SGW-59251
Revision 0

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

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

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***APPROVED***
***By Ashley R Jenkins at 6:51 am, Oct 29, 2015***

Release Approval | Date

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

# Executive Summary

This is the first 2015 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 2015. Environmental data used to generate this report are available from the Environmental Dashboard Application (https://ehs.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 fluctuating at the permit concentration limits but above *Comprehensive*

[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.

*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 monitoring levels set as the permit concentration limit.

## 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.

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.

[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.

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# Figures



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# Terms

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

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# 1 Introduction

This is the first semiannual report for 2015 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 2015. 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 (https://ehs.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.

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# 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 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-2015-05 *(Calendar Year 2014 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 (L/min) or 800 gallons per minute (gpm) and replaced the aging 1,136 L/min (300 gpm) 100-HR-3 pump and treat system. Together with the 2,271 L/min (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. Both DX and HX are being upgraded to increase the system throughput. 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 fluoride[3] (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 for fluoride. The current maximum contaminant level is 4,000 µg/L.

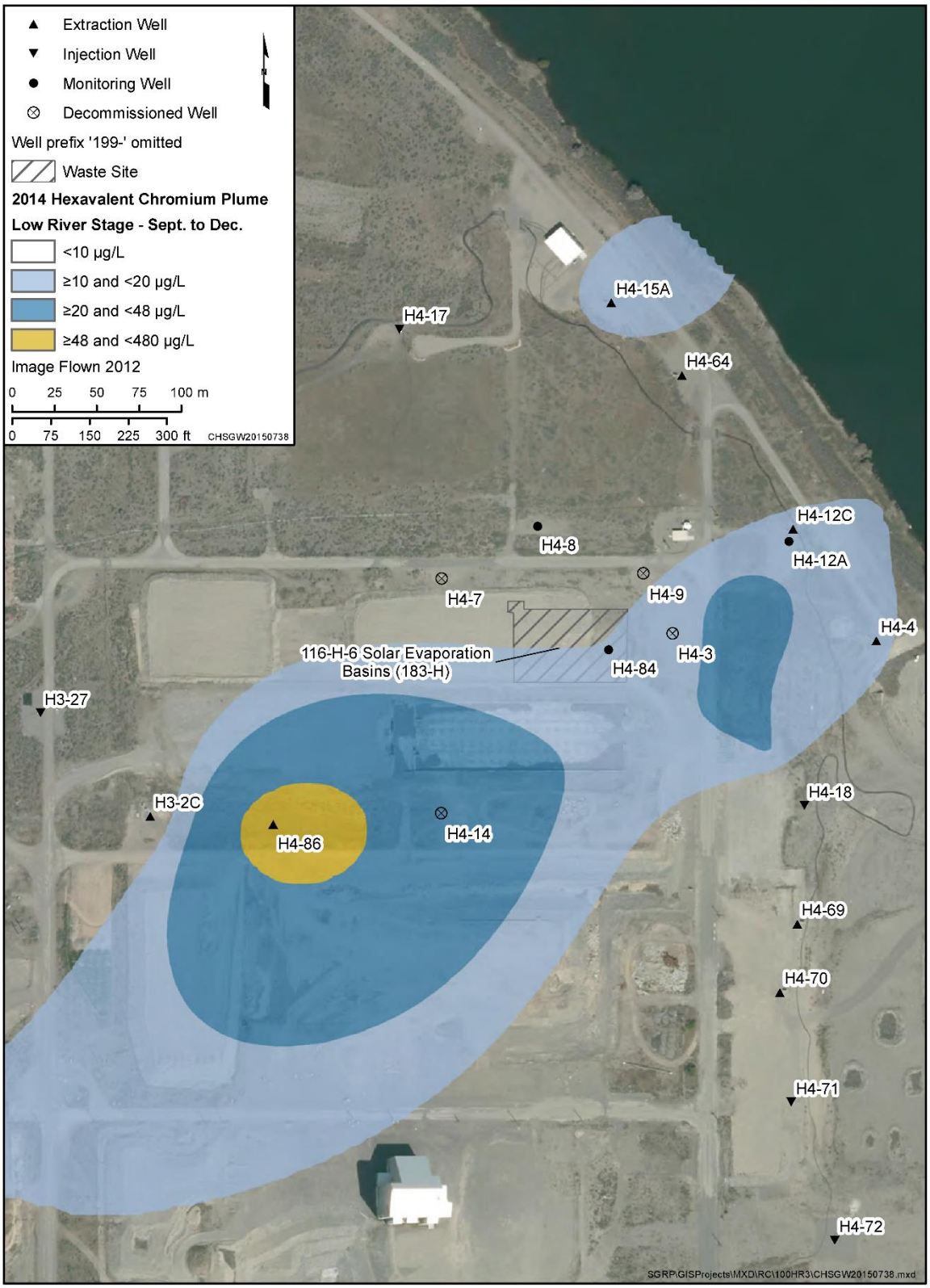


