2.9 River Corridor Summary and Recommendations

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The Hanford Reach of the Columbia River begins upstream of the Hanford Site at Priest Rapids Dam and extends 82 kilometers downstream to the upper end of Lake Wallula, impounded by McNary Dam. Although flow volume and water levels are controlled by upstream dams, the Hanford Reach is essentially the only free-flowing stretch of the Columbia River in the United States.

This section summarizes the results of remediation and groundwater monitoring in the River Corridor for 2011. Results of monitoring the Columbia River and shoreline springs (seeps) are also summarized. References are provided for other DOE activities focused on the Columbia River at the Hanford Site. Finally, recommendations are made for future groundwater-related activities in the River Corridor.

2.9.1 Soil and Groundwater Remediation

Cleaning up the River Corridor of the Hanford Site is a high priority for DOE because discharge of contaminated groundwater to the Columbia River is a pathway for contaminants to reach human or ecological receptors. More than 60 percent of the waste sites in the River Corridor have been remediated or are classified as not requiring remediation under an interim record of decision. Most of the remaining sites are scheduled to be cleaned up in the next few years.

Since the mid-1990s, interim remediation of groundwater has been underway in the 100 Area to reduce the amount of contamination entering the river. Interim remedial action objectives for the 100-KR-4 and 100-HR-3 Operable Units are to (1) protect aquatic receptors in the river bottom from contaminants in groundwater entering the Columbia River; (2) protect human health by preventing exposure to contaminants in the groundwater; and (3) provide information that will lead to final remedies. Interim remedial action objectives for 100-NR-2 include the following: (1) protect the Columbia River from the adverse impact of groundwater contamination; (2) protect the unconfined aquifer by reducing contaminant concentrations; (3) obtain information to evaluate technologies; and (4) prevent destruction of sensitive wildlife habitat and minimize disruption of cultural resources. DOE continued to meet these objectives in 2011. However, compliance goals (for example, reducing concentrations to below applicable thresholds) have not been reached.

Final decisions regarding methods to clean up the remaining contamination in the River Corridor will be based on data collected during remedial investigation studies conducted in recent years. Draft reports that present the results of these studies and make recommendations for solutions are in progress (Table 2.1-1, Section 2.1).

2.9.2 Groundwater Monitoring Results

During 2011, groundwater staff sampled 525 wells in the River Corridor groundwater interest areas as part of routine groundwater monitoring programs (Table 2.9-1). Many of the wells were sampled numerous times, for a total of 2,690 successful well sampling trips. During the year, 280 aquifer tubes were sampled, with samples collected from a total of 528 sampling trips.

Table 2.9-2 lists maximum concentrations of groundwater contaminants detected in River Corridor wells and aquifer tubes during 2011. The 2011 data did not result in any major reinterpretations of the nature and extent of groundwater contamination. The following paragraphs summarize River Corridor groundwater contamination and results of monitoring. For additional summary information, see the Executive Summary of this report.

Hexavalent chromium contaminant plumes with concentrations above the 10 µg/L ambient water quality standard are present in the unconfined aquifer in all of the 100 Areas and in the Ringold upper mud unit in the 100-H Area. Concentrations exceeded the 48 µg/L groundwater cleanup standard in 100-KR-4 and 100-HR-3 in 2011, and a new exceedance was observed in 100-BC-5 in early 2012.

Some of these plumes are shrinking as a result of remediation and natural attenuation. However, the plumes are persistent even many years after waste discharge has ceased.

Tritium concentrations exceed the 20,000 pCi/L drinking water standard in 100-BC-5, 100-KR-4, and 300-FF-5 (at the 618-11 Burial Ground). Tritium was more widespread in the River Corridor in the past, and the plumes are gradually dissipating because of radioactive decay and other natural processes.

Strontium-90 contamination persists beneath each of the 100 Areas at concentrations above the 8 pCi/L drinking water standard. The most extensive, concentrated plume is in 100-NR-2, where levels exceed the 1,100 pCi/L derived concentration standard. Groundwater samples from new wells installed in or near former waste sites in the 100-D and 100-F Areas detected higher levels of strontium-90 in 2011 than in other wells in those regions. The strontium-90 contamination tends to be stable because this constituent sorbs to sediment grains. Concentrations are gradually declining in most areas as a result of radioactive decay.

