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; DOE Order 5400.5; see Appendix D, Tables D.2 and D.5). In 2001, 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 national primary drinking water regulations of the *Safe Drinking Water Act* apply to the drinking water supplies at the Hanford Site. In Washington State, these regulations are 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. In recent years, radiological results for the Hanford Site have been reported to the state through this annual environmental report and through an annual supplemental data compilation (PNNL-13910, APP. 1). Non-radiological data have been reported to the state by Fluor Hanford, Inc. or its predecessors but have not been published.

All DOE-owned drinking water systems on the Hanford Site were in compliance with Washington State and EPA annual average radiological drinking water standards in 2001, and results were similar to those observed in recent years (see Section 4.3 in PNNL-13230 and PNNL-13487).

4.3.1 Hanford Site Drinking Water Systems

In 2001, drinking water was supplied to DOE facilities on the site by ten DOE-owned, contractor-operated, water treatment and distribution systems (Table 4.3.1), and one system owned and operated by the city of Richland. Nine of these systems (including Richland's system) used water pumped from the Columbia River. One system used groundwater from 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 HAMMER facility.

4.3.2 Hanford Site Drinking Water Supply Facilities

In 2001, radionuclide concentrations in onsite drinking water were monitored at the four DOE-owned water supply facilities shown in 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

Table 4.3.1. DOE-Owned Drinking Water Systems[a] on the Hanford Site, 2001

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-E	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-W	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. Wells P-14 and P-15 were not used in 2001. 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.