**Figure 1. Monitoring Well Locations for 183-H (116-H-6) Basins**

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-H4-84, 199-H4-12A, and 199-H4-12C were scheduled for sampling. Well 199-H4-8 was not scheduled for sampling during the reporting period. Chromium concentrations have remained below the 122 µg/L permit concentration limit in the RCRA wells completed within the unconfined aquifer since 2003.

### 2.3.1 Chromium and Hexavalent Chromium

The maximum concentration of total chromium in the unconfined aquifer reported during this monitoring period was 14.9 µg/L (unfiltered sample) in Well 199-H4-12A. The corresponding filtered sample result was 15.0 µg/L (Table 2). The corresponding hexavalent chromium results were at 14.2 and 14.0 µg/L, respectively, indicating that total chromium and hexavalent chromium track closely with each other as expected. Concentrations in the unconfined aquifer remain below the permit concentration limit of 122 µg/L, but are fluctuating near the 20 µg/L threshold at on-shore near-river monitoring locations designed to achieve the Aquatic Water Quality Criteria (AWQC) of 10 µg/L. Concentrations of total and hexavalent chromium are usually highest in Well 199-H4-84, and tend to rise when the water table is high. However, contaminant levels have fluctuated little and remained low in Well 199-H4-84 in 2015 because water levels have remained lower than average.

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 µg/L in the early 1990s to about 90 µg/L in 2009. In late 2009 pumping was initiated at the well during an aquifer test and concentrations increased to 140 µg/L (December 2010), which exceeded the CERCLA 20 µg/L threshold at on-shore near-river monitoring locations designed to achieve the AWQC of 10 µg/L and the permit concentration (122 µg/L). Well 199-H4-12C is connected to the pump-and-treat system.

Hexavalent chromium in Well 199-H4-12C reached 125 µg/L (unfiltered sample) in June, and the corresponding total chromium value was 121 µg/L. The permit limit is 122 µg/L for total chromium. Low hexavalent chromium concentrations of 49 and 68 µg/L were reported in Well 199-H4-12C during early May and early June. These results are suspected errors and were flagged for additional review.