Nitrate is a common groundwater contaminant in the River Corridor. Concentrations exceeded the 45 mg/L drinking water standard in 2011 in 100-KR-4, 100-NR-2, 100-HR-3, 100-FR-3, and 1100-EM-1, although the latter plume originated offsite. The largest onsite plume is in 100-FR-3. Concentrations are generally steady or declining.

Carbon-14 exceeds the 2,000 pCi/L drinking water standard in portions of 100-KR-4. The K West plume did not change significantly in 2011. The wells at K East that formerly had concentrations above the standard were decommissioned before a nearby facility was demolished and have not yet been replaced. Wells farther downgradient from K East have lower concentrations of carbon-14.

Uranium forms a persistent plume with levels above the 30 µg/L drinking water standard beneath portions of 300-FF-5. Concentrations vary with seasonal changes in the water table, and it appears that residual uranium remains in the vadose zone. The river was unusually high in June 2011, and uranium concentration temporarily increased by an order of magnitude in one well near the former process trenches.

Trichloroethene exceeds the 5 µg/L drinking water standard in the unconfined aquifer at 100-FR-3 and 100-KR-4. The plumes are attenuating naturally. In 300-FF-5, the contamination is generally limited to a local, finer-grained unit that is not monitored routinely. In 2011, one shallow well also had a concentration above the drinking water standard.

Remedial investigations have provided additional information about the vertical distribution of groundwater contamination in the River Corridor. In most locations and for most constituents, concentrations are highest near the top of the unconfined aquifer and decrease with depth. An exception includes hexavalent chromium concentrations in western 100-BC-5, which are highest at the top and bottom of the unconfined aquifer, and lower in between. This exception may indicate different periods of contaminant release. In some locations in 100-KR-4, hexavalent chromium concentrations were higher in the lower half of the aquifer.

Interim action performance monitoring continued to indicate that the groundwater remediation systems are functioning as designed and are meeting remedial action objectives. Contaminant concentrations in compliance wells remained above threshold values in 2011, and the remediation systems will continue to operate in 2012.

RCRA groundwater monitoring continued in 2011 at facilities in the 100-NR-2, 100-HR-3, and 300-FF-5 (Table 2.9-3). Results did not reveal any new impacts to groundwater, and the sites will continue to be monitored under existing requirements.

2.9.3 Seep and River Monitoring

DOE conducts water quality monitoring in the Columbia River environment as part of its Public Safety and Resource Protection Program, with the purpose of monitoring offsite migration of

contaminants of Hanford Site origin via multiple pathways (Section III.A of DOE/RL-91-50, *Environmental Monitoring Plan United States Department of Energy Richland Operations Office*). The Surface Environmental Surveillance Project conducts monitoring related to contaminants carried by groundwater to the Columbia River. Hanford Site shoreline monitoring is further discussed in Section 1.2 of *Water Quality Sampling Locations Along the Shoreline of the Columbia River, Hanford Site, Washington* (PNNL-19052), which also provides detailed location maps for near-river monitoring.

The DOE collects samples from seepage areas (springs) on the banks of the Columbia River in the fall when the river stage is low. Samples are analyzed for a variety of chemicals and radionuclides, and the results are published annually in the Hanford Site environmental report (Section 8.5 of PNNL-20548, *Hanford Site Environmental Report for Calendar Year 2010*). The 2010 results are summarized below. Results for 2011 were not available at the time this report was prepared.

Table 2.9-4 lists concentrations of contaminants of interest in seeps along each shoreline segment in 2010. Maximum concentrations in seep samples do not always correlate to maxima in groundwater monitoring wells because seeps are natural features that may not be near contaminant plumes. Concentrations of dissolved chromium exceeded the ambient water quality standard in seeps in 100-BC-5, 100-KR-4, 100-HR-3, and 100-FR-3. Tritium was detected in most of the shoreline segments and exceeded the drinking water standard in a seep at the former Hanford town site. Strontium-90 was detected in the 100-BC-5, 100-KR-4, 100-HR-3, and 300-FF-5 seeps, but all concentrations were below the drinking water standard. The only seep in the 100-NR-2 is downstream from the strontium-90 groundwater plume. Uranium exceeded the drinking water standard in a 300-FF-5 seep. Nitrate concentrations were below the drinking water standard in all regions but were elevated in 100-FR-3, the Hanford town site, and 300-FF-5.

