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Results of Groundwater Monitoring for the 183-H Solar Evaporation Basins

Reporting Period: January–June 2006

M. J. Hartman

October 2006

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

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Summary

This is one of a series of reports on *Resource Conservation and Recovery Act* monitoring at the 183-H basins. It fulfills a 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 June 2006.

The current objective of corrective action monitoring is simply to track trends. Although there is short-term variability in contaminant concentrations, trends over the past 10 years are downward. The current RCRA permit and monitoring plan remain adequate for the objective of tracking trends.

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1.0 Introduction

The 183-H solar evaporation basins (183-H basins) were located in the 100-H Area of the Hanford Site and have been demolished and backfilled under the *Resource Conservation and Recovery Act* (RCRA) in the Hanford Facility RCRA Permit (Ecology 2004). Post-closure actions remain for the 183-H basins. Groundwater is monitored in accordance with Washington Administrative Code (WAC) 173-303-645(11), "Corrective Action Program," and Part VI, Chapter 2 of the Hanford Facility RCRA Permit (Ecology 2004). 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[1]). 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 one of a series of reports on corrective action monitoring at the 183-H basins. It fulfills a 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 June 2006.

The regulations in WAC 173-303-645(11) require corrective action activities to reduce contaminant concentrations in groundwater. The post-closure plan (DOE 1997a), which was incorporated into Part VI of the Hanford Facility RCRA Permit in February 1998, deferred further actions at the 183-H basins to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) interim action for the 100-HR-3 Operable Unit. The post-closure plan also requires monitoring to be conducted as described in the final status RCRA groundwater monitoring plan (Hartman 1997).

2.0 Interim Remedial Measure

The interim remedial action applies to the 100-HR-3 Groundwater Operable Unit, which is under the authority of a CERCLA record of decision (EPA 1996). Groundwater in the 100-H Area is pumped from extraction wells, treated to remove chromium, and injected back into the aquifer. 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. Active extraction and injection wells for this reporting period are listed in Table 1.

[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 is sampled to monitor the performance of the interim remedial measure and to monitor the entire 100-HR-3 Operable Unit (DOE 1997b). 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 the extraction and compliance wells as specified in the Remedial Design Report and Remedial Action Work Plan (DOE 2003) and data indicate that the concentration will remain below that value. The system may also be shut down if it proves ineffective or if a better treatment technique is found. The most recent operable unit report (DOE 2006), covering calendar year 2005, concluded that chromium concentrations in groundwater were not consistently below 22 μg/L in the extraction and compliance wells. However, chromium concentrations are below the 100-μg/L drinking water standard at these wells and chromium levels in aquifer tubes along the Columbia River are near the aquatic standard.

3.0 RCRA Groundwater Monitoring Program

During the period of time that the CERCLA interim remedial measure for chromium is extracting groundwater, RCRA corrective action monitoring will continue to evaluate new analytical results relative to concentration limits stated in the permit. Additionally, fluoride results will be evaluated relative to previously established trends and to the drinking water standard for drinking water (Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit [Ecology 2004]).

Until the last reporting period (July through December 2005), the RCRA groundwater monitoring network included wells 199-H4-3, 199-H4-7, 199-H4-12A, and 199-H4-12C (Figure 1). The conditions in Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit (Ecology 2004) provide for groundwater sample collection annually in these wells. Well 199-H4-7 was converted to an injection well in August 2005 (see Table 1), so it is no longer suitable for RCRA monitoring. The U.S. Department of Energy (DOE) and Washington State Department of Ecology agreed that well 199-H4-8 will be monitored instead of well 199-H4-7.[2] Well 199-H4-8 was the only well scheduled for sampling during this reporting period. In the future, it will be sampled with the other wells in November of each year.

All of the wells were sampled for the 100-HR-3 Operable Unit at various times in the reporting period. The RCRA contaminants of interest for groundwater are chromium, nitrate, fluoride, technetium-99, and uranium.

Well 199-H4-12A has been an extraction well since 1997, and well 199-H4-3 was converted to an extraction well in August 2005. Wells 199-H4-3, 199-H4-8, and 199-H4-12A are completed at the top of the unconfined aquifer. Well 199-H4-12C is located adjacent to well 199-H4-12A and is completed deeper in the Ringold Formation. This well consistently has elevated concentrations of chromium without 183-H basins co-contaminants.

[2] Hanford Facility RCRA Permit Modification Notification Form, Part VI, Chapter 2, 183-H Solar Evaporation Basins, quarter ending March 31, 2006.

