

Chapter HFS 157

APPENDIX E

ANNUAL LIMITS ON INTAKE (ALI) AND DERIVED AIR CONCENTRATIONS (DAC) OF RADIONUCLIDES FOR OCCUPATIONAL EXPOSURE; EFFLUENT CONCENTRATIONS; CONCENTRATIONS FOR RELEASE TO SANITARY SEWERAGE

Introduction

For each radionuclide, Table I indicates the chemical form which is to be used for selecting the appropriate ALI or DAC value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1 μ (micron), and for the D, W and Y classes of radioactive material, which refer to their retention in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D if less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days. The D, W or Y class given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, column 2 and 3. Table II provides concentration limits for airborne and liquid effluents released to the general environment. Table III provides concentration limits for discharges to sanitary sewerage.

Note: The values in Tables I, II, and III are presented in the computer "E" notation. In this notation a value of 6E-02 represents a value of 6×10^{-2} or 0.06, 6E+2 represents 6×10^2 or 600, and 6E+0 represents 6×10^0 or 6.

Table I "Occupational Values"

Note that the columns in Table I of this appendix captioned "Oral Ingestion ALI," "Inhalation ALI" and "DAC" are applicable to occupational exposure to radioactive material.

The ALIs in this appendix are the annual intakes of given radionuclide by "reference man" which would result in either (1) a committed effective dose equivalent of 0.05 Sv (5 rem), stochastic ALI, or (2) a committed dose equivalent of 0.5 Sv (50 rem) to an organ or tissue, non-stochastic ALI. The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 0.05 Sv (5 rem). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, w_T . This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of w_T are listed under the definition of weighting factor in s. HFS 157.03. The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

Note: A description of the reference man is contained in the International Commission on Radiological Protection report, ICRP Publication 23, Reference Man: Anatomical, Physiological and Metabolic Characteristics, Pergamon Press, Oxford (1975). The publication may be ordered from the web-site <http://www.icrp.org/ordering.htm>.

A value of $w_T = 0.06$ is applicable to each of the 5 organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following portions of the GI

tract — stomach, small intestine, upper large intestine, and lower large intestine — are to be treated as 4 separate organs.

Note that the dose equivalents for an extremity, skin and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

When an ALI is defined by the stochastic dose limit, this value alone is given. When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. Abbreviated organ or tissue designations are used:

LLI wall = lower large intestine wall;

St wall = stomach wall;

Blad wall = bladder wall; and

Bone surf = bone surface.

The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 0.5 Sv (50 rem) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose equivalent to that organ, not the effective dose. For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, intake of each radionuclide/ $ALI_{ns} = 1.0$. If there is an external deep dose equivalent contribution of H_d , then this sum must be less than $1 - (H_d/50)$, instead of = 1.0.

Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

The derived air concentration (DAC) values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by:

$$DAC = ALI \text{ in :Ci/(2000 hours per working year} \times 60 \text{ minutes/hour} \times$$

$$2 \times 10^4 \text{ ml per minute)} = [ALI/2.4 \times 10^9] \text{ :Ci/ml,}$$

where 2×10^4 ml is the volume of air breathed per minute at work by reference man under working conditions of light work.

The DAC values relate to 1 of 2 modes of exposure: either external submersion or the internal committed dose equivalents

resulting from inhalation of radioactive materials. DACs based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

The ALI and DAC values include contributions to exposure by the single radionuclide named and any in-growth of daughter radionuclides produced in the body by decay of the parent. However, intakes that include both the parent and daughter radionuclides should be treated by the general method appropriate for mixtures.

The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both or when the individual is exposed to both internal and external irradiation. See s. HFS 157.22 (2). When an individual is exposed to radioactive materials that fall under several of the translocation classifications of the same radionuclide, such as Class D, Class W or Class Y, the exposure may be evaluated as if it were a mixture of different radionuclides.

It should be noted that the classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radionuclides. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

Table II "Effluent Concentrations"

The columns in Table II of this appendix captioned "Effluents," "Air" and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of s. HFS 157.23 (2). The concentration values given in Columns 1 and 2 of Table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.5 mSv (0.05 rem).

Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits because non-stochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table II. For this reason, the DAC and airborne effluent limits are not always proportional.

The air concentration values listed in Table II, Column 1 were derived by one of 2 methods. For those radionuclides for

which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4×10^9 ml, relating the inhalation ALI to the DAC, as explained above, and then divided by a factor of 300. The factor of 300 includes the following components: a factor of 50 to relate the 0.05 Sv (5 rem) annual occupational dose limit to the 1 mSv (0.1 rem) limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values, derived for adults, so that they are applicable to other age groups.

For those radionuclides for which submersion, that is external dose, is limiting, the occupational DAC in Table I, Column 3 was divided by 219. The factor of 219 is composed of a factor of 50, as described above, and a factor of 4.38 relating occupational exposure for 2,000 hours of a 8,760 hour full-time exposure per year. Note that an additional factor of 2 for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^7 . The factor of 7.3×10^7 ml includes the following components: the factors of 50 and 2 described above and a factor of 7.3×10^5 ml which is the annual water intake of reference man.

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings, including occupational inhalation ALIs and DACs, air and water effluent concentrations and releases to sewer, require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded as being present either from knowledge of the radionuclide composition of the source or from actual measurements.

Table III "Releases to Sewers"

The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in s. HFS 157.30 (3). The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^6 ml. The factor of 7.3×10^6 ml is composed of a factor of 7.3×10^5 ml, the annual water intake by reference man, and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of 5 mSv (0.5 rem).

List of Elements

Name	Symbol	Atomic Number
Actinium	Ac	89
Aluminum	Al	13
Americium	Am	95
Antimony	Sb	51
Argon	Ar	18
Arsenic	As	33
Astatine	At	85
Barium	Ba	56
Berkelium	Bk	97
Beryllium	Be	4
Bismuth	Bi	83
Bromine	Br	35
Cadmium	Cd	48
Calcium	Ca	20
Californium	Cf	98
Carbon	C	6
Cerium	Ce	58
Cesium	Cs	55
Chlorine	Cl	17
Chromium	Cr	24
Cobalt	Co	27
Copper	Cu	29
Curium	Cm	96
Dysprosium	Dy	66
Einsteinium	Es	99
Erbium	Er	68
Europium	Eu	63
Fermium	Fm	100
Fluorine	F	9
Francium	Fr	87
Gadolinium	Gd	64
Gallium	Ga	31
Germanium	Ge	32
Gold	Au	79
Hafnium	Hf	72
Holmium	Ho	67
Hydrogen	H	1
Indium	In	49
Iodine	I	53
Iridium	Ir	77
Iron	Fe	26
Krypton	Kr	36
Lanthanum	La	57
Lead	Pb	82
Lutetium	Lu	71
Magnesium	Mg	12
Manganese	Mn	25

List of Elements (Cont.)

Name	Symbol	Atomic Number
Mendelevium	Md	101
Mercury	Hg	80
Molybdenum	Mo	42
Neodymium	Nd	60
Neptunium	Np	93
Nickel	Ni	28
Niobium	Nb	41
Osmium	Os	76
Palladium	Pd	46
Phosphorus	P	15
Platinum	Pt	78
Plutonium	Pu	94
Polonium	Po	84
Potassium	K	19
Praseodymium	Pr	59
Promethium	Pm	61
Protactinium	Pa	91
Radium	Ra	88
Radon	Rn	86
Rhenium	Re	75
Rhodium	Rh	45
Rubidium	Rb	37
Ruthenium	Ru	44
Samarium	Sm	62
Scandium	Sc	21
Selenium	Se	34
Silicon	Si	14
Silver	Ag	47
Sodium	Na	11
Strontium	Sr	38
Sulfur	S	16
Tantalum	Ta	73
Technetium	Tc	43
Tellurium	Te	52
Terbium	Tb	65
Thallium	Tl	81
Thorium	Th	90
Thulium	Tm	69
Tin	Sn	50
Titanium	Ti	22
Tungsten	W	74
Uranium	U	92
Vanadium	V	23
Xenon	Xe	54
Ytterbium	Yb	70
Yttrium	Y	39
Zinc	Zn	30

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion			Air	Water	
			ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
1	Hydrogen-3	Water, DAC includes skin absorption	8E+4	8E+4	2E-5	1E-7	1E-3	1E-2
		Gas (HT or T ₂) Submersion ^{a/} : Use above values as HT & T ₂ oxidize in air & in the body to HTO.						
4	Beryllium-7	W, all compounds except those given for Y	4E+4	2E+4	9E-6	3E-8	6E-4	6E-3
		Y, oxides, halides, and nitrates	-	2E+4	8E-6	3E-8	-	-
4	Beryllium-10	W, see ⁷ Be	1E+3	2E+2	6E-8	2E-10	-	-
		LLI wall	(1E+3)	-	-	-	2E-5	2E-4
		Y, see ⁷ Be	-	1E+1	6E-9	2E-11	-	-
6	Carbon-11 ^{b/}	Monoxide	-	1E+6	5E-4	2E-6	-	-
		Dioxide	-	6E+5	3E-4	9E-7	-	-
		Compounds	4E+5	4E+5	2E-4	6E-7	6E-3	6E-2
6	Carbon-14	Monoxide	-	2E+6	7E-4	2E-6	-	-
		Dioxide	-	2E+5	9E-5	3E-7	-	-
		Compounds	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
9	Fluorine-18 ^{b/}	D, fluorides of H, Li, Na, K, Rb, Cs, and Fr	5E+4	7E+4	3E-5	1E-7	-	-
		St wall	(5E+4)	-	-	-	7E-4	7E-3
		W, fluorides of Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn, Tc, and Re	-	9E+4	4E-5	1E-7	-	-
		Y, lanthanum fluoride	-	8E+4	3E-5	1E-7	-	-
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10	6E-6	6E-5
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
12	Magnesium-28	D, all compounds except those given for W	7E+2	2E+3	7E-7	2E-9	9E-6	9E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	1E+3	5E-7	2E-9	-	-
13	Aluminum-26	D, all compounds except those given for W	4E+2	6E+1	3E-8	9E-11	6E-6	6E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	9E+1	4E-8	1E-10	-	-
14	Silicon-31	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and nitrates	-	3E+4	1E-5	5E-8	-	-
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-

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Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
14	Silicon-32	D, see ³¹ Si	2E+3 LLI wall (3E+3)	2E+2	1E-7	3E-10	-	-
		W, see ³¹ Si-	1E+2	5E-8	2E-10	-	4E-5	4E-4
		Y, see ³¹ Si	-	5E+0	2E-9	7E-12	-	-
15	Phosphorus-32	D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
		W, phosphates of Zn ²⁺ , S ³⁺ , Mg ²⁺ , Fe ³⁺ , Bi ³⁺ , and lanthanides	-	4E+2	2E-7	5E-10	-	-
15	Phosphorus-33	D, see ³² P	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
		W, see ³² P	-	3E+3	1E-6	4E-9	-	-
16	Sulfur-35	Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates except those given for W	1E+4 LLI wall (8E+3)	2E+4	7E-6	2E-8	-	-
		W, elemental sulfur, sulfides of Sr, Ba, Ge, Sn, Pb, As, Sb, Bi, Cu, Ag, Au, Zn, Cd, Hg, W, and Mo. Sulfates of Ca, Sr, Ba, Ra, As, Sb, and Bi	6E+3	-	-	-	1E-4	1E-3
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and Fr	-	2E+3	9E-7	3E-9	-	-
		W, chlorides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, and Re	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
17	Chlorine-38 ^{b/}	D, see ³⁶ Cl	-	2E+2	1E-7	3E-10	-	-
		St wall	2E+4 (3E+4)	4E+4	2E-5	6E-8	-	-
		W, see ³⁶ Cl	-	5E+4	2E-5	6E-8	3E-4	3E-3
17	Chlorine-39 ^{b/}	D, see ³⁶ Cl	2E+4 St wall (4E+4)	5E+4	2E-5	7E-8	-	-
		W, see ³⁶ Cl	-	6E+4	2E-5	8E-8	5E-4	5E-3
18	Argon-37	Submersion ^{a/}	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion ^{a/}	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion ^{a/}	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10	4E-6	4E-5
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9	6E-5	6E-4

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Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2 <u>Inhalation</u> ALI (μ Ci)	Col. 3 DAC (μ Ci/ml)	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44 ^{b/}	D, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
19	Potassium-45 ^{b/}	D, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
20	Calcium-41	W, all compounds	3E+3	4E+3	2E-6	-	-	-
			Bone surf (4E+3)	Bone surf (4E+3)	-	5E-9	6E-5	6E-4
20	Calcium-45	W, all compounds	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
20	Calcium-47	W, all compounds	8E+2	9E+2	4E-7	1E-9	1E-5	1E-4
21	Scandium-43	Y, all compounds	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
21	Scandium-44m	Y, all compounds	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
21	Scandium-44	Y, all compounds	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
21	Scandium-46	Y, all compounds	9E+2	2E+2	1E-7	3E-10	1E-5	1E-4
21	Scandium-47	Y, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
21	Scandium-48	Y, all compounds	8E+2	1E+3	6E-7	2E-9	1E-5	1E-4
21	Scandium-49 ^{b/}	Y, all compounds	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
22	Titanium-44	D, all compounds except those given for W and Y	3E+2	1E+1	5E-9	2E-11	4E-6	4E-5
		W, oxides, hydroxides, carbides, halides, and nitrates	-	3E+1	1E-8	4E-11	-	-
		Y, SrTiO	-	6E+0	2E-9	8E-12	-	-
22	Titanium-45	D, see ⁴⁴ Ti	9E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ⁴⁴ Ti	-	4E+4	1E-5	5E-8	-	-
		Y, see ⁴⁴ Ti	-	3E+4	1E-5	4E-8	-	-
23	Vanadium-47 ^{b/}	D, all compounds except those given for W	3E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, oxides, hydroxides, carbides, and halides	-	1E+5	4E-5	1E-7	-	-
23	Vanadium-48	D, see ⁴⁷ V	6E+2	1E+3	5E-7	2E-9	9E-6	9E-5
		W, see ⁴⁷ V	-	6E+2	3E-7	9E-10	-	-
23	Vanadium-49	D, see ⁴⁷ V	7E+4	3E+4	1E-5	-	-	-
			LLI wall (9E+4)	Bone surf (3E+4)	-	5E-8	1E-3	1E-2
		W, see ⁴⁷ V	-	2E+4	8E-6	2E-8	-	-
24	Chromium-48	D, all compounds except those given for W and Y	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, halides and nitrates	-	7E+3	3E-6	1E-8	-	-
		Y, oxides and hydroxides	-	7E+3	3E-6	1E-8	-	-
24	Chromium-49 ^{b/}	D, see ⁴⁸ Cr	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, see ⁴⁸ Cr	-	1E+5	4E-5	1E-7	-	-
		Y, see ⁴⁸ Cr	-	9E+4	4E-5	1E-7	-	-

