4.3 Radiological Surveillance of Hanford Site Drinking Water

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The quality of drinking water at the Hanford Site is monitored by routinely collecting and analyzing drinking water samples and comparing the resulting analytical data with established drinking water standards and guidelines (WAC 246-290; 40 CFR 141; EPA-570/9-76-003; EPA 822-R-96-001; Appendix D, Tables D.2 and D.5). During 2002, Pacific Northwest National Laboratory conducted radiological surveillance of drinking water supplied to Hanford Site facilities by DOE-owned pumps and water treatment facilities. Fluor Hanford, Inc. conducted routine chemical and microbiological monitoring of these drinking water systems.

The community drinking water standards of the *Safe Drinking Water Act* apply to the drinking water supplies at the Hanford Site (DOE Order 5400.5). In Washington State, adherence to these standards is enforced by the Washington State Department of Health. Washington Administrative Code (WAC 246-290) requires that all drinking water analytical results be reported routinely to the Washington State Department of Health. Radiological results for the Hanford Site are reported to the state through this annual environmental report and through an annual supplemental data compilation (PNNL-14295, APP. 1). Non-radiological data are reported to the state by Fluor Hanford, Inc. but are not published.

All DOE-owned drinking water systems on the Hanford Site were in compliance with community drinking water standards for radiological contaminant levels during 2002. Contaminant concentrations measured during the year were similar to those observed in recent years (see Section 4.3 in PNNL-13487; PNNL-13910).

4.3.1 Hanford Site Drinking Water Systems

During 2002, drinking water was supplied to DOE facilities on the site by nine DOE-owned, contractor-operated, water treatment and distribution systems (Table 4.3.1), and one system owned and operated by the city of Richland. Eight of these systems (including Richland's system) used water pumped from the Columbia River. One system used groundwater pumped from the unconfined aquifer beneath the site. Fluor Hanford, Inc. operated most of the systems. Bechtel Hanford, Inc. operated one system in the 100-N Area that was supplied with water from a pumping station operated by Fluor Hanford, Inc. The city of Richland provided drinking water to the 300 Area, Richland North Area, and Hazardous Materials Management and Emergency Response Training and Education Center (HAMMER) facility.

4.3.2 Hanford Site Drinking Water Supply Facilities

During 2002, radionuclide concentrations in onsite drinking water were monitored at four DOE-owned water supply facilities (Figure 4.3.1). The 100-B Area pumphouse continued to serve as the primary Columbia River pumping station for many areas on the site (100-B and 100-N Areas, 200-West Area, 251 Building, and 100 Areas Fire Station). The 181-KE pumphouse supplied water (Columbia River) for the 100-K Area. Water for the 200-East Area, which formerly came from the 283-E water treatment plant located in the 200-East Area, was supplied by the 283-W water treatment plant (located in the 200-West Area). Water for this treatment plant was obtained from the Columbia River via the 100-B or 100-D raw water export lines. The 283-E treatment plant was designated as an emergency supply facility in 1999 and was maintained in a standby mode during 2002. The 181-D pumphouse in the 100-D Area continues to operate and supply water to the 100-D raw water export line. This line was used as a backup to the 100-B raw water export line during 2002.