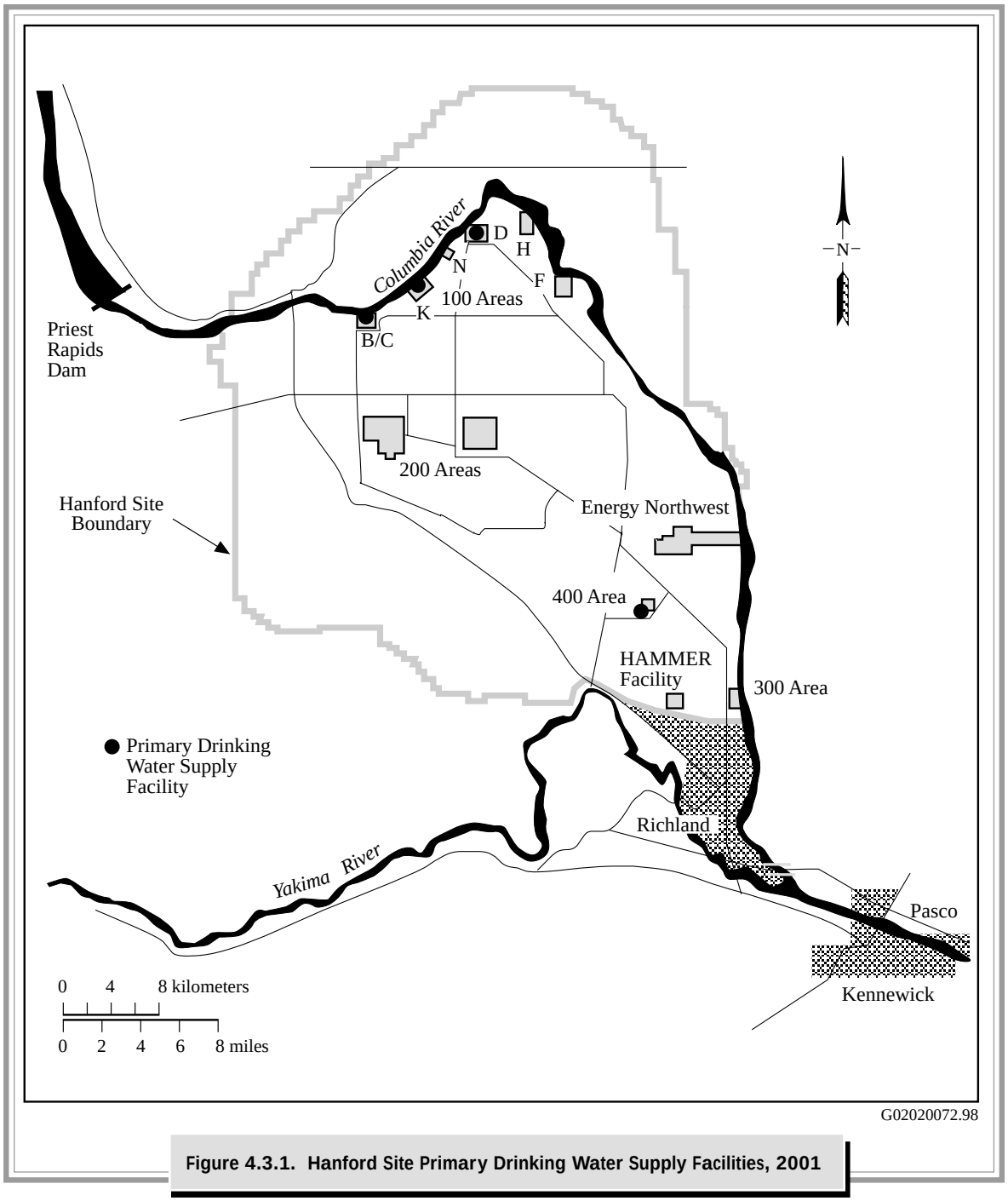


Figure 4.3.1. Hanford Site Primary Drinking Water Supply Facilities, 2001

standby mode in 2001. 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 in 2001.

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. Well 499-S1-8J is 122 meters (401 feet) deep and was installed in April 1985. Well 499-S0-8 is 90 meters (294 feet) deep and was installed in March 1972. Well 499-S0-7 (P-15), 122 meters (399 feet) deep, was installed in March 1972. The backup well with the lowest tritium level, as demonstrated by sampling and analysis, is considered the primary backup water supply. Neither well 499-S0-8 nor 499-S0-7 was used as a drinking water source in 2001. 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 for radiological analyses were collected according to a schedule established at the beginning of the calendar year (PNNL-13418). Samples at all of the locations were collected and analyzed quarterly. Samples from three locations were grab samples of untreated water. The 400 Area samples were grab samples of treated water. The Hanford Groundwater Monitoring Project collected samples of raw well water from the 400 Area drinking water wells. These samples were analyzed monthly. Drinking water samples obtained from the 400 Area in 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-13910, APP. 1.

In the 300 Area, water from the city of Richland's system was not monitored for radiological contaminants 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 monitors its water for radiological and chemical contaminants, and for general water quality and reports the data in its annual newsletter to consumers (City of Richland 2002), 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 2001 drinking water samples collected for radiological analysis were analyzed for gross alpha, gross beta, tritium, and strontium-90.

4.3.4 Radiological Results for Hanford Site Drinking Water

Results for radiological monitoring of Hanford Site drinking water during 2001 are summarized in Table 4.3.2. Individual analytical results are reported in PNNL-13910, APP. 1. The maximum amount of beta-gamma radiation from manmade radionuclides allowed in drinking water by Washington State and EPA is an annual average concentration that will not produce an annual dose equivalent to the whole body or any internal organ greater than 4 mrem/yr (0.04 mSv/yr). If both tritium and strontium-90 are present, the sum of their annual effective dose equivalent to bone marrow must not exceed 4 mrem (0.04 mSv). Compliance with this standard may be assumed if the annual average concentrations for gross alpha, gross beta, tritium, and strontium-90, by themselves, are less than 50, 15, 20,000, and 8 pCi/L, (1.85, 0.555, 740, and 0.296 Bq/L), respectively (40 CFR 141 and WAC 246-290). If two or more radionuclides are present, the total annual dose equivalent to the body or a specific organ cannot exceed 4 mrem/yr.

The Hanford Groundwater Monitoring Project collected and analyzed raw water samples monthly from all three 400 Area drinking water wells. Results from these samples show that tritium levels continued to be lowest in well 499-S1-8J, which was the only well used for drinking water in 2001, and consistently highest in well 499-S0-7 (Table 4.3.3; 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 (see Figure 4.3.2). During 2001, annual average tritium concentrations in both of these wells were below the 20,000 pCi/L (740 Bq/L) state and federal annual average drinking water standard. However, the tritium concentration in well 499-S0-7 in February was slightly above the drinking water standard. An unusually low reading in well 499-S1-8J in August (246 ± 200 pCi/L [9.1 ± 7.4 Bq/L]) was marked in the Hanford Environmental Information System database as a suspect value even though a re-analysis of the sample confirmed the low result.

