

8. REGULATIONS, ADVISORIES, AND GUIDELINES

MRLs are substance specific estimates, which are intended to serve as screening levels, are used by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites.

The international and national regulations, advisories, and guidelines regarding uranium in air, water, and other media are summarized in Table 8-1.

ATSDR has derived an MRL of 0.002 mg U/m³ for intermediate-duration inhalation exposure to insoluble uranium compounds based on a NOAEL of 1.1 mg U/m³ and a LOAEL of 8.2 mg U/m³ for renal effects in dogs exposed to uranium dioxide 6 hours/day, 6 days/week for 5 weeks (Rothstein 1949b) and an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.0001 mg U/m³ for intermediate-duration inhalation exposure to soluble uranium compounds based on a LOAEL of 0.15 mg U/m³ for renal effects in dogs exposed to uranyl fluoride 6 hours/day, 6 days/week for 5 weeks (Rothstein 1949a) and an uncertainty factor of 300 (3 for the use of a minimal LOAEL, 10 for extrapolation from animals to humans, and 10 for human variability).

ATSDR has derived an MRL of 0.0008 mg U/m³ for chronic-duration inhalation exposure to insoluble uranium compounds based on a LOAEL of 5.1 mg U/m³ for lung fibrosis in monkeys exposed to uranium dioxide 5.4 hours/day, 5 days/week for 5 years (Leach et al. 1970, 1973) and an uncertainty factor of 1,000 (10 for the use of a LOAEL, 10 for extrapolation from animals to humans, and 10 for human variability).

ATSDR has derived an MRL of 0.00004 mg U/m³ for chronic-duration inhalation exposure to soluble uranium compounds based on a BMCL₁₀ of 0.019 mg U/m³ for renal effects in dogs exposed to uranium tetrachloride 33 hours/week for 1 year (Stokinger et al. 1953) and an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.002 mg/kg/day for acute-duration oral exposure to soluble uranium compounds based on an average BMDL₀₅ of 0.2 mg U/kg/day for developmental effects in the offspring

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of mice administered via gavage uranyl acetate dehydrate on gestation days 6–15 (Domingo et al. 1989c) and an uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability).

ATSDR has derived an MRL of 0.0002 mg/kg/day for intermediate-duration oral exposure to soluble uranium compounds based on a LOAEL of 0.06 mg U/kg/day for renal effects in rats exposed to uranyl nitrate hexahydrate in drinking water for 91 days (Gilman et al. 1998a) and an uncertainty factor of 300 (3 for use of a minimal LOAEL, 10 for extrapolation from animals to humans, and 10 for human variability).

EPA derived a reference dose (RfD) of 0.003 mg/kg/day for uranium soluble salts based on a LOAEL of 2.8 mg/kg/day for initial weight loss and moderate nephrotoxicity in rabbits exposed to uranium in the diet for 30 days (Maynard and Hodge 1949) and an uncertainty factor of 1,000 (10 for the use of a LOAEL, 10 for intraspecies variability, and 10 for interspecies variability) (IRIS 2012). This RfD (developed in 1989) is currently under review by EPA.

IARC, the U.S. Department of Human and Health Services, and the NTP have not classified uranium as to its carcinogenicity. According to the Integrated Risk Information System (IRIS) database, the EPA withdrew its carcinogenic assessment of natural uranium in 1993 (IRIS 2012).

