

Post-Closure Corrective Action Groundwater Monitoring Report for the 183H Solar Evaporation Basins and the 300 Area Process Trenches: January – June 2014

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



**P.O. Box 1600
Richland, Washington 99352**

Post-Closure Corrective Action Groundwater Monitoring Report for the 183H Solar Evaporation Basins and the 300 Area Process Trenches: January – June 2014

Date Published
June 2015

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

ch2m.SM
P.O. Box 1600
Richland, Washington 99352

APPROVED

By Ashley R Jenkins at 8:03 am, Aug 03, 2015

Release Approval

Date

**Approved for Public Release;
Further Dissemination Unlimited**

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Executive Summary

This is the first 2014 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)¹ to report twice each year on the effectiveness of the corrective action program.

Groundwater monitoring objectives of RCRA, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and the *Atomic Energy Act of 1954* (AEA) often differ slightly, and the contaminants monitored are not always the same. For RCRA-regulated units, monitoring focuses on nonradioactive dangerous waste constituents. While radionuclides (source, special nuclear, and byproduct materials) may be monitored in some RCRA unit wells to support objectives of monitoring under AEA and/or CERCLA, they are not subject to RCRA regulation. Consistent with the deferral of RCRA Sections 1004 and 1006 to the AEA, the “source, special nuclear, and byproduct material” components of radioactive mixed waste are regulated by the U.S. Department of Energy (DOE), acting in accordance with its AEA authority. Therefore, while this report is used to satisfy corrective action 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. Uranium and other radionuclides in these reports serve only as “indicator parameters” which help to identify the presence of regulated dangerous wastes.

This report covers the period from January through June 2014. Environmental data used to generate this report are available from the Environmental Dashboard Application (<http://environet.hanford.gov/EDA/>) or PHOENIX (<http://phoenix.pnnl.gov>). Ongoing verification and technical review and evaluation efforts may result in differences between the data used for this publication and those available after publication of this report.

183-H Solar Evaporations Basins Groundwater Monitoring

Chromium and hexavalent chromium concentrations in the unconfined aquifer remained below permit concentration limits. Hexavalent chromium in deep Well 199-H4-12C

¹ 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>.

resulted from historical releases, and is now slightly below permit concentration limits but above *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*² (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.

Concentrations of the other contaminants (nitrate and waste indicator parameters fluoride, technetium-99 and uranium) were below the monitoring levels set as the permit concentration limit with the exception of uranium. Uranium concentrations exceeded the permit concentration limits in June 2014, with a result of 24.8µg/L in Well 199-H4-84, but did not exceed the Drinking Water Standard (DWS) of 30 µg/L.

The contaminant concentrations in Well 199-H4-84 are directly correlated with water levels. As high river stage progresses through July and early August, both hexavalent chromium and uranium concentrations are expected to continue to increase in response.

300 Area Process Trenches Groundwater Monitoring

Uranium concentrations continued to exceed the monitoring level set as the permit concentration limit (DWS of 30 µg/L) at two downgradient wells (399-1-16A and 399-1-17A) screened near the water table. Uranium concentrations at Well 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 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.

² *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>.

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

Corrective action is being accomplished through the CERCLA remedial action for groundwater, as documented in the Record of Decision issued in November 2013. The remedy for groundwater includes monitored natural attenuation, enhanced attenuation, and institutional controls.

This page intentionally left blank.

Contents

1	Introduction.....	1
2	183-H Solar Evaporation Basins.....	1
2.1	100-HR-3 CERCLA Interim Remedial Action	2
2.2	183-H Basins RCRA Groundwater Monitoring Program	3
2.3	183-H Basins Contaminant Trends	5
2.3.1	Chromium and Hexavalent Chromium	5
2.3.2	Other Contaminants	8
2.4	183-H Basins Conclusions	8
3	300 Area Process Trenches.....	9
3.1	300-FF-5 CERCLA Remedial Action.....	9
3.2	300 Area Process Trenches RCRA Groundwater Monitoring Program.....	10
3.3	300 Area Process Trenches Contaminant Trends.....	11
3.4	300 Area Process Trenches Conclusions.....	17
4	References.....	19

Figures

Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins.....	4
Figure 2. Hexavalent Chromium and Uranium Concentrations versus Water Levels (199-H4-84).....	7
Figure 3. Hexavalent Chromium and Uranium Concentrations versus Water Levels (199-H4-12A).....	7
Figure 4. Monitoring Well Locations for the 300 Area Process Trenches	11
Figure 5. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B	14
Figure 6. Cis-1,2-Dichloroethene Concentrations in Well 399-1-17B	14
Figure 7. Trichloroethene Concentrations in Well 399-1-16B	15
Figure 8. Trichloroethene Concentrations in Well 399-1-17A	15
Figure 9. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A.....	16
Figure 10. Positively Related Uranium Concentrations and Water Level in Well 399-1-17A.....	16

Tables

Table 1. WAC 173-303-645(5) Concentration Limits for 183-H Solar Evaporation Basins.....	3
Table 2. Groundwater Data for 183-H Basins, January through June 2014	6
Table 3. WAC 173-303-645(5) Concentration Limits for 300 Area Process Trenches.....	10
Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2014.....	12

This page intentionally left blank.

Terms

AEA	<i>Atomic Energy Act of 1954</i>
CERCLA	<i>Comprehensive Environmental Response, Compensation, and Liability Act of 1980</i>
DOE	U.S. Department of Energy
DWS	drinking water standard
gpm	gallons per minute
lpm	liters per minute
OU	operable unit
PHOENIX	PNNL Hanford Online Environmental Information Exchange
PNNL	Pacific Northwest National Laboratory
RAO	remedial action objective
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RUM	Ringold Formation upper mud

This page intentionally left blank.

1 Introduction

This is the first semiannual report for 2014 regarding post-closure corrective action groundwater monitoring describing the effectiveness of corrective actions at the 183-H Solar Evaporation Basins (waste site 116-H-6) and the 300 Area Process Trenches (waste site 316-5). This report 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 January through June 2014. The 183-H Solar Evaporation Basins information is presented in Chapter 2 and the 300 Area Process Trenches information is presented in Chapter 3.

