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/m^3 for intermediate-duration inhalation exposure to insoluble uranium compounds based on a NOAEL of 1.1 mg U/m^3 and a LOAEL of 8.2 mg U/m^3 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/m^3 for intermediate-duration inhalation exposure to soluble uranium compounds based on a LOAEL of 0.15 mg U/m^3 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/m^3 for chronic-duration inhalation exposure to insoluble uranium compounds based on a LOAEL of 5.1 mg U/m^3 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/m^3 for chronic-duration inhalation exposure to soluble uranium compounds based on a $BMCL_{10}$ of 0.019 mg U/m^3 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 $BMDL_{05}$ of 0.2 mg U/kg/day for developmental effects in the offspring of

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
INTERNATIONAL			
Guidelines:			
WHO	TDI	0.6 µg/kg/day	WHO 2003, 2004
	Provisional drinking water guideline	15 µg/L water	WHO 2008
ICRP	Occupational	50 mSv/year whole body 150 mSv/year lens of eye 500 mSv hands and feet 500 mSv/year skin averaged over 1 cm^2 0.5 Gy/year averaged over 10 cm^2 at 70 mm depth	ICRP 1991, 2006b
	Public	1 mSv/year, or exceptionally more if 5-year average does not exceed 1 mSv/year 15 mSv/year lens of eye 50 mSv/year skin	
NATIONAL			
Regulations:			
a. Air:			
EPA OAR	Standards of performance for new stationary sources:		
	General provisions: priority list: prioritized major source categories	Priority #56: Uranium refining	40 CFR 60, Subpart A EPA 2011k
	Metallic mineral processing plants	At uranium ore processing plants, all facilities subsequent to and including the beneficiation of uranium ore are exempted from the provisions of this subpart	40 CFR 60, Subpart LL EPA 2011x
	NESHAPs:		
	Radon emissions from underground uranium mines	10 mrem/year effective dose equivalent to public from radon-222	40 CFR 61, Subpart B EPA 2011n
	Radionuclide emissions other than radon from DOE facilities	10 mrem/year to public from other than radon-222	40 CFR 61, Subpart H EPA 2011v
	Radionuclide emissions from federal facilities other than USNRC licensees and not covered by Subpart H	10 mrem/year to public from radionuclides including iodine 3 mrem/year to public from iodine	40 CFR 61, Subpart I EPA 2011w

