**Results of Groundwater Monitoring for the 300 Area Process Trenches**
**Reporting Period: July - December 2003**
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## INTRODUCTION

The 300 Area process trenches (316-5) are a *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and/or disposal unit in the Hanford Facility RCRA Permit (Ecology 2000). From 1975 through 1994 they 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 2000). 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 2003.

## BACKGROUND

The objective of groundwater monitoring during the corrective action period was to demonstrate the effectiveness of the corrective action program by examining the trend of the constituents of interest to confirm that they were 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.

Prior to September 2001 groundwater monitoring at the 300 Area process trenches operated under a groundwater monitoring plan (Lindberg et al. 1995) that was originally designed for groundwater compliance. Sampling occurred eight times per year at eight network wells (Figure 1). Constituents of interest were uranium and volatile organic compounds (trichloroethene , cis-1,2-dichloroethene, and tetrachloroethene). As expected, groundwater samples showed that uranium and two volatile organic compounds (trichloroethene and cis-1,2-dichloroethene) exceeded specified contamination limits (Federal drinking water standards) prompting the groundwater monitoring program to move into correction action with a revised groundwater monitoring plan.

In September 2001 a revised groundwater-monitoring plan for corrective action (Lindberg and Chou 2001) was implemented for a two-year evaluation period. Changes over the previous plan included an update on the discussion of hydrogeology and conceptual model, a change in the number of network wells from 8 to 11 (Figure 1), and a revision of the statistical approach to the control chart method that tracks the contamination trends better than the previous plan with reduced costs. Based on the results of the two-year evaluation period, Ecology was to decide whether to continue, modify, or abandon the proposed approach in the revised plan.. The last groundwater samples for this two-year evaluation period were collected in September 2003, and a report was prepared on the findings (Chou 2004) and transmitted

to Ecology. Ecology is reviewing the report, and monitoring has reverted to the previous monitoring plan (Lindberg, et al., 1995).

DOE recently submitted a permit modification that proposes a revision of the RCRA monitoring program for the 300 Area process trenches. The proposed monitoring program will be integrated with CERCLA interim action monitoring, as allowed by Section II.K.7 of the Hanford Facility RCRA Permit. In this new proposal, the groundwater monitoring plan would retain eight wells in the network, eliminate radioactive constituents of interest but retain the non-radioactive constituents, reduce the sampling frequency to semiannual in all eight wells, eliminate statistical analysis, and report on results in annual groundwater reports.

## RCRA GROUNDWATER-MONITORING PROGRAM

The revised groundwater-monitoring network for the 300 Area process trenches included five well pairs plus one additional well (399-1-11) that is screened in the upper portion of the unconfined aquifer (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 overbank deposits of the Ringold Formation lower mud unit).

While complying with the revised groundwater-monitoring plan (which ceased in September 2003) the wells were sampled for the constituents of interest, including total uranium (chemical), and the volatile organic compounds cis-1,2-dichloroethene, trichloroethene, and tetrachloroethene. The drinking water standards (DWS), as specified in Lindberg and Chou (2001), are shown in Table 1 along with the current method detection levels (MDLs).

Table 1. Maximum Contaminant Levels and Method Detection Levels of 300 Area Process Trenches Constituents of Interest

| Constituents of Interest | DWS | MDL |
|---|---|---|
| Uranium | 30 ug/L | <0.09 ug/L |
| Cis-1,2-dichloroethene | 70 ug/L | 0.06 ug/L |
| Trichloroethene | 5 ug/L | 0.16 ug/L |
| Tetrachloroethene | 5 ug/L | 0.17 ug/L |

Uranium is not a listed dangerous waste constituent subject to regulation under RCRA. However, it continues to be monitored for the 300 Area process trenches because it is included in the monitoring plan referenced in the current Hanford Facility RCRA Permit.[1]

The sampling schedule is based on the concentrations of the constituents of interest reported at each well. As mentioned in the Background section, wells with constituents of interest exceeding drinking water standards are sampled quarterly. The rest are sampled semiannually. Table 2 lists the

[1] Please note that source, special nuclear and by-product materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at DOE facilities exclusively by DOE acting pursuant to its AEA authority. These materials are not subject to regulation by the State of Washington. All information contained herein and related to, or describing AEA-regulated materials and processes in any manner, may not be used to create conditions or other restrictions set forth in any permit, license, order, or any other enforceable instrument. DOE asserts that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear and by-product materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

wells in the 300 Area process trenches network, their sampling frequency, and the constituent of interest that exceed a drinking water standard.