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-----------------------------|---|--|------------|
| <u>INTERNATIONAL</u> | | | |
| Guidelines: | | | |
| IARC | Carcinogenicity classification | | IARC 2012 |
| | Mixtures of uranium isotopes ^{233}U , ^{234}U , ^{235}U , and ^{238}U (natural, enriched, and depleted uranium) | Limited evidence in humans for carcinogenicity There is sufficient evidence in experimental animals for carcinogenicity | |
| ICRP | Recommended dose limits | | ICRP 1991 |
| | Occupational | | |
| | Effective dose ^a | 20 mSv per year, averaged over defined periods of 5 years | |
| | Annual equivalent dose | | |
| | Lens of the eye | 150 mSv | |
| | Skin ^b | 500 mSv | |
| | Hands and feet | 500 mSv | |
| | Public | | |
| | Effective dose ^c | 1 mSv in a year | |
| | Annual equivalent dose | | |
| Lens of the eye | 15 mSv | | |
| Skin | 50 mSv | | |
| Hands and feet | No data | | |
| WHO | Air quality guidelines | No data | WHO 2010 |
| | Provisional drinking water quality guidelines | 0.015 mg/L ^d | WHO 2008 |
| | TDI | 0.6 µg/kg/day | |
| <u>NATIONAL</u> | | | |
| Regulations and Guidelines: | | | |
| a. Air | | | |
| ACGIH | TLV (8-hour TWA) | | ACGIH 2012 |
| | Uranium, soluble and insoluble compounds, as U | 0.2 mg/m ³ | |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|--|------------------------------|--|
| <u>NATIONAL</u> (cont.) | | | |
| | STEL | | |
| | Uranium, soluble and insoluble compounds, as U | 0.6 mg/m ³ | |
| AIHA | ERPGs | No data | AIHA 2011 |
| DOE | PAC-1 ^e | 0.6 mg/m ³ | DOE 2012 |
| | PAC-2 ^e | 0.6 mg/m ³ | |
| | PAC-3 ^e | 30 mg/m ³ | |
| EPA | AEGLs | No data | EPA 2011a |
| | Hazardous air pollutant | No data | EPA 2012a 42 USC 7412 |
| | NAAQS | No data | EPA 2010a |
| | National emission standards for radon-222 emissions from underground uranium mines | 10 mrem/year | EPA 2011k 40 CFR 61.22, Subpart B |
| | National emission standards for radionuclide emissions from federal facilities other than USNRC licensees and not covered by Subpart H | 10 mrem/year | EPA 2011l 40 CFR 61.102, Subpart I |
| | National emission standards for radon-222 emissions from the disposal of uranium mill tailings that are no longer operational | 20 pCi/(m ² -sec) | EPA 2011j 40 CFR 61.222, Subpart T |
| | National emission standards for radon-222 emissions from operating mill tailings | 20 pCi/(m ² -sec) | EPA 2011i 40 CFR 61.252, Subpart W |
| NIOSH | REL (10-hour TWA) | | NIOSH 2012 |
| | Uranium, metal and insoluble compounds, as U ^f | 0.2 mg/m ³ | |
| | Uranium, soluble compounds, as U ^f | 0.05 mg/m ³ | |
| | STEL | | |
| | Uranium, metal and insoluble compounds, as U ^f | 0.6 mg/m ³ | |
| | IDLH | | |
| | Uranium, metal, insoluble, and soluble compounds, as U ^f | 10 mg/m ³ | |
| USNRC | Effluent concentrations in the air ^g | | USNRC 2012a 10 CFR 20, Appendix B |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|---|--------------|---|
| <u>NATIONAL</u> (cont.) | | | |
| | <u>Isotope</u> | <u>Class</u> | <u>Concentration ($\mu\text{Ci/mL}$)</u> |
| | ^{230}U | D | 8×10^{-13} |
| | | W | 5×10^{-13} |
| | | Y | 4×10^{-13} |
| | ^{231}U | D | 1×10^{-8} |
| | | W | 8×10^{-9} |
| | | Y | 6×10^{-9} |
| | ^{232}U | D | 6×10^{-13} |
| | | W | 5×10^{-13} |
| | | Y | 1×10^{-14} |
| | ^{233}U | D | 3×10^{-12} |
| | | W | 1×10^{-12} |
| | | Y | 5×10^{-14} |
| USNRC | Effluent concentrations in the air ⁹ | | USNRC 2012a 10 CFR 20, Appendix B |
| | <u>Isotope</u> | <u>Class</u> | <u>Concentration ($\mu\text{Ci/mL}$)</u> |
| | ^{234}U | D | 3×10^{-12} |
| | | W | 1×10^{-12} |
| | | Y | 5×10^{-14} |
| | ^{235}U | D | 3×10^{-12} |
| | | W | 1×10^{-12} |
| | | Y | 6×10^{-14} |
| | ^{236}U | D | 3×10^{-12} |
| | | W | 1×10^{-12} |
| | | Y | 6×10^{-14} |
| | ^{237}U | D | 4×10^{-9} |
| | | W | 2×10^{-9} |
| | | Y | 2×10^{-9} |
| | ^{238}U | D | 3×10^{-12} |
| | | W | 1×10^{-12} |
| | | Y | 6×10^{-14} |
| | ^{239}U | D | 3×10^{-7} |
| | | W | 3×10^{-7} |
| | | Y | 3×10^{-7} |
| | ^{240}U | D | 5×10^{-9} |
| | | W | 4×10^{-9} |
| | | Y | 3×10^{-9} |
| | U (natural) | D | 3×10^{-12} |
| | | W | 9×10^{-13} |
| | | Y | 9×10^{-14} |

