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 C, Tables C.2 and C.5). In 1999, radiological surveillance of drinking water supplied to Hanford Site facilities by DOE-owned pump and treatment facilities was conducted by Pacific Northwest National Laboratory for DynCorp Tri-Cities Services, Inc. Routine chemical and microbiological monitoring of these drinking water systems was conducted by DynCorp Tri-Cities Services, Inc.

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-13230, APP. 1). Nonradiological data have been reported to the state by DynCorp Tri-Cities Services, Inc. but have not been published.

4.3.1 Hanford Site Drinking Water Systems

Drinking water was supplied to DOE facilities on the site by 12 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. Three systems used groundwater from beneath the site. In 1999, most of the systems were operated by DynCorp Tri-Cities Services, Inc.; however, Fluor Hanford operated two systems in the 400 and 100-K Areas, and Bechtel Hanford, Inc. operated one system in the 100-N Area that was supplied with water from a pumping station operated by DynCorp Tri-Cities Services, Inc. The city of Richland provided drinking water to the 300, 700, and Richland North Areas.

4.3.2 Hanford Site Drinking Water Supply Facilities

In 1999, radionuclide concentrations in onsite drinking water were monitored at the six 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-N Area, 200-East and 200-West Areas, 251 Building, and 100 Areas Fire Station), with the 100-D Area pumphouse available as an emergency backup. Water for the 100-K Area was supplied by the 181-KE pumphouse. Water for the 200-East Area, which formerly came from the 283-E water treatment plant located in the 200-East

Table 4.3.1. DOE-Owned Drinking Water Systems on the Hanford Site, 1999

Location/Number	Source of Supply	Notes
100-D/001761	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 183-D Headhouse. Operated by DynCorp Tri-Cities Services, Inc.
100-B/04480U	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 182-B Reservoir Pumphouse. Operated by DynCorp Tri-Cities Services, Inc.
100-K/00177J	Columbia River via 181-K Pumphouse	Filtered and chlorinated at 183-KE Water Treatment Plant. Operated by Fluor Hanford.
100-N/418532	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 183-N Water Treatment Plant. Operated by Bechtel Hanford, Inc.
200-E/41866V	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. Operated by DynCorp Tri-Cities Services, Inc.
200-W/001004	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 283-W Water Treatment Plant. Operated by DynCorp Tri-Cities Services, Inc.
251 Building/001782 (electrical switching)	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 251 Building. Operated by DynCorp Tri-Cities Services, Inc.
609 Building/001806 (100 Areas Fire Station)	Columbia River via 181-B or D raw water export	Filtered and chlorinated at 609 Building. Operated by DynCorp Tri-Cities Services, Inc.
Yakima Barricade/001848	Well 699-49-100C	No treatment provided. Operated by DynCorp Tri-Cities Services, Inc.
Patrol Training Academy/00183Q	Well 699-S28-E0	Chlorination only. Operated by DynCorp Tri-Cities Services, Inc.
400 Area/419470	Wells 499-S1-8J, 499-S0-8, and 499-S0-7	Supplied from well 499-S1-8J (P-16); well 499-S0-8 (P-14) is the emergency supply, well 499-S0-7 (P-15) is the dire emergency supply. Chlorination only. Operated by Fluor Hanford.
300 Area/418408	Treated Columbia River water via city of Richland	300 Area distribution system. Operated by DynCorp Tri-Cities Services, Inc.

