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Revision Type (check all that apply):

- Amendment
 New
 Repeal

Rule(s) Revised (ALL chapters and rules contained in filing must be listed here. If needed, copy and paste additional tables to accommodate multiple chapters. Please enter only ONE Rule Number/Rule Title per row)

Chapter Number	Chapter Title
1200-02-04	General Provisions
Rule Number	Rule Title
1200-02-04-.04	Definitions

Chapter Number	Chapter Title
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Chapter Number	Chapter Title
1200-02-11	Licensing Requirements for Land Disposal of Radioactive Waste
Rule Number	Rule Title
1200-02-11-.14	Transfer of License

(Place substance of rules and other info here. Statutory authority must be given for each rule change. For information on formatting rules go to <http://state.tn.us/sos/rules/1360/1360.htm>)

Chapter 1200-02-04
General Provisions

Amendments

Subparagraph (b) of Paragraph (1) of Rule 1200-02-04-.04 Definitions is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) 'Accelerator-produced radioactive material' means any material made radioactive by a particle accelerator.

Subparagraph (ooo) of Paragraph (1) of Rule 1200-02-04-04 Definitions is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (ooo) shall read as follows:

- (ooo) 'Waste' means those low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal at a land disposal facility. For the purposes of this definition, low-level waste is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel or byproduct material as defined in subparagraphs (11)(b), (11)(c), and (11)(d) of Rule 1200-02-05-.32.

Paragraph (1) of Rule 1200-02-04-.04 Definitions is amended by adding new subparagraphs (hhhh) through (jjjj) so that subparagraphs (hhhh) through (jjjj) shall read as follows:

- (hhhh) 'Consortium' means an association of medical use licensees and a PET radionuclide production facility in the same geographical area that jointly own or share in the operation and maintenance cost of the PET radionuclide production facility that produces PET radionuclides for use in producing radioactive drugs within the consortium for noncommercial distributions among its associated members for medical use. The PET radionuclide production facility within the consortium must be located at an educational institution or a Federal facility or a medical facility.
- (iiii) 'Cyclotron' means a particle accelerator in which the charged particles travel in an outward spiral or circular path. A cyclotron accelerates charged particles and is commonly used for production of short half-life radionuclides for medical or veterinary use.
- (jjjj) 'Discrete source' means a radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.
- (kkkk) 'Particle accelerator' means any device used to impact kinetic energy to electrically charged particles including but not limited to electrons, protons, deuterons, and helium ions. For the purpose of these regulations "accelerator" includes equipment designed for and used only for the production of x-rays of 0.9 MeV or greater and equipment capable of discharging nuclear particles into a medium external to the accelerating device. For purposes of this definition, "accelerator" is an equivalent term.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-05
Standards for Protection Against Radiation

Amendments

Paragraph (11) of Rule 1200-02-05-.32 Definitions is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (11) shall read as follows:

- (11) Byproduct material means:
 - (a) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;
 - (b) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;
 - (c)
 - 1. Any discrete source of radium-226 that is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; or
 - 2. Any material that—
 - (i) Has been made radioactive by use of a particle accelerator; and

- (ii) Is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; and
- (d) Any discrete source of naturally occurring radioactive material, other than source material, that—
 - 1. The Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and
 - 2. Is extracted or converted after extraction for use in a commercial, medical, or research activity.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (3) of Rule 1200-02-05-.50 Occupational Dose Limits for Adults is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (3) shall read as follows:

- (3) When external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the Division or by the Nuclear Regulatory Commission. The assigned deep-dose equivalent shall be for the part of the body receiving the highest exposure. The assigned shallow-dose equivalent shall be the dose averaged over the contiguous 10 cm² of skin receiving the highest exposure. Deep-dose, lens-dose and shallow-dose equivalents may be assessed from surveys or other radiation measurements to demonstrate compliance with occupational dose limits. However, this may be done only if the individual monitoring device was not subject to the highest potential exposure, or the individual monitoring results are unavailable.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (d) of paragraph (1) of Rule 1200-02-05-.120 General Disposal Requirements is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (d) shall read as follows:

- (d) As authorized under Rule 1200-02-05-.121, 1200-02-05-.122, 1200-02-05-.123, 1200-02-05-.124 or 1200-02-05-.127.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-05-.125 Transfer for Disposal and Manifests is amended by adding paragraph (5) to the rule to read as follows:

- (5) Any licensee shipping byproduct material as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 1200-02-05-.32(11) intended for ultimate disposal at a land disposal facility licensed under Chapter 1200-02-11 shall document the information required on the NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee as specified in Schedule RHS 8-33.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (2) of Rule 1200-02-05-.142 Reports to Individuals of Exposure to Radiation is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (2) shall read as follows:

- (2) Each licensee or registrant shall make dose information available to workers as shown in records maintained by the licensee or registrant under the provisions of Rule 1200-02-05-.135. The licensee shall provide an annual report to each individual monitored under Rule 1200-02-05-.71 of the dose received in that monitoring year if:

- (a) The individual's occupational dose exceeds 1 mSv (100 mrem) TEDE or 1 mSv (100 mrem) to any individual organ or tissue; or
- (b) The individual requests his or her annual dose report.

Paragraph (4) of Rule 1200-02-05-.142 Reports to Individuals of Exposure to Radiation is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (4) shall read as follows:

- (4) When a licensee or registrant is required under Rule 1200-02-05-.141, 1200-02-05-.143, or 1200-02-05-.144 to report to the Division any exposure of an individual to radiation or radioactive material, the licensee or registrant shall also provide a copy of the report submitted to the Division to the individual. Such report shall be transmitted at a time not later than the transmittal to the Division.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Schedule RHS 8-30 of Rule 1200-02-05-.161 Schedules is amended by deleting the table and substituting the following so that, as amended, Schedule RHS 8-30 shall read as follows:

RHS 8-30
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 µm, micron, and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D if less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days. The class (D, W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, columns 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 systems.

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 schedule captioned, "Oral Ingestion ALI," "Inhalation," "ALI," and "DAC," are applicable to occupational exposure to radioactive material.

The ALIs in this schedule are the annual intakes of a given radionuclide by the reference man, which would result in either a committed effective dose equivalent (CEDE) of 0.05 Sv (5 rem), stochastic ALI, or 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 1200-02-05-.32. The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of $w_T = 0.06$ is applicable to each of the five 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 four separate organs.

Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the CEDE 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:

1. LLI wall = lower large intestine wall;
2. St wall = stomach wall;
3. Blad wall = bladder wall; and
4. 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, the use of that non-stochastic ALI is considered unduly conservative, the licensee or registrant may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee or registrant 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 (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, Σ (intake [in μCi] 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

$$DAC = \frac{ALI \text{ (in } \mu\text{Ci)}}{(2000 \text{ hrs / working yr} \times 60 \text{ min/hr} \times 2 \times 10^4 \text{ ml / min})}$$

$$= \frac{ALI}{2.4 \times 10^9} \mu\text{Ci/ml}$$

exposures. The relationship between the DAC and the ALI is given by:

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

The DAC values relate to one of two 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 ingrowth 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 1200-02-05-.51. When an individual is exposed to radioactive materials, which 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 radioisotopes. 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 schedule captioned "Air" and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of 1200-02-05-.61. 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, as was the case in the previous Schedule RHS 8-1.

The air concentration values listed in Table II, Column 1 were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4×10^9 , 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 1mSv (0.1 rem) limit for members of the public; a factor of three 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 two 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 per year to full-time exposure (8,760 hours per year). Note that an additional factor of two 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 the reference man.

Note 2 of this schedule 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 1200-02-05-.122. 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 a 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

<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>	<u>Name</u>	<u>Symbol</u>	<u>Atomic Number</u>
Actinium	Ac	89	Molybdenum	Mo	42
Aluminum	Al	13	Neodymium	Nd	60
Americium	Am	95	Neptunium	Np	93
Antimony	Sb	51	Nickel	Ni	28
Argon	Ar	18	Niobium	Nb	41
Arsenic	As	33	Nitrogen	N	7
Astatine	At	85	Osmium	Os	76
Barium	Ba	56	Oxygen	O	8
Berkelium	Bk	97	Palladium	Pd	46
Beryllium	Be	4	Phosphorus	P	15
Bismuth	Bi	83	Platinum	Pt	78
Bromine	Br	35	Plutonium	Pu	94
Cadmium	Cd	48	Polonium	Po	84
Calcium	Ca	20	Potassium	K	19
Californium	Cf	98	Praseodymium	Pr	59
Carbon	C	6	Promethium	Pm	61
Cerium	Ce	58	Protactinium	Pa	91
Cesium	Cs	55	Radium	Ra	88
Chlorine	Cl	17	Radon	Rn	86
Chromium	Cr	24	Rhenium	Re	75
Cobalt	Co	27	Rhodium	Rh	45
Copper	Cu	29	Rubidium	Rb	37
Curium	Cm	96	Ruthenium	Ru	44
Dysprosium	Dy	66	Samarium	Sm	62
Einsteinium	Es	99	Scandium	Sc	21
Erbium	Er	68	Selenium	Se	34
Europium	Eu	63	Silicon	Si	14
Fermium	Fm	100	Silver	Ag	47
Fluorine	F	9	Sodium	Na	11
Francium	Fr	87	Strontium	Sr	38
Gadolinium	Gd	64	Sulfur	S	16
Gallium	Ga	31	Tantalum	Ta	73
Germanium	Ge	32	Technetium	Tc	43
Gold	Au	79	Tellurium	Te	52
Hafnium	Hf	72	Terbium	Tb	65
Holmium	Ho	67	Thallium	Tl	81
Hydrogen	H	1	Thorium	Th	90
Indium	In	49	Thulium	Tm	69
Iodine	I	53	Tin	Sn	50
Iridium	Ir	77	Titanium	Ti	22
Iron	Fe	26	Tungsten	W	74
Mercury	Hg	80	Uranium	U	92
Krypton	Kr	36	Vanadium	V	23
Lanthanum	La	57	Xenon	Xe	54
Lead	Pb	82	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40
Mendelevium	Md	101			

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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 ¹ : Use above values as HT and T2 oxidize in air and 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 ²	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
7	Nitrogen-13 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
8	Oxygen-15 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
9	Fluorine-18 ²	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	-	-
14	Silicon-32	D, see ³¹ Si	2E+3	2E+2	1E-7	3E-10	-	-
		LLI wall (3E+3)	-	-	-	-	4E-5	4E-4
		W, see ³¹ Si	-	1E+2	5E-8	2E-10	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
15	Phosphorus-32	Y, see ^{31}Si	-	5E+0	2E-9	7E-12	-	-
		D, all compounds except phosphates given for W	6E+2	9E+2	4E-7	1E-9	9E-6	9E-5
15	Phosphorus-33	W, phosphates of Zn^{2+} , S^{3+} , Mg^{2+} , Fe^{3+} , Bi^{3+} , and lanthanides	-	4E+2	2E-7	5E-10	-	-
		D, see ^{32}P	6E+3	8E+3	4E-6	1E-8	8E-5	8E-4
16	Sulfur-35	W, see ^{32}P	-	3E+3	1E-6	4E-9	-	-
		Vapor	-	1E+4	6E-6	2E-8	-	-
		D, sulfides and sulfates except those given for W	1E+4	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	LLI wall (8E+3)	-	-	-	1E-4	1E-3
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and Fr	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		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+2	1E-7	3E-10	-	-
17	Chlorine-38 ²	D, see ^{36}Cl	2E+4	4E+4	2E-5	6E-8	-	-
		St wall (3E+4)	-	-	-	-	3E-4	3E-3
17	Chlorine-39 ²	W, see ^{36}Cl	-	5E+4	2E-5	6E-8	-	-
		D, see ^{36}Cl	2E+4	5E+4	2E-5	7E-8	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
18	Argon-37	W, see ^{36}Cl	-	6E+4	2E-5	8E-8	-	-
		Submersion ¹	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion ¹	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion ¹	-	-	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
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44 ²	D, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
19	Potassium-45 ²	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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
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 ²	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 ₃	-	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 ²	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 ²	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	-	-
24	Chromium-51	D, see ⁴⁸ Cr	4E+4	5E+4	2E-5	6E-8	5E-4	5E-3
		W, see ⁴⁸ Cr	-	2E+4	1E-5	3E-8	-	-
		Y, see ⁴⁸ Cr	-	2E+4	8E-6	3E-8	-	-
25	Manganese-51 ²	D, all compounds except those given for W	2E+4	5E+4	2E-5	7E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	8E-8	-	-
25	Manganese-52m ²	D, see ⁵¹ Mn	3E+4	9E+4	4E-5	1E-7	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
		W, see ⁵¹ Mn	-	1E+5	4E-5	1E-7	-	-
25	Manganese-52	D, see ⁵¹ Mn	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
		W, see ⁵¹ Mn	-	9E+2	4E-7	1E-9	-	-
25	Manganese-53	D, see ⁵¹ Mn	5E+4	1E+4	5E-6	-	7E-4	7E-3
		-	-	Bone surf (2E+4)	-	3E-8	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
25	Manganese-54	W, see ^{51}Mn	-	1E+4	5E-6	2E-8	-	-
		D, see ^{51}Mn	2E+3	9E+2	4E-7	1E-9	3E-5	3E-4
		W, see ^{51}Mn	-	8E+2	3E-7	1E-9	-	-
25	Manganese-56	D, see ^{51}Mn	5E+3	2E+4	6E-6	2E-8	7E-5	7E-4
		W, see ^{51}Mn	-	2E+4	9E-6	3E-8	-	-
26	Iron-52	D, all compounds except those given for W	9E+2	3E+3	1E-6	4E-9	1E-5	1E-4
		W, oxides, hydroxides, and halides	-	2E+3	1E-6	3E-9	-	-
26	Iron-55	D, see ^{52}Fe	9E+3	2E+3	8E-7	3E-9	1E-4	1E-3
		W, see ^{52}Fe	-	4E+3	2E-6	6E-9	-	-
26	Iron-59	D, see ^{52}Fe	8E+2	3E+2	1E-7	5E-10	1E-5	1E-4
		W, see ^{52}Fe	-	5E+2	2E-7	7E-10	-	-
26	Iron-60	D, see ^{52}Fe	3E+1	6E+0	3E-9	9E-12	4E-7	4E-6
		W, see ^{52}Fe	-	2E+1	8E-9	3E-11	-	-
27	Cobalt-55	W, all compounds except those given for Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
27	Cobalt-56	W, see ^{55}Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ^{55}Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ^{55}Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ^{55}Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ^{55}Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ^{55}Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ^{55}Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ^{55}Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m ²	W, see ^{55}Co	1E+6	4E+6	2E-3	6E-6	-	-
		St wall (1E+6)	-	-	-	-	2E-2	2E-1
		Y, see ^{55}Co	-	3E+6	1E-3	4E-6	-	-
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 ²	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 ²	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	-	2E+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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
		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 ²	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
30	Zinc-63 ²	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 ²	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 ²	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 ²	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 ²	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

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
		W, oxides, sulfides, and halides	-	2E+4	8E-6	3E-8	-	-
32	Germanium-67 ²	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 ²	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	-	-
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 ²	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 ²	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
		St wall (4E+4)	-	-	-	6E-4	6E-3	
33	Arsenic-70 ²	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 ²	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70 ²	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 ²	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 ²	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 ²	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 ²	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	-	-
35	Bromine-74m ²	D, bromides of H,	1E+4	4E+4	2E-5	5E-8	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
		Li, Na, K, Rb, Cs, and Fr	St wall (2E+4)	-	-	-	3E-4	3E-3
		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 ²	D, see ^{74m} Br	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m} Br	-	8E+4	4E-5	1E-7	-	-
35	Bromine-75 ²	D, see ^{74m} Br	3E+4	5E+4	2E-5	7E-8	-	-
			St wall (4E+4)	-	-	-	5E-4	5E-3
		W, see ^{74m} Br	-	5E+4	2E-5	7E-8	-	-
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 ²	D, see ^{74m} Br	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see ^{74m} Br	-	2E+5	9E-5	3E-7	-	-
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	6E+4	3E-5	9E-8	-	-
			St wall (7E+4)	-	-	-	9E-4	9E-3
		W, see ^{74m} Br	-	6E+4	3E-5	9E-8	-	-
35	Bromine-84 ²	D, see ^{74m} Br	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{74m} Br	-	6E+4	3E-5	9E-8	-	-
36	Krypton-74 ²	Submersion ¹	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion ¹	-	-	9E-6	4E-8	-	-
36	Krypton-77 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion ¹	-	-	2E-5	7E-8	-	-
36	Krypton-81	Submersion ¹	-	-	7E-4	3E-6	-	-
36	Krypton-83m ²	Submersion ¹	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion ¹	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion ¹	-	-	1E-4	7E-7	-	-
36	Krypton-87 ²	Submersion ¹	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion ¹	-	-	2E-6	9E-9	-	-
37	Rubidium-79 ²	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
37	Rubidium-81m ²	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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{m}$)	Water ($\mu\text{Ci}/\text{m}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}$)							
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 ²	D, all compounds	2E+4	6E+4	3E-5	9E-8	-	-
		St wall (3E+4)	-	-	-	4E-4	4E-3	
37	Rubidium-89 ²	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
		St wall (6E+4)	-	-	-	9E-4	9E-3	
38	Strontium-80 ²	D, all soluble compounds except SrTiO ₃	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTiO ₃	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81 ²	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
38	Strontium-83	Y, see ⁸⁰ Sr	2E+2	9E+1	4E-8	1E-10	-	-
		D, see ⁸⁰ Sr	3E+3	7E+3	3E-6	1E-8	3E-5	3E-4
38	Strontium-85m ²	Y, see ⁸⁰ Sr	2E+3	4E+3	1E-6	5E-9	-	-
		D, see ⁸⁰ Sr	2E+5	6E+5	3E-4	9E-7	3E-3	3E-2
38	Strontium-85	Y, see ⁸⁰ Sr	-	8E+5	4E-4	1E-6	-	-
		D, see ⁸⁰ Sr	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
38	Strontium-87m	Y, see ⁸⁰ Sr	-	2E+3	6E-7	2E-9	-	-
		D, see ⁸⁰ Sr	5E+4	1E+5	5E-5	2E-7	6E-4	6E-3
38	Strontium-89	Y, see ⁸⁰ Sr	4E+4	2E+5	6E-5	2E-7	-	-
		D, see ⁸⁰ Sr	6E+2	8E+2	4E-7	1E-9	-	-
38	Strontium-90	LLI wall (6E+2)	-	-	-	-	8E-6	8E-5
		Y, see ⁸⁰ Sr	5E+2	1E+2	6E-8	2E-10	-	-
38	Strontium-91	D, see ⁸⁰ Sr	3E+1	2E+1	8E-9	-	-	-
		Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7	5E-6	
38	Strontium-92	Y, see ⁸⁰ Sr	-	4E+0	2E-9	6E-12	-	-
		D, see ⁸⁰ Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
38	Strontium-92	Y, see ⁸⁰ Sr	-	4E+3	1E-6	5E-9	-	-
		D, see ⁸⁰ Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
39	Yttrium-86m ²	Y, see ⁸⁰ Sr	-	7E+3	3E-6	9E-9	-	-
		W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
39	Yttrium-86	Y, oxides and hydroxides	-	5E+4	2E-5	8E-8	-	-
		W, see ^{86m} Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
39	Yttrium-87	Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
		W, see ^{86m} Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
39	Yttrium-88	Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
		W, see ^{86m} Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
39	Yttrium-90m	Y, see ^{86m} Y	-	2E+2	1E-7	3E-10	-	-
		W, see ^{86m} Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
39	Yttrium-90	Y, see ^{86m} Y	-	1E+4	5E-6	2E-8	-	-
		W, see ^{86m} Y	4E+2	7E+2	3E-7	9E-10	-	-
39	Yttrium-91m ²	LLI wall (5E+2)	-	-	-	-	7E-6	7E-5
		Y, see ^{86m} Y	-	6E+2	3E-7	9E-10	-	-
39	Yttrium-91m ²	W, see ^{86m} Y	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
39	Yttrium-91	Y, see $^{86\text{m}}\text{Y}$	-	2E+5	7E-5	2E-7	-	-
		W, see $^{86\text{m}}\text{Y}$	5E+2	2E+2	7E-8	2E-10	-	-
			LLI wall (6E+2)	-	-	-	8E-6	8E-5
39	Yttrium-92	Y, see $^{86\text{m}}\text{Y}$	-	1E+2	5E-8	2E-10	-	-
		W, see $^{86\text{m}}\text{Y}$	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
39	Yttrium-93	Y, see $^{86\text{m}}\text{Y}$	-	8E+3	3E-6	1E-8	-	-
		W, see $^{86\text{m}}\text{Y}$	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
39	Yttrium-94 ²	Y, see $^{86\text{m}}\text{Y}$	-	2E+3	1E-6	3E-9	-	-
		W, see $^{86\text{m}}\text{Y}$	2E+4	8E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
39	Yttrium-95 ²	Y, see $^{86\text{m}}\text{Y}$	-	8E+4	3E-5	1E-7	-	-
		W, see $^{86\text{m}}\text{Y}$	4E+4	2E+5	6E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
40	Zirconium-86	D, all compounds except those given for W and Y	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
		Y, carbide	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-88	D, see ^{86}Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		W, see ^{86}Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
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 (3E+3)	Bone surf (2E+1)	-	2E-11	4E-5	4E-4
		W, see ^{86}Zr	-	2E+1	1E-8	-	-	-
				Bone surf (6E+1)	-	9E-11	-	-
40	Zirconium-95	Y, see ^{86}Zr	-	6E+1	2E-8	-	-	-
				Bone surf (7E+1)	-	9E-11	-	-
		D, see ^{86}Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
				Bone surf (3E+2)	-	4E-10	-	-
40	Zirconium-97	W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
		D, see ^{86}Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
41	Niobium-88 ²	W, see ^{86}Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{86}Zr	-	1E+3	5E-7	2E-9	-	-
		W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
41	Niobium-89 ²		St wall (7E+4)	-	-	-	1E-3	1E-2
		Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41	Niobium-89 ² (66 min)	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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
			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 (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	-	-
41	Niobium-97 ²	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 ²	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, hydroxide, 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 ²	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 ²	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 ²	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 ²	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	-	-

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
43	Technetium-97	W, see ^{93m} Tc	-	1E+3	5E-7	2E-9	-	-
		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	-	-
43	Technetium-99	D, see ^{93m} Tc	4E+3	5E+3	2E-6	-	6E-5	6E-4
			-	St wall (6E+3)	-	8E-9	-	-
		W, see ^{93m} Tc	-	7E+2	3E-7	9E-10	-	-
43	Technetium-101 ²	D, see ^{93m} Tc	9E+4	3E+5	1E-4	5E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, see ^{93m} Tc	-	4E+5	2E-4	5E-7	-	-
43	Technetium-104 ²	D, see ^{93m} Tc	2E+4	7E+4	3E-5	1E-7	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
		W, see ^{93m} Tc	-	9E+4	4E-5	1E-7	-	-
44	Ruthenium-94 ²	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	-	-
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-99	D, see ^{99m} Rh	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
		W, see ^{99m} Rh	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{99m} Rh	-	2E+3	8E-7	3E-9	-	-
45	Rhodium-100	D, see ^{99m} Rh	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		W, see ^{99m} Rh	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{99m} Rh	-	4E+3	2E-6	5E-9	-	-
45	Rhodium-101m	D, see ^{99m} Rh	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see ^{99m} Rh	-	8E+3	4E-6	1E-8	-	-
		Y, see ^{99m} Rh	-	8E+3	3E-6	1E-8	-	-
45	Rhodium-101	D, see ^{99m} Rh	2E+3	5E+2	2E-7	7E-10	3E-5	3E-4
		W, see ^{99m} Rh	-	8E+2	3E-7	1E-9	-	-
		Y, see ^{99m} Rh	-	2E+2	6E-8	2E-10	-	-
45	Rhodium-102m	D, see ^{99m} Rh	1E+3	5E+2	2E-7	7E-10	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
			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 ²	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 ²	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 compounds except those given for W and 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 (4E+4)	-	Kidneys (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	-	-
47	Silver-102 ²	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 ²	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 ²	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 ²	D, see ^{102}Ag	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
47	Silver-105	W, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-
		Y, see ^{102}Ag	-	1E+5	6E-5	2E-7	-	-
		D, see ^{102}Ag	3E+3	1E+3	4E-7	1E-9	4E-5	4E-4
47	Silver-106m	W, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
		Y, see ^{102}Ag	-	2E+3	7E-7	2E-9	-	-
		D, see ^{102}Ag	8E+2	7E+2	3E-7	1E-9	1E-5	1E-4
47	Silver-106 ²	W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		D, see ^{102}Ag	6E+4	2E+5	8E-5	3E-7	-	-
47	Silver-108m	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-110m	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-111	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-112	D, see ^{102}Ag	9E+2	2E+3	6E-7	-	-	-
		LLI wall (1E+3)	-	Liver (2E+3)	-	2E-9	2E-5	2E-4
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47	Silver-115 ²	Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
		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	-	-
47	Silver-115 ²	Y, see ^{102}Ag	-	9E+3	4E-6	1E-8	-	-
		D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7	-	-
		St wall (3E+4)	-	-	-	-	4E-4	4E-3
48	Cadmium-104 ²	W, see ^{102}Ag	-	9E+4	4E-5	1E-7	-	-
		Y, see ^{102}Ag	-	8E+4	3E-5	1E-7	-	-
		D, all compounds except those given for W and Y	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
48	Cadmium-107	W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
		D, see ^{104}Cd	2E+4	5E+4	2E-5	8E-8	3E-4	3E-3
48	Cadmium-109	W, see ^{104}Cd	-	6E+4	2E-5	8E-8	-	-
		Y, see ^{104}Cd	-	5E+4	2E-5	7E-8	-	-
		D, see ^{104}Cd	3E+2	4E+1	1E-8	-	-	-
48	Cadmium-113m	Kidneys (4E+2)	-	Kidneys (5E+1)	-	7E-11	6E-6	6E-5
		W, see ^{104}Cd	-	1E+2	5E-8	-	-	-
		Y, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-
48	Cadmium-113	D, see ^{104}Cd	2E+1	2E+0	1E-9	-	-	-
		Kidneys (4E+1)	-	Kidneys (4E+0)	-	5E-12	5E-7	5E-6
		W, see ^{104}Cd	-	8E+0	4E-9	-	-	-
48	Cadmium-113	Y, see ^{104}Cd	-	Kidneys (1E+1)	-	2E-11	-	-
		D, see ^{104}Cd	2E+1	2E+0	9E-10	-	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
			Kidneys (3E+1)	Kidneys (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	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-
49	Indium-110 ² (69.1 min)	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	6E+4	2E-5	8E-8	-	-
49	Indium-110 (4.9 h)	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		W, see ^{109}In	-	2E+4	8E-6	3E-8	-	-
49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-	-
49	Indium-112 ²	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
		W, see ^{109}In	-	7E+5	3E-4	1E-6	-	-
49	Indium-113m ²	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		W, see ^{109}In	-	2E+5	8E-5	3E-7	-	-
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	5E+4	2E-5	7E-8	-	-
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
		W, see ^{109}In	-	5E+0	2E-9	8E-12	-	-
49	Indium-116m ²	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-	-
49	Indium-117m ²	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{109}In	-	4E+4	2E-5	6E-8	-	-
49	Indium-117 ²	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m ²	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, see ^{109}In	-	1E+5	6E-5	2E-7	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8	-	-
50	Tin-111 ²	D, see ¹¹⁰ Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
		W, see ¹¹⁰ Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-113	D, see ¹¹⁰ Sn	2E+3	1E+3	5E-7	2E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
50	Tin-117m	D, see ¹¹⁰ Sn	2E+3	1E+3	5E-7	-	-	-
		LLI wall (2E+3)	-	Bone surf (2E+3)	-	3E-9	3E-5	3E-4
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	D, see ¹¹⁰ Sn	3E+3	9E+2	4E-7	1E-9	-	-
		LLI wall (4E+3)	-	-	-	-	5E-5	5E-4
50	Tin-121	D, see ¹¹⁰ Sn	6E+3	2E+4	6E-6	2E-8	-	-
		LLI wall (6E+3)	-	-	-	-	8E-5	8E-4
50	Tin-123m ²	D, see ¹¹⁰ Sn	5E+4	1E+5	5E-5	2E-7	7E-4	7E-3
		W, see ¹¹⁰ Sn	-	1E+5	6E-5	2E-7	-	-
50	Tin-123	D, see ¹¹⁰ Sn	5E+2	6E+2	3E-7	9E-10	-	-
		LLI wall (6E+2)	-	-	-	-	9E-6	9E-5
50	Tin-125	D, see ¹¹⁰ Sn	4E+2	9E+2	4E-7	1E-9	-	-
		LLI wall (5E+2)	-	-	-	-	6E-6	6E-5
50	Tin-126	D, see ¹¹⁰ Sn	3E+2	6E+1	2E-8	8E-11	4E-6	4E-5
		W, see ¹¹⁰ Sn	-	7E+1	3E-8	9E-11	-	-
50	Tin-127	D, see ¹¹⁰ Sn	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		W, see ¹¹⁰ Sn	-	2E+4	8E-6	3E-8	-	-
50	Tin-128 ²	D, see ¹¹⁰ Sn	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ¹¹⁰ Sn	-	4E+4	1E-5	5E-8	-	-
51	Antimony-115 ²	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7	-	-
51	Antimony-116m ²	D, see ¹¹⁵ Sb	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ¹¹⁵ Sb	-	1E+5	6E-5	2E-7	-	-
51	Antimony-116 ²	D, see ¹¹⁵ Sb	7E+4	3E+5	1E-4	4E-7	-	-
		St wall (9E+4)	-	-	-	-	1E-3	1E-2
51	Antimony-117	D, see ¹¹⁵ Sb	7E+4	2E+5	9E-5	3E-7	9E-4	9E-3
		W, see ¹¹⁵ Sb	-	3E+5	1E-4	5E-7	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
51	Antimony-118m	W, see ^{115}Sb	-	3E+5	1E-4	4E-7	-	-
		D, see ^{115}Sb	6E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		W, see ^{115}Sb	5E+3	2E+4	9E-6	3E-8	-	-
51	Antimony-119	D, see ^{115}Sb	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{115}Sb	2E+4	3E+4	1E-5	4E-8	-	-
51	Antimony-120 ² (16 min)	D, see ^{115}Sb	1E+5	4E+5	2E-4	6E-7	-	-
		St wall (2E+5)	-	-	-	-	2E-3	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 ²	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 ²	D, see ^{115}Sb	5E+4	2E+5	8E-5	3E-7	-	-
		St wall (7E+4)	-	-	-	-	9E-4	9E-3
		W, see ^{115}Sb	-	2E+5	8E-5	3E-7	-	-
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 ² (10.4 min)	D, see ^{115}Sb	8E+4	4E+5	2E-4	5E-7	-	-
		St wall (1E+5)	-	-	-	-	1E-3	1E-2
		W, see ^{115}Sb	-	4E+5	2E-4	6E-7	-	-
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 ²	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 ²	D, see ^{115}Sb	1E+4	2E+4	1E-5	-	-	-
		Thyroid (2E+4)	Thyroid (4E+4)	-	6E-8	2E-4	2E-3	
		W, see ^{115}Sb	-	2E+4	1E-5	-	-	-
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	-	-
52	Tellurium-121m	D, see ^{116}Te	5E+2	2E+2	8E-8	-	-	-
		Bone surf (7E+2)	Bone surf (4E+2)	-	5E-10	1E-5	1E-4	
52	Tellurium-121	W, see ^{116}Te	-	4E+2	2E-7	6E-10	-	-
		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	-	-