8. REGULATIONS, ADVISORIES, AND GUIDELINES

Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | | Reference |
|-------------------------|--|--------------|--------------------|---|
| <u>NATIONAL</u> (cont.) | | | | |
| | Occupational ALIs and DACs for inhalation ⁹ | | | USNRC 2012a 10 CFR 20, Appendix B |
| | <u>Isotope</u> | <u>Class</u> | <u>ALI (μCi)</u> | <u>DAC (μCi/mL)</u> |
| | ²³⁰ U | D | 6x10 ⁻¹ | 2x10 ⁻¹⁰ |
| | | W | 4x10 ⁻¹ | 1x10 ⁻¹⁰ |
| | | Y | 3x10 ⁻¹ | 1x10 ⁻¹⁰ |
| | ²³¹ U | D | 8x10 ⁻³ | 3x10 ⁻⁶ |
| | | W | 6x10 ⁻³ | 2x10 ⁻⁶ |
| | | Y | 5x10 ⁻³ | 2x10 ⁻⁶ |
| | ²³² U | D | 4x10 ⁻¹ | 9x10 ⁻¹¹ |
| | | W | 4x10 ⁻¹ | 2x10 ⁻¹⁰ |
| | | Y | 8x10 ⁻³ | 3x10 ⁻¹² |
| | ²³³ U | D | 2x10 ⁰ | 5x10 ⁻¹⁰ |
| | | W | 7x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 4x10 ⁻² | 2x10 ⁻¹¹ |
| | ²³⁴ U | D | 2x10 ⁰ | 5x10 ⁻¹⁰ |
| | | W | 7x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 4x10 ⁻² | 2x10 ⁻¹¹ |
| | ²³⁵ U | D | 2x10 ⁰ | 6x10 ⁻¹⁰ |
| | | W | 8x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 4x10 ⁻² | 2x10 ⁻¹¹ |
| | Occupational ALIs and DACs for inhalation ⁹ | | | USNRC 2012a 10 CFR 20, Appendix B |
| | <u>Isotope</u> | <u>Class</u> | <u>ALI (μCi)</u> | <u>DAC (μCi/mL)</u> |
| | ²³⁶ U | D | 2x10 ⁰ | 5x10 ⁻¹⁰ |
| | | W | 8x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 4x10 ⁻² | 2x10 ⁻¹¹ |
| | ²³⁷ U | D | 3x10 ⁻³ | 1x10 ⁻⁶ |
| | | W | 2x10 ⁻³ | 7x10 ⁻⁷ |
| | | Y | 2x10 ⁻³ | 6x10 ⁻⁷ |
| | ²³⁸ U | D | 2x10 ⁰ | 6x10 ⁻¹⁰ |
| | | W | 8x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 4x10 ⁻² | 2x10 ⁻¹¹ |
| | ²³⁹ U | D | 2x10 ⁵ | 8x10 ⁻⁵ |
| | | W | 2x10 ⁵ | 7x10 ⁻⁵ |
| | | Y | 2x10 ⁵ | 6x10 ⁻⁵ |
| | ²⁴⁰ U | D | 4x10 ³ | 2x10 ⁻⁶ |
| | | W | 3x10 ³ | 1x10 ⁻⁶ |
| | | Y | 2x10 ³ | 1x10 ⁻⁶ |
| | U (natural) | D | 2x10 ⁰ | 5x10 ⁻¹⁰ |
| | | W | 8x10 ⁻¹ | 3x10 ⁻¹⁰ |
| | | Y | 5x10 ⁻² | 2x10 ⁻¹¹ |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|--|--|--------------------------------|
| <u>NATIONAL</u> (cont.) | | | |
| | Occupational dose limits | | USNRC 2012b |
| | Adults | 5 rems (0.05 Sv) | 10 CFR 20, Subpart C |
| | Lens dose | 15 rems (0.15 Sv) | |
| | Shallow-dose equivalent to the skin of the whole body or to the skin of any extremity | 50 rems (0.5 Sv) | |
| | Minors | 10% of the annual dose limits specified for adult workers | |
| OSHA | PEL (8-hour TWA) for general industry | | OSHA 2012c |
| | Uranium, soluble compounds, as U | 0.05 mg/m ³ | 29 CFR 1910.1000, Table Z-1 |
| | Uranium, insoluble compounds, as U | 0.25 mg/m ³ | |
| | Each area or room in which natural uranium is used or stored shall be conspicuously posted with a sign or signs bearing the radiation caution symbol | Amount >100 times the quantity of such material specified in 10 CFR, Part 20 | OSHA 2012a 29 CFR 1910.1096 |
| | Each container in which natural uranium is transported, stored, or used shall bear a durable, clearly visible label bearing the radiation caution symbol | Quantity >10 times the quantity specified in 10 CFR, Part 20, Appendix C | OSHA 2012b 29 CFR 1910.1096 |
| b. Water | | | |
| EPA | Designated as hazardous substances in accordance with Section 311(b)(2)(A) of the Clean Water Act | No data | EPA 2011b 40 CFR 116.4 |
| | Drinking water contaminant candidate list | No data | EPA 1998b 63 FR 10274 |
| | Drinking water standards and health advisories | | EPA 2011c |
| | MCL | 0.03 mg/L | |
| | MCLG | Zero | |
| | DWEL | 0.02 mg/L | |
| | National primary drinking water standards | | EPA 2009a |
| | MCL | 0.03 mg/L | |
| | Potential health effects from long-term exposure above the MCL | Increased risk of cancer and kidney toxicity | |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|---|---|--|
| <u>NATIONAL</u> (cont.) | | | |
| | Common sources of contaminant in drinking water | Erosion of natural deposits | |
| | Public health goal | Zero | |
| | National recommended water quality criteria | No data | EPA 2009b |
| | Reportable quantities of hazardous substances designated pursuant to Section 311 of the Clean Water Act | No data | EPA 2011p 40 CFR 117.3 |
| USNRC | Effluent concentrations in the water | | USNRC 2012a |