Table 2. Sampling Schedule for Wells in the 300 Area Process Trenches Network as Specified in the Groundwater Monitoring Plan (PNNL-13645) (Note: Frequency based on results prior to current reporting period.)

| Well | Sampling Frequency | Constituents of Interest Exceeding DWS |
|---|---|---|
| 399-1-7 | Quarterly | Uranium |
| 399-1-8 | Semiannually | |
| 399-1-10A | Quarterly | Uranium |
| 399-1-10B | Semiannually | |
| 399-1-11 | Quarterly | Uranium |
| 399-1-16A | Quarterly | Uranium |
| 399-1-16B | Quarterly | Cis-1,2-dichloroethene |
| 399-1-17A | Quarterly | Uranium |
| 399-1-17B | Semiannually | |
| 399-1-21A | Semiannually | |
| 399-1-21B | Semiannually | |

To be in compliance with the previous plan, groundwater samples were collected during the eight months specified earlier at four well pairs (one shallow and one deep). The wells pairs include 399-1-10A and B, 399-1-16A and B, 399-1-17A and B, and 399-1-18A and B (Figure 1). The constituents of interest are the same as in the revised plan. Of course, where the two plans overlap, only one well trip and resulting analyses is performed per well.

## 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 2003 sampling events was predominantly in its normal (low river stage) configuration. During low river stage periods the water table slopes to the south or southeast in the vicinity of the 300 Area process trenches with the result that groundwater flows mainly to the southeast, discharging to the Columbia River.

## GROUNDWATER CONTAMINANT TRENDS

This section discusses concentrations of uranium, cis-1,2-dichloroethene (cis-DCE), trichloroethene (TCE), and tetrachloroethene (the contaminants of interest) in groundwater downgradient of the 300 Area process trenches during the reporting period. Table 3 lists the analytical results for each contaminant of interest at the monitoring wells of the network. Several of the network wells were not sampled during December 2003 because of limited well access caused by surface remediation efforts.

Table 3. Results of Groundwater Analyses for 300 Area Process Trenches Contaminants of Interest During the Reporting Period July - December 2003

| Well | Sample Date | cis-1,2-DCE, ug/L | | PCE, ug/L | | TCE, ug/L | | Uranium, ug/L | |
|---|---|---|---|---|---|---|---|---|---|
| 399-1-10A | 7/14/2003 | 0.15 | J | 0.17 | U | 0.16 | U | 131 | B |
| 399-1-10A | 8/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 119 | |
| 399-1-10A | 9/16/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 99.2 | B |
| 399-1-10A | 12/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 65.5 | |
| 399-1-10A | 12/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 65.3 | |
| 399-1-10B | 7/14/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.79 | B |
| 399-1-10B | 8/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 3.19 | |
| 399-1-10B | 9/16/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.189 | B |
| 399-1-10B | 12/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.039 | |
| 399-1-11 | 9/16/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 13.6 | B |
| 399-1-11 | 12/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 13.2 | |
| 399-1-16A | 7/14/2003 | 0.29 | J | 0.17 | U | 0.44 | J | 64.3 | B |
| 399-1-16A | 8/18/2003 | 0.41 | J | 0.17 | U | 0.43 | J | 85.6 | |
| 399-1-16A | 9/16/2003 | 0.25 | J | 0.17 | U | 0.41 | J | 79.1 | B |
| 399-1-16A | 9/16/2003 | 0.25 | J | 0.17 | U | 0.39 | J | 78.9 | B |
| 399-1-16B | 7/14/2003 | 140 | D | 0.17 | U | 2.7 | | 11.5 | B |
| 399-1-16B | 8/18/2003 | 130 | D | 0.17 | U | 2.8 | | 11.3 | |
| 399-1-16B | 9/16/2003 | 160 | D | 0.17 | U | 3.3 | | 9.16 | B |
| 399-1-17A | 7/14/2003 | 0.06 | U | 0.17 | U | 0.23 | J | 53.4 | B |
| 399-1-17A | 8/19/2003 | 0.06 | U | 0.17 | U | 0.3 | J | 55.4 | |
| 399-1-17A | 9/16/2003 | 0.2 | J | 0.17 | U | 0.33 | J | 54.5 | B |
| 399-1-17A | 12/18/2003 | 0.084 | J | 0.17 | U | 0.21 | J | 45.8 | |
| 399-1-17B | 7/14/2003 | 1.8 | | 0.17 | U | 0.16 | U | 2.02 | B |
| 399-1-17B | 8/19/2003 | 2.7 | | 0.17 | U | 0.16 | U | 0.161 | |
| 399-1-17B | 9/16/2003 | 2.8 | | 0.17 | U | 0.16 | U | 0.22 | B |
| 399-1-17B | 12/18/2003 | 2.1 | | 0.17 | U | 0.16 | U | 0.00997 | |
| 399-1-18A | 7/14/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 7.05 | B |
| 399-1-18A | 8/19/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 5.8 | |
| 399-1-18A | 9/16/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 5.17 | B |
| 399-1-18B | 7/14/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.137 | B |
| 399-1-18B | 8/19/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.00835 | U |
| 399-1-18B | 9/16/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.186 | B |
| 399-1-18B | 12/18/2003 | 0.06 | U | 0.17 | U | 0.16 | U | 0.00641 | U |
| 399-1-7 | 9/16/2003 | 0.12 | J | 0.17 | U | 0.66 | J | 56 | B |