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
52	Tellurium-123m	D, see ¹¹⁶ Te	6E+2	2E+2	9E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	8E-10	1E-5	1E-4
		W, see ¹¹⁶ Te	-	5E+2	2E-7	8E-10	-	-
52	Tellurium-123	D, see ¹¹⁶ Te	5E+2	2E+2	8E-8	-	-	-
			Bone surf (1E+3)	Bone surf (5E+2)	-	7E-10	2E-5	2E-4
		W, see ¹¹⁶ Te	-	4E+2	2E-7	-	-	-
			-	Bone surf (1E+3)	-	2E-9	-	-
52	Tellurium-125m	D, see ¹¹⁶ Te	1E+3	4E+2	2E-7	-	-	-
			Bone surf (1E+3)	Bone surf (1E+3)	-	1E-9	2E-5	2E-4
		W, see ¹¹⁶ Te	-	7E+2	3E-7	1E-9	-	-
52	Tellurium-127m	D, see ¹¹⁶ Te	6E+2	3E+2	1E-7	-	9E-6	9E-5
			-	Bone surf (4E+2)	-	6E-10	-	-
		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
			-	2E+4	7E-6	2E-8	-	-
		W, see ¹¹⁶ Te	-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129m	D, see ¹¹⁶ Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
			-	2E+2	1E-7	3E-10	-	-
52	Tellurium-129 ²	D, see ¹¹⁶ Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
			-	7E+4	3E-5	1E-7	-	-
52	Tellurium-131m	D, see ¹¹⁶ Te	3E+2	4E+2	2E-7	-	-	-
			Thyroid (6E+2)	Thyroid (1E+3)	-	2E-9	8E-6	8E-5
		W, see ¹¹⁶ Te	-	4E+2	2E-7	-	-	-
			-	Thyroid (9E+2)	-	1E-9	-	-
52	Tellurium-131 ²	D, see ¹¹⁶ Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	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	2E+2	9E-8	-	-	-
			Thyroid (7E+2)	Thyroid (8E+2)	-	1E-9	9E-6	9E-5
		W, see ¹¹⁶ Te	-	2E+2	9E-8	-	-	-
			-	Thyroid (6E+2)	-	9E-10	-	-
52	Tellurium-133m ²	D, see ¹¹⁶ Te	3E+3	5E+3	2E-6	-	-	-
			Thyroid (6E+3)	Thyroid (1E+4)	-	2E-8	9E-5	9E-4
		W, see ¹¹⁶ Te	-	5E+3	2E-6	-	-	-
			-	Thyroid (1E+4)	-	2E-8	-	-
52	Tellurium-133 ²	D, see ¹¹⁶ Te	1E+4	2E+4	9E-6	-	-	-
			Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4	4E-3
		W, see ¹¹⁶ Te	-	2E+4	9E-6	-	-	-
			-	Thyroid (6E+4)	-	8E-8	-	-
52	Tellurium-134 ²	D, see ¹¹⁶ Te	2E+4	2E+4	1E-5	-	-	-
			Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4	3E-3
		W, see ¹¹⁶ Te	-	2E+4	1E-5	-	-	-
			-	Thyroid (5E+4)	-	7E-8	-	-
53	Iodine-120m ²	D, all compounds	1E+4	2E+4	9E-6	3E-8	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
53	Iodine-120 ²	D, all compounds	Thyroid (1E+4)	-	-	-	2E-4	2E-3
			4E+3	9E+3	4E-6	-	-	-
53	Iodine-121	D, all compounds	Thyroid (8E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
			1E+4	2E+4	8E-6	-	-	-
53	Iodine-123	D, all compounds	Thyroid (3E+4)	Thyroid (5E+4)	-	7E-8	4E-4	4E-3
			3E+3	6E+3	3E-6	-	-	-
53	Iodine-124	D, all compounds	Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
			5E+1	8E+1	3E-8	-	-	-
53	Iodine-125	D, all compounds	Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10	2E-6	2E-5
			4E+1	6E+1	3E-8	-	-	-
53	Iodine-126	D, all compounds	Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10	2E-6	2E-5
			2E+1	4E+1	1E-8	-	-	-
53	Iodine-128 ²	D, all compounds	Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10	1E-6	1E-5
			4E+4	1E+5	5E-5	2E-7	-	-
53	Iodine-129	D, all compounds	St wall (6E+4)	-	-	-	8E-4	8E-3
			5E+0	9E+0	4E-9	-	-	-
53	Iodine-129	D, all compounds	Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11	2E-7	2E-6
			4E+2	7E+2	3E-7	-	-	-
53	Iodine-130	D, all compounds	Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9	2E-5	2E-4
			3E+1	5E+1	2E-8	-	-	-
53	Iodine-131	D, all compounds	Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10	1E-6	1E-5
			4E+3	8E+3	4E-6	-	-	-
53	Iodine-132m ²	D, all compounds	Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4	1E-3
			4E+3	8E+3	3E-6	-	-	-
53	Iodine-132	D, all compounds	Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
			1E+2	3E+2	1E-7	-	-	-
53	Iodine-133	D, all compounds	Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6	7E-5
			2E+4	5E+4	2E-5	6E-8	-	-
53	Iodine-134 ²	D, all compounds	Thyroid (3E+4)	-	-	-	4E-4	4E-3
			8E+2	2E+3	7E-7	-	-	-
53	Iodine-135	D, all compounds	Thyroid (3E+3)	Thyroid (4E+3)	-	6E-9	3E-5	3E-4
			-	-	1E-5	4E-8	-	-
54	Xenon-120 ²	Submersion ¹	-	-	1E-5	4E-8	-	-
54	Xenon-121 ²	Submersion ¹	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion ¹	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion ¹	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion ¹	-	-	2E-5	7E-8	-	-
54	Xenon-127	Submersion ¹	-	-	1E-5	6E-8	-	-
54	Xenon-129m	Submersion ¹	-	-	2E-4	9E-7	-	-
54	Xenon-131m	Submersion ¹	-	-	4E-4	2E-6	-	-
54	Xenon-133m	Submersion ¹	-	-	1E-4	6E-7	-	-
54	Xenon-133	Submersion ¹	-	-	1E-4	5E-7	-	-
54	Xenon-135m ²	Submersion ¹	-	-	9E-6	4E-8	-	-
54	Xenon-135	Submersion ¹	-	-	1E-5	7E-8	-	-
54	Xenon-138 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
55	Cesium-125 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
			St wall (9E+4)	-	-	-	1E-3	1E-2
55	Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	9E-4	9E-3
55	Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
55	Cesium-130 ²	D, all compounds	6E+4	2E+5	8E-5	3E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
55	Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
55	Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
55	Cesium-134m	D, all compounds	1E+5	1E+5	6E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
55	Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	9E-7	9E-6
55	Cesium-135m ²	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	1E-2
55	Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
55	Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	6E-5
55	Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55	Cesium-138 ²	D, all compounds	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
56	Barium-126 ²	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 ²	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-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139 ²	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 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131 ²	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 ²	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-	D, see ¹³¹ La	4E+4	1E+5	4E-5	1E-7	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
	143^2		St wall ($4\text{E}+4$)	-	-	-	$5\text{E}-4$	$5\text{E}-3$
		W, see ^{131}La	-	$9\text{E}+4$	$4\text{E}-5$	$1\text{E}-7$	-	-
58	Cerium-134	W, all compounds except those given for Y	$5\text{E}+2$ LLI wall ($6\text{E}+2$)	$7\text{E}+2$	$3\text{E}-7$	$1\text{E}-9$	- $8\text{E}-6$	- $8\text{E}-5$
		Y, oxides, hydroxides, and fluorides	-	$7\text{E}+2$	$3\text{E}-7$	$9\text{E}-10$	-	-
58	Cerium-135	W, see ^{134}Ce	$2\text{E}+3$	$4\text{E}+3$	$2\text{E}-6$	$5\text{E}-9$	$2\text{E}-5$	$2\text{E}-4$
		Y, see ^{134}Ce	-	$4\text{E}+3$	$1\text{E}-6$	$5\text{E}-9$	-	-
58	Cerium-137m	W, see ^{134}Ce	$2\text{E}+3$ LLI wall ($2\text{E}+3$)	$4\text{E}+3$	$2\text{E}-6$	$6\text{E}-9$	- $3\text{E}-5$	- $3\text{E}-4$
		Y, see ^{134}Ce	-	$4\text{E}+3$	$2\text{E}-6$	$5\text{E}-9$	-	-
58	Cerium-137	W, see ^{134}Ce	$5\text{E}+4$	$1\text{E}+5$	$6\text{E}-5$	$2\text{E}-7$	$7\text{E}-4$	$7\text{E}-3$
		Y, see ^{134}Ce	-	$1\text{E}+5$	$5\text{E}-5$	$2\text{E}-7$	-	-
58	Cerium-139	W, see ^{134}Ce	$5\text{E}+3$	$8\text{E}+2$	$3\text{E}-7$	$1\text{E}-9$	$7\text{E}-5$	$7\text{E}-4$
		Y, see ^{134}Ce	-	$7\text{E}+2$	$3\text{E}-7$	$9\text{E}-10$	-	-
58	Cerium-141	W, see ^{134}Ce	$2\text{E}+3$ LLI wall ($2\text{E}+3$)	$7\text{E}+2$	$3\text{E}-7$	$1\text{E}-9$	- $3\text{E}-5$	- $3\text{E}-4$
		Y, see ^{134}Ce	-	$6\text{E}+2$	$2\text{E}-7$	$8\text{E}-10$	-	-
58	Cerium-143	W, see ^{134}Ce	$1\text{E}+3$ LLI wall ($1\text{E}+3$)	$2\text{E}+3$	$8\text{E}-7$	$3\text{E}-9$	- $2\text{E}-5$	- $2\text{E}-4$
		Y, see ^{134}Ce	-	$2\text{E}+3$	$7\text{E}-7$	$2\text{E}-9$	-	-
58	Cerium-144	W, see ^{134}Ce	$2\text{E}+2$ LLI wall ($3\text{E}+2$)	$3\text{E}+1$	$1\text{E}-8$	$4\text{E}-11$	- $3\text{E}-6$	- $3\text{E}-5$
		Y, see ^{134}Ce	-	$1\text{E}+1$	$6\text{E}-9$	$2\text{E}-11$	-	-
59	Praseodymium- 136^2	W, all compounds except those given for Y	$5\text{E}+4$ St wall ($7\text{E}+4$)	$2\text{E}+5$	$1\text{E}-4$	$3\text{E}-7$	- $1\text{E}-3$	- $1\text{E}-2$
		Y, oxides, hydroxides, carbides, and fluorides	-	$2\text{E}+5$	$9\text{E}-5$	$3\text{E}-7$	-	-
59	Praseodymium- 137^2	W, see ^{136}Pr	$4\text{E}+4$	$2\text{E}+5$	$6\text{E}-5$	$2\text{E}-7$	$5\text{E}-4$	$5\text{E}-3$
		Y, see ^{136}Pr	-	$1\text{E}+5$	$6\text{E}-5$	$2\text{E}-7$	-	-
59	Praseodymium- 138m	W, see ^{136}Pr	$1\text{E}+4$	$5\text{E}+4$	$2\text{E}-5$	$8\text{E}-8$	$1\text{E}-4$	$1\text{E}-3$
		Y, see ^{136}Pr	-	$4\text{E}+4$	$2\text{E}-5$	$6\text{E}-8$	-	-
59	Praseodymium- 139	W, see ^{136}Pr	$4\text{E}+4$	$1\text{E}+5$	$5\text{E}-5$	$2\text{E}-7$	$6\text{E}-4$	$6\text{E}-3$
		Y, see ^{136}Pr	-	$1\text{E}+5$	$5\text{E}-5$	$2\text{E}-7$	-	-
59	Praseodymium- 142m^2	W, see ^{136}Pr	$8\text{E}+4$	$2\text{E}+5$	$7\text{E}-5$	$2\text{E}-7$	$1\text{E}-3$	$1\text{E}-2$
		Y, see ^{136}Pr	-	$1\text{E}+5$	$6\text{E}-5$	$2\text{E}-7$	-	-
59	Praseodymium- 142	W, see ^{136}Pr	$1\text{E}+3$	$2\text{E}+3$	$9\text{E}-7$	$3\text{E}-9$	$1\text{E}-5$	$1\text{E}-4$
		Y, see ^{136}Pr	-	$2\text{E}+3$	$8\text{E}-7$	$3\text{E}-9$	-	-
59	Praseodymium- 143	W, see ^{136}Pr	$9\text{E}+2$ LLI wall ($1\text{E}+3$)	$8\text{E}+2$	$3\text{E}-7$	$1\text{E}-9$	- $2\text{E}-5$	- $2\text{E}-4$
		Y, see ^{136}Pr	-	$7\text{E}+2$	$3\text{E}-7$	$9\text{E}-10$	-	-
59	Praseodymium- 144^2	W, see ^{136}Pr	$3\text{E}+4$ St wall ($4\text{E}+4$)	$1\text{E}+5$	$5\text{E}-5$	$2\text{E}-7$	- $6\text{E}-4$	- $6\text{E}-3$
		Y, see ^{136}Pr	-	$1\text{E}+5$	$5\text{E}-5$	$2\text{E}-7$	-	-
59	Praseodymium- 145	W, see ^{136}Pr	$3\text{E}+3$	$9\text{E}+3$	$4\text{E}-6$	$1\text{E}-8$	$4\text{E}-5$	$4\text{E}-4$
		Y, see ^{136}Pr	-	$8\text{E}+3$	$3\text{E}-6$	$1\text{E}-8$	-	-
59	Praseodymium-	W, see ^{136}Pr	$5\text{E}+4$	$2\text{E}+5$	$8\text{E}-5$	$3\text{E}-7$	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{m}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	St wall (8E+4)		-	-			1E-3
	147 ²							
		Y, see ¹³⁶ Pr	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-136 ²	W, all compounds except those given for Y	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	5E+4	2E-5	8E-8	-	-
60	Neodymium-138	W, see ¹³⁶ Nd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		Y, see ¹³⁶ Nd	-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	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-139 ²	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-141	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-147	W, see ¹³⁶ Nd	1E+3	9E+2	4E-7	1E-9	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
		Y, see ¹³⁶ Nd	-	8E+2	4E-7	1E-9	-	-
60	Neodymium-149 ²	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	-	-
60	Neodymium-151 ²	W, see ¹³⁶ Nd	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		Y, see ¹³⁶ Nd	-	2E+5	8E-5	3E-7	-	-
61	Promethium-141 ²	W, all compounds except those given for Y	5E+4	2E+5	8E-5	3E-7	-	-
		St wall (6E+4)	-	-	-	-	8E-4	8E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	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-144	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	-	-
61	Promethium-145	W, see ¹⁴¹ Pm	1E+4	2E+2	7E-8	-	1E-4	1E-3
		St wall (2E+2)	-	Bone surf (2E+2)	-	3E-10	-	-
		Y, see ¹⁴¹ Pm	-	2E+2	8E-8	3E-10	-	-
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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
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 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
62	Samarium-141 ²	W, all compounds	5E+4	2E+5	8E-5	2E-7	-	-
		St wall (6E+4)	-	-	-	-	8E-4	8E-3
62	Samarium-142 ²	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 ²	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
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 ²	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
64	Gadolinium-145 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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
		W, see ^{145}Gd	-	Bone surf (6E+2)	-	9E-10	-	-
64	Gadolinium-152	D, see ^{145}Gd	2E+1	1E-2	4E-12	-	-	-
		W, see ^{145}Gd	Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7	4E-6
64	Gadolinium-153	D, see ^{145}Gd	5E+3	1E+2	6E-8	-	6E-5	6E-4
		W, see ^{145}Gd	-	Bone surf (2E+2)	-	3E-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 ²	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
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-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-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 ²	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157 ²	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159 ²	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 ²	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162 ²	W, all compounds	5E+5	2E+6	1E-3	3E-6	-	-
		St wall (8E+5)	-	-	-	1E-2	1E-1	
67	Holmium-164m ²	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164 ²	W, all compounds	2E+5	6E+5	3E-4	9E-7	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	St wall ($2\text{E}+5$)		-	-			3E-3
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-3
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
68	Erbium-172	W, all compounds	1E+3	1E+3	6E-7	2E-9	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
69	Thulium-162 ²	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
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	2E+3	8E-7	3E-9	-	-
			LLI wall (2E+3)	-	-	-	3E-5	3E-4
69	Thulium-170	W, all compounds	8E+2	2E+2	9E-8	3E-10	-	-
			LLI wall (1E+3)	-	-	-	1E-5	1E-4
69	Thulium-171	W, all compounds	1E+4	3E+2	1E-7	-	-	-
			LLI wall (1E+4)	Bone surf (6E+2)	-	8E-10	2E-4	2E-3
69	Thulium-172	W, all compounds	7E+2	1E+3	5E-7	2E-9	-	-
			LLI wall (8E+2)	-	-	-	1E-5	1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175 ²	W, all compounds	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
70	Ytterbium-162 ²	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2
			-	3E+5	1E-4	4E-7	-	-
70	Ytterbium-166	W, see ¹⁶² Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
			-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-167 ²	W, see ¹⁶² Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
			-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-169	W, see ¹⁶² Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
			-	7E+2	3E-7	1E-9	-	-
70	Ytterbium-175	W, see ¹⁶² Yb	3E+3	4E+3	1E-6	5E-9	-	-
			LLI wall (3E+3)	-	-	-	4E-5	4E-4
70	Ytterbium-177 ²	W, see ¹⁶² Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
			-	5E+4	2E-5	6E-8	-	-
70	Ytterbium-178 ²	W, see ¹⁶² Yb	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
			-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4
			-	4E+3	2E-6	6E-9	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
71	Lutetium-170	W, see ^{169}Lu	1E+3	2E+3	9E-7	3E-9	2E-5	2E-4
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
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
		Y, see ^{169}Lu	-	Bone surf (5E+2)	-	6E-10	-	-
71	Lutetium-174m	W, see ^{169}Lu	2E+3	2E+2	1E-7	-	-	-
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
		Y, see ^{169}Lu	-	Bone surf (2E+2)	-	3E-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	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
		Y, see ^{169}Lu	-	Bone surf (1E+1)	-	2E-11	-	-
71	Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
		Y, see ^{169}Lu	-	Bone surf (1E+2)	-	2E-10	-	-
71	Lutetium-177	W, see ^{169}Lu	2E+3	2E+3	9E-7	3E-9	-	-
		Y, see ^{169}Lu	-	LLI wall (3E+3)	-	-	4E-5	4E-4
71	Lutetium-178m ²	W, see ^{169}Lu	5E+4	2E+5	8E-5	3E-7	-	-
		Y, see ^{169}Lu	-	St. wall (6E+4)	-	-	8E-4	8E-3
71	Lutetium-178 ²	W, see ^{169}Lu	4E+4	1E+5	5E-5	2E-7	-	-
		Y, see ^{169}Lu	-	St wall (4E+4)	-	-	6E-4	6E-3
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
		W, see ^{170}Hf	-	Bone surf (2E+1)	-	3E-11	-	-
72	Hafnium-173	D, see ^{170}Hf	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{170}Hf	-	4E+1	2E-8	-	-	-
72	Hafnium-175	D, see ^{170}Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4
		W, see ^{170}Hf	-	Bone surf (1E+3)	-	1E-9	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
72	Hafnium-177m ²	W, see ¹⁷⁰ Hf	-	1E+3	5E-7	2E-9	-	-
		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	-	-	-
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 ²	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)	Bone surf (2E+0)	-	2E-12	5E-6	5E-5
		W, see ¹⁷⁰ Hf	-	3E+0	1E-9	-	-	-
72	Hafnium-183 ²	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 ²	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
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	-	-
73	Tantalum-174 ²	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-	W, see ¹⁷² Ta	2E+5	5E+5	2E-4	8E-7	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
	182m ²		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 ²	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 ²	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 ²	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
75	Rhenium-177 ²	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-	-
		St wall (1E+5)	-	-	-	-	2E-3	2E-2
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178 ²	D, see ¹⁷⁷ Re	7E+4	3E+5	1E-4	4E-7	-	-
		St wall (1E+5)	-	-	-	-	1E-3	1E-2
		W, see ¹⁷⁷ Re	-	3E+5	1E-4	4E-7	-	-
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	2E+3	7E-7	-	-	-
		St wall (2E+3)	-	St wall (2E+3)	-	3E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	2E+2	6E-8	2E-10	-	-
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	8E+5	4E-4	-	8E-3	8E-2
		St wall (9E+5)	-	St wall (9E+5)	-	1E-6	-	-
		W, see ¹⁷⁷ Re	-	1E+5	4E-5	1E-7	-	-

Atomic No.	Radionuclide	Class	Table I Occupational Values			Table II Effluent Concentrations		Table III Releases to Sewers
			Col. 1 Oral Ingestion ALI (μCi)	Col. 2 Inhalation		Col. 1 Air (μCi/ml)	Col. 2 Water (μCi/ml)	Monthly Average Concentration (μCi/ml)
				Col. 3 ALI (μCi)	Col. 3 DAC (μCi/ml)			
75	Rhenium-188m ²	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 ²	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 ²	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	-	-
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	-	-
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	-	-
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	-	-
77	Iridium-182 ²	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	-	-
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

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 ($\mu\text{Ci}/\text{m}^3$)
			Oral Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}^3$)							
77	Iridium-187	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	-	-
77	Iridium-188	Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		D, see ^{182}Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
77	Iridium-188	W, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ^{182}Ir	-	3E+3	1E-6	5E-9	-	-
77	Iridium-189	D, see ^{182}Ir	5E+3	5E+3	2E-6	7E-9	-	-
		LLI wall (5E+3)	-	-	-	-	7E-5	7E-4
77	Iridium-189	W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190m ²	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	-	-
77	Iridium-190	Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
		D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
77	Iridium-190	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	-	-
77	Iridium-192	Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
		D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
77	Iridium-192	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	-	-
77	Iridium-194	Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
		D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
77	Iridium-194	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	-	-
77	Iridium-195	Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
		D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-186	W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
		Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78	Platinum-188	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	6E+3	3E-6	8E-9	-	-
		LLI wall (3E+4)	-	-	-	-	4E-5	4E-4
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-	-
		LLI wall (5E+4)	-	-	-	-	6E-4	6E-3
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
78	Platinum-197m ²	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 ²	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
79	Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
79	Gold-194	W, halides and nitrates	-	2E+4	9E-6	3E-8	-	-
		Y, oxides and hydroxides	-	2E+4	8E-6	3E-8	-	-
		D, see ^{193}Au	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
79	Gold-195	W, see ^{193}Au	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{193}Au	-	5E+3	2E-6	7E-9	-	-
		D, see ^{193}Au	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
79	Gold-198m	W, see ^{193}Au	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{193}Au	-	4E+2	2E-7	6E-10	-	-
		D, see ^{193}Au	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
79	Gold-198	W, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
		D, see ^{193}Au	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
79	Gold-199	W, see ^{193}Au	-	2E+3	8E-7	3E-9	-	-
		Y, see ^{193}Au	-	2E+3	7E-7	2E-9	-	-
		D, see ^{193}Au	3E+3	9E+3	4E-6	1E-8	-	-
79	Gold-200m	LLI wall (3E+3)	-	-	-	-	4E-5	4E-4
		W, see ^{193}Au	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{193}Au	-	4E+3	2E-6	5E-9	-	-
79	Gold-200 ²	D, see ^{193}Au	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{193}Au	-	2E+4	1E-6	3E-9	-	-
79	Gold-201 ²	D, see ^{193}Au	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{193}Au	-	8E+4	3E-5	1E-7	-	-
		Y, see ^{193}Au	-	7E+4	3E-5	1E-7	-	-
79	Gold-201 ²	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7	-	-
		St wall (9E+4)	-	-	-	-	1E-3	1E-2
		W, see ^{193}Au	-	2E+5	1E-4	3E-7	-	-
80	Mercury-193m	Y, see ^{193}Au	-	2E+5	9E-5	3E-7	-	-
		Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
80	Mercury-193	D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-	-
		Vapor	-	3E+4	1E-5	4E-8	-	-
80	Mercury-194	Organic D	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		D, see $^{193\text{m}}\text{Hg}$	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see $^{193\text{m}}\text{Hg}$	-	4E+4	2E-5	6E-8	-	-
80	Mercury-195m	Vapor	-	3E+1	1E-8	4E-11	-	-
		Organic D	2E+1	3E+1	1E-8	4E-11	2E-7	2E-6
		D, see $^{193\text{m}}\text{Hg}$	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
80	Mercury-195	W, see $^{193\text{m}}\text{Hg}$	-	1E+2	5E-8	2E-10	-	-
		Vapor	-	4E+3	2E-6	6E-9	-	-
		Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
80	Mercury-197m	D, see $^{193\text{m}}\text{Hg}$	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
		W, see $^{193\text{m}}\text{Hg}$	-	4E+3	2E-6	5E-9	-	-
		Vapor	-	3E+4	1E-5	4E-8	-	-
80	Mercury-197m	Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
		D, see $^{193\text{m}}\text{Hg}$	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
		W, see $^{193\text{m}}\text{Hg}$	-	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 $^{193\text{m}}\text{Hg}$	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
		W, see $^{193\text{m}}\text{Hg}$	-	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 $^{193\text{m}}\text{Hg}$	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
		W, see $^{193\text{m}}\text{Hg}$	-	9E+3	4E-6	1E-8	-	-
80	Mercury-199m ²	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 $^{193\text{m}}\text{Hg}$	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
		W, see $^{193\text{m}}\text{Hg}$	-	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 $^{193\text{m}}\text{Hg}$	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		W, see $^{193\text{m}}\text{Hg}$	-	1E+3	5E-7	2E-9	-	-
81	Thallium-194m ²	D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
			St wall (7E+4)	-	-	-	1E-3	1E-2
81	Thallium-194 ²	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
			St wall (3E+5)	-	-	-	4E-3	4E-2
81	Thallium-195 ²	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 ²	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 ²	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 ²	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
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 ²	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 ²	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200 ²	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 ²	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 ²	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	-	-

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
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 ²	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 ²	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 ²	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 ²	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 ²	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	-	-
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 ²	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 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
87	Francium-222 ²	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
88	Radium-227 ²	W, all compounds	Bone surf (5E+0)	-	-	-	6E-8	6E-7
			2E+4	1E+4	6E-6	-	-	-
88	Radium-228	W, all compounds	Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4	3E-3
			2E+0	1E+0	5E-10	2E-12	-	-
89	Actinium-224	D, all compounds except those given for W and Y	Bone surf (4E+0)	-	-	-	6E-8	6E-7
			2E+3	3E+1	1E-8	-	-	-
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5	3E-4
			-	5E+1	2E-8	7E-11	-	-
89	Actinium-225	D, see ²²⁴ Ac	-	5E+1	2E-8	6E-11	-	-
			5E+1	3E-1	1E-10	-	-	-
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7	7E-6
			-	6E-1	3E-10	9E-13	-	-
89	Actinium-226	D, see ²²⁴ Ac	-	6E-1	3E-10	9E-13	-	-
			1E+2	3E+0	1E-9	-	-	-
			LLI wall (1E+2)	Bone surf (4E+0)	-	5E-12	2E-6	2E-5
			-	5E+0	2E-9	7E-12	-	-
89	Actinium-227	D, see ²²⁴ Ac	-	5E+0	2E-9	6E-12	-	-
			2E-1	4E-4	2E-13	-	-	-
			Bone surf (4E-1)	Bone surf (8E-4)	-	1E-15	5E-9	5E-8
			-	2E-3	7E-13	-	-	-
89	Actinium-228	D, see ²²⁴ Ac	-	Bone surf (3E-3)	-	4E-15	-	-
			2E+3	9E+0	4E-9	-	3E-5	3E-4
			-	Bone surf (2E+1)	-	2E-11	-	-
			-	4E+1	2E-8	-	-	-
90	Thorium-226 ²	W, all compounds except those given for Y	-	Bone surf (6E+1)	-	8E-11	-	-
			5E+3	2E+2	6E-8	2E-10	-	-
			St wall (5E+3)	-	-	-	7E-5	7E-4
			-	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
			-	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
			-	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
			-	2E-3	1E-12	-	-	-
90	Thorium-230	W, see ²²⁶ Th	-	Bone surf (3E-3)	-	4E-15	-	-
			4E+0	6E-3	3E-12	-	-	-
			Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
90	Thorium-230	Y, see ²²⁶ Th	-	2E-2	6E-12	-	-	-
			-	Bone surf (2E-2)	-	3E-14	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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	-	-
90	Thorium-232	W, see ^{226}Th	7E-1	1E-3	5E-13	-	-	-
			Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8	3E-7
		Y, see ^{226}Th	-	3E-3	1E-12	-	-	-
			-	Bone surf (4E-3)	-	6E-15	-	-
90	Thorium-234	W, see ^{226}Th	3E+2	2E+2	8E-8	3E-10	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{226}Th	-	2E+2	6E-8	2E-10	-	-
91	Protactinium- 227 ²	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
			-	Bone surf (2E+1)	-	3E-11	-	-
		Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-	-
91	Protactinium- 230	W, see ^{227}Pa	6E+2	5E+0	2E-9	7E-12	-	-
			Bone surf (9E+2)	-	-	-	1E-5	1E-4
		Y, see ^{227}Pa	-	4E+0	1E-9	5E-12	-	-
91	Protactinium- 231	W, see ^{227}Pa	2E-1	2E-3	6E-13	-	-	-
			Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9	6E-8
		Y, see ^{227}Pa	-	4E-3	2E-12	-	-	-
			-	Bone surf (6E-3)	-	8E-15	-	-
91	Protactinium- 232	W, see ^{227}Pa	1E+3	2E+1	9E-9	-	2E-5	2E-4
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{227}Pa	-	6E+1	2E-8	-	-	-
			-	Bone surf (7E+1)	-	1E-10	-	-
91	Protactinium- 233	W, see ^{227}Pa	1E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
		Y, see ^{227}Pa	-	6E+2	2E-7	8E-10	-	-
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_2F_2 , $\text{UO}_2(\text{NO}_3)_2$	4E+0	4E-1	2E-10	-	-	-
			Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
		W, UO_3 , UF_4 , UCl_4	-	4E-1	1E-10	5E-13	-	-
		Y, UO_2 , U_3O_8	-	3E-1	1E-10	4E-13	-	-
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	-	-
		Y, see ^{230}U	-	5E+3	2E-6	6E-9	-	-
92	Uranium-232	D, see ^{230}U	2E+0	2E-1	9E-11	-	-	-
			Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
		W, see ^{230}U	-	4E-1	2E-10	5E-13	-	-
		Y, see ^{230}U	-	8E-3	3E-12	1E-14	-	-
92	Uranium-233	D, see ^{230}U	1E+1	1E+0	5E-10	-	-	-
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
92	Uranium-234 ³	W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
92	Uranium-234 ³	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 ³	D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6	
		W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
92	Uranium-235 ³	Y, see ²³⁰ U	-	4E-2	2E-11	6E-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-236	W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	6E-14	-	-
		D, see ²³⁰ U	2E+3	3E+3	1E-6	4E-9	-	-
92	Uranium-237	LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		W, see ²³⁰ U	-	2E+3	7E-7	2E-9	-	-
		Y, see ²³⁰ U	-	2E+3	6E-7	2E-9	-	-
92	Uranium-238 ³	D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6	
		W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
92	Uranium-238 ³	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
		W, see ²³⁰ U	-	2E+5	7E-5	2E-7	-	-
92	Uranium-239 ²	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
		W, see ²³⁰ U	-	3E+3	1E-6	4E-9	-	-
92	Uranium-240	Y, see ²³⁰ U	-	2E+3	1E-6	3E-9	-	-
		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-natural ³	W, see ²³⁰ U	-	8E-1	3E-10	9E-13	-	-
		Y, see ²³⁰ U	-	5E-2	2E-11	9E-14	-	-
		W, all compounds	1E+5	2E+3	7E-7	-	2E-3	2E-2
93	Neptunium-232 ²	Bone surf (5E+2)	-	-	-	6E-9	-	-
		W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-233 ²	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-234	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-235	W, all compounds	3E+0	2E-2	9E-12	-	-	-
		Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8	9E-7	
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+3	3E+1	1E-8	-	-	-
		Bone surf (4E+3)	Bone surf (7E+1)	-	1E-10	5E-5	5E-4	
93	Neptunium-236m (22.5 h)	W, all compounds	5E-1	4E-3	2E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	1E-14	2E-8	2E-7	
93	Neptunium-237	W, all compounds	1E+3	6E+1	3E-8	-	2E-5	2E-4
		Bone surf (2E+2)	Bone surf (2E+2)	-	2E-10	-	-	
93	Neptunium-238	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-
93	Neptunium-239	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-

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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)	Inhalation		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
93	Neptunium-240 ²	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
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 ²	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	2E-2	8E-12	-	-	-
		Bone surf (4E+0)	Bone surf (4E-2)	-	5E-14	6E-8	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	7E-3	3E-12	-	-	-
		Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	-
		Y, see ²³⁴ Pu	-	2E-2	8E-12	2E-14	-	-
94	Plutonium-239	W, see ²³⁴ Pu	8E-1	6E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	-
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	-
94	Plutonium-240	W, see ²³⁴ Pu	8E-1	6E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	-
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	-
94	Plutonium-241	W, see ²³⁴ Pu	4E+1	3E-1	1E-10	-	-	-
		Bone surf (7E+1)	Bone surf (6E-1)	-	8E-13	1E-6	1E-5	-
		Y, see ²³⁴ Pu	-	8E-1	3E-10	-	-	-
		Bone surf (1E+0)	Bone surf (1E+0)	-	1E-12	-	-	-
94	Plutonium-242	W, see ²³⁴ Pu	8E-1	7E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	-
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	-
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	7E-3	3E-12	-	-	-
		Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	-
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	-
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	3E+2	1E-7	4E-10	-	-
		LLI wall (4E+2)	-	-	-	-	6E-6	6E-5
		Y, see ²³⁴ Pu	-	3E+2	1E-7	4E-10	-	-
95	Americium-237 ²	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
	238^{2}		-	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	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242m	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242	W, all compounds	4E+3	8E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (9E+1)	-	1E-10	-	-
95	Americium-243	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-244m ²	W, all compounds	6E+4	4E+3	2E-6	-	-	-
			St wall (8E+4)	Bone surf (7E+3)	-	1E-8	1E-3	1E-2
95	Americium-244	W, all compounds	3E+3	2E+2	8E-8	-	4E-5	4E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95	Americium-246m ²	W, all compounds	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
95	Americium-246 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-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	6E-1	2E-10	-	-	-
			Bone surf (8E+1)	Bone surf (6E-1)	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	2E-5	2E-4
			-	Bone surf (4E+1)	-	5E-11	-	-
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	4E-13	7E-7	7E-6
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	2E-14	3E-8	3E-7
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-	-
			Bone surf (3E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-	-
			Bone surf (4E-1)	Bone surf (3E-3)	-	4E-15	5E-9	5E-8
96	Curium-249 ²	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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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 ²	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	-	-
98	Californium-253	W, see ²⁴⁴ Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
		Y, see ²⁴⁴ Cf	-	2E+0	7E-10	2E-12	-	-
98	Californium-254	W, see ²⁴⁴ Cf	2E+0	2E-2	9E-12	3E-14	3E-8	3E-7
		Y, see ²⁴⁴ Cf	-	2E-2	7E-12	2E-14	-	-
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

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
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 ¹	-	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
-	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

ENDNOTES:

¹"Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material.

² 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 $\mu\text{Ci/ml}$ 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 1200-02-05-.52.)

- 3 For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see 1200-02-05-.50(5)). 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 shall not exceed $8E-3 (SA) \mu\text{Ci-hr/ml}$, 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:

$$SA = 3.6E-7 \text{ curies/gram U U-depleted}$$

$$SA = [0.4 + 0.38 (\text{enrichment}) + 0.0034 (\text{enrichment})^2] E-6, \text{ enrichment} \geq 0.72$$

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 schedule 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 schedule for any radionuclide that is not known to be absent from the mixture; or

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 ($\mu\text{Ci/ml}$)
			Inhalation			Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
Oral Ingestion ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)						
	If it is known that Ac-227-D and Cm-250-W are not present		-	7E-4	3E-13	-	-	-
	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	-	-	-
	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	-	-

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 ($\mu\text{Ci}/\text{m}$)
			Inhalation			Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
Oral Ingestion ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}$)						
	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	-	-
	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

3. 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.

4. 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 Schedule RHS 8-30 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" (i.e., "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:

$$\frac{C_A}{\text{DAC}_A} + \frac{C_B}{\text{DAC}_B} + \frac{C_C}{\text{DAC}_C} \leq 1$$

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

New Rules

Chapter 1200-02-05 is amended by adding new rules 1200-02-05-.127 Disposal of Certain Byproduct Material and 1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits. The new rules shall read as follows:

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- 1200-02-05-.127 Disposal of Certain Byproduct Material
- 1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits

- (1) Licensed material as defined in subparagraphs (c) and (d) of the definition of *Byproduct material* set forth in Rule 1200-02-05-.32(11) may be disposed of in accordance with Chapter 1200-02-11, even though it is not defined as low-level radioactive waste. Therefore, any licensed byproduct material being disposed of

at a facility, or transferred for ultimate disposal at a facility licensed under Chapter 1200-02-11, must meet the requirements of Rule 1200-02-05-.125.

- (2) A licensee may dispose of byproduct material, as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 1200-02-05-.32(11), at a disposal facility authorized to dispose of such material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits.

When a licensee or registrant is required by Rule 1200-02-05-.143 or 1200-02-05-.144 to report to the Division any exposure of an identified occupationally exposed individual, or an identified member of the public, to radiation or radioactive material, the licensee or registrant shall also provide the individual a report on his or her exposure data included in the report to the Division. This report must be transmitted no later than the transmittal to the Division.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-07 Use of Radionuclides in the Healing Arts

Amendments

Paragraph (32) of Rule 1200-02-07-.05 Definitions is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (32) shall read as follows:

- (32) "Radioactive drug" means any chemical compound containing radioactive material that may be used on or administered to patients or human research subjects as an aid in the diagnosis, treatment, or prevention of disease or other abnormal condition.

Rule 1200-02-07-.05 Definitions is amended by adding new paragraph (45) so that, as amended, paragraph (45) shall read as follows:

- (45) "Positron Emission Tomography (PET) radionuclide production facility" is defined as a facility operating a cyclotron or accelerator for the purpose of producing PET radionuclides.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.14 Notifications is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-07-.14 shall read as follows:

1200-02-07-.14 Notifications.

