

## 2.7 100-FR-3 Operable Unit

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The scope of this section is the 100-FR-3 groundwater interest area, which encompasses the 100-FR-3 Operable Unit and a large section of the 600 Area north of Gable Mountain (see Figure 1.0-1 in Section 1.0). The “groundwater interest areas” are informally defined to facilitate scheduling, data review, and interpretation. Figure 2.7-1 shows facilities, wells, and shoreline monitoring sites in the 100-F Area.

Groundwater flows primarily to the east and southeast beneath the 100-F Area (Figure 2.7-2). Movement of the nitrate plume indicates flow to the south-southeast (Figure 1.0-3).

The remainder of this section describes contaminant plumes and concentration trends for the contaminants of concern under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). Groundwater monitoring for the *Atomic Energy Act* (AEA) is integrated fully with CERCLA monitoring. Most of the former liquid waste sites in the 100-F Area have been excavated and backfilled. There are no active waste disposal facilities or *Resource Conservation and Recovery Act* (RCRA) sites in the 100-F Area.

*A nitrate plume with concentrations above the drinking water standard extends from the central 100-F Area about 5 kilometers south.*

### 2.7.1 Groundwater Contaminants

This section describes the distribution and trends of the contaminants of concern for the 100-FR-3 Operable Unit: nitrate, strontium-90, tritium, trichloroethene, gross alpha, uranium, and hexavalent chromium (DOE/RL-2003-49, Rev. 1).

#### 2.7.1.1 Nitrate

A large nitrate plume extends from the 100-F Area southward nearly 5 kilometers, although data are sparse in the 600 Area (see Figure 1.0-3 in Section 1.0). The plume did not change significantly between fiscal years (FY) 2006 and 2007.

Wells in the main 100-F Area continued to show levels of nitrate that exceeded the drinking water standard (45 mg/L) in FY 2007. The highest FY 2007 nitrate concentration was 100 mg/L in well 699-71-30, south of the 100-F Area. The highest concentration in the 100-F Area was 92.5 mg/L in well 199-F8-2. Concentrations in the wells within the nitrate plume are steady or declining.

Aquifer tubes south of the main 100-F Area also have elevated nitrate concentrations. Tubes at site AT-75 previously exceeded the drinking water standard, but the tubes at this site could not be located in FY 2007. The tubes were found and sampled in FY 2008.

***Groundwater monitoring in the 100-FR-3 groundwater interest area includes integrated CERCLA and AEA monitoring:***

- *Thirty-four wells are sampled annually or biennially.*
- *Fourteen aquifer tube sites and three seeps are scheduled for annual sampling. Four aquifer tube sites and two seeps could not be sampled in FY 2007.*

### 2.7.1.2 Strontium-90

Strontium-90 concentrations exceed the drinking water standard (8 pCi/L) beneath a portion of the 100-F Area around the 116-F-14 retention basin and nearby disposal trenches. The extent of the plume has not changed significantly in over 10 years (see Figure 2.7-5 in PNNL-15670 for FY 2005 map).

***Plume areas (square kilometers)  
at the 100-FR-3 Operable Unit:***

***Chromium, 20 µg/L — 0.17***

***Nitrate, 45 mg/L — 17.3***

***Strontium-90, 8 pCi/L — 0.16***

***Trichloroethene, 5 µg/L — 2.2***

Well 199-F5-1 currently has the highest strontium-90 concentrations (48.6 pCi/L in FY 2006, the most recent data from this well). Strontium-90 also exceeded the drinking water standard in well 199-F5-46 (13 pCi/L). The trends are neither increasing nor decreasing overall.

Strontium-90 shows vertical stratification in the only shallow/deep well pair in the 100-F Area. Deep well 199-F5-43B consistently has no detectable strontium-90 while its shallow counterpart, well 199-F5-43A, typically detects 2 to 4 pCi/L of strontium-90. Strontium-90 concentrations also tend to be higher in shallow aquifer tubes than in deeper aquifer tubes, but all results for FY 2007 were below the 8-pCi/L drinking water standard. The maximum concentration was 1.5 pCi/L in tube 64-D (the mid-depth and shallow tubes at that site were not sampled).

