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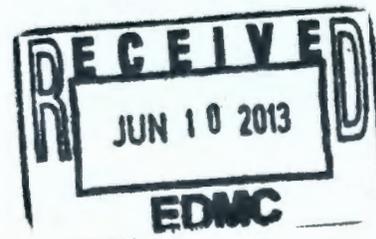
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Revision 1

# Post-Closure Corrective Action Groundwater Monitoring Report for the 183-H Solar Evaporation Basins and the 300 Area Process Trenches: July – December 2012 - Second Semi-Annual Report

Prepared for the U.S. Department of Energy  
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy  
under Contract DE-AC06-08RL14788

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**Post-Closure Corrective Action Groundwater Monitoring Report for the 183-H  
Solar Evaporation Basins and the 300 Area Process Trenches: July –  
December 2012 - Second Semi-Annual Report**

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## Executive Summary

This is the second 2012 semiannual report on post-closure corrective action groundwater monitoring for the 183-H Solar Evaporation Basins and the 300 Area Process Trenches. It fulfills the requirement of WAC 173-303-645(11)(g)<sup>1</sup> to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2012. Environmental data used to generate this report are available from the Environmental Dashboard Application. Ongoing validation, verification, and technical review efforts may result in differences between the data used for this publication and those available after publication of this report via the environmental data access tool.

### 183-H Solar Evaporations Basins Groundwater Monitoring

Chromium concentrations in the unconfined aquifer remained below permit concentration limits. Hexavalent chromium in Well 199-H4-12C results from historical releases, remaining above permit concentration limits and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*<sup>2</sup> (CERCLA) remedial action objectives. With addition of 199-H4-12C to the pump-and-treat system, corrective action through the CERCLA interim action remains effective.

Nitrate exceeded permit concentrations in two wells. Uranium, a waste indicator, exceeded the permit concentration limit of 20 µg/L in wells 199-H4-3 and 199-H4-12A, and exceeded the drinking water standard (30 µg/L) in Well 199-H4-3. Nitrate increases are most likely related to movement of existing nitrate in the aquifer. Uranium observed above the permit concentration may be related to newly mobilized uranium from the rewetted zone after high river stage, or movement of existing uranium in the aquifer. To determine if the increase in concentrations was related to river stage, nitrate and uranium concentrations were plotted against the available water level measurements; however results did not indicate a correlation. This may be due to the timing of the various measurements, but appears to indicate that uranium and nitrate increases are not related to high water periods.

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<sup>1</sup> WAC 173-303-645, "Dangerous Waste Regulations," "Releases from Regulated Units," *Washington Administrative Code*, Olympia, Washington. Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303-645>.

<sup>2</sup> *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: <http://epw.senate.gov/cercla.pdf>.

### **300 Area Process Trenches Groundwater Monitoring**

Uranium concentrations continued to exceed the permit concentration limit (20 µg/L) at three downgradient wells (399-1-10A, 399-1-16A, and 399-1-17A) screened near the water table. Uranium concentrations at Wells 399-1-10A and 399-1-16A vary inversely with water level, as is typical for wells that are located near the Columbia River. Uranium concentrations at Well 399-1-17A vary positively with water level, as is typical for wells that are located farther inland from the Columbia River, near source areas.

The increase in uranium concentrations in groundwater near source areas during high water levels is caused by mobilization of residual uranium contamination in the deep vadose zone resulting from the temporary elevation of the water table. The decrease in uranium concentrations near the shoreline during high water levels is caused by dilution from intrusion of river water into the aquifer. During seasonal low water table conditions, the highest concentrations in the plume are often observed near the river, where uranium introduced inland during the preceding period of high water table conditions has migrated downgradient to the shoreline, and intrusion of river water into the zone beneath the shoreline is lessened because of the lower river stage.

The high river stage in July 2012 resulted in a high water table at the 300 Area Process Trenches and a high concentration of uranium in groundwater at Well 399-1-17A. The July 2012 uranium concentration (838 µg/L) declined to more typical winter seasonal values by December 2012.

Cis-1,2-dichloroethene remained above the 70 µg/L permit concentration limit in one deep well (399-1-16B). Trichloroethene remained below the 5 µg/L permit concentration limit in all of the wells.

Corrective actions through the CERCLA interim action (attenuation and institutional controls) have been effective for trichloroethene and moderately effective for cis-1,2-dichloroethene, and uranium. The CERCLA remedial investigation/feasibility study report for the 300-FF-5 Operable Unit evaluates remedies for these constituents.

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## Terms

CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
DWS	drinking water standard
gpm	gallons per minute
OU	operable unit
RAO	remedial action objective
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RI/FS	remedial investigation/feasibility study
RUM	Ringold Formation upper mud

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## 1 Introduction

This second 2012 semiannual report for post-closure corrective action groundwater monitoring describes the effectiveness of corrective action at the 183-H Solar Evaporation Basins (Waste Site 116-H-6) and the 300 Area Process Trenches (Waste Site 316-5). It fulfills the requirement of WAC 173-303-645(11)(g), "Dangerous Waste Regulations," "Releases from Regulated Units," to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2012. Chapter 2 presents information for the 183-H Solar Evaporation Basins, and Chapter 3 presents information for the 300 Area Process Trenches.

Environmental data used to generate this report are available from the Environmental Dashboard Application. Ongoing validation, verification, and technical review efforts may result in differences between the data used for this publication and those available after publication of this report via the environmental data access tool.

## 2 183-H Solar Evaporation Basins

Formerly located in the 100-H Area of the Hanford Site, the 183-H Solar Evaporation Basins consisted of four concrete basins and were used for waste treatment and disposal from 1973 to 1985. The waste discharged to the basins originated in the 300 Area Fuel Fabrication Facility and included solutions of neutralized chromic, hydrofluoric, nitric, and sulfuric acids. The waste solutions contained various metallic and radioactive constituents (e.g., chromium, technetium-99, and uranium). Between 1985 and 1996, the remaining waste was removed, the facility was demolished, and underlying contaminated soil was removed and replaced with clean fill. The site is a post-closure unit in the Hanford Facility *Resource Conservation and Recovery Act of 1976 (RCRA) Permit (WA7890008967, Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste)*. Groundwater is monitored in accordance with WAC 173-303-645(11) and Part VI, Chapter 2 of the Hanford Facility RCRA Permit (WA7890008967).

The regulations in WAC 173-303-645(11) require implementation of a corrective action program to reduce contaminant concentrations in groundwater. The post-closure plan (DOE/RL-97-48, *183-H Solar Evaporation Basins Postclosure Plan*) was incorporated into Part VI of the Hanford Facility RCRA Permit (WA7890008967) in February 1998. The plan deferred further groundwater corrective action at the basins to the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) interim action for the 100-HR-3 Groundwater Operable Unit (OU)*. The post-closure plan (DOE/RL-97-48) also requires monitoring to be conducted as described in the Hanford Facility RCRA Permit (WA7890008967) groundwater monitoring plan for this facility (PNNL-11573, *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*).

### 2.1 100-HR-3 CERCLA Interim Remedial Action

The interim remedial action for groundwater contamination in the 100-HR-3 Groundwater OU is implemented under the authority of a CERCLA Interim Record of Decision (EPA et al., 1996a, *Declaration of the Record of Decision for the USDOE Hanford 100 Area 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington*). The objective of the interim remedial action is to reduce the amount of chromium entering the Columbia River, where it is a potential hazard to the ecosystem. To achieve this objective, a pump-and-treat system has been implemented to extract groundwater, treat it to remove hexavalent chromium, and inject it back into the aquifer. Figure 1 illustrates the active extraction and injection wells during the reporting period. Details of the

pump-and-treat system are specified in DOE/RL-96-84, *Remedial Design and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units' Interim Action*.

Construction of the new 3,028 Liters per minute (Lpm) (800 gallons per minute [gpm]) HX pump-and-treat system was completed and started during the reporting period. The new system replaced the aging 1136 Lpm (300 gpm) HR-3 pump-and-treat system. Together with the 2271 Lpm (600 gpm) DX pump, the 100-HR-3 OU interim action has the expanded capacity to hydraulically contain and remediate hexavalent chromium contaminated groundwater throughout the OU. The pump-and-treat system includes extraction from Well 199-H4-12C, located downgradient of the 183-H Solar Evaporation Basins.

## 2.2 183-H Basins RCRA Groundwater Monitoring Program

During the CERCLA interim remedial action, RCRA corrective action monitoring will continue to evaluate analytical results relative to permit concentration limits (Table 1). Additionally, fluoride results will be evaluated relative to established trends and the drinking water standard (DWS) for fluoride<sup>3</sup> (Hanford Facility RCRA Permit [WA7890008967], Part VI, Chapter 2).