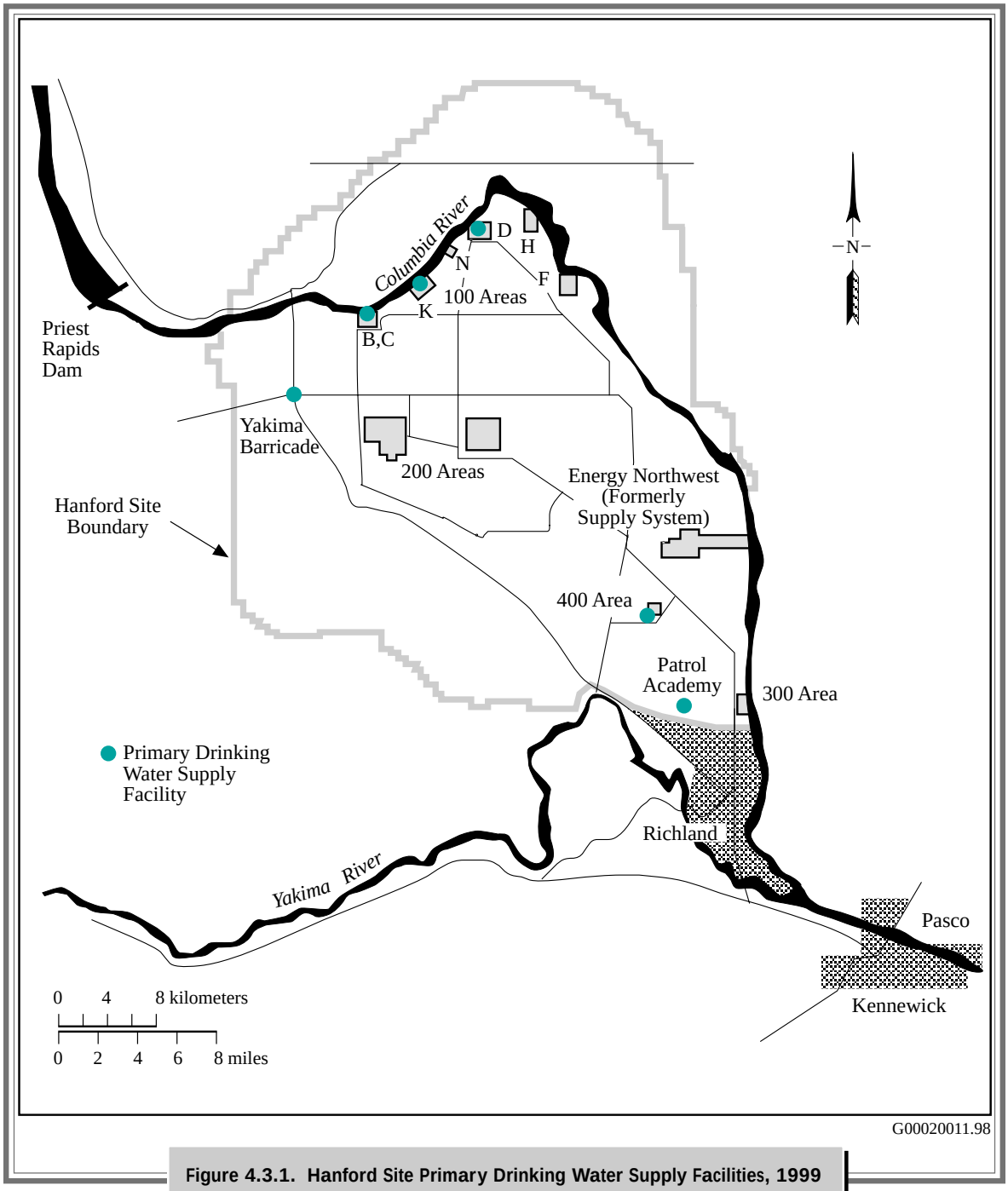


Figure 4.3.1. Hanford Site Primary Drinking Water Supply Facilities, 1999

Area, was supplied by the 283-W water treatment plant (located in the 200-West Area). The 283-E treatment plant was designated as an emergency supply facility in 1999 and was maintained in a standby mode. The Patrol Training Academy and 400 Area (Fast Flux Test Facility) obtained water from groundwater wells. However, only one sample was collected at the academy during 1999 because the academy's groundwater-supplied drinking water system was permanently shut down during the first quarter of the calendar year. The water system at the Yakima Barricade continued to operate in 1999 but was not used as a source of drinking water and was, therefore, not monitored for radiological contaminants. Water from this system was monitored for selected nonradiological contaminants by DynCorp Tri-Cities Services, Inc. The DOE-owned river water pump at 300 Area was removed from the drinking water system in late 1998 when the city of Richland began supplying drinking water to the area.

The 400 Area continued to use well 499-S1-8J (P-16) for drinking water, with well 499-S0-8 (P-14) serving as the emergency supply. 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-S0-8 supplied drinking water for a total of 35.6 hours in 1999 (1.5 hours in February, 5.2 hours in March, 12.1 hours in April, 15.7 hours in May, 1.1 hours in August) when well 499-S1-8J was offline. Well 499-S0-7 (P-15), 122 meters (399 feet) deep, was installed in March 1972 and continued to function as the dire emergency supply but was not used as a source of drinking water in 1999. In addition to supplying drinking water, these three wells were also important for maintaining fire suppression capabilities within the 400 Area.

