

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



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Richland, Washington 99352**

**Approved for Public Release;
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Release Approval

Date

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Executive Summary

This is the second 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 July through December 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 resulted from historical releases, and is now slightly below permit concentration limits

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>.

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 CERCLA interim action remains effective.

Concentrations of the other contaminants were below the permit level with the exception of waste indicator parameter uranium. Uranium concentrations exceeded the Drinking Water Standard of 30 µg/L in Well 199-H4-84 with a result of 52.1 µg/L (July 2015). Concentrations of uranium are directly correlated with water levels in Well 199-H4-84. Both hexavalent chromium and uranium levels were at their peak in July in response to the high water level, with concentrations declining in August as water levels started to drop. This trend is consistent with previous monitoring events.

300 Area Process Trenches Groundwater Monitoring

Waste indicator parameter uranium concentrations continued to exceed the 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 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.

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.

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>.

Corrective action is being accomplished through 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.

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Terms

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
RCRA	<i>Resource Conservation and Recovery Act of 1976</i>
RUM	Ringold Formation upper mud

1 Introduction

This is the second 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 July through December 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). 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).

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.

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 in the fall for RCRA as specified in 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.

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.

Well 199-H4-12C was added to the 100-HR-3 interim action extraction network in 2010, 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 was part of the pump-and-treat system until the well was decommissioned in May 2013. 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 both decommissioned to allow for waste site remediation.