**Table 1. Permit Concentration Limits for 183-H Solar Evaporation Basins**

Dangerous Waste Constituents	Concentration Limit
Chromium (total; filtered sample)	122 µg/L – local background when compliance monitoring plan written (1996); upgradient sources
Nitrate <sup>a</sup>	45 mg/L – DWS (as NO <sub>3</sub> )
Other 183-H Waste Indicators	Concentration Limit
Technetium-99	900 pCi/L – DWS
Uranium (total; chemical analysis) <sup>b</sup>	20 µg/L – proposed DWS when monitoring plan written (1996)

DWS = drinking water standard

a. Nitrate is NOT considered a dangerous waste constituent under RCRA (WAC 173-303-9905).

b. Current DWS for uranium is 30 µg/L

The RCRA groundwater monitoring network includes Wells 199-H4-3, 199-H4-8, 199-H4-12A, and 199-H4-12C (Figure 1). The conditions in the Hanford Facility RCRA Permit (WA7890008967), Part VI, Post-Closure Unit 2, provide for annual groundwater sample collection from these wells. The wells were sampled for RCRA constituents during October, November, and December.

Well 199-H4-12C is an extraction well and is completed in the semi-confined aquifer within the Ringold Formation upper mud (RUM). The other wells monitored under RCRA, Wells 199-H4-3, 199-H4-8, and 199-H4-12A, are completed in the overlying unconfined aquifer.

<sup>3</sup> The RCRA Permit (WA7890008967) gives the value 1,400 µg/L as the U.S. Environmental Protection Agency maximum contaminant level (DWS) for fluoride. The actual limit is 4,000 µg/L.

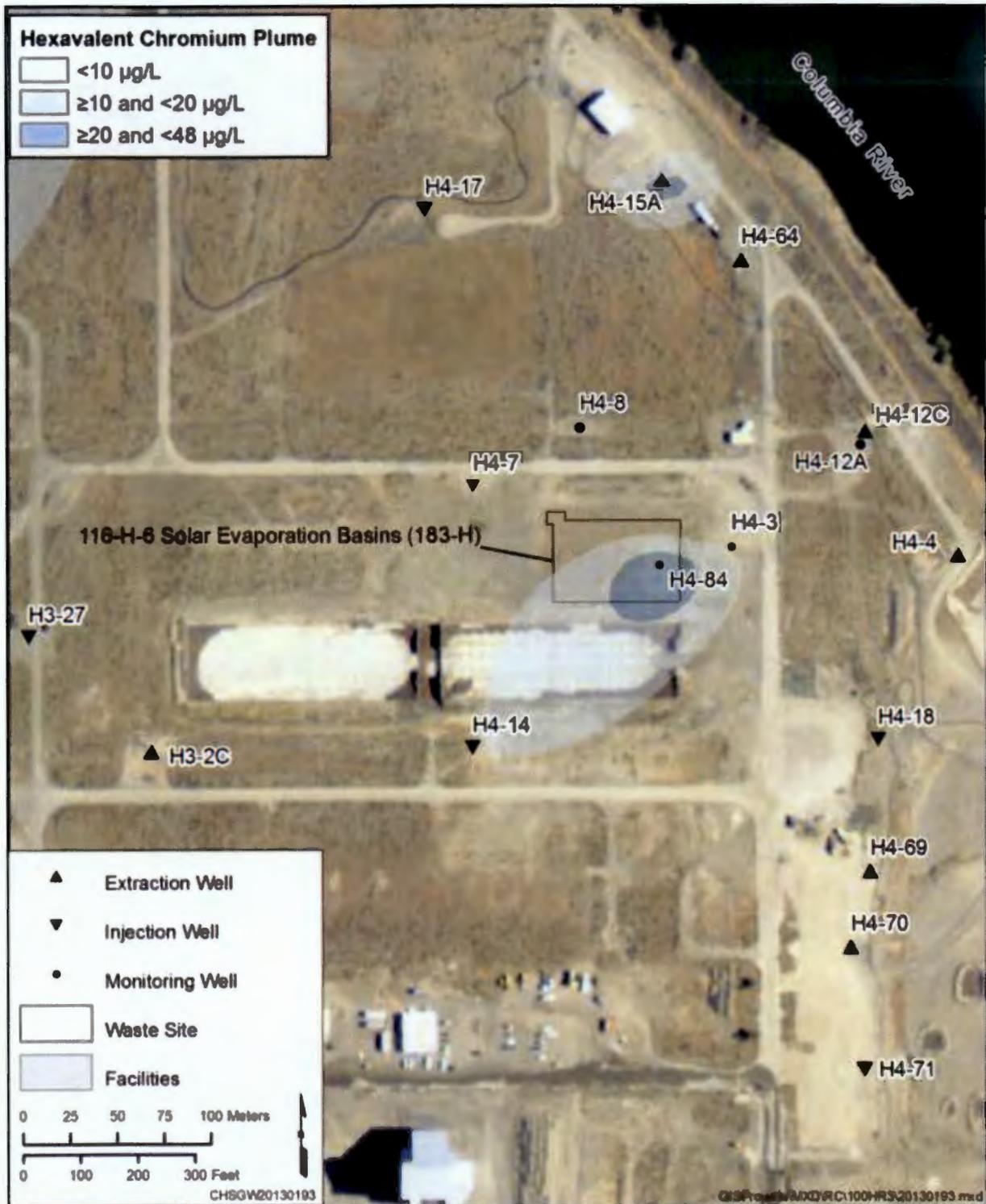


Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

Though still sampled, Well 199-H4-3 was removed from extraction service because of low production and impending waste site remediation activities. After the 100-H aquifer test and rebound study (SGW-47776, *Aquifer Testing and Rebound Study in Support of the 100-H Deep Chromium Investigation*), Well 199-H4-12C was added to the extraction network, replacing Well 199-H4-12A, to remediate the lower aquifer. Well 199-H4-8 has been part of the RCRA network since 2006; it replaced Well 199-H4-7, which was converted to an injection well and connected to the pump-and-treat system. Well 199-H4-7 is currently used as a groundwater monitoring well and is planned for decommissioning for upcoming soil remediation.

A Draft A remedial investigation/ feasibility study (RI/FS) report was conducted from 2010 through 2012 and is currently being reviewed by the Washington State Department of Ecology. As part of the RI/FS field activities, a new borehole (C7860) was installed through the former 183-H Solar Evaporation Basins (at the middle of sedimentation Basin 1) and was completed as a temporary well (199-H4-84).

Well 199-H4-84 is monitored under the CERCLA monitoring program, and results are included herein.

A Permit Modification Request is currently under review which will add Well 199-H4-84 to the RCRA permit as a replacement for Well 199-H4-3. The location of Well 199-H4-3 is within an area where waste site remediation is needed. If the permit modification is approved, Well 199-H4-3 will be decommissioned in order for the waste site remediation to proceed.

### 2.3 183-H Basins Contaminant Trends

This section discusses the concentrations of chromium, fluoride, nitrate, technetium-99, and uranium in the groundwater. During the reporting period, four wells were scheduled for sampling (199-H4-3, 199-H4-8, 199-H4-12A, 199-H4-12C). Results from the sampling are presented in Table 2. Results from Well 199-H4-84 are also included, for information only, but not included in the discussion below.

