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# Appendix C

## Standards and Permits

Operations at the Hanford Site must conform to a variety of governmental standards and permits designed to ensure the biological and physical quality of the environment for public health, ecological, or aesthetic considerations. The primary environmental quality standards and permits applicable to Hanford operations in 1996 are listed in the following tables. The State of Washington has promulgated water quality standards for the Columbia River, Washington Administrative Code 173-201A (WAC 173-201A). The Hanford Reach of the Columbia River has been designated as Class A (Excellent). This designation requires that the water be usable for substantially all needs, including drinking water, recreation, and wildlife. Class A water standards are summarized in Table C.1. Drinking water standards promulgated by the U.S. Environmental Protection Agency (EPA) in Title 40, Code of Federal Regulations, Part 141 (40 CFR 141) are summarized in Table C.2. Select surface freshwater quality criteria for toxic pollutants are included in Table C.3.

Environmental radiation protection standards are published in U.S. Department of Energy (DOE) Order 5400.5. This DOE order establishes limits for public radiation dose and gives guidance for keeping radiation exposures to members of the public as low as reasonably achievable. These standards are based on guidelines recommended by authoritative organizations such as the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements. DOE has initiated a policy for creating and implementing public radiation protection standards that are generally consistent with the standards used by the U.S. Nuclear Regulatory Commission in regulating and licensing non-DOE nuclear facilities (i.e., nuclear power plants). Table C.4 shows the radiation standards from DOE Order 5400.5. These standards govern allowable public exposures to ionizing radiation from DOE operations.

In DOE Order 5400.5, the derived concentration guides are established that reflect the concentrations of individual radionuclides in water and air that an individual could continuously consume, inhale, or be immersed in at

average annual concentrations without exceeding an effective dose equivalent of 100 mrem per year. Derived concentration guides are not exposure limits but are simply reference values that are provided to allow for comparisons of radionuclide concentrations in environmental media. Table C.5 lists selected DOE derived concentration guides for radionuclides of particular interest at the Hanford Site. The guides are useful reference values but do not generally represent concentrations in the environment that ensure compliance with either the DOE, the Clean Air Act, or drinking water dose standards.

Permits required for regulated releases to water and air have been issued by the EPA under the National Pollutant Discharge Elimination System of the Clean Water Act and the Prevention of Significant Deterioration requirements of the Clean Air Act. Also, under authority granted by the Clean Air Act, the Washington State Department of Health has issued a permit for Hanford radioactive air emissions. Permits for collecting wildlife for environmental sampling are issued by the Washington State Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. Current permits are discussed in Table C.6.

## References

Clean Water Act. 1977. Public Law 95-217, as amended, 91 Stat. 1566 and Public Law 96-148, as amended.

Clean Air Act. 1986. Public Law 88-206, as amended, 42 USC 7401 et seq.

40 CFR 61. U.S. Environmental Protection Agency, "National Emission Standards for Hazardous Air Pollutants." *Code of Federal Regulations*.

40 CFR 131.36. U.S. Environmental Protection Agency, "Toxic Criteria for Those States not Complying with the Clean Water Act Section 303(c)(2)(B)." *Code of Federal Regulations*.

**Table C.1.** Washington State Water Quality Standards for the Hanford Reach of the Columbia River

Parameter	Permissible Levels
Fecal coliform	<ol style="list-style-type: none"> <li>1) Geometric mean value 100 colonies/100 mL</li> <li>2) 10% of samples may exceed 200 colonies/100 mL</li> </ol>
Dissolved oxygen	>8 mg/L
Temperature	<ol style="list-style-type: none"> <li>1) 20°C (68°F) as a result of human activities</li> <li>2) When natural conditions exceed 20°C, no temperature increases will be allowed that will raise the temperature of the receiving water by more than 0.3°C</li> <li>3) Incremental temperature increases resulting from point sources shall not at any time exceed <math>34/(T + 9)</math>, where T = background temperature. Incremental temperature increases resulting from nonpoint sources shall not exceed 2.8°C</li> </ol>
pH	<ol style="list-style-type: none"> <li>1) 6.5 to 8.5 range</li> <li>2) &lt;0.5 unit induced variation</li> </ol>
Turbidity	5 nephelometric turbidity units over background turbidity
Toxic, radioactive, or deleterious materials	Concentrations shall be below those of public health significance, or which cause acute or chronic toxic conditions to the most sensitive aquatic biota, or which may adversely affect characteristic water uses
Aesthetic value	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste
Radioactive substances	Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed EPA drinking water regulations for radionuclides, as published in EPA (1976) or subsequent revisions thereto (see Table C.2)
Toxic substances	Shall not be introduced above natural background levels into waters of the state that have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent on those waters, or adversely affect public health, as determined by the department (see Table C.3)

40 CFR 141. U.S. Environmental Protection Agency, "National Primary Drinking Water Regulations; Radionuclides; Proposed Rule." *Code of Federal Regulations*.