Table 4.3.1. DOE-Owned Drinking Water Systems[a] on the Hanford Site, 2002

Location	Source of Supply	Notes
100-D	Columbia River via 181-B or D raw water export	The 100-D water treatment facility was permanently removed from service on July 12, 2000, but the pumping facility remains operational.
100-B	Columbia River via 181-B pumphouse and 100-B raw water export line or via the 181-D pumphouse and 100-D raw water export line	Filtered and chlorinated at 182-B Reservoir pumphouse.
100-K	Columbia River via 181-KE pumphouse	Filtered and chlorinated at 185-KE Water Treatment Plant.
100-N	Columbia River via 181-B pumphouse and 100-B raw water export line or via the 181-D pumphouse and 100-D raw water export line	Filtered and chlorinated at 186-N Water Treatment Plant. This is a small skid-mounted package plant that contains three banks of various sized filters and a sodium hypochlorite system for disinfection.
200-East	Normally from the Columbia River via the 283-W Water Treatment Plant. In emergencies, supplied via 181-B or D raw water export and 283-E Water Treatment Plant.	Filtered and chlorinated at 283-W Water Treatment Plant. The clearwells at 283-E serve as reservoirs that supply the 200-East Area distribution system. Under normal conditions, the clearwells are supplied from the 283-W Water Treatment Plant. The 283-E Water Treatment Plant is maintained in standby mode for emergencies.
200-West	Columbia River via 181-B pumphouse and 100-B raw water export line or via the 181-D pumphouse and 100-D raw water export line	Filtered and chlorinated at 283-W Water Treatment Plant.
251 Building (electrical switching)	Columbia River via 181-B pumphouse and 100-B raw water export line or via the 181-D pumphouse and 100-D raw water export line	Filtered and chlorinated at 251 Building.
609 Building (100 Areas Fire Station)	Columbia River via 181-B pumphouse and 100-B raw water export line or via the 181-D pumphouse and 100-D raw water export line	Filtered and chlorinated at 609 Building.
400 Area	Wells 499-S1-8J, 499-S0-8, and 499-S0-7	Supplied from well 499-S1-8J (P-16); wells 499-S0-8 (P-14) and 499-S0-7 (P-15) are the dire emergency supplies. Whichever well has the lowest tritium levels, as demonstrated by sampling and analysis, is considered the primary backup well. Well P-15 was not used in 2002. Chlorination only.
300 Area	Treated Columbia River water via city of Richland	300 Area distribution system.

(a) The system in the 100-N Area was operated by Bechtel Hanford, Inc. All other systems were operated by Fluor Hanford, Inc.