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Radon emissions from DOE facilities	20 pCi/m^2-second of radon-222	40 CFR 61, Subpart Q EPA 2011y
	Radon emissions from phosphogypsum stacks	20 pCi/m^2-second of radon-222	40 CFR 61, Subpart R EPA 2011z
	Radon emissions from disposal of uranium mill tailings	20 pCi/m^2-second of radon-222 for tailings pile or impoundment no longer operations	40 CFR 61, Subpart T EPA 2011aa
	Radon emissions from operating mill tailing	20 pCi/m^2-second of radon-222 Specifies number, total area, and uncovered area of impoundments	40 CFR 61, Subpart W EPA 2011bb
	Environmental radiation protection standards for nuclear power operations: environmental standards for uranium fuel cycle: standards for normal operation		40 CFR 190, Subpart B EPA 2011o
	Quantity of radioactive material entering environment per gigawatt-year	50,000 Ci krypton-85 5 mCi plutonium-239 and other alpha-emissions with half-lives >1 year	
	Environmental radiation protection standards for management and disposal of spent nuclear fuel, high-level and transuranic wastes		40 CFR 191.12 EPA 2011d
	Definitions	Defined heavy metal as uranium, plutonium, or thorium placed into a nuclear reactor	
	Standards for control of residual radioactive materials from inactive uranium processing sites	Applies to designated processing or depository sites under §108 of UMTRCA and restoration of sites after mineral use	40 CFR 192, Subpart A EPA 2011l
	Standards (for control of residual radioactive materials and their listed constituents)	20 pCi/m^2/second radon-222 annual average above disposal site from residual 0.5 pCi/L radon-222 annual average above background outside disposal area	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Standards for cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites	Applies to land and buildings that are part of the processing site and most of uranium was produced for Federal government	40 CFR 192, Subpart B EPA 2011p
	Standards	0.02 working level of radon decay products (0.03 working level including background) in habitable buildings	
	Guidance for implementation	Yes	40 CFR 192, Subpart C EPA 2011r
	Additional listed constituents (replacement list of constituents for screening purposes)	Combined uranium-234 and uranium-238	
	Standards for management of uranium byproduct materials pursuant to Section 84 of the Atomic Energy Act of 1954, as amended	Yes	40 CFR 192, Subpart D EPA 2011t
	Standards (for application during processing operations and prior to the end of the closure period—concentration limits)	5 pCi/L combined radium-226 and radium-228 20 pCi/m^2-second radon-222 after permanent radon barrier installed	
		20 pCi/m^2-second radon-222 for 200 years, and to extent feasible for 1,000 years	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information				References
NATIONAL (cont.)						
USNRC and DOE	Occupational ALIs (µCi) and DACs (µCi/m^3) for inhalation for uranium compounds of Class D, W, and Y, for which the class refers to retention times (approximately days, weeks, or years) in the pulmonary region of the lung	Isotope	Class	ALI	DAC	10 CFR 20 Appendix B USNRC 2010a
		U-230	D	$6x10^{-1}$	$2x10^{-10}$	
			W	$4x10^{-1}$	$1x10^{-10}$	
			Y	$3x10^{-1}$	$1x10^{-10}$	
		U-231	D	$8x10^{-3}$	$3x10^{-6}$	
			W	$6x10^{-3}$	$2x10^{-6}$	
			Y	$5x10^{-3}$	$2x10^{-6}$	
		U-232	D	$4x10^{-1}$	$9x10^{-11}$	
			W	$4x10^{-1}$	$2x10^{-10}$	
			Y	$8x10^{-3}$	$3x10^{-12}$	
		U-233	D	$2x10^{0}$	$5x10^{-10}$	
			W	$7x10^{-1}$	$3x10^{-10}$	
			Y	$4x10^{-2}$	$2x10^{-11}$	
		U-234	D	$2x10^{0}$	$5x10^{-10}$	
			W	$7x10^{-1}$	$3x10^{-10}$	
			Y	$4x10^{-2}$	$2x10^{-11}$	
		U-235	D	$2x10^{0}$	$6x10^{-10}$	
			W	$8x10^{-1}$	$3x10^{-10}$	
			Y	$4x10^{-2}$	$2x10^{-11}$	
		U-236	D	$2x10^{0}$	$5x10^{-10}$	
			W	$8x10^{-1}$	$3x10^{-10}$	
			Y	$4x10^{-2}$	$2x10^{-11}$	
		U-237	D	$3x10^{-3}$	$1x10^{-6}$	
			W	$2x10^{-3}$	$7x10^{-7}$	
			Y	$2x10^{-3}$	$6x10^{-7}$	
		U-238	D	$2x10^{0}$	$6x10^{-10}$	
			W	$8x10^{-1}$	$3x10^{-10}$	
			Y	$4x10^{-2}$	$2x10^{-11}$	
		U-239	D	$2x10^{5}$	$8x10^{-5}$	
			W	$2x10^{5}$	$7x10^{-5}$	
			Y	$2x10^{5}$	$6x10^{-5}$	
		U-240	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	$5x10^{-2}$	$2x10^{-11}$	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information			References
NATIONAL (cont.)					
OSHA	Effluent concentrations (µCi/mL) for uranium compounds of Class D, W, and Y, for which the class refers to retention times (approximately days, weeks, or years) in the pulmonary region of the lung	Isotope	Class	Concentration	10 CFR 20 Appendix B USNRC 2010a
		U-230	D	$5x10^{-13}$	
			W	$5x10^{-13}$	
			Y	$5x10^{-14}$	
		U-231	D	$1x10^{-8}$	
			W	$8x10^{-9}$	
			Y	$6x10^{-9}$	
		U-232	D	$6x10^{-13}$	
			W	$5x10^{-13}$	
			Y	$1x10^{-14}$	
		U-233	D	$3x10^{-12}$	
			W	$1x10^{-12}$	
			Y	$5x10^{-14}$	
		U-234	D	$3x10^{-12}$	
			W	$1x10^{-12}$	
			Y	$5x10^{-14}$	
		U-235	D	$3x10^{-12}$	
			W	$1x10^{-12}$	
			Y	$6x10^{-14}$	
		U-236	D	$3x10^{-12}$	
			W	$1x10^{-12}$	
			Y	$6x10^{-14}$	
		U-237	D	$4x10^{-9}$	
			W	$2x10^{-9}$	
			Y	$2x10^{-9}$	
		U-238	D	$3x10^{-12}$	
			W	$1x10^{-12}$	
			Y	$6x10^{-14}$	
		U-239	D	$3x10^{-7}$	
			W	$3x10^{-7}$	
			Y	$3x10^{-7}$	
		U-240	D	$5x10^{-9}$	
			W	$4x10^{-9}$	
			Y	$3x10^{-9}$	
		$U_{natural}$	D	$Ex10^{-12}$	
			W	$9x10^{-13}$	
			Y	$9x10^{-14}$	
OSHA	Radioactive materials: Post caution radioactive material signs for natural uranium	Post sign on room containing natural uranium exceeding 100 times value in 10 CFR 20 Post sign on container containing natural uranium exceeding 10 times value in 10 CFR 20 Appendix C			29 CFR 1910.1096 OSHA 2010c