### 2.7.1.3 Tritium

Tritium concentrations are somewhat elevated beneath the south 100-F Area, but do not currently exceed the drinking water standard (20,000 pCi/L). The plume extends to the southeast into the 600 Area at concentrations above 2,000 pCi/L (see Figure 1.0-2 in Section 1.0).

The only well where tritium historically exceeded the drinking water standard is well 199-F8-3, near the 118-F-1 burial ground, where concentrations were nearly 180,000 pCi/L in the mid-1990s. Concentrations in this well declined in the late 1990s, and in FY 2007, the concentration was 9,930 pCi/L (Figure 2.7-3).

***Trichloroethene  
exceeds the drinking  
water standard  
in southwest  
100-F Area.***

### 2.7.1.4 Trichloroethene

Trichloroethene concentrations in the southwest 100-F Area exceed the drinking water standard (5 µg/L). The plume appears to be centered west of the 100-F Area. A soil-gas investigation (DOE/RL-95-99) helped define the area of contamination but did not identify the source of contamination.

Wells are sampled biennially for trichloroethene. The most recent data from the wells with the highest concentrations, 199-F7-1 and 699-77-36, were from FY 2006, 14 and 13 µg/L, respectively.

### 2.7.1.5 Uranium and Gross Alpha

Uranium concentrations in 100-F Area groundwater have remained below the drinking water standard (30 µg/L) since 1996. The maximum concentration in FY 2007 was 13.3 µg/L in well 199-F8-2 in the central 100-F Area (Figure 2.7-4). This well had high concentrations in the late 1980s, but levels have been low since then.

Gross alpha concentrations were all <10 pCi/L in FY 2007. The highest was 9.9 pCi/L in well 199-F8-4.

### 2.7.1.6 Hexavalent Chromium

Chromium concentrations in groundwater beneath the 100-F Area are all below the drinking water standard (100 µg/L). Only three wells, located near the 116-F-14 retention basins and the 116-F-9 trench, had levels >20 µg/L in recent data. The highest value in FY 2007 was 60 µg/L in well 199-F5-6. Concentrations in this well are variable but generally increasing (Figure 2.7-5). The plume has changed little in the past 10 years (see Figure 2.7-8 in PNNL-15670 for a FY 2005 map).

Chromium concentrations in 100-F Area aquifer tubes continued to be low in FY 2007. Only one value exceeded the 10-µg/L aquatic standard. A sample from tube AT-72-M, located downstream of the 100-F Area, had 11 µg/L hexavalent chromium. A split sample had 8 µg/L.

