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 2003, 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 onsite drinking water.

Hanford water systems are classified as non-transient non-community public water systems. However, radionuclides in Hanford Site drinking water are monitored to community system requirements to comply with the requirements of DOE Order 5400.5. In Washington State, adherence to these requirements 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 (e.g., PNNL-14687, APP. 1). Non-radiological data are reported to the state directly by the state-accredited laboratory performing the analyses and Fluor Hanford, Inc. but are not otherwise published.

All DOE-owned drinking water systems on the Hanford Site were in compliance with community drinking water standards for radiological contaminant levels during 2003. Contaminant concentrations measured during the year were similar to those observed in recent years (see Section 4.3 in PNNL-13910 for 2001; PNNL-14295 for 2002).

4.3.1 Hanford Site Drinking Water Systems

During 2003, drinking water was supplied to DOE facilities on the site by nine DOE-owned, contractor-operated, water treatment and distribution systems, 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 near the Fast Flux Test Facility. 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 2003, radionuclide concentrations in onsite drinking water were monitored at four DOE-owned water supply facilities (Figure 4.3.1). Most site facilities were provided with drinking water pumped from the Columbia River. The 400 Area continued to use well 499-S1-8J as the primary drinking water supply well, with wells 499-S0-8 and 499-S0-7 serving as backup sources. 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 2003. Well 499-S0-8 supplied 3.38 million liters (893,000 gallons) to the distribution system during a 2-week period in March. At that time, the primary supply well (499-S1-8J) was off-line due to an electrical outage.