B= Constituent was found in associated blank
J = Estimated value; close to detection limit
U= Below detection limit

**Uranium**

The concentration of uranium in the plume downgradient of the process trenches continues to react to Columbia River stage, and, in general, is decreasing in concentration over time. Uranium concentrations exceeded the drinking water standard (30 ug/L) at four wells in the network during the reporting period. The highest concentration reported was 131 ug/L at well 399-1-10A in a sample collected in July 2003.

Suitable uranium maps of the area downgradient of the 300 Area Process Trenches can be constructed from the results of samples collected in June and December of each year. In those months a large number of 300-FF-5 wells, as well as the 300 Area process trenches network are sampled. Attempting to construct a uranium map from data collected during other months of the year is difficult because of the small number of wells sampled. During December 2003 three 300 Process Trenches network wells and four 300-FF-5 network wells were not sampled because of well access problems. Because of the location and importance of these wells that were not sampled, a uranium concentration map could not be constructed for December 2003. Therefore, the most recent uranium concentration map available is June 2003 (Figure 2), which is the month preceding the current reporting period.

Figure 2 shows that the areal extent of the uranium plume in the 300 Area remained about the same as previous years, and that there were three areas of increased uranium concentration in June 2003. The most southern area of elevated concentration represents pulses of uranium due to high river stages prior to 2003. The elevated uranium concentration immediately downgradient of the 300 Area Process Trenches is due to the elevated river stages during May and June 2003. The elevated concentration at well 399-1-10A is the tail end of an elevated uranium pulse most likely caused by remedial activities at the 618-5 Burial Grounds during 2002 (and reported in the last semiannual report of 300 Area Process Trenches groundwater monitoring, September 2003). Figure 3 shows the historical trend for uranium at well 399-1-10A, and clearly shows the large increase in uranium concentration there starting in late 2002.

**Cis-1,2-Dichloroethene**

Cis-1,2-dichloroethene (cis-DCE) was detected at five wells in the 300 Area process trenches network during the reporting period. Three of the wells are screened the upper portion of the unconfined aquifer (wells 399-1-10A, 399-1-16A and 399-1-17A), and two are screened in the lower portion of the unconfined aquifer (wells 399-1-16B and 399-1-17B). 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 were 140, 130, and 160 ug/L in July, August, and September 2003, respectively. The trend at well 399-1-16B (Figure 4) is variable, fluctuating between 130 and 170 ug/L, but overall appears to be neither decreasing or increasing. At well 399-1-17B, another well screened at the base of the unconfined aquifer, the reported result was 2.8 ug/L during September 2003. The three wells where cis-DCE was detected in the upper portions of the unconfined aquifer had reported results below 0.5 ug/L and were flagged with "J" indicating results were close to the analytical detection limit.

**Trichloroethene**

Trichloroethene (TCE) was detected at four wells in the 300 Area process trenches network during the reporting period, but the drinking water standard (5 ug/L) was not exceeded. The well with the highest reported concentration was well 399-1-16B. The source is 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 since 2000. The source of trichloroethene entering the 300 Area as a plume from offsite sources to the southwest is confined to the upper portions of the unconfined aquifer and concentrations remain below 1 ug/L.

**Tetrachloroethene**

In recent years tetrachloroethene has occasionally been detected in the well network downgradient of the 300 Area process trenches. However, it was not detected in the well network during the reporting period.