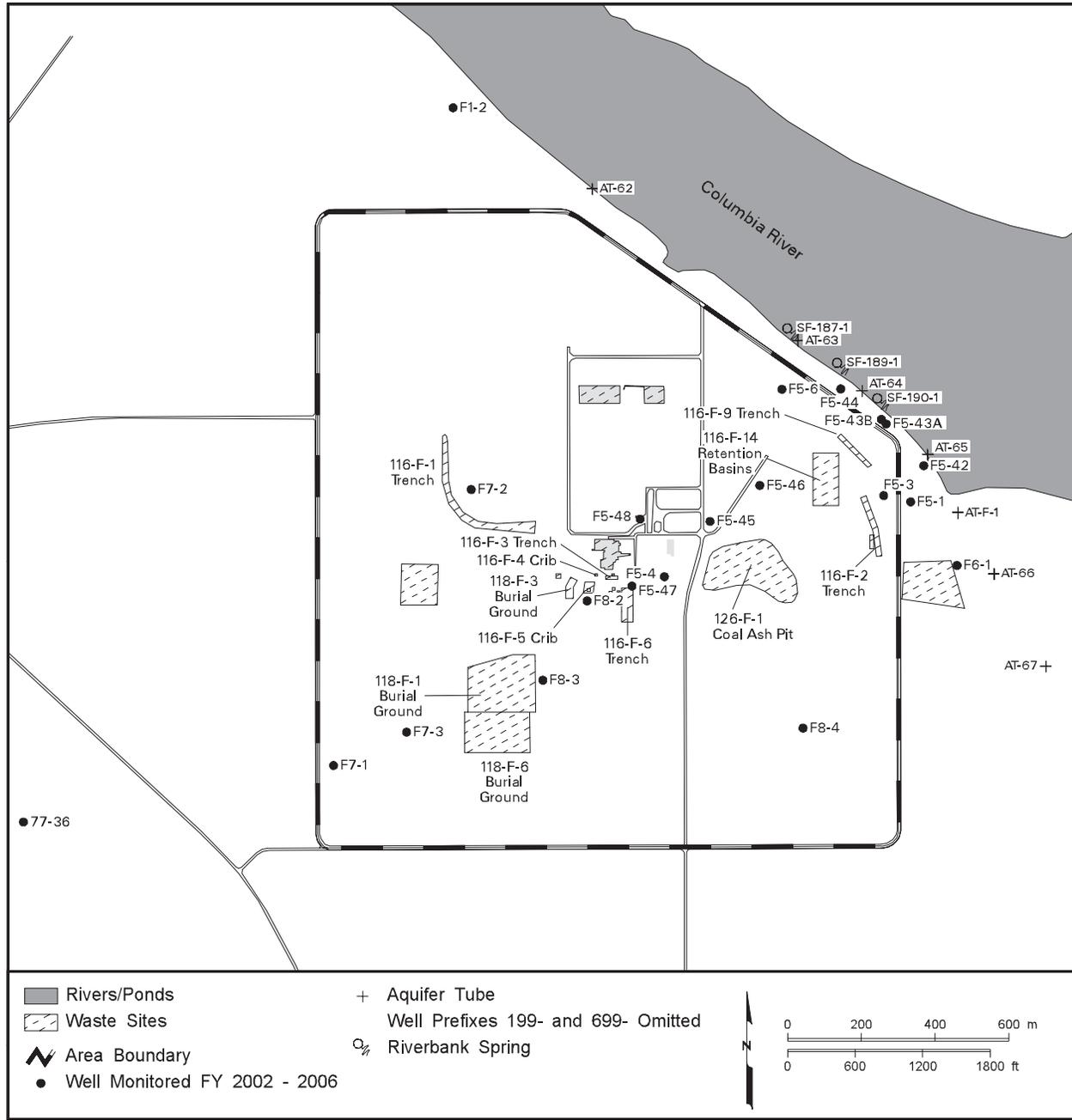
*Chromium concentrations in 100-F Area groundwater remained below the drinking water standard in FY 2007.*

### 2.7.2 Operable Unit Activities

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A record of decision has not yet been developed for the 100-FR-3 Operable Unit. DOE continues monitoring contaminant conditions while waste site remedial actions are conducted.

The groundwater sampling and analysis plan (DOE/RL-2003-49, Rev. 1) calls for annual sampling of 9 wells, 19 aquifer tube sites, and 3 shoreline seeps, and biennial sampling of 25 wells (see Appendix A). All of the wells scheduled for sampling in FY 2007 were sampled successfully. Four of the aquifer tube sites, all located downgradient of the main 100-F Area, were not sampled. The tubes could not be located in FY 2007. DOE plans to install new aquifer tubes at key sites where tubes have been destroyed. Two seeps could not be sampled; seep sampling depends on field conditions and is not always possible.



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**Figure 2.7-1. Groundwater Monitoring Wells in 100-F Area**