- (1) A licensee shall provide to the Division a copy of the board certification, the Nuclear Regulatory Commission, Agreement State or Licensing State license, or the permit issued by a licensee of broad scope for each individual no later than thirty (30) days after the date that the Licensee permits the individual to work as an authorized user, an authorized nuclear pharmacist or an authorized medical physicist, pursuant to Rule 1200-02-07-.13(1)(b).
- (2) A licensee shall notify the Division no later than thirty days after:
 - (a) An authorized user, an authorized nuclear pharmacist, a radiation safety officer, or an authorized medical physicist permanently discontinues performance of duties under the license or has a name change;
 - (b) The licensee's mailing address changes;

- (c) The licensee's name changes, but the name change does not constitute a transfer of control of the license as described in Rule 1200-02-10-.16(2); or
 - (d) The licensee has added to or changed the areas of use identified in the application or on the license where radioactive material is used under either Rule 1200-02-07-.38 or 1200-02-07-.40.
- (3) The licensee shall send the documents required in this rule to the Division at the address listed in Rule 1200-02-04-.07(1)(c).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (4) of Rule 1200-02-07-.15 Exemptions Regarding Specific Licenses of Broad Scope is amended by deleting "1200-02-07-.14(1)(a)" between the word "of" and "regarding" and replacing it with "Rule 1200-02-07-.14(2)(a)" so that, as amended, paragraph (4) shall read as follows:

- (4) The provisions of Rule 1200-02-07-.14(2)(a) regarding notification to the Division for new authorized users, new authorized medical physicists and new authorized nuclear pharmacists;

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.23 Training of Radiation Safety Officer is amended by adding "Rule 1200-02-07-.26," between the word "under" and "1200-02-07-.43" so that, as amended, subpart (ii) shall read as follows:

- (ii) In clinical nuclear medicine facilities providing diagnostic and/or therapeutic services under the direction of physicians who meet the requirements for authorized users under Rule 1200-02-07-.26, 1200-02-07-.43 or 1200-02-07-.47; and

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.24 Training for Authorized Medical Physicist is amended by adding "Rule 1200-02-07-.26," between the word "in" and "1200-02-07-.59" so that, as amended, part 2 shall read as follows:

- 2. In clinical radiation facilities providing high energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services under the direction of physicians who meet the requirements for authorized users in Rule 1200-02-07-.26, 1200-02-07-.59 or 1200-02-07-.80; and

Subparagraph (b) of paragraph (2) of Rule 1200-02-07-.24 Training for Authorized Medical Physicist is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) Has obtained written attestation that the individual has satisfactorily completed the requirements in subparagraphs (1)(a) and (1)(b) and paragraph (3), or subparagraph (2)(a) and paragraph (3) of this rule, and has achieved a level of competency sufficient to function independently as an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status. The written attestation must be signed by a preceptor authorized medical physicist who meets the requirements in Rule 1200-02-07-.24, Rule 1200-02-07-.26 or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements for an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status; and

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.26 Training for Experienced Radiation Safety Officer, Teletherapy or Medical Physicist, Authorized User, and Nuclear Pharmacist is amended by adding paragraph (3) which shall read as follows:

- (3) Individuals who need not comply with training requirements as described in this rule may serve as preceptors for, and supervisors of, applicants seeking authorization on Division or NRC licenses for the same uses for which these individuals are authorized.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.30 Determination of Dosages of Unsealed Radioactive Material for Medical Use is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-07-.30 shall read as follows:

1200-02-07-.30 Determination of Dosages of Unsealed Radioactive Material For Medical Use.

- (1) A licensee shall determine and record the activity of each dosage before medical use.
- (2) For a unit dosage, this determination must be made by:
- (a) Direct measurement of radioactivity; or
 - (b) A decay correction, based on the activity or activity concentration determined by:
 - 1. A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or
 - 2. An Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).
 - 3. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements.
- (3) For other than unit dosages, this determination must be made by:
- (a) Direct measurement of radioactivity;
 - (b) Combination of measurement of radioactivity and mathematical calculations; or
 - (c) Combination of volumetric measurements and mathematical calculations, based on the measurement made by:
 - 1. A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or
 - 2. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.38 Use of Unsealed Radioactive Material for Uptake, Dilution, and Excretion Studies for Which a Written Directive is Not Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except for quantities that require a written directive under Rule 1200-02-07-.20(2), a licensee may use any unsealed radioactive material, prepared for medical use for uptake, dilution, or excretion that is:
- (a) Obtained from:
 - 1. A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or

2. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements; or
- (b) Excluding production of PET radionuclides, prepared by:
1. An authorized nuclear pharmacist;
 2. A physician who is an authorized user and who meets the requirements specified in Rule 1200-02-07-.43, or Rule 1200-02-07-.47 and Rule 1200-02-07-.43(1)(c)1(ii)(VII); or
 3. An individual under the supervision, as specified in Rule 1200-02-07-.19, of the authorized nuclear pharmacist in part 1 of this subparagraph or the physician who is an authorized user in part 2 of this subparagraph; or
- (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA); or
- (d) Prepared by the licensee in accordance with a Radioactive Drug Research Committee approved application or an Investigational New Drug (IND) protocol accepted by Food and Drug Administration (FDA) for use in research.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.39 Training for Uptake, Dilution, and Excretion Studies is amended by adding "Rule 1200-02-07-.26," between the words "in" and "1200-02-07-.39" so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.39, 1200-02-07-.43, or 1200-02-07-.47 or equivalent U.S. Nuclear Regulatory Commission or agreement State requirements, involving:

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.39 Training for Uptake, Dilution, and Excretion Studies is amended by adding "Rule 1200-02-07-.26," between the words "in" and "1200-02-07-.39" so that, as amended, part 2 shall read as follows:

2. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.39, 1200-02-07-.43, or 1200-02-07-.47 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in parts (1)(a)1 or (1)(c)1 of this rule and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Rule 1200-02-07-.38.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.40 Use of Unsealed Radioactive Material for Imaging and Localization Studies for Which a Written Directive is Not Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee may use, for imaging and localization studies, any radioactive material prepared for medical use, in quantities that do not require a written directive as described in Rule 1200-02-07-.20(2) that is:
 - (a) Obtained from:
 1. A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent regulations of another Agreement State or U.S. Nuclear Regulatory Commission requirements; or

2. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements; or
 - (b) Excluding production of PET radionuclides prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in Rule 1200-02-07-.43, or Rule 1200-02-07-.47 and Rule 1200-02-07-.43(1)(c)1(ii)(VII), or an individual under the supervision of either as specified in Rule 1200-02-07-.19; or
 - (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA); or
 - (d) Prepared by the licensee for use in research in accordance with a radioactive drug research committee-approved application or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.41 Radionuclide Contaminants is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee shall not administer to humans a radiopharmaceutical that contains:
 - (a) More than 0.15 kilobecquerel of molybdenum-99 per megabecquerel of technetium-99m (0.15 μ Ci of Mo-99 per mCi of Tc-99m); or
 - (b) More than 0.02 kilobecquerel of strontium-82 per megabecquerel of rubidium-82 chloride injection (0.02 μ Ci of Sr-82 per mCi of Rb-82 chloride); or more than 0.2 kilobecquerel of strontium-85 per megabecquerel of rubidium-82 chloride injection (0.2 μ Ci of Sr-85 per mCi of Rb-82).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.43 Training for Imaging and Localization Studies is amended by adding “, Rule 1200-02-07-.26,” between the words “rule” and “or” so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user, who meets the requirements in this rule, Rule 1200-02-07-.26, or item (VII) of this subpart and Rule 1200-02-07-.47 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, involving:

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.43 Training for Imaging and Localization Studies is amended by deleting the part and substituting the following so that, as amended, part 2 shall read as follows:

2. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or Rule 1200-02-07-.47 and item 1(ii)(VII) of this subparagraph or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in parts (a)1 or (c)1 of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Rules 1200-02-07-.38 and 1200-02-07-.40.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.44 Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee may use any unsealed radioactive material for diagnostic or therapeutic medical use for which a written directive is required that has been:
- (a) Obtained from:
 - 1. A manufacturer or preparer licensed under Rule 1200-02-10-13(10) or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements; or
 - 2. A PET radioactive drug producer licensed under Rule 1200-02-10-11(8) or equivalent Agreement State requirements; or
 - (b) Excluding production of PET radionuclides prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in Rule 1200-02-07-43, Rule 1200-02-07-47, or an individual under the supervision of either as specified in Rule 1200-02-07-19; or
 - (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA) for use in research; or
 - (d) Prepared by the licensee for use in research in accordance with an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-47 Training for Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by adding "Rule 1200-02-07-26," between the words "rule," and "or" so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user who meets the requirements of this rule, Rule 1200-02-07-26, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements. A supervising authorized user, who meets the requirements in this subparagraph, must also have experience in administering dosages in the same dosage category or categories (i.e., item (VI) of this subpart) as the individual requesting authorized user status. The work experience must involve:

Part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-47 Training for Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by deleting the part and substituting the following so that, as amended, part 2 shall read as follows:

- 2. Have obtained written attestation that the individual has satisfactorily completed the requirements in part (a)1 and item (b)1(ii)(VI) of this paragraph or part 1 of this subparagraph and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Rule 1200-02-07-44. The written attestation must be signed by a preceptor authorized user who meets the requirements in this rule, Rule 1200-02-07-26, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements. The preceptor authorized user, who meets the requirements in this subparagraph, must have experience in administering dosages in the same dosage category or categories (i.e., item 1(ii)(VI) of this subparagraph) as the individual requesting authorized user status.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (a) of paragraph (1) of Rule 1200-02-07-48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (a) shall read as follows:

- (a) Is certified by a medical specialty board whose certification process includes all of the requirements in subparagraph (c) of this paragraph and whose certification has been recognized by the Division, the U.S. Nuclear Regulatory Commission or an Agreement State and who meets the requirements in part (c)3 of this paragraph; (The names of board certifications which have been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State will be posted on the U.S. Nuclear Regulatory Commission's Web page); or

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part, but not its subparts, and substituting the following so that, as amended, part 2, prior to its subparts, shall read as follows:

2. Has work experience, under the supervision of an authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.48, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A supervising authorized user who meets the requirements in Rule 1200-02-07-.47(1)(b), must also have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)I or II. The work experience must involve:

Part 3 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

3. Has obtained written attestation that the individual has satisfactorily completed the requirements in parts 1 and 2 of this subparagraph and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under Rule 1200-02-07-.44. The written attestation must be signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.48, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirement in Rule 1200-02-07-.47(1)(b), must also have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)I or II.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.49 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less greater than 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part, but not its subparts, and substituting the following so that, as amended, part 2, prior to its subparts, shall read as follows:

2. Has work experience, under the supervision of an authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.49 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A supervising authorized user, who meets the requirements in Rule 1200-02-07-.47(1)(b), must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)II. The work experience must involve:

Part 3 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.49 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less greater than 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

3. Has obtained written attestation that the individual has satisfactorily completed the requirements in parts 1 and 2 of this subparagraph and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under Rule 1200-02-07-.44. The written attestation must be signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirements in

Rule 1200-02-07-.47(1)(b), must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)(ii)(VI)II.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.50 Training for the Parenteral Administration of Unsealed Radioactive Material Requiring a Written Directive is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except as provided in Rule 1200-02-07-.26, a licensee shall require an authorized user for the parenteral administration requiring a written directive, to be a physician who:
 - (a) Is an authorized user under Rule 1200-02-07-.47 for uses listed in Rule 1200-02-07-.47(1)(b)(ii)(VI)III or 1200-02-07-.47(1)(b)(ii)(VI)IV, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements; or
 - (b) Is an authorized user under Rule 1200-02-07-.59 or 1200-02-07-.80, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements and who meets the requirements in subparagraph (d) of this paragraph; or
 - (c) Is certified by a medical specialty board whose certification process has been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State under Rule 1200-02-07-.59 or 1200-02-07-.80, and who meets the requirements in subparagraph (d) of this paragraph.
 - (d)
 1. Has successfully completed 80 hours of classroom and laboratory training, applicable to parenteral administrations, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide for which a written directive is required. The training must include:
 - (i) Radiation physics and instrumentation;
 - (ii) Radiation protection;
 - (iii) Mathematics pertaining to the use and measurement of radioactivity;
 - (iv) Chemistry of radioactive material for medical use; and
 - (v) Radiation biology; and
 2. Has work experience, under the supervision of an authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47 or 1200-02-07-.50, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, in the parenteral administration, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide for which a written directive is required. A supervising authorized user who meets the requirements in Rule 1200-02-07-.47 must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)(ii)(VI)III and/or IV. The work experience must involve:
 - (i) Ordering, receiving, and unpacking radioactive materials safely, and performing the related radiation surveys;
 - (ii) Performing quality control procedures on instruments used to determine the activity of dosages, and performing checks for proper operation of survey meters;
 - (iii) Calculating, measuring, and safely preparing patient or human research subject dosages;

- (iv) Using administrative controls to prevent a misadministration involving the use of unsealed radioactive material;
 - (v) Using procedures to contain spilled radioactive material safely, and using proper decontamination procedures; and
 - (vi) Administering dosages to patients or human research subjects, that include at least three cases involving the parenteral administration, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV and/or at least three cases involving the parenteral administration of any other radionuclide, for which a written directive is required; and
3. Has obtained written attestation that the individual has satisfactorily completed the requirements in subparagraphs (b) or (c) of this paragraph, and has achieved a level of competency sufficient to function independently as an authorized user for the parenteral administration of unsealed radioactive material requiring a written directive. The written attestation must be signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.50, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirements in Rule 1200-02-07-.47, must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)III and/or IV.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.59 Training for Use of Manual Brachytherapy Sources is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except as provided in Rule 1200-02-07-.26, a licensee shall require an authorized user of a manual brachytherapy source for the uses authorized under Rule 1200-02-07-.51 to be a physician who:
 - (a) Is certified by a medical specialty board whose certification process has been recognized by the Division, the U.S. Nuclear Regulatory Commission, or an Agreement State, and who meets the requirements in part (b)3 of this paragraph. (The names of board certifications which have been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State will be posted on the U.S. Nuclear Regulatory Commission's Web page.) To be recognized, a specialty board shall require all candidates for certification to:
 - 1. Successfully complete a minimum of 3 years of residency training in a radiation oncology program approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or Royal College of Physicians and Surgeons of Canada or the Committee on Postgraduate Training of the American Osteopathic Association; and
 - 2. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of manual brachytherapy; or
 - (b) 1. Has completed a structured educational program in basic radionuclide handling techniques applicable to the use of manual brachytherapy sources that includes:
 - (i) 200 hours of classroom and laboratory training in the following areas:
 - (I) Radiation physics and instrumentation;
 - (II) Radiation protection;
 - (III) Mathematics pertaining to the use and measurement of radioactivity; and
 - (IV) Radiation biology; and

- (ii) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements at a medical institution, involving:
 - (I) Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
 - (II) Checking survey meters for proper operation;
 - (III) Preparing, implanting, and removing brachytherapy sources;
 - (IV) Maintaining running inventories of material on hand;
 - (V) Using administrative controls to prevent a misadministration involving the use of radioactive material;
 - (VI) Using emergency procedures to control radioactive material; and
- 2. Has completed three (3) years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subpart 1(ii) of this subparagraph; and
- 3. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in part (a)1, or parts (b)1 and 2 of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user of manual brachytherapy sources for the medical uses authorized under Rule 1200-02-07-.51.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 3 of subparagraph (b) of paragraph (1) of rule 1200-02-07-.60 Training for Ophthalmic Use of Strontium-90 is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

- 3. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.59, this rule, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in subparagraph (b) of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user of strontium-90 for ophthalmic use.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (b) of paragraph (1) of rule 1200-02-07-.80 Training for Use of Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) 1. Has completed a structured educational program in basic radionuclide techniques applicable to the use of a sealed source in a therapeutic medical unit that includes:
 - (i) 200 hours of classroom and laboratory training in the following areas:

- (I) Radiation physics and instrumentation;
 - (II) Radiation protection;
 - (III) Mathematics pertaining to the use and measurement of radioactivity; and
 - (IV) Radiation biology; and
- (ii) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements at a medical institution, involving:
- (I) Reviewing full calibration measurements and periodic spot-checks;
 - (II) Preparing treatment plans and calculating treatment doses and times;
 - (III) Using administrative controls to prevent a misadministration involving the use of radioactive material;
 - (IV) Implementing emergency procedures to be followed in the event of the abnormal operation of the medical unit or console;
 - (V) Checking and using survey meters; and
 - (VI) Selecting the proper dose and how it is to be administered; and
2. Has completed three years of supervised clinical experience in radiation therapy, under an authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subpart 1(ii) of this subparagraph; and
3. Has obtained written attestation that the individual has satisfactorily completed the requirements in part (a)1 of this paragraph or part 1 of this subparagraph, and part 2 of this subparagraph and subparagraph (c) of this rule and has achieved a level of competency sufficient to function independently as an authorized user of each type of therapeutic medical unit for which the individual is requesting authorized user status. The written attestation must be signed by a preceptor authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status; and

Chapter 1200-02-10
Licensing and Registration

Amendments

Rule 1200-02-10-.02 Scope is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-10-.02 shall read as follows:

1200-02-10-.02 Scope.

Except as otherwise specifically provided, no person shall manufacture, produce, receive, possess, use, transfer, own, or acquire radioactive material unless authorized in a specific or general license issued pursuant to this chapter. All other sources of radiation, registered inspectors, and x-ray installations and services unless exempt

from this Chapter under Rule 1200-02-10-.03, 1200-02-10-.04, 1200-02-10-.06, 1200-02-10-.07 or 1200-02-10-.30 shall be registered with the Division in accordance with the requirements of Rule 1200-02-10-.24.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Exempt concentrations.
 - (a) Except as provided in Rule 1200-02-10-.04(1)(b) and (d), any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires products containing radioactive material introduced in concentrations not in excess of those listed in Schedule RHS 8-4.
 - (b) No person may introduce radioactive material into a product or material knowing or having reason to believe that it will be transferred to persons exempt under Rule 1200-02-10-.04(1)(a) or equivalent regulations of the U.S. Nuclear Regulatory Commission, any Agreement State or Licensing State except in accordance with a license issued pursuant to 10 CFR 32.11.
 - (c) This paragraph shall not be deemed to authorize the import of radioactive material or products containing radioactive material.
 - (d) A manufacturer, processor, or producer of a product or material is exempt from the requirements for a license set forth in these regulations to the extent that this person transfers radioactive material contained in a product or material in concentrations not in excess of those specified in Schedule RHS 8-4 in the Appendix to this Chapter and introduced into the product or material by a licensee holding a specific license issued by the NRC expressly authorizing such introduction. This exemption does not apply to the transfer of radioactive material contained in any food, beverage, cosmetic, drug, or other commodity or product designed for ingestion or inhalation by, or application to, a human being.

Paragraph (2) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (2) shall read as follows:

- (2) Exempt products.
 - (a) Except for persons who apply radioactive materials to or persons who incorporate radioactive material into the products listed in this paragraph, any person is exempt from these regulations to the extent that he receives, possesses, uses, transfers, owns or acquires the following products:
 1. Time pieces or hands or dials containing not more than the following quantities of radioactive material and not exceeding the following specified levels of radiation:
 - (i) 25 millicuries of tritium per timepiece;
 - (ii) 5 millicuries of tritium per hand;
 - (iii) 15 millicuries of tritium per dial (bezels when used shall be considered as part of the dial);
 - (iv) 100 microcuries of promethium-147 per watch or 200 microcuries of promethium-147 per any other timepiece;
 - (v) 20 microcuries of promethium-147 per watch hand or 40 microcuries of promethium-147 per other timepiece hand;
 - (vi) 60 microcuries of promethium-147 per watch dial or 120 microcuries of

promethium-147 per other timepiece dial (bezels when used shall be considered part of the dial);

- (vii) The levels of radiation from hands and dials containing radioactive materials will not exceed when measured through 50 milligrams per square centimeter of absorber:
 - (I) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface;
 - (II) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surface;
 - (III) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.
 - (viii) One (1) microcuries of radium-226 per timepiece in intact timepieces manufactured prior to the effective date of this regulation.
2. Reserved.
 3. Balances of precision containing not more than 1 millicurie of tritium per balance or not more than 0.5 millicurie of tritium per balance part manufactured before December 17, 2007.
 4. Reserved.
 5. Marine compasses containing not more than 750 millicuries of tritium gas and other marine navigational instruments containing not more than 250 millicuries of tritium gas manufactured before December 17, 2007.
 6. Reserved.
 7. Electron tubes¹ containing not more than one of the following specified quantities of radioactive material per tube:
 - (i) 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube;
 - (ii) 1 microcurie of cobalt-60;
 - (iii) 5 microcuries of nickel-63;
 - (iv) 30 microcuries of krypton-85;
 - (v) 5 microcuries of cesium-137;
 - (vi) 30 microcuries of promethium-147;provided, the levels of radiation from each electron tube containing radioactive material do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.
 8. Reserved.
 9. Gas and aerosol detectors containing radioactive material.

¹ "Electron tubes", as used in this subparagraph, include spark gap tubes, power tubes, gas tubes, including glow lamps, receiving tubes, microwave tubes, indicator tubes, pickup tubes, radiation detection tubes and any other completely sealed tube that is designed to conduct or control electrical currents.

- (i) Except for persons who manufacture, process, produce, or initially transfer for sale or distribution gas and aerosol detectors containing radioactive material, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires radioactive material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards provided that detectors containing radioactive material shall have been manufactured, processed, produced, or initially transferred² in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to section 32.26 of 10 CFR Part 32 or a licensing state pursuant to regulations equivalent to Rule 1200-02-10-.13(15) that authorizes the initial transfer of the detectors to persons who are exempt from regulatory requirements. This exemption also covers gas and aerosol detectors manufactured or distributed before the effective date of these rules in accordance with a specific license issued by an Agreement State under comparable provisions to Rule 1200-02-10-.13(15) authorizing distribution to persons exempt from regulatory requirements.
 - (ii) Gas and aerosol detectors previously manufactured and distributed to general licensees in accordance with a specific license issued by an Agreement State shall be considered exempt under Rule 1200-02-10-.04(2)(a)9(i), provided that the device is labeled in accordance with the specific license authorizing distribution of the generally licensed device, and provided further that they meet the requirements of Rule 1200-02-10-.13(15).
 - (iii) Gas and aerosol detectors containing NARM previously manufactured and distributed in accordance with a specific license issued by a Licensing State shall be considered exempt under Rule 1200-02-10-.04(2)(a)9(i), provided that the device is labeled in accordance with the specific license authorizing distribution, and provided further that they meet the requirements of Rule 1200-02-10-.13(15).
10. Self luminous products containing radioactive material.
- (i) Except for persons who manufacture, process, or produce self-luminous products containing tritium, krypton-85, or promethium-147, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns or acquires tritium, krypton-85, promethium-147 in self luminous products manufactured, processed, produced, imported, or transferred in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to Section 32.22 of 10 CFR Part 32, which license authorizes the transfer of the product to persons who are exempt from regulatory requirements.
 - (ii) The exemption in Rule 1200-02-10-.04(2)(a)10(i) does not apply to tritium, krypton-85, or promethium-147 used in products for frivolous purposes or in toys or adornments.
 - (iii) Any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, or owns self luminous products containing less than 0.1 microcurie of radium-226 which were acquired prior to the effective date of this regulation.
11. Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of radioactive material; provided that:
- (i) Each source contains no more than one exempt quantity set forth in Schedule RHS 8-3;
 - (ii) Each instrument contains no more than 10 exempt quantities. For purposes of this part, an instrument's source(s) may contain either one type or different types of radionuclides and an individual exempt quantity may be composed of

fractional parts of one or more of the exempt quantities in Schedule RHS 8-3, provided that the sum of such fractions shall not exceed unity; and

- (iii) For purposes of this part, 0.05 microcuries of americium-241 is considered an exempt quantity under Schedule RHS 8-3.

12. Reserved.

13. Ionization chamber smoke detectors containing not more than 1 microcurie (μCi) of americium-241 per detector in the form of a foil and designed to protect life and property from fires.

- (b) Any person who desires to apply radioactive material to, or to incorporate radioactive material into, the products exempted in subparagraph (a) of this paragraph or who desires to initially transfer for sale or distribution such products containing radioactive material, should apply for a specific license pursuant to 10 CFR 32.14, which license states that the product may be distributed by the licensee to persons exempt from subparagraph (a) of this paragraph.

Subparagraph (a) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (a) shall read as follows:

- (a) Except as provided in (c) through (e) of this paragraph, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires radioactive material in individual quantities each of which does not exceed the applicable quantity set forth in Schedule RHS 8-3.

Subparagraph (b) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) Any person who possesses radioactive material received or acquired before September 25, 1971, under the general license formerly provided in this Chapter is exempt from the requirements for a license set forth in this Chapter to the extent that such person possesses, uses, transfers, or owns such radioactive material.

Subparagraph (e) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by adding subparagraph (e) so that, as amended, subparagraph (e) shall read as follows:

- (e) No person may, for purposes of producing an increased radiation level, combine quantities of radioactive material covered by this exemption so that the aggregate quantity exceeds the limits set forth in Schedule RHS 8-3 in the Appendix to this Chapter, except for radioactive material combined within a device placed in use before May 3, 1999, or as otherwise permitted by the regulations in this Chapter.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 1 of subparagraph (b) of paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the part and substituting the following so that, as amended, part 1 shall read as follows:

1. The general license in subparagraph (a) of this paragraph applies only to radioactive material contained in devices that have been manufactured or initially transferred and labeled in accordance with the specifications contained in:
 - (i) A specific license issued by the Division pursuant to Rule 1200-02-10-.13(5), or
 - (ii) A specific license issued by the U.S. Nuclear Regulatory Commission pursuant to 10 CFR 32.51 or an Agreement State with provisions comparable to Rule

1200-02-10-.13(5).

Subpart (ii) of Part 8 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the subpart, but not its items, and substituting the following so that, as amended, subpart (ii), prior to its items, shall read as follows:

- (ii) Shall within thirty (30) days after the transfer of a device to a specific licensee or export, furnish a report to the Division. The report shall contain:

Subpart (iii) of Part 8 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the subpart and substituting the following so that, as amended, Subpart (iii) shall read as follows:

- (iii) Shall obtain written Division approval before transferring the device to any other specific licensee not specifically identified in subpart (i) of this part. However a holder of a specific license may transfer a device for possession and use under its own specific license without prior approval, if, the holder:
 - (I) Verifies that the specific license authorizes the possession and use, or applies for and obtains an amendment to the license authorizing the possession and use;
 - (II) Removes, alters, covers, or clearly and unambiguously augments the existing label (otherwise required by part 1 of this subparagraph) so that the device is labeled in compliance with Rule 1200-02-05-.113 of these regulations; however the manufacturer, model number, and serial number must be retained;
 - (III) Obtains manufacturer's or initial transferor's information concerning maintenance that would be applicable under the specific license (such as leak testing procedures); and
 - (IV) Reports the transfer under subpart (ii) of this part.

Part 14 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the part and substituting the following so that, as amended, part 14 shall read as follows:

- 14. Shall be subject to the bankruptcy notification requirement in paragraph (7) of Rule 1200-02-10-.16 if holding devices containing radioactive material that meet the following criteria, based on the activity indicated on the label:
 - (i) At least 10 mCi (370MBq) of cesium-137;
 - (ii) At least 0.1 mCi (3.7 MBq) of strontium-90;
 - (iii) At least 1 mCi (37 MBq) of cobalt-60;
 - (iv) At least 1 mCi (37 MBq) of americium-241 or any other transuranic (i.e., element with atomic number greater than uranium (92)); or
 - (v) At least 0.1 mCi (37 MBq) of radium-226.

Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by adding paragraph (8) so that, as amended, paragraph (8) shall read as follows:

- (8) Self Luminous Products Containing Radium-226
 - (a) A general license is hereby issued to any person to acquire, receive, possess, use, or transfer, in accordance with the provisions of subparagraphs (b) through (d) of this paragraph, radium-226

contained in the following products manufactured prior to the effective date of these rules.

1. Antiquities originally intended for use by the general public. For the purposes of this paragraph, antiquities mean products originally intended for use by the general public and distributed in the late 19th and early 20th centuries, such as radium emanator jars, revigators, radium water jars, radon generators, refrigerator cards, radium bath salts, and healing pads.
 2. Intact timepieces containing greater than 0.037 MBq (1 μ Ci), nonintact timepieces, and timepiece hands and dials no longer installed in timepieces.
 3. Luminous items installed in air, marine, or land vehicles.
 4. All other luminous products provided that no more than 100 items are used or stored at the same location at any one time.
 5. Small radium sources containing no more than 0.037 MBq (1 μ Ci) of radium-226. For the purposes of this paragraph, "small radium sources" means discrete survey instrument check sources, sources contained in radiation measuring instruments, sources used in educational demonstrations (such as cloud chambers and spinthariscopes), electron tubes, lightning rods, ionization sources, static eliminators, or as designated by the NRC.
- (b) Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in subparagraph (a) of this paragraph are exempt from the provisions of Chapters 1200-02-04 and 1200-02-05, and Rule 1200-02-10-.26, to the extent that the receipt, possession, use, or transfer of byproduct material is within the terms of the general license; provided, however, that this exemption shall not be deemed to apply to any such person specifically licensed under this Chapter.
- (c) Any person who acquires, receives, possesses, uses, or transfers byproduct material in accordance with the general license in subparagraph (a) of this paragraph shall:
1. Notify the Division should there be any indication of possible damage to the product so that it appears it could result in a loss of the radioactive material (a report containing a brief description of the event, and the remedial action taken, must be furnished to the Division at the address listed in Rule 1200-02-04-.07 within thirty (30) days;
 2. Not abandon products containing radium-226 (the product, and any radioactive material from the product, may only be disposed of according to Rule 1200-02-05-.127 of these regulations or by transfer to a person authorized by a specific license to receive the radium-226 in the product or as otherwise approved by the NRC or an Agreement State;
 3. Not export products containing radium-226 except in accordance with 10 CFR Part 110;
 4. Dispose of products containing radium-226 at a disposal facility authorized to dispose of radioactive material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005, by transfer to a person authorized to receive radium-226 by a specific license issued under this Chapter, or equivalent regulations of the NRC or an Agreement State, or as otherwise approved by the NRC or an Agreement State; and
 5. Respond to written requests from the Division to provide information relating to the general license within thirty (30) calendar days of the date of the request, or other time specified in the request. If the general licensee cannot provide the requested information within the allotted time, it shall, within that same time period, request a longer period to supply the information by providing the Division, by an appropriate method listed in 10 CFR 30.6(a), a written justification for the request.
- (d) The general license in subparagraph (a) of this paragraph does not authorize the manufacture, assembly, disassembly, repair, or import of products containing radium-226, except that

timepieces may be disassembled and repaired.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.11 Filing of Application for Specific Licenses is amended by deleting the Rule in its entirety and substituting the following so that, as amended, Rule 1200-02-10-.11 shall read as follows:

1200-02-10-.11 Filing of Application for Specific Licenses.

- (1) Application for specific licenses shall be filed in duplicate on a form prescribed by the Division.
- (2) The Division may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Division to determine whether the application should be granted or denied or whether a license should be modified or revoked.
- (3) Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on his behalf.
- (4) An application for a license may include a request for a license authorizing one or more activities.
- (5) In his application, the applicant may incorporate by reference information contained in previous applications, statements or reports filed with the Division provided such references are specific.
- (6) Applications and documents submitted to the Division may be made available for public inspection except that the Division may withhold any document or part thereof from public inspection if disclosure of its contents involves proprietary information.
- (7) An application for a specific license to use radioactive material in the form of a sealed source or in a device that contains the sealed source shall either:
 - (a) Identify the source or device by manufacturer and model number as registered with the NRC under 10 CFR 32.210 or with an Agreement State or for a source or a device containing radium-226 or accelerator-produced radioactive material with an Agreement State under provisions comparable to 10 CFR 32.210; or
 - (b) Contain the information identified in 10 CFR 32.210(c).
 - (c) For sources or devices containing naturally occurring or accelerator produced radioactive material manufactured prior to November 30, 2007 that are not registered with the NRC under 10 CFR 32.210 or with an Agreement State, and for which the applicant is unable to provide all categories of information specified in 10 CFR 32.210(c), the applicant must provide:
 1. All available information identified in 10 CFR 32.210(c) concerning the source, and, if applicable, the device; and
 2. Sufficient additional information to demonstrate that there is reasonable assurance that the radiation safety properties of the source or device are adequate to protect health and minimize danger to life and property. Such information must include a description of the source or device, a description of radiation safety features, the intended use and associated operating experience, and the results of a recent leak test.
- (8) An application from a medical facility, educational institution, or Federal facility to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to licensees in its consortium authorized for medical use under Chapter 1200-02-07 or equivalent Agreement State requirements shall include:
 - (a) A request for authorization for the production of PET radionuclides or evidence of an existing license issued under this Chapter or Agreement State requirements for a PET radionuclide production facility within its consortium from which it receives PET radionuclides;

- (b) Evidence that the applicant is qualified to produce radioactive drugs for medical use by meeting one of the criteria in Rule 1200-02-10-.13(10)(a)2;
- (c) Identification of individual(s) authorized to prepare the PET radioactive drugs if the applicant is a pharmacy, and documentation that each individual meets the requirements of an authorized nuclear pharmacist as specified in Rule 1200-02-10-.13(10)(b)2; and
- (d) Information identified in Rule 1200-02-10-.13(10)(a)3 on the PET drugs to be noncommercially transferred to members of its consortium.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (10) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (10) shall read as follows:

- (10) Manufacture, preparation or transfer for commercial distribution of radiopharmaceuticals containing radioactive material for medical use.
 - (a) An application for a specific license to manufacture, prepare, or transfer for commercial distribution radiopharmaceuticals containing radioactive material for use by persons authorized pursuant to Chapter 1200-02-07 will be approved if:
 1. The applicant satisfies the general requirements specified in Rule 1200-02-10-.12;
 2. The applicant submits evidence that the applicant is at least one of the following:
 - (i) Registered or licensed with the U.S. Food and Drug Administration (FDA) as the owner or operator of a drug establishment that engages in the manufacture, preparation, propagation, compounding, or processing of a drug under 21 CFR 207.20(a);
 - (ii) Registered or licensed with a state agency as a drug manufacturer;
 - (iii) Licensed as a pharmacy by the Tennessee Board of Pharmacy;
 - (iv) Operating as a nuclear pharmacy within a Federal medical institution; or
 - (v) A Positron Emission Tomography (PET) drug production facility registered with a state agency.
 3. The applicant submits information on the radionuclide; chemical and physical form; packaging including maximum activity per vial, syringe, generator or other container of the radioactive drug; and shielding provided by the packaging of the radioactive material for safe handling and storage of radiopharmaceuticals by medical use licensees; and
 4. The applicant satisfies the following labeling requirements:
 - (i) A label is affixed to each transport radiation shield, whether it is constructed of lead, glass, plastic or other material, of a radioactive drug to be transferred for commercial distribution. The label shall include the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL"; the name of the radioactive drug or its abbreviation; and the quantity of radioactivity at a specified date and time. For radioactive drugs with a half-life greater than one hundred (100) days, the time may be omitted.
 - (ii) A label is affixed to each syringe, vial or other container used to hold a radioactive drug to be transferred for commercial distribution. The label shall include the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL" and an identifier that ensures that the syringe, vial or other container can be correlated with the

information on the transport radiation shield label.