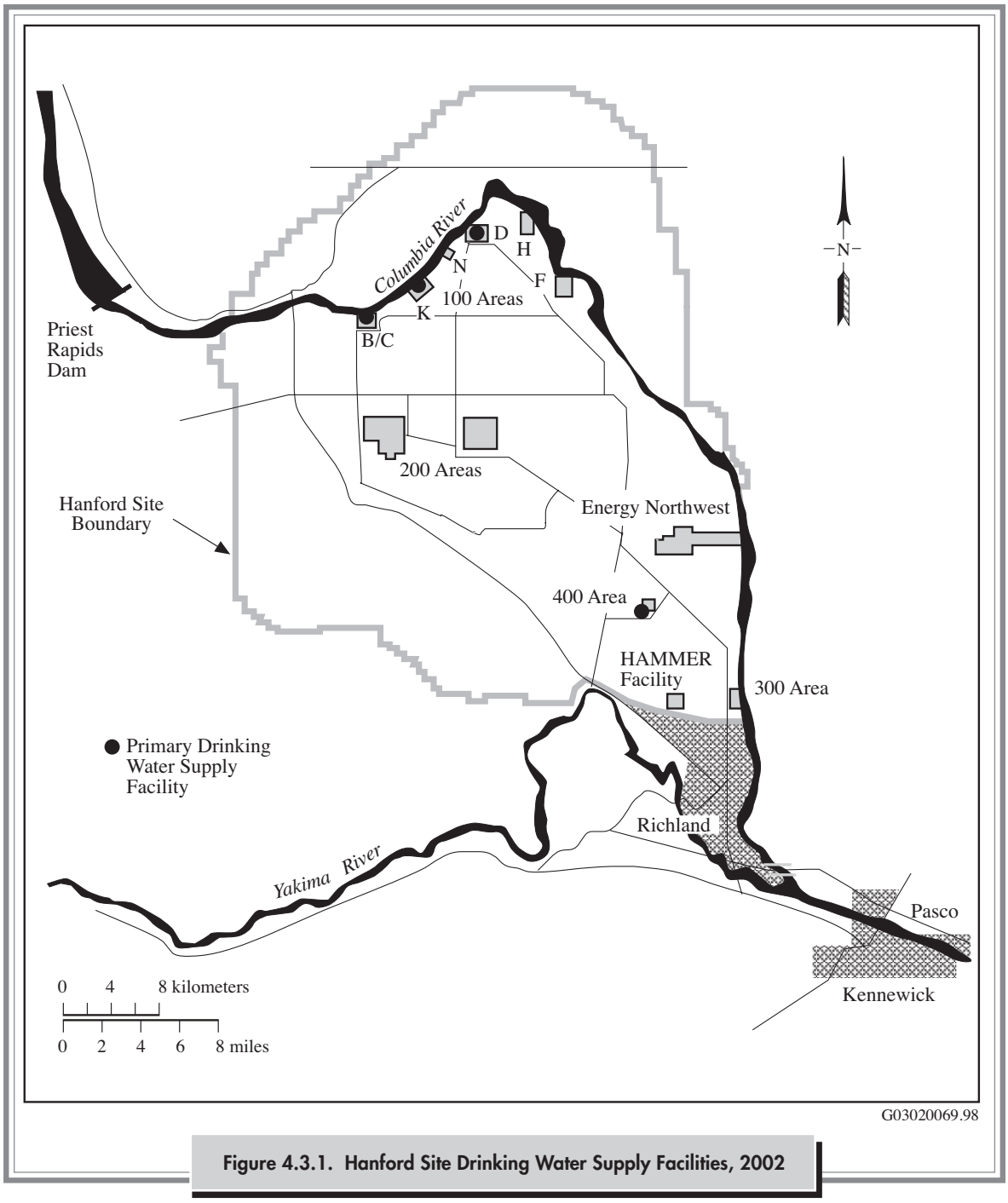

Figure 4.3.1. Hanford Site Drinking Water Supply Facilities, 2002

The 400 Area continued to use well 499-S1-8J (P-16) as the primary drinking water supply well, with wells 499-S0-8 (P-14) and 499-S0-7 (P-15) serving as backup supplies. The backup well with the lowest tritium level, as demonstrated by sampling and analysis, is considered the primary backup water supply. Well 499-S0-7 was not used as a drinking water source during 2002. Well 499-S0-8 supplied 2.13 million liters (564,000 gallons) to the distribution system in March, 154,000 liters (40,800 gallons) in May, and 1.5 million liters (399,600 gallons) in August. At these times, the primary supply well (499-S1-8J) was off-line due to an electrical outage and scheduled maintenance, an electrical outage, and an unscheduled maintenance, respectively. In addition to supplying drinking water, these three wells were also important for maintaining fire suppression capabilities within the 400 Area, where they are located.

4.3.3 Collection of Drinking Water Samples and Analytes of Interest

Drinking water samples were collected for radiological analyses according to a schedule established at the beginning of the calendar year (PNNL-13749). Samples at all of the locations were collected and analyzed quarterly. All were samples of treated water collected prior to distribution to facilities.

The Hanford Groundwater Monitoring Project collected samples of raw well water from each of the 400 Area drinking water wells four times during the first half of the calendar year. Beginning in April 2002, collection frequency changed from monthly to quarterly, with collections occurring during the first month of each quarter. The samples for the last quarter of the calendar year were scheduled for collection during October but, because of facility problems, were not obtained.

Drinking water samples obtained from the 400 Area during May were co-sampled with the Washington State Department of Health. The analytical results from the state's samples help to verify the quality of the drinking water data reported herein and in PNNL-14295, APP. 1.

Water from the city of Richland's system was not monitored for radiological contaminants in the 300 and Richland North Areas and at the HAMMER facility, through the site drinking water surveillance project; however, personnel from Pacific Northwest National Laboratory's Surface Environmental Surveillance Project routinely collected water samples from the Columbia River at the Richland Pumphouse, which is the city of Richland's drinking water intake. The analytical results (radiological) for these raw river water samples can be found in Appendix B (Table B.2). The city of Richland also monitored its water for radiological and chemical contaminants, and for general water quality and reported those data in its annual newsletter to consumers (City of Richland 2003), and on its web page (http://www.ci.richland.wa.us/UPS/waterquality.html).

Sampling of 300 Area drinking water for non-radiological analyses was conducted routinely by Fluor Hanford, Inc. to monitor the DOE-owned, contractor-operated water distribution system within the area. However, as stated earlier, non-radiological data are reported directly to the state and are not discussed in this report.

All 2002 drinking water samples collected for radiological analysis were analyzed for gross alpha, gross beta, tritium, strontium-90, iodine-131, radium-226, and radium-228.

