SGW-62854
Revision 0

POST-CLOSURE CORRECTIVE ACTION GROUNDWATER MONITORING REPORT FOR THE 183-H SOLAR EVAPORATION BASINS: JULY - DECEMBER 2018

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

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
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APPROVED
By Janis D. Aardal at 1:37 pm, Mar 19, 2019

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Executive Summary

This is the second 2018 semiannual report on post-closure corrective action groundwater monitoring for the 183-H Solar Evaporation Basins. 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. This report covers the period of July through December 2018.

The final status groundwater monitoring plan for the 183-H Solar Evaporation Basins was incorporated into the Hanford Facility *Resource Conservation and Recovery Act of 1976*[2] (RCRA) Permit (WA7890008967, Modification 8C.2017.1F[3]), on May 24, 2017. The monitoring plan, which is now part of the permit, supersedes PNNL-11573[4]. The monitoring plan includes the following:

- Constituents: Filtered total chromium and nitrate
- Well network: Wells 199-H4-8, 199-H4-84, 199-H4-85, 199-H4-88, and 199-H4-89
- RCRA concentration limits: Filtered total chromium is 48 µg/L and nitrate is 45 mg/L
- Sampling frequency:
  - Semiannual (twice per year) for wells 199-H4-8, 199-H4-84, and 199-H4-85
  - Wells 199-H4-88 and 199-H4-89 are to be sampled quarterly until 2 years of monitoring is completed and, thereafter, semiannually.

[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.

[2] *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at: https://www.gpo.gov/fdsys/pkg/STATUTE-90/pdf/STATUTE-90-Pg2795.pdf.

[3] WA7890008967, *Hanford Facility Resource Conservation and Recovery Act Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c, as amended, Washington State Department of Ecology. Available at: https://fortress.wa.gov/ecy/nwp/permitting/hdwp/rev/8c/index.html.

[4] PNNL-11573, 1997, *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*, Pacific Northwest National Laboratory, Richland, Washington. Available at: https://pdw.hanford.gov/arpir/pdf.cfm?accession=D1659822.

RCRA sampling during the reporting period occurred in August (two wells) and November (all five wells). Additional samples were collected for the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[5] (CERCLA) program.

Filtered total chromium results were below the Hanford Facility RCRA Permit concentration limit (48 µg/L) in all of the monitoring network wells. RCRA sample result concentrations of total filtered chromium ranged from 3.6 µg/L (well 199-H4-8) to 20 µg/L (well 199-H4-84). The highest filtered total chromium result from both RCRA and CERCLA sampling during the reporting period was 33.1 µg/L in well 199-H4-84 (July 2018).

Nitrate exceeded the Hanford Facility RCRA Permit concentration limit of 45 mg/L in well 199-H4-88 in August, and in wells 199-H4-84, 199-H4-88, and 199-H4-89 in November. Wells 199-H4-88 and 199-H4-84 exhibited elevated nitrate levels throughout the reporting period, with higher concentrations correlating with higher water levels, typical of an area with a continuing source. The RCRA sample results for nitrate ranged from 13.3 mg/L (well 199-H4-8) to 79.7 mg/L (well 199-H4-88). Additional samples were collected under CERCLA. The highest nitrate result from RCRA and CERCLA sampling during the reporting period was 133 mg/L in well 199-H4-84 (July 2018).

The 95% upper confidence limit of the mean was calculated for filtered total chromium and nitrate concentrations using the most recent 8 to 10 sample results (collected under RCRA and CERCLA), and these values were compared to the Hanford Facility RCRA Permit concentration limits. For calculation of the 95% upper confidence limit, the sample set is to include at least 4 detections, and 10 samples are to be used if available. The 95% UCL values exceeded the Hanford Facility RCRA Permit concentration limit for nitrate at wells 199-H4-84 (110.8 mg/L) and 199-H4-88 (80.11 mg/L).

[5] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C. 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: https://www.csu.edu/cerc/researchreports/documents/CERCLASummary1980.pdf.