**Table 2. Groundwater Data for 183-H Basins, January through June 2015**

| Well | Date | Dangerous Waste: Hexavalent Chromium (µg/L) | | Dangerous Waste: Total Chromium (µg/L) | | Dangerous Waste: Nitrate[a] (mg/L $NO_3^-$) | | Waste Indicator: Fluoride (µg/L) | | Waste Indicator: Technetium-99 (pCi/L) | | Waste Indicator: Uranium (µg/L) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Permit Concentration Limit[b]** | | ***122*** | | ***122*** | | ***45*** | | ***1400*** | | ***900*** | | ***20*** | |
| 199-H4-8 | Not sampled | -- | | -- | | -- | | -- | | -- | | -- | |
| 199-H4-12A | 2/11/2015 | 3.30 | B | 2.36 | B | -- | | | | -4.96 | U | 0.57 | |
| | 2/11/2015 | -- | | -- | | -- | | -- | | -- | | 0.55 | |
| | 2/11/2015 | 4.00 | B | 2.30 | B | -- | | -- | | -- | | 0.57 | |
| | 5/4/2015 | 14.20 | | 14.90 | | 20.10 | D | 134.00 | D | 19.10 | | 8.48 | |
| | 5/4/2015 | -- | | -- | | -- | | -- | | -- | | 9.06 | |
| | 5/4/2015 | 14.00 | | 15.00 | | -- | | -- | | -- | | 8.62 | |
| 199-H4-12C | 1/6/2015 | 110.00 | | -- | | -- | | -- | | -- | | -- | |
| | 2/4/2015 | 118.00 | | -- | | -- | | -- | | -- | | -- | |
| | 2/24/2015 | 119.00 | | 100.00 | | -- | | -- | | -- | | 1.20 | |
| | 2/24/2015 | 117.00 | | 99.00 | | -- | | -- | | -- | | 1.20 | |
| | 2/24/2015 | 113.00 | | 98.00 | | -- | | -- | | -- | | 1.20 | |
| | 2/24/2015 | 114.00 | | 97.00 | | -- | | -- | | -- | | 1.20 | |
| | 3/4/2015 | 116.00 | | -- | | -- | | -- | | -- | | -- | |
| | 5/4/2015 | 49.00 | F | -- | | -- | | -- | | -- | | -- | |
| | 6/4/2015 | 61.00 | F | -- | | -- | | -- | | -- | | -- | |
| | 6/10/2015 | **125.00** | | 121.00 | | -- | | -- | | -- | | 1.20 | |
| | 6/10/2015 | 119.00 | | 116.00 | | -- | | -- | | -- | | 1.20 | |
| 199-H4-84 | 1/26/2015 | 9.10 | | 10.90 | | 20.00 | D | 165.00 | D | 9.33 | U | 3.51 | |
| | 1/26/2015 | -- | | -- | | -- | | -- | | -- | | 3.49 | C |
| | 1/26/2015 | 9.40 | | 10.20 | | -- | | | | | | 3.46 | C |
| | 4/10/2015 | 6.30 | | 8.00 | B | 22.70 | D | 169.00 | D | 22.70 | | 5.51 | |
| | 4/10/2015 | -- | | -- | | -- | | -- | | -- | | 5.50 | |
| | 4/10/2015 | 6.40 | | 8.90 | B | -- | | -- | | -- | | 7.00 | |
| | 6/26/15 | 1.50 | UF | 7.50 | B | 27.00 | D | 162.00 | D | 25.80 | | 4.80 | |
| | 6/26/15 | -- | | -- | | -- | | -- | | -- | | 4.40 | |
| | 6/26/15 | 6.40 | | 7.50 | B | -- | | -- | | -- | | 4.40 | |

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.

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
F = Result suspect and under review

### 2.3.2 Other Contaminants

Nitrate, 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”. None of the analytical results for nitrate, fluoride, or technetium-99 exceeded permit limits (Table 2) during the reporting period.

## 2.4 183-H Basins Conclusions

A single sample from Well 199-H4-12C exceeded the permit limit for hexavalent chromium of 122 µg/L, with a result of 125 µg/L in an unfiltered sample. The filtered sample result was at 119 µg/L. In addition, the corresponding total chromium result was at 121 µg/L.

Concentrations of the waste indicators and nitrate were well below permit concentration limits.

# 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, *300 Area Process Trenches Modified Closure Plan/Postclosure Plan*) 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) 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 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

Table 3 provides the permit concentration limits established for the 300 Area Process Trenches. 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 2). 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 3. 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 January, February, March, and June.

