8.5 Columbia River Shoreline Springs Monitoring

Samples of shoreline spring water and associated sediment were collected along the Hanford Reach and analyzed to determine the potential impact of radiological and chemical contaminants from Hanford on the public and the aquatic environment. In addition, at the 100-N Area, water samples were collected from a set of shoreline seep wells to verify reported radionuclide releases for 100-N Area seeps. Sections 8.5.1 and 8.5.2 discuss the results for Columbia River shoreline spring water and sediment samples and Section 8.5.3 discusses the results from the shoreline seep-well water samples at the 100-N Area.

8.5.1 Water Monitoring at Columbia River Shoreline Springs

G. W. Patton

The Columbia River is the discharge area for the unconfined aquifer underlying the Hanford Site. Groundwater provides a means for transporting Hanford-associated contaminants, which have leached into groundwater from past waste disposal practices, to the Columbia River (DOE/RL-92-12; PNL-5289; PNL-7500; WHC-SD-EN-TI-006). Contaminated groundwater enters the Columbia River via surface and subsurface discharge. Discharge zones located above the water level of the river are identified in this report as shoreline springs. Routine monitoring of shoreline springs offers the opportunity to characterize the quality of groundwater being discharged to the river and to assess the potential human and ecological risk associated with the spring water. In addition, contaminants in groundwater near the Columbia River are monitored using shoreline groundwater-sampling tubes (aquifer tubes) (Section 8.7; PNNL-14444).

Shoreline springs were documented along the Hanford Reach long before Hanford Site operations began during World War II (Jenkins 1922). During the early 1980s, researchers walked a 66-kilometer (41-mile) stretch of the Benton County shoreline of the Hanford Reach and identified 115 springs (PNL-5289). They reported that the predominant areas of groundwater discharge at that time were in the vicinity of the 100-N Area, Hanford town site, and 300 Area. The predominance of the 100-N Area may no longer be valid because of declining water-table elevations in response to the cessation of liquid waste discharges to the ground from Hanford Site operations and the pump-and-treat systems that are being used to decontaminate groundwater at the 100-N Area. In recent years, it has become increasingly difficult to locate shoreline springs in the 100-N Area.

The presence of shoreline springs also varies with river stage (river-level height). Groundwater levels in the Hanford Reach are heavily influenced by river stage fluctuations. Water levels in the Hanford Reach of the Columbia River are controlled by upriver conditions and operations at upriver dams. As water levels fluctuate, groundwater levels and, thus, the presence of shoreline springs in the Hanford Reach vary. In addition, for the 300 Area, the water levels are influenced by the height of the McNary Dam pool. Water flows into the Hanford Site aquifer (as bank storage) as the river stage rises and then discharges from the aquifer in the form of shoreline springs as the river stage falls. Following an extended period of low river flow, groundwater discharge zones located above the water level of the river may cease to exist once the level of the aquifer comes into equilibrium with the level of the river. Thus, springs are most readily identified immediately following a decline in river stage. Bank storage of river water also affects the contaminant concentration of the springs. Spring water discharged immediately following a river stage decline generally consists of river water or a

mixture of river water and groundwater. The percentage of groundwater in the spring water discharge increases over time following a drop in river stage. Measuring the specific conductivity of the spring water discharge provides an indicator of the extent of bank storage because Hanford Site groundwater has a higher specific conductivity than Columbia River water.

Because of the effect of bank storage on groundwater discharges and contaminant concentrations, as well as variations in aquifer thickness, porosity, and plume concentrations, it is difficult to accurately estimate the volume of contaminated groundwater discharging to the Columbia River within the Hanford Reach. Studies of shoreline springs conducted during 1983 (PNL-5289) and 1988 (PNL-7500) and results of near-shore studies (PNNL-11933; PNNL-13692) noted that discharges from the springs had only localized effects on river contaminant concentrations.