Groundwater monitoring objectives of RCRA, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and the *Atomic Energy Act of 1954* (AEA) often differ slightly, and the contaminants monitored are not always the same. For RCRA-regulated units, monitoring focuses on nonradioactive dangerous waste constituents. While radionuclides (source, special nuclear, and byproduct materials) may be monitored in some RCRA unit wells to support objectives of monitoring under AEA and/or CERCLA, they are not subject to RCRA regulation. Consistent with the deferral of RCRA Sections 1004 and 1006 to the AEA, the source, special nuclear, and byproduct material components of radioactive mixed waste are regulated by the U.S. Department of Energy (DOE), acting in accordance with its AEA authority. Therefore, while this report is used to satisfy corrective action 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. Uranium and other radionuclides in these reports serve only as “indicator parameters” which help to identify the presence of regulated dangerous wastes.

Environmental data used to generate this report are available from the U.S. Department of Energy’s (DOE’s) Environmental Dashboard Application (<http://environet.hanford.gov/EDA/>) or the Pacific Northwest National Laboratory (PNNL) Online Environmental Information Exchange (PHOENIX) application (<http://phoenix.pnnl.gov/>). Ongoing data verification, technical review, and evaluation efforts by Department of Energy (DOE) contractors could result in differences between the data used for this publication and those available after publication of this report via the electronic means referenced previously.

2 183-H Solar Evaporation Basins

Located in the 100-H Area of the Hanford Site, the former 183-H Solar Evaporation Basins consisted of four concrete basins 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). 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*).

Groundwater monitoring objectives of RCRA, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and the *Atomic Energy Act of 1954* (AEA) often differ slightly, and the contaminants monitored are not always the same. For RCRA-regulated units, monitoring focuses on nonradioactive dangerous waste constituents. While radionuclides (source, special nuclear, and byproduct materials) may be monitored in some RCRA unit wells to support objectives of monitoring under AEA and/or CERCLA, they are not subject to RCRA regulation. Consistent with the deferral of RCRA Sections 1004 and 1006 to the AEA, the source, special nuclear, and byproduct material components of radioactive mixed waste are regulated by the U.S. Department of Energy (DOE), acting in accordance with its AEA authority. Therefore, while this report is used to satisfy corrective action 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. Uranium and other radionuclides in these reports serve only as “indicator parameters” which help to identify the presence of regulated dangerous wastes.

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 re-inject it into the aquifer. Figure 1 illustrates the active extraction and injection wells near the 183-H Solar Evaporation Basin waste site. 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*) and discussed in DOE/RL-2014-25 (*Calendar Year 2013 Annual Summary Report for the 100-HR-3 and 100-KR-4 Pump-and-Treat Operations, and 100-NR-2 Groundwater Remediation*).

The HX pump-and-treat system currently handles 3,028 liters per minute (lpm) or 800 gallons per minute (gpm) and replaced the aging 1,136 lpm (300 gpm) 100-HR-3 pump-and-treat system. Together with the 2,271 lpm (600 gpm) DX pump-and-treat system, 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, which is completed in the first water bearing unit of the Ringold Formation upper mud unit (RUM), and is located downgradient of the 183-H Solar Evaporation Basins.

2.2 183-H Basins RCRA Groundwater Monitoring Program

During implementation of the CERCLA interim remedial action, RCRA corrective action monitoring will continue to evaluate analytical results relative to the permit concentration limits (Table 1). Additionally, fluoride results are evaluated relative to established trends and the drinking water standard (DWS) for fluoride³ (Hanford Facility RCRA Permit [WA7890008967], Part VI, Chapter 2).

Table 1. WAC 173-303-645(5) Concentration Limits for 183-H Solar Evaporation Basins

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

a. Nitrate is not considered a dangerous waste constituent under RCRA (WAC 173-303-9905, “Dangerous Waste Regulations,” “Dangerous Waste Constituents List”).

b. Technetium-99 and uranium are monitored as waste indicators.

c. Current DWS for uranium is 30 µg/L

DWS = drinking water standard

The RCRA groundwater monitoring network includes Wells 199-H4-8, 199-H4-12A, 199-H4-12C, and 199-H4-84 (Figure 1). The wells are sampled annually for RCRA as specified in the conditions of the Hanford Facility RCRA Permit (WA7890008967), Part VI, Post-Closure Unit 2, as modified by Ecology (2013). Additional sampling is also conducted under CERCLA, and reported herein.

³ 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 current limit is 4,000 µg/L.