DOE monitors Columbia River water by collecting samples along several cross-river transects and at near-shore river locations adjacent to groundwater plumes, where humans and aquatic biota are potentially exposed to contaminants. The surveillance data provide a historical record of radionuclides and chemicals in the environment. The results of water quality monitoring along the shoreline and in the free-flowing river are presented annually in the Hanford Site environmental report (Section 8.4 of PNNL-20548) and are summarized below.

The Hanford Site environmental report for 2010 is available at: http://msa.hanford.gov/msa/index.cfm/Env._Reports_2001_-_Latest#352.

Radionuclide concentrations in river water samples collected at the city of Richland were far below applicable water quality standards in 2010. The average tritium (29 ± 17 pCi/L) and uranium (0.51 ± 0.12 pCi/L) concentrations at the City of Richland were slightly higher than at Priest Rapids Dam (19 ± 4.6 pCi/L and 0.41 ± 0.094 pCi/L, respectively). Plutonium and strontium-90 were detected in a few samples at the City of Richland, but all detections were near the minimum detectable concentrations. Concentrations of all other radionuclides were typically less than the minimum detectable concentrations. Tritium, strontium-90, and plutonium exist in worldwide fallout from historical nuclear weapons testing, as well as in effluent from Hanford Site facilities. Tritium and uranium occur naturally in the environment in addition to being present in Hanford Site effluent. Uranium from non-Hanford Site sources, such as fertilizer use, is also known to enter the Columbia River across from the Site.

All metal and anion concentrations in river water, including dissolved chromium, were less than the ambient water quality standard in 2010.

In 2010, the U.S. Geological Survey sampled Columbia River water at the Vernita Bridge (upstream from the Hanford Site) and the City of Richland. These measurements indicated no deterioration of water quality along the Hanford Reach of the Columbia River. Median concentrations of dissolved chromium

were similar for water samples collected near the Vernita Bridge and the City of Richland, and the concentrations were well below the ambient water quality criterion.

2.9.4 River Corridor Baseline Risk Assessment

A critical step in developing final remedial action decisions for portions of the Hanford Site along the Columbia River is the completion of a quantitative baseline risk assessment. The River Corridor Baseline Risk Assessment addresses potential risk to human health and the environment from post-remediation, residual contaminant concentrations in the 100 and 300 Areas, as well as the Hanford and White Bluffs town sites. This assessment also investigates risks related to the potential transport of Site contaminants to Columbia River riparian and near-shore environments adjacent to the former operational areas. Some recent documents associated with this effort include the following:

- DOE/RL-2007-21, Volume I, Part 1, *River Corridor Baseline Risk Assessment, Volume I: Ecological Risk Assessment* (August 2011)
- DOE/RL-2007-21, Volume II, Part 2, *River Corridor Baseline Risk Assessment Volume II: Human Health Risk Assessment* (August 2011)

Additional information about the River Corridor Baseline Risk Assessment and links to supporting documents and reports are available at the following website: http://www.washingtonclosure.com/projects/environmental_protection/mission_completion/project_library/#rcbra.

2.9.5 Hanford Site Releases to the Columbia River

DOE is investigating Hanford Site contaminant releases to the Columbia River (DOE/RL-2008-11, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River*). The contaminants, their concentrations, and their locations may have undesirable health effects for humans, animals, and plants that use or live in the Columbia River. The information obtained from this investigation will ultimately be used to help make final cleanup decisions for Hanford Site contaminants that are present in and along the Columbia River. Results of the study are presented in WCH-398, *Data Summary Report for the Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington.*

During the study, which concluded in 2010, samples were collected of pore water (i.e., groundwater upwelling beneath the river bottom into the space between rocks and sediment of the river bed), river sediment, river water, fish, and island soil. Pore water in some of the 100 Area samples had concentrations of hexavalent chromium above the aquatic standard, and strontium-90 exceeded the drinking water standard in some 100-N Area samples. Tritium concentrations exceeded the drinking water standard in some pore water samples near the former Hanford town site, and uranium near the 300 Area.

