# Appendix D

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## ENVIRONMENTAL SURVEILLANCE PROGRAM

Radionuclide concentrations in air and runoff samples are compared with Derived Concentration Guide values for air and water.[1] The Derived Concentration Guide values listed are provided as reference values for conducting radiological protection programs at operational Department of Energy facilities and sites.

Table D-1 lists applicable Derived Concentration Guides. The Derived Concentration Guides represent the concentrations of radioactivity in air inhaled or water ingested continuously during a year that resulted in a 100-mrem, 50-year committed effective dose equivalent. The Derived Concentration Guides are used as a point of reference only. Comparing individual measurements to the Derived Concentration Guides gives the maximum dose a person could receive at the location where the sample was collected, given the following two assumptions: (1) the concentration was at the Derived Concentration Guide level continuously for the entire year, and (2) the person receiving the exposure was at that location for the entire year, continually drinking the water or inhaling the air. In practice, Derived Concentration Guides are rarely, if ever, exceeded for even a short period during the year. In addition, the radionuclide concentration at any area accessible to the public will be even less due to the dispersion from the facility boundary (where the sample was collected) to the site boundary (the closest location where the public has unrestricted access).[2] DOE Order 5400.5[1] contains the principle standards and guides for release of radionuclides at the INEEL.

Table D-2 shows the Department of Energy and Environmental Protection Agency standards. Table D-3 shows the ambient air quality standards.

Table D-4 lists Environmental Concentration Guidelines for the radionuclides in soil that are most likely to be found in environmental samples. The Environmental Concentration Guidelines in Table D-4 are based on a homestead scenario. This scenario considers the radiation dose to the homesteader from inhaling and ingesting radionuclides, as well as external radiation. Since the hypothetical homesteader is assumed to live on a uniformly contaminated area that is large enough for subsistence farming, this scenario results in very conservative concentration guidelines. The homestead scenario overestimates the actual doses that would be received by off-homestead individuals from radionuclides in soil.

## WATER

The following environmental regulations apply to the Drinking Water Program:

- Federal Safe Drinking Water Act[3]
- Code of Federal Regulations (40 CFR Parts 141-143)[4,5,6]
- Idaho Regulations for Public Drinking Water Systems, IDAPA 58.01.08000-.08999[7]
- DOE Order 5400.5[8]
- *Environmental Compliance Planning Manual*.[9]

Table D-5 lists the parameters monitored, regulated, and reported.

The City of Idaho Falls developed an Industrial Pretreatment Program in accordance with 40 CFR 403 and the Clean Water Act. Industrial Wastewater Acceptance Forms issued by the City authorize discharges to the City of Idaho Falls sewer system in compliance with Chapter 1, Section 8, of the City of Idaho Falls Sewer Ordinance. Table D-6 lists the 2000 concentration limits for discharges to the City of Idaho Falls sewer.

Table D-7 lists the Environmental Protection Agency benchmark concentrations used as voluntary comparison criteria for the Storm Water Monitoring Program data. The Environmental Protection Agency benchmark concentrations are from the 1995 Storm Water Multi-Sector General Permit in the *Federal Register*.[10]

Table D-1. Derived Concentration Guides.

| Radionuclide | DCGs for the Public[a,b] DCG for Air ($\mu$Ci/mL) | DCG for Water ($\mu$Ci/mL) |
|---|---|---|
| H-3 | 1 E-7 | 2 E-3 |
| Sc-46 | 6 E-10 | 2 E-5 |
| Cr-51 | 5 E-8 | 1 E-3 |
| Mn-54 | 2 E-9 | 5 E-5 |
| Co-58 | 2 E-9 | 4 E-5 |
| Fe-59 | 8 E-10 | 2 E-5 |
| Co-60 | 8 E-11 | 5 E-6 |
| Zn-65 | 6 E-10 | 9 E-6 |
| Sr-90[c] | 9 E-12 | 1 E-6 |
| Nb-95 | 3 E-9 | 6 E-5 |
| Zr-95 | 6 E-10 | 4 E-5 |
| Ru-103 | 2 E-9 | 5 E-5 |
| Ru-106 | 3 E-11 | 6 E-6 |
| Ag-110m | 2 E-10 | 1 E-5 |
| Sb-125 | 1 E-9 | 5 E-5 |
| I-129 | 7 E-11 | 5 E-7 |
| I-131 | 4 E-10 | 3 E-6 |
| Cs-134 | 2 E-10 | 2 E-6 |
| Cs-137 | 4 E-10 | 3 E-6 |
| Ce-141 | 1 E-9 | 5 E-5 |
| Ce-144 | 3 E-11 | 7 E-6 |
| Eu-152 | 5 E-11 | 2 E-5 |
| Eu-154 | 5 E-11 | 2 E-5 |
| Ra-226 | 1 E-12 | 1 E-7 |
| Pu-238 | 3 E-14 | 4 E-8 |
| Pu-239[c] | 2 E-14 | 3 E-8 |
| Am-241 | 2 E-14 | 3 E-8 |
| U-235 | 1 E-13 | 6 E-7 |
| U-238 | 1 E-13 | 6 E-7 |
| Gross alpha | 2 E-14[c] | — |
| Gross beta | 9 E-12[c] | — |