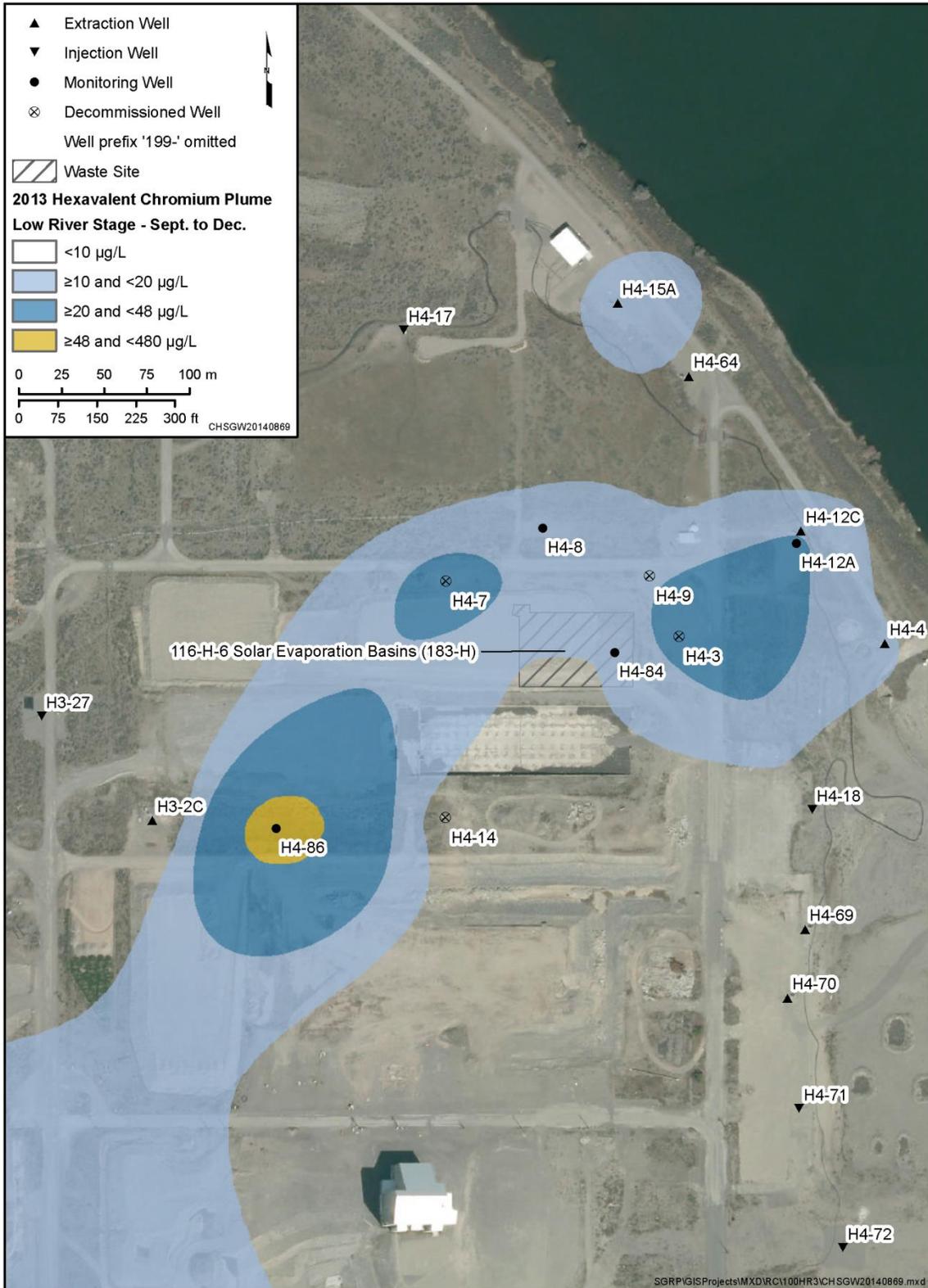


Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

Well 199-H4-12C is an extraction well completed in the first water bearing unit of the RUM, a semi-confined aquifer. The other wells monitored under RCRA are completed in the overlying unconfined aquifer.

Following an 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 100-HR-3 interim action 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-H4-84 has been in the RCRA network since May 2013 when it replaced Well 199-H4-3. Wells 199-H4-3 and 199-H4-7 were decommissioned for waste site remediation.

2.3 183-H Basins Contaminant Trends

This section discusses the concentrations of total chromium, fluoride, nitrate, technetium-99, and uranium in the groundwater near the solar evaporation basins. Hexavalent chromium results also are included. During the reporting period, Wells 199-H4-8, 199-H4-84, 199-H4-12A, and 199-H4-12C were scheduled for sampling. Chromium concentrations have remained below the 122 $\mu\text{g/L}$ permit concentration limit in the RCRA wells completed within the unconfined aquifer since 2003.

Well 199-H4-8 is scheduled for sampling on an annual basis, typically in the fall. During 2013, water levels in Well 199-H4-8 dropped to below the pump intake level and the well was unable to be sampled. Another attempt to sample the well following lowering of the pump was also unsuccessful. As a result, to ensure a sample was collected, samplers used a smaller pump and collected the sample with a low flow rate. A sample was obtained in March 2014, and results are included herein.

2.3.1 Chromium and Hexavalent Chromium

The maximum concentration of total chromium in the unconfined aquifer that was reported during this monitoring period was 20.8 $\mu\text{g/L}$ (unfiltered sample) in Well 199-H4-84. The corresponding filtered sample result was 19.6 $\mu\text{g/L}$, indicating that total chromium and hexavalent chromium track closely with each other as expected. Hexavalent chromium concentrations in Well 199-H4-84 ranged from 11.7 to 38 $\mu\text{g/L}$ during the reporting period (Table 2). Concentrations in this well remain below the permit concentration limit of 122 $\mu\text{g/L}$, but are fluctuating near the CERCLA interim remedial action objective of 20 $\mu\text{g/L}$. In June, during high river stage, the hexavalent chromium concentrations exceeded 20 $\mu\text{g/L}$, with a concentration reaching 38 $\mu\text{g/L}$. As is expected in a monitoring well located within a source area, the concentrations of hexavalent chromium and total chromium increase in Well 199-H4-84 with elevated groundwater elevations (Figure 2). Since river stage has not yet started to decline, the concentrations of hexavalent chromium are expected to continue to increase through the summer months.

Well 199-H4-12A was not sampled for total chromium during this reporting period. Hexavalent chromium concentrations ranged from 22.5 $\mu\text{g/L}$ in February to below the detection limit of 8.0 $\mu\text{g/L}$ in May (Table 2). Concentrations in this well fluctuate seasonally, with concentrations in this downgradient monitoring well increasing during low river stage (Figure 3).

Extraction Well 199-H4-12C is completed in the first water bearing unit of the RUM. Hexavalent chromium concentrations in this well are from historical releases at other sources, not releases from the 183-H Solar Evaporation Basin, as discussed further in a 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 to about 90 $\mu\text{g/L}$ in 2009. In late 2009 pumping was initiated at the well during an aquifer test and concentrations increased to 140 $\mu\text{g/L}$.