DOE Order 5400.5. "Radiation Protection of the Public and the Environment."

U.S. Environmental Protection Agency (EPA). 1976. *National Interim Primary Drinking Water Regulations*. EPA-570-9-76-003, Office of Water Supply, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1996. *Drinking Water Regulations and Health Advisories*. EPA 822-R-96-001, Office of Water, Washington, D.C.

Washington Administrative Code (WAC) 173-201A. "Water Quality Standards for Surface Waters of the State of Washington."

Washington Administrative Code (WAC) 246-290. "Group A Public Water Systems."

**Table C.2.** Selected Drinking Water Standards

Radiological Constituent	Primary Maximum Contaminant Level	Interim Drinking Water Standard	Agency <sup>(a)</sup>	Status
Total alpha <sup>(b)</sup>	15 pCi/L		DOH, <sup>(c)</sup> EPA <sup>(d)</sup>	Final
Radium-226		3	DOH <sup>(c)</sup>	Final
Beta and gamma radioactivity	4 mrem/yr <sup>(e)</sup>		DOH, <sup>(c)</sup> EPA <sup>(d)</sup>	Final
Tritium		20,000 <sup>(f)</sup> pCi/L	DOH, <sup>(c)</sup> EPA <sup>(d)</sup>	Interim
Beryllium-7		6,000 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Cobalt-60		100 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Strontium-90		8 <sup>(f)</sup> pCi/L	DOH, <sup>(c)</sup> EPA <sup>(d)</sup>	Interim
Technetium-99		900 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Ruthenium-106		30 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Antimony-125		300 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Iodine-129		1 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Iodine-131		3 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Cesium-134		20,000 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Cesium-137		200 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Europium-154		200 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Europium-155		600 <sup>(f)</sup> pCi/L	EPA <sup>(g)</sup>	Interim
Uranium	20 µg/L <sup>(h)</sup>		EPA <sup>(i)</sup>	Proposed
Fluoride	4 mg/L		DOH, <sup>(c)</sup> EPA <sup>(d,i)</sup>	Final/under review
Nitrate, as NO <sub>3</sub> <sup>-</sup>	45 mg/L		DOH, <sup>(c)</sup> EPA <sup>(d,i)</sup>	Final
Chromium	100 µg/L, 100 µg/L <sup>(j)</sup>		EPA, <sup>(d,i)</sup> DOH <sup>(c)</sup>	Final, Final
Cyanide	200 µg/L		EPA <sup>(c,d,i)</sup>	Final
Trichlorethylene	5 µg/L		DOH, <sup>(c)</sup> EPA <sup>(d,i)</sup>	Final
Tetrachloroethylene	5 µg/L		DOH, <sup>(c)</sup> EPA <sup>(d,i)</sup>	Final
Carbon tetrachloride	5 µg/L		DOH, <sup>(c)</sup> EPA <sup>(d,i)</sup>	Final
Chloroform (THM) <sup>(k)</sup>	100 µg/L		DOH, <sup>(c)</sup> EPA <sup>(i)</sup>	
Cis-1,2-dichloroethylene	0.07 mg/L		EPA <sup>(i)</sup>	Final

(a) DOH = Washington State Department of Health, EPA = U.S. Environmental Protection Agency.

(b) Including radium-226 but excluding radon and uranium.

(c) WAC 246-290.

(d) 40 CFR 141.

(e) Beta and gamma radioactivity from manmade radionuclides. Annual average concentration shall not produce an annual dose equivalent from manmade radionuclides to the total body or any internal organ greater than 4 mrem/yr. Compliance may be assumed if annual average concentrations of total beta, tritium, and strontium-90 are less than 50, 20,000, and 8 pCi/L, respectively.

(f) Concentration assumed to yield an annual dose of 4 mrem/yr.

(g) EPA (1976).

(h) Equivalent to a nationwide EPA standard of 30 pCi/L and a sitewide standard of 13.4 pCi/L (see Section 4.8, "Groundwater Protection and Monitoring Program").

(i) EPA (1996).

(j) Recently modified from 50 µg/L.

(k) Standard is for total trihalomethanes (THM).