4.0 Contaminant Trends

This section discusses concentrations of chromium, fluoride, nitrate, technetium-99, and uranium in groundwater. Results of samples collected during the reporting period are presented in Table 2, and pertinent results are discussed in the following paragraphs. No samples were collected from deep well 199-H4-12C during this reporting period.

Chromium concentrations ranged from 3 μg/L (well 199-H4-12A) to 67 μg/L (well 199-H4-3) during the reporting period. Concentrations have decreased over the past 10 years in all of the monitoring wells (Figure 2). However, chromium showed a "spike" in concentrations in well 199-H4-3, the extraction well nearest the former 183-H basins (Figure 3 shows detail of recent data). This was unusual; concentrations are usually low in early summer when river stage is high. All of the chromium results were less than the 122-μg/L concentration limit (see Table 2).

Well 199-H4-8 was the only well sampled for fluoride during the reporting period. The analysis detected 140 μg/L (see Table 2). This result is no higher than those observed in upgradient wells and far below the 4,000-μg/L concentration limit.

Nitrate concentrations continued to exceed the 45-mg/L concentration limit in well 199-H4-3, at 249 and 253 mg/L in duplicate samples. Like chromium, this was an increase from the previous reporting period. The concentration decreased in well 199-H4-12A from >100 mg/L in December 2005 to 29 mg/L in May 2006. Nitrate concentrations are variable in this well and have neither increased nor decreased overall in the past 10 years. Nitrate was detected at 29 mg/L in well 199-H4-8.

Technetium-99 and uranium concentrations increased in well 199-H4-3, in tandem with chromium and nitrate. In May 2006, technetium-99 levels in this well reached 810 and 870 pCi/L (approaching the 900-pCi/L drinking water standard), and uranium was 86 and 83 μg/L (nearly 3 times the drinking water standard). These constituents decreased in well 199-H4-12A, with variable trends over the past 10 years. Well 199-H4-8 was sampled for technetium-99 and uranium for the first time this reporting period. Levels were very low to undetectable (see Table 2).

5.0 Conclusions

The current objective of RCRA corrective action monitoring is simply to track trends, not to determine the effectiveness of the interim remedial action. Although there is short-term variability in contaminant concentrations, trends over the past 10 years are downward. The current RCRA permit (Attachment 37, Chapter 3 of Ecology [2004]), and monitoring plan (Hartman 1997), as revised by the 2006 Hanford Facility RCRA Permit Modification, remain adequate for the objective of tracking trends during the period of the CERCLA interim remedial action.

6.0 References

Atomic Energy Act. 1954. As amended, Chapter 1073, 68 Stat. 919, 42 USC 2011 et seq.

Comprehensive Environmental Response, Compensation, and Liability Act. 1980. Public Law 96-510, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

DOE. 1997a. *183-H Solar Evaporation Basins Postclosure Plan*. DOE/RL-97-48, Rev. 0, U.S. Department of Energy, Richland, Washington.

DOE. 1997b. *Interim Action Monitoring Plan for the 100-HR-3 and 100-KR-4 Operable Units*. DOE/RL-96-90, U.S. Department of Energy, Richland, Washington.

DOE. 2003. *Remedial Design and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units' Interim Action*. DOE/RL-96-84, Rev. 0-A, U.S. Department of Energy, Richland, Washington.

DOE. 2006. *Calendar Year 2005 Annual Summary Report for the 100-HR-3 and 100-KR-4, and 100-NR-2 Operable Unit Pump-and-Treat Operations*. DOE/RL-2006-08, U.S. Department of Energy, Richland, Washington.

Ecology. 2004. *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*. Permit No. WA7890008967, Rev. 8, September 2004, as amended, Washington State Department of Ecology, Olympia, Washington.

EPA. 1996. *Record of Decision for the USDOE Hanford 100-HR-3 and 100-KR-4 Operable Units Interim Remedial Actions. EPA/ROD/R10-96/134, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.*

Hartman MJ. 1997. *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*. PNNL-11573, Pacific Northwest National Laboratory, Richland, Washington.

Resource Conservation and Recovery Act. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

WAC 173-303-645. *Release from Regulated Units*. Washington Administrative Code, Olympia, Washington.