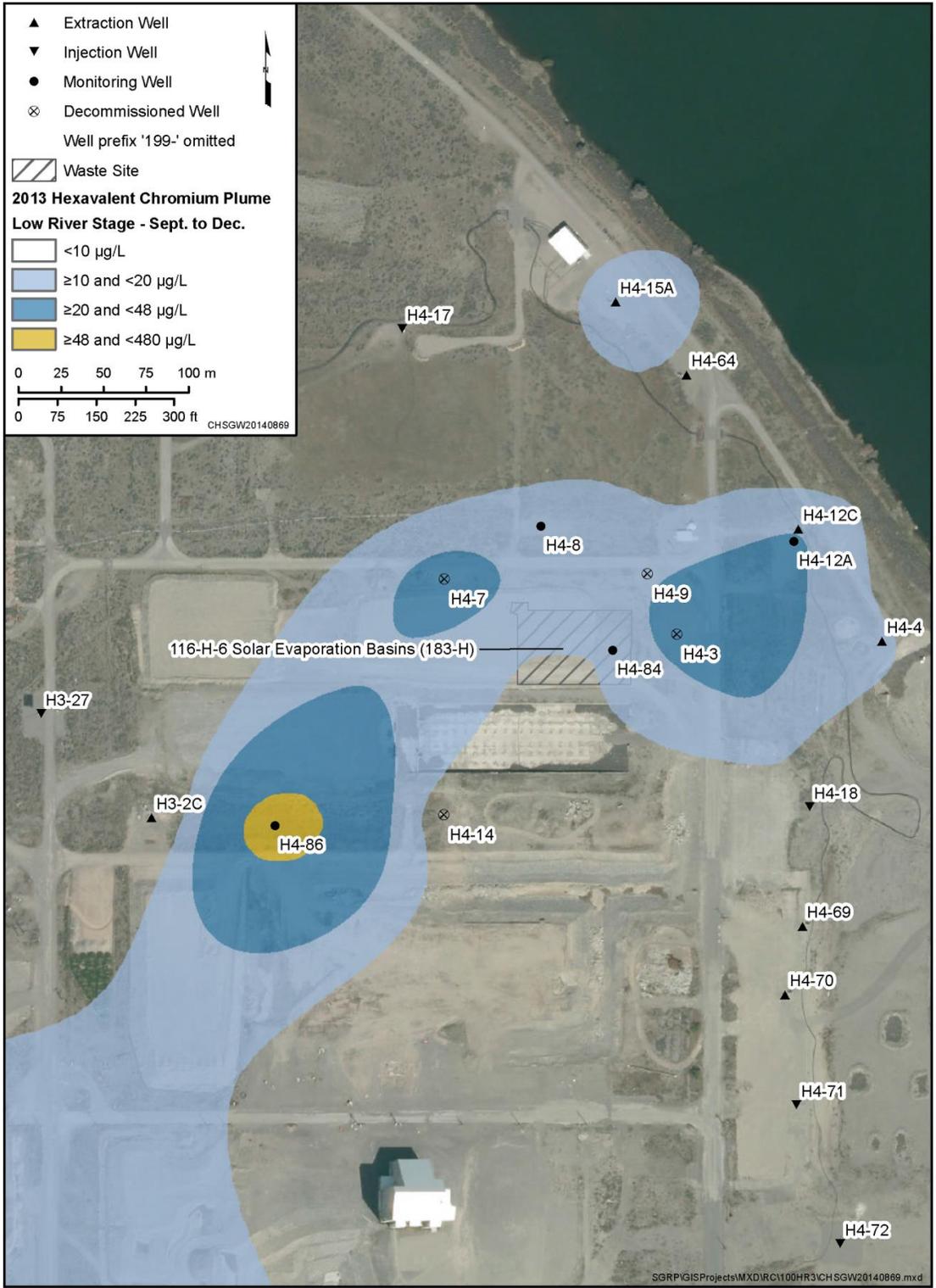


Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins

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. The RCRA required sampling was conducted in November 2014.

2.3.1 Chromium and Hexavalent Chromium

Hexavalent chromium and total chromium concentrations were below the permit limit in the unconfined aquifer wells during the reporting period. The maximum concentration of total chromium in the unconfined aquifer during the second half of 2014 was 25.9 µg/L (filtered sample) in Well 199-H4-84. The corresponding hexavalent chromium result was 26.0 µg/L, indicating that total chromium and hexavalent chromium track closely with each other as expected.

Hexavalent chromium concentrations in the unconfined aquifer were highest in Well 199-H4-84. Results in Well 199-H4-84 ranged from 6.80 µg/L to 80 µg/L over the monitoring period, with the maximum concentration reported in July, during high river stage (Table 2). As is expected in a monitoring well located within a source area, the contaminant concentrations are highest in Well 199-H4-84 during periods of higher groundwater elevations (Figure 2).

In Well 199-H4-12A and Well 199-H4-8, total chromium and hexavalent chromium concentrations are inversely related to water levels, with the highest concentrations being during low river stage. Figure 3 shows the contaminant concentration trends for Well 199-H4-12A. The highest hexavalent chromium concentrations during the reporting period in Well 199-H4-12A and 199-H4-8 were 14.70 µg/L and 4.70 µg/L, respectively.

Extraction Well 199-H4-12C is completed in the first water bearing unit of the RUM, within a semi-confined/confined aquifer. 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 continue to slowly decline but indicate slight seasonal variations (Table 2). The highest concentration in Well 199-H4-12C during the monitoring period was 121 µg/L on December 2, 2014.