Table 4.3.2. Selected Radiological Constituents in Hanford Site Drinking Water, 2001 Annual Average Concentrations, pCi/L[a,b]

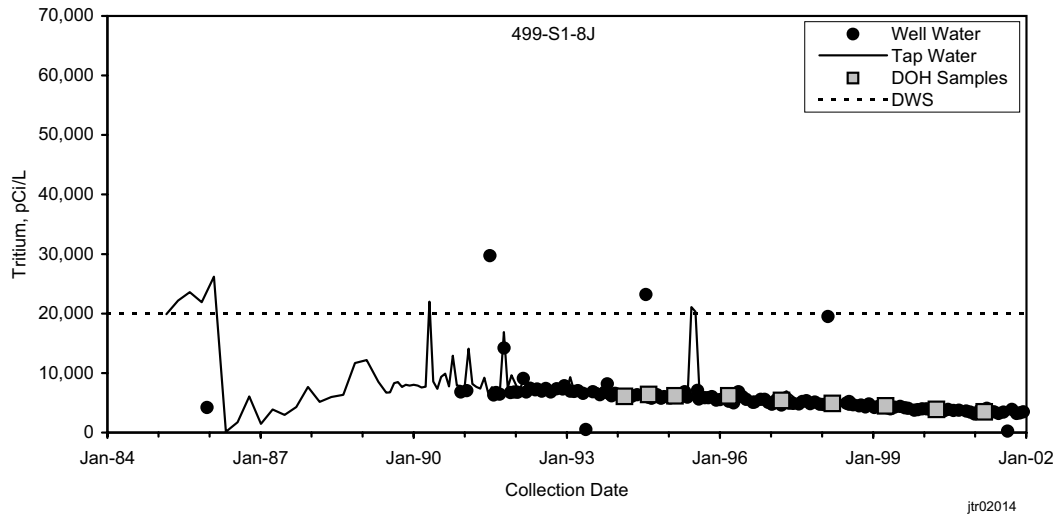
System	No. of Samples[c]	Gross Alpha	Gross Beta	Tritium	Strontium-90
100-B Area[d]	4	0.16 ± 0.46[e]	1.56 ± 1.24[e]	182 ± 79[f,g]	0.073 ± 0.026[f]
100-D Area[d]	4	0.95 ± 1.50[h]	0.62 ± 1.69[e]	11.1 ± 163[e]	0.09 ± 0.04
100-K Area[d]	4	0.37 ± 0.74[e]	1.71 ± 0.79[d]	44.3 ± 186[f]	0.08 ± 0.01
400 Area (FFTF)[i]	4	0.90 ± 3.08[e]	8.81 ± 7.29	3,457 ± 662	-0.009 ± 0.01[e]
Standards		15[j,k]	50[k,l]	20,000[k,m]	8[j,k]

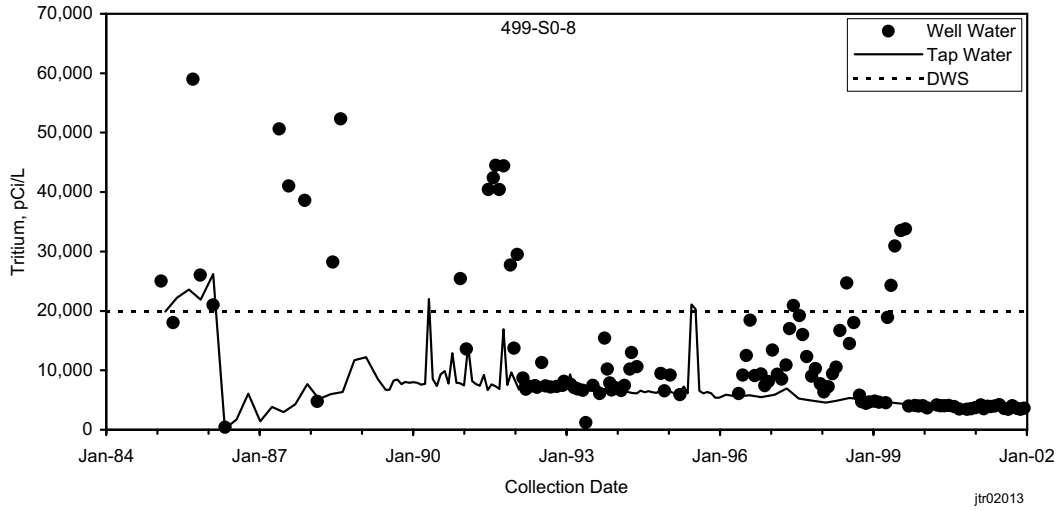
(a) Multiply pCi/L by 0.037 to convert to Bq/L.
(b) Average value ±2 standard deviations.
(c) Grab samples collected and analyzed quarterly.
(d) Untreated raw water.
(e) For all results, total analytical error > result.
(f) For 1 result, total analytical error > result.
(g) No value reported for the second quarter of the calendar year.
(h) For 3 results, total analytical error > result.
(i) FFTF = Fast Flux Test Facility; samples collected at the tap.
(j) WAC 246-290.
(k) 40 CFR 141.
(l) Equivalent to 4 mrem/yr (0.04 mSv/yr) standard.
(m) Concentration assumed to yield an annual dose of 4 mrem/yr (0.04 mSv/yr).