Table 1. 100-HR-3 Extraction and Injection Wells in the 100-H Area

January to August 2005	August 2005 to Present[(a)]
Extraction Wells	
199-H4-4	199-H4-3
199-H4-11	199-H4-4
199-H4-12A	199-H4-12A
199-H4-15A	199-H4-15A
199-H4-64	199-H4-63
199-H4-65	199-H4-64
Injections Wells	
199-H3-2A	199-H4-14[(a)]
199-H4-18	199-H4-7
199-H3-5	199-H4-17
	199-H4-18

(a) From August 2005 to January 2006, well 199-H3-2A was an injection well. In January 2006, well 199-H4-14 was substituted for well 199-H3-2A.

Table 2. Groundwater Data for 183-H Basins, January through June 2006

Well	Sample Date	Chromium[a] (μg/L)		Fluoride (mg/L)	Nitrate (mg/L)		Tc-99 (pCi/L)		Uranium (μg/L)
Concentration limits[b]		100		4,000	45		900		30
199-H4-3	1/3/2006	25							
	1/9/2006	10							
	1/18/2006	13							
	1/24/2006	14							
	1/30/2006	16							
	2/13/2006	20							
	2/13/2006	19							
	2/13/2006	16							
	2/13/2006	13							
	2/21/2006	13							
	2/28/2006	13							
	2/28/2006	24							
	3/7/2006	18							
	3/14/2006	19							
	3/22/2006	23							
	3/28/2006	21							
	4/4/2006	16							
	4/11/2006	17							
	4/18/2006	12							
	4/25/2006	6							
	5/2/2006	26							
	5/9/2006	48							
	5/16/2006	67							
	5/23/2006	52							
	5/23/2006	52							
	5/23/2006	51							
	5/23/2006	55			249		810		85.5
	5/23/2006	54			253		870		82.5
	5/30/2006	18							
	6/7/2006	20							
	6/13/2006	19							
	6/20/2006	23							
	6/27/2006	37							
199-H4-8	**3/13/2006**	**9[c]**	**B**	**140**	**29.2**	**D**	**0**	**U**	**0.782**

Table 2. (contd)

Well	Sample Date	Chromium[(a)] (μg/L)		Fluoride (mg/L)	Nitrate (mg/L)		Tc-99 (pCi/L)		Uranium (μg/L)
199-H4-12A	1/3/2006	39							
	1/9/2006	40							
	1/18/2006	25							
	1/24/2006	36							
	1/30/2006	47							
	2/13/2006	35							
	2/13/2006	33							
	2/13/2006	28							
	2/21/2006	29							
	2/28/2006	25							
	2/28/2006	41							
	3/7/2006	26							
	3/14/2006	23							
	3/22/2006	29							
	3/28/2006	21							
	4/4/2006	24							
	4/11/2006	29							
	4/18/2006	14							
	4/25/2006	11							
	5/2/2006	16							
	5/9/2006	19							
	5/16/2006	25							
	5/23/2006	21			29		16		3.17
	5/23/2006	18							
	5/23/2006	18							
	5/30/2006	6							
	6/6/2006	9							
	6/6/2006	8							
	6/13/2006	3	B						
	6/20/2006	8							
	6/27/2006	14							

(a) Unfiltered sample analyzed for hexavalent chromium unless noted otherwise
(b) Concentration limits defined in Attachment 37, Chapter 3 of the Hanford Facility RCRA Permit (Ecology 2004). Chromium concentration limit was based on upgradient concentrations in 1995 (Hartman 1997). Uranium concentration limit (20 μg/L) was the proposed drinking water standard in 1997; the standard has been changed to 30 μg/L.
(c) Filtered sample analyzed for total chromium.
Bold type indicates samples collected specifically for RCRA.
B = Less than contract-required detection limit but greater than method detection limit.
D = Sample diluted for analysis. Result corrected for dilution.
U = Below detection limit.