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	PEL TWA (corrected rule)		29 CFR 1910.1000 OSHA 2000d
	Soluble uranium	0.05 mg/m^3	
	Insoluble uranium	0.25 mg/m^3	
	STEL	0.6 mg/m^3 insoluble	
	Occupational safety and health standards for shipyard employment—8-hour TWA for air contaminants		29 CFR 1915.1000 OSHA 2010a
	Soluble uranium	0.2 mg/m^3	
	Insoluble uranium	0.2 mg/m^3	
	Safety and health regulations for construction—TWA TLVs for airborne contaminants		29 CFR 1926.55, Appendix A OSHA 2010b
	Soluble uranium	0.2 mg/m^3	
	Insoluble uranium	0.2 mg/m^3	
b. Water:			
EPA	National primary drinking water regulations		
	Monitoring and analytical requirements: analytical methods for radioactivity, uranium	Approved methodology (radiochemical, fluormetric, inductively coupled plasma-mass spectrometry, alpha spectrometry, laser phosphorimetry) and procedures for analyzing uranium in drinking water	40 CFR 141.25 EPA 2010a
		Alternate analysis procedures for uranium in drinking water	40 CFR 141 Subpart C, Appendix A EPA 2010b
	Maximum contaminant level goals for radionuclides	Zero for uranium	40 CFR 141.55 EPA 2010g
	Maximum contaminant levels for radionuclides	30 µg/L uranium	40 CFR 141.66 EPA 2010h
	BAT for reducing uranium in water	Ion exchange, reverse osmosis, lime softening, coagulation/filtration	40 CFR 141.66 EPA 2010h
	EPA administered permit programs: NPDES	Uranium is in Table V—toxic pollutants and hazardous substances required to be identified by existing dischargers if expected to be present	40 CFR 122, Appendix D EPA 2010c

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Criteria and standards for NPDES	Criteria and standards for technology-based treatment requirements in permits under section 301(b) of Clean Water Act, not specific to uranium	40 CFR 125 EPA 2011c
	Underground injection control program: criteria and standards		
	Classification of injection wells	Class III wells inject for extraction of minerals, including *in situ* production of uranium or other metals from ore bodies that have not been conventionally mined	40 CFR 146.5 EPA 2010e
	State, tribal, and EPA-administered underground injection control programs: Subpart HHH—Lands of the Navajo, Ute Mountain Ute, and All Other New Mexico Tribes		
	Aquifer exemptions	Applicants for uranium mining permit requiring an aquifer exemption must submit a plugging and abandonment plan	40 CFR 147.3003 EPA 2010d
	Plugging and abandonment of Class III wells	Addresses requirements for plugging and abandoning the wells	40 CFR 147.3011 EPA 2010i
	Environmental radiation protection standards for nuclear power operations: environmental standards for uranium fuel cycle: standards for normal operation		40 CFR 190, Subpart B EPA 2011o
	Quantity of radioactive material entering environment per gigawatt-year	5 mCi plutonium-239 and other alpha-emissions with half-lives >1 year	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Standards for cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites		40 CFR 192 Subpart A EPA 2011l
	Maximum concentration of constituents for groundwater protection	30 pCi/L combined uranium-234 and uranium-238 5 pCi/L combined radium-226 and radium-228 15 pCi/L gross alpha excluding radon and uranium	
	Environmental radiation protection standards for management and disposal of spent nuclear fuel, high-level and transuranic wastes		40 CFR 191.12 EPA 2011dd
	Definitions	Defines heavy metal as uranium, plutonium, or thorium placed into a nuclear reactor	40 CFR 191 Subpart C EPA 2011q
	Environmental standards for groundwater protection	Applies to radioactive contamination of underground sources of drinking water 10,000 years design basis for undisturbed performance 100 Ci/10,000 years cumulative release limit for uranium isotopes (233, 234, 235, 236, or 238) per 1,000 metric tons of heavy metal	
	Designation, reportable quantities, and notification of hazardous substances	Reportable quantities for uranium isotopes in Curies (Bq): U-230 1 ($3.7x10^{10}$) U-231 1,000 ($3.7x10^{13}$) U-232 0.01 ($3.7x10^{8}$) U-233 0.1 ($3.7x10^{9}$) U-234 0.1 ($3.7x10^{9}$) U-235 0.1 ($3.7x10^{9}$) U-236 0.1 ($3.7x10^{9}$) U-237 100 ($3.7x10^{12}$) U-238 0.1 ($3.7x10^{9}$) U-239 1,000 ($3.7x10^{13}$) U-240 1,000 ($3.7x10^{13}$)	40 CFR 302.4 Appendix B EPA 2011b