Table 2. Groundwater Data for 183-H Basins, January through June 2014

Well	Date	Dangerous Waste				Waste Indicator							
		Hexavalent Chromium (µg/L)		Total Chromium (µg/L)		Nitrate ^a (mg/L NO ₃ ⁻)		Fluoride (µg/L)		Technetium-99 (pCi/L)		Uranium (µg/L)	
Permit Concentration Limit^b		122		122		45		1400		900		20	
199-H4-8	3/10/14	8.00	U	2.81	D	15.30		146	B	1.40	U	1.09	D
	3/10/14 (filtered)	8.00	U	3.10	D	--		--		--		1.13	D
199-H4-12A	2/21/14	22.50		--		--		--		32.00		19.80	D
	5/5/14	8.00	U	--		1.64		130		-0.06	U	0.72	
199-H4-12C	1/29/14	118		--		--		--		--		--	
	2/3/14	114		--		--		--		--		--	
	3/3/14	118		--		--		--		--		--	
	4/1/14	110		--		--		--		--		--	
	5/12/14	108		--		--		--		--		--	
	6/4/14	105		--		--		--		--		--	
	6/5/14	104		--		--		--		--		--	
199-H4-84	1/22/14	14.30		--		--		--		--		3.02	D
	2/6/14	11.70		13.20	D	20.40	D	117	BD	8.40		2.56	D
	2/6/14 (filtered)	--		14.10	D	--		--		--		2.99	D
	3/10/14	13.00	A	--		--		--		--		2.47	D
	4/4/14	19.40		--		--		--		--		3.46	D
	5/5/14	22.00		20.80		18.10	D	150		--		5.10	
	5/5/14 (filtered)	--		19.60		--		--		--		5.20	
	6/17/14	38.00		--		--		--		--		24.80^c	D

Notes: Shading indicates filtered samples. Other results are from unfiltered samples. **Italics** indicate the permit concentration limits. **Bold** indicates an exceedance of the permit concentration limit.

a. Nitrate is not considered a dangerous waste constituent under RCRA (WAC 173-303-9905, "Dangerous Waste Regulations," "Dangerous Waste Constituents List").

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), Chapter 3, Section 3.1.1.2. It should be noted that the current DWS for uranium is 30 µg/L.

c. Exceeds the permit limit (20 µg/L) but not and the Federal drinking water standard (30 µg/L)

A = Irregularity with field paperwork

B = Analyte detected at less than contract required detection limit but greater than method detection limit

C = Analyte detected in sample and associated QC blank

D = Analyte reported at a secondary dilution factor

U = Undetected

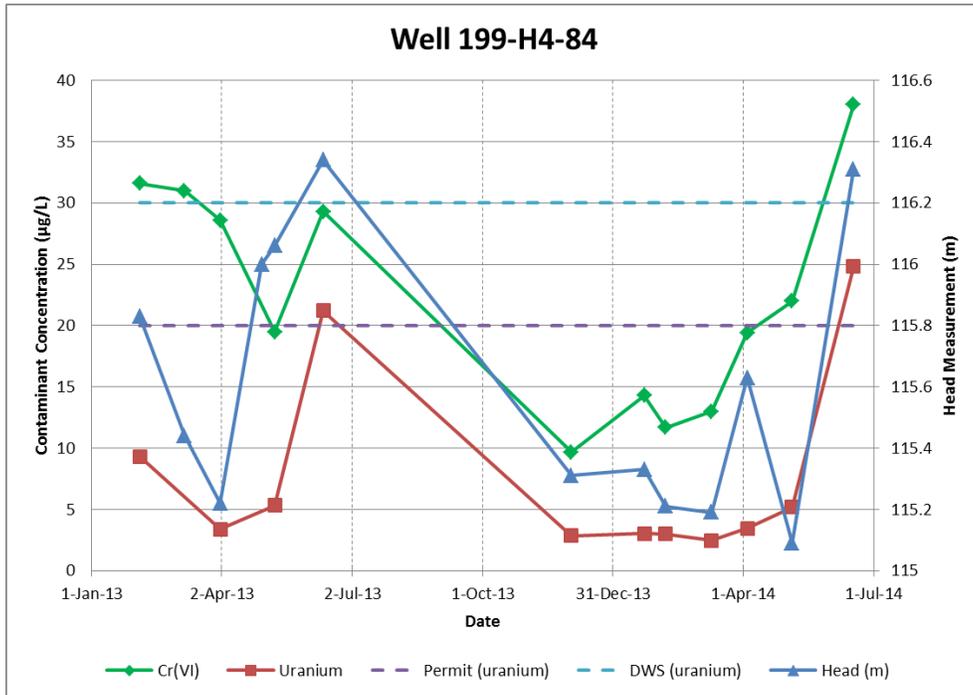


Figure 2. Hexavalent Chromium and Uranium Concentrations versus Water Levels (199-H4-84)

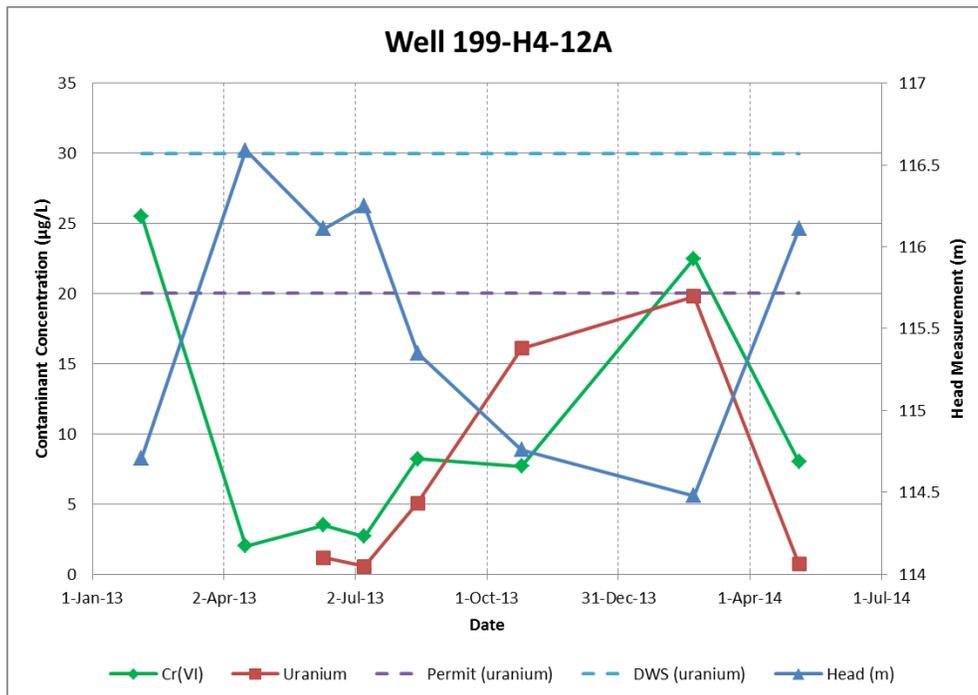


Figure 3. Hexavalent Chromium and Uranium Concentrations versus Water Levels (199-H4-12A)

(December 2010). The exceedance of the CERCLA remedial action objectives (RAOs) (20 µg/L) and permit concentrations (122 µg/L) in 199-H4-12C were addressed by connecting the well to the pump-and-treat system. Hexavalent chromium ranged from 104 to 118µg/L in 199-H4-12C, during this reporting period, which is below the permit limits.