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

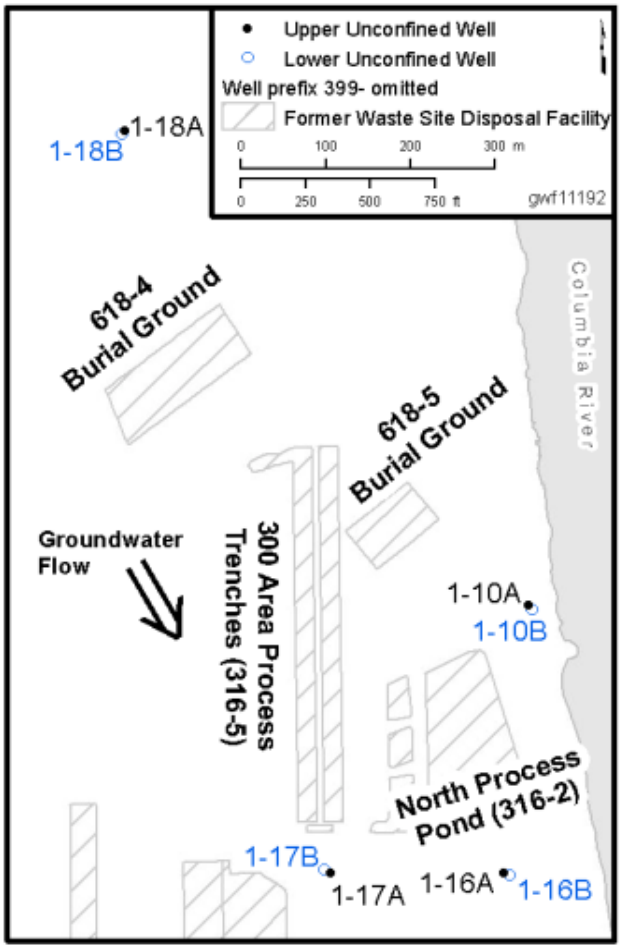


**Figure 2. Monitoring Well Locations for the 300 Area Process Trenches**

## 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 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 concentrations in Well 399-1-16B were comparable to those of the last reporting period, ranging from 154 to 185 µg/L (Figure 3). At Well 399-1-17B, cis-1,2-dichloroethene was detected four times during this reporting period; the maximum detection of 2.4 µg/L was in March 2015. The method detection limit varied from 0.09 µg/L to 1.5 µg/L.

**Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2015**

| | | | Dangerous Waste Constituents | | | | Waste Indicator | |
|---|---|---|---|---|---|---|---|---|
| Well | Date | Sampling Purpose | cis-1,2-Dichloroethene (µg/L) | | Trichloroethene (µg/L) | | Uranium[b] (µg/L) | |
| ***Permit Concentration Limits[a]*** | | | ***70*** | | ***5*** | | ***30*** | |
| 399-1-10A | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | 18.6 | D |
| | 02/18/2015 | RCRA | 0.3 | U | 0.3 | U | 20.0 | D |
| | 03/19/2015 | RCRA | 0.3 | U | 0.3 | U | 23.9 | D |
| | 06/08/2015 | RCRA | 0.3 | U | 0.3 | U | 23.0 | |
| 399-1-10B | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | 0.08 | U |
| | 02/18/2015 | RCRA | 0.09 | U | 0.25 | U | 0.175 | |
| | 03/19/2015 | RCRA | 0.09 | U | 0.25 | U | 0.07 | U |
| | 06/08/2015 | RCRA | 0.09 | U | 0.25 | U | 0.08 | U |
| 399-1-16A | 01/23/2015 | RCRA | 0.09 | U | 0.25 | U | **37.7** | |
| | 02/18/2015 | RCRA | 0.09 | U | 0.25 | U | 28.1 | |
| | 03/19/2015 | RCRA | 0.09 | U | 0.33 | J | **41.6** | |
| | 06/08/2015 | RCRA | 0.09 | U | 0.33 | J | **53.8** | |
| 399-1-16B | 01/23/2015 | RCRA | **182** | D | 1.6 | J | 8.55 | |
| | 02/18/2015 | RCRA | **154** | D | 1.41 | J | 7.04 | |
| | 03/19/2015 | RCRA | **185** | D | 1.97 | J | 8.65 | |
| | 06/08/2015 | RCRA | **172** | D | 2.17 | J | 8.94 | |
| 399-1-17A | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | **44.7** | D |
| | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | **43.3** | DG |
| | 02/18/2015 | RCRA | 0.3 | U | 0.3 | U | **42.5** | D |
| | 02/18/2015 | RCRA | 0.3 | U | 0.3 | U | **45.8** | D |
| | 03/19/2015 | RCRA | 0.3 | U | 0.3 | U | **54.2** | D |
| | 06/09/2015 | RCRA | 0.3 | U | 0.3 | U | **49.8** | D |
| | 06/09/2015 | RCRA | 0.3 | U | 0.3 | U | **50.1** | D |
| 399-1-17B | 01/23/2015 | RCRA | 1.4 | | 0.25 | U | 0.08 | U |
| | 02/18/2015 | RCRA | 1.9 | | 0.25 | U | 0.08 | U |
| | 03/19/2015 | RCRA | 2.4 | | 0.25 | U | 0.08 | UA |
| | 06/09/2015 | RCRA | 1.4 | | 0.25 | U | 0.08 | U |

