranium in Downgradient Well 399-1-16A.

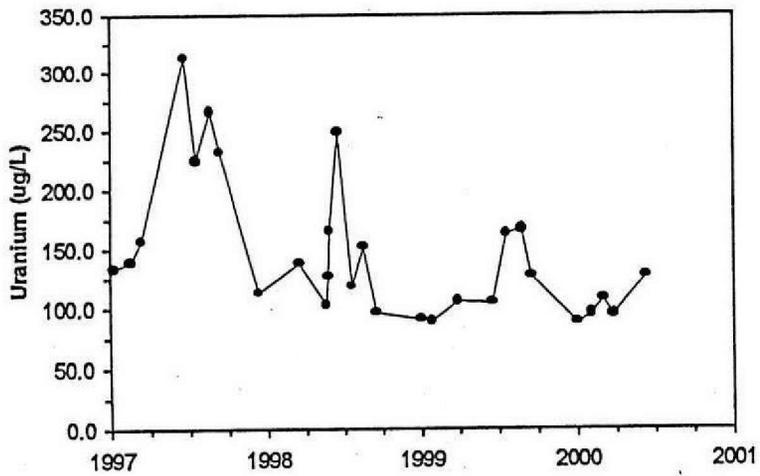


Figure 5. Uranium in Downgradient Well 399-1-17A.

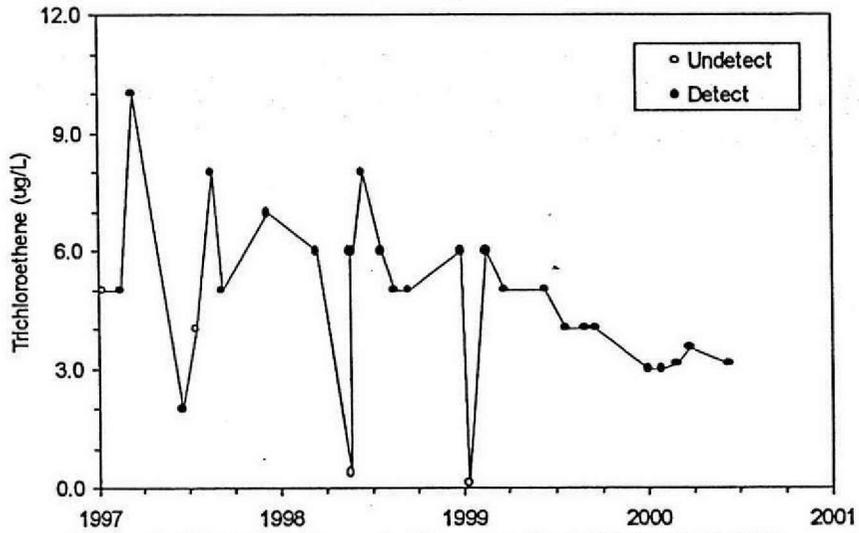


Figure 6. Trichloroethene in Downgradient Well 399-1-16B.

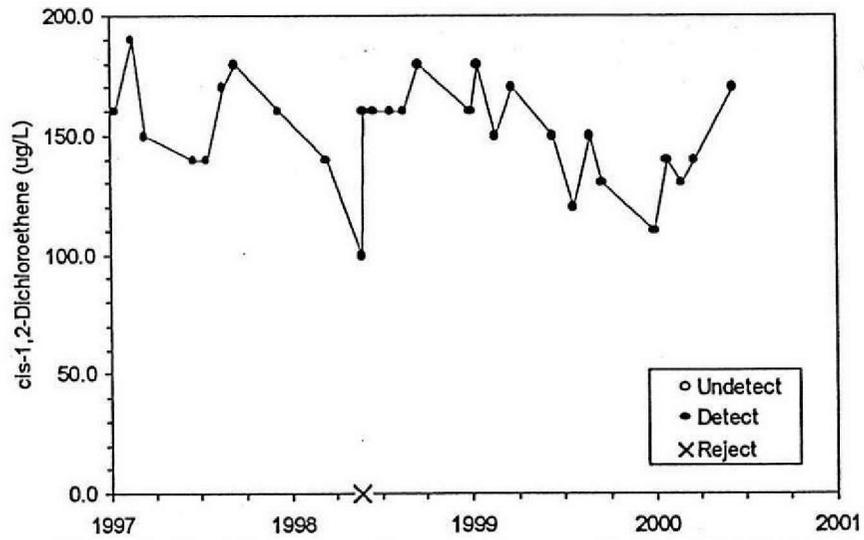


Figure 7. Cis-1,2-dichloroethene in Downgradient Well 399-1-16B.