Filtered sample results of total chromium analyses in 199-H4-12C from November 2013 were out of trend and did not agree with hexavalent chromium results or the unfiltered sample results. For that sample date, the hexavalent chromium results were at 118 and 121µg/L (unfiltered and filtered) with corresponding total chromium results at 90 and 5.35µg/L (unfiltered and filtered). Since the chromium unfiltered/filtered samples did not agree, the data did not follow the usual trend, and the data did not correlate with the hexavalent chromium results, the data were reviewed for laboratory or other errors. As a result, the data have been flagged as suspected errors. To ensure quality data and conformance with the RCRA permit, Well 199-H4-12C was sampled again for metals, including total chromium, in July 2014. Results will be included in the next semi-annual report.

2.3.2 Other Contaminants

Fluoride, technetium-99, and uranium were all analyzed during the reporting period. Fluoride, technetium-99 and uranium are monitored as other 183-H waste indicators, however monitoring levels set as the permit concentration limits are identified in the Hanford Facility RCRA Permit [WA7890008967], Part VI, Chapter 3, Section 3.1.1.2 “WAC 173-303-645(5) Concentration Limits”. Nitrate was also analyzed during the reporting period. None of the analytical results for nitrate, fluoride, or technetium-99 exceeded permit limits (Table 2) during the reporting period.

As with other contaminants in Well 199-H4-84, uranium concentrations vary directly with water levels (Figure 2). During the first portion of 2014, uranium concentrations remained low, ranging from 2.47 to 5.20µg/L in Well 199-H4-84. As groundwater levels increased in response to the rise in river stage, uranium concentration increased, reaching 24.80µg/L in mid-June 2014. This trend is consistent with the increased concentrations identified in June of 2013, when uranium reached a concentration of 21.20µg/L.

In Well 199-H4-12A, which is located downgradient of the waste site, concentrations are inversely related to groundwater elevations (Figure 3). The maximum value for uranium in Well 199-H4-12A was 19.80µg/L, detected at low river stage (February 2014).

2.4 183-H Basins Conclusions

Concentrations of chromium, hexavalent chromium and the other contaminants were below the permit level. However, concentrations of the indicator parameter uranium, exceeded the identified permit levels in June 2014, with a result of 24.8µg/L in Well 199-H4-84. The contaminant concentrations in Well 199-H4-84 are directly correlated with water levels. As high river stage progresses through July and early August, both hexavalent chromium and uranium concentrations are expected to continue to increase in response.

Hexavalent chromium and total chromium concentrations in Well 199-H4-12C remain slightly below the permit limit of 122µg/L, with a maximum concentration of 118µg/L during the reporting period. The concentrations in this well have now been below the permit limit since early 2013. The slowly declining concentration trend is expected to continue in Well 199-H4-12C.

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 through the removal of contaminated soil in the 1990s.

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. Groundwater monitoring 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/Postclosure Plan*) 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.

Groundwater monitoring objectives of RCRA, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and the *Atomic Energy Act of 1954* (AEA) often differ slightly, and the contaminants monitored are not always the same. For RCRA-regulated units, monitoring focuses on nonradioactive dangerous waste constituents. While radionuclides (source, special nuclear, and byproduct materials) may be monitored in some RCRA unit wells to support objectives of monitoring under AEA and/or CERCLA, they are not subject to RCRA regulation. Consistent with the deferral of RCRA Sections 1004 and 1006 to the AEA, the source, special nuclear, and byproduct material components of radioactive mixed waste are regulated by the U.S. Department of Energy (DOE), acting in accordance with its AEA authority. Therefore, while this report is used to satisfy corrective action 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. Uranium and other radionuclides in these reports serve only as “indicator parameters” which help to identify the presence of regulated dangerous wastes.

3.1 300-FF-5 CERCLA Remedial Action

Until November 2013, the interim action for groundwater in the 300 Area was monitored natural attenuation of uranium and volatile organic compounds, in accordance with 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*).

In November 2013 a record of decision for final action was signed (EPA et al., 2013, *Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*). The selected remedy for groundwater in the 300 Area Industrial Complex includes monitored natural attenuation for trichloroethene and cis-1,2-dichloroethene, enhanced attenuation of uranium using sequestration by phosphate application, and institutional controls. The phosphate for enhanced attenuation of uranium will be applied to the area with the highest uranium concentrations, located south and southeast of the 300 Area Process Trenches. Phosphate will be applied to the vadose zone, the periodically rewetted zone, and the top of the aquifer using a combination of surface infiltration and injection.

3.2 300 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 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 4). 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 overbank 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. WAC 173-303-645(5) Concentration Limits for 300 Area Process Trenches

Dangerous Waste Constituents	RCRA Concentration Limit^a	CERCLA Cleanup Level^b
cis-1,2-Dichloroethene	70 µg/L – DWS	16 µg/L – Risk assessment for drinking water
Trichloroethene	5 µg/L – DWS	4 µg/L – Risk assessment for drinking water
Other 300 Area Process Trenches Waste Indicator^c	Concentration Limit	CERCLA Cleanup Level^b
Uranium (total; chemical analysis)	30 µg/L – DWS	30 µg/L – DWS

a. WHC-SD-EN-AP-185

b. EPA et al., 2013 (ROD)

c. Uranium is monitored as a waste indicator.