Additional information about the remedial investigation for Hanford Site releases to the Columbia River is available at the following website: http://www.washingtonclosure.com/projects/environmental_protection/mission_completion/project_library/#investigation.

Data collected as part of this investigation will contribute to the development of an ecological risk assessment and a baseline human health risk assessment for the Columbia River component of the River Corridor Baseline Risk Assessment. These risk assessments are anticipated to be completed by 2012.

2.9.6 Recommendations for River Corridor Groundwater

The 100 and 300 Area River Corridor units are undergoing the CERCLA process for completing remediation of waste sites and groundwater. RI/FS reports (Table 2.1-1) evaluate alternatives for remediation. In addition, the following recommendations are made regarding future groundwater monitoring and remedial action evaluations. Where possible, these recommendations provide sufficient detail to describe and plan the activity. As with any such recommendation, these warrant further review and their implementation depends on technical priorities and available funding. In some cases, these recommendations are either planned for implementation in 2012 or have already been implemented as process improvements.

- Multiple interest areas
    - Conduct an analysis of wells near the Columbia River to evaluate the sensitivity of the wells to changes in river stage. This information will be used to support the refinement of near-river sampling schedules and is a component to ongoing sample optimization activities (underway in 2012).
    - Conduct a workshop and develop a strategy to assess the suitability of aquifer tube data in near-shore performance monitoring. The strategy will define methods of evaluating the representativeness of aquifer tube data and a decision framework for incorporating aquifer tube data in remediation performance monitoring (2014).
    - Update groundwater sampling and analysis plans for 100-BC-5, 100-KR-4, 100-HR-3, 100-FR-3, and 300-FF-5 to include new monitoring wells and to revise constituents and sampling frequency based on recent remediation activities and groundwater data (2013).
    - Implement actions from the third CERCLA five-year review (DOE/RL-2011-56).
    - As the Hanford Site moves from describing the extent of contamination to active cleanup, meaningful benchmarks for measuring cleanup progress are under development. As new data evaluation and reduction tools are implemented, establish final long-term benchmarks for measuring the progress of cleanup and remedy performance.
- 100-BC-5
    - Increase monitoring frequency for hexavalent chromium concentrations downgradient of 100-C-7 and 100-C-7:1 waste sites (implemented in 2012).
- 100-KR-4
    - Implement the SIR-700 resin full time at the 100-K pump-and-treat systems (implementing in 2012).
    - Connect wells 199-K-198 and 199-K-199 to the KX pump-and-treat system as extraction wells (schedule dependent on funding priorities).
    - Continue to sample wells 199-K-36 and 199-K-187, upgradient of the 183.1-KE headhouse, to investigate variable hexavalent chromium concentrations (implemented in 2012).
    - Track strontium-90 concentrations in wells downgradient of K East as the plume front migrates downgradient (implemented in 2012).
    - Install replacement wells in the vicinity of the 183.1-KW headhouse to monitor hexavalent chromium groundwater at that apparent source area during remediation (schedule dependent on funding priorities).

  - Install replacement wells in the vicinity of the 116-KE-1 and 116-KE-3 cribs to monitor carbon-14, tritium, nitrate, and strontium-90 conditions during remediation (schedule dependent on funding priorities).
  - Install a packer at 6 meters below the water table in well 199-K-185. Very high nitrate and high carbon-14 levels were identified during drilling at the top of the aquifer. Results were significantly lower during subsequent monitoring because the well has a long screen. A packer would eliminate water from the lower portion of the aquifer from entering the pump during sampling and provide more representative results of upper aquifer conditions (recommend this is done as part of the selected remedy, under the remedial design report and remedial action work plan).