8.5.1.1 Collection of Water Samples from Columbia River Shoreline Springs and Analytes of Interest

Routine monitoring of selected shoreline springs was initiated during 1988. Currently, shoreline spring water samples are collected for contaminant monitoring and to support groundwater operable unit investigations (DOE/RL-91-50). Tables 8.5.1 and 8.5.2 and Figure 8.4.1 summarize the sampling locations, types, frequencies, and analyses included in shoreline springs monitoring during

Table 8.5.1. Shoreline Springs Water Monitoring at the Hanford Site, 2004

Springs Locations	Sample Type	Frequency	Analyses
100-H Area	Grab	Annually	Alpha, beta, ^{3}H, ^{90}Sr, ^{99}Tc, U,[a] gamma energy analysis, metals (filtered and unfiltered), anions
100-F Area	Grab	Annually	Alpha, beta, ^{3}H, ^{90}Sr, U, gamma energy analysis, metals (filtered and unfiltered), anions, VOA
100-B Area	Grab	Annually	Alpha, beta, ^{3}H, ^{90}Sr, ^{99}Tc, gamma energy analysis, metals (filtered and unfiltered), anions, VOA
100-D, 100-K, and 100-N Areas	Grab	Annually	Alpha, beta, ^{3}H, ^{90}Sr, gamma energy analysis, metals (filtered and unfiltered), anions, VOA (100-K Area only)
Hanford town site	Grab	Annually	Alpha, beta, ^{3}H, ^{129}I, ^{90}Sr, ^{99}Tc, U, gamma energy analysis, metals (filtered and unfiltered), anions
300 Area	Grab	Annually	Alpha, beta, ^{3}H, ^{129}I, ^{90}Sr, U, gamma energy analysis, metals (filtered and unfiltered), anions, VOA

(a) U = Isotopic uranium-234, uranium-235, and uranium-238.
VOA = Volatile organic compounds.

Table 8.5.2. Hanford Reach Shoreline Springs Sediment Monitoring, 2004

Springs Locations[a]	Frequency	Analyses
100-B Area	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals
100-K Area	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals
100-N Area	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals
100-F Area	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals
Hanford town site	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals
300 Area	Annually	Gamma energy analysis, ^{90}Sr, U,[b] metals

(a) See Figure 8.4.1.
(b) U = Isotopic uranium-234, uranium-235, and uranium-238 analyzed by low-energy photon analysis.

2004. This section describes the monitoring efforts and summarizes the results for these aquatic environments. Detailed analytical results are reported in PNNL-15222, APP. 1. Analytes of interest for samples from shoreline springs were selected based on findings of previous investigations, reviews of contaminant concentrations observed in nearby groundwater monitoring wells, and results of preliminary risk assessments. Sampling is conducted annually when river flows are low, typically in early fall.

All samples collected during 2004 were analyzed for gamma-emitting radionuclides, gross alpha, gross beta, and tritium. Samples from selected springs were analyzed for strontium-90, technetium-99, iodine-129, uranium-234, uranium-235, and uranium-238. All samples were analyzed for metals and anions. Samples from selected locations were analyzed for volatile organic compounds. All analyses were conducted on unfiltered samples, except for metals analyses, which were conducted on both filtered and unfiltered samples (Appendix C, Table C.9; PNNL-15222, APP. 1).

8.5.1.2 Radiological Results for Water Samples from Columbia River Shoreline Springs

Contaminants of Hanford origin continued to be detected in water from shoreline springs entering the Columbia River along the Hanford Site during 2004. Tritium, strontium-90, technetium-99, iodine-129, uranium-234, uranium-235, and uranium-238 were detected in spring water (Appendix C, Table C.9). All radiological contaminant concentrations measured in shoreline springs during 2004 were less than applicable DOE derived concentration guides (DOE Order 5400.5; Appendix D, Table D.5).

Gross beta concentrations in shoreline spring water at the 100-B Area, 100-H Area, Hanford town site, and 300 Area were elevated compared to other shoreline spring water locations.