DWS = drinking water standard

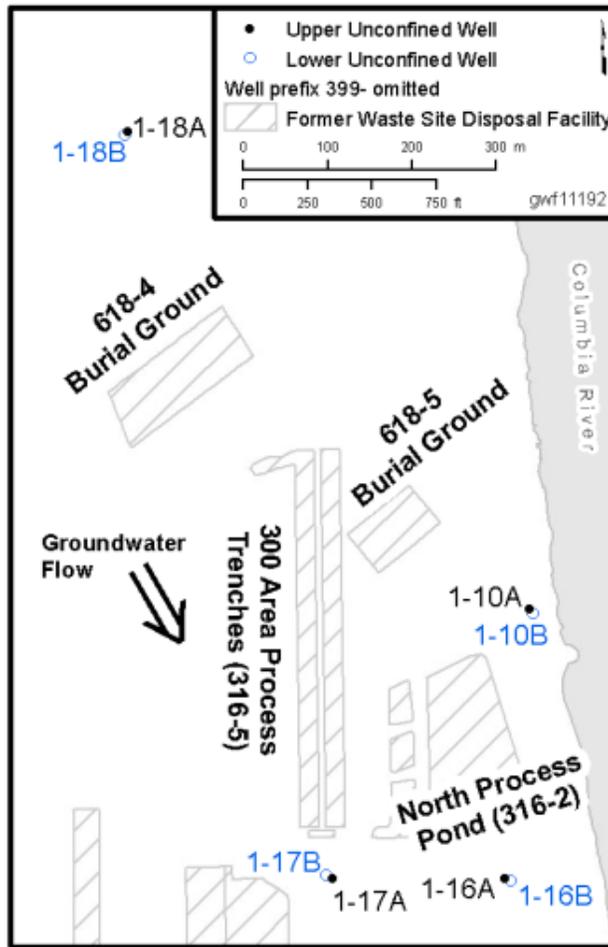


Figure 4. Monitoring Well Locations for the 300 Area Process Trenches

During the reporting period, the 300 Area Process Trenches post-closure monitoring wells were sampled during January, February, March, and June. The January sampling event was conducted in early February. The sampling event scheduled for December 2013 was delayed into January 2014, and those data were included in SGW-56886.

3.3 300 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.

Cis-1,2-dichloroethene continued to be detected in two wells in the 300 Area Process Trenches network during the reporting period (399-1-16B and 399-1-17B). Only Well 399-1-16B had concentrations that exceeded the 70 µg/L permit concentration limit. The trend at Well 399-1-16B was comparable to the last reporting period, ranging from 140 to 170 µg/L (Figure 5). At Well 399-1-17B, cis-1,2-dichloroethene was detected three times during this reporting period; the maximum detection of 3.5 µg/L was in June 2014 (Figure 6). The other two values were reported by the laboratory as an estimated value (i.e., J-flagged). The method detection limit was 1 µg/L from January through March and 0.09 µg/L to 0.3 µg/L in June.

Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2014

Well	Date	Sampling Purpose	Dangerous Waste				Waste Indicator	
			cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
<i>Permit Concentration Limits^a</i>			70		5		20	
399-1-10A	02/03/2014	RCRA	1.0	UT	0.5	U	26.6	D
	02/18/2014	RCRA	1.0	U	0.5	U	26.5	D
	03/13/2014	RCRA	1.0	U	0.5	U	24.1	D
	06/11/2014	RCRA	0.09	U	0.25	U	11.5	
399-1-10B	02/03/2014	RCRA	1.0	U	0.5	U	0.1	UD
	02/18/2014	RCRA	1.0	U	0.5	U	0.1	UD
	03/13/2014	RCRA	1.0	U	0.5	U	0.1	UD
	06/10/2014	RCRA	0.30	U	0.3	U	0.205	U
399-1-16A	02/03/2014	RCRA	1.0	U	0.5	U	79.5	D
	02/18/2014	RCRA	1.0	U	0.5	U	79.9	D
	03/13/2014	RCRA	1.0	U	0.5	U	58.8	D
	06/10/2014	RCRA	0.30	U	0.3	U	17.6	
399-1-16B	02/03/2014	RCRA	140	T	0.5	U	8.4	D
	02/18/2014	RCRA	140		1.7		10.4	D
	03/13/2014	RCRA	140		1.3		7.9	D
	06/10/2014	RCRA	170		1.7		8.47	
399-1-17A	02/03/2014	RCRA	1.0	U	0.5	U	51.9	D
	02/18/2014	RCRA	1.0	U	0.5	U	44.9	Q
	02/18/2014	RCRA	1.0	U	0.5	U	55.5	DQ
	03/13/2014	RCRA	1.0	U	0.5	U	38.2	D
	03/13/2014	RCRA	1.0	U	0.5	U	36.3	D
	06/10/2014	RCRA	0.30	U	0.38	J	48.9	D
	06/10/2014	RCRA	0.30	U	0.41	J	45.7	D
399-1-17B	02/03/2014	RCRA	1.0	U	0.5	U	0.1	UD
	02/18/2014	RCRA	3.1	J	0.5	U	0.1	UD

Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2014

Well	Date	Sampling Purpose	Dangerous Waste				Waste Indicator	
			cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
	03/13/2014	RCRA	3.4	J	0.5	U	0.1	UD
	06/10/2014	RCRA	3.5		0.25	U	0.0832	U
399-1-18A	02/03/2014	RCRA	1.0	U	0.5	U	5.87	D
	02/18/2014	RCRA	1.0	U	0.5	U	6.3	D
	03/13/2014	RCRA	1.0	U	0.5	U	5.24	D
	06/10/2014	RCRA	0.3	U	0.3	U	6.28	
399-1-18B	02/03/2014	RCRA	1.0	U	0.5	U	0.1	UD
	02/18/2014	RCRA	1.0	U	0.5	U	0.1	UD
	03/13/2014	RCRA	1.0	U	0.5	U	0.1	UD
	06/10/2014	RCRA	0.09	U	0.25	U	0.0815	U

Italics indicate the Permit Concentration Limits; Permit Concentration Limit updated for uranium following promulgation of the drinking water standard.

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

- a. 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).

- D = analyte reported at a secondary dilution factor
- J = estimated value
- Q = associated quality control sample is out of limits
- T = spike or spike duplicate sample recovery is outside control limits
- U = below detection limit

During the reporting period, trichloroethene was detected only in Wells 399-1-16B and 399-1-17A; concentrations did not exceed the 5 µg/L permit concentration limit (Figures 7 and 8). The concentrations ranged from 1.3 to 1.7 µg/L in Well 399-1-16B; estimated concentrations ranged from 0.38 to 0.41 µg/L in Well 399-1-17A. The method detection limit was 0.5 µg/L during January through March and 0.25 µg/L to 0.3 µg/L in June.