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
cis-1,2-dichloroethene			
399-1-10A	24-Jan-00	0.18	U
399-1-10A	24-Feb-00	0.18	U
399-1-10A	21-Mar-00	0.18	U
399-1-10A	06-Jun-00	0.18	U
399-1-10B	24-Jan-00	0.18	U
399-1-10B	24-Feb-00	0.25	J
399-1-10B	21-Mar-00	0.18	U
399-1-10B	06-Jun-00	0.18	U
399-1-10B	06-Jun-00	0.18	U
399-1-16A	25-Jan-00	0.18	U
399-1-16A	24-Feb-00	0.26	J
399-1-16A	21-Mar-00	0.6	J
399-1-16A	07-Jun-00	0.31	J
399-1-16B	25-Jan-00	140	D
399-1-16B	24-Feb-00	130	D
399-1-16B	21-Mar-00	140	D
399-1-16B	07-Jun-00	170	D
399-1-17A	01-Feb-00	0.18	U
399-1-17A	01-Feb-00	0.18	U
399-1-17A	28-Feb-00	0.18	U
399-1-17A	22-Mar-00	0.18	U
399-1-17A	07-Jun-00	0.18	U
399-1-17B	25-Jan-00	3.5	J
399-1-17B	28-Feb-00	3.9	J
399-1-17B	21-Mar-00	4.7	J
399-1-17B	07-Jun-00	3.5	J
399-1-18A	24-Jan-00	0.18	U
399-1-18A	24-Feb-00	0.18	U
399-1-18A	21-Mar-00	0.18	U
399-1-18A	06-Jun-00	0.18	U
399-1-18B	24-Jan-00	0.18	U
399-1-18B	24-Feb-00	0.18	U
399-1-18B	21-Mar-00	0.18	U
399-1-18B	06-Jun-00	0.18	U
Trichloroethene			
399-1-10A	24-Jan-00	0.16	U
399-1-10A	24-Feb-00	0.16	U
399-1-10A	21-Mar-00	0.16	U
399-1-10A	06-Jun-00	0.16	U
399-1-10B	24-Jan-00	0.16	U
399-1-10B	24-Feb-00	0.16	U
399-1-10B	21-Mar-00	0.16	U
399-1-10B	06-Jun-00	0.16	U
399-1-10B	06-Jun-00	0.16	U
399-1-16A	25-Jan-00	0.49	J
399-1-16A	24-Feb-00	0.49	J
399-1-16A	21-Mar-00	0.65	J
399-1-16A	07-Jun-00	0.4	J
399-1-16B	25-Jan-00	3	J

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
399-1-16B	24-Feb-00	3.1	J
399-1-16B	21-Mar-00	3.5	J
399-1-16B	07-Jun-00	3.1	J
399-1-17A	01-Feb-00	0.16	U
399-1-17A	01-Feb-00	0.27	J
399-1-17A	28-Feb-00	0.28	J
399-1-17A	22-Mar-00	0.33	J
399-1-17A	07-Jun-00	0.22	J
399-1-17B	25-Jan-00	0.16	U
399-1-17B	28-Feb-00	0.16	U
399-1-17B	21-Mar-00	0.16	U
399-1-17B	07-Jun-00	0.16	U
399-1-18A	24-Jan-00	0.16	U
399-1-18A	24-Feb-00	0.16	U
399-1-18A	21-Mar-00	0.16	U
399-1-18A	06-Jun-00	0.16	U
399-1-18B	24-Jan-00	0.16	U
399-1-18B	24-Feb-00	0.16	U
399-1-18B	21-Mar-00	0.16	U
399-1-18B	06-Jun-00	0.16	U
Uranium			
399-1-10A	24-Jan-00	49.4	
399-1-10A	24-Feb-00	49.8	
399-1-10A	21-Mar-00	48.4	
399-1-10A	06-Jun-00	53.4	
399-1-10B	24-Jan-00	0.0274	U
399-1-10B	24-Feb-00	0.0819	J
399-1-10B	21-Mar-00	0.0316	U
399-1-10B	06-Jun-00	0.197	
399-1-10B	06-Jun-00	0.37	
399-1-16A	25-Jan-00	87.8	
399-1-16A	24-Feb-00	108	
399-1-16A	21-Mar-00	131	
399-1-16A	07-Jun-00	106	
399-1-16B	25-Jan-00	8.19	
399-1-16B	24-Feb-00	12.7	
399-1-16B	21-Mar-00	12.7	
399-1-16B	07-Jun-00	11.2	
399-1-17A	01-Feb-00	96.1	
399-1-17A	01-Feb-00	95	
399-1-17A	28-Feb-00	107	
399-1-17A	22-Mar-00	94	
399-1-17A	07-Jun-00	126	
399-1-17B	25-Jan-00	0.0236	U
399-1-17B	28-Feb-00	0.0475	U
399-1-17B	21-Mar-00	0.067	U
399-1-17B	07-Jun-00	0.0192	U
399-1-18A	24-Jan-00	5.63	
399-1-18A	24-Feb-00	5.78	
399-1-18A	21-Mar-00	5.98	

Groundwater Chemistry Data for 300 Area Process Trenches,  
January-June 2000

Well	Sample Date	Result (ug/L)	Qualifier
399-1-18A	06-Jun-00	5.97	
399-1-18B	24-Jan-00	0.00802	U
399-1-18B	24-Feb-00	0.00851	U
399-1-18B	21-Mar-00	0.0773	J
399-1-18B	06-Jun-00	0.367	