- (b) A licensee described by subpart (a)2(iii) of this paragraph:
1. May prepare radiopharmaceuticals for medical use, as defined in Rule 1200-02-07-.05, provided that the radiopharmaceuticals are prepared by either an authorized nuclear pharmacist, as specified in parts 2 and 4 of this subparagraph, or an individual under the supervision of an authorized nuclear pharmacist as specified in Rule 1200-02-07-.19.
 2. May allow a pharmacist to work as an authorized nuclear pharmacist if:
 - (i) This individual qualifies as an authorized nuclear pharmacist as defined in Rule 1200-02-07-.05(4),
 - (ii) This individual meets the requirements specified in Rule 1200-02-07-.25(2) and Rule 1200-02-07-.27, and the licensee has received an approved license amendment identifying this individual as an authorized nuclear pharmacist; or
 - (iii) This individual is designated as an authorized nuclear pharmacist in accordance with part 4 of this subparagraph.
 3. The actions authorized in parts 1 and 2 of this subparagraph are permitted in spite of more restrictive language in license conditions.
 4. May designate a pharmacist (as defined in Rule 1200-02-07-.05(24)) as an authorized nuclear pharmacist if:
 - (i) The individual was a nuclear pharmacist preparing only radioactive drugs containing accelerator-produced radioactive material; and
 - (ii) The individual practiced at a pharmacy at a Government agency or Federally recognized Indian Tribe before November 30, 2007 or at all other pharmacies before August 8, 2009, or an earlier date as noticed by the NRC.
 5. Shall provide to the Division a copy of each individual's:
 - (i) Certification by a specialty board whose certification process has been recognized by the Division, U.S. Nuclear Regulatory Commission or an Agreement State as specified in Rule 1200-02-07-.25(1) with the written attestation signed by a preceptor as required by Rule 1200-02-07-.25(2)(b); or
 - (ii) The Division, U.S. Nuclear Regulatory Commission or other Agreement State license; or
 - (iii) NRC master materials licensee permit; or
 - (iv) The permit issued by a licensee or NRC master materials permittee of broad scope or the authorization from a commercial nuclear pharmacy authorized to list its own authorized nuclear pharmacist; or
 - (v) Documentation that only accelerator-produced radioactive materials were used in the practice of nuclear pharmacy at a Government agency or Federally recognized Indian Tribe before November 30, 2007 or at all other locations of use before August 8, 2009, or an earlier date as noticed by the NRC; and
 - (vi) A copy of the state pharmacy licensure or registration, no later than 30 days after the date that the licensee allows, the individual to work as an authorized nuclear pharmacist under subparts 2(i) and (iii) of this subparagraph.
- (c) A licensee shall possess and use instrumentation to measure the radioactivity of radioactive

drugs. The licensee shall have procedures for use of the instrumentation. The licensee shall measure by direct measurement or by combination of measurements and calculations, the amount of radioactivity in dosages of alpha-, beta-, or photon-emitting radioactive drugs before transfer for commercial distribution. In addition, the licensee shall:

1. Perform tests before initial use, periodically and following repair, on each instrument for accuracy, linearity and geometry dependence, as appropriate for the use of the instrument; and make adjustments when necessary; and
 2. Check each instrument for constancy and proper operation at the beginning of each day of use.
- (d) Nothing in this rule relieves the licensee from complying with applicable FDA, other Federal and State requirements governing radioactive drugs.

Paragraph (13) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (13) shall read as follows:

- (13) Manufacture and distribution of radioactive material for certain in vitro clinical or laboratory testing under general license. In addition to the requirements set forth in Rule 1200-02-10-.12, a specific license to manufacture or distribute radioactive material for use under the general license of Rule 1200-02-10-.10(7) will be issued only if:
- (a) The radioactive material is to be prepared for distribution in prepackaged units of:
 1. Iodine-125 in units not exceeding 10 microcuries each.
 2. Iodine-131 in units not exceeding 10 microcuries each.
 3. Carbon-14 in units not exceeding 10 microcuries each.
 4. Hydrogen-3 (tritium) in units not exceeding 50 microcuries each.
 5. Iron-59 in units not exceeding 20 microcuries each.
 6. Cobalt-57 in units not exceeding 10 microcuries each.
 7. Selenium-75 in units not exceeding 10 microcuries each.
 8. Mock Iodine-125 in units not exceeding 0.05 microcurie of iodine-129 and 0.005 microcurie of americium-241 each.
 - (b) Each prepackaged unit bears a durable, clearly visible label:
 1. Identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed 10 microcuries of iodine-131, iodine-125, cobalt-57, selenium-75, or carbon-14; 50 microcuries of hydrogen-3 (tritium); 20 microcuries of iron-59; or Mock Iodine-125 in units not exceeding 0.05 microcurie of iodine-129 and 0.005 microcurie of americium-241 each; and
 2. Displaying the radiation caution symbol described in Rule 1200-02-05-.110 and the words, "Caution, Radioactive Material" and "Not for Internal or External Use in Humans or Animals."
 - (c) The following statement or a substantially similar statement which contains the information called for in the following statement appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure which accompanies the package:
 1. This radioactive material may be received, acquired, possessed and used only by physicians, veterinarians in the practice of veterinary medicine, clinical laboratories or

hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation there from, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into an agreement for the exercise of regulatory authority.

(Name of Manufacturer)

- (d) The label affixed to the unit, or the leaflet or brochure which accompanies the package, contains adequate information as to the precautions to be observed in handling and storing such radioactive material. In the case of the Mock Iodine-125 reference or calibration source, the information accompanying the source must also contain directions to the licensee regarding the waste disposal requirements set out in Rule 1200-02-05-.120.

Paragraph (15) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (15) shall read as follows:

- (15) Incorporation of naturally occurring and accelerator-produced radioactive material into gas and aerosol detectors. An application for a specific license authorizing the incorporation of NARM into gas and aerosol detectors to be distributed to persons exempt under Rule 1200-02-10-.04(2)(a)9 will be approved if the application satisfies requirements equivalent to those contained in Section 32.26 of 10 CFR Part 32. The maximum quantity of radium-226 in each device shall not exceed 0.1 microcurie.

Paragraph (16) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (16) shall read as follows:

- (16) Special requirements for License to Manufacture or initially transfer calibration sources containing americium-241, plutonium or radium-226 for distribution to persons generally licensed under Rule 1200-02-10-.10(4).
- (a) An application for a specific license to manufacture or initially transfer calibration or reference sources containing americium-241, plutonium, or radium-226 for distribution to persons generally licensed under Rule 1200-02-10-.10(4) will be approved if:
1. The applicant satisfies the general requirement of Rule 1200-02-10-.12; and
 2. The applicant submits sufficient information regarding each type of calibration or reference source pertinent to evaluation of the potential radiation exposure, including:
 - (i) Chemical and physical form and maximum quantity of americium 241, plutonium or radium-226 in the source;
 - (ii) Details of construction and design;
 - (iii) Details of the method of incorporation and binding of the americium-241, plutonium or radium-226 in the source;
 - (iv) Procedures for and results of prototype testing of sources, which are designed to contain more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, to demonstrate that the americium-241, plutonium or radium-226 contained in each source will not be released or be removed from the source under normal conditions of use;
 - (v) Details of quality control procedures to be followed in manufacture of the source;
 - (vi) Description of labeling to be affixed to the source or the storage container for the source; and

- (vii) Any additional information, including experimental studies and tests, required by the Division to facilitate a determination of the safety of the source.
 3. Each source will contain no more than 185 kBq (5 μ Ci) of americium-241, plutonium or radium-226.
 4. The Division determines, with respect to any type of source containing more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, that:
 - (i) The method of incorporation and binding of the americium-241, plutonium or radium-226 in the source is such that the americium-241, plutonium or radium-226 will not be released or be removed from the source under normal conditions of use and handling of the source; and
 - (ii) The source has been subjected to and has satisfactorily passed the prototype tests prescribed by subparagraph (b) of this paragraph.
- (b) Schedule C- prototype tests for calibration or reference sources containing americium-241, plutonium or radium-226. An applicant for a license pursuant to subparagraph (a) of this paragraph shall conduct prototype tests for any type of source which is designed to contain more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, in the order listed, on each of five prototypes of such source, which contains more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, as follows:
 1. Initial measurement. The quantity of radioactive material deposited on the source shall be measured by direct counting of the source.
 2. Dry wipe test. The entire radioactive surface of the source shall be wiped with filter paper with the application of moderate finger pressure. Removal of radioactive material from the source shall be determined by measuring the radioactivity on the filter paper or by direct measurement of the radioactivity on the source following the dry wipe.
 3. Wet wipe test. The entire radioactive surface of the source shall be wiped with filter paper, moistened with water, with the application of moderate finger pressure. Removal of radioactive material from the source shall be determined by measuring the radioactivity on the filter paper after it has dried or by direct measurement of the radioactivity on the source following the wet wipe.
 4. Water soak test. The source shall be immersed in water at room temperature for a period of twenty four (24) consecutive hours. The source shall then be removed from the water. Removal of radioactive material from the source shall be determined by direct measurement of the radioactivity on the source after it has dried or by measuring the radioactivity in the residue obtained by evaporation of the water in which the source was immersed.
 5. Dry wipe test. On completion of the preceding test in part 4 of this subparagraph, the dry wipe test described in part 2 of this subparagraph shall be repeated.
 6. Observations. Removal of more than 185 Bq (0.005 μ Ci) of radioactivity in any test prescribed by this subparagraph shall be cause for rejection of the source design. Results of prototype tests submitted to the Division shall be given in terms of radioactivity in microcuries and percent of removal from the total amount of radioactive material deposited on the source.
- (c) Labeling of devices. Each person licensed under subparagraph (a) of this paragraph shall affix to each source, or storage container for the source, a label which shall contain sufficient information relative to safe use and storage of the source and shall include the following statement or a substantially similar statement which contains the information called for in the following statement:

The receipt, possession, use and transfer of this source, Model ____, Serial No. ____, are subject to a general license and the regulations of the NRC or an Agreement State. Do not remove this label.

CAUTION--RADIOACTIVE MATERIAL--
THIS SOURCE CONTAINS AMERICIUM-241 [PLUTONIUM OR RADIUM-226].
DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

Name of manufacturer or initial transferor

- (d) Leak testing of each source. Each person licensed under subparagraph (a) of this paragraph shall perform a dry wipe test upon each source containing more than 3.7 kBq (0.1 µCi) of americium-241, plutonium or radium 226 prior to transferring the source to a general licensee under Rule 1200-02-10-.10(4). This test shall be performed by wiping the entire radioactive surface of the source with a filter paper with the application of moderate finger pressure. The radioactivity on the paper shall be measured by using radiation detection instrumentation capable of detecting 185 Bq (0.005 µCi) of americium-241, plutonium, or radium-226. If any such test discloses more than 185 Bq (0.005 µCi) of radioactive material, the source shall be deemed to be leaking or losing americium-241, plutonium or radium-226 and shall not be transferred to a general licensee under Rule 1200-02-10-.10(4) or equivalent regulations of the NRC or an Agreement State.

Table 7-2 of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the table in its entirety and substituting the following so that, as amended, Table 7-2 will read as follows:

Table RHS 7-2 Quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release.

Radioactive material ¹	Release fraction	Quantity (curies)	Radioactive material ¹	Release fraction	Quantity (curies)
Actinium-228	0.001	4,000	Hafnium-181	0.01	7,000
Americium-241	0.001	2	Holmium-166m	0.01	100
Americium-242	0.001	2	Hydrogen-3	0.5	20,000
Americium-243	0.001	2	Iodine-125	0.5	10
Antimony-124	0.01	4,000	Iodine-131	0.5	10
Antimony-126	0.01	6,000	Indium-114m	0.01	1,000
Barium-133	0.01	10,000	Iridium-192	0.001	40,000
Barium-140	0.01	30,000	Iron-55	0.01	40,000
Bismuth-207	0.01	5,000	Iron-59	0.01	7,000
Bismuth-210	0.01	600	Krypton-85	1.0	6,000,000
Cadmium-109	0.01	1,000	Lead-210	0.01	8
Cadmium-113	0.01	80	Manganese-56	0.01	60,000
Calcium-45	0.01	20,000	Mercury-203	0.01	10,000
Californium-252	0.001	9 (20 mg)	Molybdenum-99	0.01	30,000
Carbon-14	0.01	50,000	Neptunium-237	0.001	2
Cerium-141	0.01	10,000	Nickel-63	0.01	20,000
Cerium-144	0.01	300	Niobium-94	0.01	300
Cesium-134	0.01	2,000	Phosphorus-32	0.5	100
Cesium-137	0.01	3,000	Phosphorus-33	0.5	1,000
Chlorine-36	0.5	100	Polonium-210	0.01	10
Chromium-51	0.01	300,000	Potassium-42	0.01	9,000
Cobalt-60	0.001	5,000	Promethium-145	0.01	4,000
Copper-64	0.01	200,000	Promethium-147	0.01	4,000
Curium-242	0.001	60	Radium-226	0.001	100
Curium-243	0.001	3	Ruthenium-106	0.01	200
Curium-244	0.001	4	Samarium-151	0.01	4,000
Curium-245	0.001	2	Scandium-46	0.01	3,000
Europium-152	0.01	500	Selenium-75	0.01	10,000
Europium-154	0.01	400	Silver-110m	0.01	1,000
Europium-155	0.01	3,000	Sodium-22	0.01	9,000
Germanium-68	0.01	2,000	Sodium-24	0.01	10,000
Gadolinium-153	0.01	5,000	Strontium-89	0.01	3,000
Gold-198	0.01	30,000	Strontium-90	0.01	90
Hafnium-172	0.01	400			

Sulfur-35	0.5	900	Zirconium-93	0.01	400
Technetium-99	0.01	10,000	Zirconium-95	0.01	5,000
Technetium-99m	0.01	400,000	Any other beta-gamma emitter	0.01	10,000
Tellurium-127m	0.01	5,000	Mixed fission products	0.01	1,000
Tellurium-129m	0.01	5,000	Mixed corrosion products	0.01	10,000
Terbium-160	0.01	4,000	Contaminated equipment beta-gamma	0.001	10,000
Thulium-170	0.01	4,000	Irradiated material, any form other than solid noncombustible	0.01	1,000
Tin-113	0.01	10,000	Irradiated material, solid noncombustible	0.001	10,000
Tin-123	0.01	3,000	Mixed radioactive waste, beta-gamma	0.01	1,000
Tin-126	0.01	1,000	Packaged mixed waste, beta-gamma ²	0.001	10,000
Titanium-44	0.01	100	Any other alpha emitter	0.001	2
Vanadium-48	0.01	7,000	Contaminated equipment, alpha	0.0001	20
Xenon-133	1.0	900,000	Packaged waste, alpha ²	0.0001	20
Yttrium-91	0.01	2,000	Combinations of radioactive materials listed above ¹		
Zinc-65	0.01	5,000			

¹ For combinations of radioactive materials, consideration of the need for an emergency plan is required if the sum of the ratios of the quantity of each radioactive material authorized to the quantity listed for that material in Table RHS 7-2 exceeds one.

² Waste packaged in Type B containers does not require an emergency plan.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.16 Specific Terms and Conditions of Licenses is amended by deleting the Rule in its entirety and substituting the following so that, as amended, Rule 1200-02-10-.16 shall read as follows:

- (1) Each license issued pursuant to this Chapter shall be subject to all provisions of the Act, now or hereafter in effect, and to all rules, regulations, and orders of the Division.
- (2) Neither the license nor any right under the license shall be assigned or otherwise transferred in violation of the provisions of the Act.
- (3) Each person licensed by the Division pursuant to this Chapter shall confine his use and possession of the material licensed to the locations and purposes authorized in the license.
- (4) Each licensee authorized under Rule 1200-02-10-.13(5) to distribute certain devices to generally licensed persons shall:
 - (a) Report to the Division within thirty (30) days after the end of each calendar quarter all transfers of such devices to persons generally licensed under Rule 1200-02-10-.10(2) or, if no transfers have been made during the reporting period, the report shall so indicate. For all transfers the report shall identify each general licensee by name and address, an individual by name and/or position who may constitute a point of contact between the Division and the general licensee, the type and model number of device transferred and the quantity and type of radioactive material contained in the device; and
 - (b) Furnish to each general licensee in this State to whom he transfers such device a copy of the general license contained in Rule 1200-02-10-.10(2).
- (5) Each specific licensee shall notify the Division in writing when the licensee decides to permanently discontinue all activities involving radioactive materials authorized under the license.
- (6) Each licensee preparing technetium-99m radiopharmaceuticals from molybdenum-99/technetium-99m generators or rubidium-82 from strontium-82/rubidium-82 generators shall test the generator eluates for molybdenum-99 breakthrough or strontium-82 and strontium-85 contamination, respectively, in accordance with Rule 1200-02-07-.41. The licensee shall record the results of each test and retain each record for three (3) years after the record is made.
- (7) Each specific licensee and each general licensee meeting the criteria of Rule 1200-02-10-.10(2)(c)14 shall:
 - (a) Provide the Division written notification, at the address in Rule 1200-02-04-.07, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code (U.S.C.):
 1. By or against the licensee;
 2. By or against an entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or
 3. By or against an affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee;
 - (b) Include in the notification required in subparagraph (a) of this paragraph the bankruptcy court in which the petition for bankruptcy was filed; and
 - (c) Include in the notification required in subparagraph (a) of this paragraph the date of the filing of the petition.

- (8) When temporary job-sites are authorized on a specific license, radioactive material may be used at temporary job-sites, in areas not under exclusive federal jurisdiction, throughout the State of Tennessee.
- (9) Each portable gauge licensee shall use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal, whenever portable gauges are not under the control and constant surveillance of the licensee.
- (10) (a) Authorization under Rule 1200-02-10-.11(8) to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to medical use licensees in its consortium does not relieve the licensee from complying with applicable FDA, other Federal, and Agreement State requirements governing radioactive drugs.
- (b) Each licensee authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall:
 - 1. Satisfy the labeling requirements in Rule 1200-02-10-.13(10)(a)4 for each PET radioactive drug transport radiation shield and each syringe, vial, or other container used to hold a PET radioactive drug intended for noncommercial distribution to members of its consortium; and
 - 2. Possess and use instrumentation to measure the radioactivity of the PET radioactive drugs intended for noncommercial distribution to members of its consortium and meet the procedural, radioactivity measurement, instrument test, instrument check, and instrument adjustment requirements in Rule 1200-02-10-.13(10)(c).
- (c) A licensee that is a pharmacy authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall require that any individual that prepares PET radioactive drugs shall be:
 - 1. An authorized nuclear pharmacist that meets the requirements in Rule 1200-02-10-.13(10)(b)2, or
 - 2. An individual under the supervision of an authorized nuclear pharmacist as specified in Rule 1200-02-07-.19.
- (d) A pharmacy, authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium that allows an individual to work as an authorized nuclear pharmacist, shall meet the requirements of Rule 1200-02-10-.13(10)(b)5.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.29 Reciprocal Recognition of Licenses is amended by adding paragraphs (4) and (5) to read as follows:

- (4) Before radioactive materials can be used at a temporary job site within the State at any Federal facility, the jurisdictional status of the job site shall be determined. If the jurisdictional status is unknown, the Federal agency should be contacted to determine if the job site is under exclusive Federal jurisdiction.
 - (a) In areas of exclusive Federal jurisdiction, the general license is subject to all the applicable rules, regulations, orders and fees of the NRC, and
 - (b) Authorizations for use of radioactive materials at job sites under exclusive Federal jurisdiction shall be obtained from the NRC by either:
 - 1. Filing a NRC Form-241 in accordance with 10 CFR 150.20(b); or
 - 2. By applying for a specific NRC license.

- (5) Before radioactive material can be used at a temporary job site in another State, authorization shall be obtained for the State if it is an Agreement State, or from the NRC for any non-Agreement State, either by filing for reciprocity or applying for a specific license.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-11
Licensing Requirements for Land Disposal of Radioactive Waste

Amendments

Subparagraph (c) of paragraph (1) of Rule 1200-02-11-.14 Transfer of License is amended by adding the words “, required by Rule 1200-02-11-.19(1)(e) and (f),” between the words “care” and “will” so that, as amended, subparagraph (c) shall read as follows:

- (c) That any funds and necessary records for care, required by Rules 1200-02-11-.19(1)(e) and (f), will be transferred to the disposal site owner;

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

I certify that this is an accurate and complete copy of rulemaking hearing rules, lawfully promulgated and adopted by the Commissioner on _____, and is in compliance with the provisions of TCA 4-5-222.

I further certify the following:

Notice of Rulemaking Hearing filed with the Department of State on: 12/20/10

Rulemaking Hearing(s) Conducted on: (add more dates). 02/22/11

Date: 6-2-11

Signature: Robert J. Martineau, Jr.

Name of Officer: Robert J. Martineau, Jr.

Title of Officer: Commissioner



Subscribed and sworn to before me on: June 2, 2011

Notary Public Signature: Freda Crutchfield

My commission expires on: May 8, 2012

All rulemaking hearing rules provided for herein have been examined by the Attorney General and Reporter of the State of Tennessee and are approved as to legality pursuant to the provisions of the Administrative Procedures Act, Tennessee Code Annotated, Title 4, Chapter 5.

Robert E. Cooper, Jr.

Robert E. Cooper, Jr.

Attorney General and Reporter

8-26-11

Date

Department of State Use Only

Filed with the Department of State on: 9/9/11

Effective on: 12/8/11

Tre Hargett by Morn Hunt, POA

Tre Hargett
Secretary of State

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2011 SEP -9 AM 8:20
SECRETARY OF STATE
PUBLICATIONS

Public Hearing Comments

One copy of a document containing responses to comments made at the public hearing must accompany the filing pursuant to T.C.A. §4-5-222. Agencies shall include only their responses to public hearing comments, which can be summarized. No letters of inquiry from parties questioning the rule will be accepted. When no comments are received at the public hearing, the agency need only draft a memorandum stating such and include it with the Rulemaking Hearing Rule filing. Minutes of the meeting will not be accepted. Transcripts are not acceptable.

Comment: Does the amended Rule 1200-02-05-.50(3) preserve the calculations as approved by the state concerning specials, heart cath, etc.?

Response: Yes, the amended rule will allow licensees or registrants to substitute "effective dose equivalent (EDE)" for "deep-dose equivalent (DDE)" for external exposures.

Comment: Rule 1200-02-05-.142(2)(a) should be eliminated or changed to 500 mrem/5 rem.

Response: The Department must adopt Rule 1200-02-05-.142 to stay compatible with the NRC.

Comment: You have defined "cyclotron" as a device that operates over 10 MeV. Most commercial cyclotrons operated for PET radiopharmaceutical production are able to operate at higher-than-needed 11 MeV for historical reasons. Some new lower energy (7.5 MeV) ones being developed are adequate energy, but physically much smaller, and aimed at medical institutions who desire to produce their own for onsite use. You may want to reconsider the energy limit in your definition.

Response: The Department agrees. The definition of cyclotron will be changed to "a particle accelerator in which the charged particles travel in an outward spiral or circular path. A cyclotron accelerates charged particles and is commonly used for production of short half-life radionuclides for medical or veterinary use."

Comment: The definition of accelerator in Rule 1200-02-09-.03 differs from the new definition of particle accelerator in Rule 1200-02-04-.04.

Response: The definition of particle accelerator in Rule 1200-02-04-.04 will be amended to be identical to the definition of accelerator in Rule 1200-02-09-.03.

Comments: The citations at the end of Part 2 and Part 3 of Rule 1200-02-07-.48(1)(c) should be separated by "or" instead of "and".

Response: The Department agrees.

Comments: In subparagraph (16)(a) of Rule 1200-02-10-.13, the "and" between "calibration" and "reference" should be changed to "or".

Response: The Department agrees.

Regulatory Flexibility Addendum

Pursuant to T.C.A. § 4-5-401 through 4-5-404, prior to initiating the rule making process as described in T.C.A. § 4-5-202(a)(3) and T.C.A. § 4-5-202(a), all agencies shall conduct a review of whether a proposed rule or rule affects small businesses.

(If applicable, insert Regulatory Flexibility Addendum here)

Chapters 1200-02-04, 1200-02-05, 1200-02-07, 1200-02-10, and 1200-02-11 are being amended so they will substantially codify 10 CFR Parts 19, 20, 30, 31, 32, 33, 35, 61, and 150 of the regulations of the Nuclear Regulatory Commission ("NRC"). These amendments are consistent with the NRC approved state suggested regulations.

Impact on Local Governments

Pursuant to T.C.A. 4-5-220 and 4-5-228 "any rule proposed to be promulgated shall state in a simple declarative sentence, without additional comments on the merits of the policy of the rules or regulation, whether the rule or regulation may have a projected impact on local governments." (See Public Chapter Number 1070 (<http://state.tn.us/sos/acts/106/pub/pc1070.pdf>) of the 2010 Session of the General Assembly)

The Department does not anticipate that these amended rules will have a financial impact on local governments.

Additional Information Required by Joint Government Operations Committee

All agencies, upon filing a rule, must also submit the following pursuant to TCA 4-5-226(i)(1).

- (A) A brief summary of the rule and a description of all relevant changes in previous regulations effectuated by such rule;

Chapters 1200-02-04, 1200-02-05, 1200-02-07, 1200-02-10 and 1200-02-11 are being amended so that they will substantially codify 10 CFR Parts 19, 20, 30, 31, 32, 33, 35, 61, and 150 of the Nuclear Regulatory Commission's ("NRC") Regulations. These amendments are consistent with the NRC's approved suggested state regulations. Its various additions and modifications will incorporate:

- a. Security requirements for portable gauges;
- b. Changes in reporting requirements for licensees distributing radioactive material to persons exempt from licensing and the modification of transferring general licenses;
- c. Expanding the definition of byproduct material to include discrete sources of radium-226, accelerator-produced radioactive material, and discrete sources of naturally occurring radioactive material as required by the Energy Policy Act of 2005;
- d. Provide a regulatory framework for licensing and regulating aforementioned byproduct material;
- e. Revising rules related to occupational dose records; and
- f. Authorized user clarification for medical use of radioactive material.

- (B) A citation to and brief description of any federal law or regulation or any state law or regulation mandating promulgation of such rule or establishing guidelines relevant thereto;

These rules are promulgated under the authorities of T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

- (C) Identification of persons, organizations, corporations or governmental entities most directly affected by this rule, and whether those persons, organizations, corporations or governmental entities urge adoption or rejection of this rule;

All licensees and registrants will be affected by these amendments. Comments from these entities did not contain any major rejection of the proposed rules but did contain suggested changes in the proposed language or sought additional clarification. The U.S. Nuclear Regulatory Commission's changes to 10 CFR and the adoption by Tennessee and other Agreement States of compatible changes represent the implementation of national standards.

- (D) Identification of any opinions of the attorney general and reporter or any judicial ruling that directly relates to the rule;

The Department is not aware of any.

- (E) An estimate of the probable increase or decrease in state and local government revenues and expenditures, if any, resulting from the promulgation of this rule, and assumptions and reasoning upon which the estimate is based. An agency shall not state that the fiscal impact is minimal if the fiscal impact is more than two percent (2%) of the agency's annual budget or five hundred thousand dollars (\$500,000), whichever is less;

There should be no increase or decrease in state or local government revenues or expenditures resulting from the promulgation of these amendments.

- (F) Identification of the appropriate agency representative or representatives, possessing substantial knowledge and understanding of the rule;

Beth Murphy
Division of Radiological Health
3rd Floor L & C Tower 401 Church Street
Nashville, Tennessee 37243-1532

- (G) Identification of the appropriate agency representative or representatives who will explain the rule at a scheduled meeting of the committees;

Alan M. Leiserson
Legal Services Director
Office of General Counsel

- (H) Office address, telephone number, and email address of the agency representative or representatives who will explain the rule at a scheduled meeting of the committees; and

Office of General Counsel
Tennessee Department of Environment and Conservation
20th Floor L & C Tower
Nashville, Tennessee 37243-1548
(615) 532-0131
Alan.Leiserson@tn.gov

- (I) Any additional information relevant to the rule proposed for continuation that the committee requests.

The Department is not aware of any.

Department of State
 Division of Publications
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 Nashville, TN 37243
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 Fax: 615-741-5133
 Email: register.information@tn.gov

For Department of State Use Only

Sequence Number: DEDLWE
 Rule ID(s): _____
 File Date: _____
 Effective Date: _____

Rulemaking Hearing Rule(s) Filing Form

Rulemaking Hearing Rules are rules filed after and as a result of a rulemaking hearing. TCA Section 4-5-205

Agency/Board/Commission:	Environment and Conservation
Division:	Radiological Health
Contact Person:	Beth Murphy
Address:	3 rd Floor L&C Annex 401 Church Street Nashville, Tennessee
Zip:	37243-1532
Phone:	(615) 532-0392
Email:	beth.murphy@tn.gov

Revision Type (check all that apply):

- Amendment
 New
 Repeal

Rule(s) Revised (ALL chapters and rules contained in filing must be listed here. If needed, copy and paste additional tables to accommodate multiple chapters. Please enter only **ONE** Rule Number/Rule Title per row)

Chapter Number	Chapter Title
1200-02-04	General Provisions
Rule Number	Rule Title
1200-02-04-.04	Definitions

Chapter Number	Chapter Title
1200-02-05	Standards for Protection Against Radiation
Rule Number	Rule Title
1200-02-05-.32	Definitions
1200-02-05-.50	Occupational Dose Limits for Adults
1200-02-05-.120	General Disposal Requirements
1200-02-05-.125	Transfer for Disposal and Manifests
1200-02-05-.127	Disposal of Certain Byproduct Material
1200-02-05-.142	Reports to Individuals of Exposure to Radiation
1200-02-05-.146	Reports to Individuals of Exceeding Dose Limits
1200-02-05-.161	Schedules

Chapter Number	Chapter Title
1200-02-07	Use of Radionuclides in the Healing Arts
Rule Number	Rule Title
1200-02-07-.05	Definitions
1200-02-07-.14	Notifications
1200-02-07-.15	Exemptions Regarding Specific Licenses of Broad Scope

1200-02-07-.23	Training of Radiation Safety Officer
1200-02-07-.24	Training for Authorized Medical Physicist
1200-02-07-.26	Training for Experienced Radiation Safety Officer, Teletherapy or Medical Physicist, Authorized User, and Nuclear Pharmacist
1200-02-07-.30	Determination of Dosages of Unsealed Radioactive Material for Medical Use
1200-02-07-.38	Use of Unsealed Radioactive Material for Uptake, Dilution, and Excretion Studies for Which a Written Directive is Not Required
1200-02-07-.39	Training for Uptake, Dilution, and Excretion Studies
1200-02-07-.40	Use of Unsealed Radioactive Material for Imaging and Localization Studies for Which a Written Directive is Not Required
1200-02-07-.41	Radionuclide Contaminants
1200-02-07-.43	Training for Imaging and Localization Studies
1200-02-07-.44	Use of Unsealed Radioactive Material for Which a Written Directive is Required
1200-02-07-.47	Training for Use of Unsealed Radioactive Material for Which a Written Directive is Required
1200-02-07-.48	Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries)
1200-02-07-.49	Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less greater than 1.22 Gigabecquerels (33 Millicuries)
1200-02-07-.50	Training for the Parenteral Administration of Unsealed Radioactive Material Requiring a Written Directive
1200-02-07-.59	Training for Use of Manual Brachytherapy Sources
1200-02-07-.60	Training for Ophthalmic Use of Strontium-90
1200-02-07-.80	Training for Use of Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units

Chapter Number	Chapter Title
1200-02-10	Licensing and Registration
Rule Number	Rule Title
1200-02-10-.02	Scope
1200-02-10-.04	Exemptions: Radioactive Materials Other Than Source Material
1200-02-10-.10	General Licenses - Radioactive Material Other Than Source Material
1200-02-10-.11	Filing of Application for Specific Licenses
1200-02-10-.13	Special Requirements for Issuance of Specific Licenses
1200-02-10-.16	Specific Terms and Conditions of Licenses
1200-02-10-.29	Reciprocal Recognition of Licenses

Chapter Number	Chapter Title
1200-02-11	Licensing Requirements for Land Disposal of Radioactive Waste
Rule Number	Rule Title
1200-02-11-.14	Transfer of License

(Place substance of rules and other info here. Statutory authority must be given for each rule change. For information on formatting rules go to <http://state.tn.us/sos/rules/1360/1360.htm>)

Chapter 1200-02-04
General Provisions

Amendments

Subparagraph (b) of Paragraph (1) of Rule 1200-02-04-.04 Definitions is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) 'Accelerator-produced **radioactive material**' means any material made radioactive by ~~an~~ a particle accelerator.

Subparagraph (ooo) of Paragraph (1) of Rule 1200-02-04-.04 Definitions is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (ooo) shall read as follows:

- (ooo) 'Waste' means those low-level radioactive wastes containing **radioactive materials source, special nuclear, or byproduct material** that are acceptable for disposal at a land disposal facility. For the purposes of this definition, low-level waste is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel or byproduct material as defined in ~~Section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste)~~ subparagraphs (11)(b), (11)(c), and (11)(d) of Rule 1200-02-05-.32.