Due to an irregularity with the chromium results from November 2013, the data from Well 199-H4-12C were flagged as suspected errors (Post-Closure Corrective Action Groundwater Monitoring Report for the 183H Solar Evaporation Basins and the 300 Area Process Trenches: January – June 2014, SGW-58475). To ensure quality data, Well 199-H4-12C was sampled again for metals, including total chromium, in July 2014. Total chromium results from July were consistent with the concentration trends, at a level of 112 µg/L for both filtered and unfiltered samples. The total chromium results corresponded well, as is expected, with the hexavalent chromium results of 108 and 112 µg/L (filtered and unfiltered).

Table 2. Groundwater Data for 183-H Basins, July through December 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		<i>122</i>	<i>122</i>	<i>45</i>	<i>1400</i>	<i>900</i>	<i>20</i>
199-H4-8	11/5/14	4.70	4.00 B	13.7	150 BD	7.53 U	1.50
	11/5/14	1.50 U	2.80 B	--	--	--	1.50
199-H4-12A	8/1/14	8.00 U	--	--	--	3.87 U	1.12
	11/5/14	14.70	14.30	21.1	142 B	18.00	12.40
	11/5/14	14.40	14.00	--	--	--	12.20
	11/5/14	--	--	--	--	--	14.60
199-H4-12C	7/2/14	108.00	--	--	--	--	--
	7/23/14	112.00	112.00 A	--	--	--	1.20 A
	7/23/14	108.00	112.00 A	--	--	--	1.20 A
	8/5/14	102.00	--	--	--	--	--
	8/14/14	111.00	--	--	--	--	--
	9/4/14	115.00	--	--	--	--	--
	10/2/14	112.00	--	--	--	--	--
	11/4/14	116.00	--	--	--	--	--
	11/10/14	117.00	120.00	12.0 D	160 BD	15.40	1.20
	11/10/14	120.00	118.00	--	--	--	1.20
12/2/14	121.00	--	--	--	--	--	
199-H4-84	7/18/14	80.00	--	--	--	--	52.10
	8/18/14	26.00	24.10	34.7 D	146 BD	--	23.00^c
	8/18/14	--	25.90	--	--	--	26.10^c
	9/9/14	16.00	--	--	--	--	15.70
	11/5/14	12.50	10.50	25.2 D	180 BD	27.50	4.20
	11/5/14	6.80	10.70	--	--	--	4.50
11/23/14	--	--	26.4	159	18.60	3.53	