| | <u>Isotope</u> | <u>Concentration ($\mu\text{Ci/mL}$)</u> | 10 CFR 20, Appendix B |
| | ²³⁰ U | 8×10^{-8} | |
| | ²³¹ U | 6×10^{-5} | |
| | ²³² U | 6×10^{-8} | |
| | ²³³ U | 3×10^{-7} | |
| | ²³⁴ U | 3×10^{-7} | |
| | ²³⁵ U | 3×10^{-7} | |
| | ²³⁶ U | 3×10^{-7} | |
| | ²³⁷ U | 3×10^{-5} | |
| | ²³⁸ U | 3×10^{-7} | |
| | ²³⁹ U | 9×10^{-4} | |
| | ²⁴⁰ U | 2×10^{-5} | |
| | U (natural) | 3×10^{-7} | |
| c. Food | | | |
| FDA | Bottled water | | FDA 2012a |
| | Uranium | 30 $\mu\text{g/L}$ | 21 CFR 165.110 |
| | EAFUS ^h | No data | FDA 2012b |
| d. Other | | | |
| ACGIH | Carcinogenicity classification | | ACGIH 2012 |
| | Uranium, soluble and insoluble compounds, as U | A1 ⁱ | |
| | BEI | | |
| | Uranium in urine, end of shift | 200 $\mu\text{g/L}$ | |
| EPA | Carcinogenicity classification | No data | IRIS 2012 |
| | RfC | No data | |
| | RfD | 0.003 mg/kg/day | |
| | Environmental radiation protection standards for management and disposal of spent nuclear fuel, high-level and transuranic radioactive wastes | | EPA 2011d 40 CFR 191, Appendix A |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|---|--|---|
| <u>NATIONAL</u> (cont.) | | | |
| | Release limit per 1,000 metric tons of heavy metal or other unit of waste for ^{233}U , ^{234}U , ^{235}U , ^{236}U , or ^{238}U | 100 | |
| | Environmental standards for the uranium fuel cycle | Yes | EPA 2011e 40 CFR 190.10, Subpart B |
| | Identification and listing of hazardous waste | No data | EPA 2011g 40 CFR 261, Appendix VIII |
| | Exclusion from Identification and listing of hazardous waste | | EPA 2011f 40 CFR 261.4 |
| | Uranium | Yes | |
| | Inert pesticide ingredients in pesticide products | No data | EPA 2011h |
| | National oil and hazardous substances pollution contingency plan; Hazard ranking system | | EPA 2011m 40 CFR 300, Appendix A |
| | Uranium | Yes | |
| | National priorities list | | EPA 2011n 40 CFR 300, Appendix B |
| | Uranium | Yes | |
| | NPDES permit application testing requirements; hazardous substance required to be tested by existing dischargers if expected to be present | | EPA 2011o 40 CFR 122, Appendix D |
| | Uranium | Yes | |
| | Master Testing List | No data | EPA 2012b |
| EPA | Standards for cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites; listed constituents | Combined ^{234}U and ^{238}U | EPA 2011q 40 CFR 192, Subpart B |
| | Standards for management of uranium byproduct materials pursuant to Section 84 of the Atomic Energy Act of 1954, as amended | Yes | EPA 2011r 40 CFR 192, Subpart D |
| | Standards for the control of residual radioactive materials from inactive uranium processing sites | | EPA 2011t 40 CFR 192, Subpart A |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|--|--------------------|---|
| <u>NATIONAL</u> (cont.) | | | |
| | Maximum concentration of constituents for groundwater protection; combined ^{234}U and ^{238}U | 30 pCi/L | |
| | Standards for owners and operators of hazardous waste TSD facilities; groundwater monitoring list | No data | EPA 2011s 40 CFR 264, Appendix IX |
| | Superfund, emergency planning, and community right-to-know | | |
| | Designated CERCLA hazardous substance and reportable quantity | | EPA 2011u 40 CFR 302.4 |
| | <u>Isotope</u> | <u>RQ (pounds)</u> | <u>Ci (Bq)</u> |
| | ^{230}U | 1 | 3.7×10^{10} |
| | ^{231}U | 1,000 | 3.7×10^{13} |
| | ^{232}U | 0.01 | 3.7×10^8 |
| | ^{233}U | 0.1 | 3.7×10^9 |
| | ^{234}U | 0.1 | 3.7×10^9 |
| | ^{235}U | 0.1 | 3.7×10^9 |
| | ^{236}U | 0.1 | 3.7×10^9 |
| | ^{237}U | 100 | 3.7×10^{12} |
| | ^{238}U | 0.1 | 3.7×10^9 |
| | ^{239}U | 1,000 | 3.7×10^{13} |
| | ^{240}U | 1,000 | 3.7×10^{13} |
| | Effective date of toxic chemical release reporting | No data | EPA 2011w 40 CFR 372.65 |
| | Extremely hazardous substances and its threshold planning quantity | No data | EPA 2011v 40 CFR 355, Appendix A |
| | TSCA chemical lists and reporting periods | No data | EPA 2011x 40 CFR 712.30 |
| | TSCA health and safety data reporting | No data | EPA 2011y 40 CFR 716.120 |
| USNRC | Releases to the sewers; monthly average concentration | | USNRC 2012a 10 CFR 20, Appendix B |