Paragraph (1) of Rule 1200-02-04-.04 Definitions is amended by adding new subparagraphs (hhhh) through (jjjj) so that subparagraphs (hhhh) through (jjjj) shall read as follows:

- (hhhh) 'Consortium' means an association of medical use licensees and a PET radionuclide production facility in the same geographical area that jointly own or share in the operation and maintenance cost of the PET radionuclide production facility that produces PET radionuclides for use in producing radioactive drugs within the consortium for noncommercial distributions among its associated members for medical use. The PET radionuclide production facility within the consortium must be located at an educational institution or a Federal facility or a medical facility.
- (iiii) 'Cyclotron' means a particle accelerator in which the charged particles travel in an outward spiral or circular path. A cyclotron accelerates charged particles and is commonly used for production of short half-life radionuclides for medical or veterinary use.
- (jjjj) 'Discrete source' means a radionuclide that has been processed so that its concentration within a material has been purposely increased for use for commercial, medical, or research activities.
- (kkkk) 'Particle accelerator' means any device used to impact kinetic energy to electrically charged particles including but not limited to electrons, protons, deuterons, and helium ions. For the purpose of these regulations "accelerator" includes equipment designed for and used only for the production of x-rays of 0.9 MeV or greater and equipment capable of discharging nuclear particles into a medium external to the accelerating device. For purposes of this definition, "accelerator" is an equivalent term.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-05
Standards for Protection Against Radiation

Amendments

Paragraph (11) of Rule 1200-02-05-.32 Definitions is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (11) shall read as follows:

- (11) Byproduct material ~~refers to~~ means:
- (a) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;
 - (b) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;
 - (c) 1. Any discrete source of radium-226 that is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; or

2. Any material that—
 - (i) Has been made radioactive by use of a particle accelerator; and
 - (ii) Is produced, extracted, or converted after extraction for use for a commercial, medical, or research activity; and
- (d) Any discrete source of naturally occurring radioactive material, other than source material, that—
 1. The Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and
 2. Is extracted or converted after extraction for use in a commercial, medical, or research activity.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (3) of Rule 1200-02-05-.50 Occupational Dose Limits for Adults is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (3) shall read as follows:

- (3) When external exposure is determined by measurement with an external personal monitoring device, the deep-dose equivalent must be used in place of the effective dose equivalent, unless the effective dose equivalent is determined by a dosimetry method approved by the Division or by the Nuclear Regulatory Commission. The assigned deep-dose equivalent shall be for the part of the body receiving the highest exposure. The assigned shallow-dose equivalent shall be the dose averaged over the contiguous 10 cm ² of skin receiving the highest exposure. Deep-dose, lens-dose and shallow-dose equivalents may be assessed from surveys or other radiation measurements to demonstrate compliance with occupational dose limits. However, this may be done only if the individual monitoring device was not subject to the highest potential exposure, or the individual monitoring results are unavailable.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (d) of paragraph (1) of Rule 1200-02-05-.120 General Disposal Requirements is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (d) shall read as follows:

- (d) As authorized under Rule 1200-02-05-.121, 1200-02-05-.122, 1200-02-05-.123, ~~or~~ 1200-02-05-.124 or 1200-02-05-.127.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-05-.125 Transfer for Disposal and Manifests is amended by adding paragraph (5) to the rule to read as follows:

- (5) Any licensee shipping byproduct material as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 1200-02-05-.32(11) intended for ultimate disposal at a land disposal facility licensed under Chapter 1200-02-11 shall document the information required on the NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee as specified in Schedule RHS 8-33.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (2) of Rule 1200-02-05-.142 Reports to Individuals of Exposure to Radiation is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (2) shall read as follows:

- (2) Each licensee or registrant, ~~at the request of any worker, shall advise such worker annually of the worker's exposure to sources of radiation as shown in records maintained by the licensee or registrant~~

~~pursuant to Rule 1200-02-05-.135.~~ shall make dose information available to workers as shown in records maintained by the licensee or registrant under the provisions of Rule 1200-02-05-.135. The licensee shall provide an annual report to each individual monitored under Rule 1200-02-05-.71 of the dose received in that monitoring year if:

- (a) The individual's occupational dose exceeds 1 mSv (100 mrem) TEDE or 1 mSv (100 mrem) to any individual organ or tissue; or
- (b) The individual requests his or her annual dose report.

Paragraph (4) of Rule 1200-02-05-.142 Reports to Individuals of Exposure to Radiation is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (4) shall read as follows:

- (4) When a licensee or registrant is required under Rule ~~1200-02-05-.141~~, 1200-02-05-.143, or 1200-02-05-.144 to report to the Division any exposure of an ~~identified occupationally exposed individual or an identified member of the public to sources of~~ to radiation or radioactive material, the licensee or registrant shall also provide a copy of the report submitted to the Division to the individual. Such report shall be transmitted at a time not later than the transmittal to the Division.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Schedule RHS 8-30 of Rule 1200-02-05-.161 Schedules is amended by deleting the table and substituting the following so that, as amended, Schedule RHS 8-30 shall read as follows:

RHS 8-30

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 μm , micron, and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks, or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times for D if less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days. The class (D, W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table I, columns 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 systems.

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 schedule captioned, "Oral Ingestion ALI," "Inhalation," "ALI," and "DAC," are applicable to occupational exposure to radioactive material.

The ALIs in this schedule are the annual intakes of a given radionuclide by the reference man, which would result in either a committed effective dose equivalent (CEDE) of 0.05 Sv (5 rem), stochastic ALI, or 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 1200-02-05-.32. The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of $w_T = 0.06$ is applicable to each of the five 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 four separate organs.

Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the CEDE 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:

1. LLI wall = lower large intestine wall;
2. St wall = stomach wall;
3. Blad wall = bladder wall; and
4. 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, the use of that non-stochastic ALI is considered unduly conservative, the licensee or registrant may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee or registrant 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 (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, $\sum (\text{intake [in } \mu\text{Ci] of each radionuclide}/ALI_{ns}) \leq 1.0$. 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

$$DAC = \frac{ALI \text{ (in } \mu\text{Ci)}}{(2000 \text{ hrs / working yr} \times 60 \text{ min/hr} \times 2 \times 10^4 \text{ ml / min})}$$

$$= \frac{ALI}{2.4 \times 10^7} \mu\text{Ci/ml}$$

exposures. The relationship between the DAC and the ALI is given by:

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

The DAC values relate to one of two 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 ingrowth 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 1200-02-05-.51. When an individual is exposed to radioactive materials, which 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 radioisotopes. 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 schedule captioned "Air" and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of 1200-02-05-.61. 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, as was the case in the previous Schedule RHS 8-1.

The air concentration values listed in Table II, Column 1 were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhalation ALI was divided by 2.4×10^9 , 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 1mSv (0.1 rem) limit for members of the public; a factor of three 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 two 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 per year to full-time exposure (8,760 hours per year). Note that an additional factor of two 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 the reference man.

Note 2 of this schedule 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 1200-02-05-.122. 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 a 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	Name	Symbol	Atomic Number
Actinium	Ac	89	Molybdenum	Mo	42
Aluminum	Al	13	Neodymium	Nd	60
Americium	Am	95	Neptunium	Np	93
Antimony	Sb	51	Nickel	Ni	28
Argon	Ar	18	Niobium	Nb	41
Arsenic	As	33	Nitrogen	N	7
Astatine	At	85	Osmium	Os	76
Barium	Ba	56	Oxygen	O	8
Berkelium	Bk	97	Palladium	Pd	46
Beryllium	Be	4	Phosphorus	P	15
Bismuth	Bi	83	Platinum	Pt	78
Bromine	Br	35	Plutonium	Pu	94
Cadmium	Cd	48	Polonium	Po	84
Calcium	Ca	20	Potassium	K	19
Californium	Cf	98	Praseodymium	Pr	59
Carbon	C	6	Promethium	Pm	61
Cerium	Ce	58	Protactinium	Pa	91
Cesium	Cs	55	Radium	Ra	88
Chlorine	Cl	17	Radon	Rn	86
Chromium	Cr	24	Rhenium	Re	75
Cobalt	Co	27	Rhodium	Rh	45
Copper	Cu	29	Rubidium	Rb	37
Curium	Cm	96	Ruthenium	Ru	44
Dysprosium	Dy	66	Samarium	Sm	62
Einsteinium	Es	99	Scandium	Sc	21
Erbium	Er	68	Selenium	Se	34
Europium	Eu	63	Silicon	Si	14
Fermium	Fm	100	Silver	Ag	47
Fluorine	F	9	Sodium	Na	11
Francium	Fr	87	Strontium	Sr	38
Gadolinium	Gd	64	Sulfur	S	16
Gallium	Ga	31	Tantalum	Ta	73
Germanium	Ge	32	Technetium	Tc	43
Gold	Au	79	Tellurium	Te	52
Hafnium	Hf	72	Terbium	Tb	65
Holmium	Ho	67	Thallium	Tl	81
Hydrogen	H	1	Thorium	Th	90
Indium	In	49	Thulium	Tm	69
Iodine	I	53	Tin	Sn	50
Iridium	Ir	77	Titanium	Ti	22
Iron	Fe	26	Tungsten	W	74
Mercury	Hg	80	Uranium	U	92
Krypton	Kr	36	Vanadium	V	23
Lanthanum	La	57	Xenon	Xe	54
Lead	Pb	82	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
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 ¹ : Use above values as HT and T ₂ oxidize in air and 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 ²	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
7	Nitrogen-13 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
8	Oxygen-15 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
9	Fluorine-18 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-
14	Silicon-32	D, see ^{31}Si	2E+3	2E+2	1E-7	3E-10	-	-
		LLI wall (3E+3)	-	-	-	-	4E-5	4E-4
		W, see ^{31}Si	-	1E+2	5E-8	2E-10	-	-
		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	2E+4	7E-6	2E-8	-	-
		LLI wall (8E+3)	-	-	-	-	1E-4	1E-3
		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	-	-	-	-	-
			-	2E+3	9E-7	3E-9	-	-
17	Chlorine-36	D, chlorides of H, Li, Na, K, Rb, Cs, and Fr	2E+3	2E+3	1E-6	3E-9	2E-5	2E-4
		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+2	1E-7	3E-10	-	-
17	Chlorine-38 ²	D, see ^{36}Cl	2E+4	4E+4	2E-5	6E-8	-	-
		St wall (3E+4)	-	-	-	-	3E-4	3E-3
		W, see ^{36}Cl	-	5E+4	2E-5	6E-8	-	-
17	Chlorine-39 ²	D, see ^{36}Cl	2E+4	5E+4	2E-5	7E-8	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
		W, see ^{36}Cl	-	6E+4	2E-5	8E-8	-	-
18	Argon-37	Submersion ¹	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion ¹	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion ¹	-	-	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
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8	9E-5	9E-4
19	Potassium-44 ²	D, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
19	Potassium-45 ²	D, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
		St wall (5E+4)	-	-	-	-	7E-4	7E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
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 ²	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 ₃	-	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 ²	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 ²	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	-	-
24	Chromium-51	D, see ⁴⁸ Cr	4E+4	5E+4	2E-5	6E-8	5E-4	5E-3
		W, see ⁴⁸ Cr	-	2E+4	1E-5	3E-8	-	-
		Y, see ⁴⁸ Cr	-	2E+4	8E-6	3E-8	-	-
25	Manganese-51 ²	D, all compounds except those given for W	2E+4	5E+4	2E-5	7E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	8E-8	-	-
25	Manganese-52m ²	D, see ⁵¹ Mn	3E+4	9E+4	4E-5	1E-7	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
		W, see ⁵¹ Mn	-	1E+5	4E-5	1E-7	-	-

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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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	-	2E+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	-	-
29	Copper-60 ²	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	-	-
29	Copper-61	Y, oxides and hydroxides	-	1E+5	4E-5	1E-7	-	-
		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	-	-
29	Copper-64	Y, see ^{60}Cu	-	4E+4	1E-5	5E-8	-	-
		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	-	-
29	Copper-67	Y, see ^{60}Cu	-	2E+4	9E-6	3E-8	-	-
		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	-	-
30	Zinc-62	Y, see ^{60}Cu	-	5E+3	2E-6	6E-9	-	-
		Y, all compounds	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		D, see ^{60}Cu	5E+3	8E+3	3E-6	1E-8	6E-5	6E-4
30	Zinc-63 ²	Y, all compounds	2E+4	7E+4	3E-5	9E-8	-	-
		St wall (3E+4)	-	-	-	-	3E-4	3E-3
		W, see ^{60}Cu	-	2E+4	1E-5	3E-8	-	-
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 ²	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 ²	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 ²	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 ²	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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
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 ²	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 ²	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	-	-
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 ²	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 ²	W, all compounds	3E+4	1E+5	5E-5	2E-7	-	-
		St wall (4E+4)	-	-	-	-	6E-4	6E-3
33	Arsenic-70 ²	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 ²	W, all compounds	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
34	Selenium-70 ²	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 ²	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 ²	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 ²	D, see ^{70}Se	6E+4	2E+5	9E-5	3E-7	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			St wall (8E+4)	-	-	-	1E-3	1E-2
		W, see ^{70}Se	-	2E+5	1E-4	3E-7	-	-
34	Selenium-83 ²	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	-	-
35	Bromine-74m ²	D, bromides of H, Li, Na, K, Rb, Cs, and Fr	1E+4	4E+4	2E-5	5E-8	-	-
		St wall (2E+4)	-	-	-	-	3E-4	3E-3
		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 ²	D, see $^{74\text{m}}\text{Br}$	2E+4	7E+4	3E-5	1E-7	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
		W, see $^{74\text{m}}\text{Br}$	-	8E+4	4E-5	1E-7	-	-
35	Bromine-75 ²	D, see $^{74\text{m}}\text{Br}$	3E+4	5E+4	2E-5	7E-8	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
		W, see $^{74\text{m}}\text{Br}$	-	5E+4	2E-5	7E-8	-	-
35	Bromine-76	D, see $^{74\text{m}}\text{Br}$	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
		W, see $^{74\text{m}}\text{Br}$	-	4E+3	2E-6	6E-9	-	-
35	Bromine-77	D, see $^{74\text{m}}\text{Br}$	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
		W, see $^{74\text{m}}\text{Br}$	-	2E+4	8E-6	3E-8	-	-
35	Bromine-80m	D, see $^{74\text{m}}\text{Br}$	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
		W, see $^{74\text{m}}\text{Br}$	-	1E+4	6E-6	2E-8	-	-
35	Bromine-80 ²	D, see $^{74\text{m}}\text{Br}$	5E+4	2E+5	8E-5	3E-7	-	-
		St wall (9E+4)	-	-	-	-	1E-3	1E-2
		W, see $^{74\text{m}}\text{Br}$	-	2E+5	9E-5	3E-7	-	-
35	Bromine-82	D, see $^{74\text{m}}\text{Br}$	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
		W, see $^{74\text{m}}\text{Br}$	-	4E+3	2E-6	5E-9	-	-
35	Bromine-83	D, see $^{74\text{m}}\text{Br}$	5E+4	6E+4	3E-5	9E-8	-	-
		St wall (7E+4)	-	-	-	-	9E-4	9E-3
		W, see $^{74\text{m}}\text{Br}$	-	6E+4	3E-5	9E-8	-	-
35	Bromine-84 ²	D, see $^{74\text{m}}\text{Br}$	2E+4	6E+4	2E-5	8E-8	-	-
		St wall (3E+4)	-	-	-	-	4E-4	4E-3
		W, see $^{74\text{m}}\text{Br}$	-	6E+4	3E-5	9E-8	-	-
36	Krypton-74 ²	Submersion ¹	-	-	3E-6	1E-8	-	-
36	Krypton-76	Submersion ¹	-	-	9E-6	4E-8	-	-
36	Krypton-77 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
36	Krypton-79	Submersion ¹	-	-	2E-5	7E-8	-	-
36	Krypton-81	Submersion ¹	-	-	7E-4	3E-6	-	-
36	Krypton-83m ²	Submersion ¹	-	-	1E-2	5E-5	-	-
36	Krypton-85m	Submersion ¹	-	-	2E-5	1E-7	-	-
36	Krypton-85	Submersion ¹	-	-	1E-4	7E-7	-	-
36	Krypton-87 ²	Submersion ¹	-	-	5E-6	2E-8	-	-
36	Krypton-88	Submersion ¹	-	-	2E-6	9E-9	-	-
37	Rubidium-79 ²	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
		St wall (6E+4)	-	-	-	-	8E-4	8E-3

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
37	Rubidium-81m ²	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 ²	D, all compounds	2E+4	6E+4	3E-5	9E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
37	Rubidium-89 ²	D, all compounds	4E+4	1E+5	6E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	9E-4	9E-3
38	Strontium-80 ²	D, all soluble compounds except SrTiO ₃	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		Y, all insoluble compounds and SrTiO ₃	-	1E+4	5E-6	2E-8	-	-
38	Strontium-81 ²	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 ²	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	
38	Strontium-91	Y, see ⁸⁰ Sr	-	4E+0	2E-9	6E-12	-	-
		D, see ⁸⁰ Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
38	Strontium-92	Y, see ⁸⁰ Sr	-	4E+3	1E-6	5E-9	-	-
		D, see ⁸⁰ Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
38	Strontium-92	Y, see ⁸⁰ Sr	-	7E+3	3E-6	9E-9	-	-
		D, see ⁸⁰ Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
39	Yttrium-86m ²	W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
		Y, oxides and hydroxides	-	5E+4	2E-5	8E-8	-	-
39	Yttrium-86	W, see ^{86m} Y	1E+3	3E+3	1E-6	5E-9	2E-5	2E-4
		Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-87	W, see ^{86m} Y	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		Y, see ^{86m} Y	-	3E+3	1E-6	5E-9	-	-
39	Yttrium-88	W, see ^{86m} Y	1E+3	3E+2	1E-7	3E-10	1E-5	1E-4
		Y, see ^{86m} Y	-	2E+2	1E-7	3E-10	-	-
39	Yttrium-90m	W, see ^{86m} Y	8E+3	1E+4	5E-6	2E-8	1E-4	1E-3
		Y, see ^{86m} Y	-	1E+4	5E-6	2E-8	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
39	Yttrium-90	W, see $^{85\text{m}}\text{Y}$	4E+2	7E+2	3E-7	9E-10	-	-
		LLI wall (5E+2)	-	-	-	-	7E-6	7E-5
39	Yttrium-91m ²	Y, see $^{85\text{m}}\text{Y}$	-	6E+2	3E-7	9E-10	-	-
		W, see $^{85\text{m}}\text{Y}$	1E+5	2E+5	1E-4	3E-7	2E-3	2E-2
39	Yttrium-91	Y, see $^{85\text{m}}\text{Y}$	-	2E+5	7E-5	2E-7	-	-
		W, see $^{85\text{m}}\text{Y}$	5E+2	2E+2	7E-8	2E-10	-	-
39	Yttrium-92	LLI wall (6E+2)	-	-	-	-	8E-6	8E-5
		Y, see $^{85\text{m}}\text{Y}$	-	1E+2	5E-8	2E-10	-	-
39	Yttrium-93	W, see $^{85\text{m}}\text{Y}$	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		Y, see $^{85\text{m}}\text{Y}$	-	8E+3	3E-6	1E-8	-	-
39	Yttrium-94 ²	W, see $^{85\text{m}}\text{Y}$	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see $^{85\text{m}}\text{Y}$	-	2E+3	1E-6	3E-9	-	-
39	Yttrium-95 ²	W, see $^{85\text{m}}\text{Y}$	2E+4	8E+4	3E-5	1E-7	-	-
		St wall (3E+4)	-	-	-	-	4E-4	4E-3
39	Yttrium-95 ²	Y, see $^{85\text{m}}\text{Y}$	-	8E+4	3E-5	1E-7	-	-
		W, see $^{85\text{m}}\text{Y}$	4E+4	2E+5	6E-5	2E-7	-	-
40	Zirconium-86	St wall (5E+4)	-	-	-	-	7E-4	7E-3
		Y, see $^{85\text{m}}\text{Y}$	-	1E+5	6E-5	2E-7	-	-
40	Zirconium-86	D, all compounds except those given for W and Y	1E+3	4E+3	2E-6	6E-9	2E-5	2E-4
		W, oxides, hydroxides, halides, and nitrates	-	3E+3	1E-6	4E-9	-	-
		Y, carbide	-	2E+3	1E-6	3E-9	-	-
40	Zirconium-88	D, see ^{86}Zr	4E+3	2E+2	9E-8	3E-10	5E-5	5E-4
		W, see ^{86}Zr	-	5E+2	2E-7	7E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
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 (3E+3)	Bone surf (2E+1)	-	2E-11	4E-5	4E-4	
		W, see ^{86}Zr	-	2E+1	1E-8	-	-	
		-	Bone surf (6E+1)	-	9E-11	-	-	
40	Zirconium-93	Y, see ^{86}Zr	-	6E+1	2E-8	-	-	-
		-	Bone surf (7E+1)	-	9E-11	-	-	
		D, see ^{86}Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
		-	Bone surf (3E+2)	-	4E-10	-	-	
40	Zirconium-95	W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
		Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
		D, see ^{86}Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
40	Zirconium-97	W, see ^{86}Zr	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{86}Zr	-	1E+3	5E-7	2E-9	-	-
		W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
41	Niobium-88 ²	St wall (7E+4)	-	-	-	-	1E-3	1E-2
		Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41	Niobium-89 ² (66 min)	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
41	Niobium-89 (122 min)	W, see ^{89}Nb	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
		Y, see ^{89}Nb	-	2E+4	6E-6	2E-8	-	-
41	Niobium-90	W, see ^{89}Nb	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		Y, see ^{89}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-93m	W, see ^{89}Nb	9E+3	2E+3	8E-7	3E-9	-	-
		LLI wall (1E+4)	-	-	-	-	2E-4	2E-3
		Y, see ^{89}Nb	-	2E+2	7E-8	2E-10	-	-
41	Niobium-94	W, see ^{89}Nb	9E+2	2E+2	8E-8	3E-10	1E-5	1E-4
		Y, see ^{89}Nb	-	2E+1	6E-9	2E-11	-	-
41	Niobium-95m	W, see ^{89}Nb	2E+3	3E+3	1E-6	4E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		Y, see ^{89}Nb	-	2E+3	9E-7	3E-9	-	-
41	Niobium-95	W, see ^{89}Nb	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
		Y, see ^{89}Nb	-	1E+3	5E-7	2E-9	-	-
41	Niobium-96	W, see ^{89}Nb	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
		Y, see ^{89}Nb	-	2E+3	1E-6	3E-9	-	-
41	Niobium-97 ²	W, see ^{89}Nb	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		Y, see ^{89}Nb	-	7E+4	3E-5	1E-7	-	-
41	Niobium-98 ²	W, see ^{89}Nb	1E+4	5E+4	2E-5	8E-8	2E-4	2E-3
		Y, see ^{89}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, hydroxide, 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 ²	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 ²	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 ²	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 ²	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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
43	Technetium-96	D, see $^{93\text{m}}\text{Tc}$	2E+3	3E+3	1E-6	5E-9	3E-5	3E-4
		W, see $^{93\text{m}}\text{Tc}$	-	2E+3	9E-7	3E-9	-	-
43	Technetium-97m	D, see $^{93\text{m}}\text{Tc}$	5E+3	7E+3	3E-6	-	6E-5	6E-4
		-	-	St Wall (7E+3)	-	1E-8	-	-
		W, see $^{93\text{m}}\text{Tc}$	-	1E+3	5E-7	2E-9	-	-
43	Technetium-97	D, see $^{93\text{m}}\text{Tc}$	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
		W, see $^{93\text{m}}\text{Tc}$	-	6E+3	2E-6	8E-9	-	-
43	Technetium-98	D, see $^{93\text{m}}\text{Tc}$	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
		W, see $^{93\text{m}}\text{Tc}$	-	3E+2	1E-7	4E-10	-	-
43	Technetium-99m	D, see $^{93\text{m}}\text{Tc}$	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
		W, see $^{93\text{m}}\text{Tc}$	-	2E+5	1E-4	3E-7	-	-
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	-	-
		W, see $^{93\text{m}}\text{Tc}$	-	7E+2	3E-7	9E-10	-	-
43	Technetium-101 ²	D, see $^{93\text{m}}\text{Tc}$	9E+4	3E+5	1E-4	5E-7	-	-
		-	-	St wall (1E+5)	-	-	2E-3	2E-2
		W, see $^{93\text{m}}\text{Tc}$	-	4E+5	2E-4	5E-7	-	-
43	Technetium-104 ²	D, see $^{93\text{m}}\text{Tc}$	2E+4	7E+4	3E-5	1E-7	-	-
		-	-	St wall (3E+4)	-	-	4E-4	4E-3
		W, see $^{93\text{m}}\text{Tc}$	-	9E+4	4E-5	1E-7	-	-
44	Ruthenium-94 ²	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	-	-
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-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	-	-
45	Rhodium-100	D, see $^{99\text{m}}\text{Rh}$	2E+3	5E+3	2E-6	7E-9	2E-5	2E-4
		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	-	-
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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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-102m	D, see $^{99\text{m}}\text{Rh}$	1E+3	5E+2	2E-7	7E-10	-	-
			LLI wall (1E+3)	-	-	-	2E-5	2E-4
		W, see $^{99\text{m}}\text{Rh}$	-	4E+2	2E-7	5E-10	-	-
45	Rhodium-102	D, see $^{99\text{m}}\text{Rh}$	6E+2	9E+1	4E-8	1E-10	8E-6	8E-5
		W, see $^{99\text{m}}\text{Rh}$	-	2E+2	7E-8	2E-10	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	6E+1	2E-8	8E-11	-	-
45	Rhodium-103m ²	D, see $^{99\text{m}}\text{Rh}$	4E+5	1E+6	5E-4	2E-6	6E-3	6E-2
		W, see $^{99\text{m}}\text{Rh}$	-	1E+6	5E-4	2E-6	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	1E+6	5E-4	2E-6	-	-
45	Rhodium-105	D, see $^{99\text{m}}\text{Rh}$	4E+3	1E+4	5E-6	2E-8	-	-
			LLI wall (4E+3)	-	-	-	5E-5	5E-4
		W, see $^{99\text{m}}\text{Rh}$	-	6E+3	3E-6	9E-9	-	-
45	Rhodium-106m	D, see $^{99\text{m}}\text{Rh}$	8E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see $^{99\text{m}}\text{Rh}$	-	4E+4	2E-5	5E-8	-	-
		Y, see $^{99\text{m}}\text{Rh}$	-	4E+4	1E-5	5E-8	-	-
45	Rhodium-107 ²	D, see $^{99\text{m}}\text{Rh}$	7E+4	2E+5	1E-4	3E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
		W, see $^{99\text{m}}\text{Rh}$	-	3E+5	1E-4	4E-7	-	-
46	Palladium-100	D, all compounds except those given for W and 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	-	-
46	Palladium-107	D, see ^{100}Pd	3E+4	2E+4	9E-6	-	-	-
			LLI wall (4E+4)	Kidneys (2E+4)	-	3E-8	5E-4	5E-3
		W, see ^{100}Pd	-	7E+3	3E-6	1E-8	-	-
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	-	-
47	Silver-102 ²	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	-	-
47	Silver-103 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
47	Silver-104m ²	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 ²	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 ²	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	-	-
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)	Liver (2E+3)	-	2E-9	2E-5	2E-4	
		W, 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 ²	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	-	-
48	Cadmium-104 ²	D, all compounds except those given for W and Y	2E+4	7E+4	3E-5	9E-8	3E-4	3E-3
		W, sulfides, halides, and nitrates	-	1E+5	5E-5	2E-7	-	-
		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)	Kidneys (5E+1)	-	7E-11	6E-6	6E-5	
		W, see ¹⁰⁴ Cd	-	1E+2	5E-8	-	-	-
48	Cadmium-113m	D, see ¹⁰⁴ Cd	2E+1	2E+0	1E-9	-	-	-
		Kidneys (4E+1)	Kidneys (4E+0)	-	5E-12	5E-7	5E-6	
		W, see ¹⁰⁴ Cd	-	8E+0	4E-9	-	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			-	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)	Kidneys (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	-	-
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8	3E-4	3E-3
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8	-	-
49	Indium-110 ² (69.1 min)	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	6E+4	2E-5	8E-8	-	-
49	Indium-110 (4.9 h)	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
		W, see ^{109}In	-	2E+4	8E-6	3E-8	-	-
49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5	6E-4
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-	-
49	Indium-112 ²	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3	2E-2
		W, see ^{109}In	-	7E+5	3E-4	1E-6	-	-
49	Indium-113m ²	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
		W, see ^{109}In	-	2E+5	8E-5	3E-7	-	-
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-	-
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see ^{109}In	-	5E+4	2E-5	7E-8	-	-
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7	5E-6
		W, see ^{109}In	-	5E+0	2E-9	8E-12	-	-
49	Indium-116m ²	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-	-
49	Indium-117m ²	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4	2E-3
		W, see ^{109}In	-	4E+4	2E-5	6E-8	-	-
49	Indium-117 ²	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4	8E-3
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-	-
49	Indium-119m ²	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			St wall (5E+4)	-	-	-	7E-4	7E-3
		W, see ^{109}In	-	1E+5	6E-5	2E-7	-	-
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8	5E-5	5E-4
		W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8	-	-
50	Tin-111 ²	D, see ^{110}Sn	7E+4	2E+5	9E-5	3E-7	1E-3	1E-2
		W, see ^{110}Sn	-	3E+5	1E-4	4E-7	-	-
50	Tin-113	D, see ^{110}Sn	2E+3	1E+3	5E-7	2E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		W, 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-5	3E-4
		W, see ^{110}Sn	-	1E+3	6E-7	2E-9	-	-
50	Tin-119m	D, see ^{110}Sn	3E+3	2E+3	1E-6	3E-9	-	-
		LLI wall (4E+3)	-	-	-	-	6E-5	6E-4
		W, see ^{110}Sn	-	1E+3	4E-7	1E-9	-	-
50	Tin-121m	D, see ^{110}Sn	3E+3	9E+2	4E-7	1E-9	-	-
		LLI wall (4E+3)	-	-	-	-	5E-5	5E-4
		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-	-
50	Tin-121	D, see ^{110}Sn	6E+3	2E+4	6E-6	2E-8	-	-
		LLI wall (6E+3)	-	-	-	-	8E-5	8E-4
		W, see ^{110}Sn	-	1E+4	5E-6	2E-8	-	-
50	Tin-123m ²	D, see ^{110}Sn	5E+4	1E+5	5E-5	2E-7	7E-4	7E-3
		W, see ^{110}Sn	-	1E+5	6E-5	2E-7	-	-
50	Tin-123	D, see ^{110}Sn	5E+2	6E+2	3E-7	9E-10	-	-
		LLI wall (6E+2)	-	-	-	-	9E-6	9E-5
		W, see ^{110}Sn	-	2E+2	7E-8	2E-10	-	-
50	Tin-125	D, see ^{110}Sn	4E+2	9E+2	4E-7	1E-9	-	-
		LLI wall (5E+2)	-	-	-	-	6E-6	6E-5
		W, see ^{110}Sn	-	4E+2	1E-7	5E-10	-	-
50	Tin-126	D, see ^{110}Sn	3E+2	6E+1	2E-8	8E-11	4E-6	4E-5
		W, see ^{110}Sn	-	7E+1	3E-8	9E-11	-	-
50	Tin-127	D, see ^{110}Sn	7E+3	2E+4	8E-6	3E-8	9E-5	9E-4
		W, see ^{110}Sn	-	2E+4	8E-6	3E-8	-	-
50	Tin-128 ²	D, see ^{110}Sn	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3
		W, see ^{110}Sn	-	4E+4	1E-5	5E-8	-	-
51	Antimony-115 ²	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7	1E-3	1E-2
		W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7	-	-
51	Antimony- 116m ²	D, see ^{115}Sb	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
		W, see ^{115}Sb	-	1E+5	6E-5	2E-7	-	-
51	Antimony-116 ²	D, see ^{115}Sb	7E+4	3E+5	1E-4	4E-7	-	-

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 ($\mu\text{Ci}/\text{m}^3$)
			Oral Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{m}^3$)	Water ($\mu\text{Ci}/\text{m}^3$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{m}^3$)			
			St wall ($9\text{E}+4$)	-	-	-	$1\text{E}-3$	$1\text{E}-2$
		W, see ^{115}Sb	-	$3\text{E}+5$	$1\text{E}-4$	$5\text{E}-7$	-	-
51	Antimony-117	D, see ^{115}Sb	$7\text{E}+4$	$2\text{E}+5$	$9\text{E}-5$	$3\text{E}-7$	$9\text{E}-4$	$9\text{E}-3$
		W, see ^{115}Sb	-	$3\text{E}+5$	$1\text{E}-4$	$4\text{E}-7$	-	-
51	Antimony-118m	D, see ^{115}Sb	$6\text{E}+3$	$2\text{E}+4$	$8\text{E}-6$	$3\text{E}-8$	$7\text{E}-5$	$7\text{E}-4$
		W, see ^{115}Sb	$5\text{E}+3$	$2\text{E}+4$	$9\text{E}-6$	$3\text{E}-8$	-	-
51	Antimony-119	D, see ^{115}Sb	$2\text{E}+4$	$5\text{E}+4$	$2\text{E}-5$	$6\text{E}-8$	$2\text{E}-4$	$2\text{E}-3$
		W, see ^{115}Sb	$2\text{E}+4$	$3\text{E}+4$	$1\text{E}-5$	$4\text{E}-8$	-	-
51	Antimony-120 ² (16 min)	D, see ^{115}Sb	$1\text{E}+5$	$4\text{E}+5$	$2\text{E}-4$	$6\text{E}-7$	-	-
			St wall ($2\text{E}+5$)	-	-	-	$2\text{E}-3$	$2\text{E}-2$
		W, see ^{115}Sb	-	$5\text{E}+5$	$2\text{E}-4$	$7\text{E}-7$	-	-
51	Antimony-120 (5.76 d)	D, see ^{115}Sb	$1\text{E}+3$	$2\text{E}+3$	$9\text{E}-7$	$3\text{E}-9$	$1\text{E}-5$	$1\text{E}-4$
		W, see ^{115}Sb	$9\text{E}+2$	$1\text{E}+3$	$5\text{E}-7$	$2\text{E}-9$	-	-
51	Antimony-122	D, see ^{115}Sb	$8\text{E}+2$	$2\text{E}+3$	$1\text{E}-6$	$3\text{E}-9$	-	-
			LLI wall ($8\text{E}+2$)	-	-	-	$1\text{E}-5$	$1\text{E}-4$
		W, see ^{115}Sb	$7\text{E}+2$	$1\text{E}+3$	$4\text{E}-7$	$2\text{E}-9$	-	-
51	Antimony- 124m ²	D, see ^{115}Sb	$3\text{E}+5$	$8\text{E}+5$	$4\text{E}-4$	$1\text{E}-6$	$3\text{E}-3$	$3\text{E}-2$
		W, see ^{115}Sb	$2\text{E}+5$	$6\text{E}+5$	$2\text{E}-4$	$8\text{E}-7$	-	-
51	Antimony-124	D, see ^{115}Sb	$6\text{E}+2$	$9\text{E}+2$	$4\text{E}-7$	$1\text{E}-9$	$7\text{E}-6$	$7\text{E}-5$
		W, see ^{115}Sb	$5\text{E}+2$	$2\text{E}+2$	$1\text{E}-7$	$3\text{E}-10$	-	-
51	Antimony-125	D, see ^{115}Sb	$2\text{E}+3$	$2\text{E}+3$	$1\text{E}-6$	$3\text{E}-9$	$3\text{E}-5$	$3\text{E}-4$
		W, see ^{115}Sb	-	$5\text{E}+2$	$2\text{E}-7$	$7\text{E}-10$	-	-
51	Antimony- 126m ²	D, see ^{115}Sb	$5\text{E}+4$	$2\text{E}+5$	$8\text{E}-5$	$3\text{E}-7$	-	-
			St wall ($7\text{E}+4$)	-	-	-	$9\text{E}-4$	$9\text{E}-3$
		W, see ^{115}Sb	-	$2\text{E}+5$	$8\text{E}-5$	$3\text{E}-7$	-	-
51	Antimony-126	D, see ^{115}Sb	$6\text{E}+2$	$1\text{E}+3$	$5\text{E}-7$	$2\text{E}-9$	$7\text{E}-6$	$7\text{E}-5$
		W, see ^{115}Sb	$5\text{E}+2$	$5\text{E}+2$	$2\text{E}-7$	$7\text{E}-10$	-	-
51	Antimony-127	D, see ^{115}Sb	$8\text{E}+2$	$2\text{E}+3$	$9\text{E}-7$	$3\text{E}-9$	-	-
			LLI wall ($8\text{E}+2$)	-	-	-	$1\text{E}-5$	$1\text{E}-4$
		W, see ^{115}Sb	$7\text{E}+2$	$9\text{E}+2$	$4\text{E}-7$	$1\text{E}-9$	-	-
51	Antimony-128 ² (10.4 min)	D, see ^{115}Sb	$8\text{E}+4$	$4\text{E}+5$	$2\text{E}-4$	$5\text{E}-7$	-	-
			St wall ($1\text{E}+5$)	-	-	-	$1\text{E}-3$	$1\text{E}-2$
		W, see ^{115}Sb	-	$4\text{E}+5$	$2\text{E}-4$	$6\text{E}-7$	-	-
51	Antimony-128 (9.01 h)	D, see ^{115}Sb	$1\text{E}+3$	$4\text{E}+3$	$2\text{E}-6$	$6\text{E}-9$	$2\text{E}-5$	$2\text{E}-4$
		W, see ^{115}Sb	-	$3\text{E}+3$	$1\text{E}-6$	$5\text{E}-9$	-	-
51	Antimony-129	D, see ^{115}Sb	$3\text{E}+3$	$9\text{E}+3$	$4\text{E}-6$	$1\text{E}-8$	$4\text{E}-5$	$4\text{E}-4$
		W, see ^{115}Sb	-	$9\text{E}+3$	$4\text{E}-6$	$1\text{E}-8$	-	-
51	Antimony-130 ²	D, see ^{115}Sb	$2\text{E}+4$	$6\text{E}+4$	$3\text{E}-5$	$9\text{E}-8$	$3\text{E}-4$	$3\text{E}-3$
		W, see ^{115}Sb	-	$8\text{E}+4$	$3\text{E}-5$	$1\text{E}-7$	-	-
51	Antimony-131 ²	D, see ^{115}Sb	$1\text{E}+4$	$2\text{E}+4$	$1\text{E}-5$	-	-	-
			Thyroid ($2\text{E}+4$)	Thyroid ($4\text{E}+4$)	-	$6\text{E}-8$	$2\text{E}-4$	$2\text{E}-3$
		W, see ^{115}Sb	-	$2\text{E}+4$	$1\text{E}-5$	-	-	-
			-	Thyroid ($4\text{E}+4$)	-	$6\text{E}-8$	-	-
52	Tellurium-116	D, all compounds except those given for W	$8\text{E}+3$	$2\text{E}+4$	$9\text{E}-6$	$3\text{E}-8$	$1\text{E}-4$	$1\text{E}-3$
		W, oxides, hydroxides, and nitrates	-	$3\text{E}+4$	$1\text{E}-5$	$4\text{E}-8$	-	-
52	Tellurium-121m	D, see ^{116}Te	$5\text{E}+2$	$2\text{E}+2$	$8\text{E}-8$	-	-	-