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			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
24	Chromium-51	D, see ^{48}Cr W, see ^{48}Cr Y, see ^{48}Cr	4E+4 - -	5E+4 2E+4 2E+4	2E-5 1E-5 8E-6	6E-8 3E-8 3E-8	5E-4 - -	5E-3 - -
25	Manganese-51 ^{b/}	D, all compounds except those given for W W, oxides, hydroxides, halides, and nitrates	2E+4 -	5E+4 6E+4	2E-5 3E-5	7E-8 8E-8	3E-4 -	3E-3 -
25	Manganese-52m ^{b/}	D, see ^{51}Mn	3E+4 St wall (4E+4)	9E+4 -	4E-5 -	1E-7 -	- 5E-4	- 5E-3
25	Manganese-52	W, see ^{51}Mn D, see ^{51}Mn W, see ^{51}Mn	- 7E+2 -	1E+5 1E+3 9E+2	4E-5 5E-7 4E-7	1E-7 2E-9 1E-9	- 1E-5 -	- 1E-4 -
25	Manganese-53	D, see ^{51}Mn	5E+4	1E+4	5E-6	-	7E-4	7E-3
25	Manganese-54	W, see ^{51}Mn D, see ^{51}Mn W, see ^{51}Mn	- 2E+3 -	Bone surf (2E+4) 1E+4	- 5E-6	3E-8 2E-8	- -	- -
25	Manganese-56	D, see ^{51}Mn W, see ^{51}Mn	5E+3 -	2E+4 2E+4	6E-6 9E-6	2E-8 3E-8	7E-5 -	7E-4 -
26	Iron-52	D, all compounds except those given for W W, oxides, hydroxides, and halides	9E+2 -	3E+3 2E+3	1E-6 1E-6	4E-9 3E-9	1E-5 -	1E-4 -
26	Iron-55	D, see ^{52}Fe W, see ^{52}Fe	9E+3 -	2E+3 4E+3	8E-7 2E-6	3E-9 6E-9	1E-4 -	1E-3 -
26	Iron-59	D, see ^{52}Fe W, see ^{52}Fe	8E+2 -	3E+2 5E+2	1E-7 2E-7	5E-10 7E-10	1E-5 -	1E-4 -
26	Iron-60	D, see ^{52}Fe W, see ^{52}Fe	3E+1 -	6E+0 2E+1	3E-9 8E-9	9E-12 3E-11	4E-7 -	4E-6 -
27	Cobalt-55	W, all compounds except those given for Y Y, oxides, hydroxides, halides, and nitrates	1E+3 -	3E+3 3E+3	1E-6 1E-6	4E-9 4E-9	2E-5 -	2E-4 -
27	Cobalt-56	W, see ^{55}Co Y, see ^{55}Co	5E+2 4E+2	3E+2 2E+2	1E-7 8E-8	4E-10 3E-10	6E-6 -	6E-5 -
27	Cobalt-57	W, see ^{55}Co Y, see ^{55}Co	8E+3 4E+3	3E+3 7E+2	1E-6 3E-7	4E-9 9E-10	6E-5 -	6E-4 -
27	Cobalt-58m	W, see ^{55}Co Y, see ^{55}Co	6E+4 -	9E+4 6E+4	4E-5 3E-5	1E-7 9E-8	8E-4 -	8E-3 -
27	Cobalt-58	W, see ^{55}Co Y, see ^{55}Co	2E+3 1E+3	1E+3 7E+2	5E-7 3E-7	2E-9 1E-9	2E-5 -	2E-4 -
27	Cobalt-60m ^{b/}	W, see ^{55}Co	1E+6 St wall (1E+6)	4E+6 -	2E-3 -	6E-6 -	- 2E-2	- 2E-1
		Y, see ^{55}Co	-	3E+6	1E-3	4E-6	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
27	Cobalt-60	W, see ⁵⁵ Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ⁵⁵ Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61 _b	W, see ⁵⁵ Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ⁵⁵ Co	2E+4	6E+4	2E-5	8E-8	-	-
27	Cobalt-62m _b	W, see ⁵⁵ Co	4E+4	2E+5	7E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
		Y, see ⁵⁵ Co	-	2E+5	6E-5	2E-7	-	-
28	Nickel-56	D, all compounds except those given for W	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		W, oxides, hydroxides, and carbides	-	1E+3	5E-7	2E-9	-	-
		Vapor	-	1E+3	5E-7	2E-9	-	-
28	Nickel-57	D, see ⁵⁶ Ni	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ⁵⁶ Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	6E+3	3E-6	9E-9	-	-
28	Nickel-59	D, see ⁵⁶ Ni	2E+4	4E+3	2E-6	5E-9	3E-4	3E-3
		W, see ⁵⁶ Ni	-	7E+3	3E-6	1E-8	-	-
		Vapor	-	E+3	8E-7	3E-9	-	-
28	Nickel-63	D, see ⁵⁶ Ni	9E+3	2E+3	7E-7	2E-9	1E-4	1E-3
		W, see ⁵⁶ Ni	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	8E+2	3E-7	1E-9	-	-
28	Nickel-65	D, see ⁵⁶ Ni	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ⁵⁶ Ni	-	3E+4	1E-5	4E-8	-	-
		Vapor	-	2E+4	7E-6	2E-8	-	-
28	Nickel-66	D, see ⁵⁶ Ni	4E+2	2E+3	7E-7	2E-9	-	-
		LLI wall (5E+2)	-	-	-	-	6E-6	6E-5
		W, see ⁵⁶ Ni	-	6E+2	3E-7	9E-10	-	-
		Vapor	-	3E+3	1E-6	4E-9	-	-
29	Copper-60 _b	D, all compounds except those given for W and Y	3E+4	9E+4	4E-5	1E-7	-	-
		St wall (3E+4)	-	-	-	-	4E-4	4E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	4E-5	1E-7	-	-
29	Copper-61	D, see ⁶⁰ Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ⁶⁰ Cu	-	4E+4	2E-5	6E-8	-	-
		Y, see ⁶⁰ Cu	-	4E+4	1E-5	5E-8	-	-
29	Copper-64	D, see ⁶⁰ Cu	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ⁶⁰ Cu	-	2E+4	1E-5	3E-8	-	-
		Y, see ⁶⁰ Cu	-	2E+4	9E-6	3E-8	-	-
29	Copper-67	D, see ⁶⁰ Cu	5E+3	8E+3	3E-6	1E-8	6E-5	6E-4
		W, see ⁶⁰ Cu	-	5E+3	2E-6	7E-9	-	-
		Y, see ⁶⁰ Cu	-	5E+3	2E-6	6E-9	-	-
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
30	Zinc-63 _{b/}	Y, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	3E-4	3E-3
30	Zinc-65	Y, all compounds	4E+2	3E+2	1E-7	4E-10	5E-6	5E-5
30	Zinc-69m	Y, all compounds	4E+3	7E+3	3E-6	1E-8	6E-5	6E-4
30	Zinc-69 _{b/}	Y, all compounds	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
30	Zinc-71m	Y, all compounds	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
30	Zinc-72	Y, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
31	Gallium-65 _{b/}	D, all compounds except those given for W	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
		W, oxides, hydroxides, carbides, halides, and nitrates	-	2E+5	8E-5	3E-7	-	-
31	Gallium-66	D, see ⁶⁵ Ga	1E+3	4E+3	1E-6	5E-9	1E-5	1E-4
		W, see ⁶⁵ Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-67	D, see ⁶⁵ Ga	7E+3	1E+4	6E-6	2E-8	1E-4	1E-3
		W, see ⁶⁵ Ga	-	1E+4	4E-6	1E-8	-	-
31	Gallium-68 _{b/}	D, see ⁶⁵ Ga	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ⁶⁵ Ga	-	5E+4	2E-5	7E-8	-	-
31	Gallium-70 _{b/}	D, see ⁶⁵ Ga	5E+4	2E+5	7E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		W, see ⁶⁵ Ga	-	2E+5	8E-5	3E-7	-	-
31	Gallium-72	D, see ⁶⁵ Ga	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ⁶⁵ Ga	-	3E+3	1E-6	4E-9	-	-
31	Gallium-73	D, see ⁶⁵ Ga	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ⁶⁵ Ga	-	2E+4	6E-6	2E-8	-	-
32	Germanium-66	D, all compounds except those given for W	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
		W, oxides, sulfides, and halides	-	2E+4	8E-6	3E-8	-	-
32	Germanium-67 _{b/}	D, see ⁶⁶ Ge	3E+4	9E+4	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	6E-4	6E-3
		W, see ⁶⁶ Ge	-	1E+5	4E-5	1E-7	-	-
32	Germanium-68	D, see ⁶⁶ Ge	5E+3	4E+3	2E-6	5E-9	6E-5	6E-4
		W, see ⁶⁶ Ge	-	1E+2	4E-8	1E-10	-	-
32	Germanium-69	D, see ⁶⁶ Ge	1E+4	2E+4	6E-6	2E-8	2E-4	2E-3
		W, see ⁶⁶ Ge	-	8E+3	3E-6	1E-8	-	-
32	Germanium-71	D, see ⁶⁶ Ge	5E+5	4E+5	2E-4	6E-7	7E-3	7E-2
		W, see ⁶⁶ Ge	-	4E+4	2E-5	6E-8	-	-
32	Germanium-75 _{b/}	D, see ⁶⁶ Ge	4E+4	8E+4	3E-5	1E-7	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ⁶⁶ Ge	-	8E+4	4E-5	1E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
32	Germanium-77	D, see ⁶⁶ Ge	9E+3	1E+4	4E-6	1E-8	1E-4	1E-3
		W, see ⁶⁶ Ge	-	6E+3	2E-6	8E-9	-	-
32	Germanium-78 _{b/}	D, see ⁶⁶ Ge	2E+4	2E+4	9E-6	3E-8	-	-
		St wall	(2E+4)	-	-	-	3E-4	3E-3
		W, see ⁶⁶ Ge	-	2E+4	9E-6	3E-8	-	-
33	Arsenic-69 _{b/}	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
		St wall	(4E+4)	-	-	-	6E-4	6E-3
33	Arsenic-70 _{b/}	W, all compounds	1E+4	5E+4	2E-5	7E-8	2E-4	2E-3
33	Arsenic-71	W, all compounds	4E+3	5E+3	2E-6	6E-9	5E-5	5E-4
33	Arsenic-72	W, all compounds	9E+2	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-73	W, all compounds	8E+3	2E+3	7E-7	2E-9	1E-4	1E-3
33	Arsenic-74	W, all compounds	1E+3	8E+2	3E-7	1E-9	2E-5	2E-4
33	Arsenic-76	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
33	Arsenic-77	W, all compounds	4E+3	5E+3	2E-6	7E-9	-	-
		LLI wall	(5E+3)	-	-	-	6E-5	6E-4
33	Arsenic-78 _{b/}	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70 _{b/}	D, all compounds except those given for W	2E+4	4E+4	2E-5	5E-8	1E-4	1E-3
		W, oxides, hydroxides, carbides, and elemental Se	1E+4	4E+4	2E-5	6E-8	-	-
34	Selenium-73m _{b/}	D, see ⁷⁰ Se	6E+4	2E+5	6E-5	2E-7	4E-4	4E-3
		W, see ⁷⁰ Se	3E+4	1E+5	6E-5	2E-7	-	-
34	Selenium-73	D, see ⁷⁰ Se	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
		W, see ⁷⁰ Se	-	2E+4	7E-6	2E-8	-	-
34	Selenium-75	D, see ⁷⁰ Se	5E+2	7E+2	3E-7	1E-9	7E-6	7E-5
		W, see ⁷⁰ Se	-	6E+2	3E-7	8E-10	-	-
34	Selenium-79	D, see ⁷⁰ Se	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
		W, see ⁷⁰ Se	-	6E+2	2E-7	8E-10	-	-
34	Selenium-81m _{b/}	D, see ⁷⁰ Se	4E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, see ⁷⁰ Se	2E+4	7E+4	3E-5	1E-7	-	-
34	Selenium-81 _{b/}	D, see ⁷⁰ Se	6E+4	2E+5	9E-5	3E-7	-	-
		St wall	(8E+4)	-	-	-	1E-3	1E-2
		W, see ⁷⁰ Se	-	2E+5	1E-4	3E-7	-	-
34	Selenium-83 _{b/}	D, see ⁷⁰ Se	4E+4	1E+5	5E-5	2E-7	4E-4	4E-3
		W, see ⁷⁰ Se	3E+4	1E+5	5E-5	2E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
35	Bromine-74m ^{b/}	D, bromides of H, Li, Na, K, Rb, Cs, and Fr	1E+4 St wall (2E+4)	4E+4	2E-5	5E-8	-	-
		W, bromides of lanthanides, Be, Mg, Ca, Sr, Ba, Ra, Al, Ga, In, Tl, Ge, Sn, Pb, As, Sb, Bi, Fe, Ru, Os, Co, Rh, Ir, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, Hf, V, Nb, Ta, Mn, Tc, and Re	-	4E+4	2E-5	6E-8	-	-
35	Bromine-74 ^{b/}	D, see ^{74m} Br	2E+4 St wall (4E+4)	7E+4	3E-5	1E-7	-	-
		W, see ^{74m} Br	-	8E+4	4E-5	1E-7	5E-4	5E-3
35	Bromine-75 ^{b/}	D, see ^{74m} Br	3E+4 St wall (4E+4)	5E+4	2E-5	7E-8	-	-
		W, see ^{74m} Br	-	5E+4	2E-5	7E-8	5E-4	5E-3
35	Bromine-76	D, see ^{74m} Br	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
		W, see ^{74m} Br	-	4E+3	2E-6	6E-9	-	-
35	Bromine-77	D, see ^{74m} Br	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
		W, see ^{74m} Br	-	2E+4	8E-6	3E-8	-	-
35	Bromine-80m	D, see ^{74m} Br	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
		W, see ^{74m} Br	-	1E+4	6E-6	2E-8	-	-
35	Bromine-80 ^{b/}	D, see ^{74m} Br	5E+4 St wall (9E+4)	2E+5	8E-5	3E-7	-	-
		W, see ^{74m} Br	-	2E+5	9E-5	3E-7	1E-3	1E-2
35	Bromine-82	D, see ^{74m} Br	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ^{74m} Br	-	4E+3	2E-6	5E-9	-	-
35	Bromine-83	D, see ^{74m} Br	5E+4 St wall (7E+4)	6E+4	3E-5	9E-8	-	-
		W, see ^{74m} Br	-	6E+4	3E-5	9E-8	9E-4	9E-3
35	Bromine-84 ^{b/}	D, see ^{74m} Br	2E+4 St wall (3E+4)	6E+4	2E-5	8E-8	-	-
		W, see ^{74m} Br	-	6E+4	3E-5	9E-8	4E-4	4E-3
36	Krypton-74 ^{b/}	Submersion ^{a/}	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion ^{a/}	-	-	9E-6	4E-8	-	-
36	Krypton-77 ^{b/}	Submersion ^{a/}	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion ^{a/}	-	-	2E-5	7E-8	-	-
36	Krypton-81	Submersion ^{a/}	-	-	7E-4	3E-6	-	-
36	Krypton-83m ^{b/}	Submersion ^{a/}	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion ^{a/}	-	-	2E-5	1E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
36	Krypton-85	Submersion ^{a/}	-	-	1E-4	7E-7	-	-
36	Krypton-87 ^{b/}	Submersion ^{a/}	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion ^{a/}	-	-	2E-6	9E-9	-	-
37	Rubidium-79 ^{b/}	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
37	Rubidium-81m ^{b/}	D, all compounds	2E+5	3E+5	1E-4	5E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
37	Rubidium-81	D, all compounds	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
37	Rubidium-82m	D, all compounds	1E+4	2E+4	7E-6	2E-8	2E-4	2E-3
37	Rubidium-83	D, all compounds	6E+2	1E+3	4E-7	1E-9	9E-6	9E-5
37	Rubidium-84	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-86	D, all compounds	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
37	Rubidium-87	D, all compounds	1E+3	2E+3	6E-7	2E-9	1E-5	1E-4
37	Rubidium-88 ^{b/}	D, all compounds	2E+4	6E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
37	Rubidium-89 ^{b/}	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
38	Strontium-80 ^{b/}	D, all soluble compounds except SrTiO ₃	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble com- pounds and SrTiO ₃	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81 ^{b/}	D, see ⁸⁰ Sr	3E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ⁸⁰ Sr	2E+4	8E+4	3E-5	1E-7	-	-
38	Strontium-82	D, see ⁸⁰ Sr	3E+2	4E+2	2E-7	6E-10	-	-
			LLI wall (2E+2)	-	-	-	3E-6	3E-5
		Y, see ⁸⁰ Sr	2E+2	9E+1	4E-8	1E-10	-	-
38	Strontium-83	D, see ⁸⁰ Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ⁸⁰ Sr	2E+3	4E+3	1E-6	5E-9	-	-
38	Strontium-85m ^{b/}	D, see ⁸⁰ Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
		Y, see ⁸⁰ Sr	-	8E+5	4E-4	1E-6	-	-
38	Strontium-85	D, see ⁸⁰ Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
		Y, see ⁸⁰ Sr	-	2E+3	6E-7	2E-9	-	-
38	Strontium-87m	D, see ⁸⁰ Sr	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ⁸⁰ Sr	4E+4	2E+5	6E-5	2E-7	-	-
38	Strontium-89	D, see ⁸⁰ Sr	6E+2	8E+2	4E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, see ⁸⁰ Sr	5E+2	1E+2	6E-8	2E-10	-	-
38	Strontium-90	D, see ⁸⁰ Sr	3E+1	2E+1	8E-9	-	-	-
			Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7	5E-6
		Y, see ⁸⁰ Sr	-	4E+0	2E-9	6E-12	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion			Air	Water	
			ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
38	Strontium-91	D, see ^{80}Sr	2E+3					
		Y, see ^{80}Sr	6E+3	2E-6	8E-9	2E-5	2E-4	
38	Strontium-92	D, see ^{80}Sr	-	4E+3	1E-6	5E-9	-	-
		Y, see ^{80}Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
39	Yttrium-86m ^{b/}	W, all compounds except those given for Y	-	7E+3	3E-6	9E-9	-	-
		Y, oxides and hydroxides	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
39	Yttrium-86	W, see ^{86m}Y	-	5E+4	2E-5	8E-8	-	-
		Y, see ^{86m}Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
39	Yttrium-87	W, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
		Y, see ^{86m}Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
39	Yttrium-88	W, see ^{86m}Y	-	3E+3	1E-6	5E-9	-	-
		Y, see ^{86m}Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
39	Yttrium-90m	W, see ^{86m}Y	-	2E+2	1E-7	3E-10	-	-
		Y, see ^{86m}Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
39	Yttrium-90	W, see ^{86m}Y	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{86m}Y	4E+2	7E+2	3E-7	9E-10	-	-
		LLI wall (5E+2)	-	-	-	-	7E-6	7E-5
39	Yttrium-91m ^{b/}	W, see ^{86m}Y	-	6E+2	3E-7	9E-10	-	-
		Y, see ^{86m}Y	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2
39	Yttrium-91	W, see ^{86m}Y	-	2E+5	7E-5	2E-7	-	-
		LLI wall (6E+2)	5E+2	2E+2	7E-8	2E-10	-	-
		Y, see ^{86m}Y	-	1E+2	5E-8	2E-10	8E-6	8E-5
39	Yttrium-92	W, see ^{86m}Y	-	1E+2	5E-8	2E-10	-	-
		Y, see ^{86m}Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
39	Yttrium-93	W, see ^{86m}Y	-	8E+3	3E-6	1E-8	-	-
		Y, see ^{86m}Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
39	Yttrium-94 ^{b/}	W, see ^{86m}Y	-	2E+3	1E-6	3E-9	-	-
		St wall (3E+4)	2E+4	8E+4	3E-5	1E-7	-	-
		Y, see ^{86m}Y	-	8E+4	3E-5	1E-7	4E-4	4E-3
39	Yttrium-95 ^{b/}	W, see ^{86m}Y	-	8E+4	3E-5	1E-7	-	-
		St wall (5E+4)	4E+4	2E+5	6E-5	2E-7	-	-
		Y, see ^{86m}Y	-	1E+5	6E-5	2E-7	7E-4	7E-3
40	Zirconium-86	D, all compounds except those given for W and Y	-	1E+5	6E-5	2E-7	-	-
		W, oxides, hydroxides, halides, and nitrates	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		Y, carbide	-	3E+3	1E-6	4E-9	-	-
40	Zirconium-88	D, see ^{86}Zr	-	2E+3	1E-6	3E-9	-	-
		W, see ^{86}Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		Y, see ^{86}Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
40	Zirconium-89	D, see ⁸⁶ Zr	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ⁸⁶ Zr	-	2E+3	1E-6	3E-9	-	-
		Y, see ⁸⁶ Zr	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-93	D, see ⁸⁶ Zr	1E+3	6E+0	3E-9	-	-	-
		Bone surf	Bone surf					
		(3E+3)	(2E+1)	-	2E-11	4E-5	4E-4	
		W, see ⁸⁶ Zr	-	2E+1	1E-8			
		Bone surf	Bone surf					
		-	(6E+1)	-	9E-11	-	-	
		Y, see ⁸⁶ Zr	-	6E+1	2E-8	-	-	
		Bone surf	Bone surf					
		-	(7E+1)	-	9E-11	-	-	
40	Zirconium-95	D, see ⁸⁶ Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
		Bone surf	Bone surf					
		(3E+2)	-	4E-10	-	-	-	
		W, see ⁸⁶ Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ⁸⁶ Zr	-	3E+2	1E-7	4E-10	-	-
40	Zirconium-97	D, see ⁸⁶ Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
		W, see ⁸⁶ Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ⁸⁶ Zr	-	1E+3	5E-7	2E-9	-	-
41	Niobium-88 ^{b/}	W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
		St wall	St wall					
		(7E+4)	-	-	-	1E-3	1E-2	
41	Niobium-89 ^{b/} (66 min)	Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
		W, see ⁸⁸ Nb	1E+4	4E+4	2E-5	6E-8	1E-4	1E-3
		Y, see ⁸⁸ Nb	-	4E+4	2E-5	5E-8	-	-
41	Niobium-89 (122 min)	W, see ⁸⁸ Nb	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ⁸⁸ Nb	-	2E+4	6E-6	2E-8	-	-
41	Niobium-90	W, see ⁸⁸ Nb	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		Y, see ⁸⁸ Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-93m	W, see ⁸⁸ Nb	9E+3	2E+3	8E-7	3E-9	-	-
		LLI wall	LLI wall					
		(1E+4)	-	-	-	2E-4	2E-3	
		Y, see ⁸⁸ Nb	-	2E+2	7E-8	2E-10	-	-
41	Niobium-94	W, see ⁸⁸ Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ⁸⁸ Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ⁸⁸ Nb	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall	LLI wall					
		(2E+3)	-	-	-	3E-5	3E-4	
		Y, see ⁸⁸ Nb	-	2E+3	9E-7	3E-9	-	-
41	Niobium-95	W, see ⁸⁸ Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ⁸⁸ Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ⁸⁸ Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ⁸⁸ Nb	-	2E+3	1E-6	3E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2 ALI (μ Ci)	Col. 3 DAC (μ Ci/ml)	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
41	Niobium-97 ^{b/}	W, see ⁸⁸ Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ⁸⁸ Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98 ^{b/}	W, see ⁸⁸ Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ⁸⁸ Nb	-	5E+4	2E-5	7E-8	-	-
42	Molybdenum-90	D, all compounds except those given for Y	4E+3	7E+3	3E-6	1E-8	3E-5	3E-4
		Y, oxides, hydroxides, and MoS ₂	2E+3	5E+3	2E-6	6E-9	-	-
42	Molybdenum-93m	D, see ⁹⁰ Mo	9E+3	2E+4	7E-6	2E-8	6E-5	6E-4
		Y, see ⁹⁰ Mo	4E+3	1E+4	6E-6	2E-8	-	-
42	Molybdenum-93	D, see ⁹⁰ Mo	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		Y, see ⁹⁰ Mo	2E+4	2E+2	8E-8	2E-10	-	-
42	Molybdenum-99	D, see ⁹⁰ Mo	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall	(1E+3)	-	-	-	2E-5	2E-4
		Y, see ⁹⁰ Mo	1E+3	1E+3	6E-7	2E-9	-	-
42	Molybdenum-101 ^{b/}	D, see ⁹⁰ Mo	4E+4	1E+5	6E-5	2E-7	-	-
		St wall	(5E+4)	-	-	-	7E-4	7E-3
		Y, see ⁹⁰ Mo	-	1E+5	6E-5	2E-7	-	-
43	Technetium-93m ^{b/}	D, all compounds except those given for W	7E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, and nitrates	-	3E+5	1E-4	4E-7	-	-
43	Technetium-93	D, see ^{93m} Tc	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		W, see ^{93m} Tc	-	1E+5	4E-5	1E-7	-	-
43	Technetium-94m ^{b/}	D, see ^{93m} Tc	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, see ^{93m} Tc	-	6E+4	2E-5	8E-8	-	-
43	Technetium-94	D, see ^{93m} Tc	9E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{93m} Tc	-	2E+4	1E-5	3E-8	-	-
43	Technetium-95m	D, see ^{93m} Tc	4E+3	5E+3	2E-6	8E-9	5E-5	5E-4
		W, see ^{93m} Tc	-	2E+3	8E-7	3E-9	-	-
43	Technetium-95	D, see ^{93m} Tc	1E+4	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ^{93m} Tc	-	2E+4	8E-6	3E-8	-	-
43	Technetium-96m ^{b/}	D, see ^{93m} Tc	2E+5	3E+5	1E-4	4E-7	2E-3	2E-2
		W, see ^{93m} Tc	-	2E+5	1E-4	3E-7	-	-
43	Technetium-96	D, see ^{93m} Tc	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		W, see ^{93m} Tc	-	2E+3	9E-7	3E-9	-	-
43	Technetium-97m	D, see ^{93m} Tc	5E+3	7E+3	3E-6	-	6E-5	6E-4
		St wall	-	(7E+3)	-	1E-8	-	-
		W, see ^{93m} Tc	-	1E+3	5E-7	2E-9	-	-
43	Technetium-97	D, see ^{93m} Tc	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
		W, see ^{93m} Tc	-	6E+3	2E-6	8E-9	-	-
43	Technetium-98	D, see ^{93m} Tc	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ^{93m} Tc	-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see ^{93m} Tc	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, see ^{93m} Tc	-	2E+5	1E-4	3E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
43	Technetium-99	D, see $^{93\text{m}}\text{Tc}$	4E+3	5E+3	2E-6	-	6E-5	6E-4
		-	St wall (6E+3)	-	8E-9	-	-	
43	Technetium-101 ^{b/}	W, see $^{93\text{m}}\text{Tc}$	-	7E+2	3E-7	9E-10	-	-
		D, see $^{93\text{m}}\text{Tc}$	9E+4	3E+5	1E-4	5E-7	-	-
		-	St wall (1E+5)	-	-	-	2E-3	2E-2
43	Technetium-104 ^{b/}	W, see $^{93\text{m}}\text{Tc}$	-	4E+5	2E-4	5E-7	-	-
		D, see $^{93\text{m}}\text{Tc}$	2E+4	7E+4	3E-5	1E-7	-	-
		-	St wall (3E+4)	-	-	-	4E-4	4E-3
44	Ruthenium-94 ^{b/}	W, see $^{93\text{m}}\text{Tc}$	-	9E+4	4E-5	1E-7	-	-
		D, all compounds except those given for W and Y	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, halides	-	6E+4	3E-5	9E-8	-	-
		Y, oxides and hydroxides	-	6E+4	2E-5	8E-8	-	-
44	Ruthenium-97	D, see ^{94}Ru	8E+3	2E+4	8E-6	3E-8	1E-4	1E-3
		W, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5	3E-4
		W, see ^{94}Ru	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{94}Ru	-	6E+2	3E-7	9E-10	-	-
44	Ruthenium-105	D, see ^{94}Ru	5E+3	1E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{94}Ru	-	1E+4	6E-6	2E-8	-	-
		Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44	Ruthenium-106	D, see ^{94}Ru	2E+2	9E+1	4E-8	1E-10	-	-
		-	LLI wall (2E+2)	-	-	-	3E-6	3E-5
		W, see ^{94}Ru	-	5E+1	2E-8	8E-11	-	-
		Y, see ^{94}Ru	-	1E+1	5E-9	2E-11	-	-
45	Rhodium-99m	D, all compounds except those given for W and Y	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		W, halides	-	8E+4	3E-5	1E-7	-	-
		Y, oxides and hydroxides	-	7E+4	3E-5	9E-8	-	-
45	Rhodium-101m	D, see $^{99\text{m}}\text{Rh}$	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see $^{99\text{m}}\text{Rh}$	-	8E+3	4E-6	1E-8	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see $^{99\text{m}}\text{Rh}$	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see $^{99\text{m}}\text{Rh}$	-	8E+2	3E-7	1E-9	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-99	D, see $^{99\text{m}}\text{Rh}$	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see $^{99\text{m}}\text{Rh}$	-	2E+3	9E-7	3E-9	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	2E+3	8E-7	3E-9	-	-
		W, see $^{99\text{m}}\text{Rh}$	-	4E+3	2E-6	6E-9	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	4E+3	2E-6	5E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Oral Ingestion ALI (μCi)	Inhalation DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
45	Rhodium-102m	D, see ^{99m} Rh	1E+3	5E+2	2E-7	7E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		W, see ^{99m} Rh	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{99m} Rh	-	1E+2	5E-8	2E-10	-	-
45	Rhodium-102	D, see ^{99m} Rh	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see ^{99m} Rh	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{99m} Rh	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m ^{b/}	D, see ^{99m} Rh	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see ^{99m} Rh	-	1E+6	5E-4	2E-6	-	-
		Y, see ^{99m} Rh	-	1E+6	5E-4	2E-6	-	-
45	Rhodium-105	D, see ^{99m} Rh	4E+3	1E+4	5E-6	2E-8	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see ^{99m} Rh	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{99m} Rh	-	6E+3	2E-6	8E-9	-	-
45	Rhodium-106m	D, see ^{99m} Rh	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{99m} Rh	-	4E+4	2E-5	5E-8	-	-
		Y, see ^{99m} Rh	-	4E+4	1E-5	5E-8	-	-
45	Rhodium-107 ^{b/}	D, see ^{99m} Rh	7E+4	2E+5	1E-4	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{99m} Rh	-	3E+5	1E-4	4E-7	-	-
		Y, see ^{99m} Rh	-	3E+5	1E-4	3E-7	-	-
46	Palladium-100	D, all compound44s except those given for W and4 Y	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4
		W, nitrates	-	1E+3	5E-7	2E-9	-	-
		Y, oxides and hydroxides	-	1E+3	6E-7	2E-9	-	-
46	Palladium-101	D, see ¹⁰⁰ Pd	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ¹⁰⁰ Pd	-	3E+4	1E-5	5E-8	-	-
		Y, see ¹⁰⁰ Pd	-	3E+4	1E-5	4E-8	-	-
46	Palladium-103	D, see ¹⁰⁰ Pd	6E+3	6E+3	3E-6	9E-9	-	-
			LLI wall (7E+3)	-	-	-	1E-4	1E-3
		W, see ¹⁰⁰ Pd	-	4E+3	2E-6	6E-9	-	-
		Y, see ¹⁰⁰ Pd	-	4E+3	1E-6	5E-9	-	-
46	Palladium-107	D, see ¹⁰⁰ Pd	3E+4	2E+4	9E-6	-	-	-
			LLI wall Kidneys (4E+4)	(2E+4)	-	3E-8	5E-4	5E-3
		W, see ¹⁰⁰ Pd	-	7E+3	3E-6	1E-8	-	-
		Y, see ¹⁰⁰ Pd	-	4E+2	2E-7	6E-10	-	-
46	Palladium-109	D, see ¹⁰⁰ Pd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		W, see ¹⁰⁰ Pd	-	5E+3	2E-6	8E-9	-	-
		Y, see ¹⁰⁰ Pd	-	5E+3	2E-6	6E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μ Ci/ml)
			Oral Ingestion ALI (μ Ci)	<u>Inhalation</u> ALI (μ Ci)	DAC (μ Ci/ml)	Air (μ Ci/ml)	Water (μ Ci/ml)	
47	Silver-102 ^{b/}	D, all compounds except those given for W and Y	5E+4	2E+5	8E-5	2E-7	-	-
		St wall	(6E+4)	-	-	-	9E-4	9E-3
		W, nitrates and sulfides	-	2E+5	9E-5	3E-7	-	-
		Y, oxides and hydroxides	-	2E+5	8E-5	3E-7	-	-
47	Silver-103 ^{b/}	D, see ¹⁰² Ag	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104m ^{b/}	D, see ¹⁰² Ag	3E+4	9E+4	4E-5	1E-7	4E-4	4E-3
		W, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
		Y, see ¹⁰² Ag	-	1E+5	5E-5	2E-7	-	-
47	Silver-104 ^{b/}	D, see ¹⁰² Ag	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ¹⁰² Ag	-	1E+5	6E-5	2E-7	-	-
		Y, see ¹⁰² Ag	-	1E+5	6E-5	2E-7	-	-
47	Silver-105	D, see ¹⁰² Ag	3E+3	1E+3	4E-7	1E-9	4E-5	4E-4
		W, see ¹⁰² Ag	-	2E+3	7E-7	2E-9	-	-
		Y, see ¹⁰² Ag	-	2E+3	7E-7	2E-9	-	-
47	Silver-106m	D, see ¹⁰² Ag	8E+2	7E+2	3E-7	1E-9	1E-5	1E-4
		W, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-106 ^{b/}	D, see ¹⁰² Ag	6E+4	2E+5	8E-5	3E-7	-	-
		St wall	(6E+4)	-	-	-	9E-4	9E-3
		W, see ¹⁰² Ag	-	2E+5	9E-5	3E-7	-	-
		Y, see ¹⁰² Ag	-	2E+5	8E-5	3E-7	-	-
47	Silver-108m	D, see ¹⁰² Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5
		W, see ¹⁰² Ag	-	3E+2	1E-7	4E-10	-	-
		Y, see ¹⁰² Ag	-	2E+1	1E-8	3E-11	-	-
47	Silver-110m	D, see ¹⁰² Ag	5E+2	1E+2	5E-8	2E-10	6E-6	6E-5
		W, see ¹⁰² Ag	-	2E+2	8E-8	3E-10	-	-
		Y, see ¹⁰² Ag	-	9E+1	4E-8	1E-10	-	-
47	Silver-111	D, see ¹⁰² Ag	9E+2	2E+3	6E-7	-	-	-
		LLI wall	(1E+3)	(2E+3)	-	2E-9	2E-5	2E-4
		W, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ¹⁰² Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-112	D, see ¹⁰² Ag	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ¹⁰² Ag	-	1E+4	4E-6	1E-8	-	-
		Y, see ¹⁰² Ag	-	9E+3	4E-6	1E-8	-	-
47	Silver-115 ^{b/}	D, see ¹⁰² Ag	3E+4	9E+4	4E-5	1E-7	-	-
		St wall	(3E+4)	-	-	-	4E-4	4E-3
		W, see ¹⁰² Ag	-	9E+4	4E-5	1E-7	-	-
		Y, see ¹⁰² Ag	-	8E+4	3E-5	1E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Oral Ingestion ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
48	Cadmium-104 ^{b/}	D, all compounds except those given for W and Y W, sulfides, halides, and nitrates	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
48	Cadmium-107	D, see ¹⁰⁴ Cd	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
		W, see ¹⁰⁴ Cd	-	6E+4	2E-5	8E-8	-	-
		Y, see ¹⁰⁴ Cd	-	5E+4	2E-5	7E-8	-	-
48	Cadmium-109	D, see ¹⁰⁴ Cd	3E+2	4E+1	1E-8	-	-	-
		Kidneys	(4E+2)	(5E+1)	-	7E-11	6E-6	6E-5
		W, see ¹⁰⁴ Cd	-	1E+2	5E-8	-	-	-
		Kidneys	-	(1E+2)	-	2E-10	-	-
		Y, see ¹⁰⁴ Cd	-	1E+2	5E-8	2E-10	-	-
48	Cadmium-113m	D, see ¹⁰⁴ Cd	2E+1	2E+0	1E-9	-	-	-
		Kidneys	(4E+1)	(4E+0)	-	5E-12	5E-7	5E-6
		W, see ¹⁰⁴ Cd	-	8E+0	4E-9	-	-	-
		Kidneys	-	(1E+1)	-	2E-11	-	-
		Y, see ¹⁰⁴ Cd	-	1E+1	5E-9	2E-11	-	-
48	Cadmium-113	D, see ¹⁰⁴ Cd	2E+1	2E+0	9E-10	-	-	-
		Kidneys	(3E+1)	(3E+0)	-	5E-12	4E-7	4E-6
		W, see ¹⁰⁴ Cd	-	8E+0	3E-9	-	-	-
		Kidneys	-	(1E+1)	-	2E-11	-	-
		Y, see ¹⁰⁴ Cd	-	1E+1	6E-9	2E-11	-	-
48	Cadmium-115m	D, see ¹⁰⁴ Cd	3E+2	5E+1	2E-8	-	4E-6	4E-5
		Kidneys	-	(8E+1)	-	1E-10	-	-
		W, see ¹⁰⁴ Cd	-	1E+2	5E-8	2E-10	-	-
		Y, see ¹⁰⁴ Cd	-	1E+2	6E-8	2E-10	-	-
48	Cadmium-115	D, see ¹⁰⁴ Cd	9E+2	1E+3	6E-7	2E-9	-	-
		LLI wall	(1E+3)	-	-	-	1E-5	1E-4
		W, see ¹⁰⁴ Cd	-	1E+3	5E-7	2E-9	-	-
		Y, see ¹⁰⁴ Cd	-	1E+3	6E-7	2E-9	-	-
48	Cadmium-117m	D, see ¹⁰⁴ Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ¹⁰⁴ Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ¹⁰⁴ Cd	-	1E+4	6E-6	2E-8	-	-
48	Cadmium-117	D, see ¹⁰⁴ Cd	5E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		W, see ¹⁰⁴ Cd	-	2E+4	7E-6	2E-8	-	-
		Y, see ¹⁰⁴ Cd	-	1E+4	6E-6	2E-8	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
49	Indium-109	D, all compounds except those given for W W, oxides, hydroxides, halides, and nitrates	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
49	Indium-110 ^{b/} (69.1 min)	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
49	Indium-110 (4.9 h)	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
49	Indium-111	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
49	Indium-112 ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
49	Indium-113m ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
49	Indium-114m	D, see ¹⁰⁹ In	3E+2	6E+1	3E-8	9E-11	-	-
		LLI wall (4E+2)	-	-	-	-	5E-6	5E-5
49	Indium-115m	W, see ¹⁰⁹ In D, see ¹⁰⁹ In W, see ¹⁰⁹ In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
49	Indium-116m ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	-	5E+4	2E-5	7E-8	-	-
49	Indium-117m ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
49	Indium-117m ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	-	5E+0	2E-9	8E-12	-	-
49	Indium-117 ^{b/}	D, see ¹⁰⁹ In W, see ¹⁰⁹ In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	-	1E+5	5E-5	2E-7	-	-
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	-	4E+4	2E-5	6E-8	-	-
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m ^{b/}	D, see ¹⁰⁹ In	4E+4	1E+5	5E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3
50	Tin-110	W, see ¹⁰⁹ In D, all compounds except those given for W W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+5	6E-5	2E-7	-	-
50	Tin-111 ^{b/}	D, see ¹¹⁰ Sn W, see ¹¹⁰ Sn	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
50	Tin-113	D, see ¹¹⁰ Sn	-	1E+4	5E-6	2E-8	-	-
50	Tin-113	D, see ¹¹⁰ Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
50	Tin-113	D, see ¹¹⁰ Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-117m	D, see ¹¹⁰ Sn	2E+3	1E+3	5E-7	2E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
50	Tin-117m	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-117m	D, see ¹¹⁰ Sn	2E+3	1E+3	5E-7	-	-	-
		LLI wall (2E+3)	-	-	-	-	-	-
		Bone surf (2E+3)	-	-	-	-	3E-9	3E-4
		W, see ¹¹⁰ Sn	-	1E+3	6E-7	2E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
50	Tin-119m	D, see ¹¹⁰ Sn	3E+3	2E+3	1E-6	3E-9	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
50	Tin-121m	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 3E+3	1E+3 9E+2	4E-7 4E-7	1E-9 1E-9	- -	- -
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
50	Tin-121	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 6E+3	5E+2 2E+4	2E-7 6E-6	8E-10 2E-8	- -	- -
			LLI wall (6E+3)	-	-	-	8E-5	8E-4
50	Tin-123m ^{b/}	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 5E+4	1E+4 1E+5	5E-6 5E-5	2E-8 2E-7	- 7E-4	- 7E-3
50	Tin-123	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 5E+2	1E+5 6E+2	6E-5 3E-7	2E-7 9E-10	- -	- -
			LLI wall (6E+2)	-	-	-	9E-6	9E-5
50	Tin-125	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 4E+2	2E+2 9E+2	7E-8 4E-7	2E-10 1E-9	- -	- -
			LLI wall (5E+2)	-	-	-	6E-6	6E-5
50	Tin-126	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 3E+2	4E+2 6E+1	1E-7 2E-8	5E-10 8E-11	- 4E-6	- 4E-5
50	Tin-127	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 7E+3	7E+1 2E+4	3E-8 8E-6	9E-11 3E-8	- 9E-5	- 9E-4
50	Tin-128 ^{b/}	W, see ¹¹⁰ Sn D, see ¹¹⁰ Sn	- 9E+3	2E+4 3E+4	8E-6 1E-5	3E-8 4E-8	- 1E-4	- 1E-3
51	Antimony-115 ^{b/}	W, see ¹¹⁰ Sn D, all compounds except those given for W W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	- 8E+4	4E+4 2E+5	1E-5 1E-4	5E-8 3E-7	- 1E-3	- 1E-2
51	Antimony-116m ^{b/}	D, see ¹¹⁵ Sb W, see ¹¹⁵ Sb	2E+4 -	7E+4 1E+5	3E-5 6E-5	1E-7 2E-7	3E-4 -	3E-3 -
51	Antimony-116 ^{b/}	D, see ¹¹⁵ Sb	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
51	Antimony-117	W, see ¹¹⁵ Sb D, see ¹¹⁵ Sb	- 7E+4	3E+5 2E+5	1E-4 9E-5	5E-7 3E-7	- 9E-4	- 9E-3
51	Antimony-118m	W, see ¹¹⁵ Sb D, see ¹¹⁵ Sb	- 6E+3	3E+5 2E+4	1E-4 8E-6	4E-7 3E-8	- 7E-5	- 7E-4
51	Antimony-119	W, see ¹¹⁵ Sb D, see ¹¹⁵ Sb	- 2E+4	3E+5 5E+4	1E-4 2E-5	5E-7 6E-8	- 2E-4	- 2E-3
			W, see ¹¹⁵ Sb	2E+4	3E+4	1E-5	4E-8	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
51	Antimony-120 ^{b/} (16 min)	D, see ¹¹⁵ Sb	1E+5 St wall (2E+5)	4E+5	2E-4	6E-7	-	2E-2
		W, see ¹¹⁵ Sb	-	5E+5	2E-4	7E-7	-	-
51	Antimony-120 (5.76 d)	D, see ¹¹⁵ Sb	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		W, see ¹¹⁵ Sb	9E+2	1E+3	5E-7	2E-9	-	-
51	Antimony-122	D, see ¹¹⁵ Sb	8E+2	2E+3	1E-6	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ¹¹⁵ Sb	7E+2	1E+3	4E-7	2E-9	-	-
51	Antimony-124m ^{b/}	D, see ¹¹⁵ Sb	3E+5	8E+5	4E-4	1E-6	3E-3	3E-2
		W, see ¹¹⁵ Sb	2E+5	6E+5	2E-4	8E-7	-	-
51	Antimony-124	D, see ¹¹⁵ Sb	6E+2	9E+2	4E-7	1E-9	7E-6	7E-5
		W, see ¹¹⁵ Sb	5E+2	2E+2	1E-7	3E-10	-	-
51	Antimony-125	D, see ¹¹⁵ Sb	2E+3	2E+3	1E-6	3E-9	3E-5	3E-4
		W, see ¹¹⁵ Sb	-	5E+2	2E-7	7E-10	-	-
51	Antimony-126m ^{b/}	D, see ¹¹⁵ Sb	5E+4 St wall (7E+4)	2E+5	8E-5	3E-7	-	-
		W, see ¹¹⁵ Sb	-	2E+5	8E-5	3E-7	9E-4	9E-3
51	Antimony-126	D, see ¹¹⁵ Sb	6E+2	1E+3	5E-7	2E-9	7E-6	7E-5
		W, see ¹¹⁵ Sb	5E+2	5E+2	2E-7	7E-10	-	-
51	Antimony-127	D, see ¹¹⁵ Sb	8E+2	2E+3	9E-7	3E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
		W, see ¹¹⁵ Sb	7E+2	9E+2	4E-7	1E-9	-	-
51	Antimony-128 ^{b/} (10.4 min)	D, see ¹¹⁵ Sb	8E+4 St wall (1E+5)	4E+5	2E-4	5E-7	-	-
		W, see ¹¹⁵ Sb	-	4E+5	2E-4	6E-7	1E-3	1E-2
51	Antimony-128 (9.01 h)	D, see ¹¹⁵ Sb	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, see ¹¹⁵ Sb	-	3E+3	1E-6	5E-9	-	-
51	Antimony-129	D, see ¹¹⁵ Sb	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, see ¹¹⁵ Sb	-	9E+3	4E-6	1E-8	-	-
51	Antimony-130 ^{b/}	D, see ¹¹⁵ Sb	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, see ¹¹⁵ Sb	-	8E+4	3E-5	1E-7	-	-
51	Antimony-131 ^{b/}	D, see ¹¹⁵ Sb	1E+4 Thyroid (2E+4)	2E+4	1E-5	-	-	-
		W, see ¹¹⁵ Sb	-	2E+4	1E-5	6E-8	2E-4	2E-3
			-	Thyroid (4E+4)	-	6E-8	-	-
52	Tellurium-116	D, all compounds except those given for W	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, oxides, hydroxides, and nitrates	-	3E+4	1E-5	4E-8	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Oral Ingestion ALI (µCi)	Inhalation DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
52	Tellurium-121m	D, see ¹¹⁶ Te	5E+2 Bone surf (7E+2)	2E+2 Bone surf (4E+2)	8E-8	-	-	-
		W, see ¹¹⁶ Te	-	4E+2	2E-7	5E-10	1E-5	1E-4
52	Tellurium-121	D, see ¹¹⁶ Te	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see ¹¹⁶ Te	-	3E+3	1E-6	4E-9	-	-
52	Tellurium-123m	D, see ¹¹⁶ Te	6E+2 Bone surf (1E+3)	2E+2 Bone surf (5E+2)	9E-8	-	-	-
		W, see ¹¹⁶ Te	-	5E+2	2E-7	8E-10	1E-5	1E-4
52	Tellurium-123	D, see ¹¹⁶ Te	5E+2 Bone surf (1E+3)	2E+2 Bone surf (5E+2)	8E-8	-	-	-
		W, see ¹¹⁶ Te	-	4E+2	2E-7	7E-10	2E-5	2E-4
			-	(1E+3)	-	2E-9	-	-
52	Tellurium-125m	D, see ¹¹⁶ Te	1E+3 Bone surf (1E+3)	4E+2 Bone surf (1E+3)	2E-7	-	-	-
		W, see ¹¹⁶ Te	-	7E+2	3E-7	1E-9	2E-5	2E-4
52	Tellurium-127m	D, see ¹¹⁶ Te	6E+2 Bone surf	3E+2 (4E+2)	1E-7	-	9E-6	9E-5
		W, see ¹¹⁶ Te	-	3E+2	1E-7	4E-10	-	-
52	Tellurium-127	D, see ¹¹⁶ Te	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ¹¹⁶ Te	-	2E+4	7E-6	2E-8	-	-
52	Tellurium-129m	D, see ¹¹⁶ Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
		W, see ¹¹⁶ Te	-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129 ^{b/}	D, see ¹¹⁶ Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ¹¹⁶ Te	-	7E+4	3E-5	1E-7	-	-
52	Tellurium-131m	D, see ¹¹⁶ Te	3E+2 Thyroid (6E+2)	4E+2 Thyroid (1E+3)	2E-7	-	8E-6	8E-5
		W, see ¹¹⁶ Te	-	4E+2	2E-7	-	-	-
			-	Thyroid (9E+2)	-	1E-9	-	-
52	Tellurium-131 ^{b/}	D, see ¹¹⁶ Te	3E+3 Thyroid (6E+3)	5E+3 Thyroid (1E+4)	2E-6	-	8E-5	8E-4
		W, see ¹¹⁶ Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-132	D, see ¹¹⁶ Te	2E+2 Thyroid (7E+2)	2E+2 Thyroid (8E+2)	9E-8	-	9E-6	9E-5
		W, see ¹¹⁶ Te	-	2E+2	9E-8	-	-	-
			-	Thyroid (6E+2)	-	9E-10	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2	Col. 3	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
				<u>Inhalation</u> ALI (μ Ci)	DAC (μ Ci/ml)			
52	Tellurium-133m ^{b/}	D, see ¹¹⁶ Te	3E+3 Thyroid (6E+3)	5E+3 Thyroid (1E+4)	2E-6	-	-	-
		W, see ¹¹⁶ Te	-	5E+3 Thyroid (1E+4)	2E-6	-	-	9E-4
52	Tellurium-133 ^{b/}	D, see ¹¹⁶ Te	1E+4 Thyroid (3E+4)	2E+4 Thyroid (6E+4)	9E-6	-	-	-
		W, see ¹¹⁶ Te	-	2E+4 Thyroid (6E+4)	9E-6	8E-8	4E-4	4E-3
52	Tellurium-134 ^{b/}	D, see ¹¹⁶ Te	2E+4 Thyroid (2E+4)	2E+4 Thyroid (5E+4)	1E-5	-	-	-
		W, see ¹¹⁶ Te	-	2E+4 Thyroid (5E+4)	1E-5	7E-8	3E-4	3E-3
53	Iodine-120m ^{b/}	D, all compounds	1E+4 Thyroid (1E+4)	2E+4	9E-6	3E-8	-	-
			4E+3 Thyroid (8E+3)	9E+3 Thyroid (1E+4)	4E-6	-	2E-4	2E-3
53	Iodine-121	D, all compounds	1E+4 Thyroid (3E+4)	2E+4 Thyroid (5E+4)	8E-6	-	-	-
			3E+3 Thyroid (1E+4)	6E+3 Thyroid (2E+4)	3E-6	-	-	4E-3
53	Iodine-123	D, all compounds	5E+1 Thyroid (2E+2)	8E+1 Thyroid (3E+2)	3E-8	-	-	-
			4E+1 Thyroid (1E+2)	6E+1 Thyroid (2E+2)	3E-8	4E-10	2E-6	2E-5
53	Iodine-124	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8	-	-	-
			4E+4 St wall (6E+4)	1E+5	5E-5	2E-7	-	1E-5
53	Iodine-125	D, all compounds	5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9	-	-	-
			4E+1 Thyroid (1E+3)	6E+1 Thyroid (2E+3)	3E-8	-	-	2E-6
53	Iodine-126	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8	-	-	-
			4E+4 St wall (6E+4)	1E+5	5E-5	2E-7	-	1E-5
53	Iodine-128 ^{b/}	D, all compounds	4E+4 St wall (6E+4)	1E+5	5E-5	2E-7	-	-
			5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9	-	8E-4	8E-3
53	Iodine-129	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7	-	-	-
			4E+1 Thyroid (1E+3)	6E+1 Thyroid (2E+3)	3E-8	4E-11	2E-7	2E-6
53	Iodine-130	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7	-	-	-
			4E+1 Thyroid (1E+3)	6E+1 Thyroid (2E+3)	3E-8	3E-9	2E-5	2E-4