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Terms

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
EDA	Environmental Dashboard Application
PHOENIX	Pacific Northwest National Laboratory Hanford Online Environmental Information Exchange
RCRA	*Resource Conservation and Recovery Act of 1976*
UCL	upper confidence limit

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1 Introduction

The 183-H Solar Evaporation Basins is a post-closure unit in the Hanford Facility *Resource Conservation and Recovery Act of 1976* (RCRA) Permit (WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Modification 8C.2017.1F; hereinafter called the Hanford Facility RCRA Permit). Groundwater is monitored in accordance with WAC 173-303-645(11), "Dangerous Waste Regulations," "Releases from Regulated Units," and the Hanford Facility RCRA Permit, Part VI, "Post-Closure Unit 2." WAC 173-303-645(11) requires implementation of a corrective action program to reduce contaminant concentrations in groundwater. This is the second semiannual report for 2018 regarding post-closure corrective action groundwater monitoring describing the effectiveness of corrective action at the 183-H Solar Evaporation Basins (116-H-6 waste site). This report fulfills the requirement of WAC 173-303-645(11)(g), to report twice each year on the effectiveness of the corrective action program. This report covers the period from July through December 2018.

The final status groundwater monitoring plan for the 183-H Solar Evaporation Basins was incorporated into the Hanford Facility RCRA Permit on May 24, 2017. The monitoring plan, which is now included in the permit, supersedes PNNL-11573, *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*. The Hanford Facility RCRA Permit includes the following:

- Constituents: Filtered total chromium and nitrate
- Well network: Wells 199-H4-8, 199-H4-84, 199-H4-85, 199-H4-88, and 199-H4-89
- RCRA Permit concentration limits: Filtered total chromium is 48 µg/L and nitrate is 45 mg/L
- Sampling Frequency:
  - Semiannual (twice per year) for wells 199-H4-8, 199-H4-84, and 199-H4-85
  - Wells 199-H4-88 and 199-H4-89 are to be sampled quarterly until 2 years of monitoring under that schedule is completed and, thereafter, semiannually

New wells 199-H4-88 and 199-H4-89 were drilled in 2016, and the monitoring plan requires the wells to be sampled quarterly for 2 years to ensure sufficient samples to support statistical evaluation. The quarterly monitoring requirement was initiated following the permit revision in May 2017. As a result, while additional samples were sampled in each well following installation, the quarterly RCRA sampling was conducted from the start of the third quarter of 2017 and will continue through the second quarter of 2019. At the end of the 2 years of quarterly sampling, the sampling frequency will reduce to semiannual, consistent with the other wells in the network.

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

2 Site Description

The former 183-H Solar Evaporation Basins, located in the 100-H Area of the Hanford Site, 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.

3 RCRA Groundwater Monitoring Program

During implementation of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) interim remedial action, RCRA corrective action monitoring will continue to evaluate analytical results relative to the Hanford Facility RCRA Permit concentration limits (Table 1). The RCRA groundwater monitoring network consists of five wells in the unconfined aquifer: 199-H4-8, 199-H4-84, 199-H4-85, 199-H4-88, and 199-H4-89 (Figure 1). As specified in the Hanford Facility RCRA Permit, total filtered chromium and nitrate will be sampled semiannually with collection scheduled during low river stage (typically September through December) and high river stage (typically April through August). Field parameter data (pH, specific conductance, temperature, dissolved oxygen, and turbidity) are also collected.

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

Dangerous Waste Constituents	Concentration Limit
Total chromium (filtered sample) [a]	48 µg/L
Nitrate [b]	45 mg/L (nitrate as NO_3^-)

References: WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Method B Cleanup Levels for Potable Groundwater Cleanup Standards."

WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Part VI ("Unit Specific Conditions for Units in Post-Closure," "183-H Solar Evaporation Basins," Chapter 3.0, "Groundwater Monitoring," Modification 8C.2017.1F).

WAC 173-303-645, "Dangerous Waste Regulations," "Releases from Regulated Units."