**Table C.3.** Select Surface Freshwater Quality Criteria for Toxic Pollutants

Compound	Level that Yields Acute Toxicity, µg/L <sup>(a)</sup>	Level that Yields Chronic Toxicity, µg/L <sup>(a)</sup>	Level to Protect Human Health for the Consumption of Water and Organisms, µg/L <sup>(b)</sup>
<b>Total Recoverable Metals</b>			
Antimony	--	--	14
Arsenic	360.0	190.0	0.018
Cadmium	2.0 <sup>(c)</sup>	0.71 <sup>(d)</sup>	--
Chromium(III) <sup>(e)</sup>	1,100 <sup>(f)</sup>	130 <sup>(g)</sup>	--
Chromium(VI)	16.0	11.0	--
Copper	10 <sup>(h)</sup>	7.1 <sup>(i)</sup>	--
Lead	38 <sup>(j)</sup>	1.5 <sup>(k)</sup>	--
Mercury	2.4	0.012	0.14
Nickel	860 <sup>(l)</sup>	95 <sup>(m)</sup>	610
Selenium	20.0	5.0	--
Silver	1.4 <sup>(n)</sup>	--	--
Thallium	--	--	1.7
Zinc	70 <sup>(o)</sup>	64 <sup>(p)</sup>	--
<b>Anions</b>			
Cyanide <sup>(q)</sup>	22.0	5.2	700
Chloride <sup>(r)</sup>	860,000	230,000	--
<b>Organic Compounds</b>			
Benzene	--	--	1.2
Carbon tetrachloride	--	--	0.25
Chloroform	--	--	5.7
1,2-dichloroethane	--	--	0.38
Methylene chloride	--	--	4.7
Toluene	--	--	6800
Tetrachloroethylene	--	--	0.8
1,1,2-trichloroethane	--	--	0.60
Trichloroethylene	--	--	2.7
Vinyl chloride	--	--	2
1,4-dichlorobenzene	--	--	400

(a) WAC 173-201A-040.

(b) 40 CFR 131.36.

(c)  $\exp(1.128[\ln(\text{hardness})]-3.828)$ . Limiting value for 1991-1996 U.S. Geological Survey results is 55 mg CaCO<sub>3</sub>/L. Hardness expressed as mg CaCO<sub>3</sub>/L.(d)  $\exp(0.7852[\ln(\text{hardness})]-3.490)$ .

(e) Where methods to measure trivalent chromium are unavailable, these criteria are to be represented by total recoverable chromium.

(f)  $\exp(0.8190[\ln(\text{hardness})]+3.688)$ .(g)  $\exp(0.8190[\ln(\text{hardness})]+1.561)$ .(h)  $\exp(0.9422[\ln(\text{hardness})]-1.464)$ .(i)  $\exp(0.8545[\ln(\text{hardness})]-1.465)$ .(j)  $\exp(1.273[\ln(\text{hardness})]-1.460)$ .(k)  $\exp(1.273[\ln(\text{hardness})]-4.705)$ .(l)  $\exp(0.8460[\ln(\text{hardness})]+3.3612)$ .(m)  $\exp(0.8460[\ln(\text{hardness})]+1.1645)$ .(n)  $\exp(1.72[\ln(\text{hardness})]-6.52)$ .(o)  $\exp(0.8473[\ln(\text{hardness})]+0.8604)$ .(p)  $\exp(0.8473[\ln(\text{hardness})]+0.7614)$ .

(q) Criteria based on weak and dissociable method.

(r) Dissolved in association with sodium.

**Table C.4.** Radiation Standards (dose limits<sup>(a)</sup>) for Protection of the Public from All Routine DOE Activities**All Pathways** (limits from DOE Order 5400.5)

The effective dose equivalent for any member of the public from all routine DOE activities<sup>(b)</sup> shall not exceed the values given below.

	<u>Effective Dose Equivalent<sup>(c)</sup></u>	
	<u>mrem/yr</u>	<u>mSv/yr</u>
Routine public dose	100	1
Potential authorized temporary public dose <sup>(d)</sup>	500	5

**Dose to Native Aquatic Animal Organisms from Liquid Discharges** (interim limits from DOE Order 5400.5)

Radioactive material in liquid wastes discharged to natural waterways shall not cause an absorbed dose<sup>(e)</sup> to native aquatic animal organisms that exceeds 1 rad per day (10 mGy per day).

**Drinking Water Pathway Only** (limits from 40 CFR 141 and DOE Order 5400.5)

Radionuclide concentrations in DOE-operated public drinking water supplies shall not cause persons consuming the water to receive an effective dose equivalent greater than 4 mrem (0.04 mSv) in a year. DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the radiological drinking water limits in 40 CFR 141 (see Table C.2).