Table 2. Groundwater Data for 183-H Basins, July through December 2012

Well	Date	Dangerous Waste			Waste Indicator					
		Hexavalent Chromium (µg/L)	Chromium, total (µg/L)	Nitrate <sup>c</sup> (mg/L)	Fluoride (µg/L)	Technetium-99 (pCi/L)	Uranium <sup>d</sup> (µg/L)			
<b>Permit Concentration Limit<sup>b</sup></b>		<b>122</b>	<b>122</b>	<b>45</b>	<b>1,400</b>	<b>900</b>	<b>20</b>			
199-H4-12A	7/30/2012	2.00	U	—	—	—	—			
	11/01/2012	32.40	33.50	58.9	D	83.10	BD	98	23.70	D
	11/01/2012	—	32.30	—	—	—	—			
199-H4-12C	7/3/2012 <sup>a</sup>	119	—	—	—	—	—			
	7/22/2012 <sup>a</sup>	120	—	—	—	—	—			
	7/22/2012 <sup>a</sup>	130	—	—	—	—	—			
	8/01/2012 <sup>a</sup>	126	—	—	—	—	—			
	8/08/2012 <sup>a</sup>	138	—	—	—	—	—			
	9/04/2012 <sup>a</sup>	125	—	—	—	—	—			
	10/28/2012	125	131	7.79	D	—	5.20	U	—	
	11/01/2012	129	132	7.66	D	81.60	BD	6.50	U	1.34

Table 2. Groundwater Data for 183-H Basins, July through December 2012

Well	Date	Dangerous Waste			Waste Indicator			
		Hexavalent Chromium (µg/L)	Chromium, total (µg/L)	Nitrate <sup>c</sup> (mg/L)	Fluoride (µg/L)	Technetium-99 (pCi/L)	Uranium <sup>d</sup> (µg/L)	
	11/01/2012	125	127	—	—	—	—	
	12/03/2012 <sup>a</sup>	137	—	—	—	—	—	
199-H4-3	7/11/2012	9.00	10.90	D	33.7	261	—	—
	8/21/2012	44.60	49.30	D	<b>58.4</b>	D	92.40	BD
	9/07/2012	65.60	71.40	D	<b>74.4</b>	D	67.60	BD
	10/12/2012	24.90	26.90	D	<b>67.3</b>	D	88.10	BD
	10/12/2012	—	26.30	—	—	—	120	<b>37.10</b>
	10/12/2012	—	26.70	—	—	—	—	—
	11/01/2012	20.60	23.40	D	<b>56.7</b>	D	82.80	BD
	12/03/2012	17.90	20.00	D	40.9	D	135	BD
199-H4-8	11/01/2012	13.40	21.10	B	18.8	D	84.90	BD
	11/01/2012	—	16.40	B	—	—	-1.20	U
<b>Non-RCRA Well</b>								
199-H4-84	7/24/2012	41.90	39.90		<b>48.7</b>	D	68.50	BD
	8/21/2012	48.20	53.20	D	<b>135</b>	D	308	D
	9/07/2012	22.80	34.20	D	<b>116</b>	D	149	D
	10/12/2012	16.30	21.60	D	<b>61.10</b>	D	76.90	BD
	11/01/2012	20.00	23.40	D	43.50	D	62.20	BD
	12/10/2012	24.40	27.20	D	33.20	D	110	BD

Notes: Analyses are from unfiltered samples unless otherwise noted.

*Italics* indicates the Permit Concentration Limits

Shading indicates filtered samples.

**Bold** emphasis added where the result exceeded the permit concentration limit.

- a. These samples were collected to monitor performance of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* interim action.
- b. Concentration limits are defined in WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste (Part VI, Post-Closure Unit 2)*.
- c. Nitrate is not considered a dangerous waste constituent under RCRA (WAC 173-303-9905).
- d. Current DWS for uranium is 30 µg/L

Qualifiers:

- A = potential issue with chain of custody
- B = analyte was found in the associated blank
- D = dilution
- H = laboratory holding time exceeded
- U = below detection limit

Chromium concentrations have remained below the 122  $\mu\text{g/L}$  permit concentration limit in all three wells completed within the unconfined aquifer since 2003. The maximum concentration of chromium in the unconfined aquifer that was reported during this monitoring period was 71.40  $\mu\text{g/L}$  in Well 199-H4-3, however results decreased to more typical concentrations for the remainder of the sampling period with a 17.9  $\mu\text{g/L}$  in December. The results from the same time frame in 2011 ranged from 10.8 to 29  $\mu\text{g/L}$  for wells in the unconfined aquifer.

Hexavalent chromium concentrations in the unconfined aquifer ranged from below detection limits (Well 199-H-12A) to a maximum of 65.60  $\mu\text{g/L}$  in Well 199-H4-3 (Table 2; Figures 2, 3, and 4). These concentrations remain below the permit concentration limit of 122  $\mu\text{g/L}$ , but exceed the CERCLA remedial action objective of 20  $\mu\text{g/L}$ . Concentrations of hexavalent chromium remain on a downward trend overall.

Hexavalent chromium concentrations observed in 199-H4-12C, completed in the first water bearing unit of the Ringold Formation upper mud, are from historical releases at other sources, not releases from the 183-H Solar Evaporation Basin. This conclusion is discussed further in the previous semiannual report (SGW-52135, *First Semiannual Report for 2011 Post-Closure Corrective Action Groundwater Monitoring at the 183-H Solar Evaporation Basins and 300 Area Process Trenches*). Concentrations of hexavalent chromium measured in this well declined from about 300  $\mu\text{g/L}$  in the early 1990s and were stable until 2009 (Figure 5), when pumping was initiated at the well during an aquifer test. The exceedance of the CERCLA remedial action objectives (RAOs) (20  $\mu\text{g/L}$ ) and permit concentrations (122  $\mu\text{g/L}$ ) in 199-H4-12C were addressed by connecting Well 199-H4-12C to the pump-and-treat system. Total chromium range from 127 to 132  $\mu\text{g/L}$  in Well 199-H4-12C, which is consistent with previous values.