WAC 173-303-9905, "Dangerous Waste Constituents List"

a. The Hanford Facility RCRA Permit concentration limit for filtered chromium is the WAC 173-340-720 Method B cleanup level for hexavalent chromium.

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

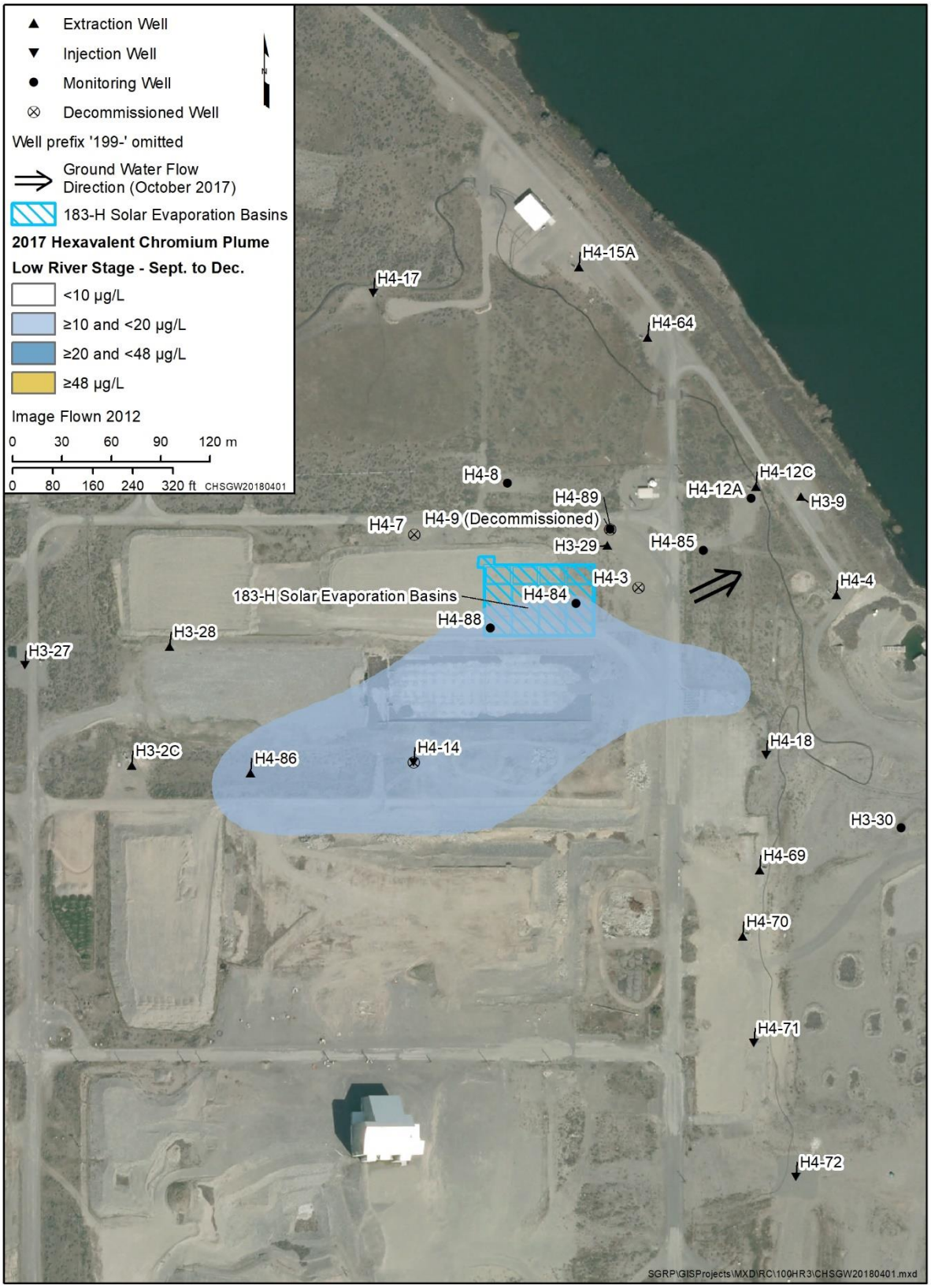

Figure 1. 183-H Solar Evaporation Basins (116-H-6) Well Network and Adjacent Wells

4 Contaminant Data

This chapter reports the concentrations of filtered total chromium and nitrate in groundwater at the 183-H Solar Evaporation Basins during the July through December 2018 reporting period. RCRA sampling was conducted in August for wells 199-H4-88 and 199-H4-89, and in November for all five wells in the network. Table 2 presents the RCRA sampling analytical results.