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-12103). Samples at all of the locations were collected and analyzed quarterly. Samples from three locations were grab samples of untreated water. The 400 Area and Patrol Academy samples were grab samples of treated water. The Hanford Groundwater Monitoring Project also 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 April were cosampled 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-13230, 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 A (Table A.2). Sampling of 300 Area drinking water for nonradiological analyses was routinely conducted by DynCorp Tri-Cities Services, Inc. to monitor the DOE-owned, contractor operated water distribution system within the area. However, as stated earlier, nonradiological data are reported directly to the state and are not discussed in this report.

All 1999 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 1999 are summarized in Table 4.3.2. The maximum amount of beta-gamma radiation from man-made 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 greater than 4 mrem/yr. If both tritium and strontium-90 are present, the sum of their annual dose equivalent to bone marrow must not exceed 4 mrem. Compliance with this standard may be assumed if the annual average concentrations for gross alpha, gross beta, tritium, and strontium-90 are less than 50, 15, 20,000, and 8 pCi/L, respectively (40 CFR 141 and WAC 246-290). 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 1999, and results were similar to those observed in recent years (see Section 4.3 in PNNL-11795 and PNNL-12088).

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-S0-8J and consistently highest in well 499-S0-7. Tritium levels were also elevated (greater than 33,000 pCi/L) in well 499-S0-8 from April through August (Table 4.3.3, Figure 4.3.2).

Table 4.3.2. Selected Radiological Constituents in Hanford Site Drinking Water, 1999 Annual Average Concentrations (pCi/L)[a]

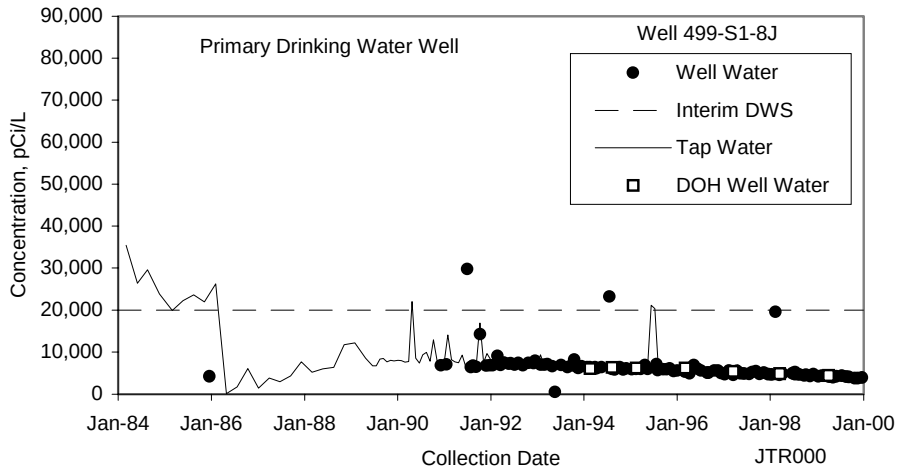
System	No. of Samples[b]	Gross Alpha	Gross Beta	Tritium	Strontium-90
100-B Area	3[c,d]	0.49 ± 0.67	0.04 ± 1.14	122 ± 81	0.08 ± 0.01
100-D Area	3[c,d]	0.40 ± 0.13	0.61 ± 0.87	132 ± 134	0.07 ± 0.01
100-K Area	4[c]	0.34 ± 0.32	1.01 ± 0.80	70 ± 48	0.05 ± 0.02
400 Area (FFTF)[e]	4	0.62 ± 0.90	6.64 ± 0.74	4,275 ± 253	-0.01 ± 0.01
Patrol Academy	1[f]	3.18 ± 1.3	4.74 ± 2.3	-11.3 ± 140	-0.04 ± 0.06
Standards		15[g,h]	50[h,i]	20,000[h,j]	8[g,h]