Notes: Grey 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. **Orange shading** indicates the result exceeded the DWS.

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

D = Analyte reported at a secondary dilution factor

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

F = Result is under review

U = Undetected above the practical quantitative limit

C = Analyte detected in sample and associated QC blank

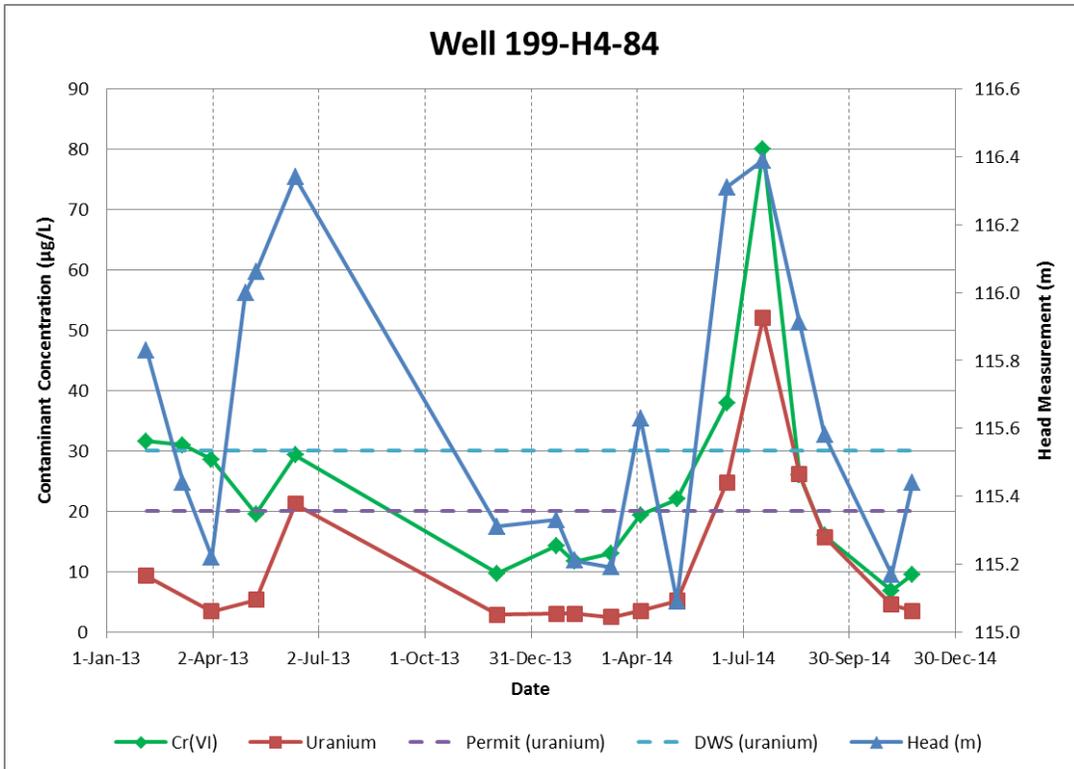


Figure 2. Hexavalent Chromium and Uranium Concentrations versus Water Levels (199-H4-84)