Table 2. 183-H Solar Evaporation Basins RCRA Sampling Summary, July Through December 2018

Well	Sample Date	Chromium (Filtered) (µg/L)	Nitrate (mg/L)	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Temperature (ºC)	Turbidity (NTU)
Concentration Limit		***48***	***45***	—	—	—	—	—
199-H4-8	11/13/18	3.6	13.3 D	8.38	7.81	486	15.9	4.78
199-H4-84	11/13/18	20.00	**70.8 D**	8.97	7.58	777	17.6	4.76
199-H4-85	11/13/18	6.6 B	28.8 D	9.25	7.75	453	18.1	1.55
199-H4-88	08/16/18	17.0	**79.7 D**	7.68	7.44	773	20.3	0.76
	11/13/18	12.10	**53.1 D**	8.92	7.42	887	12.2	3.94
199-H4-89	08/16/18	3.80 B	22.1 D	7.72	7.43	470	25.5	4.58
	11/13/18	7.10 BD	**57.5 D**	10.66	7.93	993	13.4	4.59

Reference: WA7890008967, *Hanford Facility Resource Conservation and Recovery Act (RCRA) Permit, Dangerous Waste Portion for the Treatment, Storage, and Disposal of Dangerous Waste*, Revision 8c.

Notes: *Italics* indicate Hanford Facility RCRA Permit concentration limits. The Hanford Facility RCRA Permit concentration limits for dangerous waste constituents were revised on May 24, 2017, with incorporation of the final status groundwater monitoring plan into the Hanford Facility RCRA Permit, Revision 8c.

Bold emphasis is added where the result exceeded the Hanford Facility RCRA Permit concentration limit.

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

D = analyte reported at a secondary dilution factor

NTU = nephelometric turbidity units

Total chromium (filtered sample) remained below the concentration limit of 48 µg/L in RCRA samples from each of the five wells in the monitoring network. The maximum concentration observed during the reporting period in a RCRA sampling event was 20 µg/L in well 199-H4-84. Concentrations of chromium reached a high of 33.1 µg/L (CERCLA sampling event) in well 199-H4-84 during high river stage in July 2018.

Nitrate exceeded the concentration limit of 45 mg/L during RCRA sampling events in both August and November. Elevated nitrate was present in well 199-H4-88 in August, and in wells 199-H4-84, 199-H4-88, and 199-H4-89 in November (Table 2). Both wells 199-H4-84 and 199-H4-88 exhibited elevated nitrate levels throughout the reporting period, typical of an area with a continuing source. The RCRA sample results for nitrate ranged from 13.3 mg/L (well 199-H4-8) to 79.7 mg/L (well 199-H4-88). Additional samples were collected under CERCLA. The highest nitrate result from both RCRA and CERCLA sampling during the reporting period was 133 mg/L in well 199-H4-84 (July 2018).

Chromium and nitrate concentrations in well 199-H4-84 generally rise as river levels increase. This occurs when contamination remains in the lower vadose zone and the water table rises high enough to encounter the periodically rewetted zone, releasing the contaminants into the water column. However, when river levels are extremely high, as occurred in May 2018, river water mixed sufficiently with the groundwater, diluting contaminant concentrations. This was confirmed by the specific conductance results, which declined during the May sampling when nitrate concentrations dropped to 25.2 mg/L. The CERCLA sampling results show nitrate concentrations in well 199-H4-84 as high as 137 mg/L (Figure 2). Well 199-H4-84 had nitrate levels above the concentration limit during the November 2018 sampling, with a concentration of 70.8 mg/L. The concentration was 133 mg/L in a CERCLA sample collected in July 2018. Figure 2 presents a trend chart showing the positive association between groundwater elevation in the well and contaminant concentrations, with the exception during very high water levels.