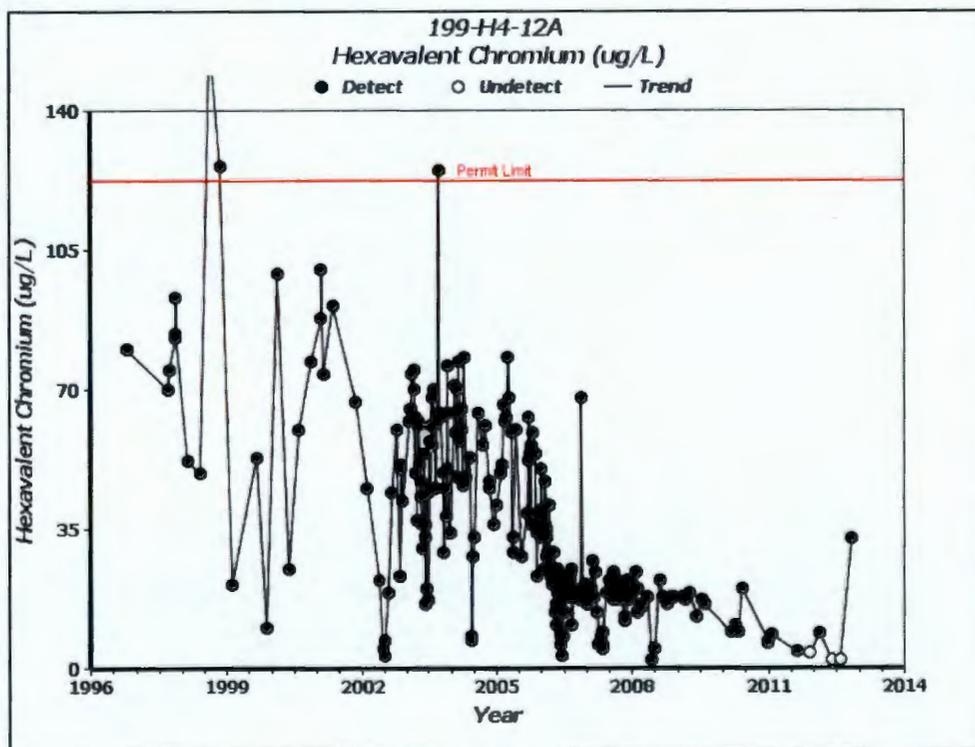


Figure 2. Hexavalent Chromium Concentrations in Well 199-H4-12A

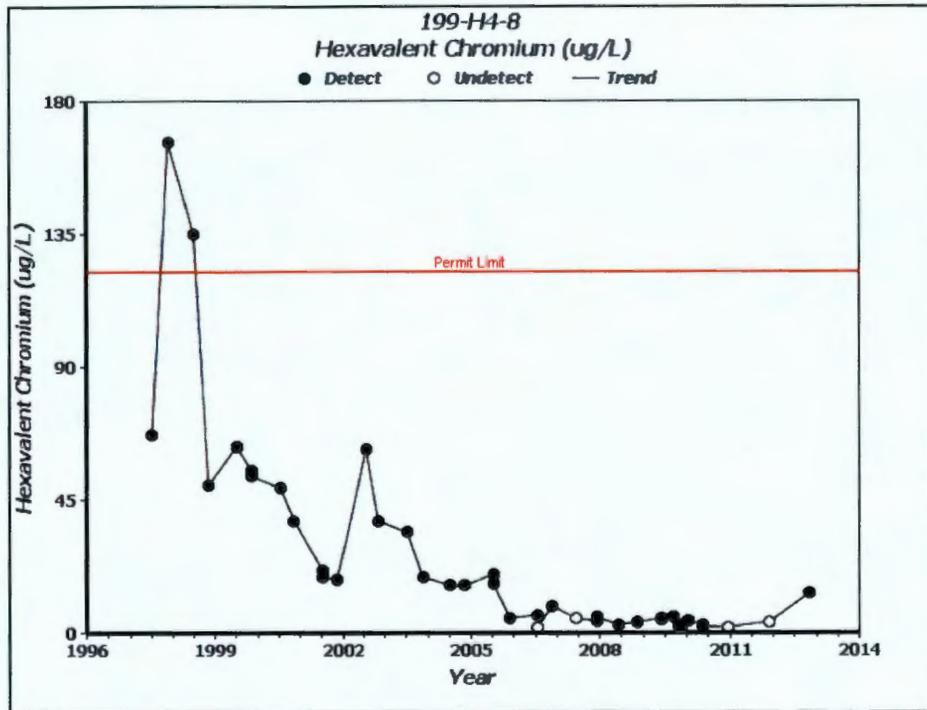


Figure 3. Hexavalent Chromium Concentrations in Well 199-H4-8

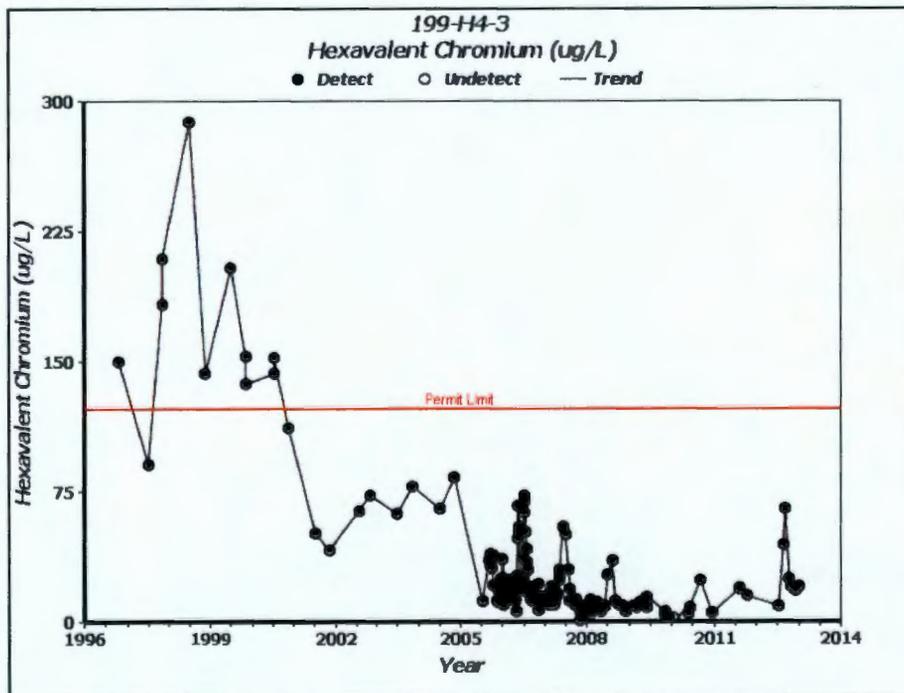
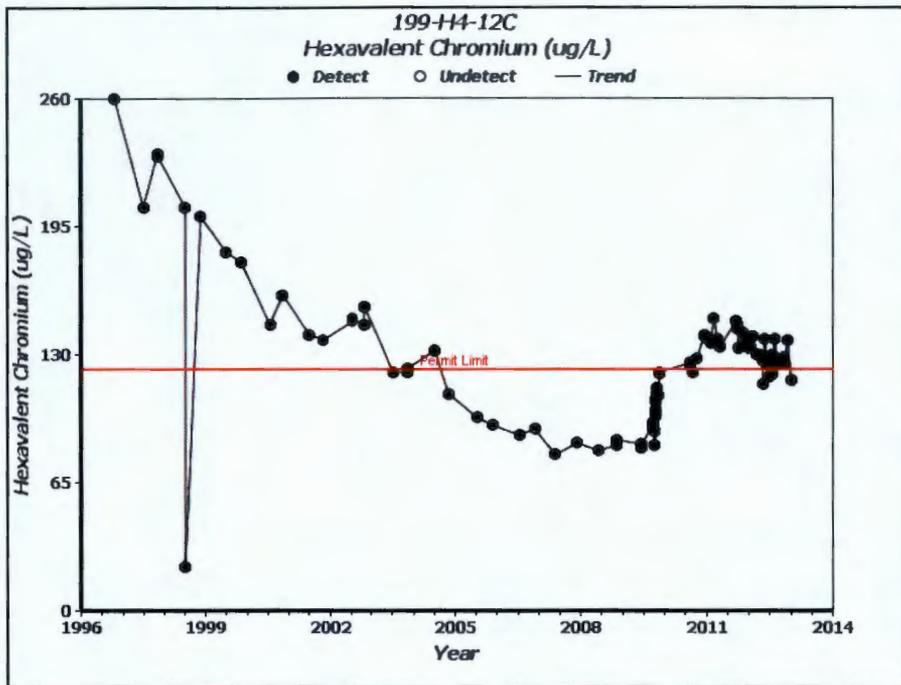


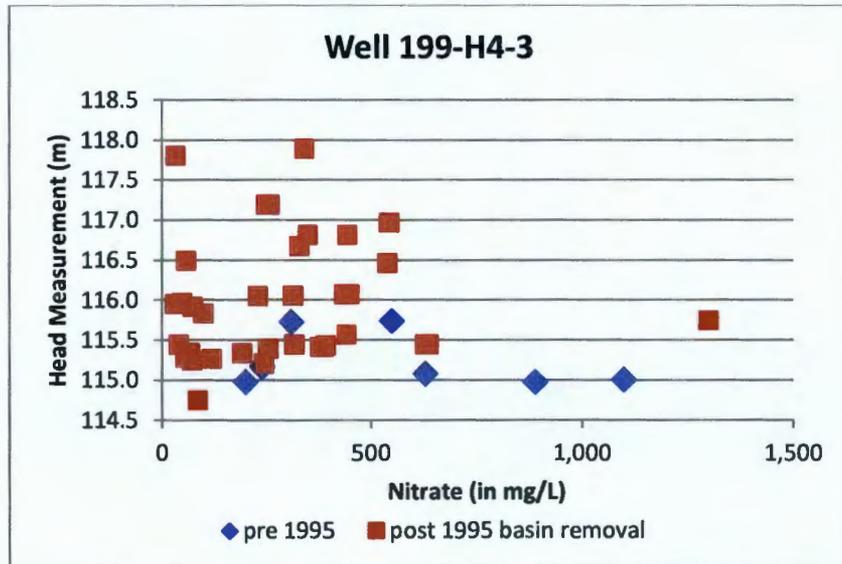
Figure 4. Hexavalent Chromium Concentrations in Well 199-H4-3



Note: Recent increasing concentrations coincide with the 2009 addition of the well to the pump-and-treat system.

**Figure 5. Hexavalent Chromium Concentrations in Well 199-H4-12C**

Nitrate concentrations in Well 199-H4-3 exceeded the permit concentration limit (45 mg/L) during 2011 and again in 2012. During the November sampling event, nitrate concentrations were also exceeded in Well 199-H4-12A, with a concentration of 58.9 mg/L. Based on 2011 data, a possible correlation between nitrate concentrations and groundwater elevations was suspected. Using 2012 data, it appears that little to no correlation is present between these parameters (Figures 6 and 7).



**Figure 6. Nitrate versus Water Level for Well 199-H4-3**

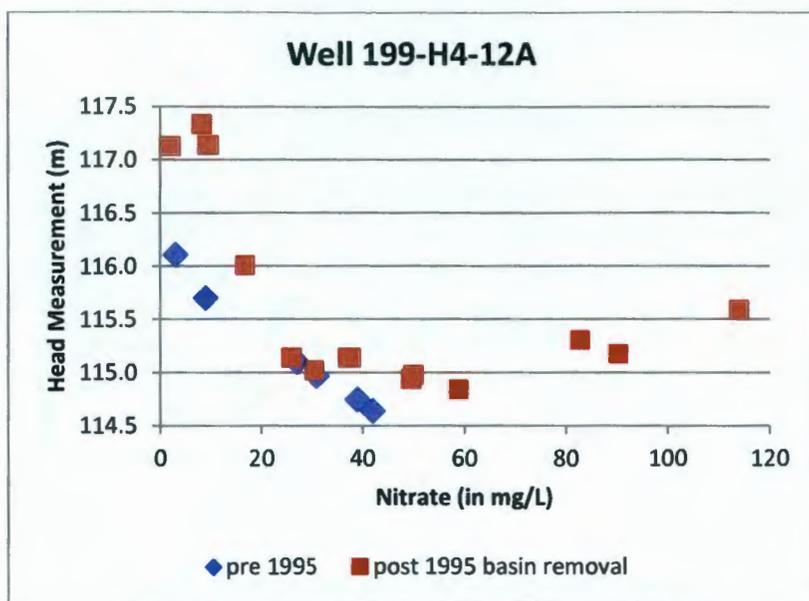


Figure 7. Nitrate versus Water Level for Well 199-H4-12A

During 2012, uranium concentrations in Well 199-H4-3 exceeded both the permit concentration limits (20  $\mu\text{g/L}$ ) and the drinking water standards (30  $\mu\text{g/L}$ ) with a concentration of 37.10  $\mu\text{g/L}$ . In addition, concentrations in Well 199-H4-12A at 23.70  $\mu\text{g/L}$  exceeded the permit concentration limit. This is an increase in both locations. The most likely cause for this increase in uranium concentration was thought to be from the unusually high river stage observed in 2011 and again in 2012. Water rising into the overlying zone of contamination may have increased the rate at which it discharges to the groundwater, causing a temporary peak in concentrations.