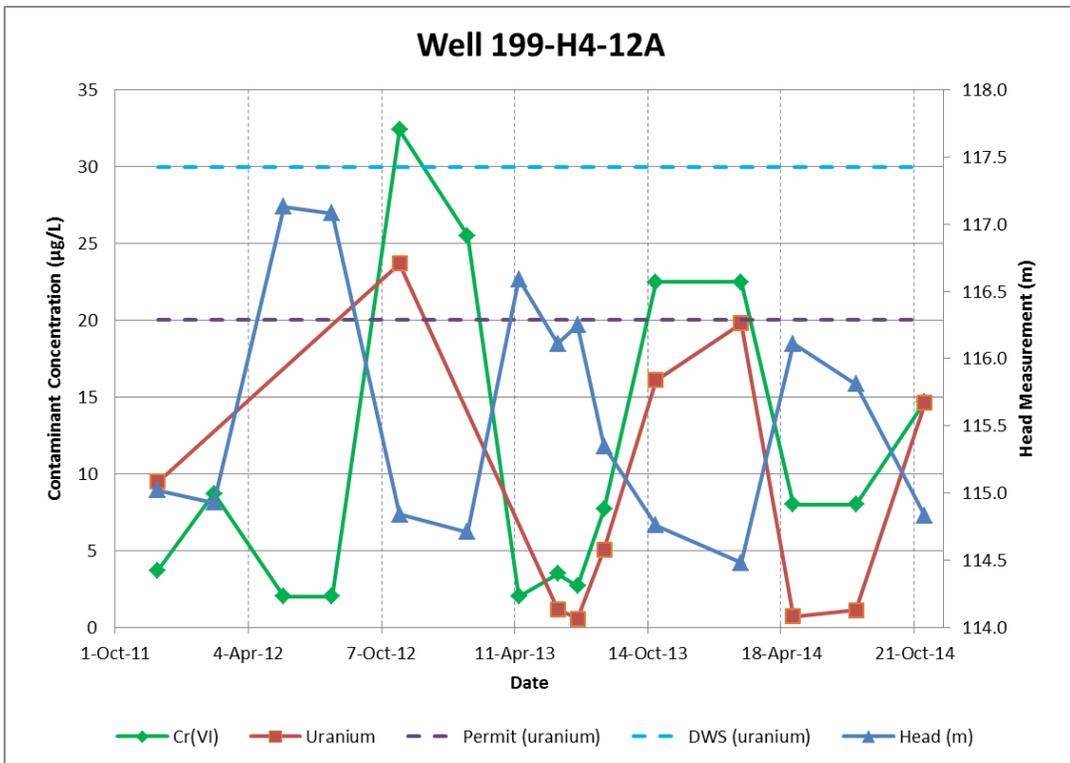


Figure 3. Hexavalent Chromium Concentrations versus Water Levels (199-H4-12A)

2.3.2 Other Contaminants

Fluoride, nitrate, 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 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 fluoride, technetium-99, or nitrate exceeded permit limits (Table 2) during the second half of 2014.

Uranium concentrations in Well 199-H4-84 vary directly with water levels (Figure 2), as with chromium. Concentrations were highest when water levels at the well were elevated, with a maximum concentration during July of 52.10 µg/L; this exceeds both the DWS (30 µg/L) and permit limits (20 µg/L). The uranium concentrations remained above the permit limit of 20 µg/L in August, with a reported value of 26.1 µg/L and 23.0 µg/L for the filtered and unfiltered results, respectively. Concentrations declined again as water levels declined, with concentrations as low as 4.2 µg/L in November 2014. This trend is consistent with previous monitoring events.

Uranium concentrations were below the permit concentration limit of 20 µg/L in Wells 199-H4-8, 199-H4-12A, and 199-H4-12C, shown in Table 2. In Well 199-H4-12A, located downgradient of the waste site, concentrations of uranium and chromium are inversely related to groundwater elevations (Figure 3).

2.4 183-H Basins Conclusions

Concentrations of chromium, hexavalent chromium and the other contaminants were below the permit level in each of the RCRA monitoring wells, with the exception of uranium. Uranium concentrations exceeded both the DWS (30 µg/L) and permit limits (20 µg/L) in July 2014, with a result of 52.1 µg/L in Well 199-H4-84. The uranium concentrations remained above 20 µg/L in August. Contaminant concentrations in Well 199-H4-84 are directly correlated with water levels. As high river stage progressed through July and early August, both hexavalent chromium and uranium concentrations remained high in response. By September, both chromium and uranium concentrations had declined, with uranium down to 15.7 µg/L.