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2 <u>Inhalation</u> ALI (μ Ci)	Col. 3 DAC (μ Ci/ml)	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
53	Iodine-131	D, all compounds	3E+1 Thyroid (9E+1)	5E+1 Thyroid (2E+2)	2E-8	-	-	-
53	Iodine-132 ^{m_b/}	D, all compounds	4E+3 Thyroid (1E+4)	8E+3 Thyroid (2E+4)	4E-6	-	-	1E-5
53	Iodine-132	D, all compounds	4E+3 Thyroid (9E+3)	8E+3 Thyroid (1E+4)	3E-6	-	-	1E-3
53	Iodine-133	D, all compounds	1E+2 Thyroid (5E+2)	3E+2 Thyroid (9E+2)	1E-7	-	-	1E-3
53	Iodine-134 ^{b/}	D, all compounds	2E+4 Thyroid (3E+4)	5E+4	2E-5	6E-8	-	7E-5
53	Iodine-135	D, all compounds	8E+2 Thyroid (3E+3)	2E+3 Thyroid (4E+3)	7E-7	-	4E-4	4E-3
54	Xenon-120 ^{b/}	Submersion ^{a/}	-	-	1E-5	4E-8	-	-
54	Xenon-121 ^{b/}	Submersion ^{a/}	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion ^{a/}	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion ^{a/}	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion ^{a/}	-	-	2E-5	7E-8	-	-
54	Xenon-127	Submersion ^{a/}	-	-	1E-5	6E-8	-	-
54	Xenon-129 ^m	Submersion ^{a/}	-	-	2E-4	9E-7	-	-
54	Xenon-131 ^m	Submersion ^{a/}	-	-	4E-4	2E-6	-	-
54	Xenon-133 ^m	Submersion ^{a/}	-	-	1E-4	6E-7	-	-
54	Xenon-133	Submersion ^{a/}	-	-	1E-4	5E-7	-	-
54	Xenon-135 ^{m_b/}	Submersion ^{a/}	-	-	9E-6	4E-8	-	-
54	Xenon-135	Submersion ^{a/}	-	-	1E-5	7E-8	-	-
54	Xenon-138 ^{b/}	Submersion ^{a/}	-	-	4E-6	2E-8	-	-
55	Cesium-125 ^{b/}	D, all compounds	5E+4 St wall (9E+4)	1E+5	6E-5	2E-7	-	-
55	Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	1E-3	1E-2
55	Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	9E-3
55	Cesium-130 ^{b/}	D, all compounds	6E+4 St wall (1E+5)	2E+5	8E-5	3E-7	-	3E-3
55	Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	1E-3	1E-2
55	Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	3E-4	3E-3
55	Cesium-134 ^m	D, all compounds	1E+5 St wall (1E+5)	1E+5	6E-5	2E-7	-	4E-4
55	Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	2E-3	-
55	Cesium-135 ^{m_b/}	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	2E-2
55	Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	9E-6
55	Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	1E-4
								6E-5