## 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 appears to be decreasing with time. 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.

## REFERENCES

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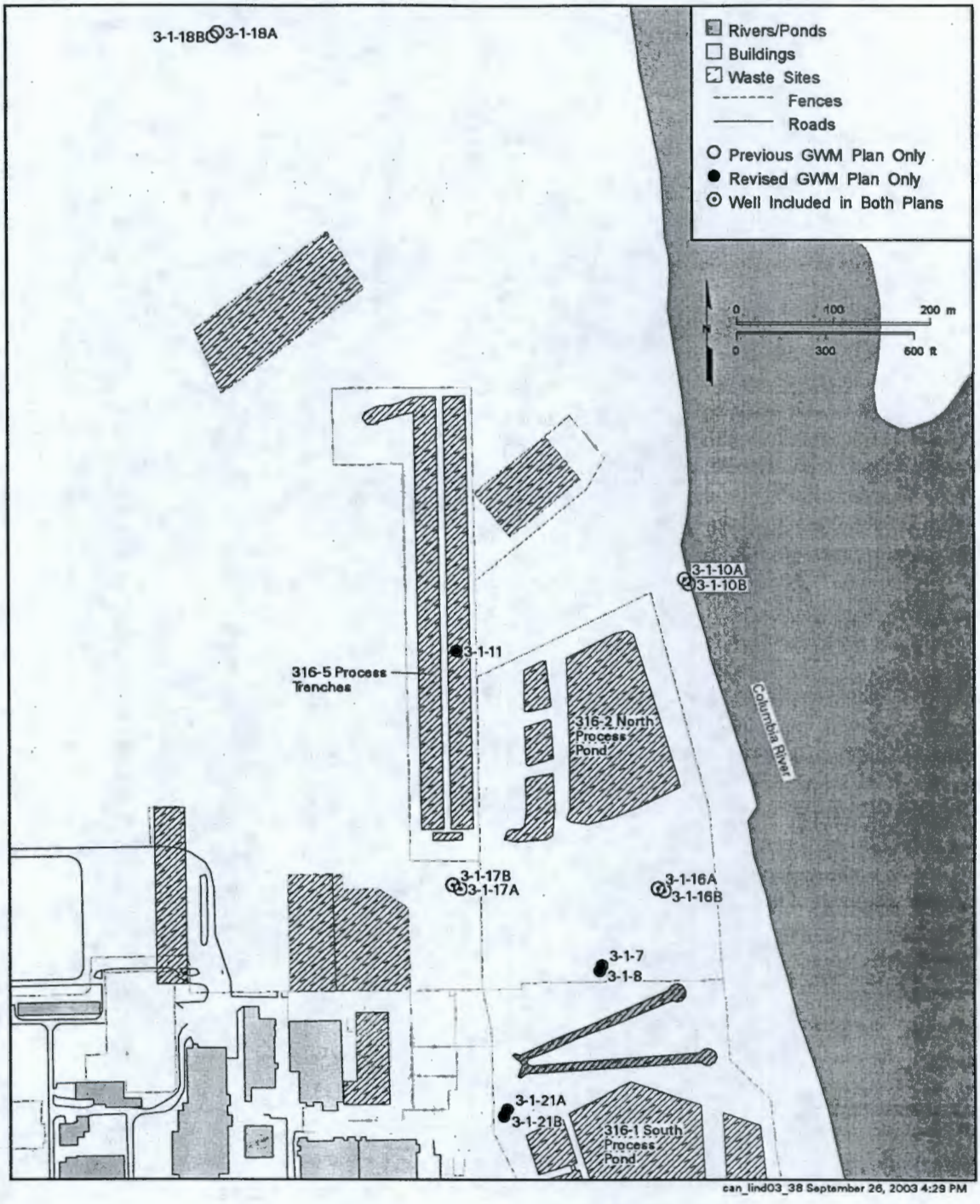


Figure 1. Locations of Wells in the previous and revised 300 Area Process Trenches Monitoring Networks (from WHC-SD-EN-AP-185 and PNNL-13645).