A persistent uranium plume underlies the 300 Area Industrial Complex. Concentrations of indicator parameter, uranium, continued to exceed the permit concentration limit (30 µg/L) at two downgradient Wells (399-1-16A and 399-1-17A) screened near the water table. Uranium concentrations at Well 399-1-16A (Figure 9) 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 10) 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.

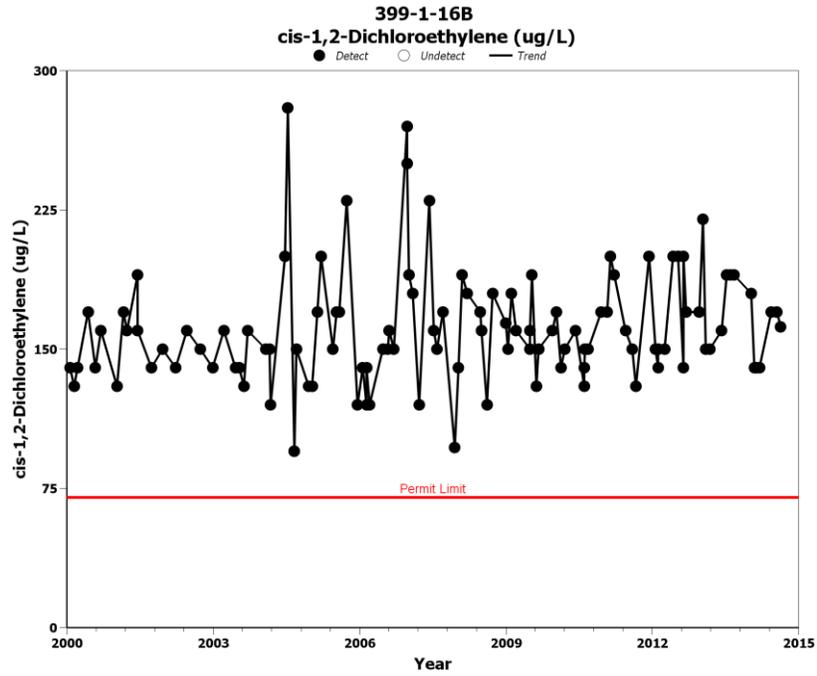


Figure 5. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B

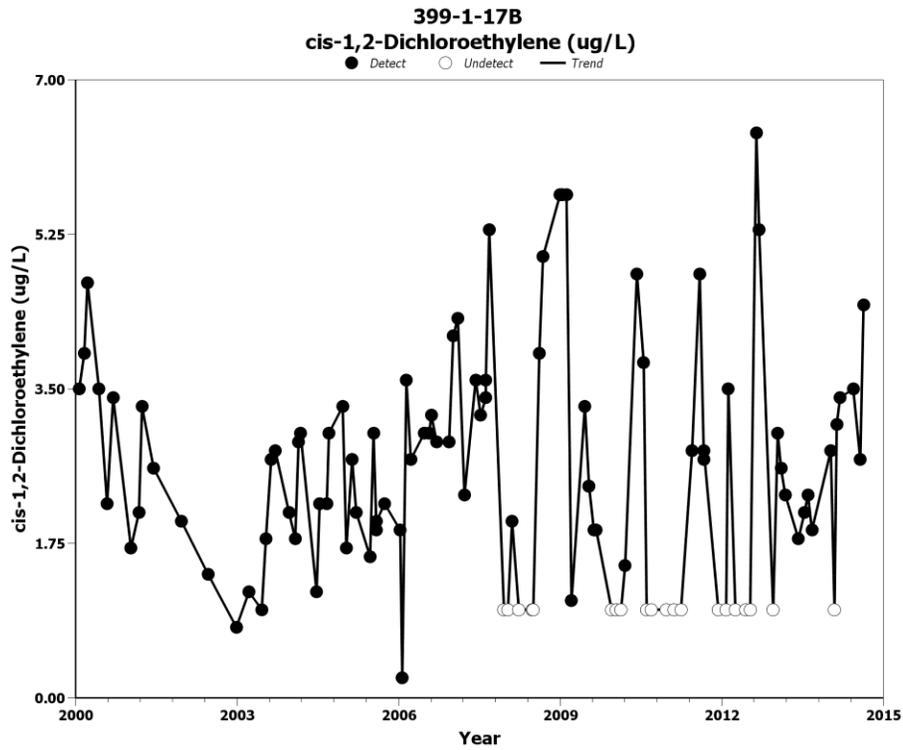


Figure 6. Cis-1,2-Dichloroethene Concentrations in Well 399-1-17B

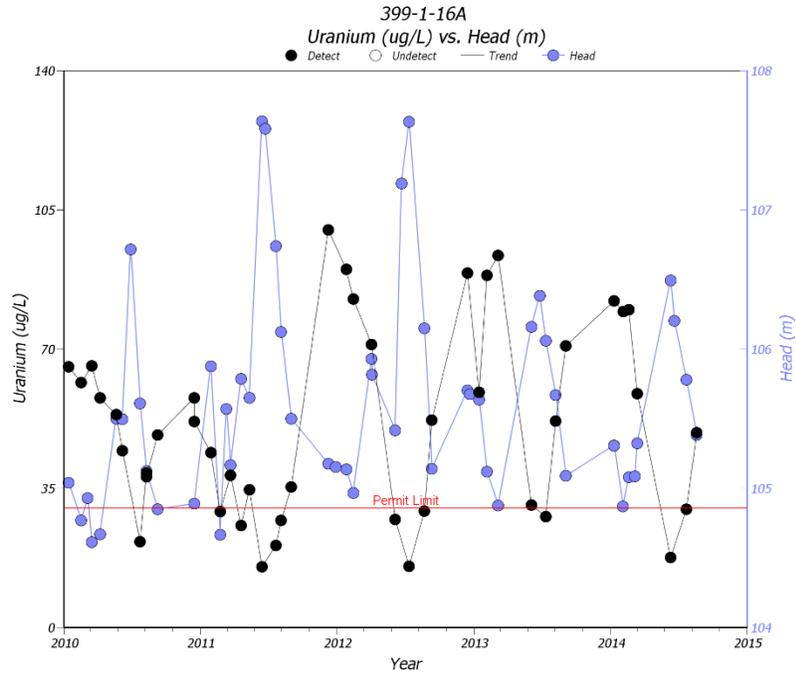


Figure 9. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A

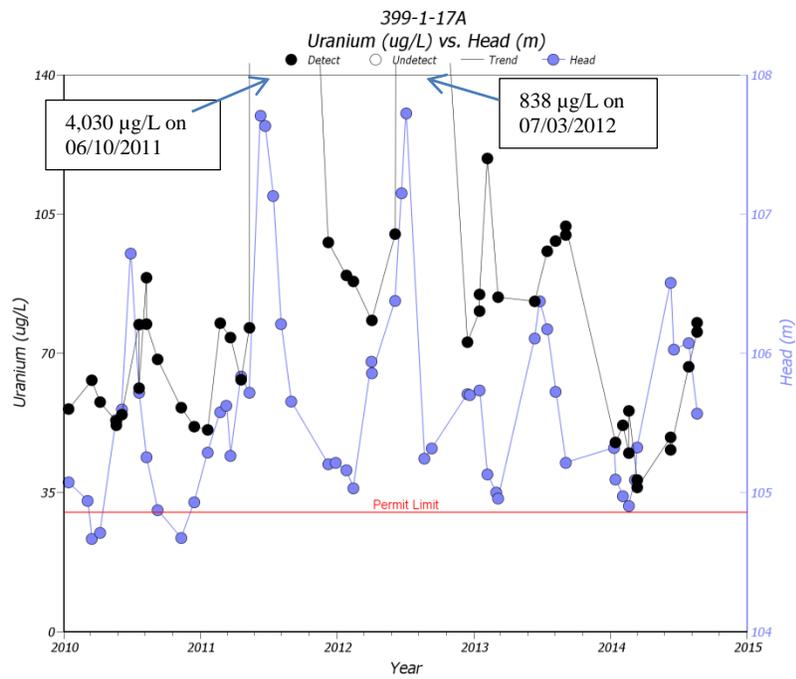


Figure 10. Positively Related Uranium Concentrations and Water Level in Well 399-1-17A

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 seasonally 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*, and PNNL-22048, *Updated Conceptual Model for the 300 Area Uranium Groundwater Plume*.

3.4 300 Area Process Trenches Conclusions

Concentrations of cis-1,2-dichloroethene and uranium remained above permit limits in selected wells. The concentration of cis-1,2-dichloroethene remained above the permit concentration limit (70 µg/L) in 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 indicator parameter uranium in two Wells (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 monitoring level specified as the permit concentration limit (30 µg/L). Uranium concentrations in Well 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.

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.

RCRA corrective actions are being accomplished through the CERCLA remedial action for groundwater (monitored natural attenuation, enhanced attenuation, and institutional controls).

This page intentionally left blank.

4 References

- Atomic Energy Act of 1954*, as amended, 42 USC 2011, Pub. L. 83-703, 68 Stat. 919. Available at: <http://epw.senate.gov/atomic54.pdf>.
- 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>.
- DOE/RL-93-73, 1995, *300 Area Process Trenches Modified Closure/Postclosure Plan*, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196000405>.
- DOE/RL-96-84, 2003, *Remedial Design and Remedial Action Work Plan for the 100-HR-3 and 100-KR-4 Groundwater Operable Units' Interim Action*, Rev. 0-A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D1348764>.
- DOE/RL-97-48, 1997, *183-H Solar Evaporation Basins Postclosure Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D197226569>.
- DOE/RL-2010-99, 2013, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088359>.
<http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088307>.
<http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088306>.
<http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088305>.