**Table 4. Groundwater Data for 300 Area Process Trenches, January through June 2015**

| | | | Dangerous Waste Constituents | | | | Waste Indicator | |
|---|---|---|---|---|---|---|---|---|
| Well | Date | Sampling Purpose | cis-1,2-Dichloroethene (µg/L) | | Trichloroethene (µg/L) | | Uranium[b] (µg/L) | |
| 399-1-18A | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | 6.04 | |
| | 02/19/2015 | RCRA | 0.09 | U | 0.25 | U | 6.05 | |
| | 03/19/2015 | RCRA | 0.09 | U | 0.25 | U | 5.65 | |
| | 06/08/2015 | RCRA | 0.09 | U | 0.25 | U | 6.07 | |
| 399-1-18B | 01/23/2015 | RCRA | 0.3 | U | 0.3 | U | 0.25 | UG |
| | 02/19/2015 | RCRA | 0.3 | U | 0.3 | U | 0.25 | U |
| | 03/19/2015 | RCRA | 0.3 | U | 0.3 | U | 0.25 | U |
| | 06/08/2015 | RCRA | 0.3 | U | 0.3 | U | 0.25 | 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).

b. Uranium non-detects are listed as the minimum detectable activity.

A = irregularity with field paperwork

D = analyte reported at a secondary dilution factor

G = record has been reviewed and determined to be correct, or the record has been corrected with laboratory confirmation or other supporting information

J = estimated value

U = below detection limit

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. Trichloroethene was detected in March and June at an estimated concentration of 0.33 µg/L in Well 399-1-16A. Estimated concentrations in all four samples from Well 399-1-16B ranged from 1.41 to 2.17 µg/L. The method detection limit ranged from 0.25 µg/L to 0.3 µg/L.

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 4) 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 5) 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.