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
55	Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55	Cesium-138 _{b/}	D, all compounds	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
56	Barium-126 _{b/}	D, all compounds	6E+3	2E+4	6E-6	2E-8	8E-5	8E-4
56	Barium-128	D, all compounds	5E+2	2E+3	7E-7	2E-9	7E-6	7E-5
56	Barium-131m _{b/}	D, all compounds	4E+5	1E+6	6E-4	2E-6	-	-
			St wall (5E+5)	-	-	-	7E-3	7E-2
56	Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
56	Barium-133m	D, all compounds	2E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139 _{b/}	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
56	Barium-140	D, all compounds	5E+2	1E+3	6E-7	2E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
56	Barium-141 _{b/}	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142 _{b/}	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131 _{b/}	D, all compounds except those given for W	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		W, oxides and hydroxides	-	2E+5	7E-5	2E-7	-	-
57	Lanthanum-132	D, see ¹³¹ La	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
		W, see ¹³¹ La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-135	D, see ¹³¹ La	4E+4	1E+5	4E-5	1E-7	5E-4	5E-3
		W, see ¹³¹ La	-	9E+4	4E-5	1E-7	-	-
57	Lanthanum-137	D, see ¹³¹ La	1E+4	6E+1	3E-8	-	2E-4	2E-3
			Liver (7E+1)	-	-	1E-10	-	-
		W, see ¹³¹ La	-	3E+2	1E-7	-	-	-
			Liver (3E+2)	-	-	4E-10	-	-
57	Lanthanum-138	D, see ¹³¹ La	9E+2	4E+0	1E-9	5E-12	1E-5	1E-4
		W, see ¹³¹ La	-	1E+1	6E-9	2E-11	-	-
57	Lanthanum-140	D, see ¹³¹ La	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ¹³¹ La	-	1E+3	5E-7	2E-9	-	-
57	Lanthanum-141	D, see ¹³¹ La	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		W, see ¹³¹ La	-	1E+4	5E-6	2E-8	-	-
57	Lanthanum-142 _{b/}	D, see ¹³¹ La	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ¹³¹ La	-	3E+4	1E-5	5E-8	-	-
57	Lanthanum-143 _{b/}	D, see ¹³¹ La	4E+4	1E+5	4E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ¹³¹ La	-	9E+4	4E-5	1E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
58	Cerium-134	W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
58	Cerium-135	W, see ¹³⁴ Ce	2E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		Y, see ¹³⁴ Ce	-	4E+3	1E-6	5E-9	-	-
58	Cerium-137m	W, see ¹³⁴ Ce	2E+3	4E+3	2E-6	6E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ¹³⁴ Ce	-	4E+3	2E-6	5E-9	-	-
58	Cerium-137	W, see ¹³⁴ Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		Y, see ¹³⁴ Ce	-	1E+5	5E-5	2E-7	-	-
58	Cerium-139	W, see ¹³⁴ Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
		Y, see ¹³⁴ Ce	-	7E+2	3E-7	9E-10	-	-
58	Cerium-141	W, see ¹³⁴ Ce	2E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		Y, see ¹³⁴ Ce	-	6E+2	2E-7	8E-10	-	-
58	Cerium-143	W, see ¹³⁴ Ce	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ¹³⁴ Ce	-	2E+3	7E-7	2E-9	-	-
58	Cerium-144	W, see ¹³⁴ Ce	2E+2	3E+1	1E-8	4E-11	-	-
			LLI wall (3E+2)	-	-	-	3E-6	3E-5
		Y, see ¹³⁴ Ce	-	1E+1	6E-9	2E-11	-	-
59	Praseodymium-136 ^{b/}	W, all compounds except those given for Y	5E+4	2E+5	1E-4	3E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	9E-5	3E-7	-	-
59	Praseodymium-137 ^{b/}	W, see ¹³⁶ Pr	4E+4	2E+5	6E-5	2E-7	-	-
			5E-4	5E-3	-	-	-	-
		Y, see ¹³⁶ Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-138m	W, see ¹³⁶ Pr	1E+4	5E+4	2E-5	8E-8	1E-4	1E-3
		Y, see ¹³⁶ Pr	-	4E+4	2E-5	6E-8	-	-
59	Praseodymium-139	W, see ¹³⁶ Pr	4E+4	1E+5	5E-5	2E-7	6E-4	6E-3
		Y, see ¹³⁶ Pr	-	1E+5	5E-5	2E-7	-	-
59	Praseodymium-142m ^{b/}	W, see ¹³⁶ Pr	8E+4	2E+5	7E-5	2E-7	1E-3	1E-2
		Y, see ¹³⁶ Pr	-	1E+5	6E-5	2E-7	-	-
59	Praseodymium-142	W, see ¹³⁶ Pr	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
		Y, see ¹³⁶ Pr	-	2E+3	8E-7	3E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2 ALI (μ Ci)	Col. 3 DAC (μ Ci/ml)	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
59	Praseodymium-143	W, see ¹³⁶ Pr	9E+2 LLI wall (1E+3)	8E+2	3E-7	1E-9	-	-
59	Praseodymium-144 ^{b/}	Y, see ¹³⁶ Pr W, see ¹³⁶ Pr	-	7E+2	3E-7	9E-10	2E-5	2E-4
			3E+4 St wall (4E+4)	1E+5	5E-5	2E-7	-	-
59	Praseodymium-145	Y, see ¹³⁶ Pr W, see ¹³⁶ Pr	-	1E+5	5E-5	2E-7	6E-4	6E-3
60	Neodymium-136 ^{b/}	W, all compounds except those given for Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, oxides, hydroxides, carbides, and fluorides	-	8E+3	3E-6	1E-8	-	-
60	Neodymium-138	W, see ¹³⁶ Nd	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ¹³⁶ Nd	-	5E+4	2E-5	8E-8	-	-
59	Praseodymium-147 ^{b/}	W, see ¹³⁶ Pr	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
			-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	Y, see ¹³⁶ Pr W, see ¹³⁶ Nd	5E+4 St wall (8E+4)	2E+5	8E-5	3E-7	1E-3	1E-2
		Y, see ¹³⁶ Nd	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-139 ^{b/}	W, see ¹³⁶ Nd	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		Y, see ¹³⁶ Nd	-	1E+4	6E-6	2E-8	-	-
60	Neodymium-141	W, see ¹³⁶ Nd	9E+4	3E+5	1E-4	5E-7	1E-3	1E-2
		Y, see ¹³⁶ Nd	-	3E+5	1E-4	4E-7	-	-
60	Neodymium-147	W, see ¹³⁶ Nd	2E+5	7E+5	3E-4	1E-6	2E-3	2E-2
		Y, see ¹³⁶ Nd	-	6E+5	3E-4	9E-7	-	-
60	Neodymium-149 ^{b/}	W, see ¹³⁶ Nd	1E+3 LLI wall (1E+3)	9E+2	4E-7	1E-9	-	-
		Y, see ¹³⁶ Nd	-	8E+2	4E-7	1E-9	2E-5	2E-4
60	Neodymium-151 ^{b/}	W, see ¹³⁶ Nd	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
		Y, see ¹³⁶ Nd	-	2E+4	1E-5	3E-8	-	-
61	Promethium-141 ^{b/}	W, all compounds except those given for Y	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	W, see ¹⁴¹ Pm	5E+4 St wall (6E+4)	2E+5	8E-5	3E-7	-	-
		Y, see ¹⁴¹ Pm	-	2E+5	8E-5	3E-7	8E-4	8E-3
61	Promethium-144	W, see ¹⁴¹ Pm	5E+3	6E+2	2E-7	8E-10	7E-5	7E-4
		Y, see ¹⁴¹ Pm	-	7E+2	3E-7	1E-9	-	-
61	Promethium-145	W, see ¹⁴¹ Pm	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		Y, see ¹⁴¹ Pm	-	1E+2	5E-8	2E-10	-	-
			1E+4	2E+2	7E-8	-	1E-4	1E-3
			-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ¹⁴¹ Pm	-	2E+2	8E-8	3E-10	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
61	Promethium-146	W, see ¹⁴¹ Pm	2E+3	5E+1	2E-8	7E-11	2E-5	2E-4
		Y, see ¹⁴¹ Pm	-	4E+1	2E-8	6E-11	-	-
61	Promethium-147	W, see ¹⁴¹ Pm	4E+3	1E+2	5E-8	-	-	-
			LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-5	7E-4
		Y, see ¹⁴¹ Pm	-	1E+2	6E-8	2E-10	-	-
61	Promethium-148m	W, see ¹⁴¹ Pm	7E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		Y, see ¹⁴¹ Pm	-	3E+2	1E-7	5E-10	-	-
61	Promethium-148	W, see ¹⁴¹ Pm	4E+2	5E+2	2E-7	8E-10	-	-
			LLI wall (5E+2)	-	-	-	7E-6	7E-5
		Y, see ¹⁴¹ Pm	-	5E+2	2E-7	7E-10	-	-
61	Promethium-149	W, see ¹⁴¹ Pm	1E+3	2E+3	8E-7	3E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		Y, see ¹⁴¹ Pm	-	2E+3	8E-7	2E-9	-	-
61	Promethium-150	W, see ¹⁴¹ Pm	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ¹⁴¹ Pm	-	2E+4	7E-6	2E-8	-	-
61	Promethium-151	W, see ¹⁴¹ Pm	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ¹⁴¹ Pm	-	3E+3	1E-6	4E-9	-	-
62	Samarium-141m ^{b/}	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
62	Samarium-141 ^{b/}	W, all compounds	5E+4	2E+5	8E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
62	Samarium-142 ^{b/}	W, all compounds	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
62	Samarium-145	W, all compounds	6E+3	5E+2	2E-7	7E-10	8E-5	8E-4
62	Samarium-146	W, all compounds	1E+1	4E-2	1E-11	-	-	-
			Bone surf (3E+1)	Bone surf (6E-2)	-	9E-14	3E-7	3E-6
62	Samarium-147	W, all compounds	2E+1	4E-2	2E-11	-	-	-
			Bone surf (3E+1)	Bone surf (7E-2)	-	1E-13	4E-7	4E-6
62	Samarium-151	W, all compounds	1E+4	1E+2	4E-8	-	-	-
			LLI wall (1E+4)	Bone surf (2E+2)	-	2E-10	2E-4	2E-3
62	Samarium-153	W, all compounds	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
62	Samarium-155 ^{b/}	W, all compounds	6E+4	2E+5	9E-5	3E-7	-	-
			St wall (8E+4)	-	-	-	1E-3	1E-2
62	Samarium-156	W, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
63	Europium-145	W, all compounds	2E+3	2E+3	8E-7	3E-9	2E-5	2E-4
63	Europium-146	W, all compounds	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
63	Europium-147	W, all compounds	3E+3	2E+3	7E-7	2E-9	4E-5	4E-4
63	Europium-148	W, all compounds	1E+3	4E+2	1E-7	5E-10	1E-5	1E-4
63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4	2E-3