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Procedures for EPA to reimburse local governments for certain emergency response costs	Excludes from this section releases of source, byproduct, or special nuclear material under Atomic Energy Act or UMTRCA regulations	40 CFR 310.3 EPA 2010k
	Nonferrous metals manufacturing point source category:		
	Secondary uranium subcategory	Applicable to discharges resulting from production of uranium (including depleted uranium) by secondary uranium facilities	40 CFR 421, Subpart AD EPA 2011m
	Secondary uranium subcategory: effluent limitations attainable by BPT (control)	Limits for Cr, Cu, Ni, F, total suspended solids, and pH	40 CFR 421.322 EPA 2011e
	Secondary uranium subcategory: effluent limitations attainable by BAT	Limits for Cr, Cu, Ni, and F	40 CFR 421.323 EPA 2011f
	Secondary uranium subcategory: standards of performance for new source	Limits for Cr, Cu, Ni, F, total suspended solids, and pH	40 CFR 421.324 EPA 2011j
	Secondary uranium subcategory: pretreatment standards for new sources	Limits for Cr, Cu, Ni, and F	40 CFR 421.326 EPA 2011h
	Effluent guidelines and standards: ore mining and dressing point source category: uranium, radium, and vanadium ores subcategory		40 CFR 440 Subpart C EPA 2011s
	Description of uranium ore subcategory	Applies to discharges from mines that produce uranium, radium, or vanadium ores and mills that extract these metals	40 CFR 440 Subpart C EPA 2011s
	Uranium effluent limits attainable by applicability of BPT (control)	4 mg/L; maximum for 1 day 2 mg/L; average for 30 consecutive days	40 CFR 440 Subpart C EPA 2011s
	Uranium effluent limits attainable by applicability of BAT	4.0 mg/L; maximum for 1 day 2.0 mg/L; average for 30 consecutive days	40 CFR 440 Subpart C EPA 2011s
	NSPS	4.0 mg/L; maximum for 1 day 2.0 mg/L; average for 30 consecutive days	40 CFR 440 Subpart C EPA 2011s

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Nonferrous metals forming and metal powders effluent guidelines and standards		
	Uranium forming subcategory:	Applies to non-uranium pollutants or pollutant properties present in effluent waste water from uranium forming processes; limits are provided as follows:	40 CFR 471 Subpart G EPA 2011u
	Effluent limitations representing the degree of effluent reduction attainable by the application of the BPT (control) currently available	Maxima for any 1 day or monthly average for metals, fluoride, oils and greases, and pH	40 CFR 471 Subpart G EPA 2011u
	Effluent limitations representing the degree of effluent reduction attainable by the application of the BAT economically achievable	Maxima for any 1 day or monthly average for metals, fluoride, oils and greases, and pH	40 CFR 471 Subpart G EPA 2011u
		Maxima for any 1 day or monthly average for metals, fluoride, oils and greases, and pH	40 CFR 471 Subpart G EPA 2011u
	PSNS	Maxima for any 1 day or monthly average for metals, fluoride, oils and greases, and pH	40 CFR 471.75 EPA 2011i
USNRC	Occupational ALIs for oral ingestion	U-230 6 µCi U-231 4,000 µCi U-232 4 µCi U-233 2 µCi U-234 20 µCi U-235 20 µCi U-236 20 µCi U-237 2,000 µCi U-238 20 µCi U-239 7 µCi U-240 1,000 µCi $U_{natural}$ 20 µCi	10 CFR 20 Appendix B USNRC 2010a