a. This table contains the air and water Derived Concentration Guides based on concentrations that could be continuously inhaled or ingested, respectively, and do not exceed an effective dose equivalent of 100 mrem/yr.

b. Derived Concentration Guides apply to radionuclide concentrations in excess of those occurring naturally or due to fallout.

c. The Derived Concentration Guides of Pu-239 and Sr-90 are the most restrictive for alpha- and beta-emitting nuclides, respectively, and are appropriate to use for gross alpha and gross beta Derived Concentration Guides.

Table D-2. Radiation standards for protection of the public at the INEEL.

| | Effective Dose Equivalent | |
|---|---|---|
| | mrem/yr | mSv/yr |
| DOE standard for routine DOE activities[a] (all pathways) | 100 | 1 |
| EPA standard for site operations (airborne pathway only) | 10 | 0.1 |

a. The effective dose equivalent for any member of the public from all routine DOE operations including remedial activities and release of naturally-occurring radionuclides shall not exceed this value. Routine operations refers to normal, planned operations and does not include accidental or unplanned releases.

Table D-3. Environmental Protection Agency ambient air quality standards.

| Pollutant | Type of Standard[a,b] | Sampling Period | EPA[c] ($\mu g/m^3$) |
|---|---|---|---|
| Sulfur dioxide | S | 3-hour average | 1,300 |
| | P | 24-hour average | 365 |
| | P | Annual average | 80 |
| Nitrogen dioxide | S&P | Annual average | 100 |
| | S | 24-hour average | 150 |
| Total particulates | S&P | Annual average | 50 |

a. National primary (P) ambient air quality standards define levels of air quality to protect the public health. Secondary (S) ambient air quality standards define levels of air quality to protect the public welfare from any known or anticipated adverse effects of a pollutant.

b. The primary and secondary standard to the annual average applies only to "particulates with an aerodynamic diameter less than or equal to a nominal 10 micrometers."

c. The State of Idaho has adopted these same ambient air quality standards.

Table D-4. Environmental Concentration Guidelines for common radionuclides found in environmental soil samples.

| Radionuclide | Environmental Concentration Guidelines for Soil[a] ($\mu$Ci/g) |
|---|---|
| Mn-54 | 4 E-6 |
| Co-58 | 4 E-6 |
| Co-60 | 1 E-6 |
| Ru-106 | 2 E-5 |
| Sb-125 | 8 E-6 |
| Cs-134 | 2 E-6 |
| Cs-137 | 6 E-6 |
| Ce-144 | 6 E-5 |
| Eu-152 | 3 E-6 |
| Am-241 | 4 E-5 |
| Sr-90 | 6 E-6 |
| U-232 | 2 E-6 |
| U-233 | 2 E-4 |
| U-234 | 2 E-4 |
| U-235 | 2 E-5 |
| U-238 | 1 E-4 |
| Pu-238 | 8 E-5 |
| Pu-239, -240 | 8 E-5 |

a. See Reference 2. Concentrations correspond to a 50-yr dose commitment of 100 mrem/yr to a homesteader beginning in the first year after release from facility. This concentration assumes uniform contamination of an area adequate for subsistence farming.

