Regulation 61-63

Radioactive Materials (Title A)

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S.C. Department of Health and Environmental Control

2600 Bull Street | Columbia, SC 29201

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PART I
General Provisions

RHA 1.1. Scope.

Except as otherwise specifically provided, these regulations apply to all persons who receive, possess, use, transfer or acquire any radioactive material; provided, however, that nothing in these regulations shall apply to any person to the extent such person is subject to regulation by the United States Nuclear Regulatory Commission. Nothing in Part III of these regulations shall be interpreted as limiting the intentional exposure of patients to radiation for the purpose of diagnostic or therapy by persons licensed to practice one or more of the health professions within the authority granted to them by statute or regulation. These regulations shall become effective January 1, 1994.

RHA 1.2. Definitions.

As used in these regulations:

1.2.1 “Accelerator-produced material” means any material made radioactive by a particle accelerator.

1.2.2 “Act” means Act No. 223, Atomic Energy and Radiation Control Act enacted by the 1967 Session South Carolina Legislature. (Section 13-7-40 et. seq, 1976 S.C. Code of Law [as amended]).

1.2.3 “Agreement State” means any State with which the United States Nuclear Regulatory Commission has entered into an effective agreement under Section 274b. of the Atomic Energy Act of 1954, as amended (73 Stat. 689).

1.2.4 “Airborne radioactive material” means any radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors or gases.

1.2.5 “Airborne radioactivity area” means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations—

i) In excess of the derived air concentrations (DACs) specified in Appendix B, RHA 3.53, or

ii) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

1.2.6 “Byproduct material” means:

(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material;

(2) 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;

(3)(i) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or

(ii) Any material that

(A) Has been made radioactive by use of a particle accelerator; and

(B) Is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and

(4) Any discrete source of naturally occurring radioactive material, other than source material, that

(i) The Nuclear Regulatory Commission, (NRC) 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

(ii) Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

1.2.7 “Calendar quarter” means not less than 12 consecutive weeks nor more than 14 consecutive weeks. The first calendar quarter of each year shall begin in January; and subsequent calendar quarters shall be such that no day is included in more than one calendar quarter or omitted from inclusion within a calendar quarter. No licensee shall change the method observed by him of determining calendar quarters except at the beginning of a calendar year.

1.2.8 “Department” means the South Carolina Department of Health and Environmental Control.

1.2.9 “Depleted Uranium” means the source material uranium in which the isotope Uranium-235 is less than 0.711 weight percent of the total uranium present. Depleted uranium does not include special nuclear material.

1.2.10 “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.

1.2.11 “Dosimetry processor” means an individual or an organization that processes and evaluates personnel monitoring equipment in order to determine the radiation dose delivered to the equipment.

1.2.12 “High Radiation Area” means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

1.2.13 “Human Use” means the intentional internal or external administration of radiation or radioactive material to any individual.

1.2.14 “Individual” means any human being.

1.2.15 “License” except where otherwise specified, means either a general license or specific license issued pursuant to these regulations as further defined in Part II of these regulations.

1.2.16 “Licensing State” means any State with regulations equivalent to the Suggested State Regulations for Control of Radiation.

1.2.17 “NARM” means any naturally occurring or accelerator produced radioactive material. It does not include byproduct, source, or special nuclear material.

1.2.18 “Natural radioactivity” means radioactivity of naturally occurring nuclides.

1.2.19 “Occupational dose” means exposure of an individual to radiation (i) in a restricted area; or (ii) in the course of employment in which the individual’s duties involve exposure to radiation; provided that occupational dose shall not be deemed to include any exposure of an individual to radiation for the purpose of medical diagnosis or medical therapy of such individual.

1.2.20 “Particle accelerator” means any machine capable of accelerating electrons, protons, deuterons, or other charged particles in a vacuum and of discharging the resultant particulate or other radiation into a medium at energies usually in excess of 1 megaelectron volt. For purposes of this definition, “accelerator” is an equivalent term.

1.2.21 “Person” means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group agency, political subdivision of this State, any other state or political subdivision or agency thereof, and any legal successor, representative, agent or agency of the foregoing, other than United States Nuclear Regulatory Commission, and other than Federal Government Agencies licensed by the United States Nuclear Regulatory Commission.

1.2.22 “Personnel monitoring equipment” means devices designed to be carried or worn by an individual for the purpose of measuring the dose which an individual receives (e.g. film badges, film rings, pocket chambers, pocket dosimeters, thermoluminescent dosimeters, etc.).

1.2.23 “Pharmacist” means an individual licensed by the State of South Carolina to compound and dispense drugs, prescriptions and poisons.

1.2.24 “Physician” means an individual licensed by the State of South Carolina to dispense drugs in the practice of medicine.

1.2.25 “Principal activities” means activities authorized by the license which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

1.2.26 “Radiation” means gamma rays, X-rays, alpha and beta particles, high-speed electrons, neutrons, and other nuclear particles; but not sound or radio waves, or visible, infrared, or ultra-violet light.

1.2.27 “Radiation Area” means any area, accessible to individuals, in which there exists ionizing radiation at such levels that the whole body could receive a dose equivalent in excess of 5 millirem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

1.2.28 “Radiation safety officer” means any person directly responsible for protection against radiation.

1.2.29 “Radioactive material” means any material, solid, liquid, or gas, which emits radiation spontaneously.

1.2.30 “Research and development” means (i) theoretical analysis, exploration, or experimentation or (ii) the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental purposes, including the experimental production and testing of models, devices, equipment, materials, and processes. “Research and development” as used in these regulations, does not include the internal or external administration of radiation or radioactive materials to human beings.

1.2.31 “Restricted area” means any area to which access is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. “Restricted area” shall not include any areas used for residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area.

1.2.32 “Sealed source” means radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling.

1.2.33 “Source material” means: (1) uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores that contain by weight one-twentieth of one percent (0.05 percent) or more of (i) uranium, (ii) thorium, or (iii) any combination thereof. Source material does not include special nuclear material.

1.2.34 “Source of radiation” means any radioactive material, or any device or equipment emitting or capable of producing radiation.

1.2.35 “Special nuclear material in quantities not sufficient to form a critical mass” means uranium enriched in the isotope U-235 in quantities not exceeding 350 grams of contained U-235; Uranium-233 in quantities not exceeding 200 grams; plutonium in quantities not exceeding 200 grams; or any combination of them in accordance with the following formula: for each kind of special nuclear material, determine the ratio between the quantity of that special nuclear material and the quantity specified above for the same kind of special nuclear material. The sum of such ratios for all of the kinds of special nuclear material in combination shall not exceed “1” (i.e., unity). For example, the following quantities in combination would not exceed the limitation and are within the formula, as follows:

$$[175 \text{ (grams contained U-235)}]/350 + [50\text{(grams U-233)}]/200 + [50 \text{ (grams Pu)}]/200 = 1$$

1.2.36 “Storage container” means a device in which sealed sources are transported or stored.

1.2.37 “Survey” means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of sources of radiation. When appropriate, such evaluation includes a physical survey of the location of materials and/or equipment and measurements of levels of radiation or concentrations of radioactive material present.

1.2.38 “Unrefined and unprocessed ore” means ore in its natural form prior to any processing such as grinding, roasting, beneficiating, or refining. Processing does not include sieving or encapsulation of ore or preparation of samples for laboratory analysis.

1.2.39 “Unrestricted area” means any area access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

1.2.40 “These regulations” means Parts I, II, III, IV, V, VI, VII, VIII, IX, X, and XI of Regulation 61-63.

1.2.41 “Whole body” means the entire body, or a major portion thereof, or the head and trunk, or the active blood forming organs, or the lens of the eyes or the gonads. Whole body does not refer to the skin of the whole body.

1.2.42 Definitions of certain other words and phrases as used in these regulations are set forth in other sections.

RHA 1.3. Units of Radiation Dose.

1.3.1 “Dose” means the quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body. When these regulations specify a dose during a period of time, the dose means the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units as used in these regulations are set forth in the following paragraphs: 1.3.2 and 1.3.3.

1.3.2 The “rad” is a measure of the dose of any radiation to body tissues in terms of the energy absorbed per unit mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue. (One millirad [mrad] = 0.001 rad.)

1.3.3 The “rem” is a measure of the dose of any radiation to body tissue in terms of its estimated biological effect relative to a dose of one roentgen (R) of x-rays. (One millirem [mrem] = 0.001 rem.) The relation of the rem to other dose units depends on the biological effect under consideration and upon the conditions of irradiation. For the purpose of these regulations, any of the following is considered to be equivalent to a dose of one rem:

1.3.3.1 A dose of 1 R due to x or gamma radiation;

1.3.3.2 A dose of 1 rad due to x, gamma, or beta radiation;

1.3.3.3 A dose of 0.1 rad due to neutrons or high energy protons;

1.3.3.4 A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye.

If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in sub-paragraph 1.3.3.3 of this paragraph, one rem of neutron radiation may, for the purposes of these regulations, be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; of, if there exists sufficient information to estimate with reasonable accuracy the

approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:

NEUTRON FLUX DOSE EQUIVALENTS

Neutron Energy (Mev)	Number per square centimeter equivalent to a dose of 1 rem (Neutrons/cm^2)	Average Flux to deliver 100 millirem in 40 hrs. (Neutrons/cm^2/sec.)
Thermal	970×10^6	670
0.0001	720×10^6	500
0.005	820×10^6	570
0.02	400×10^6	280
0.1	120×10^6	80
0.5	43×10^6	30
1.0	26×10^6	18
2.5	29×10^6	20
5.0	26×10^6	18
7.5	24×10^6	17
10.0	24×10^6	17
10 to 30	15×10^6	10

1.3.3.5 For determining the doses specified in RHA 3.2 a dose from ×- or gamma rays up to 3 mev may, for purposes of these regulations, be assumed to be equivalent to the exposure measured in air at or near body surfaces in the region of the highest dose rate by a properly calibrated appropriate instrument.

RHA 1.4. Units of Radioactivity.

1.4.1 For the purposes of this part, activity is expressed in the special unit of curies (Ci) or in the SI unit of becquerels (Bq), or their multiples, or disintegrations (transformations) per unit of time.

1.4.1.1 One becquerel = 1 disintegration per second (s^{-1}).

1.4.1.2 One curie = 3.7 X 10^{10} disintegrations per second = 3.7 X 10^{10} becquerels =2.22 X 10^{12} disintegrations per minute. Commonly used submultiples of the curie are the millicurie (mCi) and the microcurie (uCi). One mCi = .001 curie (Ci) = 3.7 X 10^7 dps or 2.22 X 10^9 dpm. One uCi = .000001 Ci = 2.22 X 10^6 dpm.

1.4.2 For purposes of these regulations, it may be assumed that the daughter activity concentrations in the following table are equivalent to an air concentration of 10^{-7} microcuries of Radon 222 per milliliter of air in equilibrium with the daughters RaA, RaB, RaC, and RaC[1]:

Maximum time between collection and measurement (hours)*	Alpha-emitting daughter activity collected per millimeter of air: Microcuries/ml.	Alpha-emitting daughter activity collected per millimeter of air: Total alpha disintegrations per minute per ml.
0.5	7.2×10^{-8}	0.16

Maximum time between collection and measurement (hours)*	Alpha-emitting daughter activity collected per millimeter of air: Microcuries/ml.	Alpha-emitting daughter activity collected per millimeter of air: Total alpha disintegrations per minute per ml.
1	4.5×10^{-8}	0.10
2	1.3×10^{-8}	0.029
3	0.3×10^{-8}	0.0067

*The duration of sample collection and the duration of measurement should be sufficiently short compared to the time between collection and measurement, as not to have a statistically significant effect upon the results.

[1]Note: The unit 'Ci' is the currently used abbreviation for 'curie' replacing the older unit 'c'. Where the unit 'c' occurs in the text or tables of these regulations, it is to be interpreted to mean 'Ci', likewise uc = uCi and mc = mCi.

RHA 1.5. Records.

1.5.1 Each licensee shall keep records showing the receipt, transfer, and disposal of all sources of radiation and any other records as specifically required by these regulations.

RHA 1.6. Inspections.

1.6.1 Each licensee shall afford, at all reasonable times, the Department or its duly authorized representative, the opportunity to inspect sources of radiation and the premises and installations wherein such sources of radiation are used or stored.

1.6.2 Each licensee shall make available for inspection, to the Department, or its duly authorized representative, records maintained pursuant to these regulations.

RHA 1.7. Tests and Surveys.

1.7.1 Each licensee shall make or cause to be made such surveys as are necessary for him to comply with these regulations.

1.7.2 Each licensee shall perform, upon instruction from the Department, or shall permit the Department to perform such reasonable tests as the Department deems appropriate and necessary including, but not limited to tests of:

Sources of radiation;

Location wherein sources of radiation are used or stored;

Radiation detection and monitoring instruments;

Other equipment and devices used in connection with utilization or storage of licensed sources of radiation.

RHA 1.8. Impounding.

1.8.1 Sources of radioactive material shall be subject to impounding pursuant to the Act.

RHA 1.9. Exemptions from Licensing.

The following are exempt from the provisions of Part II, Licensing of Radioactive Materials:

1.9.1 Carriers. Common and contract carriers, freight forwarders and warehousemen operating within this State are exempt from these regulations to the extent that they transport or store sources of radiation in the regular course of their carriage for another or storage incident thereto.

1.9.2 U. S. Department of Energy contractors and U. S. Nuclear Regulatory Commission contractors. Any U. S. Department of Energy contractor or subcontractor and any U. S. Nuclear Regulatory Commission contractor or subcontractor of the following categories operating within the state is exempt from these regulations to the extent that such contractor or subcontractor under his contract receives, possesses, uses, transfers, or acquires sources of radiation:

1.9.2.1 Prime contractors performing work for the Department of Energy at U. S. Government-owned or controlled sites, including the transportation of sources of radiation to or from such sites and the performance of contract services during temporary interruptions of such transportation;

1.9.2.2 Prime contractors of the Department of Energy performing research in, or development, manufacture, storage, testing, or transportation of, atomic weapons or components thereof;

1.9.2.3 Prime contractors of the Department of Energy using or operating nuclear reactors or other nuclear devices in a United States Government-owned vehicle or vessel; and

1.9.2.4 Any other prime contractor or subcontractor of the Department of Energy or of the Nuclear Regulatory Commission when the State and the Nuclear Regulatory Commission jointly determine:

1.9.2.4.1 that the exemption of the prime contractor or subcontractor is authorized by law, and

1.9.2.4.2 that under the terms of the contract or subcontract, there is adequate assurance that the work thereunder can be accomplished without undue risk to the public health and safety.

RHA 1.10. Exemptions from Requirements of These Regulations.

1.10.1 The Department may, upon application thereof or upon its own initiative, grant such exemptions or exceptions from the requirements of these regulations as it determines are authorized by law and will not result in undue hazard to public health and safety or property.

RHA 1.11. Additional Requirements.

1.11.1 The Department may, by rule, regulation, or order, impose upon any licensee such requirements in addition to those established in these regulations as it deems appropriate or necessary to minimize danger to public health and safety or property.

RHA 1.12. Violations.

1.12.1 An injunction or other court order may be obtained prohibiting any violation of any provision of the Act or any regulation or order issued thereunder. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder shall be guilty of a misdemeanor and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

1.12.2 The Department is authorized to hold public hearings, compel attendance of witnesses, make findings of fact and determinations and to assess fines and civil penalties relating to violations of the provisions of the Act or any regulation, license or license condition, temporary or permanent order, or final determination of the Department. Any person violating any provision of the Act or any regulation, license or license condition, temporary or permanent order, or final determination of the Department is subject to the schedule of fines and civil penalties in RHA 1.15, Schedule A of this Part, provided that the maximum penalty for any violation shall not exceed twenty-five thousand dollars. Each day of noncompliance shall constitute a separate violation.

RHA 1.13. Communications.

1.13.1 All communications and reports concerning these regulations, and applications filed thereunder, should be addressed to the Department at its office located at:

South Carolina Department of Health and Environmental Control
Bureau of Radiological Health
2600 Bull Street
Columbia, South Carolina 29201

RHA 1.14. Annual Fees.

1.14.1 Any person issued or granted a specific radioactive material license by the Department for the possession, use, storage, or distribution of radioactive material, or for the storage or disposal of radioactive material shall pay an annual license fee in accordance with a schedule of fees issued by the Department.

1.14.2 Payment of fees shall be made in accordance with the instructions of a “Statement of Fees Due” issued annually by the Department.

1.14.3 Persons failing to pay the fees required by paragraph 1.14.1 within thirty days after payment is due shall also pay a penalty of Fifty Dollars. If failure to pay the required fee continues for more than sixty days after payment is due, the licensee shall be notified by the Department by certified mail to be sent to his last known address that his license is revoked, and that any activities permitted under the authority of the license must cease immediately.