- 100-NR-2
  - Prepare an integrated sampling and analysis plan to include CERCLA and RCRA groundwater monitoring (schedule dependent on implementation of the Hanford Facility RCRA Permit (WA7890008967).
  - Evaluate the 1324-N/NA monitoring network with respect to flow direction changes, and incorporate the site into the integrated groundwater monitoring plan.
  - Conduct additional sampling in 100-NR-2 to investigate the total organic carbon increases in groundwater at the 1324-N/NA facilities (implemented in 2012).
  - Evaluate additional apatite injections in the permeable reactive barrier in response to increasing strontium-90 concentrations.

- 100-HR-3
  - Evaluate the effectiveness of the new DX and HX pump-and-treat systems in 2013, using groundwater concentration data, hydraulic head data, capture zone analyses, and further modeling to optimize the operation of the systems. Include a comparison of DX and HX to the HR-3 and DR-5 systems, and prepare a written report.
  - Conduct a data quality objectives analysis to determine data needs for performance monitoring of the new DX and HX systems in 2013. Document the evaluation, and develop a new monitoring plan for 100-HR-3.
  - Evaluate the realignment and/or addition of specific wells to the DX and HX pump-and-treat system well network in 2013, and prepare a written report.
  - Conduct additional sampling of 100-HR-3 wells 199-H1-27 and 199-H4-75 and nearby wells in 2013 to investigate the persistence and extent of nitrate contamination discovered in 2011.
  - Sample 100-HR-3 well 199-D5-93 and nearby wells for beta-emitting radionuclides in 2013 to investigate the cause and extent of elevated gross beta levels observed in 2011.

- 100-FR-3
  - Monitor temporary wells 199-F5-55 and 199-F5-56 (implemented in 2012).
  - Monitor strontium-90 in wells near the F Reactor to determine the extent of contamination in temporary well 199-F5-56 (implemented in 2012).

- 300-FF-5
    - Increase monitoring frequency for metals at the 618-10 Burial Ground during remediation activities to assess the impact of dust suppression water on contaminant mobility (implemented in 2012).
- 1100-EM-1
    - Prepare a groundwater sampling and analysis plan for 1100-EM-1 to include monitoring objectives for tracking Hanford Site and offsite plumes and trends.

Hanford Reach National Monument

The Hanford Reach of the Columbia River, the last free-flowing stretch of this river in the United States, is part of the Hanford Reach National Monument. The monument also includes the Saddle Mountains Wildlife Refuge north of the river, and the Fitzner-Eberhardt Arid Lands Ecology Reserve in the southwestern Hanford Site. The 195,000-acre monument contains a wealth of wildlife and remnants of human history spanning more than 10,000 years.

The monument was established by Presidential decree (Clinton, 2000, Hanford Reach National Monument) in 2000 and is administered by the U.S. Fish and Wildlife Service (USFWS, 2008, Hanford Reach National Monument: Final Comprehensive Conservation Plan and Environmental Impact Statement Adams, Benton, Grant and Franklin Counties, Washington).

For more information, see http://www.fws.gov/hanfordreach/.

Table 2.9-1. Number of Wells and Well Sampling Trips in the River Corridor, 2011

Interest Area	Number of Wells Sampled	Number of Successful Well Trips	Number of Aquifer Tubes Sampled	Number of Successful Aquifer Tube Trips
100-BC-5	25	82	19	26
100-KR-4	74	928	30	37
100-NR-2	102	152	43	132
100-HR-3-D	116	789	74	156
100-HR-3-H	84	380	55	67
100-FR-3	28	44	32	44
300-FF-5	82	256	25	47
1100-EM-1	18	20	2	5
Total	529	2,651	280	514

Note: A successful sampling trip is determined by the presence of data in HEIS. A trip may consist of routine sampling, characterization sampling, or sampling conducted to support groundwater remediation systems.