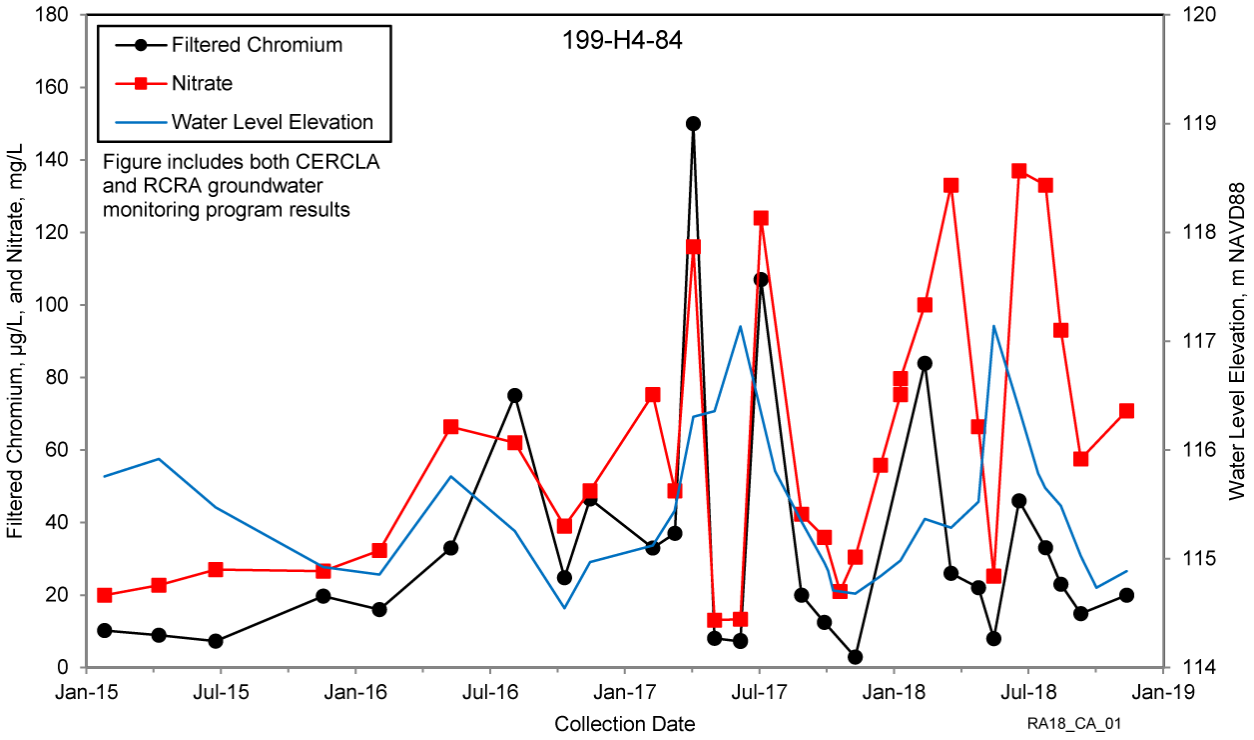

Figure 2. Nitrate, Filtered Chromium, and Water Level in Well 199-H4-84

In well 199-H4-89, nitrate concentrations are also associated with river levels, but higher concentrations are observed during low river stage. This is typical of an area downgradient of a source area and near the Columbia River. The concentration in this well exceeded the concentration limit during November 2018, at 57.5 mg/L, but not during other sampling events within the year.

As shown in Figure 1, wells 199-H4-84 and 199-H4-88 both lie within the former footprint of the 183-H Solar Evaporation Basins. Contaminant trends for both chromium and nitrate associated directly with the groundwater levels in those wells, with concentrations increasing during high river stage and concentrations declining during low river stage, indicating the presence of a continuing source.