Tritium concentrations varied widely with location. The highest tritium concentration measured in shoreline springs was at the Hanford town site (67,000 ± 4,800 pCi/L [2,500 ± 180 Bq/L]), which was above the Washington State ambient surface-water quality criterion of 20,000 pCi/L (740 Bq/L) (WAC 173-201A; 40 CFR 141), followed by 11,000 ± 430 pCi/L (420 ± 16 Bq/L) in the 100-N Area, and 11,000 ± 880 pCi/L (430 ± 33 Bq/L) in the 300 Area. Tritium concentrations in all shoreline spring samples were elevated compared to the 2004 average Columbia River concentration at Priest Rapids Dam (23 ± 12 pCi/L [0.85 ± 0.44 Bq/L]). Figure 8.5.1 depicts concentrations of selected radionuclides in 300 Area shoreline spring water (spring 42-2 and spring DR 42-2) from 1999 through 2004. Concentrations of radionuclides in 300 Area shoreline springs in 2004 were lower than in previous years and reflected the lower specific conductivity values reported with the samples (i.e., bank storage effect). The elevated tritium levels measured in 300 Area shoreline springs are indicators of the contaminated groundwater plume from the 200 Areas (Section 5.9 in PNL-10698). Tritium was the only specific radionuclide detected in 100-N Area shoreline spring water during 2004.

Samples from shoreline springs were analyzed for strontium-90 in the 100-B, 100-K, 100-N, 100-D, 100-H, 100-F, and 300 Areas. The highest strontium-90 concentration detected in shoreline spring water was at the 100-H Area (6.8 ± 1.1 pCi/L [0.25 ± 0.041 Bq/L]). This value was 85% of the ambient surface-water quality criterion of 8 pCi/L (0.30 Bq/L). Groundwater at the 100-N Area has historically had the highest strontium-90 concentrations; however, since 1997, no visible shoreline springs have been observed along the shoreline where strontium-90 concentrations in groundwater are elevated.

Samples from shoreline springs in the 100-B, 100-K, 100-H Areas, and at the Hanford town site were analyzed for technetium-99. All results for technetium-99 were below the EPA drinking water standard of 900 pCi/L (33 Bq/L) (Appendix D, Table D.2). The highest technetium-99 concentration was found in shoreline spring water from the Hanford town site (78 ± 4.5 pCi/L [2.9 ± 0.17 Bq/L].

Samples from shoreline springs at the Hanford town site and 300 Area were analyzed for iodine-129. The highest concentration was measured in a water sample from the Hanford town site spring (0.20 ± 0.014 pCi/L [0.0074 ± 0.00052 Bq/L]). This Hanford town site value was roughly 22,000 times higher than the 2004 average concentration measured at Priest Rapids Dam (0.0000091 ± 0.0000050 pCi/L [0.00000034 ± 0.000000018 Bq/L]) but was below the surface-water quality criterion of 1 pCi/L (0.037 Bq/L) (Appendix D, Table D.2). Concentrations