4.3.4 Radiological Results for Hanford Site Drinking Water Samples

Results for radiological monitoring of Hanford Site drinking water during 2002 are summarized in Table 4.3.2. Individual analytical results are reported in PNNL-14295, APP. 1. The maximum amount of beta-gamma radiation from manmade radionuclides allowed in drinking water by Washington State and the EPA is an annual average concentration that will not produce an annual dose equivalent to the whole body or any internal organ >4 mrem (>0.04 mSv). If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any internal organ must not exceed 4 mrem (0.04 mSv). Maximum contaminant levels for gross alpha (excluding uranium and radon), and radium-226 and radium-228 (a combined total) are 15 pCi/L (0.56 Bq/L) and 5 pCi/L (0.18 Bq/L), respectively. The maximum allowable limit for tritium is 20,000 pCi/L (740 Bq/L) (40 CFR 141; WAC 246-290). During 2002, annual average concentrations of all monitored radionuclides in Hanford Site drinking water were well below state and federal maximum contaminant levels. All iodine-131 and gross alpha results were below their respective analytical detection limits (that is, concentrations were so low that they could not be measured) and concentrations of gross beta, tritium, and radium-228 in half of the samples analyzed during the year were also below their respective detection limits (Table 4.3.2).

The Hanford Groundwater Monitoring Project collected and analyzed raw water samples from all three 400 Area drinking water wells. Results from these samples show that tritium levels are lowest in wells 499-S1-8J and 499-S0-8 and consistently highest in well 499-S0-7 (Table 4.3.3;

Table 4.3.2. Concentrations (pCi/L)[a] of Selected Radiological Constituents in Hanford Site Drinking Water, 2002

Constituent	No. of Samples[b]	Systems				Standards
		100-K Area	100-N Area	200-West Area	400 Area	
Gross alpha[c]	4	-0.02 ± 0.58[d]	0.40 ± 1.09[d]	0.51 ± 0.66[d]	0.48 ± 1.19[d]	15[e,f]
Gross beta[c]	4	0.47 ± 2.22[d]	1.11 ± 4.15	0.49 ± 1.04[d]	6.93 ± 1.90	50[f]
Tritium[c]	3[g]	44.2 ± 88.4[d]	78.4 ± 105.9[d]	154.7 ± 257.6	3,160 ± 311	20,000[f]
Strontium-90[c]	3	0.08 ± 0.04	0.07 ± 0.03	0.07 ± 0.03	0.006 ± 0.03[d]	8[e,f]
Iodine-131[h]	1	1.05 ± 6.2[i]	-1.87 ± 5.3[i]	-2.27 ± 4.7[i]	1.91 ± 5.9[i]	3[j]
Radium-226[h]	1	0.05 ± 0.01	0.03 ± 0.01	0.08 ± 0.02	0.03 ± 0.01	combined
Radium-228[h]	1	0.29 ± 0.24[i]	0.67 ± 0.29	0.62 ± 0.30	0.52 ± 0.31[i]	5[f]

(a) Multiply pCi/L by 0.037 to convert to Bq/L.
(b) Grab samples collected and analyzed quarterly.
(c) Annual average ±2 standard deviations.
(d) Analytical results for all samples were below the detection limit.
(e) WAC 246-290.
(f) 40 CFR 141.
(g) Four samples at the 400 Area.
(h) Single result ±2 total propagated analytical error.
(i) Below the detection limit.
(j) EPA-570/9-76/003.

Table 4.3.3. Tritium Concentrations (pCi/L)[a] in Hanford Site 400 Area Drinking Water Wells, 2002[b]

Sampling Date	Primary Drinking Water Well 499-S1-8J (P-16)	Backup Drinking Water Well 499-S0-8 (P-14)	Backup Drinking Water Well 499-S0-7 (P-15)
Jaunuary 15, 2002	3,420 ± 450	3,510 ± 460	11,300 ± 860
February 8, 2002	3,610 ± 410	3,340 ± 390	13,000 ± 850
April 15, 2002	3,170 ± 430	3,480 ± 450	11,400 ± 850
July 16, 2002	3,420 ± 390	3,590 ± 400	12,500 ± 820

(a) Multiply pCi/L by 0.037 to convert to Bq/L.
(b) Reported concentration ±2 total propagated analytical error.

Figure 4.3.2). A tritium plume that originates in the 200-East Area extends under the 400 Area and has historically affected tritium concentrations in wells 499-S0-7 and 499-S0-8 (Figure 4.3.2). During 2002, annual average tritium concentrations in all three wells were below the 20,000 pCi/L (740 Bq/L) state and federal annual average drinking water standard.