1.14.4 A license suspended for failure to pay the required fee under paragraph 1.14.3 may be reinstated by the Department upon payment of the required fee, the penalty of Fifty Dollars, and an additional penalty of One Hundred Dollars, if the licensee is otherwise in good standing and presents to the Department a satisfactory explanation for his failure to pay the required fee.

1.14.5 Fees required by paragraph 1.14.1 for a specific radioactive materials license which is issued during a calendar year shall be prorated for the remainder of that year based on the date of issuance of the license.

RHA 1.15. Financial Assurances and Recordkeeping for Decommissioning.

1.15.1 The Department shall consider on a case-by-case basis, and require if found necessary before issuance of a license, financial assurances for the purpose of decommissioning or decontaminating facilities and the environment prior to closure and release for unrestricted use, or cleanup of the environment and facilities due to operations and accidental and unexpected releases of radioactive materials. The form and amount of such financial assurances shall be specifically determined by the Department.

1.15.2 Financial or surety arrangements generally acceptable to the Department include surety bonds, cash deposits, certificates of deposits, deposits of government securities, escrow accounts, irrevocable letters or lines of credit, trust funds, and combinations of the above or such other types of arrangements as may be approved by the Department.

1.15.3 Notwithstanding the requirements of RHA 1.15.1 and 1.15.2 above, each applicant for a specific license of the types described in RHA 1.15.3.1 through 1.15.3.4 shall submit a decommissioning funding plan as described in RHA 1.15.11.

1.15.3.1 Authorizing the possession and use of unsealed byproduct material of half-life greater than 120 days and in quantities exceeding 10^5 times the applicable quantities set forth in Appendix C, RHA 3.54 or when a combination of isotopes is involved if R divided by 10^5 is greater than 1 (unity rule), where R is defined here as the sum of the ratios of the quantity of each isotope to the applicable value in Appendix C, RHA 3.54.

1.15.3.2 Authorizing the possession and use of sealed sources or plated foils of half-life greater than 120 days and in quantities exceeding 10^{12} times the applicable quantities set forth in Appendix C, RHA 3.54 (or when a combination of isotopes is involved if R, as defined in RHA 1.15.3.1, divided by 10^{12} is greater than 1).

1.15.3.3 Authorizing the possession and use of more than 100 millicuries of source material in a readily dispersible form.

1.15.3.4 Authorizing the possession of unsealed special nuclear material in quantities exceeding 10^5 times the applicable quantities set forth in Appendix C, RHA 3.54 or when a combination of isotopes is involved if R divided by 10^5 is greater than 1 (unity rule), where R is the sum of the ratios of the quantity of each isotope to the applicable value in Appendix C, RHA 3.54.

1.15.4 Each applicant for a specific license as described in 1.15.3 and in quantities specified in RHA 1.15.10 of this section shall either—

1.15.4.1 Submit a decommissioning funding plan as described in RHA 1.15.11 of this section; or

1.15.4.2 Submit a certification that financial assurance for decommissioning has been provided in the amount prescribed by RHA 1.15.10 of this section using one of the methods described in RHA 1.15.12 of this section. For an applicant, this certification may state that the appropriate assurance will be obtained after the application has been approved and the license issued but prior to the receipt of licensed material.

If the applicant defers execution of the financial instrument until after the license has been issued, a signed original of the financial instrument obtained to satisfy the requirements of RHA 1.15.12 must be submitted to the Department before receipt of licensed material. If the applicant does not defer execution of financial instrument, the applicant shall submit to the Department, as part of the certification, a signed original of the financial instrument obtained to satisfy the requirements of RHA 1.15.12.

1.15.5 Each holder of a specific license issued on or after the effective date of these regulations, which is of a type described in RHA 1.15.3 or 1.15.4 of this section, shall provide financial assurance for decommissioning in accordance with. RHA 1.15.12.

1.15.6 Each holder of a specific license of a type described in RHA 1.15.3 of this section shall submit a decommissioning funding plan as described in RHA 1.15.11 or a certification of financial assurance for decommissioning in an amount at least equal to $1,125,000 in accordance with the criteria set forth in this section. If the licensee submits the certification of financial assurance rather than a decommissioning funding plan, the licensee shall include a decommissioning funding plan in any application for license renewal.

1.15.7 Each holder of a specific license of a type described in RHA 1.15.4 shall submit a decommissioning funding plan as described in RHA 1.15.11 or a certification of financial assurance for decommissioning in accordance with RHA 1.15.12.

1.15.8 Any licensee who has submitted an application for renewal of license in accordance with RHA 2.12 shall provide financial assurance for decommissioning in accordance with RHA 1.15.3 and RHA 1.15.4.

1.15.9 Waste collectors and waste processors, as defined in RHA 3.2, must provide financial assurance in an amount based on a decommissioning funding plan as described in RHA 1.15.11. The decommissioning funding plan must include the cost of disposal of the maximum amount (curies) of radioactive material permitted by license, and the cost of disposal of the maximum quantity, by volume, of radioactive material which could be present at the licensee's facility at any time, in addition to the cost to remediate the licensee's site to meet the license termination criteria of RHA 2.11. The decommissioning funding plan must be submitted by June 30, 2007.

1.15.10 Required Amounts of Financial Assurance for Decommissioning by Quantity of Material. Licensees required to submit the $1,125,000 must do so by June 30, 2007. Licensees required to submit $113,000 or $225,000 amount must do so by June 30, 2007. Licensees having possession limits exceeding the upper bounds of this table must base financial assurance on a decommissioning funding plan.

TABLE I

(i) greater than 10^4 but less than or equal to 10^5 times the applicable quantities of Appendix C, RHA 3.54 in unsealed form. (For a combination of isotopes, if R, as defined in RHA 1.15.3.1, divided by 10^4 is greater than 1 but R divided by 10^5 is less than or equal to 1)	$1,125,000
(ii) greater than 10^3 but less than or equal to 10^4 times the applicable quantities of Appendix C, RHA 3.54 in unsealed form. (For a combination of isotopes, if R, as defined in RHA 1.15.3.1, divided by 10^3 is greater than 1 but R divided by 10^4 is less than or equal to 1.)	$225,000

(iii) greater than 10^{10} times the applicable quantities of Appendix C, RHA 3.54 in sealed sources or plated foils. (For a combination of isotopes, if R, as defined in RHA 1.15.3.1, divided by 10^{10} is greater than 1, but R divided by 10^{12} is less than or equal to 1.)	$113,000

1.15.10.1 Prepayment. Prepayment is the deposit prior to the start of the operation into an account segregated from licensee assets and outside the licensee's administrative control of cash or liquid assets such that the amount of funds would be sufficient to pay decommissioning costs. Prepayment may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities.

1.15.10.2 A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid should the licensee default. A surety method may be in the form of a surety bond, letter of credit, or line of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in RHA 1.17, Appendix A to this part. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this section. A guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in Appendix B of this part. A guarantee by the applicant or licensee may not be used in combination with any other financial methods to satisfy the requirements of this section or in any situation where the applicant or licensee has a parent company holding majority control of the voting stock of the company. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:

(i) The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the Department, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Department within 30 days after receipt of notification of cancellation.

(ii) The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the Department. An acceptable trustee includes an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.

(iii) The surety method or insurance must remain in effect until the Department has terminated the license.

1.15.10.3 An external sinking fund in which deposits are made at least annually, coupled with a surety method or insurance, the value of which may decrease by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities. The surety or insurance provisions must be as stated in RHA 1.15.10.2 of this section.

1.15.10.4 In the case of Federal, State, or local government licensees, a statement of intent containing a cost estimate for decommissioning or an amount based on the Table in RHA 1.15.8 of this section, and indicating that funds for decommissioning will be obtained when necessary.

1.15.11 Decommissioning Funding Plan.

1.15.11.1 Each decommissioning funding plan must be submitted for review and approval and must contain:

1.15.11.1.1 A detailed cost estimate for decommissioning, in an amount reflecting:

1.15.11.1.1.1 The cost of an independent contractor to perform all decommissioning activities;

1.15.11.1.1.2 The cost of meeting the RHA 3.57.2 criteria for unrestricted use, provided that, if the applicant or licensee can demonstrate its ability to meet the provisions of RHA 3.57.3, the cost estimate may be based on meeting the RHA 3.57.3 criteria;

1.15.11.1.1.3 The volume of onsite subsurface material containing residual radioactivity that will require remediation to meet the criteria for license termination; and

1.15.11.1.1.4 An adequate contingency factor.

1.15.11.1.2 Identification of and justification for using the key assumptions contained in the DCE;

1.15.11.1.3 A description of the method of assuring funds for decommissioning from RHA 1.15.12, including means for adjusting cost estimates and associated funding levels periodically over the life of the facility;

1.15.11.1.4 A certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning; and

1.15.11.1.5 A signed original of the financial instrument obtained to satisfy the requirements of RHA 1.15.12 of this section (unless a previously submitted and accepted financial instrument continue to cover the cost estimate for decommissioning).

1.15.11.2 At the time of license renewal and at intervals not to exceed 3 years, the decommissioning funding plan must be resubmitted with adjustments as necessary to account for changes in costs and the extent of contamination. If the amount of financial assurance will be adjusted downward, this cannot be done until the updated decommissioning funding plan is approved. The decommissioning funding plan must update the information submitted with the original or prior approved plan, and must specifically consider the effect of the following events on decommissioning costs:

1.15.11.2.1 Spills of radioactive material producing additional residual radioactivity in onsite subsurface material;

1.15.11.2.2 Waste inventory increasing above the amount previously estimated;

1.15.11.2.3 Waste disposal costs increasing above the amount previously estimated;

1.15.11.2.4 Facility modifications;

1.15.11.2.5 Changes in authorized possession limits;

1.15.11.2.6 Actual remediation costs that exceed the previous cost estimate;

1.15.11.2.7 Onsite disposal; and

1.15.11.2.8 Use of a settling pond.

1.15.12 The financial instrument must include the licensee's name, license number, and docket number; and the name, address, and other contact information of the issuer, and, if a trust is used, the trustee. When any of the foregoing information changes, the licensee must, within 30 days, submit financial instruments reflecting such changes. The financial instrument submitted must be a signed original or signed original duplicate, except where a copy is specifically permitted. Financial assurance for decommissioning must be provided by one or more of the following methods:

1.15.12.1 Prepayment. Prepayment is the deposit prior to the start of the operation into an account segregated from licensee assets and outside the licensee's administrative control of cash or liquid assets such that the amount of funds would be sufficient to pay decommissioning costs. Prepayment may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities.

1.15.12.2 A surety method, insurance, or other guarantee method. These methods guarantee that decommissioning costs will be paid should the licensee default. A surety method may be in the form of a surety bond, letter of credit, or line of credit. A parent company guarantee of funds for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in RHA 1.17, Appendix A to this part. A parent company guarantee may not be used in combination with other financial methods to satisfy the requirements of this section. A guarantee of funds by the applicant or licensee for decommissioning costs based on a financial test may be used if the guarantee and test are as contained in Appendix B of this part. A guarantee by the applicant or licensee may not be used in combination with any other financial methods to satisfy the requirements of this section or in any situation where the applicant or licensee has a parent company holding majority control of the voting stock of the company. Any surety method or insurance used to provide financial assurance for decommissioning must contain the following conditions:

(i) The surety method or insurance must be open-ended or, if written for a specified term, such as five years, must be renewed automatically unless 90 days or more prior to the renewal date, the issuer notifies the Department, the beneficiary, and the licensee of its intention not to renew. The surety method or insurance must also provide that the full face amount be paid to the beneficiary automatically prior to the expiration without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Department within 30 days after receipt of notification of cancellation.

(ii) The surety method or insurance must be payable to a trust established for decommissioning costs. The trustee and trust must be acceptable to the Department. An acceptable trustee includes an appropriate State or Federal government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a federal or State agency.

(iii) The surety method or insurance must remain in effect until the Department has terminated the license.

1.15.12.3 An external sinking fund in which deposits are made at least annually, coupled with a surety method or insurance, the value of which may decrease by the amount being accumulated in the sinking fund. An external sinking fund is a fund established and maintained by setting aside funds periodically in an account segregated from licensee assets and outside the licensee's administrative control in which the total amount of funds would be sufficient to pay decommissioning costs at the time termination of operation is expected. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities. The surety or insurance provisions must be stated in RHA 1.15.12.2 of this section.

1.15.12.4 In the case of Federal, State or local government licensees, a statement of intent containing a cost estimate for decommissioning or an amount backed on the Table in RHA 1.15.10 of this section, and indicating that funds for decommissioning will be obtained when necessary.

1.15.13 Each person licensed under this part or Parts II, IV or V of these regulations shall keep records of information important to the decommissioning of a facility in an identified location until the site is released for unrestricted use. Before licensed activities are transferred or assigned in accordance with RHA 2.10.2, licensees shall transfer all records described in this paragraph to the new license. In this case, the new licensee will be responsible for maintaining these records until the license is terminated. If records important to the decommissioning of a facility are kept for other purposes, reference to these records and their locations may be used. Information the Department considers important to decommissioning consists of:

1.15.13.1 Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site. These records may be limited to instances when contamination remains after any cleanup procedures or when there is reasonable likelihood that contaminants may have spread to inaccessible areas as in the case of possible seepage into porous materials such as concrete. These records must include any known information on identification of involved nuclides, quantities, forms, and concentrations.

1.15.13.2 As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored, and of locations of possible inaccessible contamination such as buried pipes, which may be subject to contamination. If required drawings are referenced, each relevant document need not be indexed individually. If drawings are not available, the licensee shall substitute appropriate records of available information concerning these areas and locations.

1.15.13.3 Except for areas containing sealed sources (provided the sources have not leaked or not contamination remains after any leak), or where licensed material has been used in a device or component and is intact (for example depleted uranium used only for shielding or as penetrators in unused munitions), or byproduct materials having only half-lives of less than 65 days, a list contained in a single document and updated every 2 years of the following:

1.15.13.3.1 All areas designated and formerly designated restricted areas as defined RHA 1.2;

1.15.13.3.2 All areas outside of restricted areas that required documentation under RHA 1.15;

1.15.13.3.3 All areas outside of restricted areas where current and previous wastes have been buried as documented under RHA 3.41; and

1.15.13.3.4 All areas outside of restricted areas, which contain material such that, if the license expired, the licensee would be required to either decontaminate the area to unrestricted levels or apply for approval for disposal under RHA 3.28.

1.15.13.4 Records of the cost estimate performed for the decommissioning funding plan or of the amount certified for decommissioning, and records of the funding method used for assuring funds if either a funding plan or certification is used.

RHA 1.16. Schedule A.

SCHEDULE OF CIVIL PENALTIES

A. Severity I Category Level: Not less than Twenty Thousand Dollars, nor more than Twenty-Five Thousand Dollars, per violation.