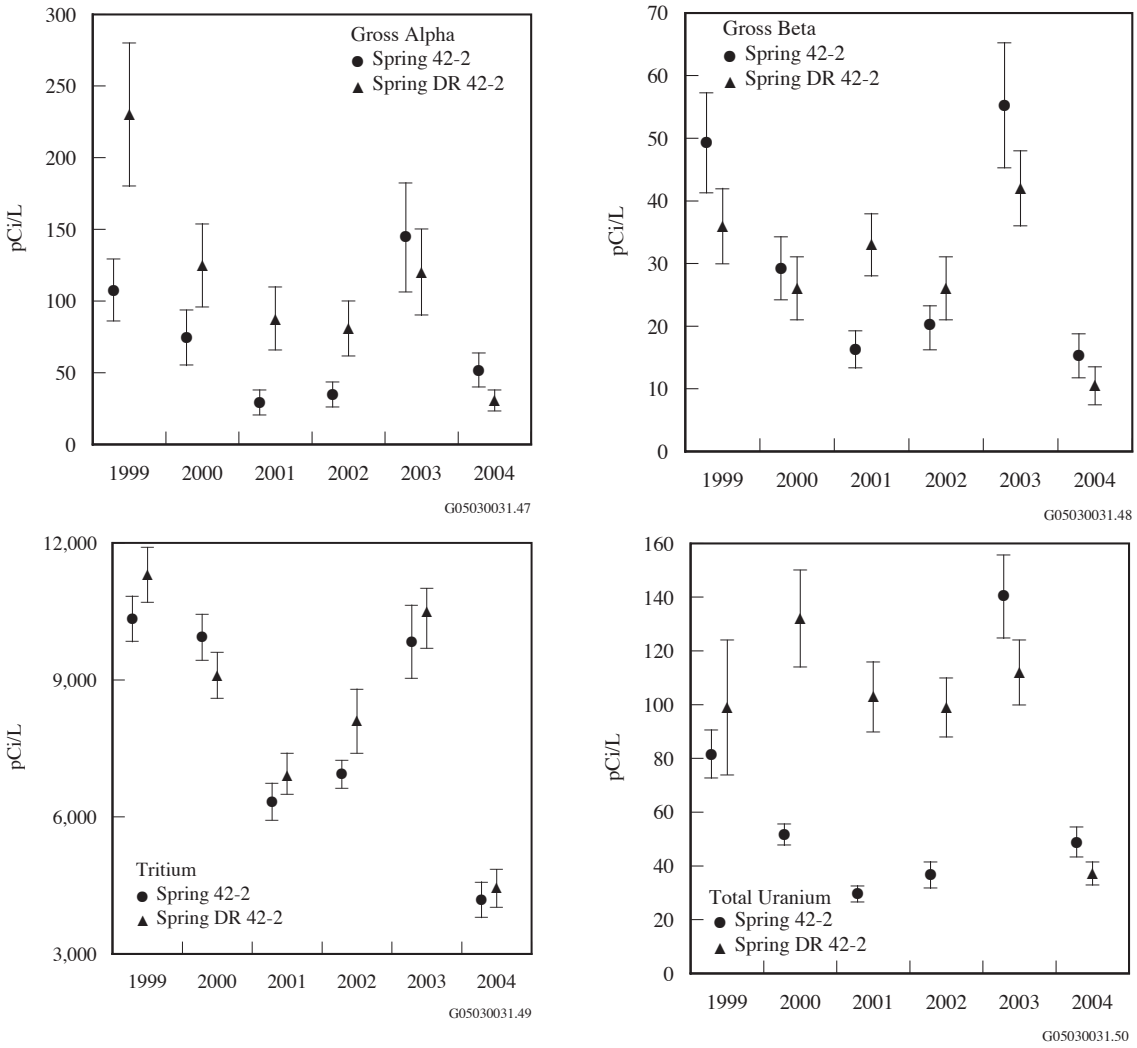

Figure 8.5.1. Concentrations (results ±2 total propagated analytical uncertainty) of Selected Radionuclides in Water from Columbia River Shoreline Springs Near the Hanford Site's 300 Area, 1999 through 2004. Multiple samples were collected for 300 Area shoreline springs in 2001, the results are for the May 10, 2001 sampling event. Note: DR refers to downriver, thus DR 42-2 is a spring located downriver from Hanford Mile Marker 42-2.

of selected radionuclides in shoreline spring water near the Hanford town site (spring 28-2) from 1999 through 2004 are provided in Figure 8.5.2. Annual fluctuations in these values reflect the influence of bank storage during the sampling period.

Uranium was analyzed for in shoreline spring water samples from the 100-H Area, 100-F Area, Hanford town site, and 300 Area in 2004 (Figure 8.4.1). The highest total uranium level was found in 300 Area spring water (48 ± 5.5 pCi/L [1.8 ± 0.20 Bq/L] or approximately 43 ± 5.0 µg/L), which was collected downgradient from the retired 300 Area process trenches. The total uranium concentration in this spring exceeded the EPA drinking water standard of 30 µg/L (approximately 27 pCi/L [1.0 Bq/L]). The 300 Area spring had an elevated gross alpha concentration (48 ± 11 pCi/L [1.8 ± 0.041 Bq/L], which exceeded the Washington State ambient surface water quality criterion of 15 pCi/L (0.56 Bq/L) (Appendix D, Table D.2). Elevated uranium concentrations exist in the unconfined aquifer beneath the 300 Area in the vicinity of former uranium fuel fabrication facilities and inactive waste sites. The increase in uranium concentrations in 2003 samples from shoreline spring 42-2 was not