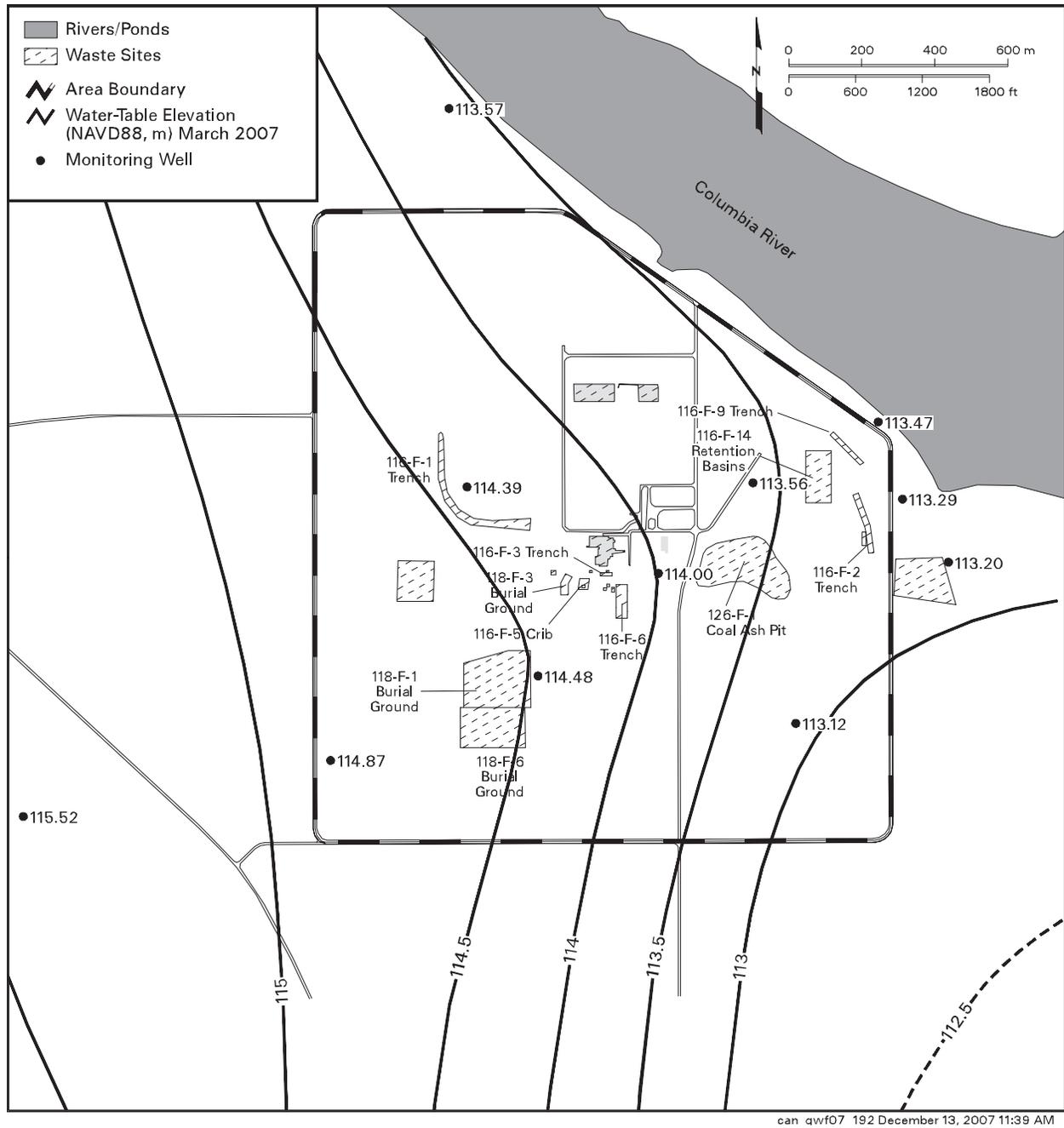


Figure 2.7-2. 100-F Area Water-Table Map, March 2007

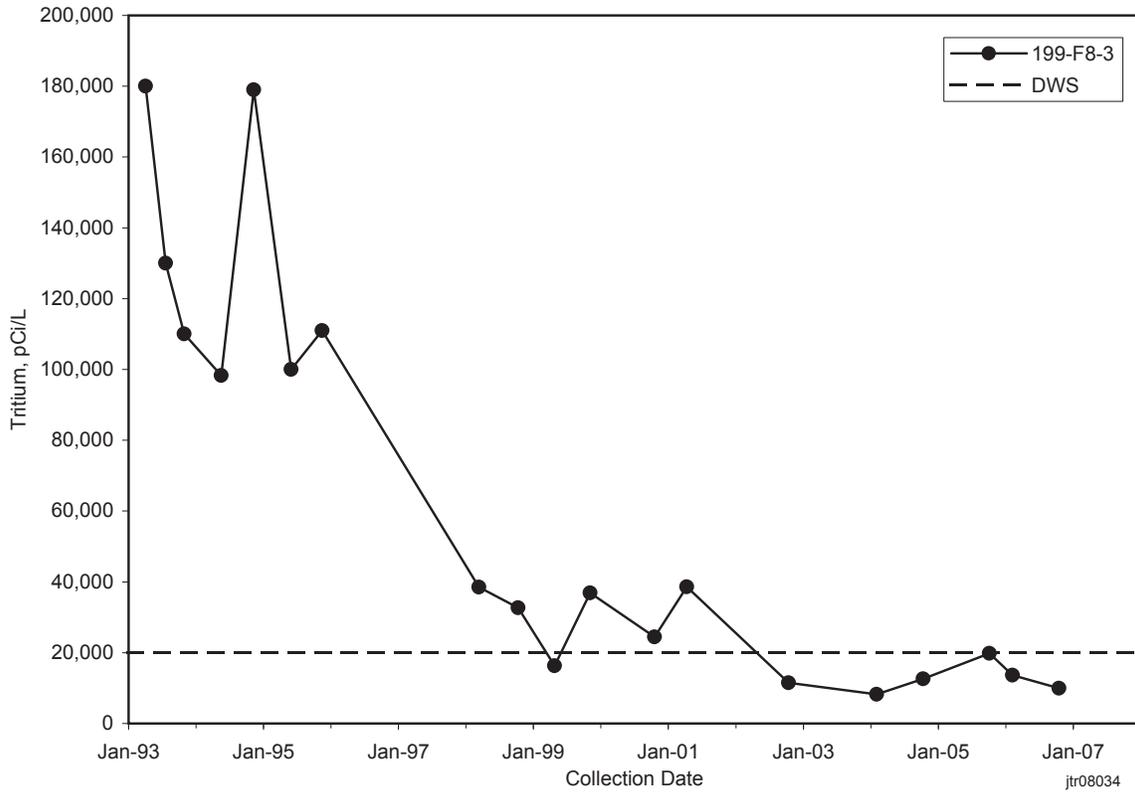