- Environmental Dashboard Application, 2012, U.S. Department of Energy, Available at: <http://environet.hanford.gov/EDA>.
- Ecology, 2013, *Ecology approves changes for Hanford's dangerous waste permit*, Washington State Department of Ecology. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0088099>
- EPA, Ecology, and DOE, 1996a, *Declaration of Record of Decision for the USDOE Hanford 100 Area 100-HR-3 and 100-KR-4 Operable Units, Hanford Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196097243>.
- EPA, Ecology, and DOE, 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*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196245781>.

- EPA, Ecology, and DOE, 2013, *Record of Decision for 300-FF-2 and 300-FF-5, and Record of Decision Amendment for 300-FF-1*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: <http://pdw.hanford.gov/arpir/pdf.cfm?accession=0087180>
- PHOENIX, 2013, PNNL Hanford Online Environmental Information Exchange, Pacific Northwest National Laboratory, Richland, Washington. Available at: <http://phoenix.pnnl.gov/>.
- PNNL-11573, 1997, *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*, Pacific Northwest National Laboratory, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D1659822>.
- PNNL-17034, 2008, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnl.gov/main/publications/external/technical_reports/PNNL-17034.pdf.
- PNNL-22048, 2012, *Updated Conceptual Model for the 300 Area Uranium Groundwater Plume*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22048.pdf.
- Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at: <http://www.epa.gov/epawaste/inforesources/online/index.htm>.
- SGW-47776, 2010, *Aquifer Testing and Rebound Study in Support of the 100-H Deep Chromium Investigation*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: <http://www.osti.gov/scitech/servlets/purl/1038045>.
- SGW-52135, 2012, *First Semiannual Report for 2011 Post-Closure Corrective Action Groundwater Monitoring at the 183-H Solar Evaporation Basins and 300 Area Process Trenches: January – June 2011*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093013>.
- WA7890008967, 2007, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, as amended, Washington State Department of Ecology, Richland, Washington. Available at: <http://www.ecy.wa.gov/programs/nwp/permitting/HDWP/>.
- WAC 173-303-645, “Dangerous Waste Regulations,” “Release from Regulated Units,” *Washington Administrative Code*. Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303-645>.
- WAC 173-303-9905, “Dangerous Waste Regulations,” “Dangerous Waste Constituents List,” *Washington Administrative Code*. Available at: <http://apps.leg.wa.gov/WAC/default.aspx?cite=173-303-9905>.
- WHC-SD-EN-AP-185, 1995, *Groundwater Monitoring Plan for the 300 Area Process Trenches*, Rev. 0A, Westinghouse Hanford Company, Richland, Washington. Available at: <http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=D196020117>.