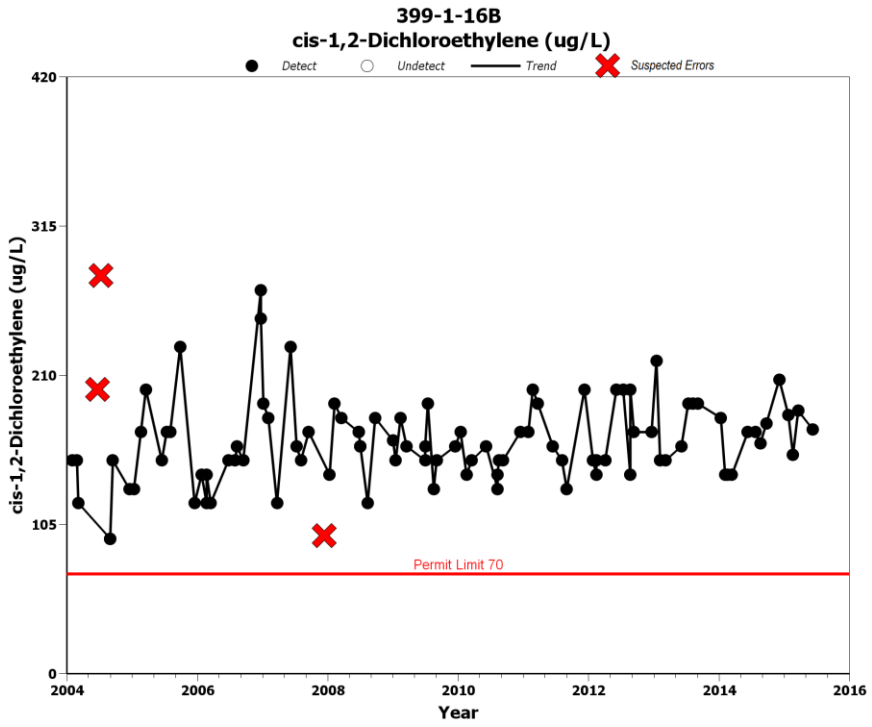


**Figure 3. Cis-1,2-Dichloroethene Concentrations in Well 399-1-16B**

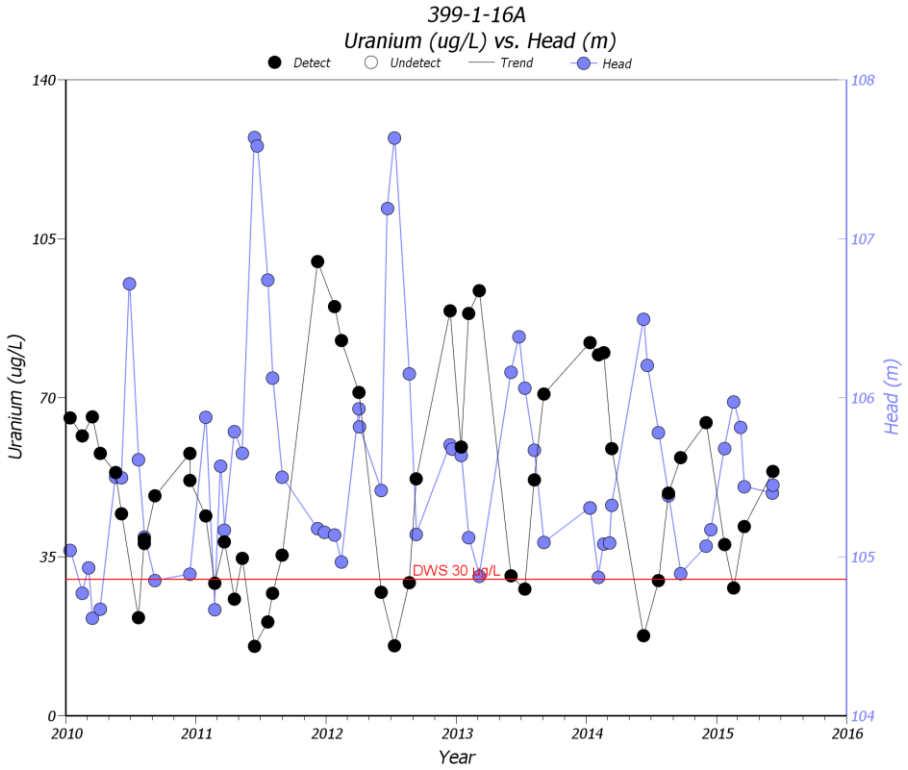


**Figure 4. Inversely Related Uranium Concentrations and Water Level in Well 399-1-16A**

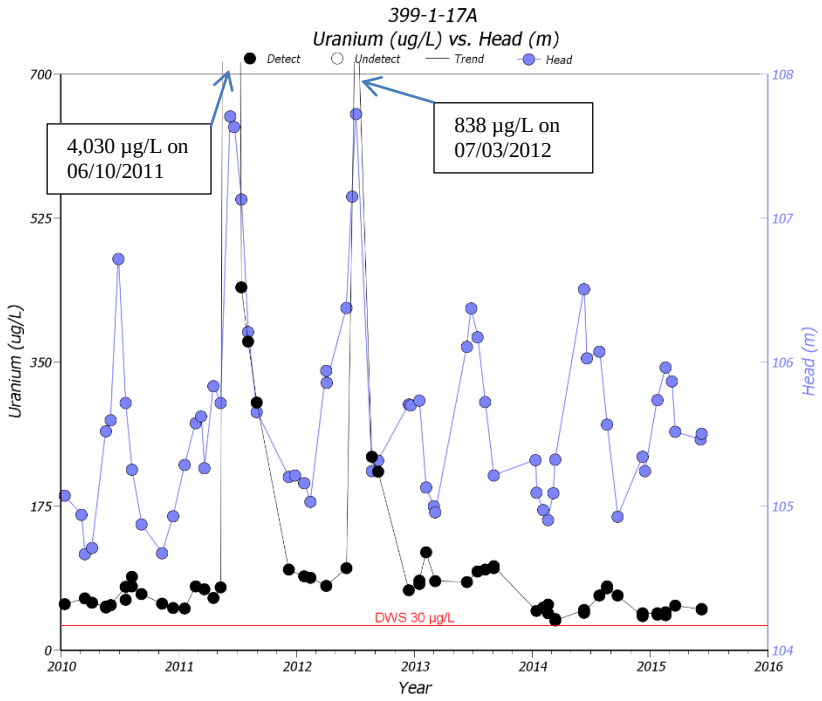


**Figure 5. Positively Related Uranium Concentrations and Water Level in Well 399-1-17A**

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 remained above the monitoring level specified as the permit concentration limit (30 µg/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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