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|-------------------------|--------------------------------------|---|---|
| <u>NATIONAL</u> (cont.) | | | |
| | <u>Isotope</u> | <u>Concentration (μCi/mL)</u> | |
| | ²³⁰ U | 8x10 ⁻⁷ | |
| | ²³¹ U | 6x10 ⁻⁴ | |
| | ²³² U | 6x10 ⁻⁷ | |
| | ²³³ U | 3x10 ⁻⁶ | |
| | ²³⁴ U | 3x10 ⁻⁶ | |
| | ²³⁵ U | 3x10 ⁻⁶ | |
| | ²³⁶ U | 3x10 ⁻⁶ | |
| | ²³⁷ U | 3x10 ⁻⁴ | |
| | ²³⁸ U | 3x10 ⁻⁶ | |
| | ²³⁹ U | 9x10 ⁻³ | |
| | ²⁴⁰ U | 2x10 ⁻⁴ | |
| | U (natural) | 3x10 ⁻⁶ | |
| | Occupational ALIs for oral ingestion | | USNRC 2012a 10 CFR 20, Appendix B |
| | <u>Isotope</u> | <u>ALI (μCi)</u> | |
| | ²³⁰ U | 4.0 | |
| | ²³¹ U | 5,000 | |
| | ²³² U | 2.0 | |
| | ²³³ U | 10 | |
| | ²³⁴ U | 10 | |
| | ²³⁵ U | 10 | |
| | ²³⁶ U | 10 | |
| | ²³⁷ U | 2,000 | |
| | ²³⁸ U | 10 | |
| | ²³⁹ U | 70,000 | |
| | ²⁴⁰ U | 1,000 | |
| | U (natural) | 10 | |
| NTP | Carcinogenicity classification | | NTP 2012 77 FR 2728 |
| | Uranium (depleted) | Nominated to the Report on Carcinogens | |