Table 2.9-2. Maximum Concentrations of Selected Groundwater Contaminants in River Corridor Interest Areas in 2011

Contaminant, Units	DWS (DCS)[a]	100-BC-5		100-KR-4		100-NR-2		100-HR-3-D		100-HR-3-H		100-FR-3		300-FF-5		1100-EM-1	
		Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes
Radionuclides																	
Carbon-14, pCi/L	2,000 (62,000)			19,200	314	40.4											
Cesium-137, pCi/L	200 (3,000)			1.9		7.16											
Cobalt-60, pCi/L	100 (7,200)					9.64											
Gross alpha, pCi/L	15	4.3	3.2	5.7	2.2	21		4.28		6.3	2.8	11.9		200	41.8	15	7.3
Gross beta, pCi/L	50	23	25	130	4.3	22,000	3,700	186		68	11	49		130	19.4	44	9.31
Plutonium-239/240, pCi/L	N/A (140)					0.099											
Strontium-90, pCi/L	8 (1,100)	36	10	251	7.48	13,500	1,300	45	5.4	33	18	270	4.85	2.1			
Technetium-99, pCi/L	900 (44,000)			49.6		57				157				190		54	
Tritium, pCi/L	20,000 (1,900,000)	28,000	14,000	290,000	4,060	16,500	12,000	18,000	11,000	4,330		12,000		1,000,000	3,080	375	
Uranium, µg/L	30			6.25		7.14		6.1		28.9	2.3	34.7		4,030	104	26.4[c]	14.4
Metals[b]																	
Arsenic (filtered), µg/L	10			7.4	2.18	16.5	4.4	11.2	2.63	2.8	2.2	4.72		5.2			
Arsenic, µg/L	10			7.5	2.23	16.8	5	12.5	2.55		2.41	4.86		3.8			
Barium (filtered), µg/L	2,000	97	50	67	45	241	54.3	114	74.3	102	45.8	107	113	245	64.6	165	79
Barium, µg/L	2,000	96	54	69	46	275	53	288	106	102	46.4	105	116	235	73.3	171	77
Beryllium (filtered), µg/L	4			1		0.55			0.91								
Beryllium, µg/L	4			1.5		1.5											
Chromium (filtered), µg/L	100	53	27	3,360	1.78	200	5.2	5,460	77	142	29.8	25.5	5.4	64			
Chromium, µg/L	100	52	27	3,250	2.09	204	5.4	5,420	78	143	30.3	41.6	5.7	67	4	11	
Hexavalent Chromium (filt.), µg/L	48	53.5	24.1	3,340	66.5	34.4	8.2	28,100	96.7	133	40.8	23	7	2			
Hexavalent Chromium, µg/L	48	53.1	23.3	3,310	67.4	198	7.7	27,900	95.8	153	40.9	24.1	3.9				
Mercury (filtered), µg/L	2			0.12			0.13										
Mercury, µg/L	2			0.18			0.097										
Selenium (filtered), µg/L	50			3.39		3.21						1.63		2.5			
Selenium, µg/L	50			2.4		5.54						1.98					
Anions																	
Cyanide, µg/L	200									4.4							
Fluoride, mg/L	4.0	0.301	0.130	0.430	0.162	0.650	0.485	0.534	0.231	0.886	0.195	0.682	0.213	3,500	0.359	1.35	0.174
Nitrate as NO_3, mg/L	45	12.4	26.7	97.4	48.7	394	44.7	98.3	32.2	49.1	37.1	201	27.9	141[c]	66[c]	302[c]	79.2[c]

Table 2.9-2. Maximum Concentrations of Selected Groundwater Contaminants in River Corridor Interest Areas in 2011

Contaminant, Units	DWS (DCS)[a]	100-BC-5		100-KR-4		100-NR-2		100-HR-3-D		100-HR-3-H		100-FR-3		300-FF-5		1100-EM-1	
		Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes	Wells	Tubes
Nitrite as NO_2, mg/L	3.3	0.229	0.182	0.486	0.306	4.2	0.203	3.19	0.233	1.56	0.374	1.11	0.168	0.450	0.233	0.486	
Organics																	
1,1-Dichloroethene, µg/L	7					0.22									0.19		
Benzene, µg/L	5					0.14											
Benzo(a)pyrene, µg/L	0.2					0.72											
Carbon tetrachloride, µg/L	5					3.2						2.2		2.7	0.48	1.4	
Chloroform, µg/L	80	1.9		1.8		8.4		0.56	0.16	3.7	1.3	3.9		0.29	2.4		
cis-1,2-Dichloroethylene, µg/L	70													200	5.7		
Ethylbenzene, µg/L	700			2.5		1.1											
Methylene chloride, µg/L	5			0.31		0.29						0.28		0.3	1.7		
Tetrachloroethene, µg/L	5					2.6			0.26					0.22	1.8		
Toluene, µg/L	1,000					0.092						6.6			0.31		
Trichloroethene, µg/L	5	2.2		6.6								14		14	210		
Xylenes (total), µg/L	10,000			6.1		1.5									0.42		