Table 4.3.3. Tritium Concentrations (pCi/L)[a] in 400 Area Drinking Water Wells, 2001[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)
February 6, 2001	3,790 ± 440	4,170 ± 460	20,700 ± 1,200
February 28, 2001	3,430 ± 420	3,540 ± 430	14,000 ± 940
March 27, 2001	4,050 ± 460	3,920 ± 460	16,300 ± 1,000
April 17, 2001	3,560 ± 440	3,890 ± 470	16,300 ± 1,100
May 16, 2001	3,470 ± 430	3,990 ± 460	16,100 ± 1,000
June 19, 2001	3,200 ± 410	4,220 ± 470	15,000 ± 990
July 23, 2001	3,400 ± 420	3,560 ± 430	12,300 ± 860
August 21, 2001	246 ± 200[c]	3,440 ± 410	14,600 ± 950
September 21, 2001	3,900 ± 470	4,040 ± 480	14,900 ± 1,000
October 25, 2001	3,180 ± 410	3,560 ± 430	15,000 ± 980
November 16, 2001	3,270 ± 410	3,430 ± 420	12,400 ± 860
December 13, 2001	3,490 ± 470	3,610 ± 480	12,400 ± 920

(a) Multiply pCi/L by 0.037 to convert to Bq/L.
(b) Reported concentration ±2 total propagated analytical error.
(c) Marked as a suspect value in the Hanford Environmental Information System database.





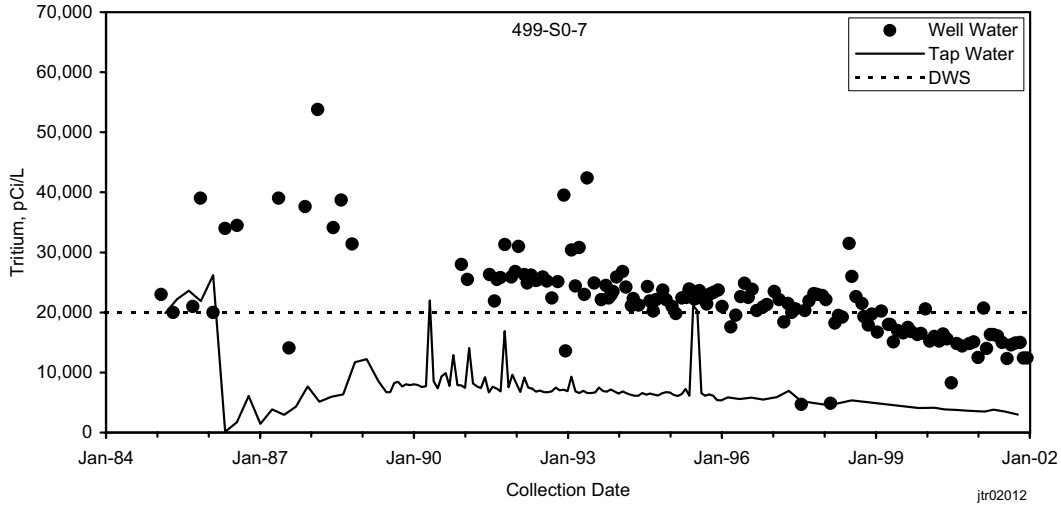


Figure 4.3.2. Tritium Concentrations in Drinking Water from Three Wells in the 400 Area, 1984 through 2001. Only well 499-S1-8J was used for drinking water in 2001 (DOH = Washington State Department of Health, DWS = drinking water standard). Multiply pCi/L by 0.037 to convert to Bq/L.