To determine if a correlation could be substantiated, uranium concentrations were plotted against the head measurements at Well 199-H4-3, 199-H4-12A, and 199-H4-8. As shown in Figure 8, which presents results from Well 199-H4-3, concentrations do not appear to coincide with changes in water level. It is possible that the timing of the water level measurements has biased the data and made correlation more difficult, but the data indicate that a correlation is not present. It is interesting to note that nitrate and uranium do correlate with each other, as shown in the previous semi-annual report for this site (SGW-53895, *First Semiannual Report for 2012 Post-Closure Corrective Action Groundwater Monitoring at the 183-H Solar Evaporation Basins and 300 Area Process Trenches: January – June 2012*). Data will continue to be evaluated to if the high measurements resulted from movement of existing contamination in the groundwater, or given the proximity of 199-H4-3 to the river, a release from the periodic rewetted zone after high river stage.

Fluoride concentrations observed in the four wells remain significantly below the permit concentration limit of 1,400  $\mu\text{g/L}$ . As depicted in Figure 9, fluoride concentrations measured this reporting period are higher than in recent reporting periods. However, the fluoride concentrations continue their overall downward trend.

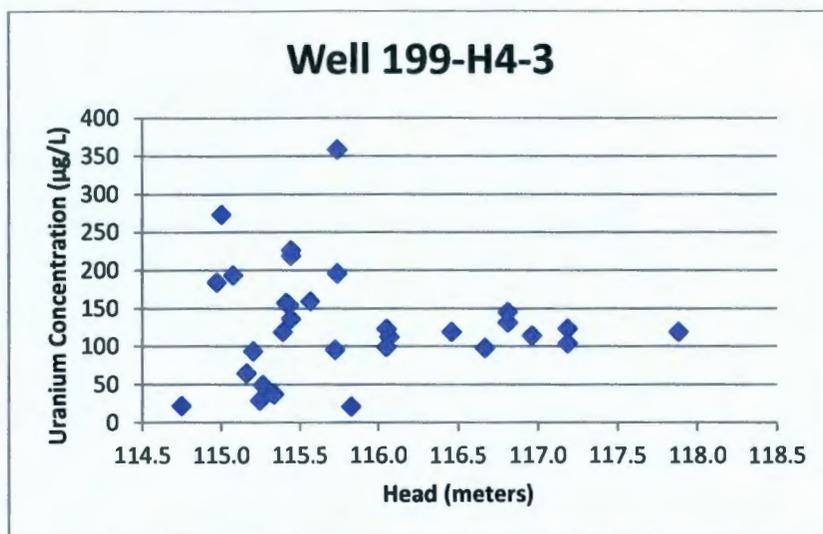


Figure 8. Uranium versus Water Level for Well 199-H4-3

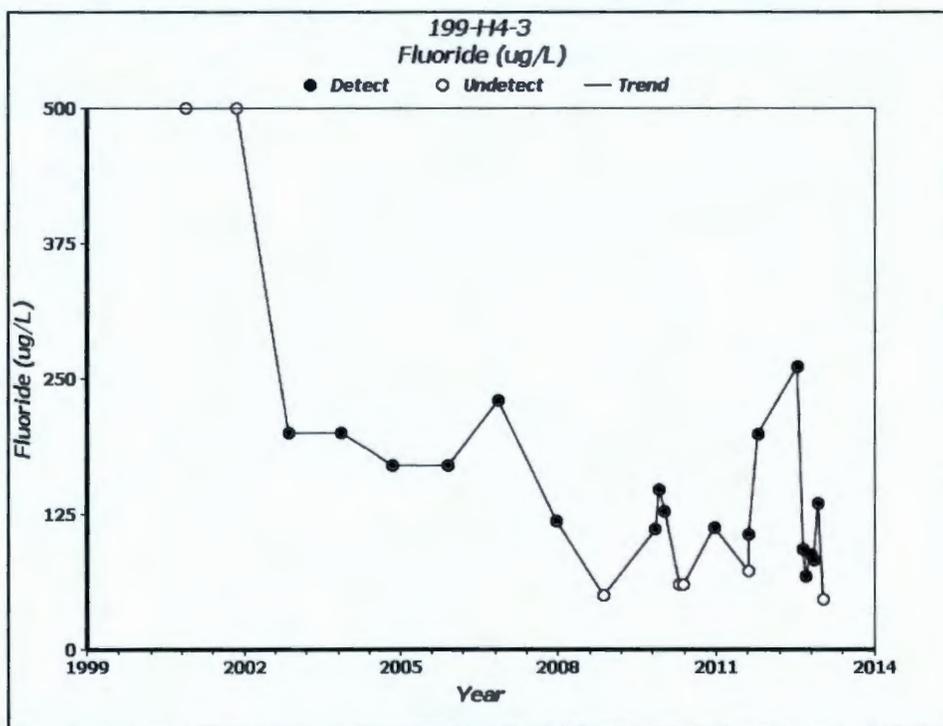


Figure 9. Fluoride Concentrations over Time for Well 199-H4-3

## 2.4 183-H Basins Conclusions

From July through December 2012, chromium concentrations in the unconfined aquifer remained below permit concentration limits. Fluoride measurements in the 183-H wells remain far below the permit concentration limits. Concentrations of nitrate and uranium exceeded the permit concentration limit in this reporting period. The increase observed for nitrate (in both August and October samples from 199-H4-3)

is most likely related to movement of existing nitrate in the aquifer. Uranium observed above the permit concentration in Well 199-H4-3 and Well 199-H4-12A may be related to newly mobilized uranium from the rewetted zone after seasonal river stage changes, or movement of existing uranium in the aquifer.

Concentrations of hexavalent chromium in 199-H4-12C result from historical releases, and remain above permit concentration limits and CERCLA RAOs. With addition of 199-H4-12C to the pump-and-treat system, corrective action through the CERCLA interim action remains effective.

### 3 300 Area Process Trenches

The 300 Area Process Trenches are permitted as a RCRA treatment, storage, and/or disposal unit in post-closure corrective action monitoring. From 1975 through 1985, the trenches received effluent discharges of dangerous mixed waste from fuel fabrication and research laboratories in the 300 Area followed by continued discharge of clean effluent until December 1994. The site was remediated in the 1990s. Groundwater monitoring at the 300 Area process trenches is conducted in accordance with WAC 173-303-645(11) and the Hanford Facility RCRA Permit (WA7890008967), Part VI, Chapter 1. The closure plan (DOE/RL-93-73, *300 Area Process Trenches Modified Closure Plan and Part A, Form 3*) indicates groundwater corrective action will be addressed as part of the remediation for the CERCLA 300-FF-5 Groundwater OU. The waste site designation is 316-5.

The objective of groundwater monitoring is to demonstrate the effectiveness of the corrective action program by confirming that trends in the data for groundwater constituents reflect natural attenuation, as expected by the CERCLA interim record of decision (EPA et al., 1996b, *Declaration of the Record of Decision for the USDOE Hanford 300 Area 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington*). The 300 Area Process Trenches were closed under a modified closure/post closure plan (DOE/RL-93-73) and remain in the groundwater corrective action program because groundwater contamination continues to exceed CERCLA RAOs and Hanford Facility RCRA Permit (WA7890008967) concentration limits.

#### 3.1 300 Area Process Trenches RCRA Groundwater Monitoring Program

The permit concentration limits established for the 300 Area Process Trenches are provided in Table 3. RCRA corrective action monitoring will continue to evaluate new analytical results relative to permit concentration limits.