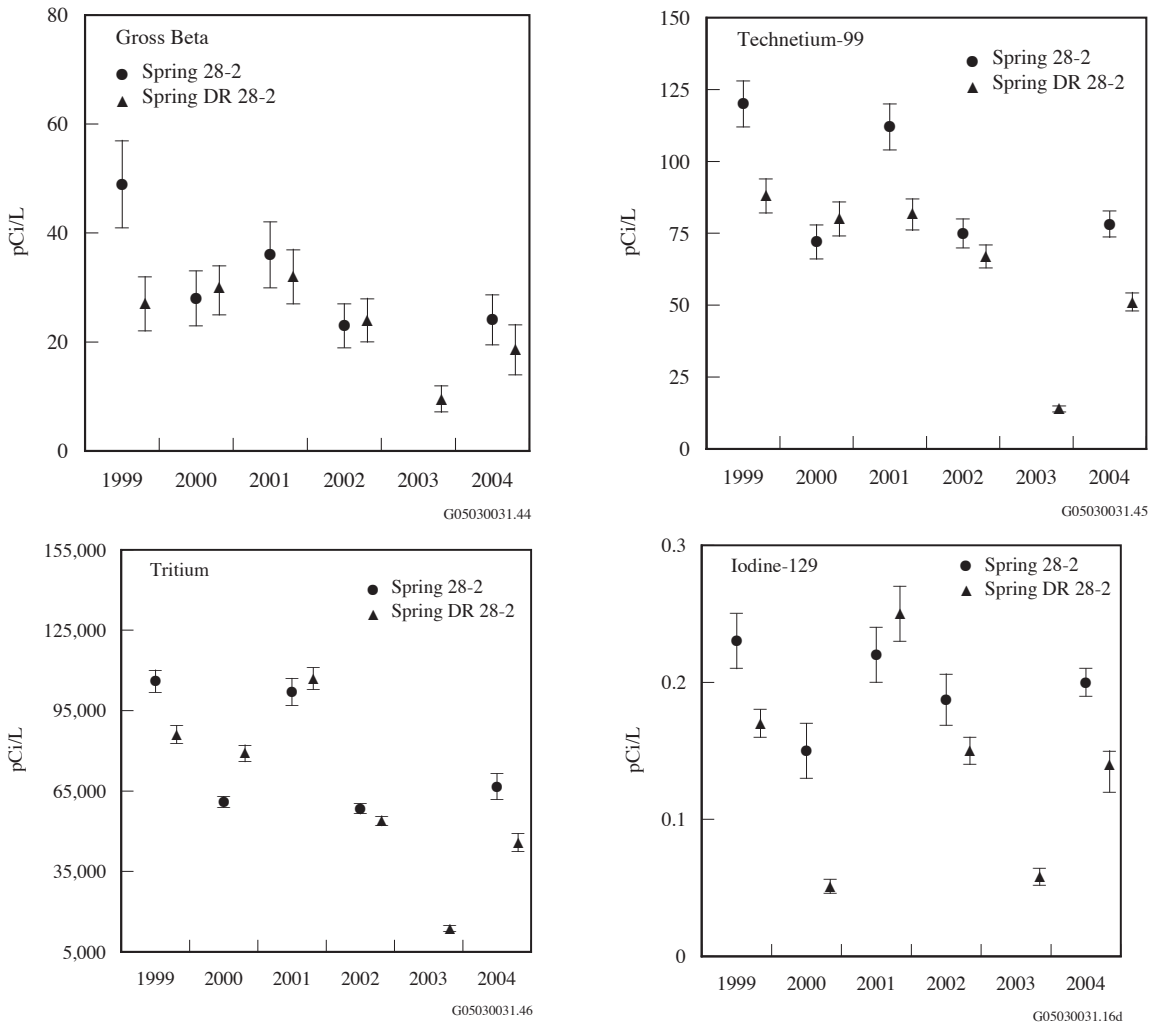

Figure 8.5.2. Concentrations (results ±2 total propagated analytical uncertainty) of Selected Radionuclides in Columbia River Shoreline Springs Water at the Hanford Town Site (Spring 28-2 and Spring 28-2 DR), 1999 through 2004. As a result of figure scale, some uncertainties (error bars) are concealed by the point symbol. Note: DR refers to downriver, thus DR 28-2 is a spring located downriver from Hanford Mile Marker 28-2.

unexpected. A pulse of increased uranium concentrations in groundwater was created by waste site excavation activities during fall 2002 at a location just inland of this shoreline spring (PNNL-14548). The pulse has passed well 399-1-10A, located adjacent to the spring, and has now probably discharged to the river. The gross alpha and gross beta concentrations in 300 Area shoreline spring water from 1999 through 2004 parallel uranium and are likely associated with its presence. Concentrations of radionuclides in 300 Area shoreline springs in 2004 were lower than in previous years and reflected the lower specific conductivity values reported with the samples (i.e., bank storage effect).