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Effluent concentrations	U-230 $8x10^{-8}$ µCi/mL U-231 $6x10^{-5}$ µCi/mL U-232 $6x10^{-8}$ µCi/mL U-233 $3x10^{-7}$ µCi/mL U-234 $3x10^{-7}$ µCi/mL U-235 $3x10^{-7}$ µCi/mL U-236 $3x10^{-7}$ µCi/mL U-237 $3x10^{-5}$ µCi/mL U-238 $3x10^{-7}$ µCi/mL U-239 $9x10^{-4}$ µCi/mL U-240 $2x10^{-5}$ µCi/mL $U_{natural}$ $3x10^{-7}$ µCi/mL	10 CFR 20 Appendix B USNRC 2010a
	Releases to sewers (monthly average concentration)	U-230 $8x10^{-7}$ µCi/mL U-231 $6x10^{-4}$ µCi/mL U-232 $6x10^{-7}$ µCi/mL U-233 $3x10^{-6}$ µCi/mL U-234 $3x10^{-6}$ µCi/mL U-235 $3x10^{-6}$ µCi/mL U-236 $3x10^{-6}$ µCi/mL U-237 $3x10^{-4}$ µCi/mL U-238 $3x10^{-6}$ µCi/mL U-239 $9x10^{-3}$ µCi/mL U-240 $2x10^{-4}$ µCi/mL $U_{natural}$ $3x10^{-6}$ µCi/mL	
c. Other:			
DOI Office of Surface Mine Reclamation and Enforcement	Abandoned mine reclamation: Exclusion of certain non-coal reclamation sites	Uncertified states/tribes may not use funds from §872.29 to reclaim sites designated for remediation under UMTRCA or CERCLA	30 CFR 875.16 DOI 2011
EPA	Environmental radiation protection standards for nuclear power operations: environmental standards for uranium fuel cycle: standards for normal operation		40 CFR 190 Subpart B EPA 2011o
	Annual dose equivalent limit to members of the public	25 mrems whole body 75 mrems thyroid 25 mrems any other organ	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
EPA	Standards for cleanup of land and buildings contaminated with residual radioactive materials from inactive uranium processing sites	Applies to land and buildings that are part of the processing site and most of uranium was produced for Federal government	40 CFR 192, Subpart B EPA 2011p
	Standards	5 pCi/g radium-226 averaged over top 15 cm of soil 15 pCi/g radium-226 over lower 15 cm layers of soil 20 µR/hour gamma radiation above background	
EPA OSWER	Exclusion from identification and listing of uranium as a hazardous waste	Yes	40 CFR 261.4 EPA 2011g
	Land disposal restriction phase IV: Final rule promulgating treatment standards for metal wastes and mineral processing wastes	Yes	63 FR 28556 EPA 1998d
	Uncontrolled hazardous waste site ranking system: definitions	Lists relevant sections of the Uranium Mill Tailings Radiation Control Act Standards as part of EPA hazard ranking system used to place sites on NPL	40 CFR 300 Appendix A, §1.1 EPA 2011a
	National oil and hazardous substance pollution contingency plan: definitions	Excludes releases of substances regulated under UMTRCA	40 CFR 300.5 EPA 2011d
EPA	Timing of Administration Act under Uranium Mill Tailing Radiation Control Act of 1978	Date/time of promulgation shall be 1 pm Eastern time 2 weeks after notice published in Federal Register	40 CFR 23.8 EPA 2011cc
USNRC	Standards for protection against radiation		
	Definition of byproduct material	Includes tailings or waste from U or Th ore processed primarily for its source material content	10 CFR 20.1003 USNRC 2010c
	Dose limits for individual members of the public—total effective dose equivalent	0.1 rem/year from licensed operation 0.1 rem for access to controlled areas 0.5 rem when visiting any one patient who is restricted for containing medical radioactive material	10 CFR 20.1301 USNRC 2010e