B. Severity II Category Level: Not less than Ten Thousand Dollars, nor more than Twenty Thousand Dollars, per violation.

C. Severity III Category Level: Not less than Five Thousand Dollars, nor more than Ten Thousand Dollars, per violation.

D. Severity IV Category Level: Not less than Two Thousand Dollars, nor more than Five Thousand Dollars, per violation.

E. Severity V Category Level: Not less than One Thousand Dollars, nor more than Two Thousand Dollars, per violation.

F. Severity VI Category Level: Not more than One Thousand Dollars, per violation.

SCHEDULE OF SEVERITY CATEGORIES

I. Health Physics and Radiation Protection:

A. Severity I—Very Significant violations involving:

1. Single exposure or a quarterly accumulation of exposures to a worker in excess of 25 rems of radiation to the whole body, 150 rems to the skin of the whole body, or 375 rems to the feet, ankles, hands, or forearms, when such exposures are contrary to the provisions of RHA 3.2, Title A;

2. Annual whole body exposure of a member of the public in excess of 2.5 rems of radiation;

3. Release of radioactive material to an unrestricted area in excess of ten times the limits of RHA 3.5, Title A;

4. Disposal of licensed material in quantities or concentrations in excess of ten times the limits of RHA 3.13, Title A; or

5. Exposure of a worker in restricted areas in excess of ten times the limits of RHA 3.3, Title A.

B. Severity II—Very Significant violations involving:

1. Single exposure or a quarterly accumulation of exposures to a worker in excess of 5 rems of radiation to the whole body, 30 rems to the skin of the whole body, or 75 rems to the feet, ankles, hands, or forearms, when such exposures are contrary to the provisions of RHA 3.2, Title A;

2. Annual whole body exposure of a member of the public in excess of 0.5 rems of radiation;

3. Release of radioactive material to an unrestricted area in excess of five times the limits of RHA 3.5, Title A;

4. Failure to make an immediate notification as required by RHA 3.18, Title A;

5. Disposal of licensed material in quantities or concentrations in excess of five times the limits of RHA 3.13, Title A; or

6. Exposure of a worker in restricted areas in excess of five times the limits of RHA 3.3, Title A.

C. Severity III—Significant violations involving:

1. Single exposure or a quarterly accumulation of exposures to a worker in excess of 3 rems of radiation to the whole body, 7.5 rems to the skin of the whole body, or 18.75 rems to the feet, ankles, hands, or forearms, when such exposures are contrary to the provisions of RHA 3.2, Title A;

2. A radiation level in an unrestricted area that exceeds 100 millirems/hour for a one-hour period;

3. Failure to make a 24-hour notification as required by RHA 3.18, Title A, or an immediate notification required by RHA 3.17, Title A;

4. Substantial potential for an exposure or release in excess of limits specified in Part III, Title A, where such exposure or release does not occur (e.g., entry into high radiation areas in the vicinity of exposed radiographic sources without having performed an adequate survey, failure to provide security or prevent unauthorized entry into a high radiation area, operation of a radiation facility with a nonfunctioning interlock system);

5. Release of radioactive material to an unrestricted area in excess of the limits of RHA 3.5, Title A;

6. Improper disposal of licensed material not covered in Severity Levels I or II;

7. Exposure of a worker in restricted areas in excess of the limits of RHA 3.3, Title A;

8. Release for unrestricted use of contaminated or radioactive material or equipment which poses a realistic potential for exposure to members of the public, or failure to decontaminate facility areas as required;

9. Cumulative worker exposure above regulatory limits when such cumulative exposure reflects a programmatic, rather than an isolated weakness in radiation protection;

10. Conduct of licensee activities by a technically unqualified person or person not meeting training requirements specified by regulation or license conditions; or

11. Failure to control or provide security for licensed material.

D. Severity IV—Violations involving:

1. Failure to follow requirements not covered in Severity Levels I, II, or III, that substantially reduces the margin of safety (e.g., inadequate survey, incomplete dosimetry, improper posting, failure to maintain proper security);

2. A radiation level in an unrestricted area such that an individual may receive greater than 2 millirems in a one hour period or 100 millirems in any seven consecutive days; or

3. Failure to make a 30-day written notification required by RHA 3.19, Title A.

E. Severity V—Violations involving any other matter involving failure to follow procedures, rules and regulations or license conditions, that has other than minor safety or environmental significance.

F. Severity VI—Violations that have minor safety or environmental significance.

II. Radioactive Materials Operations:

A. Severity I—Very Significant violations involving:

1. A technically unqualified or unauthorized person conducting a licensee activity that results in radiation levels, contamination levels, or releases that exceed ten times regulatory limits or limits specified in the license;

2. Use of unauthorized equipment that results in radiation levels, contamination levels, or releases that exceed ten times regulatory limits or limits specified in the license;

3. Possession or use of unauthorized radioactive materials requiring a license that results in radiation levels, contamination levels, or releases that exceed ten times regulatory limits;

4. Failure to perform required surveys, tests, or evaluations, or to institute required safety precautions that results in radiation levels, contamination levels, or releases that exceed ten times regulatory limits or limits specified in the license; or

5. A system designed to prevent or mitigate a serious safety event being inoperable when actually required to perform its design function.

B. Severity II—Violations involving:

1. A technically unqualified or unauthorized person conducting a licensee activity that results in radiation levels, contamination levels, or releases that exceed five times regulatory limits, or limits specified in the license;

2. Possession or use of unauthorized equipment or material in the conduct of licensed activities that results in radiation levels, contamination levels, or releases that exceed five times regulatory limits or limits specified in the license;

3. Possession or use of unauthorized radioactive materials requiring a license that results in radiation levels, contamination levels, or releases that exceed five times regulatory limits.

4. Failure to perform required surveys, tests, or evaluations that results in radiation levels, contamination levels or releases that exceed five times regulatory limits, or limits specified in the license; or

5. Failure to make required initial notifications associated with Severity Level I or II violations.

C. Severity III—Violations involving:

1. Failure to control access to licensed materials for radiation purposes as specified by regulatory requirements;

2. Possession or use of unauthorized equipment, materials or facilities in the conduct of licensed activities;

3. Possession or use of unauthorized radioactive materials requiring a license;

4. Use of radioactive materials on humans where such use is not authorized;

5. Conduct of licensee activities by a technically unqualified or unauthorized person;

6. Degradation of a system designed to prevent or mitigate a serious safety event;

7. Failure to provide adequate measures to prevent loss or theft of radioactive materials; or

8. Radiation levels, contamination levels, or releases that exceed regulatory limits or limits specified in the license.

D. Severity IV—Violations involving:

1. Failure to maintain patients containing Cobalt-60, Cesium-137, Iridium-192, or Radium implants hospitalized, or failure to conduct and record surveys of such patients prior to release;

2. Failure to conduct required leakage or contamination tests; or

3. Use of improperly calibrated survey equipment or counting equipment.

E. Severity V—Other violations such as failure to follow procedures, rules and regulations, or license conditions that have other than minor safety or environmental significance.

F. Severity VI—Violations that have minor safety or environmental significance.

III. Transportation of Radioactive Materials:

For purposes of this Schedule, radioactive material transported as radioactive waste into or within South Carolina is subject to the provisions of the S.C. Department of Health and Environmental Control Regulation 61-83, Regulation for the Transportation of Radioactive Waste Into or Within South Carolina. Radioactive materials, other than radioactive wastes as defined in S.C. Department of Health and Environmental Control Regulation 61-83, are subject to the following Severity Categories:

A. Severity I—Very Significant violations of State and Federal Regulations involving:

1. Annual whole body exposure of a member of the public in excess of 2.5 rem of radiation; or

2. Breach of package integrity resulting in surface contamination or external radiation levels in excess of ten times the Nuclear Regulatory Commission (NRC) or Department of Transportation (DOT) limits.

B. Severity II—Very Significant violations of State and Federal Regulations involving:

1. Annual whole body exposure of a member of the public in excess of 0.5 rem of radiation;

2. Breach of package integrity resulting in surface contamination or external radiation levels less than ten times in excess of NRC or DOT limits.

3. Surface contamination or external radiation levels in excess of three times NRC or DOT limits that did not result from a breach of package integrity; or

4. Failure to make required initial notifications associated with Severity Level I or II violations.

C. Severity III—Violation of State and Federal Regulations involving:

1. Breach of package integrity;

2. Surface contamination or external radiation levels in excess of but less than a factor of three above NRC or DOT requirements that did not result from a breach of package integrity;

3. Any noncompliance with labelling, placarding, shipping paper, packaging, loading or other requirements that could reasonably result in the following:

a. Improper identification of the type, quantity, or form of material;

b. Failure of the carrier or recipient to exercise adequate controls;

c. Substantial potential for personnel exposure or contamination; or

4. Failure to make required initial notification associated with Severity Level III violations.

D. Severity IV—Violation of State and Federal regulation involving any noncompliance of package selection or preparation requirements which does not result in a breach of package integrity or surface contamination, or external radiation levels in excess of NRC or DOT requirements.

E. Severity V—Other violations such as failure to follow procedures or rules and regulations that have other than minor safety or environmental significance.

F. Severity VI—Violations that have minor safety or environmental significance.

RHA 1.17. [Appendix A] Criteria Relating to Use of Financial Tests and Parent Company Guarantees for Providing Reasonable Assurance of Funds for Decommissioning.

I. INTRODUCTION

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on obtaining a parent company guarantee that funds will be available for decommissioning costs and on a demonstration that the parent company passes a financial test. This appendix establishes criteria for passing the financial test and for obtaining the parent company guarantee.

II. FINANCIAL TEST

A. To pass the financial test, the parent company must meet the criteria of either paragraph A.1 or A.2 of this section:

1. The parent company must have:

(i) Two of the following three ratios: A ratio of total liabilities to net worth less than 2.0; a ratio of the sum of net income plus depreciation, depletion, and amortization to total liabilities greater than 0.1; and a ratio of current assets to current liabilities greater than 1.5; and

(ii) Net working capital and tangible net worth each at least six times the current decommissioning cost estimates (or prescribed amount if a certification is used); and

(iii) Tangible net worth of at least $10 million; and

(iv) Assets located in the United States amounting to at least 90 percent of total assets or at least six times the current decommissioning cost estimates (or prescribed amount if a certification is used).

2. The parent company must have:

(i) A current rating for its most recent bond issuance of AAA, AA, A, or BBB as issued by Standard and Poor's or Aaa, Aa, A, or Baa as issued by Moody's; and

(ii) Tangible net worth at least six times the current decommissioning cost estimate (or prescribed amount if a certification is used); and

(iii) Tangible net worth of at least $10 million; and

(iv) Assets located in the United States amounting to at least 90 percent of total assets or at least six times the current decommissioning cost estimates (or prescribed amount if certification is used).

B. The parent company's independent certified public accountant must have compared the data used by the parent company in the financial test, which is derived from the independently audited, year end

financial statements for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure the licensee shall inform the Department within 90 days of any matters coming to the auditor's attention which cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.

C.1. After the initial financial test, the parent company must repeat the passage of the test within 90 days after the close of each succeeding fiscal year.

2. If the parent company no longer meets the requirements of paragraph A of this section, the licensee must send notice to the Department of intent to establish alternate financial assurance as specified in the Department's regulations. The notice must be sent by certified mail within 90 days after the end of the fiscal year for which the year end financial data show that the parent company no longer meets the financial test requirements. The licensee must provide alternate financial assurance within 120 days after the end of such fiscal year.

III. PARENT COMPANY GUARANTEE

The terms of a parent company guarantee which an applicant or licensee obtains must provide that:

A. The parent company guarantee will remain in force unless the guarantor sends notice of cancellation by certified mail to the licensee and the Department. Cancellation may not occur, however, during the 120 days beginning on the date of receipt of the notice of cancellation by both the licensee and the Department, as evidenced by the return receipts.

B. If the licensee fails to provide alternate financial assurance as specified in the Department's regulations within 90 days after receipt by the licensee and Department of a notice of cancellation of the parent company guarantee from the guarantor, the guarantor will provide such alternative financial assurance in the name of the licensee.

C. The parent company guarantee and financial test provisions must remain in effect until the Department has terminated the license.

D. If a trust is established for decommissioning costs, the trustee and trust must be acceptable to the Department. An acceptable trustee includes an appropriate State or Federal Government agency or an entity which has the authority to act as a trustee and whose trust operations are regulated and examined by a Federal or State agency.

RHA 1.18. [Appendix B] Criteria Relating to Use of Financial Tests and Self Guarantees for Providing Reasonable Assurance of Funds for Decommissioning.

I. INTRODUCTION

An applicant or licensee may provide reasonable assurance of the availability of funds for decommissioning based on furnishing its own guarantee that funds will be available for decommissioning costs and on a demonstration that the company passes the financial test of Section II of this appendix. The terms of the self-guarantee are Section III of this appendix. This appendix establishes criteria for passing the financial test for the self guarantee and establishes the terms for a self-guarantee.

II. FINANCIAL TEST

A. To pass the financial test, a company must meet all of the following criteria:

1. Tangible net worth at least 10 times the total current decommissioning cost estimate (or the current amount required if certification is used) for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor.

2. Assets located in the United States amounting to at least 90 percent of total assets or at least 10 times the total current decommissioning cost estimate (or the current amount required if certification is used) for all decommissioning activities for which the company is responsible as self-guaranteeing licensee and as parent-guarantor.

3. A current rating for its most recent bond issuance of AAA, AA, A as issued by Standard and Poors (S&P), or Aaa, Aa, or A as issued by Moodys.

B. To pass the financial test, a company must meet all of the following additional requirements:

1. The company must have at least one class of equity securities registered under the Securities Exchange Act of 1934.

2. The company's independent certified public accountant must have compared the data used by the company in the financial test which is derived from the independently audited, year end financial statements for the latest fiscal year, with the amounts in such financial statement. In connection with that procedure, the licensee shall notify the Department within 90 days of any matters coming to the attention of the auditor that cause the auditor to believe that the data specified in the financial test should be adjusted and that the company no longer passes the test.

3. After the initial financial test, the company must repeat passage of the test within 90 days after the close of each succeeding fiscal year.

C. If the licensee no longer meets the requirements of Section II.A, of this appendix, the licensee must send immediate notice to the Department of its intent to establish alternate financial assurance as specified in the Department's regulations within 120 days of such notice.

III. COMPANY SELF-GUARANTEE

The terms of a self-guarantee which as applicant or licensee furnishes must provide that:

A. The guarantee will remain in force unless the licensee sends notice of cancellation by certified mail to the Department. Cancellation may not occur, however, during the 120 days beginning on the date of receipt of the notice of cancellation by the Department, as evidenced by the return receipt.

B. The licensee shall provide alternative financial assurance as specified in the Department's regulations within 90 days following receipt by the Department of a notice of cancellation of the guarantee.

C. The guarantee and financial test provisions must remain in effect until the Department has terminated the license or until another financial assurance method acceptable to the Department has been put in effect by the licensee.

D. The licensee will promptly forward to the Department and the licensee's independent auditor all reports covering the latest fiscal year filed by the licensee with the Securities and Exchange Commission pursuant to the requirements of section 13 of the Securities And Exchange Act of 1934.

E. If at any time, the licensee's most recent bond issuance ceases to be rated in any category of "A" or above by either Standard and Poors or Moodys, the licensee will provide notice in writing of such fact to the Department within 20 days after publication of the change by the rating service. If the licensee's most recent bond issuance ceases to be rated in any category of A or above by both Standard and Poors and Moodys, the licensee no longer meets the requirements of Section II.A, of this appendix.

F. The applicant or licensee must provide to the Department a written guarantee (a written commitment by a corporate officer) which states that the licensee will fund and carry out the required decommissioning activities or, upon issuance of an order by the Department, the licensee will set up and fund a trust in the amount of the current cost estimate for decommissioning.

PART II
Licensing of Radioactive Material

RHA 2.1. Purpose and Scope.

2.1.1 No person shall manufacture, produce, transfer, receive, acquire, own, possess, or use byproduct material except as authorized in a specific or general license issued pursuant to these regulations, or as otherwise provided in these regulations.

NOTE: Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing source, by-product, or special nuclear material, intended for use by the general public may be obtained only from the United States Nuclear Regulatory Commission, Washington, D.C. 20555.

2.1.2 Deliberate misconduct

2.1.2.1 Any licensee, applicant for a license, employee of a licensee or applicant; or any contractor (including a supplier or consultant), subcontractor, employee of a contractor or subcontractor of any licensee or applicant for a license, who knowingly provides to any licensee, applicant, contractor, or subcontractor, any components, equipment, materials, or other goods or services that relate to a licensee's or applicant's activities in this part, may not:

2.1.2.1.1 Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license issued by the Department; or

2.1.2.1.2 Deliberately submit to the Department, a licensee, an applicant, or a licensee's or applicant's contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the Department.

2.1.2.2 A person who violates RHA 2.1.2.1.1 or 2.1.2.1.2 of this section may be subject to enforcement action in accordance with the procedures in RHA 1.12.

2.1.2.3 For the purposes of RHA 2.1.2.1.1, deliberate misconduct by a person means an intentional act or omission that the person knows:

2.1.2.3.1 Would cause a licensee or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation, of any license issued by the Department; or

2.1.2.3.2 Constitutes a violation of a requirement, procedure, instruction, contract, purchase order, or policy of a licensee, applicant, contractor, or subcontractor.

RHA 2.2. Types of Licenses.

Licenses for radioactive materials are of two types; general and specific.

The Department issues a specific license to a named person who has filed an application for the license under the provisions of this regulation (61-63). A general license is provided by regulation, grants authority to a person for certain activities involving radioactive material, and is effective without the filing of an application with the Department or the issuance of a licensing document to a particular person. However, registration with the Department may be required by the particular general license.

RHA 2.3. General Licenses—Source Material.