Figure 2.7-3. Tritium Concentrations Near 118-F-1 Burial Ground

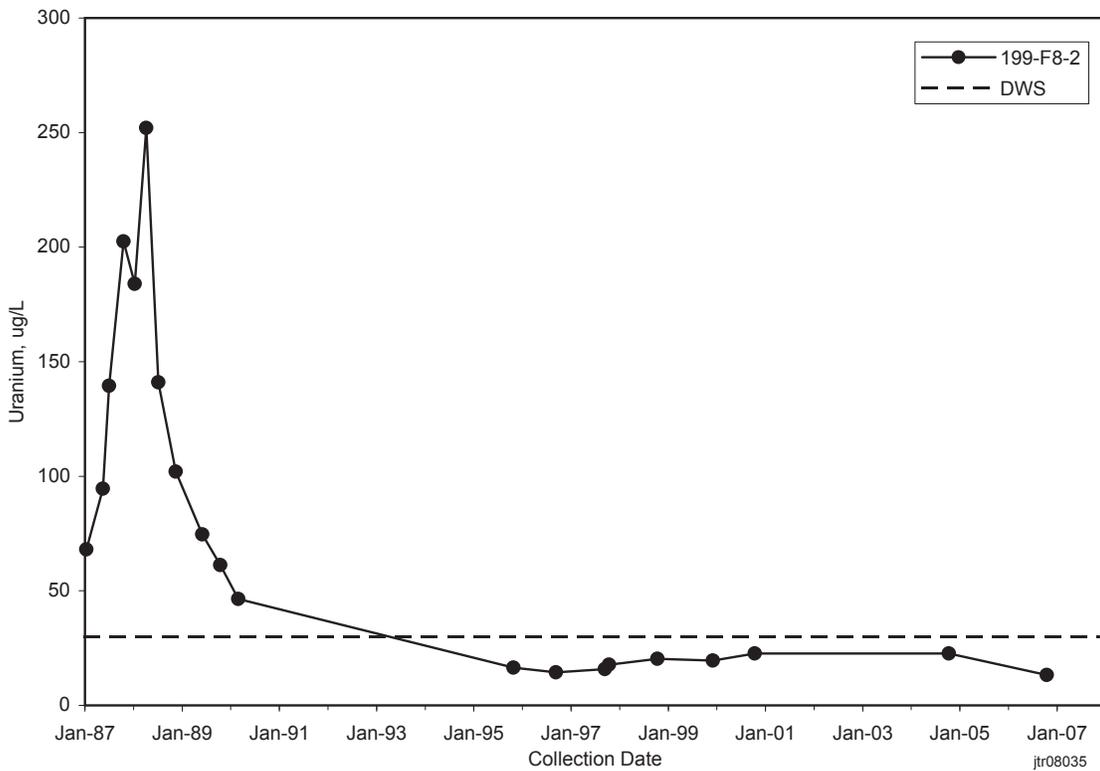


Figure 2.7-4. Uranium Concentrations in Well 