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

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

DWS = drinking water standard
a. WHC-SD-EN-AP-185
b. EPA et al., 2013 (ROD)
c. Uranium is monitored as a waste indicator

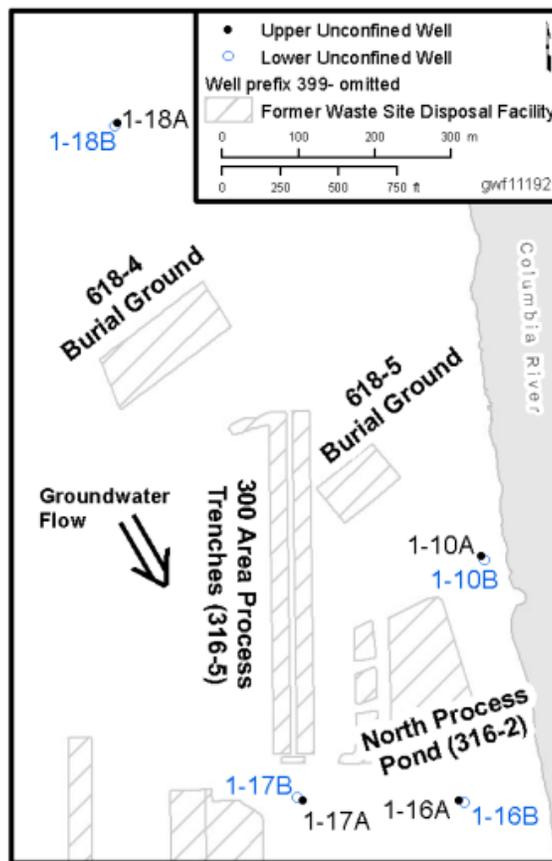


Figure 4. Monitoring Well Locations for the 300 Area Process Trenches

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 was detected in three wells in the 300 Area Process Trenches network during the reporting period (399-1-16A, 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 162 to 207 µg/L (Figure 5). At Well 399-1-17B, cis-1,2-dichloroethene was detected four times during this reporting period; the maximum detection was 4.45 µg/L. At Well 399-1-16A, cis-1,2-dichloroethene was detected three times during this reporting period; the maximum detection was 0.25 µg/L.

Table 4. Groundwater Data for 300 Area Process Trenches, July through December 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	30

Table 4. Groundwater Data for 300 Area Process Trenches, July through December 2014

Well	Date	Sampling Purpose	Dangerous Waste				Waste Indicator	
			cis-1,2-Dichloroethene (µg/L)		Trichloroethene (µg/L)		Uranium (µg/L)	
399-1-10A	07/22/2014	RCRA	0.30	UZ	0.30	UZ	23.6	D
	08/19/2014	RCRA	0.09	U	0.25	U	28.3	
	09/24/2014	RCRA	0.09	U	0.25	U	26.8	Q
	12/03/2014	RCRA	0.30	U	0.30	U	27.9	D
399-1-10B	07/22/2014	RCRA	0.09	U	0.25	U	0.0751	U
	08/19/2014	RCRA	0.30	U	0.30	U	0.931	UD
	09/22/2014	RCRA	0.30	U	0.30	U	0.233	U
	12/03/2014	RCRA	0.09	U	0.25	U	0.0746	U
399-1-16A	07/22/2014	RCRA	0.30	UZ	0.42	JZ	29.7	D
	08/19/2014	RCRA	0.23	J	0.31	J	49.0	
	09/22/2014	RCRA	0.17	J	0.25	U	56.8	
	12/03/2014	RCRA	0.25	J	0.38	J	64.5	
399-1-16B	07/22/2014	RCRA	170		1.70		8.14	
	08/19/2014	RCRA	162	D	1.99	J	8.13	D
	09/22/2014	RCRA	176	D	1.55	J	7.65	
	12/03/2014	RCRA	207	D	1.72	J	8.20	
399-1-17A	07/28/2014	RCRA	0.30	UZ	0.30	UZ	66.6	D
	08/20/2014	RCRA	0.09	U	0.25	U	75.4	
	08/20/2014	RCRA	0.09	U	0.25	U	77.7	
	09/22/2014	RCRA	0.09	U	0.25	U	66.3	
	12/08/2014	RCRA	0.30	U	0.30	U	41.5	D
	12/08/2014	RCRA	0.30	U	0.30	U	45.0	D
399-1-17B	07/28/2014	RCRA	2.70		0.25	U	0.0768	U
	08/19/2014	RCRA	4.45	J	0.30	U	0.931	UD
	09/22/2014	RCRA	3.50	J	0.30	U	0.233	U
	12/03/2014	RCRA	1.60		0.25	U	0.0754	U
399-1-18A	07/28/2014	RCRA	0.30	U	0.30	U	6.23	
	08/20/2014	RCRA	0.09	U	0.25	U	5.86	
	09/24/2014	RCRA	0.09	U	0.25	U	5.52	Q
	12/03/2014	RCRA	0.09	U	0.25	U	5.61	
399-1-18B	07/28/2014	RCRA	0.09	U	0.25	U	0.0765	U
	08/20/2014	RCRA	0.30	U	0.30	U	0.931	UD
	09/24/2014	RCRA	0.30	U	0.30	U	0.55	Q
	09/24/2014	RCRA	0.30	U	0.30	U	0.233	UQ
	12/03/2014	RCRA	0.30	U	0.30	U	0.233	U