Table D-5. Parameters and maximum contaminant levels.[a]

| Parameter | Maximum Contaminant Level |
|---|---|
| **REGULATED VOLATILE ORGANIC COMPOUNDS** | |
| Benzene | 0.005 mg/L |
| Vinyl chloride | 0.002 mg/L |
| Carbon tetrachloride | 0.005 mg/L |
| 1,2-dichloroethane | 0.005 mg/L |
| Trichloroethylene | 0.005 mg/L |
| 1,1-dichloroethylene | 0.007 mg/L |
| 1,2,4-trichlorobenzene | 0.07 mg/L |
| 1,1,1-trichloroethane | 0.200 mg/L |
| 1,1,2-trichloroethane | 0.005 mg/L |
| Para-dichlorobenzene | 0.075 mg/L |
| Cis-1,2-dichloroethylene | 0.07 mg/L |
| 1,2-dichloropropane | 0.005 mg/L |
| Dichloromethane | 0.005 mg/L |
| Ethylbenzene | 0.7 mg/L |
| Chlorobenzene | 0.1 mg/L |
| o-dichlorobenzene | 0.6 mg/L |
| Styrene | 0.1 mg/L |
| Tetrachloroethylene | 0.005 mg/L |
| Toluene | 1.0 mg/L |
| Trans-1,2-dichloroethylene | 0.1 mg/L |
| Xylenes (total) | 10.0 mg/L |
| **MICROBIOLOGICAL** | |
| Total coliform | If less than 40 samples per month collected, no more than 1 positive |
| **INORGANIC** | |
| Asbestos | 7 million fibers per liter (>10 $\mu$m) |
| Fluoride | 4 mg/L |
| Cadmium | 0.005 mg/L |
| Chromium | 0.1 mg/L |
| Mercury | 0.002 mg/L |
| Selenium | 0.05 mg/L |
| Arsenic | 0.05 mg/L |

Table D-5. (continued).

| Parameter | Maximum Contaminant Level |
|---|---|
| Barium | 2 mg/L |
| Lead | 0.015 mg/L |
| Nitrate | 10 mg/L (as nitrogen) |
| Nitrite | 1 mg/L (as nitrogen) |
| Copper | 1.3 mg/L |
| Antimony | 0.006 mg/L |
| Beryllium | 0.004 mg/L |
| Thallium | 0.002 mg/L |
| Cyanide | 0.2 mg/L |
| **ORGANICS** | |
| Alachor | 0.002 mg/L |
| Atrazine | 0.003 mg/L |
| Carbofuran | 0.04 mg/L |
| Chlordane | 0.002 mg/L |
| Dibromochloropropane (DBCP) | 0.0002 mg/L |
| 2,4-D | 0.07 mg/L |
| Ethylene dibromide (EDB) | 0.00005 mg/L |
| Heptachlor | 0.0004 mg/L |
| Heptachlor epoxide | 0.0002 mg/L |
| Lindane | 0.0002 mg/L |
| Methoxychlor | 0.04 mg/L |
| Polychlorinated biphenyls (PCBs) | 0.0005 mg/L |
| Toxaphene | 0.003 mg/L |
| 2,4,5-TP (silvex) | 0.05 mg/L |
| Pentachlorophenol | 0.001 mg/L |
| Aldicarb | 0.003 mg/L |
| Aldicarb sulfone | 0.002 mg/L |
| Aldicarb sulfoxide | 0.004 mg/L |
| Dalapon | 0.2 mg/L |
| Dinoseb | 0.007 mg/L |
| Diquat | 0.02 mg/L |
| Endothall | 0.1 mg/L |
| Endrin | 0.002 mg/L |

Table D-5. (continued).

| Parameter | Maximum Contaminant Level |
|---|---|
| Glyphosate | 0.7 mg/L |
| Oxamyl (vydate) | 0.2 mg/L |
| Picloram | 0.5 mg/L |
| Simazine | 0.004 mg/L |
| Benzo(a)pyrene, (PAH) | 0.0002 mg/L |
| Di(2-ethylhexyl), (adipate) | 0.4 mg/L |
| Di(2-ethylhexyl), (phthalate) | 0.006 mg/L |
| Hexachlorobenzene | 0.001 mg/L |
| Hexachlorocyclo-pentadience (HEX) | 0.05 mg/L |
| 2,3,7,8-TCDD (dioxin) | 0.00000003 mg/L |
| **RADIONUCLIDES** | |
| Radium-226/228 | 5 pCi/L |
| Gross alpha particle activity (including radium-226, but excluding radon and uranium) | 15 pCi/L |
| Beta particle/photon radioactivity | Shall not produce annual dose equivalent to the total body or internal organ greater than 4 millirem/year |
| Tritium | 20,000 pCi/L |
| Strontium-90 | 8 pCi/L |
| **DISINFECTION BY-PRODUCTS** | |
| Total trihalomethanes (the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribomomethane [bromoform] and trichloromethane [chloroform]) | 0.10 mg/L |
| **SECONDARY DRINKING WATER STANDARDS** | |
| Aluminum | 0.05 to 0.2 mg/L |
| Chloride | 250 mg/L |
| Color | 15 color units mg/L |
| Copper | 1.0 mg/L |
| Corrosivity | Noncorrosive |
| Fluoride | 2.0 mg/L |
| Foaming agents | 0.5 mg/L |
| Iron | 0.3 mg/L |