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
		W, see ¹¹⁶ Te	-	2E+4	1E-5	-	-	-
			-	Thyroid (5E+4)	-	7E-8	-	-
53	Iodine-120m ²	D, all compounds	1E+4	2E+4	9E-6	3E-8	-	-
			Thyroid (1E+4)	-	-	-	2E-4	2E-3
53	Iodine-120 ²	D, all compounds	4E+3	9E+3	4E-6	-	-	-
			Thyroid (8E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-121	D, all compounds	1E+4	2E+4	8E-6	-	-	-
			Thyroid (3E+4)	Thyroid (5E+4)	-	7E-8	4E-4	4E-3
53	Iodine-123	D, all compounds	3E+3	6E+3	3E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8	1E-4	1E-3
53	Iodine-124	D, all compounds	5E+1	8E+1	3E-8	-	-	-
			Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10	2E-6	2E-5
53	Iodine-125	D, all compounds	4E+1	6E+1	3E-8	-	-	-
			Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10	2E-6	2E-5
53	Iodine-126	D, all compounds	2E+1	4E+1	1E-8	-	-	-
			Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10	1E-6	1E-5
53	Iodine-128 ²	D, all compounds	4E+4	1E+5	5E-5	2E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
53	Iodine-129	D, all compounds	5E+0	9E+0	4E-9	-	-	-
			Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11	2E-7	2E-6
53	Iodine-130	D, all compounds	4E+2	7E+2	3E-7	-	-	-
			Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9	2E-5	2E-4
53	Iodine-131	D, all compounds	3E+1	5E+1	2E-8	-	-	-
			Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10	1E-6	1E-5
53	Iodine-132m ²	D, all compounds	4E+3	8E+3	4E-6	-	-	-
			Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4	1E-3
53	Iodine-132	D, all compounds	4E+3	8E+3	3E-6	-	-	-
			Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-133	D, all compounds	1E+2	3E+2	1E-7	-	-	-
			Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6	7E-5
53	Iodine-134 ²	D, all compounds	2E+4	5E+4	2E-5	6E-8	-	-
			Thyroid (3E+4)	-	-	-	4E-4	4E-3
53	Iodine-135	D, all compounds	8E+2	2E+3	7E-7	-	-	-
			Thyroid (3E+3)	Thyroid (4E+3)	-	6E-9	3E-5	3E-4
54	Xenon-120 ²	Submersion ¹	-	-	1E-5	4E-8	-	-
54	Xenon-121 ²	Submersion ¹	-	-	2E-6	1E-8	-	-
54	Xenon-122	Submersion ¹	-	-	7E-5	3E-7	-	-
54	Xenon-123	Submersion ¹	-	-	6E-6	3E-8	-	-
54	Xenon-125	Submersion ¹	-	-	2E-5	7E-8	-	-
54	Xenon-127	Submersion ¹	-	-	1E-5	6E-8	-	-
54	Xenon-129m	Submersion ¹	-	-	2E-4	9E-7	-	-
54	Xenon-131m	Submersion ¹	-	-	4E-4	2E-6	-	-
54	Xenon-133m	Submersion ¹	-	-	1E-4	6E-7	-	-
54	Xenon-133	Submersion ¹	-	-	1E-4	5E-7	-	-
54	Xenon-135m ²	Submersion ¹	-	-	9E-6	4E-8	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
54	Xenon-135	Submersion ¹	-	-	1E-5	7E-8	-	-
54	Xenon-138 ²	Submersion ¹	-	-	4E-6	2E-8	-	-
55	Cesium-125 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	-	-
			St wall (9E+4)	-	-	-	1E-3	1E-2
55	Cesium-127	D, all compounds	6E+4	9E+4	4E-5	1E-7	9E-4	9E-3
55	Cesium-129	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4	3E-3
55	Cesium-130 ²	D, all compounds	6E+4	2E+5	8E-5	3E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
55	Cesium-131	D, all compounds	2E+4	3E+4	1E-5	4E-8	3E-4	3E-3
55	Cesium-132	D, all compounds	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
55	Cesium-134m	D, all compounds	1E+5	1E+5	6E-5	2E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
55	Cesium-134	D, all compounds	7E+1	1E+2	4E-8	2E-10	9E-7	9E-6
55	Cesium-135m ²	D, all compounds	1E+5	2E+5	8E-5	3E-7	1E-3	1E-2
55	Cesium-135	D, all compounds	7E+2	1E+3	5E-7	2E-9	1E-5	1E-4
55	Cesium-136	D, all compounds	4E+2	7E+2	3E-7	9E-10	6E-6	6E-5
55	Cesium-137	D, all compounds	1E+2	2E+2	6E-8	2E-10	1E-6	1E-5
55	Cesium-138 ²	D, all compounds	2E+4	6E+4	2E-5	8E-8	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
56	Barium-126 ²	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 ²	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-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5	2E-4
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5	4E-4
56	Barium-139 ²	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 ²	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4	3E-3
56	Barium-142 ²	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
57	Lanthanum-131 ²	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
		W, see ¹³¹ La	-	Liver (7E+1)	-	1E-10	-	-
		W, see ¹³¹ La	-	Liver (3E+2)	1E-7	-	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
57	Lanthanum-142 ²	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 ²	D, see ¹³¹ La	4E+4	1E+5	4E-5	1E-7	-	-
		St wall (4E+4)	-	-	-	-	5E-4	5E-3
58	Cerium-134	W, see ¹³¹ La	-	9E+4	4E-5	1E-7	-	-
		W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
58	Cerium-135	LLI wall (6E+2)	-	-	-	-	8E-6	8E-5
		Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
58	Cerium-137m	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-137	W, see ¹³⁴ Ce	2E+3	4E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
58	Cerium-139	Y, see ¹³⁴ Ce	-	4E+3	2E-6	5E-9	-	-
		W, see ¹³⁴ Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
58	Cerium-141	Y, see ¹³⁴ Ce	-	1E+5	5E-5	2E-7	-	-
		W, see ¹³⁴ Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
58	Cerium-143	Y, see ¹³⁴ Ce	-	7E+2	3E-7	9E-10	-	-
		W, see ¹³⁴ Ce	2E+3	7E+2	3E-7	1E-9	-	-
58	Cerium-144	LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
		Y, see ¹³⁴ Ce	-	6E+2	2E-7	8E-10	-	-
58	Cerium-144	W, see ¹³⁴ Ce	1E+3	2E+3	8E-7	3E-9	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
58	Cerium-144	Y, see ¹³⁴ Ce	-	2E+3	7E-7	2E-9	-	-
		W, see ¹³⁴ Ce	2E+2	3E+1	1E-8	4E-11	-	-
59	Praseodymium-136 ²	LLI wall (3E+2)	-	-	-	-	3E-6	3E-5
		Y, see ¹³⁴ Ce	-	1E+1	6E-9	2E-11	-	-
59	Praseodymium-137 ²	W, all compounds except those given for Y	5E+4	2E+5	1E-4	3E-7	-	-
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	9E-5	3E-7	-	-
59	Praseodymium-138m	St wall (7E+4)	-	-	-	-	1E-3	1E-2
		W, see ¹³⁶ Pr	4E+4	2E+5	6E-5	2E-7	5E-4	5E-3
59	Praseodymium-139	Y, see ¹³⁶ Pr	-	1E+5	6E-5	2E-7	-	-
		W, see ¹³⁶ Pr	1E+4	5E+4	2E-5	8E-8	1E-4	1E-3
59	Praseodymium-142m ²	Y, see ¹³⁶ Pr	-	4E+4	2E-5	6E-8	-	-
		W, see ¹³⁶ Pr	4E+4	1E+5	5E-5	2E-7	6E-4	6E-3
59	Praseodymium-142	Y, see ¹³⁶ Pr	-	1E+5	6E-5	2E-7	-	-
		W, see ¹³⁶ Pr	8E+4	2E+5	7E-5	2E-7	1E-3	1E-2
59	Praseodymium-143	Y, see ¹³⁶ Pr	-	1E+5	6E-5	2E-7	-	-
		W, see ¹³⁶ Pr	1E+3	2E+3	9E-7	3E-9	1E-5	1E-4
59	Praseodymium-144 ²	LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
		Y, see ¹³⁶ Pr	-	7E+2	3E-7	9E-10	-	-
59	Praseodymium-144 ²	W, see ¹³⁶ Pr	3E+4	1E+5	5E-5	2E-7	-	-
		St wall (4E+4)	-	-	-	-	6E-4	6E-3
59	Praseodymium-144 ²	Y, see ¹³⁶ Pr	-	1E+5	5E-5	2E-7	-	-
		W, see ¹³⁶ Pr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
	145	Y, see ^{136}Pr	-	8E+3	3E-6	1E-8	-	-
59	Praseodymium-147 ²	W, see ^{136}Pr	5E+4	2E+5	8E-5	3E-7	-	-
		St wall (8E+4)	-	-	-	-	1E-3	1E-2
		Y, see ^{136}Pr	-	2E+5	8E-5	3E-7	-	-
60	Neodymium-136 ²	W, all compounds except those given for Y	1E+4	6E+4	2E-5	8E-8	2E-4	2E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	5E+4	2E-5	8E-8	-	-
60	Neodymium-138	W, see ^{136}Nd	2E+3	6E+3	3E-6	9E-9	3E-5	3E-4
		Y, see ^{136}Nd	-	5E+3	2E-6	7E-9	-	-
60	Neodymium-139m	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-139 ²	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-141	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-147	W, see ^{136}Nd	1E+3	9E+2	4E-7	1E-9	-	-
		LLI wall (1E+3)	-	-	-	-	2E-5	2E-4
		Y, see ^{136}Nd	-	8E+2	4E-7	1E-9	-	-
60	Neodymium-149 ²	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	-	-
60	Neodymium-151 ²	W, see ^{136}Nd	7E+4	2E+5	8E-5	3E-7	9E-4	9E-3
		Y, see ^{136}Nd	-	2E+5	8E-5	3E-7	-	-
61	Promethium-141 ²	W, all compounds except those given for Y	5E+4	2E+5	8E-5	3E-7	-	-
		St wall (6E+4)	-	-	-	-	8E-4	8E-3
		Y, oxides, hydroxides, carbides, and fluorides	-	2E+5	7E-5	2E-7	-	-
61	Promethium-143	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-144	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	-	-
61	Promethium-145	W, see ^{141}Pm	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	-	-
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-	W, see ^{141}Pm	1E+3	2E+3	8E-7	3E-9	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)	LLI wall ($1\text{E}+3$)		-	-			2E-5
	149							
		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 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-3
62	Samarium-141 ²	W, all compounds	5E+4	2E+5	8E-5	2E-7	-	-
		St wall (6E+4)	-	-	-	-	8E-4	8E-3
62	Samarium-142 ²	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 ²	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
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 ²	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3
64	Gadolinium-145 ²	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	

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
		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 ²	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4	1E-3
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-156m (24.4 h)	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4	1E-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 ²	W, all compounds	4E+4	2E+5	6E-5	2E-7	6E-4	6E-3
67	Holmium-157 ²	W, all compounds	3E+5	1E+6	6E-4	2E-6	4E-3	4E-2
67	Holmium-159 ²	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 ²	W, all compounds	5E+4	3E+5	1E-4	4E-7	7E-4	7E-3
67	Holmium-162 ²	W, all compounds	5E+5	2E+6	1E-3	3E-6	-	-
			St wall (8E+5)	-	-	-	1E-2	1E-1

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci/ml}$)			
67	Holmium-164m ²	W, all compounds	1E+5	3E+5	1E-4	4E-7	1E-3	1E-2
67	Holmium-164 ²	W, all compounds	2E+5 St wall (2E+5)	6E+5 -	3E-4 -	9E-7 -	- 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 LLI wall (9E+2)	2E+3 -	7E-7 -	2E-9 -	- 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-3
68	Erbium-169	W, all compounds	3E+3 LLI wall (4E+3)	3E+3 -	1E-6 -	4E-9 -	- 5E-5	- 5E-4
68	Erbium-171	W, all compounds	4E+3	1E+4	4E-6	1E-8	5E-5	5E-4
68	Erbium-172	W, all compounds	1E+3 LLI wall (1E+3)	1E+3 -	6E-7 -	2E-9 -	- 2E-5	- 2E-4
69	Thulium-162 ²	W, all compounds	7E+4 St wall (7E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
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 -	- 3E-5	- 3E-4
69	Thulium-170	W, all compounds	8E+2 LLI wall (1E+3)	2E+2 -	9E-8 -	3E-10 -	- 1E-5	- 1E-4
69	Thulium-171	W, all compounds	1E+4 LLI wall (1E+4)	3E+2 Bone surf (6E+2)	1E-7 -	- 8E-10	- 2E-4	- 2E-3
69	Thulium-172	W, all compounds	7E+2 LLI wall (8E+2)	1E+3 -	5E-7 -	2E-9 -	- 1E-5	- 1E-4
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
69	Thulium-175 ²	W, all compounds	7E+4 St wall (9E+4)	3E+5 -	1E-4 -	4E-7 -	- 1E-3	- 1E-2
70	Ytterbium-162 ²	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7	1E-3	1E-2
		Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7	-	-
70	Ytterbium-166	W, see ¹⁶² Yb	1E+3	2E+3	8E-7	3E-9	2E-5	2E-4
		Y, see ¹⁶² Yb	-	2E+3	8E-7	3E-9	-	-
70	Ytterbium-167 ²	W, see ¹⁶² Yb	3E+5	8E+5	3E-4	1E-6	4E-3	4E-2
		Y, see ¹⁶² Yb	-	7E+5	3E-4	1E-6	-	-
70	Ytterbium-169	W, see ¹⁶² Yb	2E+3	8E+2	4E-7	1E-9	2E-5	2E-4
		Y, 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 -	- 4E-5	- 4E-4
		Y, see ¹⁶² Yb	-	3E+3	1E-6	5E-9	-	-
70	Ytterbium-177 ²	W, see ¹⁶² Yb	2E+4	5E+4	2E-5	7E-8	2E-4	2E-3
		Y, see ¹⁶² Yb	-	5E+4	2E-5	6E-8	-	-
70	Ytterbium-178 ²	W, see ¹⁶² Yb	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		Y, see ¹⁶² Yb	-	4E+4	2E-5	5E-8	-	-
71	Lutetium-169	W, all compounds except those given for Y	3E+3	4E+3	2E-6	6E-9	3E-5	3E-4

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
		Y, oxides, hydroxides, and fluorides	-	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
		Y, see ^{169}Lu	-	2E+3	8E-7	3E-9	-	-
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
		Y, see ^{169}Lu	-	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	-	-	-
		Y, see ^{169}Lu	-	Bone surf (3E+2)	-	5E-10	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
		Y, see ^{169}Lu	-	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	-	-
71	Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
		Y, see ^{169}Lu	-	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
		Y, see ^{169}Lu	-	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	-	-
		Y, see ^{169}Lu	-	LLI wall (3E+3)	-	-	4E-5	4E-4
		Y, see ^{169}Lu	-	2E+3	9E-7	3E-9	-	-
71	Lutetium-178m ²	W, see ^{169}Lu	5E+4	2E+5	8E-5	3E-7	-	-
		Y, see ^{169}Lu	-	St. wall (6E+4)	-	-	8E-4	8E-3
		Y, see ^{169}Lu	-	2E+5	7E-5	2E-7	-	-
71	Lutetium-178 ²	W, see ^{169}Lu	4E+4	1E+5	5E-5	2E-7	-	-
		Y, see ^{169}Lu	-	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
		W, see ^{170}Hf	-	Bone surf (2E+1)	-	3E-11	-	-
		Y, see ^{170}Hf	-	4E+1	2E-8	-	-	-
		Y, see ^{170}Hf	-	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	-	-
72	Hafnium-175	D, see ^{170}Hf	3E+3	9E+2	4E-7	-	4E-5	4E-4

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			-	Bone surf (1E+3)	-	1E-9	-	-
		W, see ^{170}Hf	-	1E+3	5E-7	2E-9	-	-
72	Hafnium-177m ²	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 ²	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)	Bone surf (2E+0)	-	2E-12	5E-6	5E-5
		W, see ^{170}Hf	-	3E+0	1E-9	-	-	-
			-	Bone surf (7E+0)	-	1E-11	-	-
72	Hafnium-183 ²	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 ²	W, all compounds except those given for Y	4E+4	1E+5	5E-5	2E-7	5E-4	5E-3
		Y, elemental Ta, oxides, hydroxides, halides, carbides, nitrates, and nitrides	-	1E+5	4E-5	1E-7	-	-
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	-	-
73	Tantalum-174 ²	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	-	-

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		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci/ml}$)							
73	Tantalum-182m ²	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 ²	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 ²	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 ²	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
75	Rhenium-177 ²	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	2E-3	2E-2
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-	-
75	Rhenium-178 ²	D, see ¹⁷⁷ Re	7E+4	3E+5	1E-4	4E-7	-	-
			St wall (1E+5)	-	-	-	1E-3	1E-2
		W, see ¹⁷⁷ Re	-	3E+5	1E-4	4E-7	-	-
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	2E+3	7E-7	-	-	-
			St wall (2E+3)	St wall (2E+3)	-	3E-9	2E-5	2E-4
		W, see ¹⁷⁷ Re	-	2E+2	6E-8	2E-10	-	-
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	8E+5	4E-4	-	8E-3	8E-2
			-	St wall (9E+5)	-	1E-6	-	-
		W, see ¹⁷⁷ Re	-	1E+5	4E-5	1E-7	-	-

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		Air (μCi/ml)	Water (μCi/ml)	
ALI (μCi)	DAC (μCi/ml)							
75	Rhenium-188m ²	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 ²	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 ²	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	-	-
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	-	-
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	-	-
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	-	-
77	Iridium-182 ²	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	-	-
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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
		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	-	-
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	-	-
77	Iridium-189	D, see ^{182}Ir	5E+3	5E+3	2E-6	7E-9	-	-
		LLI wall (5E+3)	-	-	-	-	7E-5	7E-4
77	Iridium-190m ²	W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190	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	-	-
77	Iridium-192m	Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
		D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
77	Iridium-192	W, see ^{182}Ir	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{182}Ir	-	9E+2	4E-7	1E-9	-	-
77	Iridium-194m	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	-	-
77	Iridium-194	Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
		D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
77	Iridium-195m	W, see ^{182}Ir	-	4E+2	2E-7	6E-10	-	-
		Y, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
77	Iridium-195	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	-	-
77	Iridium-194	Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
		D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
77	Iridium-195m	W, see ^{182}Ir	-	2E+3	9E-7	3E-9	-	-
		Y, see ^{182}Ir	-	2E+3	8E-7	3E-9	-	-
77	Iridium-195	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	-	-
77	Iridium-195	Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
		D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
78	Platinum-186	W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
		Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78	Platinum-188	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78	Platinum-189	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78	Platinum-191	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78	Platinum-193m	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
		LLI wall (3E+4)	3E+3	6E+3	3E-6	8E-9	-	-
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-	-
		LLI wall (5E+4)	-	-	-	-	6E-4	6E-3
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	-	3E-5	3E-4
78	Platinum-197m ²	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 ²	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
79	Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4	1E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
		W, halides and nitrates	-	2E+4	9E-6	3E-8	-	-
		Y, oxides and hydroxides	-	2E+4	8E-6	3E-8	-	-
79	Gold-194	D, see ^{193}Au	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
		W, see ^{193}Au	-	5E+3	2E-6	8E-9	-	-
		Y, see ^{193}Au	-	5E+3	2E-6	7E-9	-	-
79	Gold-195	D, see ^{193}Au	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{193}Au	-	1E+3	6E-7	2E-9	-	-
		Y, see ^{193}Au	-	4E+2	2E-7	6E-10	-	-
79	Gold-198m	D, see ^{193}Au	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
		W, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
		Y, see ^{193}Au	-	1E+3	5E-7	2E-9	-	-
79	Gold-198	D, see ^{193}Au	1E+3	4E+3	2E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	2E+3	8E-7	3E-9	-	-
		Y, see ^{193}Au	-	2E+3	7E-7	2E-9	-	-
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	-	4E+3	2E-6	6E-9	-	-
		Y, see ^{193}Au	-	4E+3	2E-6	5E-9	-	-
79	Gold-200m	D, see ^{193}Au	1E+3	4E+3	1E-6	5E-9	2E-5	2E-4
		W, see ^{193}Au	-	3E+3	1E-6	4E-9	-	-
		Y, see ^{193}Au	-	2E+4	1E-6	3E-9	-	-
79	Gold-200 ²	D, see ^{193}Au	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
		W, see ^{193}Au	-	8E+4	3E-5	1E-7	-	-
		Y, see ^{193}Au	-	7E+4	3E-5	1E-7	-	-
79	Gold-201 ²	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7	-	-
		St wall (9E+4)	-	-	-	-	1E-3	1E-2
		W, see ^{193}Au	-	2E+5	1E-4	3E-7	-	-
		Y, see ^{193}Au	-	2E+5	9E-5	3E-7	-	-
80	Mercury-193m	Vapor	-	8E+3	4E-6	1E-8	-	-
		Organic D	4E+3	1E+4	5E-6	2E-8	6E-5	6E-4
		D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
		W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-	-
80	Mercury-193	Vapor	-	3E+4	1E-5	4E-8	-	-
		Organic D	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		D, see $^{193\text{m}}\text{Hg}$	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
		W, see $^{193\text{m}}\text{Hg}$	-	4E+4	2E-5	6E-8	-	-
80	Mercury-194	Vapor	-	3E+1	1E-8	4E-11	-	-
		Organic D	2E+1	3E+1	1E-8	4E-11	2E-7	2E-6
		D, see $^{193\text{m}}\text{Hg}$	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
		W, see $^{193\text{m}}\text{Hg}$	-	1E+2	5E-8	2E-10	-	-
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 $^{193\text{m}}\text{Hg}$	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
		W, see $^{193\text{m}}\text{Hg}$	-	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 $^{193\text{m}}\text{Hg}$	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
		W, see $^{193\text{m}}\text{Hg}$	-	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 $^{193\text{m}}\text{Hg}$	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
80	Mercury-197	W, see ^{193m} Hg	-	5E+3	2E-6	7E-9	-	-
		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
80	Mercury-199m ²	W, see ^{193m} Hg	-	9E+3	4E-6	1E-8	-	-
		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
80	Mercury-203	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	-	-
		Vapor	-	8E+2	4E-7	1E-9	-	-
		Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
81	Thallium-194m ²	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	-	-
		D, all compounds	5E+4	2E+5	6E-5	2E-7	-	-
		St wall (7E+4)	-	-	-	-	1E-3	1E-2
81	Thallium-194 ²	D, all compounds	3E+5	6E+5	2E-4	8E-7	-	-
		St wall (3E+5)	-	-	-	-	4E-3	4E-2
81	Thallium-195 ²	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 ²	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 ²	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 ²	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
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 ²	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 ²	D, all compounds	9E+3	8E+2	3E-7	1E-9	1E-4	1E-3
83	Bismuth-200 ²	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 ²	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 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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 ²	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 ²	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 ²	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 ²	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 ²	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	-	-
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 ²	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 (or 12 working level months)	9E-9 (or 1.0 working level)	3E-11	-	-
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-	-
		With daughters present	-	1E+2 (or 4 working level months)	3E-8 (or 0.33 working level)	1E-10	-	-
87	Francium-222 ²	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5	3E-4
87	Francium-223 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			Bone surf (5E+0)	-	-	-	6E-8	6E-7
88	Radium-227 ²	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	-	-
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 ²	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	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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	-	-
90	Thorium-232	W, see ^{226}Th	7E-1	1E-3	5E-13	-	-	-
			Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8	3E-7
		Y, see ^{226}Th	-	3E-3	1E-12	-	-	-
90	Thorium-234	W, see ^{226}Th	3E+2	2E+2	8E-8	3E-10	-	-
			LLI wall (4E+2)	-	-	-	5E-6	5E-5
		Y, see ^{226}Th	-	2E+2	6E-8	2E-10	-	-
91	Protactinium-227 ²	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
			-	Bone surf (2E+1)	-	3E-11	-	-
91	Protactinium-230	Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-	-
		W, see ^{227}Pa	6E+2	5E+0	2E-9	7E-12	-	-
91	Protactinium-231		Bone surf (9E+2)	-	-	-	1E-5	1E-4
		Y, see ^{227}Pa	-	4E+0	1E-9	5E-12	-	-
		W, see ^{227}Pa	2E-1	2E-3	6E-13	-	-	-
91	Protactinium-232		Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9	6E-8
		Y, see ^{227}Pa	-	4E-3	2E-12	-	-	-
			-	Bone surf (6E-3)	-	8E-15	-	-
91	Protactinium-233	W, see ^{227}Pa	1E+3	2E+1	9E-9	-	2E-5	2E-4
			-	Bone surf (6E+1)	-	8E-11	-	-
		Y, see ^{227}Pa	-	6E+1	2E-8	-	-	-
91	Protactinium-234		-	Bone surf (7E+1)	-	1E-10	-	-
		W, see ^{227}Pa	1E+3	7E+2	3E-7	1E-9	-	-
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
91	Protactinium-234	Y, see ^{227}Pa	-	6E+2	2E-7	8E-10	-	-
		W, see ^{227}Pa	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
92	Uranium-230	Y, see ^{227}Pa	-	7E+3	3E-6	9E-9	-	-
		D, UF_6 , UO_2F_2 , $\text{UO}_2(\text{NO}_3)_2$	4E+0	4E-1	2E-10	-	-	-
			Bone surf (6E+0)	Bone surf (6E-1)	-	8E-13	8E-8	8E-7
92	Uranium-231		-	4E-1	1E-10	5E-13	-	-
		Y, UO_2 , U_3O_8	-	3E-1	1E-10	4E-13	-	-
		D, see ^{230}U	5E+3	8E+3	3E-6	1E-8	-	-
92	Uranium-232		LLI wall (4E+3)	-	-	-	6E-5	6E-4
		W, see ^{230}U	-	6E+3	2E-6	8E-9	-	-
		Y, see ^{230}U	-	5E+3	2E-6	6E-9	-	-
92	Uranium-233	D, see ^{230}U	2E+0	2E-1	9E-11	-	-	-
			Bone surf (4E+0)	Bone surf (4E-1)	-	6E-13	6E-8	6E-7
		W, see ^{230}U	-	4E-1	2E-10	5E-13	-	-
92	Uranium-233	Y, see ^{230}U	-	8E-3	3E-12	1E-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	

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
92	Uranium-234 ³	W, see ²³⁰ U	-	7E-1	3E-10	1E-12	-	-
		Y, see ²³⁰ U	-	4E-2	2E-11	5E-14	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
92	Uranium-234 ³	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 ³	D, see ²³⁰ U	1E+1	1E+0	6E-10	-	-	-
		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6	
		W, see ²³⁰ U	-	8E-1	3E-10	1E-12	-	-
92	Uranium-235 ³	Y, see ²³⁰ U	-	4E-2	2E-11	6E-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-236	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-236	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-237	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-237	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-238 ³	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-239 ²	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	-	-
		D, see ²³⁰ U	1E+1	1E+0	5E-10	-	-	-
92	Uranium-natural ³	Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7	3E-6	
		W, see ²³⁰ U	-	8E-1	3E-10	9E-13	-	-
		Y, see ²³⁰ U	-	5E-2	2E-11	9E-14	-	-
93	Neptunium-232 ²	W, all compounds	1E+5	2E+3	7E-7	-	2E-3	2E-2
93	Neptunium-232 ²	Bone surf (5E+2)	-	-	-	6E-9	-	-
		W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93	Neptunium-233 ²	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
93	Neptunium-234	W, all compounds	2E+4	8E+2	3E-7	-	-	-
		W, all compounds	LLI wall (2E+4)	Bone surf (1E+3)	-	2E-9	3E-4	3E-3
93	Neptunium-235	W, all compounds	3E+0	2E-2	9E-12	-	-	-
		Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8	9E-7	
93	Neptunium-236 (1.15E+5 y)	W, all compounds	3E+3	3E+1	1E-8	-	-	-
		Bone surf (4E+3)	Bone surf (7E+1)	-	1E-10	5E-5	5E-4	
93	Neptunium-236m (22.5 h)	W, all compounds	5E-1	4E-3	2E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	1E-14	2E-8	2E-7	
93	Neptunium-237	W, all compounds	1E+3	6E+1	3E-8	-	2E-5	2E-4
		Bone surf (2E+2)	Bone surf (2E+2)	-	2E-10	-	-	
93	Neptunium-238	W, all compounds	2E+3	2E+3	9E-7	3E-9	-	-

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
				ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)			
			LLI wall (2E+3)	-	-	-	2E-5	2E-4
93	Neptunium-240 ²	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4	3E-3
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 ²	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	2E-2	8E-12	-	-	-
		Bone surf (4E+0)	Bone surf (4E+0)	-	5E-14	6E-8	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	7E-3	3E-12	-	-	-
		Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	
		Y, see ²³⁴ Pu	-	2E-2	8E-12	2E-14	-	-
94	Plutonium-239	W, see ²³⁴ Pu	8E-1	6E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	
94	Plutonium-240	W, see ²³⁴ Pu	8E-1	6E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	
94	Plutonium-241	W, see ²³⁴ Pu	4E+1	3E-1	1E-10	-	-	-
		Bone surf (7E+1)	Bone surf (6E-1)	-	8E-13	1E-6	1E-5	
		Y, see ²³⁴ Pu	-	8E-1	3E-10	-	-	-
		Bone surf (1E+0)	Bone surf (1E+0)	-	1E-12	-	-	
94	Plutonium-242	W, see ²³⁴ Pu	8E-1	7E-3	3E-12	-	-	-
		Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	
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	7E-3	3E-12	-	-	-
		Bone surf (2E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7	
		Y, see ²³⁴ Pu	-	2E-2	7E-12	-	-	-
		Bone surf (2E-2)	Bone surf (2E-2)	-	2E-14	-	-	
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	3E+2	1E-7	4E-10	-	-
		LLI wall (4E+2)	-	-	-	-	6E-6	6E-5
		Y, see ²³⁴ Pu	-	3E+2	1E-7	4E-10	-	-
95	Americium-237 ²	W, all compounds	8E+4	3E+5	1E-4	4E-7	1E-3	1E-2
95	Americium-	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
	^{238}Pu		-	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	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242m	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-242	W, all compounds	4E+3	8E+1	4E-8	-	5E-5	5E-4
			-	Bone surf (9E+1)	-	1E-10	-	-
95	Americium-243	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
95	Americium-244m ²	W, all compounds	6E+4	4E+3	2E-6	-	-	-
			St wall (8E+4)	Bone surf (7E+3)	-	1E-8	1E-3	1E-2
95	Americium-244	W, all compounds	3E+3	2E+2	8E-8	-	4E-5	4E-4
			-	Bone surf (3E+2)	-	4E-10	-	-
95	Americium-245	W, all compounds	3E+4	8E+4	3E-5	1E-7	4E-4	4E-3
95	Americium-246m ²	W, all compounds	5E+4	2E+5	8E-5	3E-7	-	-
			St wall (6E+4)	-	-	-	8E-4	8E-3
95	Americium-246 ²	W, all compounds	3E+4	1E+5	4E-5	1E-7	4E-4	4E-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	6E-1	2E-10	-	-	-
			Bone surf (8E+1)	Bone surf (6E-1)	-	9E-13	1E-6	1E-5
96	Curium-241	W, all compounds	1E+3	3E+1	1E-8	-	2E-5	2E-4
			-	Bone surf (4E+1)	-	5E-11	-	-
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	4E-13	7E-7	7E-6
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	2E-14	3E-8	3E-7
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-	-
			Bone surf (3E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-	-
			Bone surf (1E+0)	Bone surf (1E-2)	-	2E-14	2E-8	2E-7
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-	-
			Bone surf (4E-1)	Bone surf (3E-3)	-	4E-15	5E-9	5E-8
96	Curium-249 ²	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

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		Air (μCi/ml)	Water (μCi/ml)	
				ALI (μCi)	DAC (μCi/ml)			
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 ²	W, all compounds except those given for Y	3E+4	6E+2	2E-7	8E-10	-	-
			St wall (3E+4)	-	-	-	4E-4	4E-3
98	Californium-246	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	4E+2	9E+0	4E-9	1E-11	5E-6	5E-5
			-	9E+0	4E-9	1E-11	-	-
98	Californium-248	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	8E+0	6E-2	3E-11	-	-	-
			Bone surf (2E+1)	Bone surf (1E-1)	-	2E-13	2E-7	2E-6
98	Californium-249	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
			-	1E-2	4E-12	-	-	-
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-250	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	1E+0	9E-3	4E-12	-	-	-
			Bone surf (2E+0)	Bone surf (2E-2)	-	3E-14	3E-8	3E-7
98	Californium-251	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	5E-1	4E-3	2E-12	-	-	-
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8	2E-7
			-	Bone surf (1E-2)	-	2E-14	-	-
98	Californium-252	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+0	2E-2	8E-12	-	-	-
			Bone surf (5E+0)	Bone surf (4E-2)	-	5E-14	7E-8	7E-7
98	Californium-253	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+2	2E+0	8E-10	3E-12	-	-
			Bone surf (4E+2)	-	-	-	5E-6	5E-5
98	Californium-254	W, see ²⁴⁴ Cf Y, see ²⁴⁴ Cf	2E+0	2E-2	9E-12	3E-14	3E-8	3E-7
			-	2E-2	7E-12	2E-14	-	-
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

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 Ingestion ALI (μCi)	Inhalation		Air ($\mu\text{Ci}/\text{ml}$)	Water ($\mu\text{Ci}/\text{ml}$)	
ALI (μCi)	DAC ($\mu\text{Ci}/\text{ml}$)							
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 ¹	-	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
-	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

ENDNOTES:

¹"Submersion" means that values given are for submersion in a hemispherical semi-infinite cloud of airborne material.