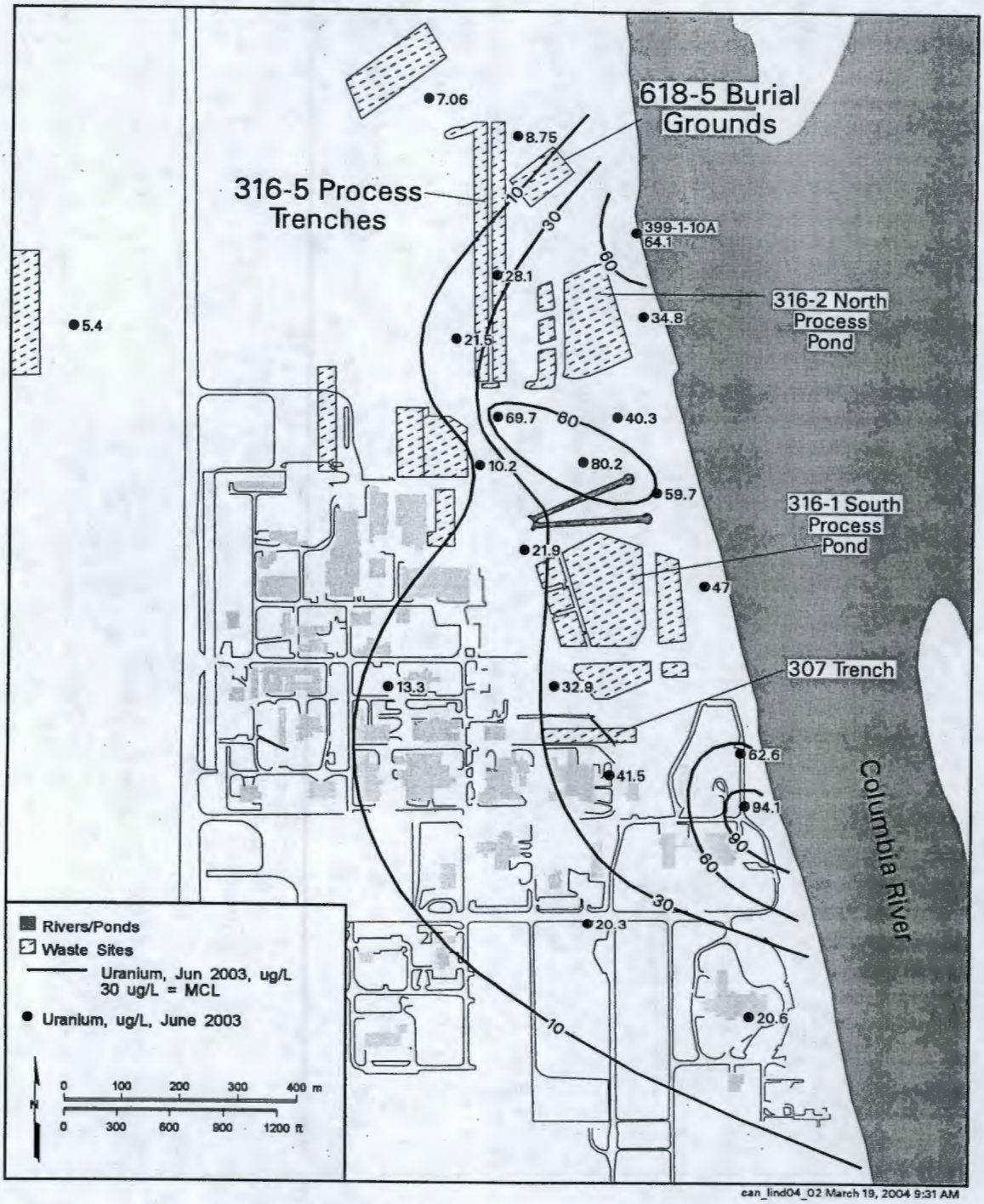


Figure 2. Uranium Concentrations in the Upper Portion of the Unconfined Aquifer in June 2003.