2.3.1 A general license is hereby issued authorizing commercial and industrial firms; research, educational, and medical institutions; and Federal, State, and local government agencies to receive, possess, use, and transfer uranium and thorium, in their natural isotopic concentrations and in the form of depleted uranium, for research, development, educational, commercial, or operational purposes in the following forms and quantities:

2.3.1.1 No more than 1.5 kg (3.3 lb) of uranium and thorium in dispersible forms (e.g., gaseous, liquid, powder, etc.) at any one time. Any material processed by the general licensee that alters the chemical or physical form of the material containing source material must be accounted for as a dispersible form. A person authorized to possess, use, and transfer source material under this paragraph may not receive more than a total of 7 kg (15.4 lb) of uranium and thorium in any one calendar year. Persons possessing source material in excess of these limits as of August 27, 2013, may continue to possess up to 7 kg (15.4 lb) of uranium and thorium at any one time for one year beyond this date, or until the Department takes final action on a pending application submitted on or before August 27, 2014, for a specific license for such material; and receive up to 70 kg (154 lb) of uranium or thorium in any one calendar year until December 31, 2014, or until the Department takes final action on a pending application submitted on or before August 27, 2014, for a specific license for such material; and

2.3.1.2 No more than a total of 7 kg (15.4 lb) of uranium and thorium at any one time. A person authorized to possess, use, and transfer source material under this paragraph may not receive more than a total of 70 kg (154 lb) of uranium and thorium in any one calendar year. A person may not alter the chemical or physical form of the source material possessed under this paragraph unless it is accounted for under the limits of RHA 2.3.1.1; or

2.3.1.3 No more than 7 kg (15.4 lb) of uranium, removed during the treatment of drinking water, at any one time. A person may not remove more than 70 kg (154 lb) of uranium from drinking water during a calendar year under this paragraph; or

2.3.1.4 No more than 7 kg (15.4 lb) of uranium and thorium at laboratories for the purpose of determining the concentration of uranium and thorium contained within the material being analyzed at any one time. A person authorized to possess, use, and transfer source material under this paragraph may not receive more than a total of 70 kg (154 lb) of source material in any one calendar year.

2.3.2 Any person who receives, possesses, uses, or transfers source material in accordance with the general license in RHA 2.3.1:

2.3.2.1 Is prohibited from administering source material, or the radiation there from, either externally or internally, to human beings except as may be authorized by the Department in a specific license.

2.3.2.2 Shall not abandon such source material. Source material may be disposed of as follows:

2.3.2.2.1 A cumulative total of 0.5 kg (1.1 lb) of source material in a solid, non-dispersible form may be transferred each calendar year, by a person authorized to receive, possess, use, and transfer source material under this general license to persons receiving the material for permanent disposal. The recipient of source material transferred under the provisions of this paragraph is exempt from the requirements to obtain a license under this part to the extent the source material is permanently disposed. This provision does not apply to any person who is in possession of source material under a specific license issued under this chapter; or

2.3.2.2.2 In accordance with RHA 3.27.

2.3.2.3 Is subject to the provisions in Part II of Title A.

2.3.2.4 Shall not export such source material except in accordance with 10 CFR Part 110.

2.3.3 Any person who receives possesses, uses, or transfers source material in accordance with RHA 2.3.1 shall conduct activities so as to minimize contamination of the facility and the environment. When activities involving such source material are permanently ceased at any site, if evidence of significant contamination is identified, the general licensee shall notify the Department about such contamination and may consult with the Department as to the appropriateness of sampling and restoration activities to ensure that any contamination or residual source material remaining at the site where source material was used under this general license is not likely to result in exposures that exceed the limits in RHA 3.57.2.

2.3.4 Any person who receives, possesses, uses, or transfers source material in accordance with the general license granted in RHA 2.3.1 is exempt from the provisions of Parts III and VI of this Regulation to the extent that such receipt, possession, use, and transfer are within the terms of this general license, except that such person shall comply with the provisions of RHA 3.27 and 3.57.2 to the extent necessary to meet the provisions of RHA 2.3.2.2 and 2.3.3. However, this exemption does not apply to any person who also holds a specific license issued under this Part.

2.3.5 No person may initially transfer or distribute source material to persons generally licensed under RHA 2.3.1.1 and 2.3.1.2, or equivalent regulations of the NRC or of an Agreement State, unless authorized by a specific license issued in accordance with RHA 2.6 or equivalent provisions of the NRC or an Agreement State. This prohibition does not apply to analytical laboratories returning processed samples to the client who initially provided the sample. Initial distribution of source material to persons generally licensed by RHA 2.3.1 of this section before August 27, 2013, without specific authorization may continue for one (1) year beyond this date. Distribution may also be continued until the Department takes final action

on a pending application for license or license amendment to specifically authorize distribution submitted on or before August 27, 2014.

2.3.6 A general license is hereby issued authorizing the receipt of title to source material without regard to quantity. This general license does not authorize any person to receive, possess, use, or transfer source material.

2.3.7 Depleted Uranium in Industrial Products and Devices.

2.3.7.1 A general license is hereby issued to receive, acquire, possess, use, or transfer, in accordance with the provisions of subparagraphs 2.3.4.2, 2.3.4.3, 2.3.4.4, and 2.3.4.5, depleted uranium contained in industrial products or devices for the purpose of providing a concentrated mass in a small volume of the product or device.

2.3.7.2 The general license in subparagraph 2.3.4.1 applies only to industrial products or devices which have been manufactured either in accordance with a specific license issued to the manufacturer of the products or devices pursuant to RHA 2.27 or in accordance with a specific license issued to the manufacturer by the U.S. Nuclear Regulatory Commission or an Agreement State which authorizes manufacture of the products or devices for distribution to persons generally licensed by the U.S. Nuclear Regulatory Commission or an Agreement State.

2.3.7.3 Persons who receive, acquire, possess, or use depleted uranium pursuant to the general license established by subparagraph 2.3.4.1 shall file Department Form RHA 100-2 "Registration Certificate Use of Depleted Uranium Under General License," with the Department. The Form shall be submitted within 30 days after the first receipt or acquisition of such depleted uranium. The registrant shall furnish on Department Form RHA 100-2 the following information and such other information as may be required by that form:

2.3.7.3.1 Name and address of the registrant.

2.3.7.3.2 A statement that the registrant has developed and will maintain procedures designed to establish physical control over the depleted uranium described in subparagraph 2.3.4.1 and designed to prevent transfer of such depleted uranium in any form, including metal scrap, to persons not authorized to receive the depleted uranium; and

2.3.7.3.3 Name and/or title, address, and telephone number of the individual duly authorized to act for and on behalf of the registrant in supervising the procedures identified in 2.3.4.3.2.

The registrant possessing or using depleted Uranium under the general license established by subparagraph 2.3.7.1 shall report, in writing, to the Department any changes in information furnished by him in Department Form RHA 100-2 "Registration Certificate—Use of Depleted Uranium." The report shall be submitted within 30 days after the effective date of such change.

2.3.7.4 A person who receives, acquires, possesses, or uses depleted uranium pursuant to the general license established by subparagraph 2.3.4.1:

2.3.7.4.1 Shall not introduce such depleted uranium, in any form, into a chemical, physical, or metallurgical treatment or process, except a treatment or process for repair or restoration of any plating or other covering of the depleted uranium.

2.3.7.4.2 Shall not abandon such depleted uranium.

RHA 2.4. General Licenses—Radioactive Material Other Than Source Material.

2.4.1 Purpose and Scope.

This part establishes general licenses for the possession and use of radioactive material and a general license for ownership of radioactive material. Specific provisions of Part II are applicable to general licenses established by this section. These provisions are specified herein or in the particular general license. The general licenses provided in this part are subject to the general provisions of Part II and RHA 1.5, 1.6, 1.7, 1.8, 1.11, 1.12, 2.9, 2.17, 2.18, 2.20.2.1.2, Part III and Part VI of these regulations unless indicated otherwise in the specific provision of the general license.[1]

2.4.2 Certain Detecting, Measuring, Gauging or Controlling Devices and Certain Devices for Producing Light or an Ionized Atmosphere.

2.4.2.1 A general license is hereby issued to commercial and industrial firms and to research, educational and medical institutions, individuals in the conduct of their business, and State or local government agencies to own, receive, acquire, possess, use or transfer in accordance with the provisions of RHA 2.4.2.2, 2.4.2.3, and 2.4.2.4, radioactive material, excluding special nuclear material, contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.

2.4.2.2 The general license in RHA 2.4.2.1 applies only to radioactive material contained in devices which have been manufactured or initially transferred and labeled in accordance with the specifications contained in the subparagraphs below. The devices must have been received from one of the specific licensees described in the following subparagraphs or through a transfer made under RHA 2.4.2.3.8 of this part:

2.4.2.2.1 A specific license issued under Part 2 of this Regulation; or

2.4.2.2.2 An equivalent specific license issued by an Agreement State; or

2.4.2.2.3 An equivalent specific license issued by a State with provisions comparable to Part 2 of this Regulation.

2.4.2.3 Any person who receives, acquires, possesses, uses, or transfers radioactive material in a device pursuant to the general license in RHA 2.4.2.1:

2.4.2.3.1 shall assure that all labels affixed to the device at the time of receipt, and bearing a statement that removal of the label is prohibited, are maintained thereon and shall comply with all instructions and precautions provided by such labels;

[1]Attention is directed particularly to the provisions of Part III of this regulation concerning labeling of containers.

2.4.2.3.2 shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label; however;

2.4.2.3.2.1 devices containing only krypton need not be tested for leakage of radioactive material, and

2.4.2.3.2.2 devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose;

2.4.2.3.3 Shall assure that the tests required by RHA 2.4.2.3.2 and other testing, installation, servicing, and removal from installation involving the radioactive materials, its shielding or containment, are performed:

2.4.2.3.3.1 in accordance with the instructions provided by the labels; or

2.4.2.3.3.2 by a person holding a specific license from the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State to perform such activities;

2.4.2.3.4 Shall maintain records showing compliance with the requirements of RHA 2.4.2.3.2 and 2.4.2.3.3. The records shall show the results of tests. The records also shall show the dates of performance of, and the names of the persons performing, testing installation services, and removal from installation concerning the radioactive material, its shielding or containment;

The licensee shall retain these records as follows:

2.4.2.3.4.1 Each record of a test for leakage of radioactive material required by paragraph RHA 2.4.2.3.2 of this section must be retained for three years after the next required leak test is performed or until the sealed source is transferred or disposed of.

2.4.2.3.4.2 Each record of a test of the on-off mechanism and indicator required by paragraph RHA 2.4.2.3.2 of this section must be retained for three years after the next required test of the on-off mechanism and indicator is performed or until the sealed source is transferred or disposed of.

2.4.2.3.4.3 Each record that is required by paragraph RHA 2.4.2.3.3 of this section must be retained for three years from the date of the recorded event or until the device is transferred or disposed of.

2.4.2.3.5 Shall immediately suspend operation of the device if there is a failure of, or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie (185 bequerel) or more of removable radioactive material. The device may not be operated until it has been repaired by the manufacturer or other person holding a specific license to repair such devices that was issued by the Department or by the U.S. Nuclear Regulatory Commission or an Agreement State. The device and any radioactive material from the device may only be disposed of by transfer to a person authorized by a specific license to receive the radioactive material in the device or as otherwise approved by the Department. A report containing a brief description of the event and the remedial action taken; and, in the case of detection of 0.005 microcurie or more removable radioactive material or failure of or damage to a source likely to result in contamination of the premises or the environs, a plan for ensuring that the premises and environs are acceptable for

unrestricted use, must be furnished to the Department within 30 days. Under these circumstances, the criteria set out in RHA 3.57.2 "Radiological criteria for unrestricted use," may be applicable, as determined by the Department on a case-by-case basis;

2.4.2.3.6 shall not abandon the device containing radioactive material;

2.4.2.3.7 Shall transfer or dispose of the device containing radioactive material only by export as provided by RHA 2.4.2.3.14 of this section, by transfer to another general licensee as authorized in RHA 2.4.2.3.8 or to a person authorized to receive the device by a specific license issued by this Department or by the U.S. Nuclear Regulatory Commission or an Agreement State or as otherwise approved under RHA 2.4.2.3.7.2. In complying with this section, the licensee:

2.4.2.3.7.1 Shall furnish a report to the Department within 30 days after the transfer of a device to a specific licensee or export. The report must contain the identification of the device by manufacturer's (or initial transferor's) name, model number, and serial number; the name, address, and license number of the person receiving the device (license number not applicable if exported); and the date of the transfer.

2.4.2.3.7.2 Shall obtain written Departmental approval before transferring the device to any other specific licensee not specifically identified in RHA 2.4.2.3.7; 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:

2.4.2.3.7.2.1 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;

2.4.2.3.7.2.2 Removes, alters, covers, or clearly and unambiguously augments the existing label (otherwise required by RHA 2.4.2.3.1) so that the device is labeled in compliance with RHA 3.24; however the manufacturer, model number, and serial number must be retained;

2.4.2.3.7.2.3 Obtains manufacturer's or initial transferor's information concerning maintenance that would be applicable under the specific license (such as leak testing procedures); and

2.4.2.3.7.2.4 Reports the transfer under RHA 2.4.2.3.7.1.

2.4.2.3.8 Shall transfer the device to another general licensee only:

2.4.2.3.8.1 Where the device remains in use at a particular location. In this case, the transferor shall give the transferee a copy of this regulation, a copy of RHA 2.4.1, 2.18, 3.44, and 3.45 of this chapter, and any safety documents identified in the label of the device. Within 30 days of the transfer, the transferor shall report to the Department the manufacturer's (or initial transferor's) name; the model number and the serial number of the device transferred; the transferee's name and mailing address for the location of use; and the name, title, and phone number of the responsible individual identified by the transferee in accordance with RHA 2.4.2.3.10 to have knowledge of and authority to take actions to ensure compliance with the appropriate regulations and requirements or:

2.4.2.3.8.2 Where the device is held in storage by an intermediate person in the original shipping container at its intended location of use prior to initial use by a general licensee.

2.4.2.3.9 shall comply with the provisions of RHA 3.17 and 3.18 for reporting radiation incidents, theft, or loss of licensed material, but shall be exempt from the other requirements of Parts III and VI.

2.4.2.3.10 Shall appoint an individual responsible for having knowledge of the appropriate regulations and requirements and the authority for taking required actions to comply with appropriate regulations and requirements. The general licensee, through this individual, shall ensure the day-to-day compliance with appropriate regulations and requirements. This appointment does not relieve the general licensee of any of its responsibility in this regard.

2.4.2.3.11 Shall register generally licensed devices:

2.4.2.3.11.1 When the device contains at least 10 mCi (370 MBq) of cesium-137, 0.1 mCi (3.7 MBq) of strontium-90, 1 mCi (37 MBq) of cobalt-60, 0.1 mCi (3.7 MBq) of radium-226, or 1 mCi (37 MBq) of americium-241 or any other transuranic (i.e., element with atomic number greater than uranium (92)), based on the activity indicated on the label. Each address for a location of use, as described under paragraph RHA 2.4.2.3.11.3 (iv), represents a separate general licensee and requires a separate registration and fee.

2.4.2.3.11.2 Annually, if in possession of a device meeting the criteria of RHA 2.4.2.3.11.1. Registration shall be made with the Department and the fee required by Department Regulation 61-30 shall be paid. Registration must be done by verifying, correcting, and/or adding to the information provided in a request for registration received from the Department. The registration information must be submitted to the Department within 30 days of the date of the request for registration or as otherwise indicated in the request. In addition, a general licensee holding devices meeting the criteria of RHA 2.4.2.3.11.1 is subject to the bankruptcy notification requirement in RHA 2.10.6.

2.4.2.3.11.3 In registering devices, the general licensee shall furnish the following information and any other information specifically requested by the Department:

(i) Name and mailing address of the general licensee.

(ii) Information about each device: the manufacturer (or initial transferor), model number, serial number, the radioisotope and activity (as indicated on the label).

(iii) Name, title, and telephone number of the responsible person designated as a representative of the general licensee under RHA 2.4.2.3.10.

(iv) Address or location at which the device(s) are used and/or stored. For portable devices, the address of the primary place of storage.

(v) Certification by the responsible representative of the general licensee that the information concerning the device(s) has been verified through a physical inventory and checking of label information.

(vi) Certification by the responsible representative of the general licensee that they are aware of the requirements of the general license.

2.4.2.3.11.4 Persons generally licensed by the U.S. Nuclear Regulatory Commission with respect to devices meeting the criteria in RHA 2.4.2.3.11.1 are not subject to registration requirements if the devices are used in areas subject to Departmental jurisdiction for a period less than 180 days in any calendar year. The Department will not request registration information from such licensees.

2.4.2.3.12 Shall report changes to the mailing address for the location of use (including change in name of general licensee) to the Department within 30 days of the effective date of the change. For a portable device, a report of address change is only required for a change in the device's primary place of storage.

2.4.2.3.13 May not hold devices that are not in use for longer than 2 years. If devices with shutters are not being used, the shutter must be locked in the closed position. The testing required by RHA 2.4.2.3.2 need not be performed during the period of storage only. However, when devices are put back into service or transferred to another person, and have not been tested within the required test interval, they must be tested for leakage before use or transfer and the shutter tested before use. Devices kept in standby for future use are excluded from the two-year time limit if the general licensee performs quarterly physical inventories of these devices while they are in standby.