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2 <u>Inhalation</u> ALI (μ Ci)	Col. 3 DAC (μ Ci/ml)	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
63	Europium-150 (12.62 h)	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5	4E-4
63	Europium-150 (34.2 y)	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5	1E-4
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5	1E-4
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6	7E-5
63	Europium-155	W, all compounds	4E+3	9E+1	4E-8	-	5E-5	5E-4
				Bone surf (1E+2)	-	2E-10	-	-
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6	8E-5
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
63	Europium-158 ^{b/}	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
64	Gadolinium-145 ^{b/}	D, all compounds except those given for W	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	6E-4	6E-3
		W, oxides, hydroxides, and fluorides	-	2E+5	7E-5	2E-7	-	-
64	Gadolinium-146	D, see ¹⁴⁵ Gd	1E+3	1E+2	5E-8	2E-10	2E-5	2E-4
		W, see ¹⁴⁵ Gd	-	3E+2	1E-7	4E-10	-	-
64	Gadolinium-147	D, see ¹⁴⁵ Gd	2E+3	4E+3	2E-6	6E-9	3E-5	3E-4
		W, see ¹⁴⁵ Gd	-	4E+3	1E-6	5E-9	-	-
64	Gadolinium-148	D, see ¹⁴⁵ Gd	1E+1	8E+3	3E-12	-	-	-
			Bone surf (2E+1)	Bone surf (2E-2)	-	2E-14	3E-7	3E-6
		W, see ¹⁴⁵ Gd	-	3E-2	1E-11	-	-	-
			-	Bone surf (6E-2)	-	8E-14	-	-
64	Gadolinium-149	D, see ¹⁴⁵ Gd	3E+3	2E+3	9E-7	3E-9	4E-5	4E-4
		W, see ¹⁴⁵ Gd	-	2E+3	1E-6	3E-9	-	-
64	Gadolinium-151	D, see ¹⁴⁵ Gd	6E+3	4E+2	2E-7	-	9E-5	9E-4
			-	Bone surf (6E+2)	-	9E-10	-	-
		W, see ¹⁴⁵ Gd	-	1E+3	5E-7	2E-9	-	-
64	Gadolinium-152	D, see ¹⁴⁵ Gd	2E+1	1E-2	4E-12	-	-	-
			Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7	4E-6
		W, see ¹⁴⁵ Gd	-	4E-2	2E-11	-	-	-
			-	Bone surf (8E-2)	-	1E-13	-	-
64	Gadolinium-153	D, see ¹⁴⁵ Gd	5E+3	1E+2	6E-8	-	6E-5	6E-4
			-	Bone surf (2E+2)	-	3E-10	-	-
		W, see ¹⁴⁵ Gd	-	6E+2	2E-7	8E-10	-	-
64	Gadolinium-159	D, see ¹⁴⁵ Gd	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ¹⁴⁵ Gd	-	6E+3	2E-6	8E-9	-	-
65	Terbium-147 ^{b/}	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5	7E-4
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5	7E-4
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5	7E-4
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5	2E-4
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65	Terbium-156m (5.0 h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3
65	Terbium-156	W, all compounds	1E+3	1E+3	6E-7	2E-9	1E-5	1E-4
65	Terbium-157	W, all compounds	5E+4	3E+2	1E-7	-	-	-
			LLI wall (5E+4)	Bone surf (6E+2)	-	8E-10	7E-4	7E-3
65	Terbium-158	W, all compounds	1E+3	2E+1	8E-9	3E-11	2E-5	2E-4
65	Terbium-160	W, all compounds	8E+2	2E+2	9E-8	3E-10	1E-5	1E-4
65	Terbium-161	W, all compounds	2E+3	2E+3	7E-7	2E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
66	Dysprosium-155	W, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
66	Dysprosium-157	W, all compounds	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
66	Dysprosium-159	W, all compounds	1E+4	2E+3	1E-6	3E-9	2E-4	2E-3
66	Dysprosium-165	W, all compounds	1E+4	5E+4	2E-5	6E-8	2E-4	2E-3
66	Dysprosium-166	W, all compounds	6E+2	7E+2	3E-7	1E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
67	Holmium-155 ^{b/}	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157 ^{b/}	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159 ^{b/}	W, all compounds	2E+5	1E+6	4E-4	1E-6	3E-3	3E-2
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7	1E-3	1E-2
67	Holmium-162m ^{b/}	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162 ^{b/}	W, all compounds	5E+5	2E+6	1E-3	3E-6	-	-
			St wall (8E+5)	-	-	-	1E-2	1E-1
67	Holmium-164m ^{b/}	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164 ^{b/}	W, all compounds	2E+5	6E+5	3E-4	9E-7	-	-
			St wall (2E+5)	-	-	-	3E-3	3E-2
67	Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67	Holmium-166	W, all compounds	9E+2	2E+3	7E-7	2E-9	-	-
			LLI wall (9E+2)	-	-	-	1E-5	1E-4
67	Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68	Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68	Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-
68	Erbium-169	W, all compounds	3E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
68	Erbium-172	W, all compounds	1E+3 LLI wall (1E+3)	1E+3	6E-7	2E-9	-	-
69	Thulium-162 ^{b/}	W, all compounds	7E+4 St wall (7E+4)	3E+5	1E-4	4E-7	-	2E-4
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5	6E-4
69	Thulium-167	W, all compounds	2E+3 LLI wall (2E+3)	2E+3	8E-7	3E-9	-	-
69	Thulium-170	W, all compounds	8E+2 LLI wall (1E+3)	2E+2	9E-8	3E-10	3E-5	3E-4
69	Thulium-171	W, all compounds	1E+4 LLI wall (1E+4)	3E+2	1E-7	-	1E-5	1E-4
69	Thulium-172	W, all compounds	7E+2 LLI wall (8E+2)	1E+3	5E-7	2E-9	-	-
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175 ^{b/}	W, all compounds	7E+4 St wall (9E+4)	3E+5	1E-4	4E-7	-	-
70	Ytterbium-162 ^{b/}	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2
70	Ytterbium-166	W, see ¹⁶² Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
70	Ytterbium-167 ^{b/}	W, see ¹⁶² Yb	-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-169	W, see ¹⁶² Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
70	Ytterbium-175	W, see ¹⁶² Yb	-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-177 ^{b/}	W, see ¹⁶² Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
70	Ytterbium-178 ^{b/}	W, see ¹⁶² Yb	-	7E+2	3E-7	1E-9	-	-
70	Ytterbium-175	W, see ¹⁶² Yb	3E+3 LLI wall (3E+3)	4E+3	1E-6	5E-9	-	-
70	Ytterbium-177 ^{b/}	W, see ¹⁶² Yb	-	3E+3	1E-6	5E-9	4E-5	4E-4
70	Ytterbium-178 ^{b/}	W, see ¹⁶² Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
70	Ytterbium-178 ^{b/}	W, see ¹⁶² Yb	-	5E+4	2E-5	6E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
71	Lutetium-169	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y Y, oxides, hydroxides, and fluorides	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4
71	Lutetium-170	W, see ¹⁶⁹ Lu	-	4E+3	2E-6	6E-9	-	-
71	Lutetium-170	W, see ¹⁶⁹ Lu	1E+3	2E+3	9E-7	3E-9	2E-5	2E-4
71	Lutetium-170	W, see ¹⁶⁹ Lu	-	2E+3	8E-7	3E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
71	Lutetium-171	W, see ¹⁶⁹ Lu	2E+3	2E+3	8E-7	3E-9	3E-5	3E-4
		Y, see ¹⁶⁹ Lu	-	2E+3	8E-7	3E-9	-	-
71	Lutetium-172	W, see ¹⁶⁹ Lu	1E+3	1E+3	5E-7	2E-9	1E-5	1E-4
		Y, see ¹⁶⁹ Lu	-	1E+3	5E-7	2E-9	-	-
71	Lutetium-173	W, see ¹⁶⁹ Lu	5E+3	3E+2	1E-7	-	7E-5	7E-4
				Bone surf				
			-	(5E+2)	-	6E-10	-	-
		Y, see ¹⁶⁹ Lu	-	3E+2	1E-7	4E-10	-	-
71	Lutetium-174m	W, see ¹⁶⁹ Lu	2E+3	2E+2	1E-7	-	-	-
				LLI wall				
			(3E+3)	(3E+2)	-	5E-10	4E-5	4E-4
		Y, see ¹⁶⁹ Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-176	W, see ¹⁶⁹ Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
				Bone surf				
			-	(1E+1)	-	2E-11	-	-
		Y, see ¹⁶⁹ Lu	-	8E+0	3E-9	1E-11	-	-
71	Lutetium-177m	W, see ¹⁶⁹ Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
				Bone surf				
			-	(1E+2)	-	2E-10	-	-
		Y, see ¹⁶⁹ Lu	-	8E+1	3E-8	1E-10	-	-
71	Lutetium-177	W, see ¹⁶⁹ Lu	2E+3	2E+3	9E-7	3E-9	-	-
				LLI wall				
			(3E+3)	-	-	-	4E-5	4E-4
		Y, see ¹⁶⁹ Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m ^{b/}	W, see ¹⁶⁹ Lu	5E+4	2E+5	8E-5	3E-7	-	-
				St wall				
			(6E+4)	-	-	-	8E-4	8E-3
		Y, see ¹⁶⁹ Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178 ^{b/}	W, see ¹⁶⁹ Lu	4E+4	1E+5	5E-5	2E-7	-	-
				St wall				
			(4E+4)	-	-	-	6E-4	6E-3
		Y, see ¹⁶⁹ Lu	-	1E+5	5E-5	2E-7	-	-
71	Lutetium-179	W, see ¹⁶⁹ Lu	6E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ¹⁶⁹ Lu	-	2E+4	6E-6	3E-8	-	-
72	Hafnium-170	D, all compounds except those given for W	3E+3	6E+3	2E-6	8E-9	4E-5	4E-4
		W, oxides, hydroxides, carbides, and nitrates	-	5E+3	2E-6	6E-9	-	-
72	Hafnium-172	D, see ¹⁷⁰ Hf	1E+3	9E+0	4E-9	-	2E-5	2E-4
				Bone surf				
			-	(2E+1)	-	3E-11	-	-
		W, see ¹⁷⁰ Hf	-	4E+1	2E-8	-	-	-
				Bone surf				
			-	(6E+1)	-	8E-11	-	-
72	Hafnium-173	D, see ¹⁷⁰ Hf	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ¹⁷⁰ Hf	-	1E+4	5E-6	2E-8	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μ Ci)	Col. 2	Col. 3	Col. 1 Air (μ Ci/ml)	Col. 2 Water (μ Ci/ml)	Monthly Average Concentration (μ Ci/ml)
				<u>Inhalation</u> ALI (μ Ci)	DAC (μ Ci/ml)			
72	Hafnium-175	D, see ¹⁷⁰ Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4
				Bone surf (1E+3)	-	1E-9	-	-
		W, see ¹⁷⁰ Hf	-	1E+3	5E-7	2E-9	-	-
72	Hafnium-177m ^{b/}	D, see ¹⁷⁰ Hf	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		W, see ¹⁷⁰ Hf	-	9E+4	4E-5	1E-7	-	-
72	Hafnium-178m	D, see ¹⁷⁰ Hf	3E+2	1E+0	5E-10	-	3E-6	3E-5
				Bone surf (2E+0)	-	3E-12	-	-
		W, see ¹⁷⁰ Hf	-	5E+0	2E-9	-	-	-
				Bone surf (9E+0)	-	1E-11	-	-
72	Hafnium-179m	D, see ¹⁷⁰ Hf	1E+3	3E+2	1E-7	-	1E-5	1E-4
				Bone surf (6E+2)	-	8E-10	-	-
		W, see ¹⁷⁰ Hf	-	6E+2	3E-7	8E-10	-	-
72	Hafnium-180m	D, see ¹⁷⁰ Hf	7E+3	2E+4	9E-6	3E-8	1E-4	1E-3
		W, see ¹⁷⁰ Hf	-	3E+4	1E-5	4E-8	-	-
72	Hafnium-181	D, see ¹⁷⁰ Hf	1E+3	2E+2	7E-8	-	2E-5	2E-4
				Bone surf (4E+2)	-	6E-10	-	-
		W, see ¹⁷⁰ Hf	-	4E+2	2E-7	6E-10	-	-
72	Hafnium-182m ^{b/}	D, see ¹⁷⁰ Hf	4E+4	9E+4	4E-5	1E-7	5E-4	5E-3
		W, see ¹⁷⁰ Hf	-	1E+5	6E-5	2E-7	-	-
72	Hafnium-182	D, see ¹⁷⁰ Hf	2E+2	8E-1	3E-10	-	-	-
				Bone surf (4E+2)	-	2E-12	5E-6	5E-5
		W, see ¹⁷⁰ Hf	-	3E+0	1E-9	-	-	-
				Bone surf (7E+0)	-	1E-11	-	-
72	Hafnium-183 ^{b/}	D, see ¹⁷⁰ Hf	2E+4	5E+4	2E-5	6E-8	3E-4	3E-3
		W, see ¹⁷⁰ Hf	-	6E+4	2E-5	8E-8	-	-
72	Hafnium-184	D, see ¹⁷⁰ Hf	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ¹⁷⁰ Hf	-	6E+3	3E-6	9E-9	-	-
73	Tantalum-172 ^{b/}	W, all compounds except those given for Y Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
				Bone surf (2E+2)	-	3E-10	-	-
71	Lutetium-174	W, see ¹⁶⁹ Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
				Bone surf (2E+2)	-	3E-10	-	-
		Y, see ¹⁶⁹ Lu	-	2E+2	6E-8	2E-10	-	-
71	Lutetium-176m	W, see ¹⁶⁹ Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		Y, see ¹⁶⁹ Lu	-	2E+4	9E-6	3E-8	-	-
73	Tantalum-173	W, see ¹⁷² Ta	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		Y, see ¹⁷² Ta	-	2E+4	7E-6	2E-8	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
73	Tantalum-174 _{b/}	W, see ¹⁷² Ta	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
		Y, see ¹⁷² Ta	-	9E+4	4E-5	1E-7	-	-
73	Tantalum-175	W, see ¹⁷² Ta	6E+3	2E+4	7E-6	2E-8	8E-5	8E-4
		Y, see ¹⁷² Ta	-	1E+4	6E-6	2E-8	-	-
73	Tantalum-176	W, see ¹⁷² Ta	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		Y, see ¹⁷² Ta	-	1E+4	5E-6	2E-8	-	-
73	Tantalum-177	W, see ¹⁷² Ta	1E+4	2E+4	8E-6	3E-8	2E-4	2E-3
		Y, see ¹⁷² Ta	-	2E+4	7E-6	2E-8	-	-
73	Tantalum-178	W, see ¹⁷² Ta	2E+4	9E+4	4E-5	1E-7	2E-4	2E-3
		Y, see ¹⁷² Ta	-	7E+4	3E-5	1E-7	-	-
73	Tantalum-179	W, see ¹⁷² Ta	2E+4	5E+3	2E-6	8E-9	3E-4	3E-3
		Y, see ¹⁷² Ta	-	9E+2	4E-7	1E-9	-	-
73	Tantalum-180m	W, see ¹⁷² Ta	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ¹⁷² Ta	-	6E+4	2E-5	8E-8	-	-
73	Tantalum-180	W, see ¹⁷² Ta	1E+3	4E+2	2E-7	6E-10	2E-5	2E-4
		Y, see ¹⁷² Ta	-	2E+1	1E-8	3E-11	-	-
73	Tantalum-182m _{b/}	W, see ¹⁷² Ta	2E+5	5E+5	2E-4	8E-7	-	-
		St wall (2E+5)	-	-	-	-	3E-3	3E-2
		Y, see ¹⁷² Ta	-	4E+5	2E-4	6E-7	-	-
73	Tantalum-182	W, see ¹⁷² Ta	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		Y, see ¹⁷² Ta	-	1E+2	6E-8	2E-10	-	-
73	Tantalum-183	W, see ¹⁷² Ta	9E+2	1E+3	5E-7	2E-9	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
		Y, see ¹⁷² Ta	-	1E+3	4E-7	1E-9	-	-
73	Tantalum-184	W, see ¹⁷² Ta	2E+3	5E+3	2E-6	8E-9	3E-5	3E-4
		Y, see ¹⁷² Ta	-	5E+3	2E-6	7E-9	-	-
73	Tantalum-185 _{b/}	W, see ¹⁷² Ta	3E+4	7E+4	3E-5	1E-7	4E-4	4E-3
		Y, see ¹⁷² Ta	-	6E+4	3E-5	9E-8	-	-
73	Tantalum-186 _{b/}	W, see ¹⁷² Ta	5E+4	2E+5	1E-4	3E-7	-	-
		St wall (7E+4)	-	-	-	-	1E-3	1E-2
		Y, see ¹⁷² Ta	-	2E+5	9E-5	3E-7	-	-
74	Tungsten-176	D, all compounds	1E+4	5E+4	2E-5	7E-8	1E-4	1E-3
74	Tungsten-177	D, all compounds	2E+4	9E+4	4E-5	1E-7	3E-4	3E-3
74	Tungsten-178	D, all compounds	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
74	Tungsten-179 _{b/}	D, all compounds	5E+5	2E+6	7E-4	2E-6	7E-3	7E-2
74	Tungsten-181	D, all compounds	2E+4	3E+4	1E-5	5E-8	2E-4	2E-3
74	Tungsten-185	D, all compounds	2E+3	7E+3	3E-6	9E-9	-	-
		LLI wall (3E+3)	-	-	-	-	4E-5	4E-4
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5	3E-4
74	Tungsten-188	D, all compounds	4E+2	1E+3	5E-7	2E-9	-	-
		LLI wall (5E+2)	-	-	-	-	7E-6	7E-5