Table 4. Groundwater Data for 300 Area Process Trenches, July through December 2014

Well	Date	Sampling Purpose	Dangerous Waste		Waste Indicator
			cis-1,2-Dichloroethene (µg/L)	Trichloroethene (µg/L)	Uranium (µg/L)

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
- U = below detection limit
- Z = miscellaneous circumstances exist

During the reporting period, trichloroethene was detected only in Wells 399-1-16A and 399-1-16B; concentrations did not exceed the 5 µg/L permit concentration limit. The concentrations ranged from 1.55 to 1.99 µg/L in Well 399-1-16B from 0.31 to 0.42 µg/L in Well 399-1-16A.

A persistent uranium plume underlies the 300 Area Industrial Complex. Uranium concentrations 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 6) 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 7) 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.

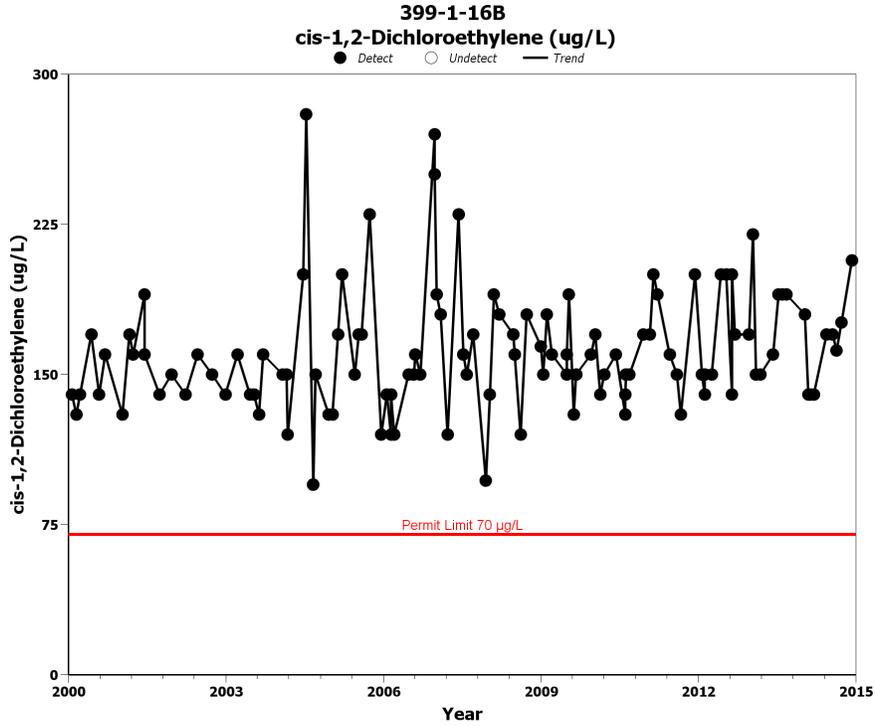


Figure 5. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B

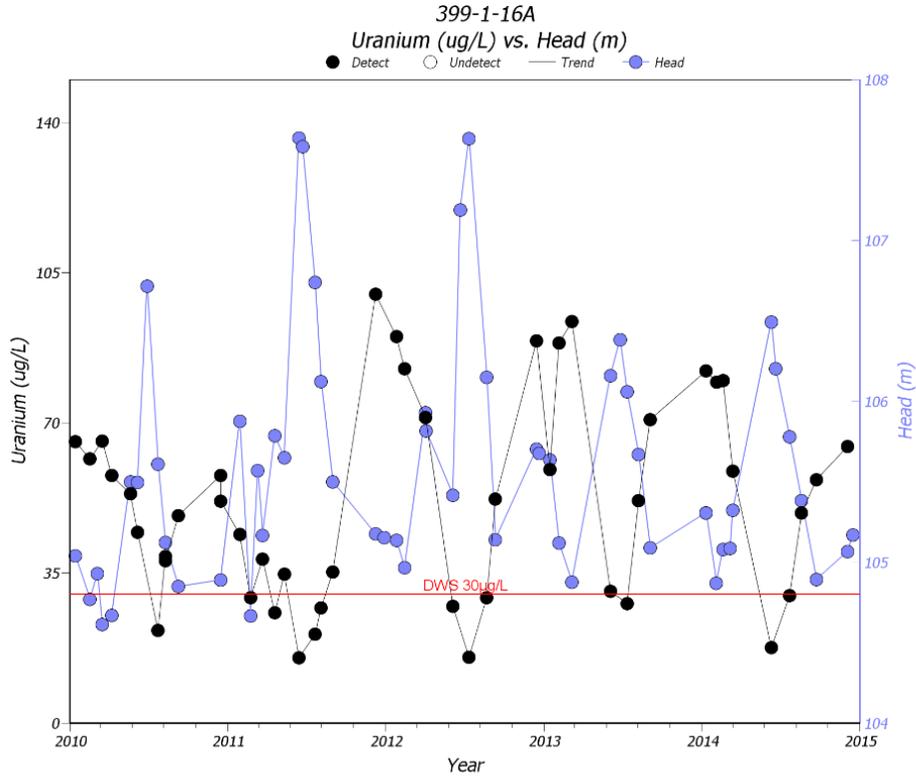


Figure 6. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A

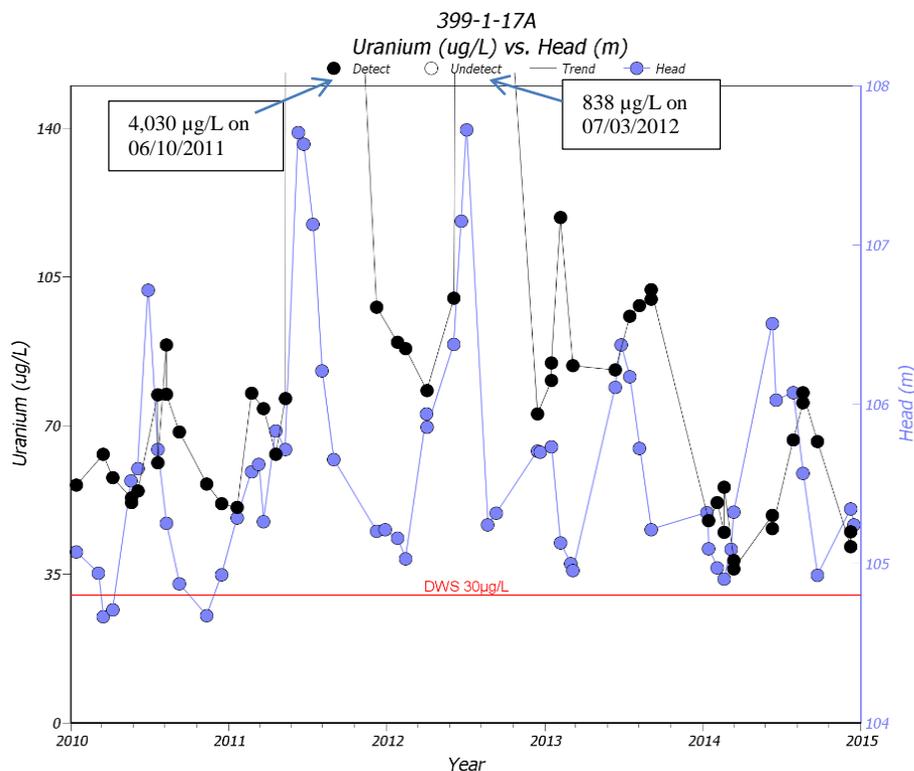


Figure 7. Positively Related Uranium Concentrations and Water Level in Well 399-1-17A

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

The concentration of cis-1,2-dichloroethene remained above the permit concentration limit (70 $\mu\text{g/L}$) 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 remained above the monitoring level specified as the permit concentration limit (30 $\mu\text{g/L}$) 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. 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).

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