199-F8-2, Near 116-F-5 Crib

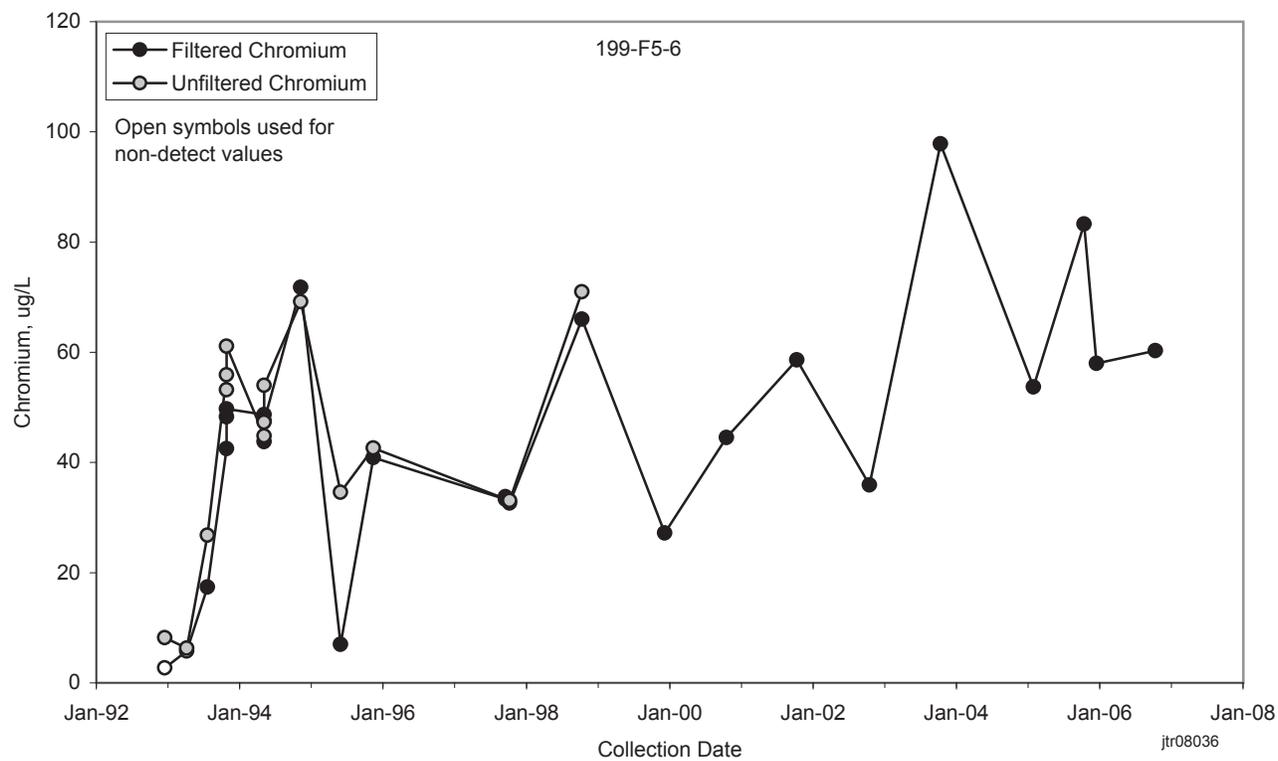


Figure 2.7-5. Chromium Concentrations in Well 199-F5-6 in Northeast 100-F Area