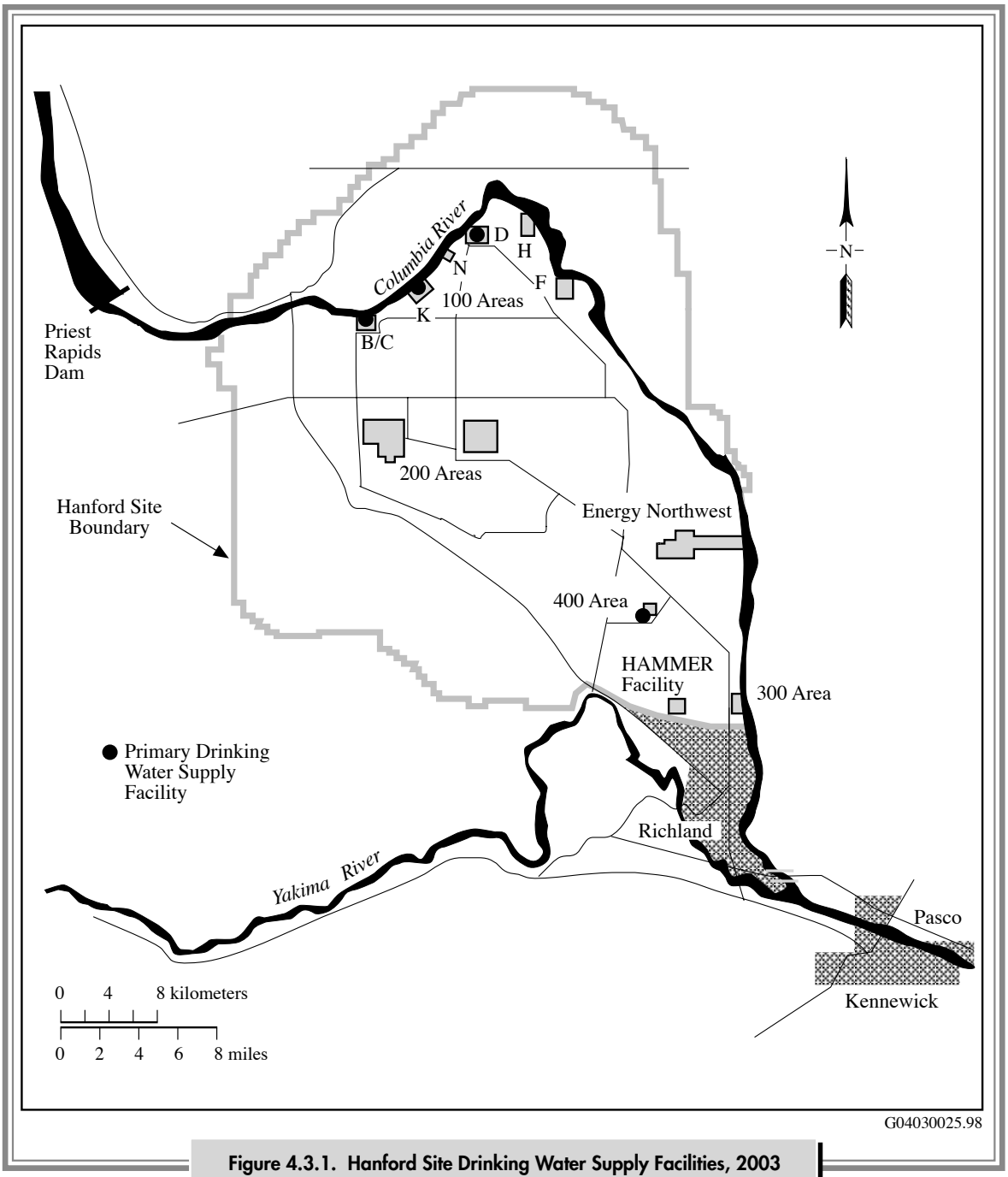

Figure 4.3.1. Hanford Site Drinking Water Supply Facilities, 2003

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-14184). Samples at all of the locations were collected and analyzed quarterly. All were samples of treated water collected before the water was distributed for general use. The Hanford Groundwater Performance Assessment Project also collected and analyzed samples of raw well water from each of the 400 Area drinking water wells during the calendar year.

Drinking water in the 300 and Richland North Areas and at the HAMMER facility is supplied by the city of Richland and was not routinely monitored for radiological contaminants by DOE contractor personnel. However, personnel from Pacific Northwest National Laboratory's Surface Environmental Surveillance Project routinely collected water samples from the Columbia River at Richland. The Columbia River is the primary source of the city of Richland's drinking water. The analytical results (radiological) for these raw river water samples can be found in Appendix C (Table C.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/RICHLAND/Utilities/index.cfm?PageNum=15>.

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 2003 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 2003 are summarized in Table 4.3.1. Individual analytical results are reported in PNNL-14687, 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 greater than 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

Table 4.3.1. Concentrations (pCi/L)[a] of Selected Radiological Constituents in Hanford Site Drinking Water, 2003

Constituent	No. of Samples Analyzed	Systems				Standards
		100-K Area	100-N Area	200-West Area	400 Area	
Gross alpha[b]	4[c]	0.38 ± 0.22[d]	0.40 ± 0.70[d]	0.34 ± 1.25	0.41 ± 1.81[d]	15[e,f]
Gross beta[b]	4[g]	1.41 ± 1.81[d]	1.19 ± 2.24[d]	1.24 ± 2.96	7.00 ± 0.81	50[f]
Tritium[h]	1[i]	-0.94 ± 84	148 ± 94	164 ± 100	3,350 ± 311	20,000[f]
Strontium-90[h]	1[i]	0.07 ± 0.03	0.10 ± 0.03	0.09 ± 0.04	-0.00 ± 0.04	8[e,f]
Iodine-131[b]	4[c]	0.05 ± 0.48[d]	0.00 ± 0.31[d]	0.11 ± 0.44[d]	0.01 ± 0.19[d]	3[j]
Radium-226[b]	4[c]	0.04 ± 0.03	0.04 ± 0.03	0.06 ± 0.03	0.04 ± 0.07	combined
Radium-228[b]	4[c]	0.50 ± 0.72	0.36 ± 0.50	0.37 ± 0.71	0.35 ± 0.26[d]	5[f]

(a) Multiply pCi/L by 0.037 to convert to Bq/L.
(b) Annual average ±2 times the standard deviation.
(c) Samples are collected and analyzed quarterly.
(d) Analytical results for all samples were below the detection limit.
(e) WAC 246-290.
(f) 40 CFR 141.
(g) Samples are collected monthly, composited, and analyzed quarterly.
(h) Single result ±2 times the total propagated analytical error.
(i) Samples are collected quarterly, composited, and analyzed annually.
(j) EPA-570/9-76/003.

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 2003, 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 15 of 16 gross alpha results were below their respective minimum detectable concentrations. Eleven of 12 gross beta results for river water samples were also below the minimum detectable concentration, as was 1 of 3 river water tritium results and 4 of 12 river water radium-228 results. Radium-226 was detected in every sample analyzed and gross beta and tritium were measured in all 400 Area well water samples. Strontium-90 was measured in all river water samples but was not detected in 400 Area well water (Table 4.3.1).

The Groundwater Performance Assessment Project collected and analyzed raw water samples from all three 400 Area drinking water wells. 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. During 2003, 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 (Table 4.3.2; Figure 4.3.2).

A sample of drinking water was collected from the well at the Laser Interferometer Gravitational Wave Observatory (LIGO) (see Figure 1.0.1) in July 2003 as part of a special study. The sample was analyzed for carbon-14, iodine-129, technetium-99, tritium, uranium 234, uranium-235, and uranium-239. None of these radionuclides were detected in the sample.