**Air Pathways Only** (limits from 40 CFR 61)

	<u>Effective Dose Equivalent<sup>(c)</sup></u>	
	<u>mrem/yr</u>	<u>mSv/yr</u>
Public dose limit at location of maximum annual air concentration as a consequence of routine DOE activities <sup>(b)</sup>	10	0.1

- (a) Radiation doses received from natural background, residual weapons testing and nuclear accident fallout, medical exposures, and consumer products are excluded from the implementation of these dose limits.
- (b) "Routine DOE activities" implies normal, planned activities and does not include actual or potential accidental or unplanned releases.
- (c) Effective dose equivalent is expressed in rem (or millirem) with the corresponding value in sievert (or millisievert) in parentheses.
- (d) Authorized temporary annual dose limits may be greater than 100 mrem/yr (but cannot exceed 500 mrem/yr) if unusual circumstances exist that make avoidance of doses greater than 100 mrem to the public impracticable. DOE Richland Operations Office is required to request and receive specific authorization from DOE Headquarters for an increase from the routine public dose limit to a temporary annual dose limit.
- (e) Absorbed dose is expressed in rad (or millirad) with the corresponding value in gray (or milligray) in parentheses.

**Table C.5.** Selected Derived Concentration Guides<sup>(a,b,c)</sup>

<u>Radionuclide</u>	<u>Water, pCi/L (10<sup>-9</sup> μCi/mL)</u>	<u>Air, pCi/m<sup>3</sup> (10<sup>-12</sup> μCi/mL)</u>
Tritium	2,000,000	100,000
Carbon-14	70,000	500,000
Chromium-51	1,000,000	60,000
Manganese-54	50,000	2,000
Cobalt-60	5,000	80
Zinc-65	9,000	600
Krypton-85	NS <sup>(d)</sup>	3,000,000
Strontium-90	1,000	9
Technetium-99	100,000	2,000
Ruthenium-103	50,000	2,000
Ruthenium-106	6,000	30
Antimony-125	60,000	1,000
Iodine-129	500	70
Iodine-131	3,000	400
Cesium-137	3,000	400
Cerium-144	7,000	30
Europium-154	20,000	50
Europium-155	100,000	300
Uranium-234	500	0.09
Uranium-235	600	0.1
Uranium-238	600	0.1
Plutonium-238	40	0.03
Plutonium-239	30	0.02
Plutonium-240	30	0.02
Americium-241	NS	0.02

- (a) Concentration of a specific radionuclide in water or air that could be continuously consumed or inhaled at average annual rates and not exceed an effective dose equivalent of 100 mrem/yr.
- (b) Values in this table represent the lowest, most conservative derived concentration guides considered potentially applicable to Hanford Site operations and may be adjusted upward (larger) if accurate solubility information is available.
- (c) From DOE Order 5400.5.
- (d) NS = no numerical standard but the effective dose equivalent cannot exceed 100 mrem/yr.

**Table C.6.** Environmental Permits**Clean Water Act Permit**

Additional details are given in Section 2.2, "Compliance Status."

**Clean Air Act Permits**

Prevention of Significant Deterioration Permit No. PSD-X80-14, issued to DOE Richland Operations Office by EPA Region 10; covers emission of NO<sub>x</sub> to the atmosphere from the Plutonium-Uranium Extraction Plant and the Uranium-TriOxide Plant. No expiration date.

Radioactive Air Emission Permit No. FF-01, issued to DOE Richland Operations Office by the Washington State Department of Health under authority granted by the Clean Air Act; covers operations on the Hanford Site having a potential to emit radioactive airborne effluents. Initially issued August 15, 1991, the permit was updated August 1993.

**Wildlife Sampling Permits**

Scientific Collection Permit WM-0038, issued by Washington State Department of Fish and Wildlife to Pacific Northwest National Laboratory for 1996; covered the collection of food fish, shellfish, and wildlife, including game fish, for environmental monitoring purposes. Renewed annually.

Federal Fish and Wildlife Permit No. 671877, issued by the U.S. Fish and Wildlife Service to Pacific Northwest National Laboratory; covers the collection of migratory wildlife. Renewed every other year.

**National Pollutant Discharge Elimination Permits** (governing effluent discharges to the Columbia River)

Permit #WA-000374-3 includes two outfalls in the 100-K Area, one in the 300 Area, and two inactive outfalls in the 100-N Area.

Permit #WA-002592-7 includes the outfall for the 300 Area Treated Effluent Disposal Facility.

Copies of the regulations concerning these permits may be obtained from the following organizations:

State of Washington  
Department of Ecology  
P.O. Box 47600  
Olympia, WA 92504-7600

U.S. Environmental Protection Agency  
Region 10  
1200 Sixth Avenue  
Seattle, WA 98101

U.S. Department of Energy  
Richland Operations Office  
825 Jadwin Ave.  
Richland, WA 99352