² 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 $\mu\text{Ci}/\text{ml}$ 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 1200-02-05-52.)

³ For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see 1200-02-05-.50(5)). 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 shall not exceed $8E-3$ (SA) $\mu\text{Ci-hr/ml}$, 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:

$$\text{SA} = 3.6E-7 \text{ curies/gram U U-depleted}$$

$$\text{SA} = [0.4 + 0.38 (\text{enrichment}) + 0.0034 (\text{enrichment})^2] E-6, \quad \text{enrichment} \geq 0.72$$

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 schedule 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 schedule for any radionuclide that is not known to be absent from the mixture; or

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 ($\mu\text{Ci/ml}$)
			Inhalation			Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
Oral Ingestion ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)						
	If it is known that Ac-227-D and Cm-250-W are not present		-	7E-4	3E-13	-	-	-
	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	-	-	-
	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	-	-

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 ($\mu\text{Ci/ml}$)
			Inhalation			Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	
Oral Ingestion ALI (μCi)	ALI (μCi)	DAC ($\mu\text{Ci/ml}$)						
	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	-	-
	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

3. 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.

4. 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 Schedule RHS 8-30 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" (i.e., "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:

$$\frac{C_A}{\text{DAC}_A} + \frac{C_B}{\text{DAC}_B} + \frac{C_C}{\text{DAC}_C} \leq 1$$

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

New Rules

Chapter 1200-02-05 is amended by adding new rules 1200-02-05-.127 Disposal of Certain Byproduct Material and 1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits. The new rules shall read as follows:

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- 1200-02-05-.127 Disposal of Certain Byproduct Material
- 1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits

- (1) Licensed material as defined in subparagraphs (c) and (d) of the definition of *Byproduct material* set forth in Rule 1200-02-05-.32(11) may be disposed of in accordance with Chapter 1200-02-11, even though it is not defined as low-level radioactive waste. Therefore, any licensed byproduct material being disposed of

at a facility, or transferred for ultimate disposal at a facility licensed under Chapter 1200-02-11, must meet the requirements of Rule 1200-02-05-.125.

- (2) A licensee may dispose of byproduct material, as defined in subparagraphs (c) and (d) of the definition of Byproduct material set forth in Rule 1200-02-05-.32(11), at a disposal facility authorized to dispose of such material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

1200-02-05-.146 Reports to Individuals of Exceeding Dose Limits.

When a licensee or registrant is required by Rule 1200-02-05-.143 or 1200-02-05-.144 to report to the Division any exposure of an identified occupationally exposed individual, or an identified member of the public, to radiation or radioactive material, the licensee or registrant shall also provide the individual a report on his or her exposure data included in the report to the Division. This report must be transmitted no later than the transmittal to the Division.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-07 Use of Radionuclides in the Healing Arts

Amendments

Paragraph (32) of Rule 1200-02-07-.05 Definitions is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (32) shall read as follows:

- (32) **Reserved** "Radioactive drug" means any chemical compound containing radioactive material that may be used on or administered to patients or human research subjects as an aid in the diagnosis, treatment, or prevention of disease or other abnormal condition.

Rule 1200-02-07-.05 Definitions is amended by adding new paragraph (45) so that, as amended, paragraph (45) shall read as follows:

- (45) "Positron Emission Tomography (PET) radionuclide production facility" is defined as a facility operating a cyclotron or accelerator for the purpose of producing PET radionuclides.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.14 Notifications is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-07-.14 shall read as follows:

1200-02-07-.14 Notifications.

- (1) A licensee shall provide to the Division a copy of the board certification, the Nuclear Regulatory Commission, Agreement State or Licensing State license, or the permit issued by a licensee of broad scope for each individual no later than thirty (30) days after the date that the Licensee permits the individual to work as an authorized user, an authorized nuclear pharmacist or an authorized medical physicist, pursuant to Rule 1200-02-07-.13(1)(b).

~~(1)~~(2) A licensee shall notify the Division no later than thirty days after:

- (a) An authorized user, an authorized nuclear pharmacist, a radiation safety officer, or an authorized medical physicist permanently discontinues performance of duties under the license or has a name change;
- (b) The licensee's mailing address changes;

- (c) The licensee's name changes, but the name change does not constitute a transfer of control of the license as described in **Rule 1200-02-10-.16(2)**; or
- (d) The licensee has added to or changed the areas of use identified in the application or on the license where radioactive material is used under either **Rule 1200-02-07-.38** or **1200-02-07-.40**.

(2)(3) The licensee shall send the documents required in this rule to the Division at the address listed in **Rule 1200-02-04-.07(1)(c)**.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (4) of Rule 1200-02-07-.15 Exemptions Regarding Specific Licenses of Broad Scope is amended by deleting "1200-02-07-.14(1)(a)" between the word "of" and "regarding" and replacing it with "Rule 1200-02-07-.14(2)(a)" so that, as amended, paragraph (4) shall read as follows:

- (4) The provisions of ~~1200-02-07-.14(1)(a)~~ **Rule 1200-02-07-.14(2)(a)** regarding notification to the Division for new authorized users, new authorized medical physicists and new authorized nuclear pharmacists;

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.23 Training of Radiation Safety Officer is amended by adding "Rule 1200-02-07-.26," between the word "under" and "1200-02-07-.43" so that, as amended, subpart (ii) shall read as follows:

- (ii) In clinical nuclear medicine facilities providing diagnostic and/or therapeutic services under the direction of physicians who meet the requirements for authorized users under **Rule 1200-02-07-.26**, 1200-02-07-.43 or 1200-02-07-.47; and

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.24 Training for Authorized Medical Physicist is amended by adding "Rule 1200-02-07-.26," between the word "in" and "1200-02-07-.59" so that, as amended, part 2 shall read as follows:

- 2. In clinical radiation facilities providing high energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services under the direction of physicians who meet the requirements for authorized users in **Rule 1200-02-07-.26**, 1200-02-07-.59 or 1200-02-07-.80; and

Subparagraph (b) of paragraph (2) of Rule 1200-02-07-.24 Training for Authorized Medical Physicist is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) Has obtained written attestation that the individual has satisfactorily completed the requirements in subparagraphs (1)(a) and (1)(b) and paragraph (3), or subparagraph (2)(a) and paragraph (3) of this rule, and has achieved a level of competency sufficient to function independently as an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status. The written attestation must be signed by a preceptor authorized medical physicist who meets the requirements in **Rule 1200-02-07-.24**, **Rule 1200-02-07-.26** or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements for an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status; and

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.26 Training for Experienced Radiation Safety Officer, Teletherapy or Medical Physicist, Authorized User, and Nuclear Pharmacist is amended by adding paragraph (3) which shall read as follows:

- (3) Individuals who need not comply with training requirements as described in this rule may serve as preceptors for, and supervisors of, applicants seeking authorization on Division or NRC licenses for the same uses for which these individuals are authorized.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-07-.30 Determination of Dosages of Unsealed Radioactive Material for Medical Use is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-07-.30 shall read as follows:

1200-02-07-.30 Determination of Dosages of Unsealed Radioactive Material For Medical Use.

- (1) A licensee shall determine and record the activity of each dosage before medical use.
- (2) For a unit dosage, this determination must be made by:
- (a) Direct measurement of radioactivity; or
 - (b) A decay correction, based on the activity or activity concentration determined by:
 1. A manufacturer or preparer licensed under **Rule 1200-02-10-.13(10)** or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or
 2. An Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).
 3. **A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements.**
- (3) For other than unit dosages, this determination must be made by:
- (a) Direct measurement of radioactivity;
 - (b) Combination of measurement of radioactivity and mathematical calculations; or
 - (c) Combination of volumetric measurements and mathematical calculations, based on the measurement made by: ~~a manufacturer or preparer licensed under 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements.~~
 1. **A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or**
 2. **A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements.**

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.38 Use of Unsealed Radioactive Material for Uptake, Dilution, and Excretion Studies for Which a Written Directive is Not Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except for quantities that require a written directive under **Rule 1200-02-07-.20(2)**, a licensee may use any unsealed radioactive material, prepared for medical use for uptake, dilution, or excretion that is:
- (a) Obtained from: ~~a manufacturer or preparer licensed under 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or~~
 1. **A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements; or**

2. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements; or
- (b) ~~Prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in 1200-02-07-.43 or 1200-02-07-.47 and 1200-02-07-.43(1)(c)1(ii)(VII), or an individual under the supervision, as specified in 1200-02-07-.19, or~~ Excluding production of PET radionuclides, prepared by:
1. An authorized nuclear pharmacist;
 2. A physician who is an authorized user and who meets the requirements specified in Rule 1200-02-07-.43, or Rule 1200-02-07-.47 and Rule 1200-02-07-.43(1)(c)1(ii)(VII); or
 3. An individual under the supervision, as specified in Rule 1200-02-07-.19, of the authorized nuclear pharmacist in part 1 of this subparagraph or the physician who is an authorized user in part 2 of this subparagraph; or
- (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA); or
- (d) Prepared by the licensee in accordance with a Radioactive Drug Research Committee approved application or an Investigational New Drug (IND) protocol accepted by Food and Drug Administration (FDA) for use in research.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.39 Training for Uptake, Dilution, and Excretion Studies is amended by adding "Rule 1200-02-07-.26," between the words "in" and "1200-02-07-.39" so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.39, 1200-02-07-.43, or 1200-02-07-.47 or equivalent U.S. Nuclear Regulatory Commission or agreement State requirements, involving:

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.39 Training for Uptake, Dilution, and Excretion Studies is amended by adding "Rule 1200-02-07-.26," between the words "in" and "1200-02-07-.39" so that, as amended, part 2 shall read as follows:

2. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.39, 1200-02-07-.43, or 1200-02-07-.47 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in parts (1)(a)1 or (1)(c)1 of this rule and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under **Rule 1200-02-07-.38**.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.40 Use of Unsealed Radioactive Material for Imaging and Localization Studies for Which a Written Directive is Not Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee may use, for imaging and localization studies, any radioactive material prepared for medical use, in quantities that do not require a written directive as described in **Rule 1200-02-07-.20(2)** that is:

- (a) Obtained from: ~~a manufacturer or preparer licensed under Chapter 1200-02-10-.13(10) or equivalent regulations of another Agreement State or U.S. Nuclear Regulatory Commission requirements; or~~
 - 1. A manufacturer or preparer licensed under Rule 1200-02-10-.13(10) or equivalent regulations of another Agreement State or U.S. Nuclear Regulatory Commission requirements; or
 - 2. A PET radioactive drug producer licensed under Rule 1200-02-10-.11(8) or equivalent Agreement State requirements; or
- (b) ~~Excluding production of PET radionuclides~~ prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in Rule 1200-02-07-.43, or Rule 1200-02-07-.47 and Rule 1200-02-07-.43(1)(c)1(ii)(VII), or an individual under the supervision of either as specified in Rule 1200-02-07-.19; or
- (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with a radioactive drug research committee-approved protocol or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA); or
- (d) Prepared by the licensee for use in research in accordance with a radioactive drug research committee-approved application or an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.41 Radionuclide Contaminants is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee shall not administer to humans a ~~radioactive drug containing radiopharmaceutical that contains:~~
 - (a) More than 0.15 kilobecquerel of molybdenum-99 per megabecquerel of technetium-99m (0.15 μ Ci of Mo-99 per mCi of Tc-99m); or
 - (b) More than 0.02 kilobecquerel of strontium-82 per megabecquerel of rubidium-82 chloride injection (0.02 μ Ci of Sr-82 per mCi of Rb-82 chloride); or ~~more than 0.2 kilobecquerel of strontium-85 per megabecquerel of rubidium-82 chloride injection (0.2 μ Ci of Sr-85 per mCi of Rb-82).~~
 - ~~(c) More than 0.2 kilobecquerel of strontium-85 per megabecquerel of rubidium-82 chloride injection (0.2 μ Ci of Sr-85 per mCi of Rb-82).~~

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.43 Training for Imaging and Localization Studies is amended by adding ", Rule 1200-02-07-.26," between the words "rule" and "or" so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user, who meets the requirements in this rule, Rule 1200-02-07-.26, or item (VII) of this subpart and Rule 1200-02-07-.47 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, involving:

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.43 Training for Imaging and Localization Studies is amended by deleting the part and substituting the following so that, as amended, part 2 shall read as follows:

- 2. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in this rule, Rule 1200-02-07-.26, or Rule 1200-02-07-.47 and item 1(ii)(VII) of this subparagraph or equivalent Agreement State or U.S. Nuclear Regulatory

Commission requirements, that the individual has satisfactorily completed the requirements in parts (a)1 or (c)1 of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under **Rules** 1200-02-07-.38 and 1200-02-07-.40.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.44 Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) A licensee may use any unsealed radioactive material for diagnostic or therapeutic medical use for which a written directive is required that has been:
 - (a) Obtained from: ~~a manufacturer or preparer licensed under 1200-02-07-10-13(10) or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements; or~~
 1. A manufacturer or preparer licensed under Rule 1200-02-10-13(10) or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements; or
 2. A PET radioactive drug producer licensed under Rule 1200-02-10-11(8) or equivalent Agreement State requirements; or
 - (b) ~~Excluding production of PET radionuclides~~ prepared by an authorized nuclear pharmacist, a physician who is an authorized user and who meets the requirements specified in **Rule** 1200-02-07-.43, **Rule** 1200-02-07-.47, or an individual under the supervision of either as specified in **Rule** 1200-02-07-.19; or
 - (c) Obtained from and prepared by an Agreement State or U.S. Nuclear Regulatory Commission licensee for use in research in accordance with an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA) for use in research; or
 - (d) Prepared by the licensee for use in research in accordance with an investigational new drug (IND) protocol accepted by Food and Drug Administration (FDA).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subpart (ii) of Part 1 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.47 Training for Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by adding "Rule 1200-02-07-.26," between the words "rule," and "or" so that, as amended, subpart (ii) shall read as follows:

- (ii) Work experience, under the supervision of an authorized user who meets the requirements of this rule, **Rule 1200-02-07-.26**, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements. A supervising authorized user, who meets the requirements in this subparagraph, must also have experience in administering dosages in the same dosage category or categories (i.e., item (VI) of this subpart) as the individual requesting authorized user status. The work experience must involve:

Part 2 of subparagraph (b) of paragraph (1) of Rule 1200-02-07-.47 Training for Use of Unsealed Radioactive Material for Which a Written Directive is Required is amended by deleting the part and substituting the following so that, as amended, part 2 shall read as follows:

2. Have obtained written attestation that the individual has satisfactorily completed the requirements in **subparagraph part (a)1** and item (b)1(ii)(VI) of this paragraph or **subparagraph (b) part 1** of this **subparagraph** and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under **Rule** 1200-02-07-.44. The written attestation must be signed by a preceptor authorized user who meets the requirements in this rule, **Rule 1200-02-07-.26**, or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements. The

preceptor authorized user, who meets the requirements in this subparagraph, must have experience in administering dosages in the same dosage category or categories (i.e., item 1(ii)(VI) of this subparagraph) as the individual requesting authorized user status.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (a) of paragraph (1) of Rule 1200-02-07-.48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (a) shall read as follows:

- (a) Is certified by a medical specialty board whose certification process includes all of the requirements in subparagraph (c) of this paragraph and whose certification has been recognized by the Division, the U.S. Nuclear Regulatory Commission or an Agreement State **and who meets the requirements in part (c)3 of this paragraph**; (The names of board certifications which have been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State will be posted on the U.S. Nuclear Regulatory Commission's Web page); or

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part, but not its subparts, and substituting the following so that, as amended, part 2, prior to its subparts, shall read as follows:

2. Has work experience, under the supervision of an authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.47, 1200-02-07-.48, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A supervising authorized user who meets the requirements in **Rule 1200-02-07-.47(1)(b)**, must also have experience in administering dosages as specified in **Rule 1200-02-07-.47(1)(b)1(ii)(VI)I and/or II**. The work experience must involve:

Part 3 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.48 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less Than or Equal to 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

3. Has obtained written attestation that the individual has satisfactorily completed the requirements in parts 1 and 2 of this subparagraph and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under **Rule 1200-02-07-.44**. The written attestation must be signed by a preceptor authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.47, 1200-02-07-.48, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirement in **Rule 1200-02-07-.47(1)(b)**, must also have experience in administering dosages as specified in **Rule 1200-02-07-.47(1)(b)1(ii)(VI)I and/or II**.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 2 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.49 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less greater than 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part, but not its subparts, and substituting the following so that, as amended, part 2, prior to its subparts, shall read as follows:

2. Has work experience, under the supervision of an authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.47, 1200-02-07-.49 or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A supervising authorized user, who meets the requirements in **Rule 1200-02-07-.47(1)(b)**, must have experience in administering dosages as specified in **Rule 1200-02-07-.47(1)(b)1(ii)(VI)II**. The work experience must involve:

Part 3 of subparagraph (c) of paragraph (1) of Rule 1200-02-07-.49 Training for the Oral Administration of Sodium Iodine I-131 Requiring a Written Directive in Quantities Less greater than 1.22 Gigabecquerels (33 Millicuries) is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

3. Has obtained written attestation that the individual has satisfactorily completed the requirements in parts 1 and 2 of this subparagraph and has achieved a level of competency sufficient to function independently as an authorized user for medical uses authorized under Rule 1200-02-07-.44. The written attestation must be signed by a preceptor authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47, 1200-02-07-.49, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirements in Rule 1200-02-07-.47(1)(b), must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)II.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.50 Training for the Parenteral Administration of Unsealed Radioactive Material Requiring a Written Directive is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except as provided in Rule 1200-02-07-.26, a licensee shall require an authorized user for the parenteral administration requiring a written directive, to be a physician who:
 - (a) Is an authorized user under Rule 1200-02-07-.47 for uses listed in Rule 1200-02-07-.47(1)(b)1(ii)(VI)III or 1200-02-07-.47(1)(b)1(ii)(VI)IV, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements; or
 - (b) Is an authorized user under Rule 1200-02-07-.59 or 1200-02-07-.80, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements and who meets the requirements in subparagraph (d) of this paragraph; or
 - (c) Is certified by a medical specialty board whose certification process has been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State under Rule 1200-02-07-.59 or 1200-02-07-.80, and who meets the requirements in subparagraph (d) of this paragraph.
 - (d)
 1. Has successfully completed 80 hours of classroom and laboratory training, applicable to parenteral administrations, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide for which a written directive is required. The training must include:
 - (i) Radiation physics and instrumentation;
 - (ii) Radiation protection;
 - (iii) Mathematics pertaining to the use and measurement of radioactivity;
 - (iv) Chemistry of radioactive material for medical use; and
 - (v) Radiation biology; and
 2. Has work experience, under the supervision of an authorized user who meets the requirements in Rule 1200-02-07-.26, 1200-02-07-.47 or 1200-02-07-.50, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, in the parenteral administration, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV, and/or parenteral administration of any other radionuclide for which a written directive is required. A supervising authorized user who meets the requirements in Rule 1200-02-07-.47 must have experience in administering dosages as specified in Rule 1200-02-07-.47(1)(b)1(ii)(VI)III and/or IV. The work experience must involve:

- (i) Ordering, receiving, and unpacking radioactive materials safely, and performing the related radiation surveys;
- (ii) Performing quality control procedures on instruments used to determine the activity of dosages, and performing checks for proper operation of survey meters;
- (iii) Calculating, measuring, and safely preparing patient or human research subject dosages;
- (iv) Using administrative controls to prevent a misadministration involving the use of unsealed radioactive material;
- (v) Using procedures to contain spilled radioactive material safely, and using proper decontamination procedures; and
- (vi) Administering dosages to patients or human research subjects, that include at least three cases involving the parenteral administration, for which a written directive is required, of any beta emitter or any photon-emitting radionuclide with a photon energy less than 150 keV and/or at least three cases involving the parenteral administration of any other radionuclide, for which a written directive is required; and

~~(e)~~3. Has obtained written attestation that the individual has satisfactorily completed the requirements in subparagraphs (b) or (c) of this paragraph, and has achieved a level of competency sufficient to function independently as an authorized user for the parenteral administration of unsealed radioactive material requiring a written directive. The written attestation must be signed by a preceptor authorized user who meets the requirements in **Rule 1200-02-07-.26**, 1200-02-07-.47, 1200-02-07-.50, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements. A preceptor authorized user, who meets the requirements in **Rule 1200-02-07-.47**, must have experience in administering dosages as specified in **Rule 1200-02-07-.47(1)(b)1(ii)(VI)III** and/or IV.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-07-.59 Training for Use of Manual Brachytherapy Sources is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

- (1) Except as provided in **Rule 1200-02-07-.26**, a licensee shall require an authorized user of a manual brachytherapy source for the uses authorized under **Rule 1200-02-07-.51** to be a physician who:
 - (a) Is certified by a medical specialty board whose certification process has been recognized by the Division, the U.S. Nuclear Regulatory Commission, or an Agreement State, and who meets the requirements in part ~~(1)~~(b)3 of this **rule paragraph**. (The names of board certifications which have been recognized by the U.S. Nuclear Regulatory Commission or an Agreement State will be posted on the U.S. Nuclear Regulatory Commission's Web page.) To be recognized, a specialty board shall require all candidates for certification to:
 - 1. Successfully complete a minimum of 3 years of residency training in a radiation oncology program approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or Royal College of Physicians and Surgeons of Canada or the Committee on Postgraduate Training of the American Osteopathic Association; and
 - 2. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of manual brachytherapy; or
 - (b) 1. Has completed a structured educational program in basic radionuclide handling techniques applicable to the use of manual brachytherapy sources that includes:

- (i) 200 hours of classroom and laboratory training in the following areas:
 - (I) Radiation physics and instrumentation;
 - (II) Radiation protection;
 - (III) Mathematics pertaining to the use and measurement of radioactivity; and
 - (IV) Radiation biology; and
 - (ii) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements at a medical institution, involving:
 - (I) Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
 - (II) Checking survey meters for proper operation;
 - (III) Preparing, implanting, and removing brachytherapy sources;
 - (IV) Maintaining running inventories of material on hand;
 - (V) Using administrative controls to prevent a misadministration involving the use of radioactive material;
 - (VI) Using emergency procedures to control radioactive material; and
2. Has completed [three \(3\)](#) years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subpart 1(ii) of this subparagraph; and
 3. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in part (a)1, or parts (b)1 and 2 of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user of manual brachytherapy sources for the medical uses authorized under [Rule 1200-02-07-.51](#).

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 3 of subparagraph (b) of paragraph (1) of rule 1200-02-07-.60 Training for Ophthalmic Use of Strontium-90 is amended by deleting the part and substituting the following so that, as amended, part 3 shall read as follows:

3. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in [Rule 1200-02-07-.26](#), [1200-02-07-.59](#), this rule, or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements, that the individual has satisfactorily completed the requirements in subparagraphs ~~(a) and~~ (b) of this paragraph and has achieved a level of competency sufficient to function independently as an authorized user of strontium-90 for ophthalmic use.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Subparagraph (b) of paragraph (1) of rule 1200-02-07-.80 Training for Use of Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) 1. Has completed a structured educational program in basic radionuclide techniques applicable to the use of a sealed source in a therapeutic medical unit that includes:
 - (i) 200 hours of classroom and laboratory training in the following areas:
 - (I) Radiation physics and instrumentation;
 - (II) Radiation protection;
 - (III) Mathematics pertaining to the use and measurement of radioactivity; and
 - (IV) Radiation biology; and
 - (ii) 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements at a medical institution, involving:
 - (I) Reviewing full calibration measurements and periodic spot-checks;
 - (II) Preparing treatment plans and calculating treatment doses and times;
 - (III) Using administrative controls to prevent a misadministration involving the use of radioactive material;
 - (IV) Implementing emergency procedures to be followed in the event of the abnormal operation of the medical unit or console;
 - (V) Checking and using survey meters; and
 - (VI) Selecting the proper dose and how it is to be administered; and
- 2. Has completed three years of supervised clinical experience in radiation therapy, under an authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subpart 1(ii) of this subparagraph; and
- 3. Has obtained written attestation that the individual has satisfactorily completed the requirements in part (a)1 of this paragraph or part 1 of this subparagraph, and part 2 of this subparagraph and subparagraph (c) of this rule and has achieved a level of competency sufficient to function independently as an authorized user of each type of therapeutic medical unit for which the individual is requesting authorized user status. The written attestation must be signed by a preceptor authorized user who meets the requirements in this rule, [Rule 1200-02-07-.26](#), or equivalent U.S. Nuclear Regulatory Commission or Agreement State requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status; and

Amendments

Rule 1200-02-10-.02 Scope is amended by deleting the rule and substituting the following so that, as amended, Rule 1200-02-10-.02 shall read as follows:

1200-02-10-.02 Scope.

Except as otherwise specifically provided, no person shall **manufacture, produce**, receive, possess, use, transfer, own, or acquire radioactive material unless authorized in a specific or general license issued pursuant to this chapter. All other sources of radiation, registered inspectors, and x-ray installations and services unless exempt from this Chapter under **Rule** 1200-02-10-.03, 1200-02-10-.04, 1200-02-10-.06, 1200-02-10-.07 or 1200-02-10-.30 shall be registered with the Division in accordance with the requirements of **Rule** 1200-02-10-.24 ~~of this Chapter.~~

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (1) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (1) shall read as follows:

(1) Exempt concentrations.

- (a) Except as provided in **Rule** 1200-02-10-.04(1)(b) **and (d)**, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires products containing radioactive material introduced in concentrations not in excess of those listed in Schedule RHS 8-4.
- (b) No person may introduce radioactive material into a product or material knowing or having reason to believe that it will be transferred to persons exempt under **Rule** 1200-02-10-.04(1)(a) or equivalent regulations of the U.S. Nuclear Regulatory Commission, any Agreement State or Licensing State except in accordance with a license issued pursuant to ~~1200-02-10-.13(8) or the general license provided in 1200-02-10-.10 and 1200-02-10-.29~~ 10 CFR 32.11.
- (c) ~~This paragraph shall not be deemed to authorize the import of radioactive material or products containing radioactive material.~~
- (d) ~~A manufacturer, processor, or producer of a product or material is exempt from the requirements for a license set forth in these regulations to the extent that this person transfers radioactive material contained in a product or material in concentrations not in excess of those specified in Schedule RHS 8-4 in the Appendix to this Chapter and introduced into the product or material by a licensee holding a specific license issued by the NRC expressly authorizing such introduction. This exemption does not apply to the transfer of radioactive material contained in any food, beverage, cosmetic, drug, or other commodity or product designed for ingestion or inhalation by, or application to, a human being.~~

Paragraph (2) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (2) shall read as follows:

(2) Exempt products.

- (a) Except for persons who apply radioactive materials to or persons who incorporate radioactive material into the products listed in this paragraph, any person is exempt from these regulations to the extent that he receives, possesses, uses, transfers, owns or acquires the following products:
 - ~~(a)1.~~ Time pieces or hands or dials containing not more than the following quantities of radioactive material and not exceeding the following specified levels of radiation:
 - ~~1-(i)~~ 25 millicuries of tritium per timepiece;

- 2-(ii) 5 millicuries of tritium per hand;
 - 3-(iii) 15 millicuries of tritium per dial (bezels when used shall be considered as part of the dial);
 - 4-(iv) 100 microcuries of promethium-147 per watch or 200 microcuries of promethium-147 per any other timepiece;
 - 5-(v) 20 microcuries of promethium-147 per watch hand or 40 microcuries of promethium-147 per other timepiece hand;
 - 6-(vi) 60 microcuries of promethium-147 per watch dial or 120 microcuries of promethium-147 per other timepiece dial (bezels when used shall be considered part of the dial);
 - 7-(vii) The levels of radiation from hands and dials containing radioactive materials will not exceed when measured through 50 milligrams per square centimeter of absorber:
 - (i) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface;
 - (ii) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surface;
 - (iii) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.
 - 8-(viii) One (1) microcuries of radium-226 per timepiece in **intact** timepieces **acquired manufactured** prior to the effective date of this regulation.
- (b)2. ~~Reserved. Lock illuminators containing not more than 15 millicuries of tritium or not more than 2 millicuries of promethium-147 installed in automobile locks. The levels of radiation from each lock illuminator containing promethium-147 will not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 50 milligrams per square centimeter of absorber.~~
 - (c)3. Balances of precision containing not more than 1 millicurie of tritium per balance or not more than 0.5 millicurie of tritium per balance part **manufactured before December 17, 2007**.
 - (d)4. ~~Reserved. Automobile shift quadrants containing not more than 25 millicuries of tritium.~~
 - (e)5. Marine compasses containing not more than 750 millicuries of tritium gas and other marine navigational instruments containing not more than 250 millicuries of tritium gas **manufactured before December 17, 2007**.
 - (f)6. ~~Reserved. Thermostat dials and pointers containing not more than 25 millicuries of tritium per thermostat.~~
 - (g)7. Electron tubes¹ containing not more than one of the following specified quantities of radioactive material per tube:
 - 1-(i) 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube;

¹ "Electron tubes", as used in this subparagraph, include spark gap tubes, power tubes, gas tubes, including glow lamps, receiving tubes, microwave tubes, indicator tubes, pickup tubes, radiation detection tubes and any other completely sealed tube that is designed to conduct or control electrical currents.

- ~~2.~~(ii) 1 microcurie of cobalt-60;
- ~~3.~~(iii) 5 microcuries of nickel-63;
- ~~4.~~(iv) 30 microcuries of krypton-85;
- ~~5.~~(v) 5 microcuries of cesium-137;
- ~~6.~~(vi) 30 microcuries of promethium-147;

provided, the levels of radiation from each electron tube containing radioactive material do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.

~~(h)8. Reserved. Resins containing scandium-46 and designed for sand consolidation in oil wells.~~

- ~~1. Any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns or acquires synthetic plastic resins containing scandium-46 which are designed for sand consolidation in oil wells.~~
- ~~2. Such resins shall have been manufactured or imported in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission, or shall have been manufactured in accordance with the specifications contained in a specific license issued by the Division or any Agreement State to the manufacturer of such resins pursuant to licensing requirements equivalent to those in Sections 32.16 and 32.17 of 10 CFR (Code of Federal Regulations) Part 32 of the regulations of the U.S. Nuclear Regulatory Commission.~~
- ~~3. This exemption does not authorize the manufacture of any resins containing scandium-46.~~

~~(i)9. Gas and aerosol detectors containing radioactive material.~~

- ~~1.~~(i) Except for persons who manufacture, process, ~~or produce~~, or initially transfer for sale or distribution gas and aerosol detectors containing radioactive material, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires radioactive material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards provided that detectors containing radioactive material shall have been manufactured, ~~imported—processed, produced, or initially transferred~~² in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to section 32.26 of 10 CFR Part 32 or a licensing state pursuant to regulations equivalent to Rule 1200-02-10-.13(15) that authorizes the initial transfer of the detectors to persons who are exempt from regulatory requirements. This exemption also covers gas and aerosol detectors manufactured or distributed before the effective date of these rules in accordance with a specific license issued by an Agreement State under comparable provisions to Rule 1200-02-10-.13(15) authorizing distribution to persons exempt from regulatory requirements.
- ~~2.~~(ii) Gas and aerosol detectors previously manufactured and distributed to general licensees in accordance with a specific license issued by an Agreement State shall be considered exempt under ~~1200-02-10-.04(2)(i)1. Rule 1200-02-10-.04(2)(a)9(i)~~, provided that the device is labeled in accordance with the specific license authorizing distribution of the generally licensed device, and provided further that they meet the requirements of Rule 1200-02-10-.13(15).
- ~~3.~~(iii) Gas and aerosol detectors containing NARM previously manufactured and distributed in accordance with a specific license issued by a Licensing State shall

be considered exempt under ~~1200-02-10-.04(2)(i)~~ Rule 1200-02-10-.04(2)(a)9(i), provided that the device is labeled in accordance with the specific license authorizing distribution, and provided further that they meet the requirements of Rule 1200-02-10-.13(15).

~~(j)~~10. Self luminous products containing radioactive material.

- ~~4-~~(i) Except for persons who manufacture, process, or produce self-luminous products containing tritium, krypton-85, or promethium-147, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns or acquires tritium, krypton-85, promethium-147 in self luminous products manufactured, processed, produced, imported, or transferred in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to Section 32.22 of 10 CFR Part 32, which license authorizes the transfer of the product to persons who are exempt from regulatory requirements.
- ~~2-~~(ii) The exemption in ~~1200-02-10-.04(2)(j)~~1, Rule 1200-02-10-.04(2)(a)10(i) does not apply to tritium, krypton-85, or promethium-147 used in products for frivolous purposes or in toys or adornments.
- ~~3-~~(iii) Any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, or owns self luminous products containing less than 0.1 microcurie of radium-226 which were acquired prior to the effective date of this regulation.

~~(k)~~11. Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of radioactive material; provided that:

- ~~4-~~(i) Each source contains no more than one exempt quantity set forth in Schedule RHS 8-3;
- ~~2-~~(ii) Each instrument contains no more than 10 exempt quantities. For purposes of this ~~subparagraph (k) part~~, an instrument's source(s) may contain either one type or different types of radionuclides and an individual exempt quantity may be composed of fractional parts of one or more of the exempt quantities in Schedule RHS 8-3, provided that the sum of such fractions shall not exceed unity; and
- ~~3-~~(iii) For purposes of this ~~subparagraph (k) part~~, 0.05 microcuries of americium-241 is considered an exempt quantity under Schedule RHS 8-3.

~~(i)~~12. ~~Reserved. Spark gap irradiators containing not more than 1 microcurie of cobalt-60 per spark gap irradiator for use in electrically ignited fuel oil burners having a firing rate of at least 3 gallons per hour (11.4 liters per hour).~~

13. Ionization chamber smoke detectors containing not more than 1 microcurie (μCi) of americium-241 per detector in the form of a foil and designed to protect life and property from fires.