8.5.1.3 Chemical Results for Water Samples from Columbia River Shoreline Springs

Hanford-origin contaminants continued to be detected in water from shoreline springs entering the Columbia River along the Hanford Site during 2004. Metals and anions

(chloride, fluoride, nitrate, and sulfate) were detected in spring water. Volatile organic compounds were near or below the detection limits for all samples. Trichloroethene, toluene, and xylenes were detected in shoreline spring water samples from the 300 Area and were the only analytes with detectable values for all shoreline spring locations (all detected values were <1 µg/L). Trichloroethene has been consistently detected at low concentrations in 300 Area shoreline spring water.

Concentration ranges of selected chemicals measured in shoreline spring water during 1999 through 2004 are presented in Table 8.5.3. For most locations, the 2004 chemical sample results were similar to those reported previously (PNNL-14687). Nitrate concentrations were highest in spring water samples from the Hanford town site. Dissolved chromium concentrations were highest in the 100-D, 100-B, 100-H, and 100-N Areas' shoreline springs. Hanford groundwater monitoring results for 2004 indicated similar contaminant concentrations in shoreline areas (Section 8.7, Figure 8.7.6).

The ambient surface-water quality criteria for cadmium, copper, lead, nickel, silver, and zinc are total-hardness dependent (WAC 173-201A; Appendix D, Table D.3). For comparison purposes, spring water criteria were calculated using the same 47-milligram calcium carbonate per liter hardness given in Appendix D, Table D.3. The concentrations of most metals measured in water collected from shoreline springs along the Hanford Site shoreline during 1999 through 2004 were below Washington State ambient surface-water chronic toxicity levels (WAC 173-201A). However, concentrations of dissolved chromium in 100-B, 100-N, 100-D, 100-H, and 100-F Areas' shoreline spring water were above the Washington State ambient surface water chronic toxicity level (Appendix D, Table D.3) and above the acute toxicity level at the 100-B, 100-K, 100-D, 100-H, and 100-F Areas. Arsenic concentrations in shoreline spring water were well below the Washington State ambient surface-water chronic toxicity level, but concentrations in all samples (including upriver Columbia River water samples) exceeded the federal limit for the protection of human health for the consumption of water and organisms; however, this EPA value is more than 10,500 times lower than the Washington State chronic toxicity standard (40 CFR 141; Appendix D, Table D.3). Nitrate concentrations at all spring water locations were below the drinking water standard (Appendix D, Table D.2).

8.5.2 Monitoring Columbia River Shoreline Springs Sediment

G. W. Patton

Sampling of sediment from shoreline springs began during 1993 at the Hanford town site and the 300 Area. Sampling of shoreline springs sediment in the 100-B, 100-K, and 100-F Areas began during 1995. Substrates at sampling locations of shoreline springs in the 100-N, 100-D, and 100-H Areas consist predominantly of large cobble and are unsuitable for sampling.

Radiological Results for Sediment Samples from Columbia River Shoreline Springs

During 2004, sediment samples were collected at shoreline springs in the 100-B, 100-F, and 300 Areas and the Hanford town site. No sediment was available for sampling at the 100-K Area location because the spring that was scheduled for sampling was not flowing and an alternate spring was sampled (i.e., only water samples were collected; no sediment was found). Results for 2004 samples were similar to those observed for previous years (PNNL-15222; APP. 1; Appendix C, Table C.7). Potassium-40, cesium-137, and uranium isotopes were the only radionuclides reported above the minimum detectable concentrations. During 2004, radionuclide concentrations in shoreline spring sediment were similar to those observed in Columbia River sediment, with the exception of the 300 Area where uranium concentrations were roughly two to four times the background concentrations measured for sediment from Priest Rapids Dam. Elevated uranium concentrations for 300 Area spring sediment compared to Priest Rapids Dam sediment have been previously reported (PNNL-14687).