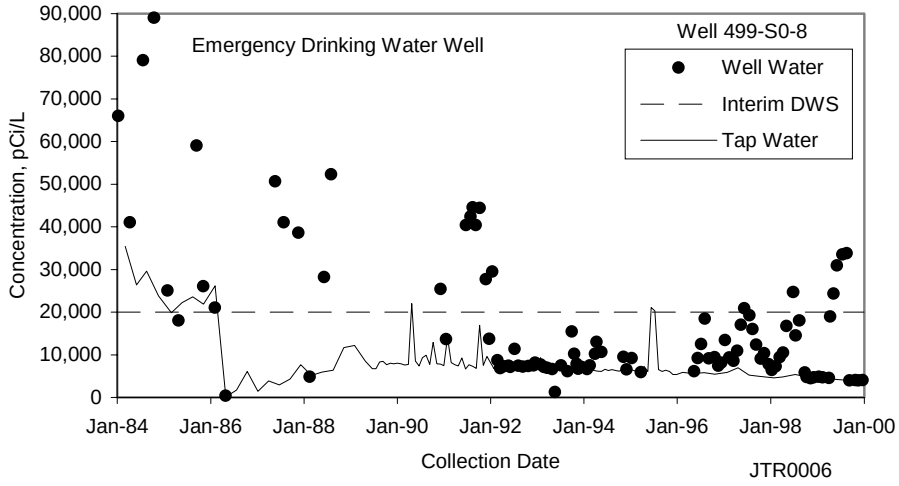
(a) Average value ±2 standard error of the calculated mean.
(b) Grab samples collected and analyzed quarterly.
(c) Untreated raw water.
(d) No sample collected in first quarter of calendar year.
(e) FFTF = Fast Flux Test Facility; samples collected at the tap.
(f) Result ± total analytical error.
(g) WAC 246-290.
(h) 40 CFR 141.
(i) Equivalent to 4 mrem/yr standard.
(j) Concentration assumed to yield an annual dose of 4 mrem/yr.

Table 4.3.3. Tritium Concentrations (pCi/L) in 400 Area Drinking Water Wells, 1999[a]

Sampling Date	Primary Drinking Water Well 499-S1-8J (P-16)	Emergency Drinking Water Well 499-S0-8 (P-14)	Dire Emergency Drinking Water Well 499-S0-7 (P-15)
January 12, 1999	4,210 ± 485	4,790 ± 527	16,700 ± 1,390
February 11, 1999	4,380 ± 493	4,640 ± 513	20,200 ± 1,640
April 1, 1999	4,260 ± 495	4,540 ± 514	18,000 ± 1,490
April 13, 1999	4,150 ± 470	18,900 ± 1,160	18,000 ± 1,120
May 7, 1999	3,990 ± 458	24,300 ± 1,390	15,100 ± 990
June 4, 1999	4,250 ± 460	30,900 ± 1,650	17,000 ± 1,050
July 16, 1999	4,370 ± 460	33,500 ± 1,800	16,600 ± 1,000
August 18, 1999	4,150 ± 460	33,800 ± 1,800	17,500 ± 1,100
September 10, 1999	4,050 ± 450	3,970 ± 450	16,800 ± 1,000
October 25, 1999	3,760 ± 430	4,050 ± 450	16,300 ± 1,000
November 19, 1999	3,820 ± 450	3,960 ± 460	16,500 ± 1,100
December 21, 1999	3,960 ± 450	4,020 ± 460	20,600 ± 1,200

(a) Reported concentration ±2 total propagated analytical error.





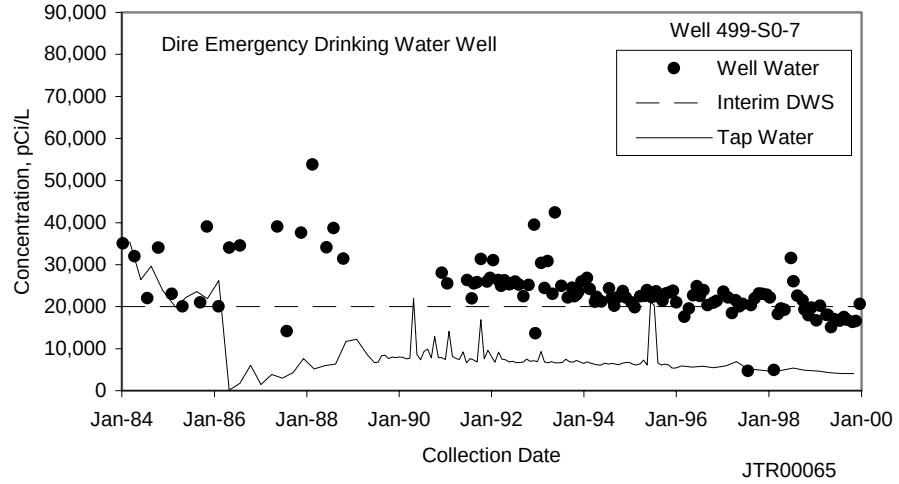


Figure 4.3.2. Tritium Concentrations in Drinking Water from Three Wells in the 400 Area, 1984 Through 1999 (DOH = Washington State Department of Health, DWS = drinking water standard)