5 Statistical Evaluation

A statistical evaluation was performed to compare the total chromium and nitrate results to the Hanford Facility RCRA Permit concentration limits. The evaluation applies to results at individual point of compliance (downgradient) wells. The 95% upper confidence limit (UCL) on the mean concentration is calculated for datasets with at least one result that exceeds the concentration limit. A nonstatistical analysis is used for datasets with all results less than the concentration limit. Samples collected for both RCRA and CERCLA were included for the statistical evaluation. The 95% UCL on the mean is calculated on datasets with at least eight independent sample results, with at least one result above a concentration limit, and using up to 10 of the most recent results. Where all results in a dataset are less than the exceedance level or there are fewer than eight results, the data are evaluated visually to ensure compliance. EPA, 2015, ProUCL, Version 5.1, was used to calculate the 95% UCL for nitrate and filtered total chromium.

As shown in Table 3, the 95% UCL values exceeded the Hanford Facility RCRA concentration limit for nitrate at wells 199-H4-84 and 199-H4-88. The environmental calculation file for the 95% UCL evaluation, including time-series plots for all datasets, is contained in ECF-HANFORD-18-0083, *Calculation of Upper Confidence Limits for RCRA Monitoring at the 183-H Solar Evaporation Basins to Support the July – December 2018 RCRA Semiannual Report*.

Table 3. Statistical Evaluation of 183-H Solar Evaporation Basins Dangerous Waste Constituents, July through December 2018

Well	Chromium (filtered) (µg/L)		Nitrate (mg/L)	
	95% UCL	Hanford Facility RCRA Permit Concentration Limit	95% UCL	Permit Concentration Limit
199-H4-8	-[a]	48	-[a]	45
199-H4-84	41.37[b]	48	110.8[b]	45
199-H4-85	-[a,b]	48	-[a,b]	45
199-H4-88	-[a,b]	48	80.11[b]	45
199-H4-89	-[a,b]	48	37.54[b]	45

Source: ECF-HANFORD-18-0083, *Calculation of Upper Confidence Limits for RCRA Monitoring at the 183-H Solar Evaporation Basins to Support the July – December 2018 RCRA Semiannual Report*.

a. No results exceeded the concentration limit.

b. Included non-RCRA samples.

RCRA = *Resource Conservation and Recovery Act of 1976*

UCL = upper confidence limit

6 Conclusions

The five monitoring wells in the RCRA network were sampled for filtered total chromium and nitrate in accordance with the 183-H Solar Evaporation Basins groundwater monitoring plan during the July through December 2018 reporting period. Concentrations of filtered total chromium were below the concentration limit (48 µg/L) in all RCRA samples during the reporting period. Nitrate concentrations exceeded the concentration limit of 45 mg/L in wells 199-H4-84 and 199-H4-88 throughout the reporting period. In addition, concentrations in well 199-H4-88 exhibited higher concentrations during high water periods, typical of an area with a continuing source. Well 199-H4-89 had elevated nitrate concentrations during low river stage, but not during any other sampling event. Nitrate concentrations in well 199-H4-89 are inversely associated to water levels, consistent with the well location downgradient from the source area and near the Columbia River.

The 95% UCL for filtered total chromium and nitrate was calculated using the most recent eight to ten samples (which included RCRA and CERCLA samples) and compared to the Hanford Facility RCRA concentration limits. The 95% UCL values exceeded the concentration limit for nitrate at wells 199-H4-84 (110.8 mg/L) and 199-H4-88 (80.11 mg/L).

7 References

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: https://www.csu.edu/cerc/researchreports/documents/CERCLASummary1980.pdf.

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Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: https://www.gpo.gov/fdsys/pkg/STATUTE-90/pdf/STATUTE-90-Pg2795.pdf.

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WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303.

303-645, "Release from Regulated Units."

303-9905, "Dangerous Waste Constituents List."

WAC 173-340-720, "Model Toxics Control Act—Cleanup," "Groundwater Cleanup Standards," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-720.