Concentrations of metals in shoreline spring sediment samples during 2004 were similar to concentrations in Hanford Reach Columbia River sediment samples. Currently, there are no Washington State freshwater sediment quality criteria for comparison to the measured values.

Table 8.5.3. Concentration Ranges for Selected Chemicals in Water Monitoring Samples from Columbia River Shoreline Springs at the Hanford Site, 1999 through 2004

	Ambient Water Quality Criterion Level[a]	Concentration, µg/L							
		100-B Area	100-K Area	100-N Area	100-D Area	100-H Area	100-F Area	Hanford Town Site	300 Area
No. of Samples		14	11	7	10	16	7	11	9
Dissolved Metals (µg/L)									
Antimony	NA	0.081 - 0.31	0.13 - 0.29	0.16 - 0.29	0.17 - 0.26	0.18 - 0.42	0.096 - 0.23	0.13 - 0.39	0.18 - 0.36
Arsenic	190	0.60 - 1.6	0.32 - 2.1	1.4 - 3.4	0.54 - 1.3	0.30 - 3.0	1.4 - 2.6	0.99 - 4.8	0.95 - 2.9
Cadmium	0.59	0.0056 - 0.024	0.0044 - 0.051	0.011 - 0.031	0.014 - 0.093	0.0044 - 0.040	0.0091 - 0.045	0.010 - 0.089	0.012 - 0.078
Chromium	10[b]	7.5 - 20	0.97 - 82	5.6 - 12	10 - 150	4.0 - 88	3.3 - 22	0.52 - 4.6	2.2 - 5.0
Copper	6	0.20 - 2.1	0.37 - 1.1	0.25 - 0.43	0.38 - 1.4	0.29 - 5.6	0.32 - 1.1	0.20 - 0.88	0.32 - 0.60
Lead	1.1	0.004 - 0.60	0.004 - 0.14	0.0050 - 0.17	0.0073 - 0.20	0.0050 - 0.57	0.0078 - 0.16	0.004 - 0.14	0.0050 - 0.35
Nickel	83	0.028 - 1.6	0.12 - 1.7	0.027 - 1.7	0.22 - 5.0	0.070 - 1.3	0.070 - 2.2	0.62 - 1.7	0.055 - 2.1
Silver	0.94[c]	0.0012 - 0.021	0.0012 - 0.021	0.0012 - 0.021	0.0017 - 0.021	0.0050 - 0.021	0.0012 - 0.042	0.0017 - 0.053	0.0017 - 0.021
Thallium	NA	0.0035 - 0.020	0.0035 - 0.023	0.0071 - 0.016	0.009 - 0.098	0.0059 - 0.026	0.0035 - 0.011	0.010 - 0.028	0.010 - 0.038
Zinc	55	0.14 - 5.0	0.43 - 3.7	1.2 - 3.7	1.2 - 12	0.35 - 5.0	0.66 - 2.5	0.54 - 3.1	0.93 - 3.0
No. of Samples		11	11	7	10	15	7	16	10
Total Recoverable Metals (µg/L)									
Chromium	96[d]	7.2 - 20	1.2 - 93	7.6 - 14	11 - 190	4.0 - 99	10 - 33	0.88 - 5.4	1.9 - 24
Mercury	0.012	0.00038 - 0.0013[e]	0.00098 - 0.014[f]	0.00044 - 0.0062[g]	0.00047 - 0.020[e]	0.00056 - 0.041[h]	0.0017 - 0.012[g]	0.00079 - 0.0052[i]	0.00074 - 0.0047[e]
Selenium	5	0.50 - 2.2	0.10 - 2.2	0.41 - 0.96	0.10 - 2.7	0.15 - 2.9	0.68 - 2.3	0.45 - 2.3	1.7 - 4.1
No. of Samples		14	11	5	16[j]	19	9	13	9
Anions (mg/L)									
Nitrate	45[k]	0.1 - 3.4	0.028 - 4.9	2.0 - 4.9	0.41 - 6.3	0.10 - 20	0.11 - 33	0.47 - 8.1	1.7 - 6.4

(a) Ambient Water Quality Criteria Values (WAC 173-201A-040) for chronic toxicity unless otherwise noted.
(b) Value for hexavalent chromium.
(c) Value for acute toxicity; chronic value not available.
(d) Value for trivalent chromium.
(e) Number of samples = 9.
(f) Number of samples = 7.
(g) Number of samples = 5.
(h) Number of samples = 11.
(i) Number of samples = 14.
(j) One nitrate result of 295 mg/L for riverbank spring (SD-110-2) on October 17, 2000, was not included in the range because it was considered an anomalously high value.
(k) Drinking water standard (WAC 246-290).
NA = Not available.