The groundwater monitoring network for the 300 Area Process Trenches (WHC-SD-EN-AP-185, *Groundwater Monitoring Plan for the 300 Area Process Trenches*) includes four well pairs (Figure 10). Each of the well pairs has one shallow and one deep well. The shallow wells (with the well numbers ending in "A") are screened near the water table, and the deep wells (with the well numbers ending in "B") are screened in the lower portion of the unconfined aquifer (above the lacustrine and over-bank deposits of the Ringold Formation lower mud unit). One well pair is upgradient and the other three pairs are downgradient of the process trenches. The wells are monitored for the constituents in Table 4. The reporting period is semiannual, but the wells are sampled four times (at monthly intervals) in each reporting period in order to collect the required number of independent samples. As a result, the wells are sampled during the months of December, January, February, March, and June, July, August, September. Data from RCRA monitoring at the 300 Area Process Trenches are used as supplementary information to construct larger-scale water table and uranium-concentration maps that extend beyond the area of the 300 Area Process Trenches network.

Table 3. Permit Concentration Limits for 300 Area Process Trenches

Dangerous Waste Constituents	Concentration Limit
cis-1,2-Dichloroethene	70 µg/L – DWS
Trichloroethene	5 µg/L – DWS
Other 300 Area Process Trenches Waste Constituent	Concentration Limit
Uranium (total; chemical analysis)	20 µg/L – proposed DWS when monitoring plan written (1996)

DWS = drinking water standard

During the July through December 2012 reporting period, the 300 Area Process Trenches post-closure monitoring wells were sampled during July, August, September, and December.

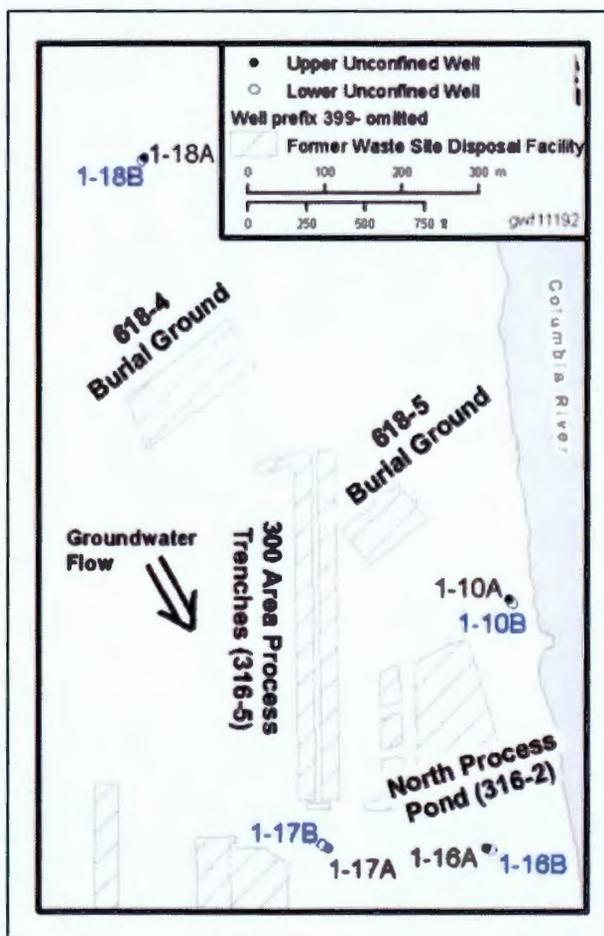


Figure 10. Monitoring Well Locations for the 300 Area Process Trenches

### 3.2 300 Area Process Trenches Contaminant Trends

This section discusses concentrations of cis-1,2-dichloroethene, trichloroethene, and uranium measured during the reporting period. Table 4 lists the analytical results for contaminants measured in each well.

**Table 4. Groundwater Data for 300 Area Process Trenches, July through December 2012**

Well	Date	Sampling Purpose	cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
<i>Permit Concentration Limit*</i>			<i>70</i>		<i>5</i>		<i>20</i>	
399-1-10A	07/25/2012	RCRA	1	U	1	U	8.85	D
	08/21/2012	RCRA	1	U	1	U	19.8	D
	09/07/2012	RCRA	1	U	1	U	36.1	D
	12/14/2012	RCRA	1	U	1	U	19.7	D
399-1-10B	08/20/2012	RCRA	1	UA	1	U	0.1	UD
	08/21/2012	RCRA	1	U	1	U	0.1	UD
	09/07/2012	RCRA	1	U	1	U	0.1	UD
	12/14/2012	RCRA	1	U	1	U	0.1	UD
399-1-16A	07/11/2012	RCRA	1	U	1	U	15.4	D
	08/21/2012	RCRA	1	U	1	U	29.3	D
	09/10/2012	RCRA	1	U	1	U	52.2	D
	12/14/2012	RCRA	1	U	1	U	89.1	D
399-1-16B	07/12/2012	RCRA	200	A	1.9	JA	9.14	DA
	08/21/2012	RCRA	140	Q	2.8	J	8.47	D
	08/21/2012	RCRA	200	Q	2.3	J	8.53	D
	09/10/2012	RCRA	170		1.9	J	11.0	D
	12/18/2012	RCRA	170		2.1	J	8.64	D
399-1-17A	07/03/2012	RCRA	1	U	1	U	838	DGQ
	08/21/2012	RCRA	1	U	1	U	235	D
	09/10/2012	RCRA	1	U	1	U	217	D
	12/14/2012	RCRA	1	U	1	U	72.8	D
399-1-17B	07/11/2012	RCRA	1	UH	1	UH	0.1	UD
	08/22/2012	RCRA	6.4		1	U	0.1	UD
	09/10/2012	RCRA	5.3	J	1	U	0.1	UD
	12/14/2012	RCRA	1	U	1	U	0.1	UD
399-1-18A	07/11/2012	RCRA	1	U	1	U	6.31	D

Table 4. Groundwater Data for 300 Area Process Trenches, July through December 2012

Well	Date	Sampling Purpose	cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
	08/22/2012	RCRA	1	U	1	U	8.14	D
	09/10/2012	RCRA	1	U	1	U	6.58	D
	12/14/2012	RCRA	1	U	1	U	5.92	D
399-1-18B	07/11/2012	RCRA	3.2	JY	1	U	0.1	UD
	08/22/2012	RCRA	1	U	1	U	0/1	UD
	09/10/2012	RCRA	1	U	1	U	0.1	UD
	12/14/2012	RCRA	1	U	1	U	0.1	UD

Notes: Analyses are from unfiltered samples unless otherwise noted.

*Italics* indicates the Permit Concentration Limits

Shading indicates filtered samples.

**Bold** emphasis added where the result exceeded the permit concentration limit.

\* Concentration limits are defined in WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion, Revision 8C, for the Treatment, Storage, and Disposal of Dangerous Waste (Part VI, Post-Closure Unit 1)*

Qualifiers:

- A = potential issue with chain of custody
- D = dilution
- G = result has been reviewed and determined to be correct
- H = laboratory holding time exceeded
- J = estimated value
- Q = associated quality control sample was out of limits
- U = below detection limit
- Y = result suspect

Cis-1,2-dichloroethene was observed in three wells in the 300 Area Process Trenches network during the reporting period (399-1-16B, 399-1-17B, and 399-1-18B). Only Well 399-1-16B had concentrations of cis-1,2-dichloroethene that exceeded the 70 µg/L permit concentration limit. While slightly higher than last reporting period, the trend at Well 399-1-16B was stable, ranging from 140 to 200 µg/L (Figure 11). At Well 399-1-17B, cis-1,2-dichloroethene was detected twice during this reporting period. The detection of 6.4 µg/L in August 2012 is the maximum concentration that has been detected at this well (Figure 12). At Well 399-1-18B, cis-1,2-dichloroethene was detected once during this reporting period at an estimated concentration of 3.2 µg/L. Because cis-1,2-dichloroethene was not detected at this well before July 2012 and was not detected after July 2012, this result was flagged as "Y" (suspect), indicating that there is insufficient evidence to determine if it is valid. The current method detection limit is 1 µg/L.

During the reporting period, trichloroethene was detected in one well; concentrations did not exceed the 5 µg/L permit concentration limit (Figure 13). Five measurements (two in August) from Well 399-1-16B detected trichloroethene at concentrations ranging from 1.9 µg/L to 2.8 µg/L. Each of the values is flagged "J" by the laboratory, indicating that it is an estimated value. The current method detection limit is 1 µg/L.