2.4.2.3.14 Shall not export the device containing radioactive material except in accordance with 10CFR part 110, Code of Federal Regulations;

2.4.2.3.15 Shall respond to written requests from the Department to provide information relating to the general license within 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 Chief of the Bureau of Radiological Health, SC Department of Health and Environmental Control, by an appropriate method listed in RHA 1.13 of this regulation, a written justification for the request.

2.4.2.4 The general license in RHA 2.4.2.1 does not authorize the manufacture or import of devices containing radioactive material.

2.4.2.5 The general license provided in RHA 2.4.2.1 is subject to the provisions of RHA 1.5 through 1.8, RHA 1.11, RHA 1.12, RHA 2.10, RHA 2.18, RHA 2.19, and RHA 2.22.

2.4.2.6 Any person who holds a specific license issued by the NRC or an Agreement State authorizing the holder to manufacture, install, or service a device described in RHA 2.4.2 through 2.4.2.5 is hereby granted a general license to install and service such device and a general license to install and service such device in South Carolina, provided that:

2.4.2.6.1 [Reserved]

2.4.2.6.2 The device has been manufactured, labeled, installed, and serviced in accordance with applicable provisions of the specific license issued to such person by the NRC or Agreement State.

2.4.2.6.3 Such person assures that any labels required to be affixed to the device under regulations of the NRC or Agreement State which licensed manufacture of the device bear a statement that removal of the label is prohibited.

2.4.3 General License for in Vitro Clinical or Laboratory Testing

2.4.3.1 A general license is hereby issued to any physician, veterinarian in the practice of veterinary medicine, clinical laboratory or hospital to receive, acquire, possess, transfer, or use, for any of the following stated tests, in accordance with the provisions of subparagraphs 2.4.3.2, 2.4.3.3, 2.4.3.4, 2.4.3.5, and 2.4.3.6 of this paragraph:

2.4.3.1.1 Iodine-125 in units not exceeding 10 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.2 Iodine-131, in units not exceeding 10 microcuries each from use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.3 Carbon-14, in units not exceeding 10 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.4 Hydrogen-3 (tritium), in units not exceeding 50 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.5 Iron-59, in units not exceeding 20 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.6 Cobalt-57, in units not exceeding 10 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.1.7 Selenium-75, in units not to exceed 10 microcuries each for use in in vitro clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation therefrom; to human beings or animals.

2.4.3.1.8 Mock Iodine-125 reference or calibration sources, in units not exceeding 0.05 microcurie of Iodine-129 and 0.005 microcurie of Americium-241 each for use in in vitro clinical or laboratory administration of radioactive material, or the radiation therefrom, to human beings or animals.

2.4.3.2 No person shall receive, acquire, possess, use or transfer radioactive material pursuant to the general license established by subparagraph 2.4.3.1 of this paragraph until he has filed Form RHA-100-1, "Certificate—In Vitro Testing with Radioactive Material Under General License," with the Department and received from the Department a validated copy of Form RHA-100-1 with a certification number assigned. The physician, veterinarian, clinical laboratory or hospital shall furnish on Form RHA-100-1 the following information and such other information as may be required by that form:

2.4.3.2.1 Name and address of the physician, veterinarian, clinical laboratory, or hospital;

2.4.3.2.2 The location of use; and,

2.4.3.2.3 A Statement that the physician, veterinarian, laboratory or hospital has appropriate radiation measuring instruments to carry out in vitro clinical or laboratory tests with radioactive materials as authorized under the general license in subparagraph 2.4.3.1 of this paragraph and that such tests will be performed only by personnel competent in the use of such instruments and in the handling of the radioactive materials.

2.4.3.3 A person who receives, acquires, possesses or uses radioactive material pursuant to the general license established by subparagraph 2.4.3.1 of this paragraph shall comply with the following:

2.4.3.3.1 The general licensee shall not possess at any one time, pursuant to the general license in subparagraph 2.4.3.1 of this paragraph, at any one location of storage or use a total amount of Iodine 125 and/or Iodine 131 in excess of 200 microcuries.

2.4.3.3.2 The general licensee shall store the radioactive material, until used, in the original shipping container or in a container providing equivalent radiation protection.

2.4.3.3.3 The general licensee shall use the radioactive material only for the uses authorized by subparagraph 2.4.3.1 of this paragraph.

2.4.3.3.4 The general licensee shall only transfer radioactive material to a person who is authorized to receive it pursuant to a license issued by the Department, the U.S. Nuclear Regulatory Commission, any Agreement State, or a Licensing State nor transfer the radioactive material in any manner other than in the unopened, labeled shipping container as received from the supplier.

2.4.3.3.5 The general licensee shall dispose of the Mock Iodine-125 reference or calibration sources described in subparagraph 2.4.3.1.8 as required by RHA 3.12.

2.4.3.4 The general licensee shall not receive, acquire, possess, or use radioactive material pursuant to subparagraph 2.4.3.1 of this paragraph:

2.4.3.4.1 Except as prepackaged units which are labeled in accordance with the provisions of a specific license issued under Paragraph 2.7.5 of this Part or in accordance with the provisions of a specific license issued by the U.S. Nuclear Regulatory Commission, any Agreement State, or a Licensing State which authorizes the manufacture of Iodine-125, Iodine-131 or Cobalt 57 for distribution to persons generally licensed under Paragraph 2.4.3 or its equivalent.

2.4.3.4.2 Unless 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:

This radioactive material may be received, acquired, possessed, and used only by physicians, veterinarians, 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 therefrom, 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, an Agreement State, or a Licensing State.

_____
Name of Manufacturer

2.4.3.5 The physician, veterinarian, clinical laboratory or hospital possessing or using radioactive materials under the general license of subparagraph 2.4.3.1 of this paragraph shall report in writing to the Department, any changes in the information furnished by him in the "Certificate—In Vitro Testing With Radioactive Material Under General License," Form RHA-100-1. The report shall be furnished within 30 days after the effective date of such change.

2.4.3.6 Any person using radioactive material pursuant to the general license of subparagraph 2.4.3.1 of this paragraph is exempt from the requirements of Part III and Part VI of these regulations with respect to radioactive materials covered by that general license, except that such persons using the Mock Iodine-125 described in subparagraphs 2.4.3.1.8 shall comply with the provisions RHA 3.14, RHA 3.17, and RHA 3.18.

2.4.4 Luminous Safety Devices for Aircraft.

2.4.4.1 A general license is hereby issued to own, receive, acquire, possess and use tritium or promethium 147 contained in luminous safety devices for use in aircraft provided:

2.4.4.1.1 Each device contains not more than ten curies of tritium or 300 millicuries of promethium 147; and

2.4.4.1.2 Each device has been manufactured, assembled, or imported in accordance with a specific license issued by the United States Nuclear Regulatory Commission, or each device has been manufactured or assembled in accordance with the specifications contained in a specific license or equivalent licensing document issued by the Department or any Agreement State to the manufacturer or assembler of such device pursuant to licensing requirements equivalent to those in Section 32.53 of 10 CFR Part 32 of the regulations of the United States Nuclear Regulatory Commission.

2.4.4.2 Persons who own, receive, acquire, possess, or use luminous safety devices pursuant to the general license in 2.4.4.1 are exempt from the requirements of Part III and Part VI, except that they shall comply with the provisions of RHA 3.17 and RHA 3.18.

2.4.4.3 This general license does not authorize the manufacture, assembly, or repair of luminous safety devices containing tritium or promethium 147.

2.4.4.4 This general license does not authorize the ownership, receipt, acquisition, possession, or use of promethium 147 contained in instrument dials.

2.4.4.5 The general license provided in RHA 2.4.4 is subject to the provisions of RHA 1.5 through RHA 1.8, RHA 1.12, RHA 1.13, RHA 2.10, RHA 2.18, RHA 2.19, and RHA 2.22.

2.4.5 Calibration and Reference Sources.

2.4.5.1 A general license is hereby issued to those persons listed below to own, receive, acquire, possess, use and transfer, in accordance with the provisions of 2.4.5.3, and 2.4.5.4, americium 241 in the form of calibration or reference sources:

2.4.5.1.1 Any person who holds a specific license issued by the Department which authorizes him to receive, possess, use, and transfer radioactive material; and

2.4.5.1.2 Any person who holds a specific license issued by the U. S. Nuclear Regulatory Commission which authorizes him to receive, possess, use, and transfer special nuclear material.

2.4.5.2 A general license is hereby issued to receive, possess, use and transfer, plutonium and radium 226 in the form of calibration or reference sources in accordance with the provisions of 2.4.5.3 and 2.4.5.4,

to any person who holds a specific license issued by the Department which authorizes him to receive, possess, use, and transfer radioactive material.

2.4.5.3 The general licenses in paragraphs 2.4.5.1 and 2.4.5.2 of this subsection apply only to calibration or reference sources which have been manufactured in accordance with the specifications contained in a specific license issued to the manufacturer or importer of the sources by the U.S. Nuclear Regulatory Commission pursuant to Section 32.57 of 10 CFR, Part 32, Section 70.39 of 10 CFR, Part 70 or which have been manufactured in accordance with the specifications contained in a specific license or equivalent licensing document issued to the manufacturer by the Department, any Agreement State, or a Licensing State pursuant to licensing requirements equivalent to those contained in Section 32.57 of 10 CFR, Part 32 or Section 70.39 of 10 CFR, Part 70 of the regulations of the U.S. Nuclear Regulatory Commission.

2.4.5.4 The general licenses in paragraphs 2.4.5.1 and 2.4.5.2 of this subsection are subject to the provisions of Section RHA 1.5 through RHA 1.8, RHA 1.12, RHA 1.13, RHA 2.10, RHA 2.18, RHA 2.19, RHA 2.22, Part III and Part VI of these regulations. In addition, persons who own, receive, acquire, possess, use and transfer one or more calibration or reference sources pursuant to these general licenses;

2.4.5.4.1 Shall not possess at any one time, at any one location of storage or use, more than 5 microcuries of americium 241, 5 microcuries of plutonium or 5 microcuries of radium 226 in such sources;

2.4.5.4.2 Shall not receive, possess, use or transfer such source unless the source or the storage container bears a label which includes 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 U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State. Do not remove this label.
>
> CAUTION—RADIOACTIVE MATERIAL—THIS SOURCE CONTAINS (AMERICIUM 241). (PLUTONIUM).* DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.
>
> _____
> (Name of Manufacturer of Importer)

2.4.5.4.3 Shall not transfer, abandon, or dispose of such source except by transfer to a person authorized by a license from the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State to receive the source;

2.4.5.4.4 Shall store such source, except when the source is being used, in a closed container, adequately designed and constructed to contain americium 241, plutonium or radium 226 which might otherwise escape during storage; and,

2.4.5.4.5 Shall not use such source for any purpose other than the calibration of radiation detectors or the standardization of other sources.

2.4.5.5 These general licenses do not authorize the manufacture of calibration or reference sources containing americium 241, plutonium or radium 226.

*Showing only the name of the appropriate material.

2.4.6 Medical Diagnostic Uses.

2.4.6.1 A general license is hereby issued to any physician to receive, possess, transfer, or use for any of the following stated diagnostic uses, in accordance with the provisions of 2.4.6.2, 2.4.6.3, and 2.4.6.4, the following radioactive materials in capsules, disposable syringes, or other forms of prepackaged individual doses,** and the radioactive material has been manufactured in accordance with a specific license issued pursuant to RHA 2.7.4 by the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State authorizing distribution under the general license granted in this paragraph or its equivalent:

2.4.6.1.1 Iodine 131 as sodium iodide (NaI-131) for measurement of thyroid uptake;

2.4.6.1.2 Iodine 131 as iodinated human serum albumin (IHSA) for determinations of blood and blood plasma volume;

2.4.6.1.3 Iodine 125 as iodinated human serum albumin (IHSA) for determinations of blood and blood plasma volume;

2.4.6.1.4 Cobalt 57 for the measurement of intestinal absorption of cyanocobalamin;

2.4.6.1.5 Cobalt 58 for the measurement of intestinal absorption of cyanocobalamin;

2.4.6.1.6 Cobalt 60 for the measurement of intestinal absorption of cyanocobalamin;

2.4.6.1.7 Chromium 51 as sodium radiochromate for determination of red blood cell volumes and studies of red blood cell survival time.

2.4.6.2 No physician shall receive, possess, use, or transfer radioactive material pursuant to the general license established by 2.4.6.1 until he has filed Form RHA-100, “Certificate-Medical Use of Radioactive Material Under General License” with the Department and received from the Department a validated copy of the Form RHA-100. The generally licensed physician shall furnish on Form RHA-100 the following information and such other information as may be required by that form;

2.4.6.2.1 Name and address of the generally licensed physician;

2.4.6.2.2 A statement that the generally licensed physician is a duly licensed physician authorized to dispense drugs in the practice of medicine in the State of South Carolina and specifying the license number; and,

2.4.6.2.3 A statement that the generally licensed physician has appropriate radiation measuring instruments to carry out the diagnostic procedures for which he proposed to use radioactive material under the general license of 2.4.6 and that he is competent in the use of such instruments.

**Note: RHA 2.7.8 requires manufacturers of radiopharmaceuticals which are under the general license in this paragraph to affix a certain identifying label to the container or in the leaflet or brochure which accompanies the radiopharmaceutical.

2.4.6.3 A physician who receives, possesses or uses a pharmaceutical containing radioactive material pursuant to the general license established by 2.4.6.1 shall comply with the following:

2.4.6.3.1 He shall not possess at any one time pursuant to the general license in 2.4.6.1 more than:

2.4.6.3.1.1 200 microcuries of Iodine 131,

2.4.6.3.1.2 200 microcuries of Iodine 125,

2.4.6.3.1.3 5 microcuries of Cobalt 57

2.4.6.3.1.4 5 microcuries of Cobalt 60, and

2.4.6.3.1.5 5 microcuries of Cobalt 58, and

2.4.6.3.1.6 200 microcuries of Chromium 51;

2.4.6.3.2 He shall store the pharmaceutical, until administered, in the original shipping container or a container providing the equivalent radiation protection;

2.4.6.3.3 He shall use the pharmaceutical only for the uses authorized by 2.4.6.1;

2.4.6.3.4 He shall not administer the pharmaceutical to a woman with confirmed pregnancy or to a person under 18 years of age;

2.4.6.3.5 He shall not transfer the radioactive material to a person who is not authorized to receive it pursuant to a license issued by the Department, the U.S. Nuclear Regulatory Commission, any Agreement State, or a Licensing State, or in any manner other than in the unopened, labeled shipping container as received from the supplier, except by administering it to a patient.

2.4.6.4 The generally licensed physician possessing or using radioactive material under the general license of 2.4.6.1 shall report in duplicate to the Department, any changes in the information furnished by him in the "Certificate-Medical Use of Radioactive Material Under General License," Form RHA-100. The report shall be submitted within 30 days after the effective date of change.

2.4.6.5 Any person using radioactive material pursuant to the general license of 2.4.6.1 is exempt from the requirements of Part III and Part VI of these regulations with respect to the radioactive materials covered by the general license.

2.4.7 Ice Detection Devices.

2.4.7.1 A general license is hereby issued to own, receive, acquire, possess, use, and transfer strontium 90 contained in ice detection devices, provided each device contains not more than fifty microcuries of strontium 90 and each device has been manufactured or imported in accordance with a specific license issued by the U. S. Nuclear Regulatory Commission or each device has been manufactured in accordance with specifications contained in a specific license or equivalent licensing document issued by the Department or any agreement state to the manufacturer of such device pursuant to licensing requirements

equivalent to those in Section 32.61 of CFR 32 of the regulations of the U. S. Nuclear Regulatory Commission.

2.4.7.2 Persons who own, receive, acquire, possess, use or transfer strontium 90 contained in ice detection devices pursuant to the general license in paragraph 2.4.7.1:

2.4.7.2.1 Shall, upon occurrence of visually observable damage, such as a bend or crack or discoloration from overheating, to the device, discontinue use of the device until it has been inspected, tested for leakage and repaired by a person holding a specific license or equivalent licensing document from the U. S. Nuclear Regulatory Commission or agreement state to manufacture or service such devices; or shall dispose of the device pursuant to the provisions of this regulation;

2.4.7.2.2 Shall assure that all labels affixed to the device at the time of receipt, and which bear a statement which prohibits removal of the labels, are maintained thereon; and

2.4.7.2.3 Are exempt from the requirements of Part III and Part VI except that such persons shall comply with the provisions of Sections RHA 3.12, RHA 3.17, and RHA 3.18 of these regulations.