Table 4.3.2. Tritium Concentrations (pCi/L)[a] in Hanford Site 400 Area Drinking Water Wells, 2003[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 4, 2003	3,010 ± 250	2,970 ± 250	11,000 ± 520
April 8, 2003	2,990 ± 250	3,220 ± 260	13,600 ± 650
July 16, 2003	3,770 ± 280	3,350 ± 280	14,200 ± 750
October 9, 2003	2,970 ± 260	3,050 ± 260	10,400 ± 580

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

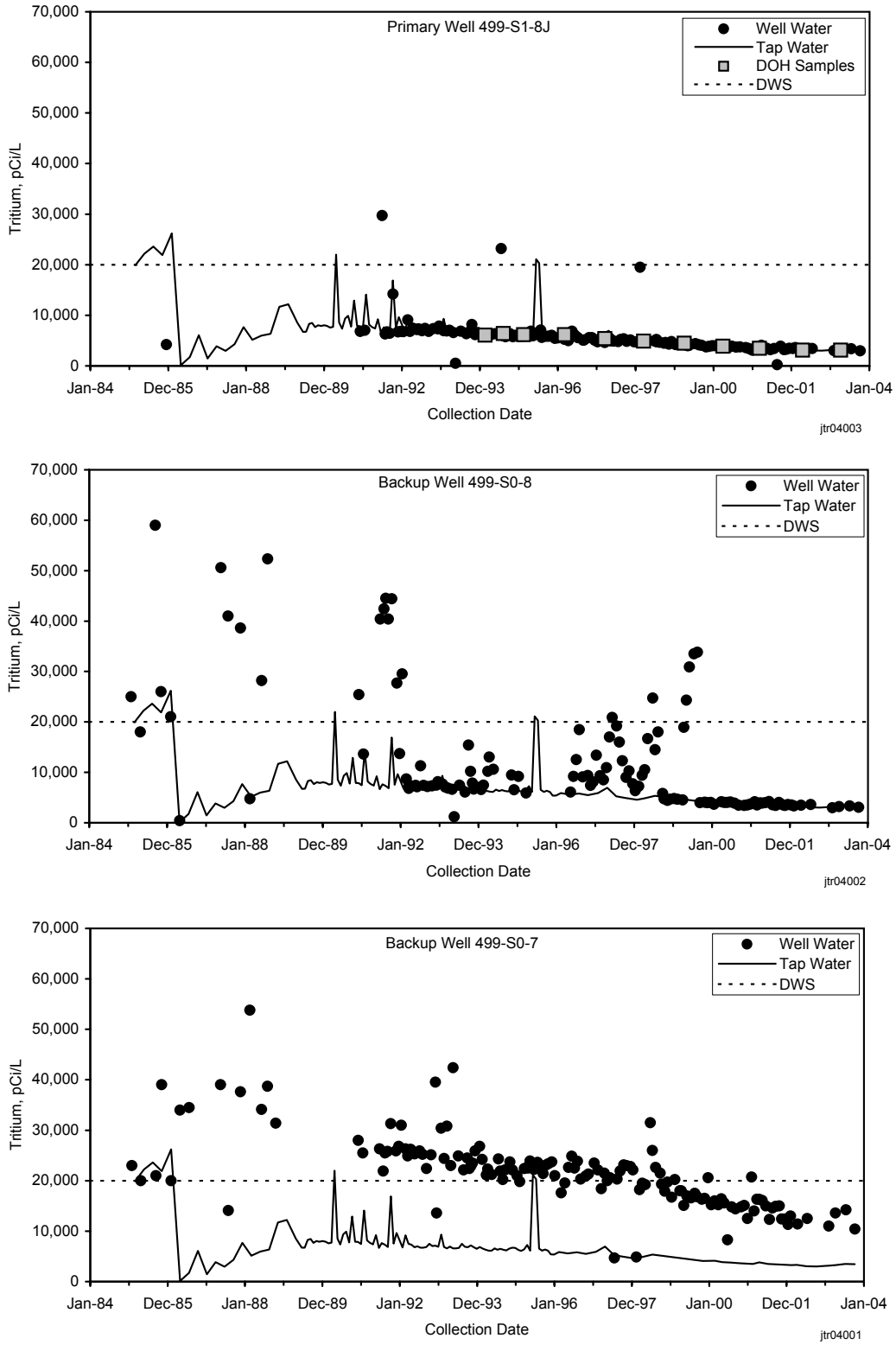

Figure 4.3.2. Tritium Concentrations in Drinking Water from Three Wells in the Hanford Site's 400 Area, 1985 through 2003. (DOH = Washington State Department of Health, DWS = drinking water standard). Multiply pCi/L by 0.037 to convert to Bq/L.