8.5.3 Radiological Monitoring of Columbia River Shoreline Spring Water in Seep Wells in the 100-N Area (N Springs)

C. J. Perkins

In the past, radioactive effluent streams from operations in the 100-N Area were sent to the now retired 116-N-1 (1301-N) and 116-N-3 (1325-N) liquid waste disposal facilities (i.e., engineered soil columns). After moving through the soil column to the water table, this wastewater migrated with the groundwater and entered the Columbia River via springs located along the adjacent shoreline region sometimes called N Springs. Historically, the highest concentrations of radionuclides have been in the general vicinity of monitoring well 199-N-46. Well 199-N-46 is a 7.5-meter- (24.5-foot-) deep groundwater well with a 15.2-centimeter (6-inch) diameter located along the river shoreline at N Springs. Water from shoreline springs and/or shoreline seep wells along the N Springs area is sampled annually to verify that the radionuclide release estimates at N Springs, based on analyses of water samples collected routinely from monitoring well 199-N-46, are not under reported. The locations of the shoreline seep wells and monitoring well 199-N-46, as well as a comprehensive presentation of the analytical data from well water samples, are available in PNNL-15222, APP. 2.

The shoreline seep wells are constructed such that shallow, subsurface (down to 1.06 meters [3.5 feet]) run-off water is intercepted and collected within a 30.5-centimeter (12-inch) diameter casing. The series of 13 shoreline seep wells, approximately 46 to 61 meters (150 to 200 feet) apart, were installed in the late 1970s in locations where surface spring water run-off was visible. To prevent accidental contamination of personnel and wildlife that might wander through the area, the entire expanse of the N Springs run-off area was covered with large boulders immediately after the shoreline seep wells were installed.

Shoreline seep-well samples were analyzed for strontium-90, tritium, and gamma-emitting radionuclides. Analytical results and discussion of these releases may be found in Section 8.3 and in HNF-EP-0527-14, *Environmental Releases for Calendar Year 2004*. A groundwater pump-and-treat system designed to reduce the discharge of strontium-90 to the Columbia River in the 100-N Area was put into operation in 1995 and continued to operate in 2004. Additional discussion about this system and its effects may be found in Section 8.7.

During October 2004, samples were collected from eight of the thirteen 100-N Area shoreline seep wells (i.e., one sample from each well). Five of the wells were dry at the time of sample collection. The samples were collected using a bailer carefully lowered into the water column of each well to avoid sediment suspension, and a 4-liter (1-gallon) sample was obtained. Strontium-90 was detected in all eight of the seep-well water samples, and none of the concentrations exceeded DOE derived concentration guide values (Appendix D, Table D.5). Tritium and gamma-emitting radionuclide concentrations were below analytical detection limits in all eight samples. Maximum and average tritium and strontium-90 concentrations in seep wells, and in well 199-N-46, are summarized in Table 8.5.4. Tritium and strontium-90 data from 2004 shoreline spring water samples, including surveillance samples collected near N Springs, are summarized in Appendix C, Table C.9.

Table 8.5.4. Radionuclide Concentrations (pCi/L)[a] in Samples Collected from Wells Along the Columbia River Shoreline in the 100-N Area (N Springs), 2004

	N Springs Monitoring Well, 199-N-46		N Springs Seep Wells		
Radionuclide	Maximum[b]	Average[c]	Maximum[b]	Average[c]	DCG[d]
Tritium	820 ± 130	250 ± 770	ND	ND	2,000,000
Strontium-90	3,400 ± 41	2,200 ± 1,700	19 ± 3.8	6.0 ± 13	1,000

(a) To convert to international metric system units (SI), multiply pCi/L by 0.03704 to obtain Bq/L.
(b) ± total analytical uncertainty.
(c) ±2 standard deviations.
(d) DOE derived concentration guide (DOE Order 5400.5).
ND = Not detected.