- (b) Any person who desires to apply radioactive material to, or to incorporate radioactive material into, the products exempted in subparagraph (a) of this paragraph or who desires to initially transfer for sale or distribution such products containing radioactive material, should apply for a specific license pursuant to 10 CFR 32.14, which license states that the product may be distributed by the licensee to persons exempt from subparagraph (a) of this paragraph.

Subparagraph (a) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (a) shall read as follows:

- (a) Except as provided in (c) ~~and (d) through (e)~~ of this paragraph, any person is exempt from these

regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires radioactive material in individual quantities each of which does not exceed the applicable quantity set forth in Schedule RHS 8-3; ~~however, these quantities shall not be administered in any form to human beings internally or externally for any purpose.~~

Subparagraph (b) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by deleting the subparagraph and substituting the following so that, as amended, subparagraph (b) shall read as follows:

- (b) Any person who possesses radioactive material received or acquired ~~before September 25, 1971,~~ under the general license formerly provided in ~~subparagraph RHS 7.203 A.2.~~ this Chapter is exempt from the requirements for a license set forth in this Chapter to the extent that such person possesses, uses, transfers, or owns such radioactive material. ~~Such exemption does not apply for radium-226.~~

Subparagraph (e) of Paragraph (3) of Rule 1200-02-10-.04 Exemptions: Radioactive Materials Other Than Source Material is amended by adding subparagraph (e) so that, as amended, subparagraph (e) shall read as follows:

- (e) No person may, for purposes of producing an increased radiation level, combine quantities of radioactive material covered by this exemption so that the aggregate quantity exceeds the limits set forth in Schedule RHS 8-3 in the Appendix to this Chapter, except for radioactive material combined within a device placed in use before May 3, 1999, or as otherwise permitted by the regulations in this Chapter.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Part 1 of subparagraph (b) of paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the part and substituting the following so that, as amended, part 1 shall read as follows:

1. The general license in subparagraph (a) ~~of this paragraph~~ applies only to radioactive material contained in devices that have been manufactured or initially transferred and labeled in accordance with the specifications contained in:
 - (i) A specific license issued by the Division pursuant to ~~1200-02-10-.13(4)~~ Rule 1200-02-10-.13(5), or
 - (ii) A specific license issued by the U.S. Nuclear Regulatory Commission pursuant to 10 CFR 32.51 or an Agreement State ~~or a Licensing State that authorizes distribution of devices to persons generally licensed by the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State with provisions comparable to Rule 1200-02-10-.13(5).~~

Subpart (ii) of Part 8 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the subpart, but not its items, and substituting the following so that, as amended, subpart (ii), prior to its items, shall read as follows:

- (ii) Shall within ~~thirty~~ (30) days after the transfer of a device to a specific licensee or export, furnish a report to the Division. The report shall contain:

Subpart (iii) of Part 8 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the subpart and substituting the following so that, as amended, Subpart (iii) shall read as follows:

- (iii) Shall obtain written Division approval before transferring the device to any other specific licensee not specifically identified in subpart ~~(2)(e)8(i)~~ of this part. ~~However a holder of a specific license may transfer a device for possession and use under its own specific license without prior approval, if, the holder:~~
 - (l) Verifies that the specific license authorizes the possession and use, or

applies for and obtains an amendment to the license authorizing the possession and use;

- (II) Removes, alters, covers, or clearly and unambiguously augments the existing label (otherwise required by part 1 of this subparagraph) so that the device is labeled in compliance with Rule 1200-02-05-.113 of these regulations; however the manufacturer, model number, and serial number must be retained;
- (III) Obtains manufacturer's or initial transferor's information concerning maintenance that would be applicable under the specific license (such as leak testing procedures); and
- (IV) Reports the transfer under subpart (ii) of this part.

Part 14 of Subparagraph (c) of Paragraph (2) of Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by deleting the part and substituting the following so that, as amended, part 14 shall read as follows:

- 14. Shall be subject to the bankruptcy notification requirement in paragraph (7) of Rule 1200-02-10-.16~~(7)~~ if holding devices containing radioactive material that meet the following criteria, based on the activity indicated on the label:
 - (i) At least 10 mCi (370MBq) of cesium-137;
 - (ii) At least 0.1 mCi (3.7 MBq) of strontium-90;
 - (iii) At least 1 mCi (37 MBq) of cobalt-60; ~~or~~
 - (iv) At least 1 mCi (37 MBq) of americium-241 or any other transuranic (i.e., element with atomic number greater than uranium (92)); ~~or~~
 - (v) At least 0.1 mCi (37 MBq) of radium-226.

Rule 1200-02-10-.10 General Licenses - Radioactive Material Other Than Source Material is amended by adding paragraph (8) so that, as amended, paragraph (8) shall read as follows:

(8) Self Luminous Products Containing Radium-226

- (a) A general license is hereby issued to any person to acquire, receive, possess, use, or transfer, in accordance with the provisions of subparagraphs (b) through (d) of this paragraph, radium-226 contained in the following products manufactured prior to the effective date of these rules.
 - 1. Antiquities originally intended for use by the general public. For the purposes of this paragraph, antiquities mean products originally intended for use by the general public and distributed in the late 19th and early 20th centuries, such as radium emanator jars, revigators, radium water jars, radon generators, refrigerator cards, radium bath salts, and healing pads.
 - 2. Intact timepieces containing greater than 0.037 MBq (1 μ Ci), nonintact timepieces, and timepiece hands and dials no longer installed in timepieces.
 - 3. Luminous items installed in air, marine, or land vehicles.
 - 4. All other luminous products provided that no more than 100 items are used or stored at the same location at any one time.
 - 5. Small radium sources containing no more than 0.037 MBq (1 μ Ci) of radium-226. For the purposes of this paragraph, "small radium sources" means discrete survey instrument check sources, sources contained in radiation measuring instruments, sources used in

educational demonstrations (such as cloud chambers and spinthariscopes), electron tubes, lightning rods, ionization sources, static eliminators, or as designated by the NRC.

- (b) Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in subparagraph (a) of this paragraph are exempt from the provisions of Chapters 1200-02-04 and 1200-02-05, and Rule 1200-02-10-.26, to the extent that the receipt, possession, use, or transfer of byproduct material is within the terms of the general license; provided, however, that this exemption shall not be deemed to apply to any such person specifically licensed under this Chapter.
- (c) Any person who acquires, receives, possesses, uses, or transfers byproduct material in accordance with the general license in subparagraph (a) of this paragraph shall:
 - 1. Notify the Division should there be any indication of possible damage to the product so that it appears it could result in a loss of the radioactive material (a report containing a brief description of the event, and the remedial action taken, must be furnished to the Division at the address listed in Rule 1200-02-04-.07 within thirty (30) days);
 - 2. Not abandon products containing radium-226 (the product, and any radioactive material from the product, may only be disposed of according to Rule 1200-02-05-.127 of these regulations or by transfer to a person authorized by a specific license to receive the radium-226 in the product or as otherwise approved by the NRC or an Agreement State;
 - 3. Not export products containing radium-226 except in accordance with 10 CFR Part 110;
 - 4. Dispose of products containing radium-226 at a disposal facility authorized to dispose of radioactive material in accordance with any Federal or State solid or hazardous waste law, including the Solid Waste Disposal Act, as authorized under the Energy Policy Act of 2005, by transfer to a person authorized to receive radium-226 by a specific license issued under this Chapter, or equivalent regulations of the NRC or an Agreement State, or as otherwise approved by the NRC or an Agreement State; and
 - 5. Respond to written requests from the Division to provide information relating to the general license within thirty (30) calendar days of the date of the request, or other time specified in the request. If the general licensee cannot provide the requested information within the allotted time, it shall, within that same time period, request a longer period to supply the information by providing the Division, by an appropriate method listed in 10 CFR 30.6(a), a written justification for the request.
- (d) The general license in subparagraph (a) of this paragraph does not authorize the manufacture, assembly, disassembly, repair, or import of products containing radium-226, except that timepieces may be disassembled and repaired.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.11 Filing of Application for Specific Licenses is amended by deleting the Rule in its entirety and substituting the following so that, as amended, Rule 1200-02-10-.11 shall read as follows:

1200-02-10-.11 Filing of Application for Specific Licenses.

- (1) Application for specific licenses shall be filed in duplicate on a form prescribed by the Division.
- (2) The Division may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Division to determine whether the application should be granted or denied or whether a license should be modified or revoked.
- (3) Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on his behalf.
- (4) An application for a license may include a request for a license authorizing one or more activities.

- (5) In his application, the applicant may incorporate by reference information contained in previous applications, statements or reports filed with the Division provided such references are specific.
- (6) Applications and documents submitted to the Division may be made available for public inspection except that the Division may withhold any document or part thereof from public inspection if disclosure of its contents involves proprietary information.
- (7) An application for a specific license to use radioactive material in the form of a sealed source or in a device that contains the sealed source shall either:
 - (a) Identify the source or device by manufacturer and model number as registered with the NRC under 10 CFR 32.210 or with an Agreement State or for a source or a device containing radium-226 or accelerator-produced radioactive material with an Agreement State under provisions comparable to 10 CFR 32.210; or
 - (b) Contain the information identified in 10 CFR 32.210(c).
 - (c) For sources or devices containing naturally occurring or accelerator produced radioactive material manufactured prior to November 30, 2007 that are not registered with the NRC under 10 CFR 32.210 or with an Agreement State, and for which the applicant is unable to provide all categories of information specified in 10 CFR 32.210(c), the applicant must provide:
 - 1. All available information identified in 10 CFR 32.210(c) concerning the source, and, if applicable, the device; and
 - 2. Sufficient additional information to demonstrate that there is reasonable assurance that the radiation safety properties of the source or device are adequate to protect health and minimize danger to life and property. Such information must include a description of the source or device, a description of radiation safety features, the intended use and associated operating experience, and the results of a recent leak test.
- (8) An application from a medical facility, educational institution, or Federal facility to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to licensees in its consortium authorized for medical use under Chapter 1200-02-07 or equivalent Agreement State requirements shall include:
 - (a) A request for authorization for the production of PET radionuclides or evidence of an existing license issued under this Chapter or Agreement State requirements for a PET radionuclide production facility within its consortium from which it receives PET radionuclides;
 - (b) Evidence that the applicant is qualified to produce radioactive drugs for medical use by meeting one of the criteria in Rule 1200-02-10-.13(10)(a)2;
 - (c) Identification of individual(s) authorized to prepare the PET radioactive drugs if the applicant is a pharmacy, and documentation that each individual meets the requirements of an authorized nuclear pharmacist as specified in Rule 1200-02-10-.13(10)(b)2; and
 - (d) Information identified in Rule 1200-02-10-.13(10)(a)3 on the PET drugs to be noncommercially transferred to members of its consortium.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Paragraph (10) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (10) shall read as follows:

- (10) Manufacture, preparation or transfer for commercial distribution of radiopharmaceuticals containing radioactive material for medical use.
 - (a) An application for a specific license to manufacture, prepare, or transfer for commercial

distribution radiopharmaceuticals containing radioactive material for use by persons authorized pursuant to **Chapter** 1200-02-07 will be approved if:

1. The applicant satisfies the general requirements specified in **Rule** 1200-02-10-.12;
 2. The applicant submits evidence that the applicant is at least one of the following:
 - (i) Registered or licensed with the U.S. Food and Drug Administration (FDA) as the owner or operator of a drug establishment that engages in the manufacture, preparation, propagation, compounding, or processing of a drug **under 21 CFR 207.20(a)**;
 - (ii) Registered or licensed with a state agency as a drug manufacturer; ~~or~~
 - (iii) Licensed as a pharmacy by the Tennessee Board of Pharmacy;
 - (iv) **Operating as a nuclear pharmacy within a Federal medical institution; or**
 - (v) **A Positron Emission Tomography (PET) drug production facility registered with a state agency.**
 3. The applicant submits information on the radionuclide; chemical and physical form; packaging including maximum activity per vial, syringe, generator or other container of the radioactive drug; and shielding provided by the packaging of the radioactive material for safe handling and storage of radiopharmaceuticals by medical use licensees; and
 4. The applicant satisfies the following labeling requirements:
 - (i) A label is affixed to each transport radiation shield, whether it is constructed of lead, glass, plastic or other material, of a radioactive drug to be transferred for commercial distribution. The label shall include the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL"; the name of the radioactive drug or its abbreviation; and the quantity of radioactivity at a specified date and time. For radioactive drugs with a half-life greater than **one hundred (100)** days, the time may be omitted.
 - (ii) A label is affixed to each syringe, vial or other container used to hold a radioactive drug to be transferred for commercial distribution. The label shall include the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL" and an identifier that ensures that the syringe, vial or other container can be correlated with the information on the transport radiation shield label.
- (b) A licensee described by subpart (a)2(iii) of this paragraph:
1. May prepare radiopharmaceuticals for medical use, as defined in **subparagraph Rule** 1200-02-07-.05, provided that the radiopharmaceuticals are prepared by either an authorized nuclear pharmacist, as specified in parts 2 and 4 of this subparagraph, or an individual under the supervision of an authorized nuclear pharmacist as specified in **Rule** 1200-02-07-.19.
 2. May allow a pharmacist to work as an authorized nuclear pharmacist if:
 - (i) This individual qualifies as an authorized nuclear pharmacist as defined in **subparagraph Rule** 1200-02-07-.05(4),
 - (ii) This individual meets the requirements specified in **Rule** 1200-02-07-.25(2) and **Rule** 1200-02-07-.27, and the licensee has received an approved license amendment identifying this individual as an authorized nuclear pharmacist; or

- (iii) This individual is designated as an authorized nuclear pharmacist in accordance with part 4 of this subparagraph.
3. The actions authorized in parts 1 and 2 of this subparagraph are permitted in spite of more restrictive language in license conditions.
 4. May designate a pharmacist (as defined in ~~paragraph 1200-02-07-.05(23)~~ Rule 1200-02-07-.05(24)) as an authorized nuclear pharmacist if: ~~the individual is identified as of {April 18, 2002}, as an 'authorized user' on a nuclear pharmacy license issued by the Division under this chapter.~~
 - (i) ~~The individual was a nuclear pharmacist preparing only radioactive drugs containing accelerator-produced radioactive material; and~~
 - (ii) ~~The individual practiced at a pharmacy at a Government agency or Federally recognized Indian Tribe before November 30, 2007 or at all other pharmacies before August 8, 2009, or an earlier date as noticed by the NRC.~~
 5. Shall provide to the Division a copy of each individual's:
 - (i) Certification by a specialty board whose certification process has been recognized by the Division, U.S. Nuclear Regulatory Commission or an Agreement State as specified in Rule 1200-02-07-.25(1) with the written attestation signed by a preceptor as required by Rule 1200-02-07-.25(2)(b); or
 - (ii) The Division, U.S. Nuclear Regulatory Commission or other Agreement State license; or
 - (iii) ~~The permit issued by a licensee of broad scope; and NRC master materials licensee permit; or~~
 - (iv) ~~State pharmacy licensure or registration, no later than 30 days after the date that the licensee allows, pursuant to subparts 2(i) and (iii) of this subparagraph, the individual to work as an authorized nuclear pharmacist.~~ The permit issued by a licensee or NRC master materials permittee of broad scope or the authorization from a commercial nuclear pharmacy authorized to list its own authorized nuclear pharmacist; or
 - (v) Documentation that only accelerator-produced radioactive materials were used in the practice of nuclear pharmacy at a Government agency or Federally recognized Indian Tribe before November 30, 2007 or at all other locations of use before August 8, 2009, or an earlier date as noticed by the NRC; and
 - (vi) A copy of the state pharmacy licensure or registration, no later than 30 days after the date that the licensee allows, the individual to work as an authorized nuclear pharmacist under subparts 2(i) and (iii) of this subparagraph.
- (c) A licensee shall possess and use instrumentation to measure the radioactivity of radioactive drugs. The licensee shall have procedures for use of the instrumentation. The licensee shall measure by direct measurement or by combination of measurements and calculations, the amount of radioactivity in dosages of alpha-, beta-, or photon-emitting radioactive drugs before transfer for commercial distribution. In addition, the licensee shall:
1. Perform tests before initial use, periodically and following repair, on each instrument for accuracy, linearity and geometry dependence, as appropriate for the use of the instrument; and make adjustments when necessary; and
 2. Check each instrument for constancy and proper operation at the beginning of each day of use.

- (d) Nothing in this rule relieves the licensee from complying with applicable FDA, other Federal and State requirements governing radioactive drugs.

Paragraph (13) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (13) shall read as follows:

- (13) Manufacture and distribution of radioactive material for certain in vitro clinical or laboratory testing under general license. In addition to the requirements set forth in **Rule 1200-02-10-.12**, a specific license to manufacture or distribute radioactive material for use under the general license of **Rule 1200-02-10-.10(7)** will be issued only if:
- (a) The radioactive material is to be prepared for distribution in prepackaged units of:
1. Iodine-125 in units not exceeding 10 microcuries each.
 2. Iodine-131 in units not exceeding 10 microcuries each.
 3. Carbon-14 in units not exceeding 10 microcuries each.
 4. Hydrogen-3 (tritium) in units not exceeding 50 microcuries each.
 5. Iron-59 in units not exceeding 20 microcuries each.
 6. Cobalt-57 in units not exceeding 10 microcuries each.
 7. Selenium-75 in units not exceeding 10 microcuries each.
 8. Mock Iodine-125 in units not exceeding 0.05 microcurie of iodine-129 and 0.005 microcurie of americium-241 each.
- (b) Each prepackaged unit bears a durable, clearly visible label:
1. Identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed 10 microcuries of iodine-131, iodine-125, cobalt-57, selenium-75, or carbon-14; 50 microcuries of hydrogen-3 (tritium); 20 microcuries of iron-59; or Mock Iodine-125 in units not exceeding 0.05 microcurie of iodine-129 and 0.005 microcurie of americium-241 each; and
 2. Displaying the radiation caution symbol **described in Rule 1200-02-05-.110** and the words, "Caution, Radioactive Material" and "Not for Internal or External Use in Humans or Animals."
- (c) ~~One of~~ The following statements, ~~as appropriate~~, or a substantially similar statement which contains the information called for in ~~one of~~ the following statements, appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure which accompanies the package:
1. This radioactive material may be received, acquired, possessed and used only by physicians, veterinarians in the practice of veterinary medicine, clinical laboratories or hospitals and only for in vitro clinical or laboratory tests not involving internal or external administration of the material, or the radiation there from, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into an agreement for the exercise of regulatory authority.

(Name of Manufacturer)

- ~~2. This radioactive material may be received, acquired, possessed and used only by physicians, veterinarians in the practice of veterinary medicine, clinical laboratories or hospitals and only for in vitro clinical or laboratory tests not involving internal or external~~

~~administration of the material, or the radiation there from, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of a Licensing State.~~

(Name of Manufacturer)

- (d) The label affixed to the unit, or the leaflet or brochure which accompanies the package, contains adequate information as to the precautions to be observed in handling and storing such radioactive material. In the case of the Mock Iodine-125 reference or calibration source, the information accompanying the source must also contain directions to the licensee regarding the waste disposal requirements set out in **Rule 1200-02-05-.120**.

Paragraph (15) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (15) shall read as follows:

- (15) Incorporation of naturally occurring and accelerator-produced radioactive material into gas and aerosol detectors. An application for a specific license authorizing the incorporation of NARM into gas and aerosol detectors to be distributed to persons exempt under ~~1200-02-10-.04(2)(i)~~ **Rule 1200-02-10-.04(2)(a)9** will be approved if the application satisfies requirements equivalent to those contained in Section 32.26 of 10 CFR Part 32. The maximum quantity of radium-226 in each device shall not exceed 0.1 microcurie.

Paragraph (16) of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the paragraph and substituting the following so that, as amended, paragraph (16) shall read as follows:

- (16) **Special requirements for License to Manufacture or initially transfer of** calibration sources containing americium-241, plutonium or radium-226 for distribution to persons generally licensed under **Rule 1200-02-10-.10(4)**. ~~In addition to the requirements set forth in 1200-02-10-.12, a specific license to manufacture calibration and reference sources containing americium-241, plutonium or radium-226 to persons generally licensed under 1200-02-10-.10(4) will be issued only if the requirements of Sections 32.57, 32.58, 32.59, and 32.102 of 10 CFR Part 32 and Section 70.39 of 10 CFR Part 70 or their equivalent are met.~~
- (a) An application for a specific license to manufacture or initially transfer calibration or reference sources containing americium-241, plutonium, or radium-226 for distribution to persons generally licensed under **Rule 1200-02-10-.10(4)** will be approved if:
1. The applicant satisfies the general requirement of **Rule 1200-02-10-.12**; and
 2. The applicant submits sufficient information regarding each type of calibration or reference source pertinent to evaluation of the potential radiation exposure, including:
 - (i) Chemical and physical form and maximum quantity of americium 241, plutonium or radium-226 in the source;
 - (ii) Details of construction and design;
 - (iii) Details of the method of incorporation and binding of the americium-241, plutonium or radium-226 in the source;
 - (iv) Procedures for and results of prototype testing of sources, which are designed to contain more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, to demonstrate that the americium-241, plutonium or radium-226 contained in each source will not be released or be removed from the source under normal conditions of use;
 - (v) Details of quality control procedures to be followed in manufacture of the source;
 - (vi) Description of labeling to be affixed to the source or the storage container for the source; and

- (vii) Any additional information, including experimental studies and tests, required by the Division to facilitate a determination of the safety of the source.
 3. Each source will contain no more than 185 kBq (5 μ Ci) of americium-241, plutonium or radium-226.
 4. The Division determines, with respect to any type of source containing more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, that:
 - (i) The method of incorporation and binding of the americium-241, plutonium or radium-226 in the source is such that the americium-241, plutonium or radium-226 will not be released or be removed from the source under normal conditions of use and handling of the source; and
 - (ii) The source has been subjected to and has satisfactorily passed the prototype tests prescribed by subparagraph (b) of this paragraph.
- (b) Schedule C- prototype tests for calibration or reference sources containing americium-241, plutonium or radium-226. An applicant for a license pursuant to subparagraph (a) of this paragraph shall conduct prototype tests for any type of source which is designed to contain more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, in the order listed, on each of five prototypes of such source, which contains more than 185 Bq (0.005 μ Ci) of americium-241, plutonium or radium-226, as follows:
 1. Initial measurement. The quantity of radioactive material deposited on the source shall be measured by direct counting of the source.
 2. Dry wipe test. The entire radioactive surface of the source shall be wiped with filter paper with the application of moderate finger pressure. Removal of radioactive material from the source shall be determined by measuring the radioactivity on the filter paper or by direct measurement of the radioactivity on the source following the dry wipe.
 3. Wet wipe test. The entire radioactive surface of the source shall be wiped with filter paper, moistened with water, with the application of moderate finger pressure. Removal of radioactive material from the source shall be determined by measuring the radioactivity on the filter paper after it has dried or by direct measurement of the radioactivity on the source following the wet wipe.
 4. Water soak test. The source shall be immersed in water at room temperature for a period of twenty four (24) consecutive hours. The source shall then be removed from the water. Removal of radioactive material from the source shall be determined by direct measurement of the radioactivity on the source after it has dried or by measuring the radioactivity in the residue obtained by evaporation of the water in which the source was immersed.
 5. Dry wipe test. On completion of the preceding test in part 4 of this subparagraph, the dry wipe test described in part 2 of this subparagraph shall be repeated.
 6. Observations. Removal of more than 185 Bq (0.005 μ Ci) of radioactivity in any test prescribed by this subparagraph shall be cause for rejection of the source design. Results of prototype tests submitted to the Division shall be given in terms of radioactivity in microcuries and percent of removal from the total amount of radioactive material deposited on the source.
- (c) Labeling of devices. Each person licensed under subparagraph (a) of this paragraph shall affix to each source, or storage container for the source, a label which shall contain sufficient information relative to safe use and storage of the source and shall include the following statement or a substantially similar statement which contains the information called for in the following statement:

The receipt, possession, use and transfer of this source, Model ___, Serial No. ___, are subject to a general license and the regulations of the NRC or an Agreement State. Do not remove this label.

CAUTION--RADIOACTIVE MATERIAL--
THIS SOURCE CONTAINS AMERICIUM-241 [PLUTONIUM OR RADIUM-226].
DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

 Name of manufacturer or initial transferor

- (d) Leak testing of each source. Each person licensed under subparagraph (a) of this paragraph shall perform a dry wipe test upon each source containing more than 3.7 kBq (0.1 µCi) of americium-241, plutonium or radium 226 prior to transferring the source to a general licensee under Rule 1200-02-10-.10(4). This test shall be performed by wiping the entire radioactive surface of the source with a filter paper with the application of moderate finger pressure. The radioactivity on the paper shall be measured by using radiation detection instrumentation capable of detecting 185 Bq (0.005 µCi) of americium-241, plutonium, or radium-226. If any such test discloses more than 185 Bq (0.005 µCi) of radioactive material, the source shall be deemed to be leaking or losing americium-241, plutonium or radium-226 and shall not be transferred to a general licensee under Rule 1200-02-10-.10(4) or equivalent regulations of the NRC or an Agreement State.

Table 7-2 of Rule 1200-02-10-.13 Special Requirements for Issuance of Specific Licenses is amended by deleting the table in its entirety and substituting the following so that, as amended, Table 7-2 will read as follows:

Table RHS 7-2 Quantities of radioactive materials requiring consideration of the need for an emergency plan for responding to a release.

Radioactive material ¹	Release fraction	Quantity (curies)	Radioactive material ¹	Release fraction	Quantity (curies)
Actinium-228	0.001	4,000	Gold-198	0.01	30,000
Americium-241	0.001	2	Hafnium-172	0.01	400
Americium-242	0.001	2	Hafnium-181	0.01	7,000
Americium-243	0.001	2	Holmium-166m	0.01	100
Antimony-124	0.01	4,000	Hydrogen-3	0.5	20,000
Antimony-126	0.01	6,000	Iodine-125	0.5	10
Barium-133	0.01	10,000	Iodine-131	0.5	10
Barium-140	0.01	30,000	Indium-114m	0.01	1,000
Bismuth-207	0.01	5,000	Iridium-192	0.001	40,000
Bismuth-210	0.01	600	Iron-55	0.01	40,000
Cadmium-109	0.01	1,000	Iron-59	0.01	7,000
Cadmium-113	0.01	80	Krypton-85	1.0	6,000,000
Calcium-45	0.01	20,000	Lead-210	0.01	8
Californium-252	0.001	9 (20 mg)	Manganese-56	0.01	60,000
Carbon-14	0.01	50,000	Mercury-203	0.01	10,000
	Non-CO		Molybdenum-99	0.01	30,000
Cerium-141	0.01	10,000	Neptunium-237	0.001	2
Cerium-144	0.01	300	Nickel-63	0.01	20,000
Cesium-134	0.01	2,000	Niobium-94	0.01	300
Cesium-137	0.01	3,000	Phosphorus-32	0.5	100
Chlorine-36	0.5	100	Phosphorus-33	0.5	1,000
Chromium-51	0.01	300,000	Polonium-210	0.01	10
Cobalt-60	0.001	5,000	Potassium-42	0.01	9,000
Copper-64	0.01	200,000	Promethium-145	0.01	4,000
Curium-242	0.001	60	Promethium-147	0.01	4,000
Curium-243	0.001	3	Radium-226	0.001	100
Curium-244	0.001	4	Ruthenium-106	0.01	200
Curium-245	0.001	2	Samarium-151	0.01	4,000
Europium-152	0.01	500	Scandium-46	0.01	3,000
Europium-154	0.01	400	Selenium-75	0.01	10,000
Europium-155	0.01	3,000	Silver-110m	0.01	1,000
Germanium-68	0.01	2,000	Sodium-22	0.01	9,000
Gadolinium-153	0.01	5,000	Sodium-24	0.01	10,000

Strontium-89	0.01	3,000	Zinc-65	0.01	5,000
Strontium-90	0.01	90	Zirconium-93	0.01	400
Sulfur-35	0.5	900	Zirconium-95	0.01	5,000
Technetium-99	0.01	10,000	Any other beta-gamma emitter	0.01	10,000
Technetium-99m	0.01	400,000	Mixed fission products	0.01	1,000
Tellurium-127m	0.01	5,000	Mixed corrosion products	0.01	10,000
Tellurium-129m	0.01	5,000	Contaminated equipment beta-gamma	0.001	10,000
Terbium-160	0.01	4,000	Irradiated material, any form other than solid noncombustible	0.01	1,000
Thulium-170	0.01	4,000	Irradiated material, solid noncombustible	0.001	10,000
Tin-113	0.01	10,000	Mixed radioactive waste, beta-gamma	0.01	1,000
Tin-123	0.01	3,000	Packaged mixed waste, beta-gamma ²	0.001	10,000
Tin-126	0.01	1,000	Any other alpha emitter	0.001	2
Titanium-44	0.01	100	Contaminated equipment, alpha	0.0001	20
Vanadium-48	0.01	7,000	Packaged waste, alpha ²	0.0001	20
Xenon-133	1.0	900,000	Combinations of radioactive materials listed above ¹		
Yttrium-91	0.01	2,000			

¹ For combinations of radioactive materials, consideration of the need for an emergency plan is required if the sum of the ratios of the quantity of each radioactive material authorized to the quantity listed for that material in Table RHS 7-2 exceeds one.

² Waste packaged in Type B containers does not require an emergency plan.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.16 Specific Terms and Conditions of Licenses is amended by deleting the Rule in its entirety and substituting the following so that, as amended, Rule 1200-02-10-.16 shall read as follows:

- (1) Each license issued pursuant to this Chapter shall be subject to all provisions of the Act, now or hereafter in effect, and to all rules, regulations, and orders of the Division.
- (2) Neither the license nor any right under the license shall be assigned or otherwise transferred in violation of the provisions of the Act.
- (3) Each person licensed by the Division pursuant to this Chapter shall confine his use and possession of the material licensed to the locations and purposes authorized in the license.
- (4) Each licensee authorized under **Rule 1200-02-10-.13(5)** to distribute certain devices to generally licensed persons shall:
 - (a) Report to the Division within **thirty (30) days** after the end of each calendar quarter all transfers of such devices to persons generally licensed under **Rule 1200-02-10-.10(2)** or, if no transfers have been made during the reporting period, the report shall so indicate. For all transfers the report shall identify each general licensee by name and address, an individual by name and/or position who may constitute a point of contact between the Division and the general licensee, the type and model number of device transferred and the quantity and type of radioactive material contained in the device; and
 - (b) Furnish to each general licensee in this State to whom he transfers such device a copy of the general license contained in **Rule 1200-02-10-.10(2)**.
- (5) Each specific licensee shall notify the Division in writing when the licensee decides to permanently discontinue all activities involving radioactive materials authorized under the license.
- (6) Each licensee preparing technetium-99m radiopharmaceuticals from molybdenum-99/technetium-99m generators **or rubidium-82 from strontium-82/rubidium-82 generators** shall test the generator eluates for molybdenum-99 breakthrough **or strontium-82 and strontium-85 contamination, respectively**, in accordance with **Rule 1200-02-07-.41**. **The licensee shall record the results of each test and retain each record for three (3) years after the record is made.**
- (7) Each specific licensee and each general licensee meeting the criteria of **part Rule 1200-02-10-.10(2)(c)14** shall:
 - (a) Provide the Division written notification, at the address in Rule 1200-02-04-.07, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code (U.S.C.):
 1. By or against the licensee;
 2. By or against an entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or
 3. By or against an affiliate (as that term is defined in 11 U.S.C. 101(2)) of the licensee;
 - (b) Include in the notification required in **subparagraph (7)(a)** of this **rule paragraph** the bankruptcy court in which the petition for bankruptcy was filed; and
 - (c) Include in the notification required in **subparagraph (7)(a)** of this **rule paragraph** the date of the filing of the petition.

- (8) When temporary job-sites are authorized on a specific license, radioactive material may be used at temporary job-sites, in areas not under exclusive federal jurisdiction, throughout the State of Tennessee.
- (9) Each portable gauge licensee shall use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal, whenever portable gauges are not under the control and constant surveillance of the licensee.
- (10)
 - (a) Authorization under Rule 1200-02-10-.11(8) to produce Positron Emission Tomography (PET) radioactive drugs for noncommercial transfer to medical use licensees in its consortium does not relieve the licensee from complying with applicable FDA, other Federal, and Agreement State requirements governing radioactive drugs.
 - (b) Each licensee authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall:
 - 1. Satisfy the labeling requirements in Rule 1200-02-10-.13(10)(a)4 for each PET radioactive drug transport radiation shield and each syringe, vial, or other container used to hold a PET radioactive drug intended for noncommercial distribution to members of its consortium; and
 - 2. Possess and use instrumentation to measure the radioactivity of the PET radioactive drugs intended for noncommercial distribution to members of its consortium and meet the procedural, radioactivity measurement, instrument test, instrument check, and instrument adjustment requirements in Rule 1200-02-10-.13(10)(c).
 - (c) A licensee that is a pharmacy authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall require that any individual that prepares PET radioactive drugs shall be:
 - 1. An authorized nuclear pharmacist that meets the requirements in Rule 1200-02-10-.13(10)(b)2, or
 - 2. An individual under the supervision of an authorized nuclear pharmacist as specified in Rule 1200-02-07-.19.
 - (d) A pharmacy, authorized under Rule 1200-02-10-.11(8) to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium that allows an individual to work as an authorized nuclear pharmacist, shall meet the requirements of Rule 1200-02-10-.13(10)(b)5.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Rule 1200-02-10-.29 Reciprocal Recognition of Licenses is amended by adding paragraphs (4) and (5) to read as follows:

- (4) Before radioactive materials can be used at a temporary job site within the State at any Federal facility, the jurisdictional status of the job site shall be determined. If the jurisdictional status is unknown, the Federal agency should be contacted to determine if the job site is under exclusive Federal jurisdiction.
 - (a) In areas of exclusive Federal jurisdiction, the general license is subject to all the applicable rules, regulations, orders and fees of the NRC, and
 - (b) Authorizations for use of radioactive materials at job sites under exclusive Federal jurisdiction shall be obtained from the NRC by either:
 - 1. Filing a NRC Form-241 in accordance with 10 CFR 150.20(b); or
 - 2. By applying for a specific NRC license.

- (5) Before radioactive material can be used at a temporary job site in another State, authorization shall be obtained for the State if it is an Agreement State, or from the NRC for any non-Agreement State, either by filing for reciprocity or applying for a specific license.

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.

Chapter 1200-02-11
Licensing Requirements for Land Disposal of Radioactive Waste

Amendments

Subparagraph (c) of paragraph (1) of Rule 1200-02-11-.14 Transfer of License is amended by adding the words “, required by Rule 1200-02-11-.19(1)(e) and (f),” between the words “care” and “will” so that, as amended, subparagraph (c) shall read as follows:

- (c) That any funds and necessary records for care, **required by Rules 1200-02-11-.19(1)(e) and (f)**, will be transferred to the disposal site owner;

Authority: T.C.A. §§ 68-202-201 et seq. and 4-5-201 et seq.