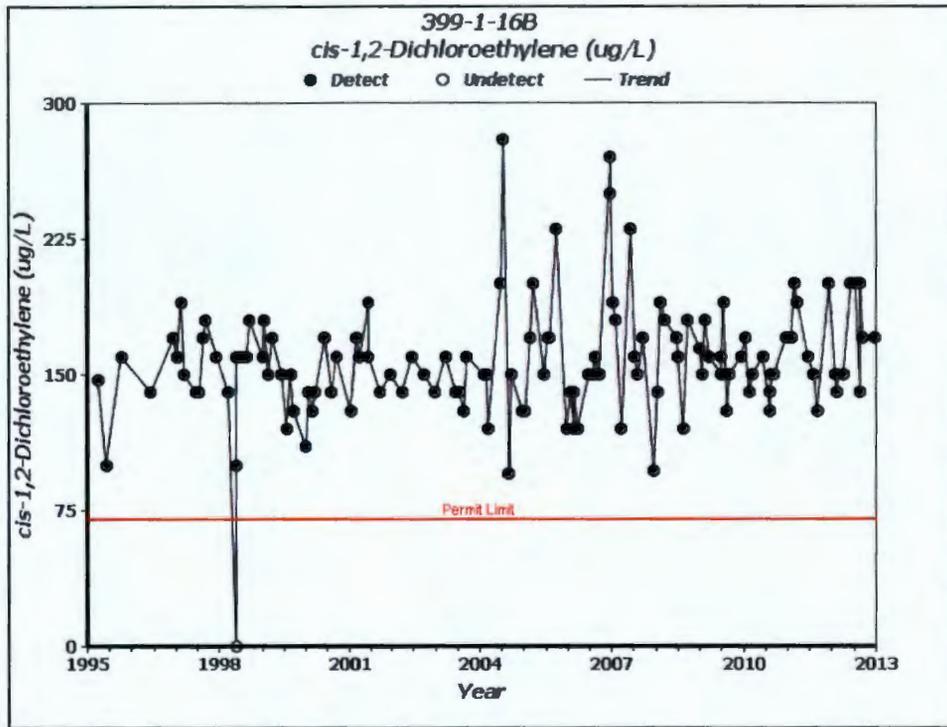


Figure 11. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B

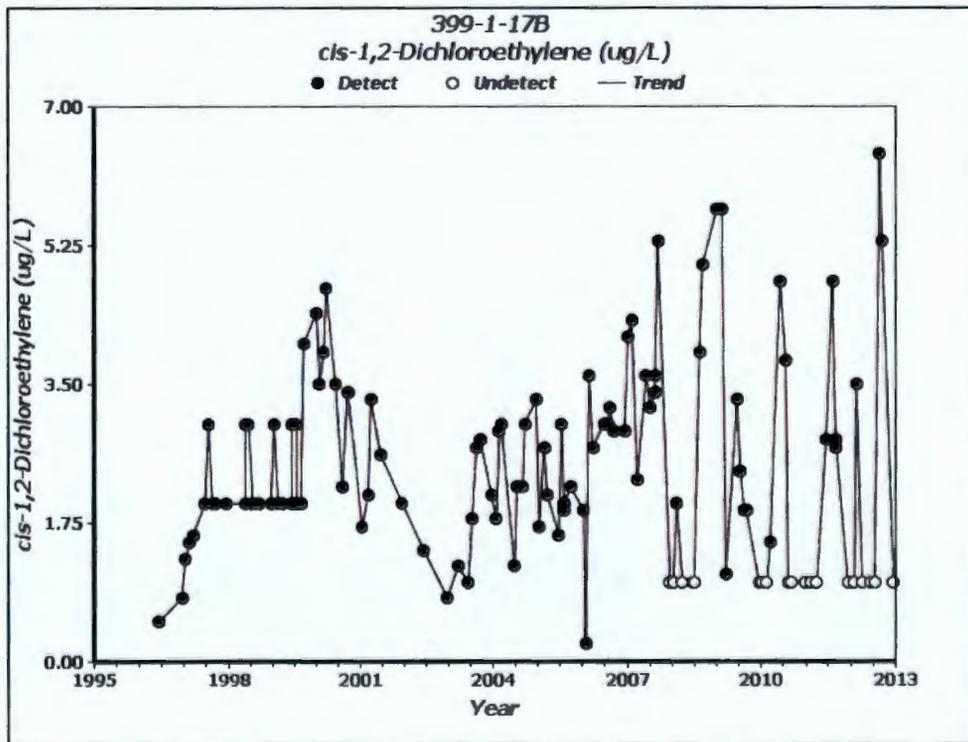
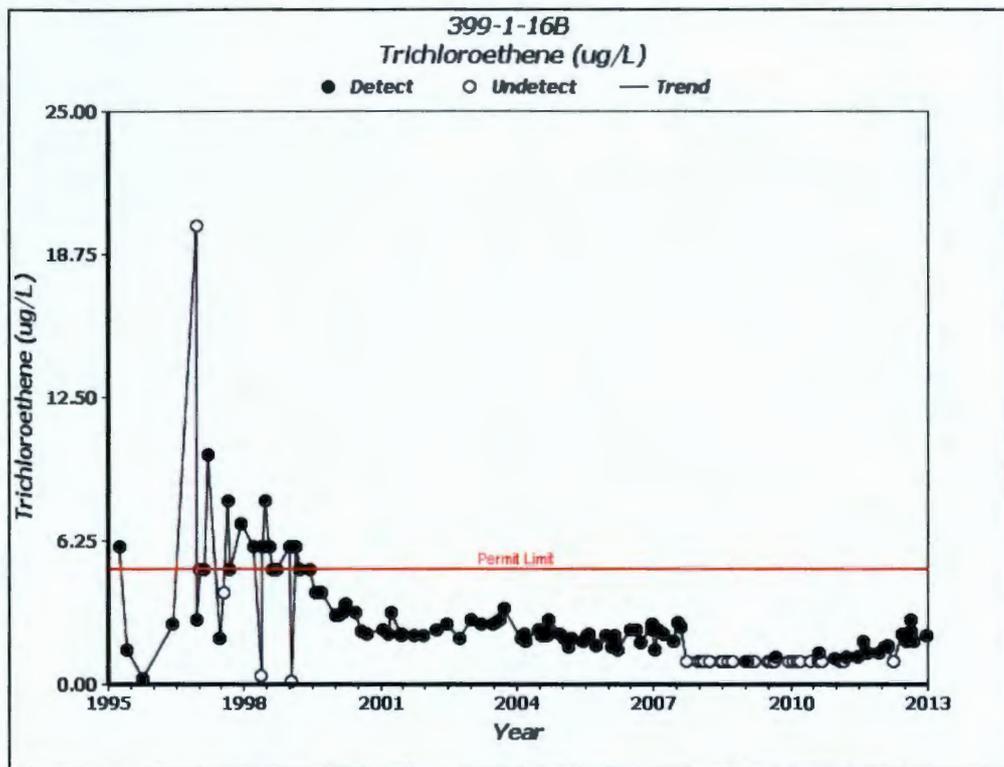


Figure 12. Cis-1,2-Dichloroethene Concentrations in Well 399-1-17B



**Figure 13. Trichloroethene Concentrations in Well 399-1-16B**

A persistent uranium plume underlies the 300 Area Industrial Complex. Uranium concentrations continued to exceed the permit concentration limit (20  $\mu\text{g/L}$ ) at three downgradient wells (399-1-10A, 399-1-16A, and 399-1-17A) screened near the water table. Uranium concentrations at Wells 399-1-10A and 399-1-16A (Figures 14 and 15, respectively) tend to be highest in the fall and winter when water levels are low, and lowest in spring and early summer when water levels are high. This inverse relationship between uranium concentration and water level is typical for wells that are located near the Columbia River. Uranium concentrations at Well 399-1-17A (Figure 16) tend to be lowest in the fall and winter and highest in spring and early summer. The positive relationship between uranium concentration and water level is typical for wells that are located farther inland from the Columbia River, near source areas.

The increase in uranium concentrations near source areas during high water levels is caused by mobilization of residual contamination in the vadose zone resulting from the temporary elevation of the water table. The decrease in uranium concentrations near the shoreline during high water levels is caused by dilution from intrusion of river water into the aquifer. During seasonal low water table conditions, the highest concentrations in the plume are often observed near the river, where uranium introduced inland during the preceding period of high water table conditions has migrated downgradient to the shoreline, and intrusion of river water into the zone beneath the shoreline is lessened because of the lower river stage. Uranium concentrations in the 300 Area are described in detail in PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*.