Table lists highest value for 2011 for each groundwater interest area, excluding those flagged F, R or Y, or non-routine samples (e.g. characterization) Blank cells indicate a constituent was not detected or not analyzed. Blue cells exceed drinking water standard. Yellow cells exceed derived concentration standard.

a. References for drinking water standards and derived concentrations standards listed in Table 1-1.

b. Antimony, cadmium, and thallium excluded because detection limits are typically higher than DWS, creating false exceedances near the detection limits. Nickel excluded because it typically indicates corrosion of stainless steel well screens and casing.

c. From offsite sources.

Table 2.9-3. RCRA Monitoring Status for the River Corridor, 2011

RCRA Unit	Report Section	Status for Reporting Period
1301-N (116-N-1) LWDF	Section 2.4.9.1	Continued indicator evaluation.*
1324-NA (120-N-1) and 1324-N (120-N-2) Ponds	Section 2.4.9.2	Continued indicator evaluation.*
1325-N (116-N-3) LWDF	Section 2.4.9.3	Continued indicator evaluation.*
116-H-6 (183-H) Evaporation Basins	Section 2.5.7	Corrective action alternative program during interim remedial action; chromium and nitrate.
316-5 (300 Area) Process Trenches	Section 2.7.8	Compliance/corrective action; organics.

* Analysis of RCRA contamination indicator parameters provided no evidence of groundwater contamination with dangerous waste or dangerous waste constituents from the unit.

Table 2.9-4. Hanford Site Contaminants in Columbia River Seeps

Groundwater Interest Area	Spring Names Sampled Fall 2010	Maximum Concentration, Fall 2010					
		Chromium[a] (µg/L)	Nitrate (mg/L)	Strontium-90[b] (pCi/L)	Tritium[b] (pCi/L)	TCE (µg/L)	Uranium[c] (µg/L)
100-BC-5	100-B SPRING 38-3 100-B SPRING 39-2	12.4	6.0	1.65 ±0.294	2,140 ±469	0.48 J	no data
100-KR-4	100-K SPRING 63-1 100-K SPRING 77-1	63.4	16.5	1.38 ±0.228	1,390 ±340	3.04	no data
100-NR-2	100-N SPRING 8-13	8.3	13.9	<0.0331	3,640 ±749	no data	no data
100-HR-3	100-D SPRING 110-1	6.2	1.3	0.154 ±0.053	<134	no data	no data
100-HR-3	100-H SPRING 145-1 100-H SPRING 153-1	15.5	16.5[d]	6.27 ±0.982	1,570 ±373	no data	1.8
100-FR-3	100-F SPRING 207-1	11.1	38.5[d]	<0.032	749 ±237	<0.25	6.6
200-PO-1 (old Hanford town site)	HANFORD SPR DR 4-2; HANFORD SPR UR 28-2; HANFORD SPR 28-2	2.4	21.7 [d]	no data	36,700 ±7,170	no data	3.8
300-FF-5	300 AREA SPR DR 42-2; 300 AREA SPRING 41-9; 300 AREA SPRING 42-2	3.0	25.1	0.298 ±0.074	5,210 ±1,050	1.42 J	103
Offsite	RICHLAND SPR (SRL 437-1)	0.49	12.3	<0.031	306 ±161	no data	1.9

Source: Hanford Environmental Information System (HEIS) database.

a. Total chromium in filtered samples (equivalent to hexavalent chromium)

b. Reported result plus or minus total analytical error

c. Estimated based on isotopic uranium results

d. Analyzed past recommended holding time

J = estimated concentration; near detection limit