2.4.7.3 This general license does not authorize the manufacture, assembly, disassembly, or repair of strontium 90 in ice detection devices.

2.4.7.4 The general license provided in this paragraph is subject to the provisions of Sections RHA 1.5, through RHA 1.8, RHA 1.11, RHA 1.12, RHA 2.10, RHA 2.18, RHA 2.19, and RHA 2.22.

2.4.8 Self-Luminous Products Containing Ra-226

2.4.8.1 A general license is hereby issued to any person to acquire, receive, possess, use, or transfer, in accordance with the provisions of paragraphs 2.4.8.2, 2.4.8.3, and 2.4.8.4 of this section, Radium-226 contained in the following products manufactured prior to November 30, 2007.

2.4.8.1.1 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.

2.4.8.1.2 Intact timepieces containing greater than 0.037 megabecquerel (1 microcurie), nonintact timepieces, and timepiece hands and dials no longer installed in timepieces.

2.4.8.1.3 Luminous items installed in air, marine, or land vehicles.

2.4.8.1.4 All other luminous products, provided that no more than 100 items are used or stored at the same location at any one time.

2.4.8.1.5 Small radium sources containing no more than 0.037 megabecquerel (1 microcurie) 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.

2.4.8.2 Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in 2.4.8.1 of this section are exempt from the provisions of Parts 3 and 6 of this Regulation, 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.

2.4.8.3 Any person who acquires, receives, possesses, uses, or transfers byproduct material in accordance with the general license in 2.4.8.1 of this section:

2.4.8.3.1 Shall notify the Department 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 Director of the Division of Waste Management, South Carolina Department of Health & Environmental Control, 2600 Bull Street, Columbia SC, 29201 within 30 days.

2.4.8.3.2 Shall not abandon products containing Radium-226. The product, and any radioactive material from the product, may only be disposed of according to Part 3 of this Regulation 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 Department.

2.4.8.3.3 Shall not export products containing Radium-226 except in accordance with this Regulation.

2.4.8.3.4 Shall 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 Regulation, or equivalent regulations of an Agreement State, or as otherwise approved by the Department.

2.4.8.3.5 Shall respond to written requests from the Department to provide information relating to the general license within 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 Director of the Division of Waste Management, South Carolina Department of Health & Environmental Control, 2600 Bull Street, Columbia SC, 29201, a written justification for the request.

2.4.8.4 The general license in paragraph 2.4.8.1 of this section does not authorize the manufacture, assembly, disassembly, repair, or import of products containing Radium-226, except that timepieces may be disassembled and repaired.

RHA 2.5. Filing of Application for Specific Licenses.

2.5.1 Applications for specific licenses shall be filed on a form prescribed by the Department. The applicant shall set forth all applicable information called for by the form.

2.5.2 The Department 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 Department to determine whether the application should be granted or denied or whether a license should be modified or revoked. Prelicensing

visits may be made to the applicant's facility for purpose of amplying information furnished in the original application.

2.5.3 Each application shall be signed by the applicant or licensee or a person duly authorized to act for and on his behalf.

2.5.4 An application for a license may include a request for a license authorizing one or more activities.

2.5.5 In his application, the applicant may incorporate by reference information contained in previous applications, statements, or reports filed with the Department provided such references are clear and specific.

2.5.6 Applications and documents submitted to the Department may be made available for public inspection except that the Department may withhold upon request, any document or part thereof from public inspection if disclosure of its contents is not required in the public interest and would adversely affect the interest of a person concerned.

2.5.7 Application for a specific license in form of sealed source.

2.5.7.1 Except as provided in RHA 2.5.7.2, 2.5.7.3, and 2.5.7.4, an application for a specific license to use byproduct material in the form of a sealed source or in a device that contains the sealed source must either—

2.5.7.1.1 Identify the source or device by manufacturer and model number as registered with the Department under RHA 2.29 or comparable regulation, or for a source or a device containing radium 226 or accelerator-produced radioactive material with a State under provisions comparable to RHA 2.29; or

2.5.7.1.2 Contain the information identified in RHA 2.29.

2.5.7.2 For sources or devices manufactured before October 23, 2012 that are not registered with the Commission 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 RHA 2.29, the application must include:

2.5.7.2.1 All available information identified in RHA 2.29 concerning the source, and, if applicable, the device; and

2.5.7.2.2 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.

2.5.7.3 For sealed sources and devices allowed to be distributed without registration of safety information in accordance with RHA 2.29, the applicant may supply only the manufacturer, model number, and radionuclide and quantity.

2.5.7.4 If it is not feasible to identify each sealed source and device individually, the applicant may propose constraints on the number and type of sealed sources and devices to be used and the conditions under which they will be used, in lieu of identifying each sealed source and device.

2.5.8 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 Part 4 of this Regulation shall include:

2.5.8.1 A request for authorization for the production of PET radionuclides or evidence of an existing license issued under Part 2 of this Regulation for a PET radionuclide production facility within its consortium from which it receives PET radionuclides.

2.5.8.2 Evidence that the applicant is qualified to produce radioactive drugs for medical use by meeting one of the criteria in Part 2 of this Regulation.

2.5.8.3 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 Part 2 of this Regulation.

2.5.8.4 Information identified in Part 2 of this Regulation on the PET drugs to be noncommercially transferred to members of its consortium.

RHA 2.6. General Requirements for the Issuance of Specific Licenses.

A license application will be approved if the Agency determines that:

2.6.1 The applicant is qualified by reason of training and experience to use the material in question for the purpose requested in accordance with these regulations and in such a manner as to protect health and minimize danger to life and property; and

2.6.2 The applicant's proposed equipment, facilities, and procedures are adequate to protect health and minimize danger to life and property; and

2.6.3 The issuance of the license will not be inimical to the health and safety of the public; and

2.6.4 The applicant satisfies any applicable special requirements in RHA 2.7 and RHA 2.8.

RHA 2.7. Special Requirements for Issuance of Certain Specific Licenses for Radioactive Materials.

2.7.1 Licensing the Manufacture and the Distribution of Devices to Persons Generally Licensed under RHA 2.4.2.

2.7.1.1 An application for a specific license to manufacture or distribute devices containing radioactive material, excluding special nuclear material, to persons generally licensed under RHA 2.4.2 or equivalent regulations of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State will be approved if:

2.7.1.1.1 the applicant satisfies the general requirements of RHA 2.6;

2.7.1.1.2 the applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control, labels, proposed uses, installation, servicing, leak testing, operating and safety instructions, and potential hazards of the device to provide reasonable assurance that:

2.7.1.1.2.1 the device can be safely operated by persons not having training in radiological protection;

2.7.1.1.2.2 Under ordinary conditions of handling, storage, and use of the device, the radioactive material contained in the device will not be released or inadvertently removed from the device, and it is unlikely that any person will receive in one year a dose in excess of 10% of the annual limits specified in RHA 3.5.1; and

2.7.1.1.2.3 under accident conditions (such as fire and explosion) associated with handling, storage, and the use of the device, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the following organ doses: Whole body: 15 rems head and trunk; active bloodforming organs; gonads; or lens of eye: Hands and forearms; 200 rems feet and ankles; localized areas of skin averaged over areas no larger than 1 square centimeter. Other organs 50 rems.

2.7.1.1.3 Each device bears a durable, legible, clearly visible label or labels approved by the Department, which contain in a clearly identified and separate statement:

2.7.1.1.3.1 instructions and precautions necessary to assure safe installation, operation, and servicing of the device (documents such as operating and service manuals may be identified in the label and used to provide this information);

2.7.1.1.3.2 the requirement, or lack of requirement, for leak testing, or for testing any on-off mechanism and indicator, including the maximum time interval for such testing, and the identification of radioactive material by isotope, quantity of radioactivity, and date of determination of the quantity; and

2.7.1.1.3.3 The information called for in the following statement in the same or substantially similar form:

> Receipt, possession, use, and transfer of this device Mode[3*], Serial No[3*], containing (Identity and quantity of radioactive material) are subject to a general license or the equivalent and the regulations of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State. This label shall be maintained on the device in a legible condition. Removal of this label is prohibited.
>
> **CAUTION-RADIOACTIVE MATERIAL**
>
> _____
>
> **(Name of manufacturer or initial transferor)[3*]**

2.7.1.1.4 Each device having a separable source housing that provides the primary shielding for the source also bears, on the source housing, a durable label containing the device model number and serial number, the isotope and quantity, the words, “Caution-Radioactive Material,” the radiation symbol described in RHA 3.21, and the name of the manufacturer or initial distributor.

[3*]The model, serial number, and name of manufacturer, assembler, or initial transferor may be omitted from this label provided they are elsewhere specified in labeling affixed to the device.

2.7.1.1.5 Each device meeting the criteria of RHA 2.4.2.3.11.1 bears a permanent (e.g., embossed, etched, stamped, or engraved) label affixed to the source housing if separable, or the device if the source housing is not separable, that includes the words, “Caution-Radioactive Material,” and, if practicable the radiation symbol described in RHA 3.21.

2.7.1.1.6 The device has been registered in the Sealed Source and Device Registry.

2.7.1.2 In the event the applicant desires that the device be required to be tested at intervals longer than six months, either for proper operation of the on-off mechanism and indicator, if any, or for leakage of radioactive material or for both, he shall include in his application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the device or similar devices and by design features which have a significant bearing on the probability or consequences of leakage of radioactive material from the device or failure of the on-off mechanism and indicator. In determining the acceptable interval for the test for leakage of radioactive material, the Department will consider information which includes, but is not limited to:

2.7.1.2.1 primary containment (source capsule);

2.7.1.2.2 protection of primary containment;

2.7.1.2.3 method of sealing containment;

2.7.1.2.4 containment construction materials;

2.7.1.2.5 form of contained radioactive material;

2.7.1.2.6 maximum temperature withstood during prototype test;

2.7.1.2.7 maximum pressure withstood during prototype tests;

2.7.1.2.8 maximum quantity of contained radioactive material;

2.7.1.2.9 radiotoxicity of contained radioactive material; and

2.7.1.2.10 operating experience with identical devices or similarly designed and constructed devices.

2.7.1.3 In the event the applicant desires that the general licensee under RHA 2.4.2, or under the equivalent regulations of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State be authorized to install the device, collect the sample to be analyzed by a specific licensee for leakage of radioactive material, service the device, test the on-off mechanism and indicator, or remove the device from installation, he shall include in his application written instructions to be followed by the general licensee, estimated calendar quarter doses associated with such activity or activities, and bases for such estimates. The submitted information shall demonstrate that performance of such activity or activities by an individual untrained in radiological protection, in addition to other handling, storage, and use of devices under the general license, is unlikely to cause that individual to receive a calendar quarter dose in excess of 10% of the limits specified in the table in RHA 3.2.1.

2.7.1.4 If a device containing radioactive material is to be transferred for use under the general license contained in RHA 2.4.2 of this part, each person that is licensed under RHA 2.7.1 shall provide the information specified in this paragraph to each person to whom a device is to be transferred. This information must be provided before the device may be transferred. In the case of a transfer through an intermediate person, the information must also be provided to the intended user prior to initial transfer to the intermediate person. The required information includes—

2.7.1.4.1 A copy of the general license contained in RHA 2.4.2; if RHA 2.4.2.3.2 through 2.4.2.3.4 or RHA 2.4.2.3.11 do not apply to the particular device, those paragraphs may be omitted.

2.7.1.4.2 A copy of RHA 2.4.1, 2.18, 3.44, and 3.45 of this part;

2.7.1.4.3 A list of the services that can only be performed by a specific licensee;

2.7.1.4.4 Information on acceptable disposal options including estimated costs of disposal; and

2.7.1.4.5 An indication that the Department's policy is to issue high civil penalties for improper disposal.

2.7.1.5 If radioactive material is to be transferred in a device for use under an equivalent general license of the NRC or an Agreement State, each person that is licensed under RHA 2.7.1 shall provide the information specified in this paragraph to each person to whom a device is to be transferred. This information must be provided before the device may be transferred. In the case of a transfer through an intermediate person, the information must also be provided to the intended user prior to initial transfer to the intermediate person. The required information includes—

2.7.1.5.1 A copy of the NRC or Agreement State or regulations equivalent to RHA 2.4.1, 2.4.2, 2.18, 3.44 and 3.45 of this part or a copy of these Agreement State regulations. If a copy of the Department's regulations is provided to a prospective general licensee in lieu of the NRC regulations, it shall be accompanied by a note explaining that use of the device is regulated by the NRC or other Agreement State; if certain paragraphs of the regulations do not apply to the particular device, those paragraphs may be omitted.

2.7.1.5.2 A list of the services that can only be performed by a specific licensee;

2.7.1.5.3 Information on acceptable disposal options including estimated costs of disposal; and

2.7.1.5.4 The name or title, address, and phone number of the contact at the appropriate regulatory agency, NRC or Agreement State, having jurisdiction at the devices new location, from which additional information may be obtained.

2.7.1.6 An alternative approach to informing customers may be proposed by the licensee for approval by the Department.

2.7.1.7 Each device that is transferred after February 2004 must meet the labeling requirements in RHA 2.7.1.4.3 through 2.7.1.4.5.

2.7.1.8 If a notification of bankruptcy has been made under RHA 2.10.6 or the license is to be terminated, each person licensed under RHA 2.7.1 shall provide, upon request, to the Department and to

the appropriate regulatory agency, NRC or Agreement State, having jurisdiction at the devices new location, records of final disposition required under RHA 2.7.1.9.2.

2.7.1.9 Each person licensed under RHA 2.7.1 to initially transfer devices to generally licensed persons shall comply with the requirements of this section.

2.7.1.9.1 The person shall report all transfers of devices to persons for use under the general license in RHA 2.4.2 of these regulations and for use under equivalent NRC regulations (10 CFR 31.5) or other Agreement State's regulations and all receipts of devices from persons licensed under RHA 2.4.2 to the Department or to the appropriate NRC office or other Agreement State office. The report must be submitted on a quarterly basis on NRC Form 653—"Transfers of Industrial Devices Report" or in a clear and legible report containing all of the data required by the form. (NRC Form 653 may be obtained from the Department or found in NUREG-1556, Vol. 16.)

2.7.1.9.1.1 The required information for transfers to general licensees includes—

(i) The identity of each general licensee by name and mailing address for the location of use; if there is no mailing address for the location of use, an alternate address for the general licensee shall be submitted along with information on the actual location of use.

(ii) The name, title, and phone number of the person identified by the general licensee as having knowledge of and authority to take required actions to ensure compliance with the appropriate regulations and requirements;

(iii) The date of transfer;

(iv) The type, model number, and serial number of the device transferred; and

(v) The quantity and type of radioactive material contained in the device.

2.7.1.9.1.2 If one or more intermediate persons will temporarily possess the device at the intended place of use before its possession by the user, the report must include the same information for both the intended user and each intermediate person, and clearly designate the intermediate person(s).

2.7.1.9.1.3 For devices received from a general licensee, the report must include the identity of the general licensee by name and address, the type, model number, and serial number of the device received, the date of receipt, and, in the case of devices not initially transferred by the reporting licensee, the name of the manufacturer or initial transferor.

2.7.1.9.1.4 If the licensee makes changes to a device possessed by a general licensee, such that the label must be changed to update required information, the report must identify the general licensee, the device, and the changes to information on the device label.

2.7.1.9.1.5 The report must cover each calendar quarter, must be filed within 30 days of the end of the calendar quarter, and must clearly indicate the period covered by the report.

2.7.1.9.1.6 The report must clearly identify the specific licensee submitting the report and include the license number of the specific licensee.

2.7.1.9.1.7 If no transfers have been made to or from persons generally licensed under RHA 2.4.2 during the reporting period, the report must so indicate. If no transfers have been made to or from an NRC or other Agreement State during the reporting period, this information should be made available to the responsible agency upon their request.

2.7.1.9.2 The person shall maintain all information concerning transfers and receipts of devices that supports the reports required by this section. Records required by this paragraph must be maintained for a period of 3 years following the date of the recorded event.