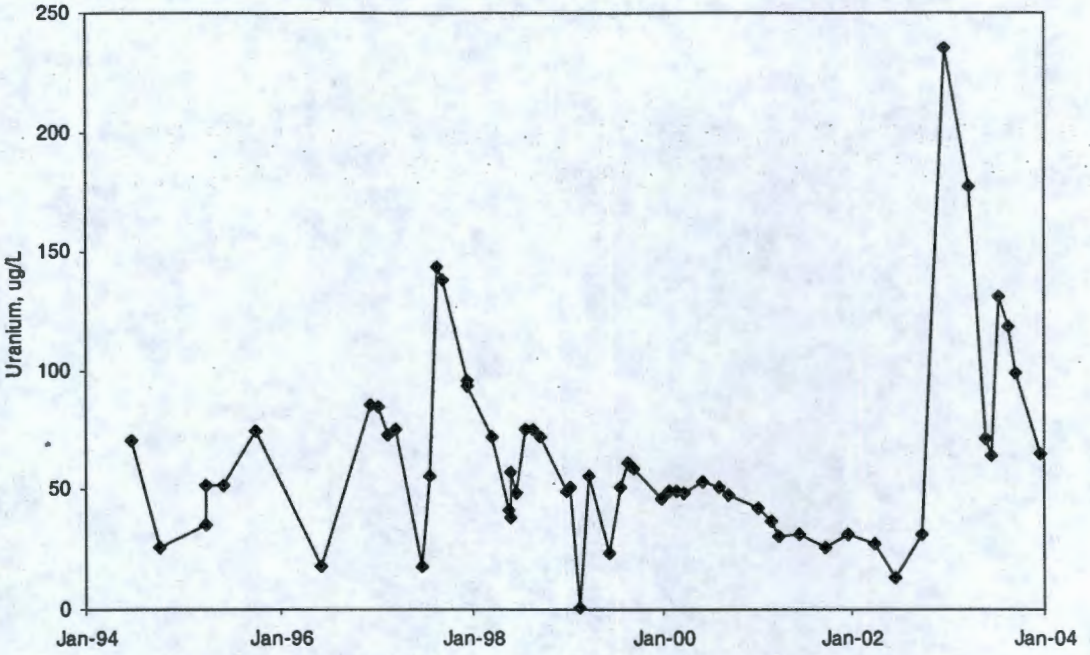


Figure 3. Uranium Concentrations in Well 399-1-10A.

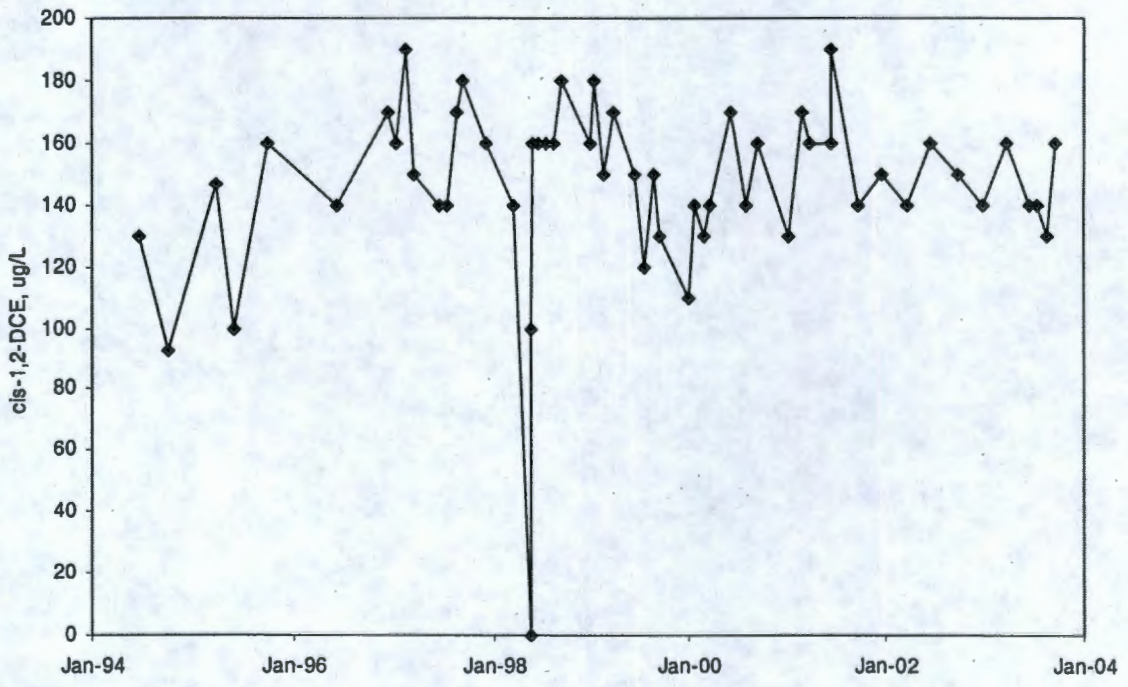


Figure 4. cis-1,2-Dichloroethene Concentrations in Well 399-1-16B.