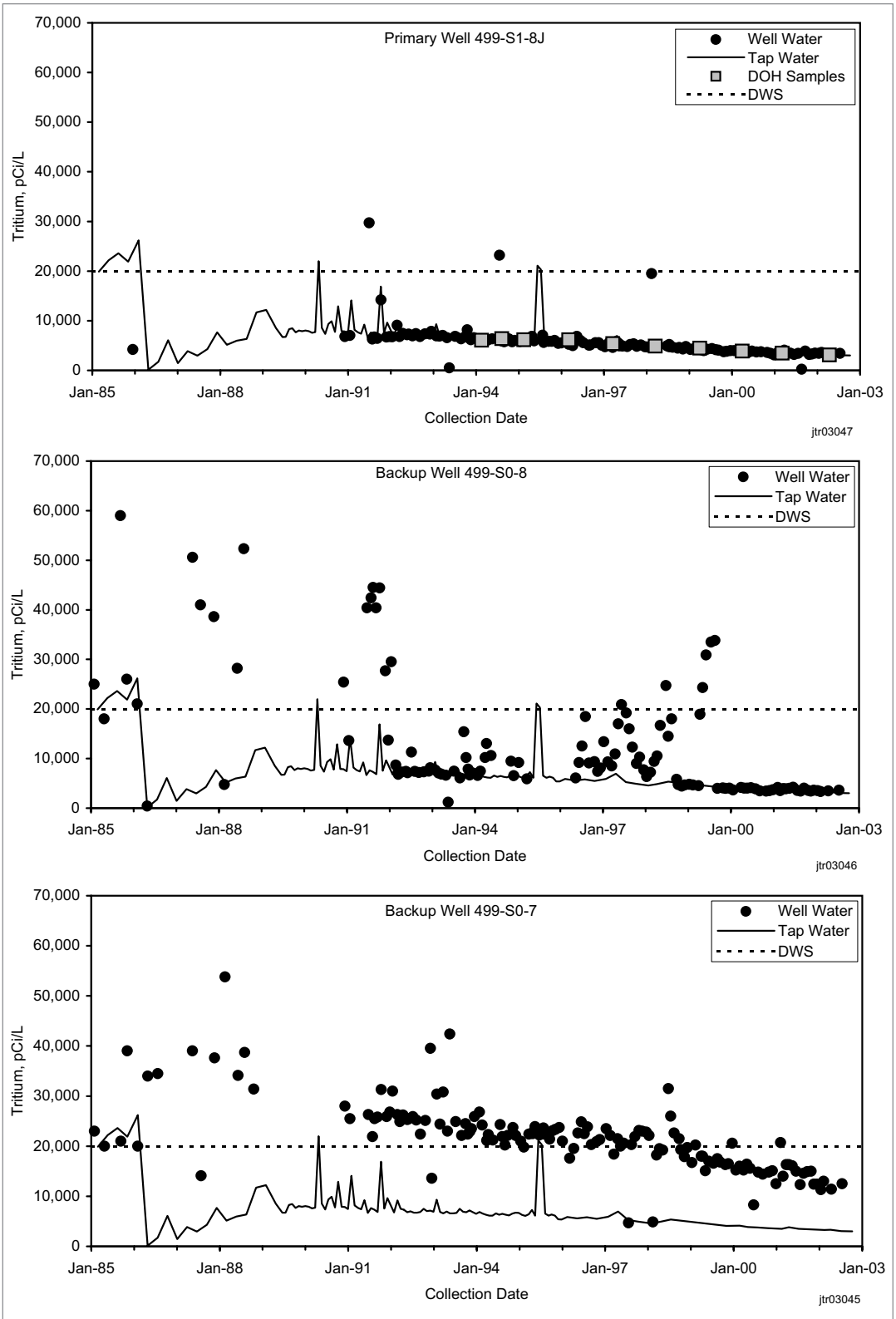

Figure 4.3.2. Tritium Concentrations in Drinking Water from Three Wells in the Hanford Site's 400 Area, 1985 through 2002. (DOH = Washington State Department of Health, DWS = drinking water standard). Multiply pCi/L by 0.037 to convert to Bq/L.