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
75	Rhenium-177 ^{b/}	D, all compounds except those given for W	9E+4 St wall (1E+5)	3E+5	1E-4	4E-7	-	-
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178 ^{b/}	D, see ¹⁷⁷ Re	7E+4 St wall (1E+5)	3E+5	1E-4	4E-7	-	-
		W, see ¹⁷⁷ Re	-	3E+5	1E-4	4E-7	1E-3	1E-2
75	Rhenium-181	D, see ¹⁷⁷ Re	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
		W, see ¹⁷⁷ Re	-	9E+3	4E-6	1E-8	-	-
75	Rhenium-182 (12.7 h)	D, see ¹⁷⁷ Re	7E+3	1E+4	5E-6	2E-8	9E-5	9E-4
		W, see ¹⁷⁷ Re	-	2E+4	6E-6	2E-8	-	-
75	Rhenium-182 (64.0 h)	D, see ¹⁷⁷ Re	1E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	2E+3	9E-7	3E-9	-	-
75	Rhenium-184m	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	4E+2	2E-7	6E-10	-	-
75	Rhenium-184	D, see ¹⁷⁷ Re	2E+3	4E+3	1E-6	5E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	1E+3	6E-7	2E-9	-	-
75	Rhenium-186m	D, see ¹⁷⁷ Re	1E+3 St wall (2E+3)	2E+3	7E-7	-	-	-
		W, see ¹⁷⁷ Re	-	2E+2	6E-8	2E-10	2E-5	2E-4
75	Rhenium-186	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ¹⁷⁷ Re	-	2E+3	7E-7	2E-9	-	-
75	Rhenium-187	D, see ¹⁷⁷ Re	6E+5 St wall (9E+5)	8E+5	4E-4	-	8E-3	8E-2
		W, see ¹⁷⁷ Re	-	1E+5	4E-5	1E-6	-	-
75	Rhenium-188m ^{b/}	D, see ¹⁷⁷ Re	8E+4	1E+5	6E-5	2E-7	1E-3	1E-2
		W, see ¹⁷⁷ Re	-	1E+5	6E-5	2E-7	-	-
75	Rhenium-188	D, see ¹⁷⁷ Re	2E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	3E+3	1E-6	4E-9	-	-
75	Rhenium-189	D, see ¹⁷⁷ Re	3E+3	5E+3	2E-6	7E-9	4E-5	4E-4
		W, see ¹⁷⁷ Re	-	4E+3	2E-6	6E-9	-	-
76	Osmium-180 ^{b/}	D, all compounds except those given for W and Y	1E+5	4E+5	2E-4	5E-7	1E-3	1E-2
		W, halides and nitrates	-	5E+5	2E-4	7E-7	-	-
		Y, oxides and hydroxides	-	5E+5	2E-4	6E-7	-	-
76	Osmium-181 ^{b/}	D, see ¹⁸⁰ Os	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ¹⁸⁰ Os	-	5E+4	2E-5	6E-8	-	-
		Y, see ¹⁸⁰ Os	-	4E+4	2E-5	6E-8	-	-
76	Osmium-182	D, see ¹⁸⁰ Os	2E+3	6E+3	2E-6	8E-9	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	4E+3	2E-6	6E-9	-	-
		Y, see ¹⁸⁰ Os	-	4E+3	2E-6	6E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion			Air	Water	
			ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
76	Osmium-185	D, see ¹⁸⁰ Os	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	8E+2	3E-7	1E-9	-	-
		Y, see ¹⁸⁰ Os	-	8E+2	3E-7	1E-9	-	-
76	Osmium-189m	D, see ¹⁸⁰ Os	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, see ¹⁸⁰ Os	-	2E+5	9E-5	3E-7	-	-
		Y, see ¹⁸⁰ Os	-	2E+5	7E-5	2E-7	-	-
76	Osmium-191m	D, see ¹⁸⁰ Os	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ¹⁸⁰ Os	-	2E+4	8E-6	3E-8	-	-
		Y, see ¹⁸⁰ Os	-	2E+4	7E-6	2E-8	-	-
76	Osmium-191	D, see ¹⁸⁰ Os	2E+3	2E+3	9E-7	3E-9	-	-
		LLI wall	(3E+3)	-	-	-	3E-5	3E-4
		W, see ¹⁸⁰ Os	-	2E+3	7E-7	2E-9	-	-
		Y, see ¹⁸⁰ Os	-	1E+3	6E-7	2E-9	-	-
76	Osmium-193	D, see ¹⁸⁰ Os	2E+3	5E+3	2E-6	6E-9	-	-
		LLI wall	(2E+3)	-	-	-	2E-5	2E-4
		W, see ¹⁸⁰ Os	-	3E+3	1E-6	4E-9	-	-
		Y, see ¹⁸⁰ Os	-	3E+3	1E-6	4E-9	-	-
76	Osmium-194	D, see ¹⁸⁰ Os	4E+2	4E+1	2E-8	6E-11	-	-
		LLI wall	(6E+2)	-	-	8E-6	8E-5	-
		W, see ¹⁸⁰ Os	-	6E+1	2E-8	8E-11	-	-
		Y, see ¹⁸⁰ Os	-	8E+0	3E-9	1E-11	-	-
77	Iridium-182 ^{b/}	D, all compounds except those given for W and Y	4E+4	1E+5	6E-5	2E-7	-	-
		St wall	(4E+4)	-	-	-	6E-4	6E-3
		W, halides, nitrates, and metallic iridium	-	2E+5	6E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
77	Iridium-184	D, see ¹⁸² Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ¹⁸² Ir	-	3E+4	1E-5	5E-8	-	-
		Y, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-185	D, see ¹⁸² Ir	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ¹⁸² Ir	-	1E+4	5E-6	2E-8	-	-
		Y, see ¹⁸² Ir	-	1E+4	4E-6	1E-8	-	-
77	Iridium-186	D, see ¹⁸² Ir	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ¹⁸² Ir	-	6E+3	3E-6	9E-9	-	-
		Y, see ¹⁸² Ir	-	6E+3	2E-6	8E-9	-	-
77	Iridium-187	D, see ¹⁸² Ir	1E+4	3E+4	1E-5	5E-8	1E-4	1E-3
		W, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ¹⁸² Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-188	D, see ¹⁸² Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		W, see ¹⁸² Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ¹⁸² Ir	-	3E+3	1E-6	5E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
77	Iridium-189	D, see ^{182}Ir	5E+3 LLI wall (5E+3)	5E+3 -	2E-6 -	7E-9 -	- 7E-5	- 7E-4
		W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190m ^{b/}	D, see ^{182}Ir	2E+5	2E+5	8E-5	3E-7	2E-3	2E-2
		W, see ^{182}Ir	-	2E+5	9E-5	3E-7	-	-
		Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
77	Iridium-190	D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
		W, see ^{182}Ir	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{182}Ir	-	9E+2	4E-7	1E-9	-	-
77	Iridium-192m	D, see ^{182}Ir	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
		W, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
		Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
77	Iridium-192	D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		W, see ^{182}Ir	-	4E+2	2E-7	6E-10	-	-
		Y, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
77	Iridium-194m	D, see ^{182}Ir	6E+2	9E+1	4E-8	1E-10	9E-6	9E-5
		W, see ^{182}Ir	-	2E+2	7E-8	2E-10	-	-
		Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
77	Iridium-194	D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{182}Ir	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{182}Ir	-	2E+3	8E-7	3E-9	-	-
77	Iridium-195m	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
77	Iridium-195	D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
		Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78	Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78	Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78	Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78	Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78	Platinum-193m	D, all compounds	3E+3 LLI wall (3E+4)	6E+3 -	3E-6 -	8E-9 -	- 4E-5	- 4E-4
78	Platinum-193	D, all compounds	4E+4 LLI wall (5E+4)	2E+4 -	1E-5 -	3E-8 -	- 6E-4	- 6E-3
78	Platinum-195m	D, all compounds	2E+3 LLI wall (2E+3)	4E+3 -	2E-6 -	6E-9 -	- 3E-5	- 3E-4
78	Platinum-197m ^{b/}	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5	4E-4
78	Platinum-199 ^{b/}	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
79	Gold-193	D, all compounds except those given for W and Y W, halides and nitrates Y, oxides and hydroxides	9E+3 - -	3E+4 2E+4 2E+4	1E-5 9E-6 8E-6	4E-8 3E-8 3E-8	1E-4 -	1E-3 - -
79	Gold-194	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	3E+3 - -	8E+3 5E+3 5E+3	3E-6 2E-6 2E-6	1E-8 8E-9 7E-9	4E-5 -	4E-4 - -
79	Gold-195	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	5E+3 - -	1E+4 1E+3 4E+2	5E-6 6E-7 2E-7	2E-8 2E-9 6E-10	7E-5 -	7E-4 - -
79	Gold-198m	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	3E+3 1E+3 1E+3	1E-6 5E-7 5E-7	4E-9 2E-9 2E-9	1E-5 -	1E-4 - -
79	Gold-198	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	4E+3 2E+3 2E+3	2E-6 8E-7 7E-7	5E-9 3E-9 2E-9	2E-5 -	2E-4 - -
79	Gold-199	D, see ^{193}Au	3E+3	9E+3	4E-6	1E-8	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
		W, see ^{193}Au Y, see ^{193}Au	- -	4E+3 4E+3	2E-6 2E-6	6E-9 5E-9	-	- -
79	Gold-200m	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	1E+3 - -	4E+3 3E+3 2E+4	1E-6 1E-6 1E-6	5E-9 4E-9 3E-9	2E-5 -	2E-4 - -
79	Gold-200 _b ^l	D, see ^{193}Au W, see ^{193}Au Y, see ^{193}Au	3E+4 - -	6E+4 8E+4 7E+4	3E-5 3E-5 3E-5	9E-8 1E-7 1E-7	4E-4 -	4E-3 - -
79	Gold-201 _b ^l	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{193}Au Y, see ^{193}Au	- -	2E+5 2E+5	1E-4 9E-5	3E-7 3E-7	-	- -
80	Mercury-193m	Vapor Organic D D, sulfates W, oxides, hydroxides, halides, nitrates, and sulfides	- 4E+3 3E+3 -	8E+3 1E+4 9E+3 8E+3	4E-6 5E-6 4E-6 3E-6	1E-8 2E-8 1E-8 1E-8	- 6E-5 4E-5 -	- 6E-4 4E-4 -
80	Mercury-193	Vapor Organic D D, see $^{193\text{m}}\text{Hg}$ W, see $^{193\text{m}}\text{Hg}$	- 2E+4 2E+4 -	3E+4 6E+4 4E+4 4E+4	1E-5 3E-5 2E-5 2E-5	4E-8 9E-8 6E-8 6E-8	- 3E-4 2E-4 -	- 3E-3 2E-3 -
80	Mercury-194	Vapor Organic D D, see $^{193\text{m}}\text{Hg}$ W, see $^{193\text{m}}\text{Hg}$	- 2E+1 8E+2 -	3E+1 3E+1 4E+1 1E+2	1E-8 1E-8 2E-8 5E-8	4E-11 4E-11 6E-11 2E-10	- 2E-7 1E-5 -	- 2E-6 1E-4 -