^aWith the further provision that the effective dose should not exceed 50 mSv in any single year. Additional restrictions apply to the occupational exposure of pregnant women.

^bThe guideline value is designated as provisional because of outstanding uncertainties regarding the toxicology and epidemiology of uranium as well as difficulties concerning its technical achievability in smaller supplies.

^cThe limitation on the effective dose provides sufficient protection for the skin against stochastic effects. An additional limit is needed for localized exposure in order to prevent deterministic effects.

^dIn special circumstances, a higher value of effective dose could be allowed in a single year, provided that the average over 5 years does not exceed 1 mSv per year.

^ePAC-1: mild, transient health effects. PAC-2: irreversible or other serious health effects that could impair the ability to take protective action. PAC-3: life-threatening health effects.

^fNIOSH potential occupational carcinogen.

^gThree classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times of <10 days for D, for W from 10 to 100 days, and for Y >100 days.

^hThe EAFUS list of substances contains ingredients added directly to food that FDA has either approved as food additives or listed or affirmed as GRAS.

ⁱA1: confirmed human carcinogen

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Table 8-1. Regulations, Advisories, and Guidelines Applicable to Uranium

| Agency | Description | Information | Reference |
|--|-------------|-------------|-----------|
| <p>ACGIH = American Conference of Governmental Industrial Hygienists; AEGL = acute exposure guideline levels; AIHA = American Industrial Hygiene Association; ALI = annual limit on intake; BEI = biological exposure indices; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CFR = Code of Federal Regulations; DAC = derived air concentration; DOE = Department of Energy; DWEL = drinking water equivalent level; EAFUS = Everything Added to Food in the United States; EPA = Environmental Protection Agency; ERPG = emergency response planning guidelines; FDA = Food and Drug Administration; FR = Federal Register; GRAS = Generally Recognized As Safe; IARC = International Agency for Research on Cancer; ICRP = International Commission on Radiological Protection; IDLH = immediately dangerous to life or health; IRIS = Integrated Risk Information System; MCL = maximum contaminant level; MCLG = maximum contaminant level goal; NAAQS = National Ambient Air Quality Standards; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PAC = Protective Action Criteria; PEL = permissible exposure limit; REL = recommended exposure limit; RfC = inhalation reference concentration; RfD = oral reference dose; STEL = short-term exposure level; TDI = tolerable daily intake; TLV = threshold limit values; TSCA = Toxic Substances Control Act; TSD = treatment, storage, and disposal; TWA = time-weighted average; U = uranium; USC = United States Code; USNRC = U.S. Nuclear Regulatory Commission; WHO = World Health Organization</p> | | | |