2.7.2 Licensing the Introduction of Radioactive Material Into Products in Exempt Concentration

In addition to the requirements set forth in RHA 2.6, a specific license authorizing the introduction of radioactive material into a product or material owned by or in the possession of a licensee or another to be transferred to persons exempt under 2.20.2.1.1 will be issued only if:

2.7.2.1 The applicant submits a description of the product or material into which the radioactive material will be introduced, intended use of the radioactive material and the product or material into which it is introduced, method of introduction, initial concentration of the radioactive material in the product or material, control methods to assure that no more than the specified concentration is introduced into the product or material, estimated time interval between introduction and transfer of the radioactive material in the product or material at the time of transfer; and

2.7.2.2 The applicant provides reasonable assurance that the concentrations of radioactive material at the time of transfer will not exceed the concentrations in RHA 2.25 Schedule C, that reconcentration of the radioactive material in concentrations exceeding those in RHA 2.25 Schedule C is not likely, that use of lower concentrations is not feasible, and that the product or material is not likely to be incorporated in any food, beverage, cosmetic, drug, or other commodity or product designed for ingestion or inhalation by, or application to, a human being. Each person licensed under this section 2.7.2 shall file an annual report with the Department which shall identify the type and quantity of each product or material into which radioactive material has been introduced during the reporting period; name and address of the person who owned or possessed the product or material, into which radioactive material has been introduced, at the time of introduction; the type and quantity of radionuclide introduced into each such product or material; and the initial concentrations of the radionuclide in the product or material at time of transfer of the radioactive material by the licensee. If no transfers of radioactive material have been made pursuant to this section 2.7.2 during the reporting period, the report shall so indicate. The report shall cover the year ending June 30, and shall be filed within 30 days thereafter.

2.7.3 Manufacture and Distribution of Radioactive Materials for Medical Use Under General License.

In addition to the requirements set forth in RHA 2.6 above, a specific license authorizing the distribution of radioactive material for use by physicians under the general license of 2.4.6 will be issued only if:

2.7.3.1 The applicant submits evidence that the radioactive material is to be manufactured, labeled and packaged in accordance with a new drug application Administration has approved, or in accordance with a license for a biologic product issued by the Secretary, Department of Health, Education, and Welfare; and,

2.7.3.2 The following statement, or a substantially similar statement which contains information called for in the following statement, appears on the label affixed to the container or appears in the leaflet or brochure which accompanies the package: “This radioactive drug may be received, possessed, and used only by physicians licensed to dispense drugs in the practice of medicine. Its receipt, possession, use and

transfer are subject to the regulations and a general license (or the equivalent) of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State."

_____
(Name of Manufacturer)

2.7.4 Manufacture and Distribution of Radioactive Materials for Certain In Vitro Clinical, or Laboratory Testing Under General License

An application for a specific license to manufacture or distribute radioactive material for use under the general license of 2.4.3 of this part will be applied if:

2.7.4.1 The applicant satisfies the general requirements specified in RHA 2.6.

2.7.4.1.1 Has specialized training in the diagnostic or therapeutic use of the sealed source considered or has experience equivalent to such training, and

2.7.4.1.2 Is a physician.

2.7.4.2 The radioactive material is to be prepared for distribution in prepackaged units of:

2.7.4.2.1 Iodine-125 in units not exceeding 10 microcuries each.

2.7.4.2.2 Iodine-131 in units not exceeding 10 microcuries each.

2.7.4.2.3 Carbon-14 in units not exceeding 10 microcuries each.

2.7.4.2.4 Hydrogen-3 (tritium) in units not exceeding 50 microcuries each.

2.7.4.2.5 Iron-59 in units not exceeding 20 microcuries each.

2.7.4.2.6 Cobalt-57 in units not exceeding 10 microcuries (0.37 MBq) each.

2.7.4.2.7 Selenium-75 in units not exceeding 10 microcuries each.

2.7.4.2.8 Mock Iodine-125 in units not exceeding 0.05 microcuries of Iodine 129 and 0.005 microcuries of Americium 241 each.

2.7.4.3 Each prepackage unit bears a durable, clearly visible label:

2.7.4.3.1 Identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed 10 microcuries (0.37 MBq) of Iodine-125, Iodine-131, Selenium-75, or Carbon-14; 50 microcuries (1.85 MBq) of Hydrogen-3 (tritium); or 20 microcuries (0.74 MBq) of Iron-59; or Mock Iodine-125 in units not exceeding 0.05 microcurie (1.85 kBq) of Iodine-129 and 0.005 microcurie (0.185 kBq) of Americium-241 each; or Cobalt-57 in units not exceeding 10 microcuries (0.37 MBq); and

2.7.4.3.2 Displaying the radiation caution symbol described in RHA 3.8 (3.8.1) of Part III and the words, “CAUTION, RADIOACTIVE MATERIAL,” and “Not for Internal or External Use in Humans or Animals.”

2.7.4.4 The following statement, or 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.

“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 therefrom, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of the United States Nuclear Regulatory Commission, an Agreement State, or a licensing State.”

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Name of Manufacturer

2.7.4.5 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 RHA 3.12.

2.7.5 Manufacture, preparation, or transfer for commercial distribution of radioactive drugs containing radioactive material for medical use under Part IV.

2.7.5.1 An application for a specific license to manufacture, prepare, or transfer for commercial distribution radioactive drugs containing radioactive material for use by persons licensed pursuant to Part IV of these regulations will be approved if:

2.7.5.1.1 The applicant satisfies the general requirements specified in RHA 2.6;

2.7.5.1.2 The applicant submits evidence that the applicant is at least one of the following:

2.7.5.1.2.1 Registered 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);

2.7.5.1.2.3 Licensed as a pharmacy by a State Board of Pharmacy;

2.7.5.1.2.4 Operating as a nuclear pharmacy within a Federal medical institution; or

2.7.5.1.2.5 A Positron Emission Tomography (PET) drug production facility registered with a State agency.

2.7.5.1.3 The applicant submits information on the radionuclide; the chemical and physical form; the maximum activity per vial, syringe, generator, or other container of the radioactive drug; and the shielding provided by the packaging to show it is appropriate for the safe handling and storage of the radioactive drugs by medical use licensees; and

2.7.5.1.4 The applicant commits to the following labeling requirements:

2.7.5.1.4.1 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 must 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 100 days, the time may be omitted.

2.7.5.1.4.2 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 must 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.

2.7.5.2 A licensee described by paragraph 2.7.5.1.2.3 or 2.7.5.1.2.4 of this section:

2.7.5.2.1 May prepare radioactive drugs for medical use, as defined in RHA 4.2 provided that the radioactive drug is prepared by either an authorized nuclear pharmacist, as specified in 2.7.5.2.2 and 2.7.5.2.4 of this section, or an individual under the supervision of an authorized nuclear pharmacist as specified in RHA 4.15.

2.7.5.2.2 May allow a pharmacist to work as an authorized nuclear pharmacist if:

2.7.5.2.2.1 This individual qualifies as an authorized nuclear pharmacist as defined in RHA 4.2.

2.7.5.2.2.2 This individual meets the requirements specified in Part 4 of this Regulation, and the licensee has received an approved license amendment identifying this individual as an authorized nuclear pharmacist; or

2.7.5.2.2.3 This individual is designated as an authorized nuclear pharmacist in accordance with 2.7.5.2.4 of this section.

2.7.5.2.3 The actions authorized in 2.7.5.2.1 and 2.7.5.2.2 of this section are permitted in spite of more restrictive language in license conditions.

2.7.5.2.4 May designate a pharmacist (as defined in RHA 4.2) as an authorized nuclear pharmacist if:

2.7.5.2.4.1 The individual was a nuclear pharmacist preparing only radioactive drugs containing accelerator-produced radioactive material; and

2.7.5.2.4.2 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.

2.7.5.2.5 Shall provide to the Department:

2.7.5.2.5.1 A copy of each individual's certification by a specialty board whose certification process has been recognized by the Nuclear Regulatory Commission or an Agreement State as specified in RHA 4.22.1; or

2.7.5.2.5.2 The Commission or Agreement State license; or

2.7.5.2.5.3 Commission master materials licensee permit; or

2.7.5.2.5.4 The permit issued by a licensee or Commission master materials permittee of broad scope or the authorization from a commercial nuclear pharmacy authorized to list its own authorized nuclear pharmacist; or

2.7.5.2.5.5 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

2.7.5.2.5.6 A copy of the State pharmacy licensure or registration, no later than 30 days after the date that the licensee allows, under paragraphs RHA 2.7.5.2.2.1 and 2.7.5.2.2.3, the individual to work as an authorized nuclear pharmacist.

2.7.5.3 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 prior to transfer for commercial distribution. In addition, the licensee shall:

2.7.5.3.1 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

2.7.5.3.2 Check each instrument for constancy and proper operation at the beginning of each day of use.

2.7.5.4 A licensee shall satisfy the labeling requirements in paragraph 2.7.5.1.4 of this section.

2.7.5.5 Nothing in this section relieves the licensee from complying with applicable FDA, other Federal, and State requirements governing radioactive drugs.

2.7.6 [Deleted]

2.7.7 Manufacture and Distribution of Sources or Devices Containing Radioactive Material for Medical Use

2.7.7.1 An application for a specific license to manufacture and distribute sources and devices containing radioactive material to persons licensed pursuant to Part IV of these regulations for use as a calibration, transmission, or reference source or for the uses listed in RHA 4.46, 4.56, 4.58 and 4.88 of Part IV of these regulations will be approved if:

2.7.7.1.1 The applicant satisfies the general requirements in RHA 2.6 of this Part; and

2.7.7.1.2 The applicant submits sufficient information regarding each type of source or device pertinent to an evaluation of its radiation safety, including:

2.7.7.1.2.1 The radioactive material contained, its chemical and physical form, and amount;

2.7.7.1.2.2 Details of design and construction of the source or device;

2.7.7.1.2.3 Procedures for, and results of, prototype tests to demonstrate that the source or device will maintain its integrity under stresses likely to be encountered in normal use and accidents;

2.7.7.1.2.4 For devices containing radioactive material, the radiation profile of a prototype device;

2.7.7.1.2.5 Details of quality control procedures to assure that production sources and devices meet the standards of design and prototype tests;

2.7.7.1.2.6 Procedures and standards for calibrating sources and devices;

2.7.7.1.2.7 Legend and methods for labeling sources and devices as to their radioactive content;

2.7.7.1.2.8 Instruction for handling and storing the source or device from the radiation safety standpoint; these instructions are to be included on a durable label attached to a permanent storage container for the source or device; provided, that instructions which are too lengthy for such label may be summarized on the label and printed in detail on a brochure which is referenced on the label;

2.7.7.1.3 The label affixed to the source or device, or to the permanent storage container for the source or device, contains information on the radionuclide, quantity, and date of assay, and a statement that (insert name of source or device) is licensed by the Department for distribution to persons licensed pursuant to RHA 4.28, RHA 4.46, 4.56 and 4.58 of Part IV of these regulations or under equivalent licenses of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State.

2.7.7.1.4 The source or device has been registered in the Sealed Source and Device Registry.

2.7.7.2 In the event the applicant desires that the source or device be required to be tested for leakage of radioactive material at intervals longer than six months, he shall include in his application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the source or device or similar sources or devices and by design features that have a significant bearing on the probability or consequences of leakage of radioactive material from the source. In determining the acceptable interval for test of leakage of radioactive material, the Department will consider information that includes, but is not limited to:

2.7.7.2.1 Primary containment (source capsule);

2.7.7.2.2 Protection of primary containment;

2.7.7.2.3 Method of sealing containment;

2.7.7.2.4 Containment construction materials;

2.7.7.2.5 Form of contained radioactive material;

2.7.7.2.6 Maximum temperature withstood during prototype tests;

2.7.7.2.7 Maximum pressure withstood during prototype tests;

2.7.7.2.8 Maximum quantity of contained radioactive material;

2.7.7.2.9 Radiotoxicity of contained radioactive material; and

2.7.7.2.10 Operating experience with identical sources or devices or similarly designed and constructed sources or devices.

2.7.7.3 If an application is filed pursuant to RHA 2.7.7.1 on or before August 9, 1977, for a license to manufacture and distribute a source or device that was distributed commercially on or before July 9, 1977, the applicant may continue the distribution of such source or device to authorized licenses until the Department issues the license or notifies the applicant otherwise.

2.7.8 Manufacture and distribution of radioactive materials for medical use under general license. In addition to the requirements set forth in RHA 2.6 above, a specific license authorizing the distribution of radioactive material for use by physicians under the general license of 2.4.6 will be issued only if:

2.7.8.1 The applicant submits evidence that the radioactive material is to be manufactured, labeled and packaged in accordance with a new drug application which the Commissioner of Food and Drug Administration, has approved, or in accordance with a license for a biologic product issued by the Secretary, Department of Health, Education, and Welfare; and,

2.7.8.2 The following statement, or a substantially similar statement which contains information called for in the following statement, appears on the label affixed to the container or appears in the leaflet or brochure which accompanies the package:

"This radioactive drug may be received, possessed, and used only by physicians licensed to dispense drugs in the practice of medicine. Its receipt, possession, use and transfer are subject to the regulations and a general license or the equivalent of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State.

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(Name of Manufacturer)

2.7.9 Manufacture and Distribution of Radioactive Materials for Certain in Vitro Clinical, or Laboratory Testing Under General License. An application for a specific license to manufacture or distribute radioactive material for use under the general license of 2.4.3 of this Part will be approved if:

2.7.9.1 The applicant satisfies the general requirements specified in RHA 2.6.

2.7.9.2 The radioactive material is to be prepared for distribution in prepackaged units of:

2.7.9.2.1 Iodine 125 in units not exceeding 10 microcuries each.

2.7.9.2.2 Iodine 131 in units not exceeding 10 microcuries each.

2.7.9.2.3 Carbon 14 in units not exceeding 10 microcuries each.

2.7.9.2.4 Hydrogen 3 (tritium) in units not exceeding 50 microcuries each.

2.7.9.2.5 Iron 59 in units not exceeding 20 microcuries each.

2.7.9.2.6 Cobalt-57 in units not exceeding 10 microcuries each.

2.7.9.2.7 Selenium-75 in units not exceeding 10 microcuries each.

2.7.9.2.8 Mock Iodine-125 in units not exceeding 0.05 microcuries of Iodine-129 and 0.005 microcuries of Americium-241 each.

2.7.9.3 Each prepackaged unit bears a durable, clearly visible label:

2.7.9.3.1 Identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed 10 microcuries of iodine-125, Iodine-131, Carbon-14, Cobalt-57, Selenium-75; 50 microcuries of Hydrogen-3; 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

2.7.9.3.2 Displaying the radiation caution symbol described in RHA 3.8 (3.8.1) of Part III and the words, “CAUTION, RADIOACTIVE MATERIAL,” and “Not for Internal or External Use in Humans or Animals.”

2.7.9.4 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.

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 therefrom, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of the United States Nuclear Regulatory Commission, an Agreement State, or a Licensing State.

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Name of Manufacturer

2.7.9.5 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.

2.7.10 Manufacture and Distribution of Radiopharmaceuticals Containing Radioactive Material for Medical Use Under Group Licenses.

2.7.10.1 An application for a specific license to manufacture and distribute radiopharmaceuticals containing radioactive material for use by persons licensed pursuant to RHA 2.7.3 for the uses listed in Group I, Group II, IV, or V of RHA 2.26 Schedule D of this part will be approved if:

2.7.10.1.1 The applicant satisfies the general requirements specified in RHA 2.6 of this part;

2.7.10.1.2 The applicant submits evidence that:

2.7.10.1.2.1 The radiopharmaceutical containing radioactive material will be manufactured, labeled and packed in accordance with the Federal Food, Drug and Cosmetic Act or the Public Health Service Act, such as a new drug application (NDA) approved by the Food and Drug Administration (FDA), a biologic product license issued by FDA or a "Notice of Claimed Investigational Exemption for a New Drug" (IND) that has been accepted by the FDA; or

2.7.10.1.2.2 The manufacture and distribution of the radiopharmaceutical containing radioactive material is not subject to the Federal Food, Drug, and Cosmetic Act and the Public Health Service Act.

2.7.10.1.3 The applicant submits information on the radionuclide, chemical and physical form, packaging including maximum activity per package, and shielding provided by the packaging of the radioactive material which is appropriate for safe handling and storage of radiopharmaceuticals by group licensees; and

2.7.10.1.4 The label affixed to each package of the radiopharmaceutical contains information on the radionuclide, quantity, and date of assay and the label affixed to each package, or the leaflet or brochure which accompanies each package, contains a statement that the radiopharmaceutical is licensed by the Department for distribution to persons licensed pursuant to RHA 2.7.3 and RHA 2.26 Schedule D, Group I, Group II, Group IV, and V of Part II, as appropriate, or under equivalent licenses of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State or that an application for such license has been filed with the Department on or before August 9, 1977 and is still pending.

The labels, leaflets, or brochures required by this paragraph are in addition to the labeling required by the Food and Drug Administration (FDA) and they may be separate from or, with the approval of FDA, may be combined with the labeling required by FDA.

2.7.10.2 If an application is filed pursuant to RHA 2.7.10.1 on or before **[Aug. 9, 1977], for a license to manufacture and distribute a radiopharmaceutical that was distributed commercially on or before* the applicant may continue the distribution of such radiopharmaceutical to group licensees until the Department issues the license or notifies the applicant otherwise.