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
	Occupational dose limits for adults	5 rem/year total effective dose equivalent; 50 rem/year deep dose equivalent plus committed dose equivalent (other than lens of eye); 15 rem/year lens dose equivalent; 50 rem/year skin dose equivalent; ALI and DAC limits apply; 10 mg/week intake of soluble uranium	10 CFR 20.1201, Subpart C USNRC 2010h; 10 CFR 20.1206 USNRC 2010g
	Planned special exposures	Dose in excess of the 10 CFR 20.1201 limit can equal the 10 CFR 20.1201 limit in any 1 year up to 5 times the annual limit in a lifetime	10 CFR 20.1206 USNRC 2010g
	Occupational dose limits to minors	10% of annual dose limits in 10 CFR 20.1201	10 CFR 20.1207 USNRC 2010f
	Dose equivalent to embryo/fetus	0.5 rem for entire pregnancy; if dose exceeds 0.45 rem when female declares pregnancy to licensee, 0.05 rem additional is allowed	10 CFR 20.1208 USNRC 2011d
	Radiological criteria for license termination—applicability	Not applicable to U/Th extraction facilities subject to 10 CFR 40 Appendix A or to U solution extraction facilities	10 CFR 20, Subpart E USNRC 2000i
	Requirements for transfers of low-level radioactive waste intended for disposal at licensed land disposal facilities and manifests	Requires reporting U-233 and U-235 masses in special nuclear material and total uranium and thorium masses in each waste container or in uncontainerized waste	10 CFR 20, Appendix G USNRC 2010b
Guidelines:			
a. Air:			
ACGIH	Soluble and insoluble		ACGIH 2011
	TLV-TWA	0.2 mg/m^3	
	Ceiling	0.6 mg/m^3	
NIOSH	Insoluble		NIOSH 2010a, 2010b
	REL-TWA (insoluble)	0.2 mg/m^3	
	REL-STEL	0.6 mg/m^3	
	Soluble		
	REL-TWA (soluble)	0.05 mg/m^3	

Table 8-1. Regulations and Guidelines Applicable to Uranium

Agency	Description	Information	References
NATIONAL (cont.)			
b. Other			
EPA-OSWER	Use of soil cleanup criteria in 40 CFR Part 192 as remediation goals for CERCLA cleanup	OSWER Directive 9200.4-25	EPA 1998e
	Establishment of cleanup levels for CERCLA site with radioactive contamination	OSWER Directive 9200.4-18	EPA 1997f
ACGIH	Cancer classification	A1[a]	ACGIH 2011
EPA-IRIS	Cancer classification	Withdrawn	IRIS 2011
NIOSH	Cancer classification	Ca[b]	NIOSH 2010a, 2010b

[a]A1 cancer classification indicates that the agent is a confirmed human carcinogen.
[b]Ca cancer classification indicates that the agent is a potential occupational carcinogen.

ACGIH = American Conference of Governmental Industrial Hygienists; ALI = annual limits on intake; BAT = best available technology; BPT = best practicable technology; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; DAC = derived air concentration; DOE = Department of Energy; DOI = Department of the Interior; EPA = Environmental Protection Agency; ICRP = International Commission on Radiological Protection; IRIS = Integrated Risk Information System; Gy = gray; Sv = sievert; NESHAP = National Emission Standards for Hazardous Air Pollutants; NIOSH = National Institute for Occupational Safety and Health; NPDES = National Pollutant Discharge Elimination System; NPL = National Priorities List; NSPS = New Source Performance Standard; OAR = Office of Air and Radiation; OPPTS = Office of Pollution Prevention and Toxic Substances; OSHA = Occupational Safety and Health Administration; OSWER = Office of Solid Waste and Emergency Response; PEL = permissible exposure limit; PSNS = Pretreatment Standards for New Sources; REL = recommended exposure limit; STEL = short-term exposure limit; TDI = tolerable daily intake; TLV = Threshold Limit Values; TWA = time-weighted average; UMTRCA = Uranium Mill Tailings Radiation Control Act; USNRC = U.S. Nuclear Regulatory Commission; WHO = World Health Organization

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 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 2011). 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 IRIS database, the EPA withdrew its carcinogenic assessment of uranium in 1993 (IRIS 2011).