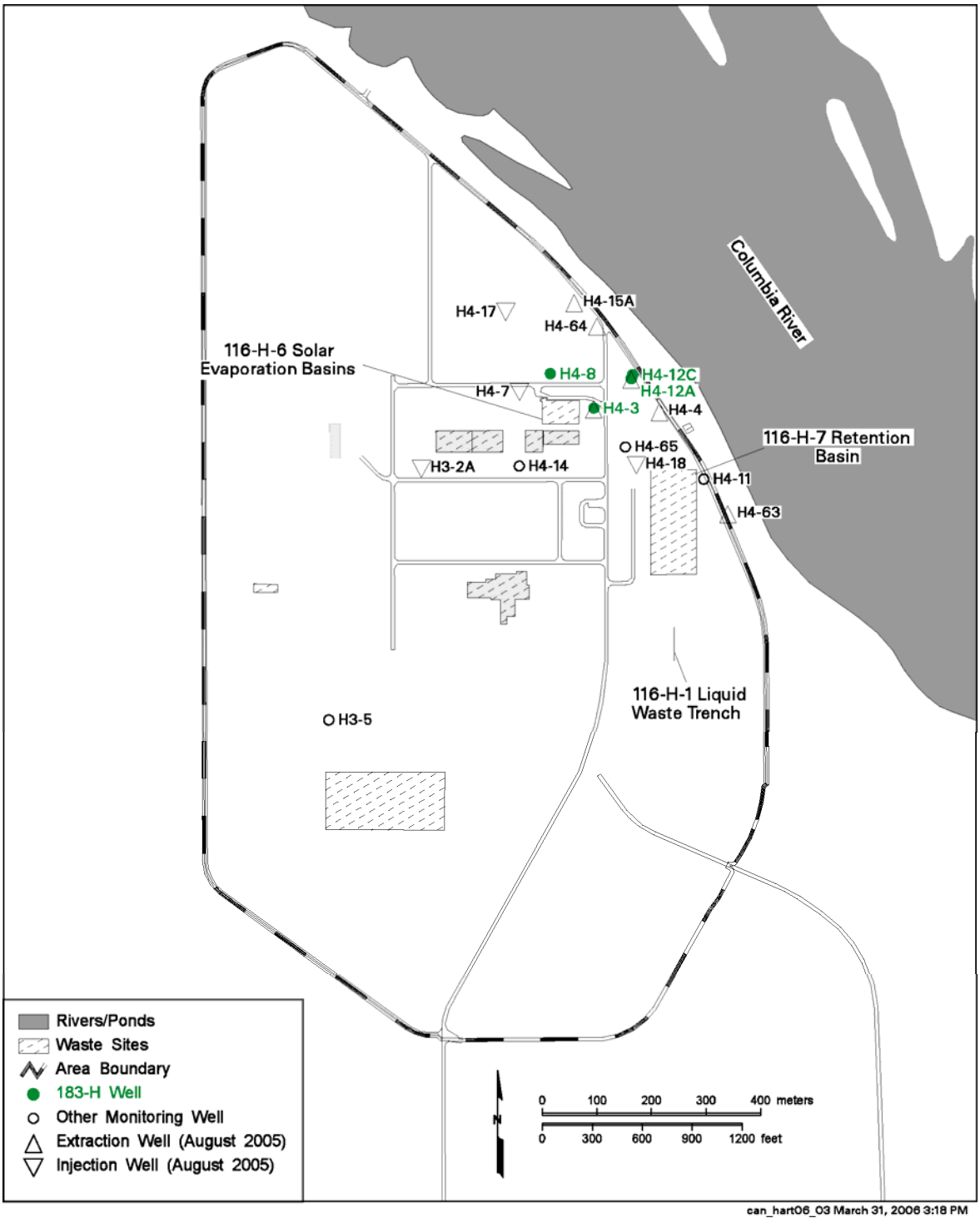

Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

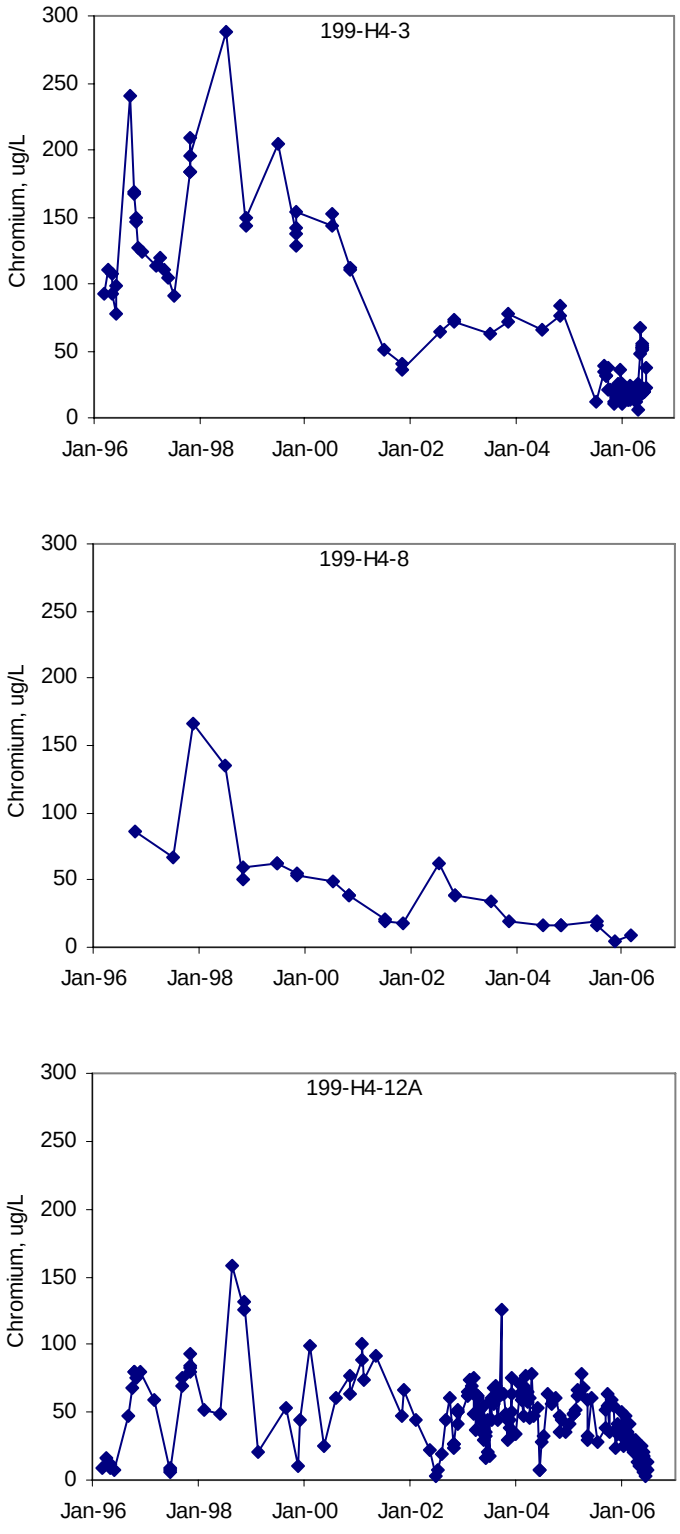

Figure 2. Chromium in Wells Monitoring 183-H Basins