Table D-5. (continued).

| Parameter | Maximum Contaminant Level |
|---|---|
| Manganese | 0.05 mg/L |
| Odor | 3 threshold odor number |
| pH | 6.5–8.5 |
| Silver | 0.1 mg/L |
| Sulfate | 250 mg/L |
| Total dissolved solids (TDS) | 500 mg/L |
| Zinc | 5 mg/L |

a. 40 CFR 141.24, "Organic Chemicals Other Than Total Trihalomethanes, Sampling and Analytical Requirements," current edition.

Table D-6. City of Idaho Falls Sewer Code effluent concentration limits for 2000.

| Parameter | Sewer Limit (mg/L) |
|---|---|
| pH | 5.5–9.0 |
| Arsenic | 0.04 |
| Cadmium | 0.26 |
| Chromium, total | 2.77 |
| Copper | 1.93 |
| Cyanide | 1.04 |
| Lead | 0.29 |
| Mercury | 0.002 |
| Nickel | 2.38 |
| Silver | 0.43 |
| Oil and grease (petroleum or mineral oil products) | 100 |
| Oil and grease (animal and vegetable based) | 250 |
| Trichloroethylene | 0.00 |
| Zinc | 0.90 |
| Stoddard solvent | 0.00 |

Table D-7. Environmental Protection Agency benchmark concentrations for storm water monitoring parameters.[a]

| Chemical | NPDES Benchmark (mg/L) |
|---|---|
| Aluminum | 0.75 |
| Antimony | 0.636 |
| Arsenic | 0.168 |
| Beryllium | 0.13 |
| Cadmium | 0.0159 |
| Copper | 0.0636 |
| Iron | 1.0 |
| Lead | 0.0816 |
| Nickel | 1.417 |
| Selenium | 0.2385 |
| Silver | 0.0318 |
| Zinc | 0.117 |
| Mercury | 0.0024 |
| Solids, total suspended | 100 |
| Nitrogen, nitrate + nitrite | 0.68 |
| Phosphorous, total | 2 |
| Oil and grease, total | 15 |
| Oxygen demand, biochemical | 30 |
| Oxygen demand, chemical | 120 |
| Hydrogen ion (pH) | 6.0 to 9.0 |

a. Benchmark concentrations are from 1995 NPDES Storm Water Multi-Sector General Permit, *Federal Register*, Vol. 60, #189, p. 50826, Sept. 29, 1995.[10]

# REFERENCES


1. DOE Order 5400.5, "Radiation Protection of the Public and the Environment," U.S. Department of Energy, February 8, 1990.

2. EG&G Idaho, Inc., *Development of Criteria for Release of Idaho National Engineering Laboratory Sites Following Decontamination and Decommissioning*, EGG-2400, August 1986.

3. Public Law 99-339, *Safe Drinking Water Act*, Current edition.

4. 40 CFR 141, "National Primary Drinking Water Standards," *Code of Federal Regulations*, Office of the Federal Register, Current edition.

5. 40 CFR 142, "National Primary Drinking Water Regulations Implementation," *Code of Federal Regulations*, Office of the Federal Register, June 18, 1996.

6. 40 CFA 143, "National Secondary Drinking Water Regulations," *Code of Federal Regulations*, Office of the Federal Register, Current edition.

7. IDAPA 58.01., "Idaho Regulations for Public Drinking Water Systems," Current edition.

8. DOE Order 5400.5, Change 2, "Radiation Protection of the Public and the Environment," U.S. Department of Energy, January 7, 1993.

9. U.S. Department of Energy Idaho Operations Office, *Environmental Compliance Planning Manual*, May 1995.

10. 60 FR 189, "Final National Pollutant Discharge Elimination System Storm Water Multi-Sector General Permit for Industrial Activities," *Federal Register*, U.S. Environmental Protection Agency, September 1995, p. 50804.