During 2012, the river stage in the 300 Area began to increase in April 2012 and was highest in July (107.68 m above mean sea level, measured at the 300 Area river gauge). Based on the elevated uranium concentrations measured at Well 399-1-17A in June 2011 during high water conditions, the July 2012

sample was collected at Well 399-1-17A slightly earlier than the samples at the other wells to ensure that the sampling was during high water conditions. During high water conditions, the water table was elevated sufficiently to rewet a portion of the vadose zone where residual amounts of mobile uranium remain at some locations. The concentration in the July 2012 sample was 838  $\mu\text{g/L}$ . The uranium concentration in June 2011 was 4,030  $\mu\text{g/L}$ . These are the two highest uranium concentrations measured at this well (Figure 14). These anomalously high concentrations declined to more typical winter seasonal values by December 2011 and by December 2012.

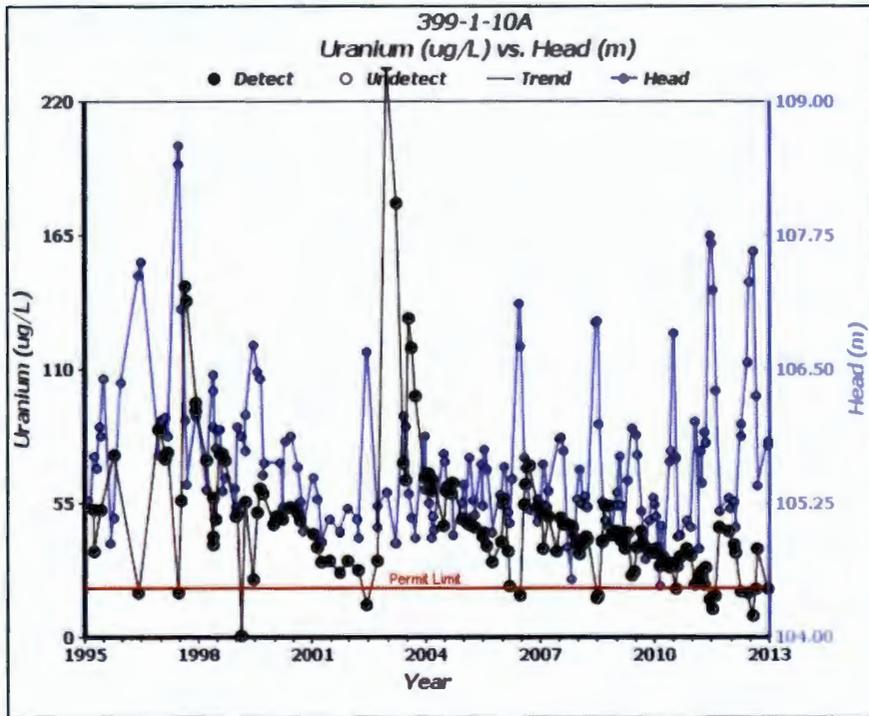


Figure 14. Inversely Related Uranium Concentrations and Water Level in Well 399-1-10A

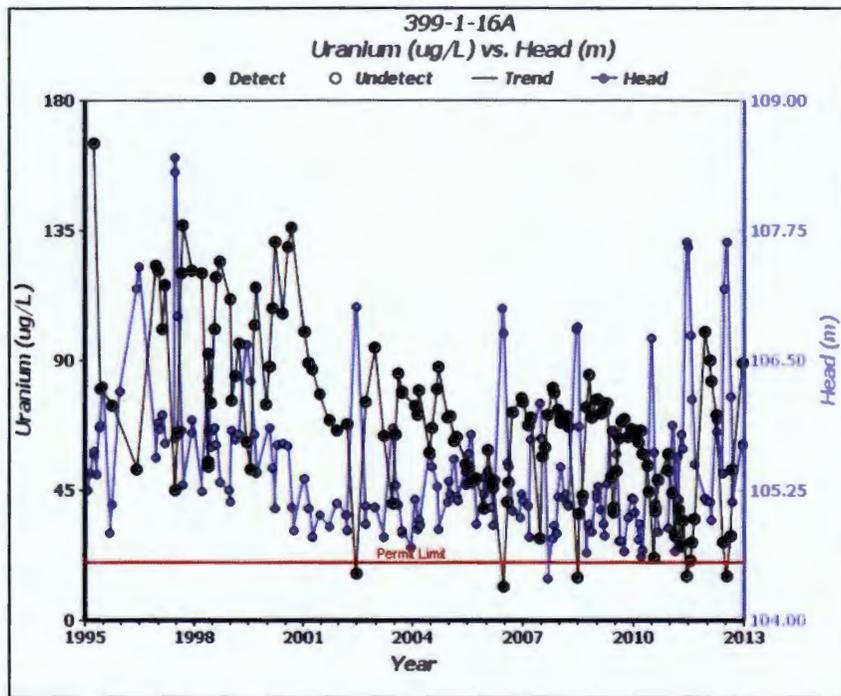


Figure 15. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A

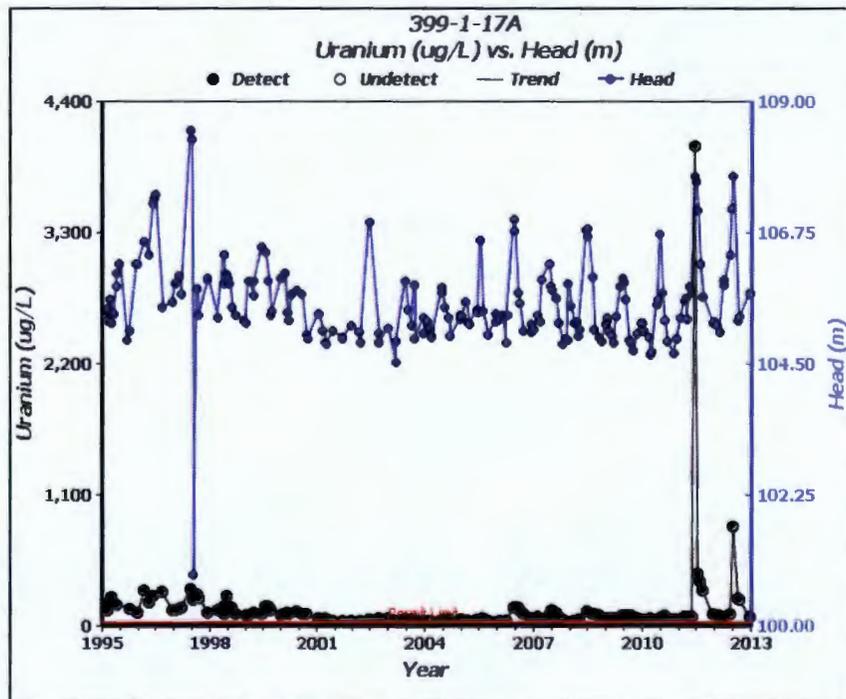


Figure 16. Positively Related Uranium Concentrations and Water Level in Well 399-1-17A

### 3.3 300 Area Process Trenches Conclusions

Concentrations of cis-1,2-dichloroethene and uranium have not attenuated as quickly as expected under the CERCLA interim record of decision. The concentration of cis-1,2-dichloroethene remained above the permit concentration limit (70 µg/L) in one well (399-1-16B), which is screened near the bottom of the unconfined aquifer. Concentrations in this well are not affected by river stage, as shown in a previous semiannual report (SGW-52135).

Concentrations of uranium in three wells (399-1-10A, 399-1-16A, and 399-1-17A) downgradient of the 300 Area Process Trenches and screened near the top of the unconfined aquifer remained above the permit concentration limit (20 µg/L). Uranium concentrations in Wells 399-1-10A and 399-1-16A vary inversely with seasonal fluctuations in the water table elevation, and uranium concentrations in Well 399-1-17A vary positively with seasonal fluctuations in the water table elevation. The seasonal fluctuations in the water table elevation are caused by seasonal fluctuations in the river elevation.

Residual concentrations of uranium within the periodically rewetted zone may be mobilized to the groundwater during high water conditions at inland locations near sources. The high river stage in July 2012 resulted in a high water table at the 300 Area Process Trenches and a high concentration of uranium in groundwater at Well 399-1-17A. The July 2012 uranium concentration (838 µg/L) was lower than the June 2011 concentration (4,030 µg/L) also measured during high water conditions. These anomalously high concentrations declined to more typical winter seasonal values by December 2011 and by December 2012.

Trichloroethene concentrations remained below the permit concentration limit (5 µg/L) during the reporting period. However, monitoring of this volatile organic compound will continue in compliance with the groundwater monitoring plan.

Corrective actions through the CERCLA interim action (attenuation and institutional controls) have been effective for trichloroethene and moderately effective for cis-1,2-dichloroethene and uranium. DOE/RL-2010-99, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, evaluates remedies for these constituents.

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