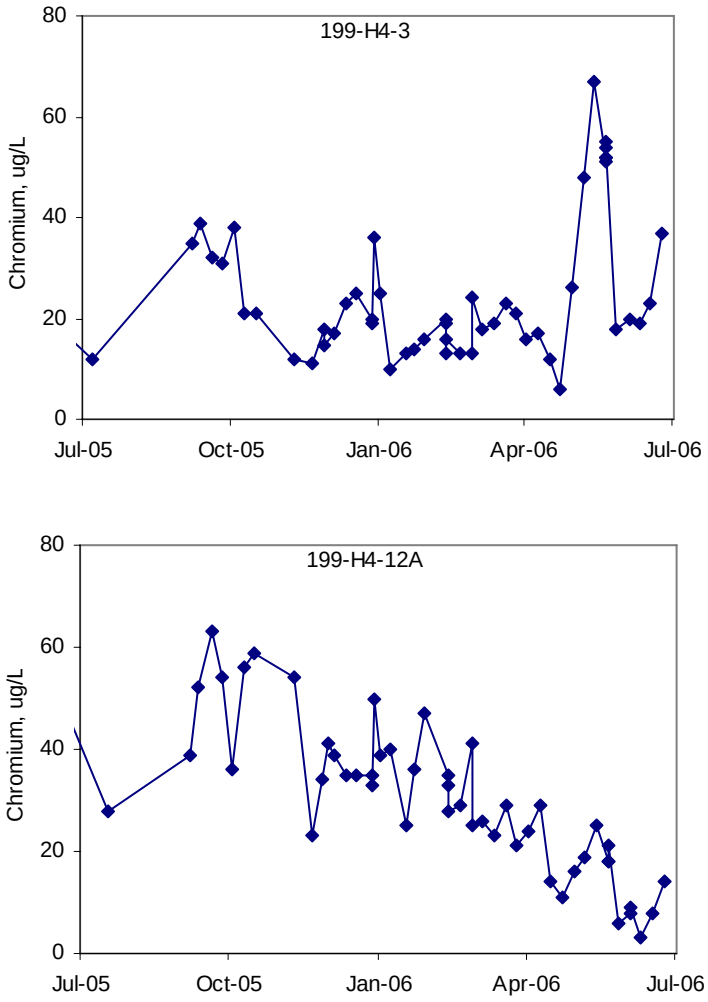

Figure 3. Recent Chromium Data in Extraction Wells 199-H4-3 and 199-H4-12A

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