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci}/\text{ml}$)
			Oral			Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
			Ingestion ALI (μCi)	Inhalation ALI DAC (μCi) ($\mu\text{Ci}/\text{ml}$)				
80	Mercury-195m	Vapor	-	4E+3	2E-6	6E-9	-	-
		Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
		D, see ^{193m} Hg	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
		W, see ^{193m} Hg	-	4E+3	2E-6	5E-9	-	-
80	Mercury-195	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		D, see ^{193m} Hg	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{193m} Hg	-	3E+4	1E-5	5E-8	-	-
80	Mercury-197m	Vapor	-	5E+3	2E-6	7E-9	-	-
		Organic D	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
		D, see ^{193m} Hg	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193m} Hg	-	5E+3	2E-6	7E-9	-	-
80	Mercury-197	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	7E+3	1E+4	6E-6	2E-8	9E-5	9E-4
		D, see ^{193m} Hg	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{193m} Hg	-	9E+3	4E-6	1E-8	-	-
80	Mercury-199m ^{b/}	Vapor	-	8E+4	3E-5	1E-7	-	-
		Organic D	6E+4	2E+5	7E-5	2E-7	-	-
		St wall (1E+5)	-	-	-	-	1E-3	1E-2
		D, see ^{193m} Hg	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
		W, see ^{193m} Hg	-	2E+5	7E-5	2E-7	-	-
80	Mercury-203	Vapor	-	8E+2	4E-7	1E-9	-	-
		Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
		D, see ^{193m} Hg	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		W, see ^{193m} Hg	-	1E+3	5E-7	2E-9	-	-
81	Thallium-194m ^{b/}	D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
		St wall (7E+4)	-	-	-	-	1E-3	1E-2
81	Thallium-194 ^{b/}	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
		St wall (3E+5)	-	-	-	-	4E-3	4E-2
81	Thallium-195 ^{b/}	D, all compounds	6E+4	1E+5	5E-5	2E-7	9E-4	9E-3
81	Thallium-197	D, all compounds	7E+4	1E+5	5E-5	2E-7	1E-3	1E-2
81	Thallium-198m ^{b/}	D, all compounds	3E+4	5E+4	2E-5	8E-8	4E-4	4E-3
81	Thallium-198	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
81	Thallium-199	D, all compounds	6E+4	8E+4	4E-5	1E-7	9E-4	9E-3
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4	2E-3
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5	2E-4
82	Lead-195m ^{b/}	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4	8E-3
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
82	Lead-199 ^{b/}	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5	4E-4
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4	1E-3
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6	2E-5

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μ Ci/ml)
			Oral			Air (μ Ci/ml)	Water (μ Ci/ml)	
			Ingestion ALI (μ Ci)	Inhalation ALI DAC (μ Ci) (μ Ci/ml)				
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5	7E-4
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5	5E-4
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
82	Lead-210	D, all compounds	6E-1	2E-1	1E-10	-	-	-
			Bone surf (1E+0)	Bone surf (4E-1)	-	6E-13	1E-8	1E-7
82	Lead-211 ^{b/}	D, all compounds	1E+4	6E+2	3E-7	9E-10	2E-4	2E-3
82	Lead-212	D, all compounds	8E+1	3E+1	1E-8	5E-11	-	-
			Bone surf (1E+2)	-	-	-	2E-6	2E-5
82	Lead-214 ^{b/}	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200 ^{b/}	D, nitrates	3E+4	8E+4	4E-5	1E-7	4E-4	4E-3
		W, all other compounds	-	1E+5	4E-5	1E-7	-	-
83	Bismuth-201 ^{b/}	D, see ²⁰⁰ Bi	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
		W, see ²⁰⁰ Bi	-	4E+4	2E-5	5E-8	-	-
83	Bismuth-202 ^{b/}	D, see ²⁰⁰ Bi	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ²⁰⁰ Bi	-	8E+4	3E-5	1E-7	-	-
83	Bismuth-203	D, see ²⁰⁰ Bi	2E+3	7E+3	3E-6	9E-9	3E-5	3E-4
		W, see ²⁰⁰ Bi	-	6E+3	3E-6	9E-9	-	-
83	Bismuth-205	D, see ²⁰⁰ Bi	1E+3	3E+3	1E-6	3E-9	2E-5	2E-4
		W, see ²⁰⁰ Bi	-	1E+3	5E-7	2E-9	-	-
83	Bismuth-206	D, see ²⁰⁰ Bi	6E+2	1E+3	6E-7	2E-9	9E-6	9E-5
		W, see ²⁰⁰ Bi	-	9E+2	4E-7	1E-9	-	-
83	Bismuth-207	D, see ²⁰⁰ Bi	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see ²⁰⁰ Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-210m	D, see ²⁰⁰ Bi	4E+1	5E+0	2E-9	-	-	-
			Kidneys (6E+1)	Kidneys (6E+0)	-	9E-12	8E-7	8E-6
		W, see ²⁰⁰ Bi	-	7E-1	3E-10	9E-13	-	-
83	Bismuth-210	D, see ²⁰⁰ Bi	8E+2	2E+2	1E-7	-	1E-5	1E-4
			-	Kidneys (4E+2)	-	5E-10	-	-
		W, see ²⁰⁰ Bi	-	3E+1	1E-8	4E-11	-	-
83	Bismuth-212 ^{b/}	D, see ²⁰⁰ Bi	5E+3	2E+2	1E-7	3E-10	7E-5	7E-4
		W, see ²⁰⁰ Bi	-	3E+2	1E-7	4E-10	-	-
83	Bismuth-213 ^{b/}	D, see ²⁰⁰ Bi	7E+3	3E+2	1E-7	4E-10	1E-4	1E-3
		W, see ²⁰⁰ Bi	-	4E+2	1E-7	5E-10	-	-
83	Bismuth-214 ^{b/}	D, see ²⁰⁰ Bi	2E+4	8E+2	3E-7	1E-9	-	-
			St wall (2E+4)	-	-	-	3E-4	3E-3
		W, see ²⁰⁰ Bi	-	9E-2	4E-7	1E-9	-	-
84	Polonium-203 ^{b/}	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-	-
84	Polonium-205 ^{b/}	D, see ²⁰³ Po	2E+4	4E+4	2E-5	5E-8	3E-4	3E-3
		W, see ²⁰³ Po	-	7E+4	3E-5	1E-7	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
84	Polonium-207	D, see ²⁰³ Po	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
		W, see ²⁰³ Po	-	3E+4	1E-5	4E-8	-	-
84	Polonium-210	D, see ²⁰³ Po	3E+0	6E-1	3E-10	9E-13	4E-8	4E-7
		W, see ²⁰³ Po	-	6E-1	3E-10	9E-13	-	-
85	Astatine-207 _{b/}	D, halides	6E+3	3E+3	1E-6	4E-9	8E-5	8E-4
		W	-	2E+3	9E-7	3E-9	-	-
85	Astatine-211	D, halides	1E+2	8E+1	3E-8	1E-10	2E-6	2E-5
		W	-	5E+1	2E-8	8E-11	-	-
86	Radon-220	With daughters removed	-	2E+4	7E-6	2E-8	-	-
		With daughters present	-	2E+1	9E-9	3E-11	-	-
				(or 12 WLM)	(or 1.0 WL)			
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2	3E-8	1E-10	-	-
				(or 4 WLM)	(or 0.33 WL)			
87	Francium-222 _{b/}	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223 _{b/}	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6	8E-5
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (9E+0)	-	-	-	1E-7	1E-6
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-	-
			Bone surf (2E+1)	-	-	-	2E-7	2E-6
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-	-
			Bone surf (5E+0)	-	-	-	6E-8	6E-7
88	Radium-227 _{b/}	W, all compounds	2E+4	1E+4	6E-6	-	-	-
			Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-	-
			Bone surf (4E+0)	-	-	-	6E-8	6E-7
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-	-
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-	-
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-	-
89	Actinium-225	D, see ²²⁴ Ac	5E+1	3E-1	1E-10	-	-	-
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
		W, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-
		Y, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
89	Actinium-226	D, see ²²⁴ Ac	1E+2	3E+0	1E-9	-	-	-
			LLI wall (1E+2)	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
		W, see ²²⁴ Ac	-	5E+0	2E-9	7E-12	-	-
		Y, see ²²⁴ Ac	-	5E+0	2E-9	6E-12	-	-
89	Actinium-227	D, see ²²⁴ Ac	2E-1	4E-4	2E-13	-	-	-
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
		W, see ²²⁴ Ac	-	2E-3	7E-13	-	-	-
			Bone surf	(3E-3)	-	4E-15	-	-
		Y, see ²²⁴ Ac	-	4E-3	2E-12	6E-15	-	-
89	Actinium-228	D, see ²²⁴ Ac	2E+3	9E+0	4E-9	-	3E-5	3E-4
			Bone surf	(2E+1)	-	2E-11	-	-
		W, see ²²⁴ Ac	-	4E+1	2E-8	-	-	-
			Bone surf	(6E+1)	-	8E-11	-	-
		Y, see ²²⁴ Ac	-	4E+1	2E-8	6E-11	-	-
90	Thorium-226 ^{b/}	W, all compounds except those given for Y	5E+3	2E+2	6E-8	2E-10	-	-
			St wall (5E+3)	-	-	-	7E-5	7E-4
		Y, oxides and hydroxides	-	1E+2	6E-8	2E-10	-	-
90	Thorium-227	W, see ²²⁶ Th	1E+2	3E-1	1E-10	5E-13	2E-6	2E-5
		Y, see ²²⁶ Th	-	3E-1	1E-10	5E-13	-	-
90	Thorium-228	W, see ²²⁶ Th	6E+0	1E-2	4E-12	-	-	-
			Bone surf (1E+1)	Bone surf (2E-2)	-	3E-14	2E-7	2E-6
		Y, see ²²⁶ Th	-	2E-2	7E-12	2E-14	-	-
90	Thorium-229	W, see ²²⁶ Th	6E-1	9E-4	4E-13	-	-	-
			Bone surf (1E+0)	Bone surf (2E-3)	-	3E-15	2E-8	2E-7
		Y, see ²²⁶ Th	-	2E-3	1E-12	-	-	-
			Bone surf	(3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ²²⁶ Th	4E+0	6E-3	3E-12	-	-	-
			Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
		Y, see ²²⁶ Th	-	2E-2	6E-12	-	-	-
			Bone surf	(2E-2)	-	3E-14	-	-
90	Thorium-231	W, see ²²⁶ Th	4E+3	6E+3	3E-6	9E-9	5E-5	5E-4
		Y, see ²²⁶ Th	-	6E+3	3E-6	9E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μ Ci/ml)
			Oral Ingestion ALI (μ Ci)	<u>Inhalation</u> ALI (μ Ci)	DAC (μ Ci/ml)	Air (μ Ci/ml)	Water (μ Ci/ml)	
90	Thorium-232	W, see ²²⁶ Th	7E-1 Bone surf (2E+0)	1E-3 Bone surf (3E-3)	5E-13 -	-	-	-
		Y, see ²²⁶ Th	-	3E-3 Bone surf (4E-3)	1E-12 -	-	-	3E-7
90	Thorium-234	W, see ²²⁶ Th	3E+2 LLI wall (4E+2)	2E+2	8E-8	3E-10	-	-
		Y, see ²²⁶ Th	-	2E+2	6E-8	2E-10	5E-6	5E-5
91	Protactinium-227 ^{b/}	W, all compounds except those given for Y	4E+3	1E+2	5E-8	2E-10	5E-5	5E-4
		Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-	-
91	Protactinium-228	W, see ²²⁷ Pa	1E+3	1E+1	5E-9	-	2E-5	2E-4
		Y, see ²²⁷ Pa	-	2E+1 Bone surf (2E+1)	-	3E-11	-	-
91	Protactinium-230	W, see ²²⁷ Pa	6E+2 Bone surf (9E+2)	5E+0	2E-9	7E-12	-	-
		Y, see ²²⁷ Pa	-	4E+0	1E-9	5E-12	1E-5	1E-4
91	Protactinium-231	W, see ²²⁷ Pa	2E-1	2E-3	6E-13	-	-	-
		Y, see ²²⁷ Pa	(5E-1)	4E-3 Bone surf (6E-3)	-	6E-15	6E-9	6E-8
91	Protactinium-232	W, see ²²⁷ Pa	1E+3	2E+1	9E-9	-	2E-5	2E-4
		Y, see ²²⁷ Pa	-	6E+1 Bone surf (7E+1)	-	8E-11	-	-
		Y, see ²²⁷ Pa	-	6E+1	2E-8	-	-	-
91	Protactinium-233	W, see ²²⁷ Pa	1E+3 LLI wall (2E+3)	7E+2	3E-7	1E-9	-	-
		Y, see ²²⁷ Pa	-	-	-	-	2E-5	2E-4
91	Protactinium-234	W, see ²²⁷ Pa	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		Y, see ²²⁷ Pa	-	7E+3	3E-6	9E-9	-	-
92	Uranium-230	D, UF ₆ , UO ₂ F ₂ , UO ₂ (NO ₃) ₂	4E+0 Bone surf (6E-1)	4E-1 Bone surf -	2E-10 8E-13	-	-	-
		W, UO ₃ , UF ₄ , UCl ₄	-	4E-1	1E-10	5E-13	-	-
		Y, UO ₂ , U ₃ O ₈	-	3E-1	1E-10	4E-13	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion			Air (µCi/ml)	Water (µCi/ml)	
			ALI (µCi)	ALI (µCi)	DAC (µCi/ml)			
92	Uranium-231	D, see ²³⁰ U	5E+3	8E+3	3E-6	1E-8	-	-
			LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ²³⁰ U	-	6E+3	2E-6	8E-9	-	-
92	Uranium-232	Y, see ²³⁰ U	-	5E+3	2E-6	6E-9	-	-
		D, see ²³⁰ U	2E+0	2E-1	9E-11	-	-	-
			Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
92	Uranium-233	W, see ²³⁰ U	-	4E-1	2E-10	5E-13	-	-
		Y, see ²³⁰ U	-	8E-3	3E-12	1E-14	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
92	Uranium-234 ^{c/}		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
92	Uranium-235 ^{c/}	D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
92	Uranium-236	Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
92	Uranium-237	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
92	Uranium-238 ^{c/}		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
		W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
92	Uranium-239 ^{b/}	D, see ²³⁰ U	2E+3	3E+3	1E-6	4E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
		W, see ²³⁰ U	-	2E+3	7E-7	2E-9	-	-
92	Uranium-240	Y, see ²³⁰ U	-	2E+3	6E-7	2E-9	-	-
		D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6
92	Uranium-240	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
		D, see ²³⁰ U	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
92	Uranium-240	W, see ²³⁰ U	-	2E+5	7E-5	2E-7	-	-
		Y, see ²³⁰ U	-	2E+5	6E-5	2E-7	-	-
		D, see ²³⁰ U	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
92	Uranium-240	W, see ²³⁰ U	-	3E+3	1E-6	4E-9	-	-
		Y, see ²³⁰ U	-	2E+3	1E-6	3E-9	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
92	Uranium-natural ^{c/}	D, see ²³⁰ U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10	-	-	-
		W, see ²³⁰ U	-	8E-1	3E-10	3E-12	3E-7	3E-6
		Y, see ²³⁰ U	-	5E-2	2E-11	9E-13	-	-
93	Neptunium-232 ^{b/}	W, all compounds	1E+5 Bone surf	2E+3 (5E+2)	7E-7	-	2E-3	2E-2
93	Neptunium-233 ^{b/}	W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-235	W, all compounds	2E+4	8E+2	3E-7	-	-	-
			LLI wall (2E+4)	Bone surf (1E+3)	-	2E-9	3E-4	3E-3
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+0 Bone surf (6E+0)	2E-2 Bone surf (5E-2)	9E-12	8E-14	9E-8	9E-7
93	Neptunium-236 (22.5 h)	W, all compounds	3E+3 Bone surf (4E+3)	3E+1 Bone surf (7E+1)	1E-8	-	-	-
93	Neptunium-237	W, all compounds	5E-1 Bone surf (1E+0)	4E-3 Bone surf (1E-2)	2E-12	1E-10	5E-5	5E-4
93	Neptunium-238	W, all compounds	1E+3 Bone surf	6E+1 (2E+2)	3E-8	1E-14	2E-8	2E-7
93	Neptunium-239	W, all compounds	2E+3 Bone surf (2E+3)	2E+3 LLI wall	9E-7	3E-9	-	-
93	Neptunium-240 ^{b/}	W, all compounds	2E+4	8E+4	3E-5	1E-7	2E-5	2E-4
94	Plutonium-234	W, all compounds except PuO ₂	8E+3	2E+2	9E-8	3E-10	1E-4	1E-3
		Y, PuO ₂	-	2E+2	8E-8	3E-10	-	-
94	Plutonium-235 ^{b/}	W, see ²³⁴ Pu	9E+5	3E+6	1E-3	4E-6	1E-2	1E-1
		Y, see ²³⁴ Pu	-	3E+6	1E-3	3E-6	-	-
94	Plutonium-236	W, see ²³⁴ Pu	2E+0 Bone surf (4E+0)	2E-2 Bone surf (4E-2)	8E-12	-	5E-14	6E-7
		Y, see ²³⁴ Pu	-	4E-2	2E-11	6E-14	-	-
94	Plutonium-237	W, see ²³⁴ Pu	1E+4	3E+3	1E-6	5E-9	2E-4	2E-3
		Y, see ²³⁴ Pu	-	3E+3	1E-6	4E-9	-	-
94	Plutonium-238	W, see ²³⁴ Pu	9E-1 Bone surf (2E+0)	7E-3 Bone surf (1E-2)	3E-12	-	2E-14	2E-7
		Y, see ²³⁴ Pu	-	2E-2	8E-12	2E-14	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μ Ci/ml)
			Oral Ingestion ALI (μ Ci)	Inhalation ALI (μ Ci)	DAC (μ Ci/ml)	Air (μ Ci/ml)	Water (μ Ci/ml)	
94	Plutonium-239	W, see ²³⁴ Pu	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	-	-	2E-7
		Y, see ²³⁴ Pu	-	2E-2 Bone surf (2E-2)	7E-12 -	-	-	-
94	Plutonium-240	W, see ²³⁴ Pu	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	-	-	2E-7
		Y, see ²³⁴ Pu	-	2E-2 Bone surf (2E-2)	7E-12 -	-	-	-
94	Plutonium-241	W, see ²³⁴ Pu	4E+1 Bone surf (7E+1)	3E-1 Bone surf (6E-1)	1E-10 -	-	-	-
		Y, see ²³⁴ Pu	-	8E-1 Bone surf (1E+0)	3E-10 -	8E-13	1E-6	1E-5
94	Plutonium-242	W, see ²³⁴ Pu	8E-1 Bone surf (1E+0)	7E-3 Bone surf (1E-2)	3E-12 -	-	-	-
		Y, see ²³⁴ Pu	-	2E-2 Bone surf (2E-2)	7E-12 -	2E-14	2E-8	2E-7
94	Plutonium-243	W, see ²³⁴ Pu	2E+4	4E+4	2E-5	5E-8	2E-4	2E-3
		Y, see ²³⁴ Pu	-	4E+4	2E-5	5E-8	-	-
94	Plutonium-244	W, see ²³⁴ Pu	8E-1 Bone surf (2E+0)	7E-3 Bone surf (1E-2)	3E-12 -	-	-	-
		Y, see ²³⁴ Pu	-	2E-2 Bone surf (2E-2)	7E-12 -	2E-14	2E-8	2E-7
94	Plutonium-245	W, see ²³⁴ Pu	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		Y, see ²³⁴ Pu	-	4E+3	2E-6	6E-9	-	-
94	Plutonium-246	W, see ²³⁴ Pu	4E+2 LLI wall (4E+2)	3E+2	1E-7	4E-10	-	-
		Y, see ²³⁴ Pu	-	3E+2	1E-7	4E-10	6E-6	6E-5
95	Americium-237 ^{b/}	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-238 ^{b/}	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3
			-	Bone surf (6E+3)	-	9E-9	-	-
95	Americium-239	W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95	Americium-240	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95	Americium-241	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	-	-	-
			-	2E-2	7E-12	2E-14	2E-8	2E-7

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers	
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)	
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)		
95	Americium-242m	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-	
95	Americium-242	W, all compounds	4E+3 Bone surf	8E+1 (9E+1)	4E-8	-	2E-14	2E-8	2E-7
95	Americium-243	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	-	-	
95	Americium-244m ^{b/}	W, all compounds	6E+4 St wall (8E+4)	4E+3 Bone surf (7E+3)	2E-6	-	2E-14	2E-8	2E-7
95	Americium-244	W, all compounds	3E+3 Bone surf	2E+2 (3E+2)	8E-8	-	1E-8	1E-3	1E-2
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	-	1E-7	4E-4	4E-3
95	Americium-246m ^{b/}	W, all compounds	5E+4 St wall (6E+4)	2E+5	8E-5	-	3E-7	-	-
95	Americium-246 ^{b/}	W, all compounds	3E+4	1E+5	4E-5	-	1E-7	8E-4	8E-3
96	Curium-238	W, all compounds	2E+4	1E+3	5E-7	-	2E-9	2E-4	2E-3
96	Curium-240	W, all compounds	6E+1 Bone surf (8E+1)	6E-1 Bone surf (6E-1)	2E-10	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	-	2E-5	2E-4
96	Curium-242	W, all compounds	- Bone surf (5E+1)	(4E+1) Bone surf (3E-1)	-	-	5E-11	-	-
96	Curium-243	W, all compounds	3E+1 Bone surf (5E+1)	3E-1 Bone surf (3E-1)	1E-10	-	4E-13	7E-7	7E-6
96	Curium-244	W, all compounds	1E+0 Bone surf (2E+0)	9E-3 Bone surf (2E-2)	4E-12	-	-	-	-
96	Curium-245	W, all compounds	1E+0 Bone surf (2E+0)	1E-2 Bone surf (2E-2)	5E-12	-	2E-14	3E-8	3E-7
96	Curium-246	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1 Bone surf (4E-1)	2E-3 Bone surf (3E-3)	7E-13	-	4E-15	5E-9	5E-8

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	<u>Inhalation</u> ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
96	Curium-249 ^{b/}	W, all compounds	5E+4	2E+4	7E-6	-	7E-4	7E-3
				Bone surf (3E+4)		4E-8		
96	Curium-250	W, all compounds	4E-2	3E-4	1E-13	-	-	-
			Bone surf (6E-2)	Bone surf (5E-4)		8E-16	9E-10	9E-9
97	Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97	Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
97	Berkelium-247	W, all compounds	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)		1E-14	2E-8	2E-7
97	Berkelium-249	W, all compounds	2E+2	2E+0	7E-10	-	-	-
			Bone surf (5E+2)	Bone surf (4E+0)		5E-12	6E-6	6E-5
97	Berkelium-250	W, all compounds	9E+3	3E+2	1E-7	-	1E-4	1E-3
				Bone surf (7E+2)		1E-9		
98	Californium-244 ^{b/}	W, all compounds except those given for Y	3E+4	6E+2	2E-7	8E-10	-	-
			St wall (3E+4)				4E-4	4E-3
		Y, oxides and hydroxides		6E+2	2E-7	8E-10		
98	Californium-246	W, see ²⁴⁴ Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
		Y, see ²⁴⁴ Cf		9E+0	4E-9	1E-11		
98	Californium-248	W, see ²⁴⁴ Cf	8E+0	6E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)		2E-13	2E-7	2E-6
		Y, see ²⁴⁴ Cf		1E-1	4E-11	1E-13		
98	Californium-249	W, see ²⁴⁴ Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)		1E-14	2E-8	2E-7
		Y, see ²⁴⁴ Cf		1E-2	4E-12			
				Bone surf (1E-2)		2E-14		
98	Californium-250	W, see ²⁴⁴ Cf	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)		3E-14	3E-8	3E-7
		Y, see ²⁴⁴ Cf		3E-2	1E-11	4E-14		
98	Californium-251	W, see ²⁴⁴ Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)		1E-14	2E-8	2E-7
		Y, see ²⁴⁴ Cf		1E-2	4E-12			
				Bone surf (1E-2)		2E-14		
98	Californium-252	W, see ²⁴⁴ Cf	2E+0	2E-2	8E-12	-	-	-
			Bone surf (5E+0)	Bone surf (4E-2)		5E-14	7E-8	7E-7
		Y, see ²⁴⁴ Cf		3E-2	1E-11	5E-14		

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (μCi/ml)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC (μCi/ml)	Air (μCi/ml)	Water (μCi/ml)	
98	Californium-253	W, see ²⁴⁴ Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
98	Californium-254	Y, see ²⁴⁴ Cf W, see ²⁴⁴ Cf	2E+0	2E+0	7E-10	2E-12	-	-
		Y, see ²⁴⁴ Cf	-	2E-2	9E-12	3E-14	3E-8	3E-7
99	Einsteinium-250	W, all compounds	4E+4	5E+2	2E-7	-	6E-4	6E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-251	W, all compounds	7E+3	9E+2	4E-7	-	1E-4	1E-3
			-	Bone surf (1E+3)	-	2E-9	-	-
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6	2E-5
99	Einsteinium-254m	W, all compounds	3E+2	1E+1	4E-9	1E-11	-	-
			LLI wall (3E+2)	-	-	-	4E-6	4E-5
99	Einsteinium-254	W, all compounds	8E+0	7E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
100	Fermium-252	W, all compounds	5E+2	1E+1	5E-9	2E-11	6E-6	6E-5
100	Fermium-253	W, all compounds	1E+3	1E+1	4E-9	1E-11	1E-5	1E-4
100	Fermium-254	W, all compounds	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
100	Fermium-255	W, all compounds	5E+2	2E+1	9E-9	3E-11	7E-6	7E-5
100	Fermium-257	W, all compounds	2E+1	2E-1	7E-11	-	-	-
			Bone surf (4E+1)	Bone surf (2E-1)	-	3E-13	5E-7	5E-6
101	Mendelevium-257	W, all compounds	7E+3	8E+1	4E-8	-	1E-4	1E-3
			-	Bone surf (9E+1)	-	1E-10	-	-
101	Mendelevium-258	W, all compounds	3E+1	2E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	5E-13	6E-7	6E-6
	-Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours	Submersion ^{a/}	-	2E+2	1E-7	1E-9	-	-
	-Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours	...	-	2E-1	1E-10	1E-12	1E-8	1E-7

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	Inhalation ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	
	-Any single radionuclide not listed above that decays by alpha emission or spontaneous fission, or any mixture for which either the identity or the concentration of any radionuclide in the mixture is not known	-	4E-4	2E-13	1E-15	2E-9	2E-8

Footnotes:

a/ "Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material.

b/ These radionuclides have radiological half-lives of less than 2 hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do NOT include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute 1E-7 µCi/ml for the listed DAC to account for the submersion dose prospectively, but should use individual monitoring devices or other radiation measuring instruments that measure external exposure to demonstrate compliance with the limits. (See s. HFS 157.22 (3))

c/ For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see D.201e.). If the percent by weight enrichment of U-235 is not greater than 5, the concentration value for a 40-hour workweek is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek may not exceed 8E-3 (SA) µCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

SA = 3.6E-7 curies/gram U U-depleted

SA = [0.4 + 0.38 enrichment + 0.0034 enrichment²] E-6, enrichment ≥ 0.72

where enrichment is the percentage by weight of U-235, expressed as percent.

Note:

1. If the identity of each radionuclide in a mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the DAC for the mixture shall be the most restrictive DAC of any radionuclide in the mixture.

2. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in this appendix are not present in the mixture, the inhalation ALI, DAC, and effluent and sewage concentrations for the mixture are the lowest values specified in this appendix for any radionuclide that is not known to be absent from the mixture; or

If it is known that Ac-227-D and Cm-250-W are not present

-	7E-4	3E-13	-	-	-
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If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present

-	7E-3	3E-12	-	-	-
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**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration ($\mu\text{Ci/ml}$)
			Oral Ingestion ALI (μCi)	Inhalation ALI (μCi)	DAC ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
	If, in addition, it is known that Sm-146-W, Sm-147-W, Gd-148-D,W, Gd-152-D,W, Th-228-W,Y, Th-230-Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, Np-236-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-Y, Pu-240-Y, Pu-242-Y, Pu-244-W,Y, Cm-243-W, Cm-244-W, Cf-248-W, Cf-249-Y, Cf-250-W,Y, Cf-251-Y, Cf-252-W,Y, and Cf-254-W,Y are not present		7E-2	3E-11	-	-	-	-
	If, in addition, it is known that Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-Y, Es-254-W, Fm-257-W, and Md-258-W are not present		-	7E-1	3E-10	-	-	-
	If, in addition, it is known that Si-32-Y, Ti-44-Y, Fe-60-D, Sr-90-Y, Zr-93-D, Cd-113m-D, Cd-113-D, In-115-D,W, La-138-D, Lu-176-W, Hf-178m-D,W, Hf-182-D,W, Bi-210m-D, Ra-224-W, Ra-228-W, Ac-226-D,W,Y, Pa-230-W,Y, U-233-D,W, U-234-D,W, U-235-D,W, U-236-D,W, U-238-D,W, Pu-241-Y, Bk-249-W, Cf-253-W,Y, and Es-253-W are not present		-	7E+0	3E-9	-	-	-
	If it is known that Ac-227-D,W,Y, Th-229-W,Y, Th-232-W,Y, Pa-231-W,Y, Cm-248-W, and Cm-250-W are not present		-	-	-	1E-14	-	-
	If, in addition, it is known that Sm-146-W, Gd-148-D,W, Gd-152-D, Th-228-W,Y, Th-230-W,Y, U-232-Y, U-233-Y, U-234-Y, U-235-Y, U-236-Y, U-238-Y, U-Nat-Y, Np-236-W, Np-237-W, Pu-236-W,Y, Pu-238-W,Y, Pu-239-W,Y, Pu-240-W,Y, Pu-242-W,Y, Pu-244-W,Y, Am-241-W, Am-242m-W, Am-243-W, Cm-243-W, Cm-244-W, Cm-245-W, Cm-246-W, Cm-247-W, Bk-247-W, Cf-249-W,Y, Cf-250-W,Y, Cf-251-W,Y, Cf-252-W,Y, and Cf-254-W,Y are not present		-	-	-	1E-13	-	-
	If, in addition, it is known that Sm-147-W, Gd-152-W, Pb-210-D, Bi-210m-W, Po-210-D,W, Ra-223-W, Ra-225-W, Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y, U-230-D,W,Y, U-232-D,W, U-Nat-W, Pu-241-W, Cm-240-W, Cm-242-W, Cf-248-W,Y, Es-254-W, Fm-257-W, and Md-258-W are not present		-	-	-	1E-12	-	-

**Annual Limits on Intake (ALI) & Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure
Effluent Concentrations
Concentrations for Release to Sanitary Sewerage**

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	Monthly Average Concentration (µCi/ml)
			Oral Ingestion ALI (µCi)	<u>Inhalation</u> ALI (µCi)	DAC (µCi/ml)	Air (µCi/ml)	Water (µCi/ml)	

If, in addition it is known that Fe-60, Sr-90, Cd-113m, Cd-113, In-115, I-129, Cs-134, Sm-145, Sm-147, Gd-148, Gd-152, Hg-194 (organic), Bi-210m, Ra-223, Ra-224, Ra-225, Ac-225, Th-228, Th-230, U-233, U-234, U-235, U-236, U-238, U-Nat, Cm-242, Cf-248, Es-254, Fm-257, and Md-258 are not present

- - - - 1E-6 1E-5

- If a mixture of radionuclides consists of uranium and its daughters in ore dust (10 µm AMAD particle distribution assumed) prior to chemical separation of the uranium from the ore, the following values may be used for the DAC of the mixture: 6E-11 µCi of gross alpha activity from uranium-238, uranium-234, thorium-230, and radium-226 per milliliter of air; 3E-11 µCi of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.
- If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in Appendix E for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed "1," which is "unity".

Example: If radionuclides "A," "B," and "C" are present in concentrations C_A, C_B, and C_C, and if the applicable DACs are DAC_A, DAC_B, and DAC_C, respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{DAC_A} + \frac{C_B}{DAC_B} + \frac{C_C}{DAC_C} \leq 1$$