2.7.11 Manufacture and Distribution of Generators or Reagent Kits for Preparation of Radiopharmaceuticals Containing Radioactive Material.

2.7.11.1 An application for a specific license to manufacture and distribute generators or reagent kits containing radioactive material for preparation of radiopharmaceuticals by persons licensed pursuant to RHA 2.7.3 for the uses listed in Group III of RHA 2.26 Schedule D of this part will be approved if:

2.7.11.1.1 The applicant satisfies the general requirements specified in RHA 2.6 of this part;

**Adoption date of these Regulatory changes
*30 days prior to adoption date

2.7.11.1.2 The applicant submits evidence that:

The generator or reagent kit is to be manufactured, labeled and packaged in accordance with the Federal Food, Drug, and Cosmetic Act or the Public Health Service Act, such as a new drug application (NDA) approved by the Food and Drug Administration (FDA), a biologic product license issued by FDA, or a "Notice of Claimed Investigational Exemption for a New Drug" (IND) that has been accepted by the FDA; or

The manufacture and distribution of the generator or reagent kit are not subject to the Federal Food, Drug, and Cosmetic Act and the Public Health Service Act.

2.7.11.1.3 The applicant submits information on the radionuclide, chemical and physical form, packaging including maximum activity per package, and shielding provided by the packaging of the radioactive material contained in the generator or reagent kit;

2.7.11.1.4 The label affixed to the generator or reagent kit contains information on the radionuclide, quantity, and date of assay; and

2.7.11.1.5 The label affixed to the generator or reagent kit, or the leaflet or brochure which accompanies the generator or reagent kit, contains:

2.7.11.1.5.1 Adequate information, from a radiation safety standpoint, on the procedures to be followed and the equipment and shielding to be used in eluting the generator or processing radioactive material with the reagent kit, and

2.7.11.1.5.2 A statement that this generator reagent kit (as appropriate) is approved for use by persons licensed by the Department pursuant to RHA 2.7.3 and RHA 2.26 Schedule D, Group III of Part II or under equivalent licenses of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State or that an application for such license has been filed with the Department on or before August 9, 1977 and is still pending. The labels, leaflets or brochures required by this paragraph are in addition to the labeling required by FDA and they may be separate from or, with the approval of FDA, may be combined with the labeling required by FDA.

2.7.11.2 If an application is filed pursuant to RHA 2.7.11.1 on or before **[Aug. 9, 1977], for a license to manufacture and distribute a generator or reagent kit that was distributed commercially on or before* the applicant may continue the distribution of such generator or reagent kit until the Department issues the license or notifies the applicant otherwise.

2.7.12 Manufacture and Distribution of Sources or Devices Containing Radioactive Material for Medical Use.

2.7.12.1 An application for a specific license to manufacture and distribute sources and devices containing radioactive material to persons licensed pursuant to RHA 2.7.3 for use as a calibration or reference source or for the uses listed in Group VI of RHA 2.26 Schedule D of this part will be approved if:

2.7.12.1.1 The applicant satisfies the general requirements in RHA 2.6 of this Part; and

2.7.12.1.2 The applicant submits sufficient information regarding each type of source or device pertinent to an evaluation of its radiation safety, including:

NOTE: Although the Department does not regulate the manufacture and distribution of reagent kits that do not contain radioactive material, it does regulate the use of such reagent kits for the preparation of radiopharmaceuticals containing radioactive material as part of its licensing and regulation of the users of radioactive material. Any manufacturer of reagent kits that do not contain radioactive material who desires to have his reagent kits approved by the Department for use by persons licensed pursuant to RHA 2.7.3 and Group III of RHA 2.26 Schedule D of this part may submit the pertinent information specified in RHA 2.7.11.

2.7.12.1.2.1 The radioactive material contained, its chemical and physical form, and amount;

2.7.12.1.2.2 Details of design and construction of the source or device;

2.7.12.1.2.3 Procedures for, and results of, prototype tests to demonstrate that the source or device will maintain its integrity under stresses likely to be encountered in normal use and accidents;

2.7.12.1.2.4 For devices containing radioactive material, the radiation profile of a prototype device;

2.7.12.1.2.5 Details of quality control procedures to assure that production sources and devices meet the standards of the design and prototype tests;

2.7.12.1.2.6 Procedures and standards for calibrating sources and devices;

2.7.12.1.2.7 Legend and methods for labeling sources and devices as to their radioactive content;

2.7.12.1.2.8 Instruction for handling and storing the source or device from the radiation safety standpoint; these instructions are to be included on a durable label attached to the source or device or attached to a permanent storage container for the source or device; Provided, that instructions which are too lengthy for such label and printed in detail on a brochure which is referenced on the label;

2.7.12.1.3 The label affixed to the source or device, or to the permanent storage container for the source or device, contains information on the radionuclide, quantity, and date of assay, and a statement that the (name of source or device) is licensed by the Department for distribution to persons licensed pursuant to RHA 2.7.3 and RHA 2.26 Schedule D, Group VI of this part or under equivalent licenses of the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State, or that a pending application for such license has been filed with the Department on or before August 9, 1977; provided, that such labeling for sources which do not require long term storage (e.g., gold-198 seeds) may be on a leaflet or brochure which accompanies the source.

2.7.12.2 In the event the applicant desires that the source or device be required to be tested for leakage of radioactive material at intervals longer than six months, he shall include in his application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the source or device or similar sources or devices and by design features that have a significant bearing on the probability or consequences of leakage of radioactive material from the source.

In determining the acceptable interval for test of leakage of radioactive material, the Department will consider information that includes, but is not limited to:

2.7.12.2.1 Primary containment (source capsule);

2.7.12.2.2 Protection of primary containment;

2.7.12.2.3 Method of sealing containment;

2.7.12.2.4 Containment construction materials;

2.7.12.2.5 Form of contained radioactive material;

2.7.12.2.6 Maximum temperature withstood during prototype tests;

2.7.12.2.7 Maximum pressure withstood during prototype tests;

2.7.12.2.8 Maximum quantity of contained radioactive material;

2.7.12.2.9 Radiotoxicity of contained radioactive material; and

2.7.12.2.10 Operating experience with identical sources or devices or similarly designed and constructed sources or devices.

2.7.12.3 If an application is filed pursuant to RHA 2.7.12.1 on or before **[Aug. 9, 1977], for a license to manufacture and distribute a source or device that was distributed commercially on or before*, the applicant may continue the distribution of such source or device to group licensees until the Department issues the license or notifies the applicant otherwise.

2.7.13 Calibration or reference sources containing Americium-241 or Radium-226: Requirements for license to manufacture or initially transfer.

2.7.13.1 An application for a specific license to manufacture or initially transfer calibration or reference sources containing Americium-241 or Radium-226, for distribution to persons generally licensed under RHA 2.4, will be approved if:

2.7.13.1.1 The applicant satisfies the general requirements of RHA 2.6;

2.7.13.1.2 The applicant submits sufficient information regarding each type of calibration or reference source pertinent to evaluation of the potential radiation exposure, including:

2.7.13.1.2.1 Chemical and physical form and maximum quantity of Americium 241 or Radium-226 in the source;

2.7.13.1.2.2 Details of construction and design;

2.7.13.1.2.3 Details of the method of incorporation and binding of the Americium-241 or Radium-226 in the source;

2.7.13.1.2.4 Procedures for and results of prototype testing of sources, which are designed to contain more than 0.005 microcurie of Americium-241 or Radium-226, to demonstrate that the Americium-241 or Radium-226 contained in each source will not be released or be removed from the source under normal conditions of use;

2.7.13.1.2.5 Details of quality control procedures to be followed in manufacture of the source;

2.7.13.1.2.6 Description of labeling to be affixed to the source or the storage container for the source;

2.7.13.1.2.7 Any additional information, including experimental studies and tests, required by the Department to facilitate a determination of the safety of the source.

2.7.13.1.3 Each source will contain no more than 5 microcuries of Americium-241 or Radium-226.

2.7.13.1.4 The Department determines, with respect to any type of source containing more than 0.005 microcuries of Americium-241 or Radium-226, that:

2.7.13.1.4.1 The method of incorporation and binding of the Americium-241 or Radium-226 in the source is such that the Americium-241 will not be released or be removed from the source under normal conditions of use and handling of the source; and

2.7.13.1.4.2 The source has been subjected to and has satisfactorily passed the appropriate tests prescribed by 2.7.8.4.

2.7.13.1.5 The applicant shall subject at least five prototypes of each source that is designed to contain more than 0.185 kilobecquerel (0.005 microcurie) of americium-241 or radium-226 to tests as follows:

2.7.13.1.5.1 The initial quantity of radioactive material deposited on each source is measured by direct counting of the source.

2.7.13.1.5.2 The sources are subjected to tests that adequately take into account the individual, aggregate, and cumulative effects of environmental conditions expected in service that could adversely affect the effective containment or binding of americium-241 or radium-226, such as physical handling, moisture, and water immersion.

2.7.13.1.5.3 The sources are inspected for evidence of physical damage and for loss of americium-241 or radium-226, after each stage of testing, using methods of inspection adequate for determining compliance with the criteria in RHA 2.7.8.1.5.4.

2.7.13.1.5.4 Source designs are rejected for which the following has been detected for any unit: removal of more than 0.185 kilobecquerel (0.005 microcurie) of americium-241 or radium-226 from the source or any other evidence of physical damage.

2.7.13.2 Each person licensed under this Section 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 United States Nuclear Regulatory Commission or of a State with which the Commission has entered into an agreement for the exercise of regulatory authority. Do not remove this label.

CAUTION-RADIOACTIVE MATERIAL-THIS SOURCE CONTAINS AMERICIUM-241 (or RADIUM-226). DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

Name of manufacturer or initial transferor

2.7.13.3 Each person licensed under RHA 2.7.8 shall perform a dry wipe test upon each source containing more than 3.7 kilobecquerels (0.1 microcurie) of Americium-241 or Radium-226 before transferring the source to a general licensee under RHA 2.4.5, or comparable regulation. 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 methods capable of detecting 0.185 kilobecquerel (0.005 microcurie) of Americium-241 or Radium-226. If a source has been shown to be leaking or losing more than 0.185 kilobecquerel (0.005 microcurie) of americium-241 or radium-226 by the methods described in this section, the source must be rejected and must not be transferred to a general licensee RHA 2.4.5 or comparable regulation.

2.7.13.4 An applicant for a license under this Section shall, for any type of source which is designed to contain more than 0.185 kilobecquerel (0.005 microcurie) of Americium-241 or Radium-226, conduct prototype tests, in the order listed, on each of five prototypes of the source, which contains more than 0.185 kilobecquerel (0.005 microcurie) of Americium-241 or Radium-226, as follows:

2.7.13.4.1 *Initial measurement*. The quantity of radioactive material deposited on the source shall be measured by direct counting of the source.

2.7.13.4.2 *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.

2.7.13.4.3 *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.

2.7.13.4.4 *Water soak test*. The source shall be immersed in water at room temperature for a period of 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.

2.7.13.4.5 *Dry wipe test*. On completion of the preceding test in this section, the dry wipe test described in 2.7.13.4.2 shall be repeated.

2.7.13.4.6 *Observations*. Removal of more than 0.005 microcurie of radioactivity in any test prescribed by this section shall be cause for rejection of the source design. Results of prototype tests submitted to the Commission shall be given in terms of radioactivity in microcuries and percent of removal from the total amount of radioactive material deposited on the source.

2.7.14 Luminous safety devices for use in aircraft: Requirements for license to manufacture, assemble, repair or initially transfer. An application for a specific license to manufacture, assemble, repair or initially transfer luminous safety devices containing tritium or promethium-147 for use in aircraft, for distribution to persons generally licensed under RHA 2.4.4, will be approved if:

2.7.14.1 The applicant satisfies the general requirements specified in RHA 2.6;

2.7.14.2 The applicant submits sufficient information regarding each device pertinent to evaluation of the potential radiation exposure, including:

2.7.14.2.1 Chemical and physical form and maximum quantity of tritium or promethium-147 in each device;

2.7.14.2.2 Details of construction and design;

2.7.14.2.3 Details of the method of binding or containing the tritium or promethium-147;

2.7.14.2.4 Procedures for and results of prototype testing to demonstrate that the tritium or promethium 147 will not be released to the environment under the most severe conditions likely to be encountered in normal use;

2.7.14.2.5 Quality assurance procedures to be followed that are sufficient to ensure compliance with Section 32.55;

2.7.14.2.6 Any additional information, including experimental studies and tests, required by the Department to facilitate a determination of the safety of the device.

2.7.14.3 Each device will contain no more than 10 curies of tritium or 300 millicuries of promethium 147. The levels of radiation from each device containing promethium-147 will not exceed 0.5 millirad per hour at 10 centimeters from any surface when measured through 50 milligrams per square centimeter of absorber.

2.7.14.4 The Department determines that:

2.7.14.4.1 The method of incorporation and binding of the tritium or promethium-147 in the device is such that the tritium or promethium-147 will not be released under the most severe conditions which are likely to be encountered in normal use and handling of the device;

2.7.14.4.2 The tritium or promethium-147 is incorporated or enclosed so as to preclude direct physical contact by any person with it;

2.7.14.4.3 The device is so designed that it cannot easily be disassembled; and

2.7.14.4.4 Prototypes of the device have been subjected to and have satisfactorily passed the tests required by 2.7.14.5.

2.7.14.5 The applicant shall subject at least five prototypes of the device to tests as follows:

2.7.14.5.1 The devices are subjected to tests that adequately take into account the individual, aggregate, and cumulative effects of environmental conditions expected in service that could adversely affect the effective containment of tritium or promethium-147, such as temperature, moisture, absolute pressure, water immersion, vibration, shock, and weathering.

2.7.14.5.2 The devices are inspected for evidence of physical damage and for loss of tritium or promethium-147, after each stage of testing, using methods of inspection adequate for determining compliance with the criteria in RHA 2.7.14.5.3.

2.7.14.5.3 Device designs are rejected for which the following has been detected for any unit:

2.7.14.5.3.1 A leak resulting in a loss of 0.1 percent or more of the original amount of tritium or promethium-147 from the device; or

2.7.14.5.3.2 Surface contamination of tritium or promethium-147 on the device of more than 2,200 disintegrations per minute per 100 square centimeters of surface area; or

2.7.14.5.3.3 Any other evidence of physical damage.

2.7.14.6 The device has been registered in the Sealed Source and Device Registry.

2.7.14.7 Quality assurance and prohibition of transfer for luminous safety devices for use in aircraft.

2.7.14.7.1 Each person licensed under RHA 2.7.14 shall visually inspect each device and shall reject any that has an observable physical defect that could adversely affect containment of the tritium or promethium-147.

2.7.14.7.2 Each person licensed under RHA 2.7.14 shall:

2.7.14.7.2.1 Maintain quality assurance systems in the manufacture of the luminous safety device in a manner sufficient to provide reasonable assurance that the safety-related components of the distributed devices are capable of performing their intended functions; and

2.7.14.7.2.2 Subject inspection lots to acceptance sampling procedures, by procedures specified in paragraph (c) of this section and in the license issued under RHA 2.7.14, to provide at least 95 percent confidence that the Lot Tolerance Percent Defective of 5.0 percent will not be exceeded.

2.7.14.7.3 The licensee shall subject each inspection lot to:

2.7.14.7.3.1 Tests that adequately take into account the individual, aggregate, and cumulative effects of environmental conditions expected in service that could adversely affect the effective containment of tritium or promethium-147, such as absolute pressure and water immersion.

2.7.14.7.3.2 Inspection for evidence of physical damage, containment failure, or for loss of tritium or promethium-147 after each stage of testing, using methods of inspection adequate for applying the following criteria for defective:

2.7.14.7.3.2.1 A leak resulting in a loss of 0.1 percent or more of the original amount of tritium or promethium-147 from the device;

2.7.14.7.3.2.2 Levels of radiation in excess of 5 microgray (0.5 millirad) per hour at 10 centimeters from any surface when measured through 50 milligrams per square centimeter of absorber, if the device contains promethium-147; and

2.7.14.7.3.2.3 Any other criteria specified in the license issued under RHA 2.7.14.

2.7.14.7.4 No person licensed under RHA 2.7.14 shall transfer to persons generally licensed under RHA 2.4.4, or under an equivalent general license of an Agreement State:

2.7.14.7.4.1 Any luminous safety device tested and found defective under any condition of a license issued under RHA 2.7.14, or RHA 2.7.14.8, unless the defective luminous safety device has been repaired or reworked, retested, and determined by an independent inspector to meet the applicable acceptance criteria; or

2.7.14.7.4.2 Any luminous safety device contained within any lot that has been sampled and rejected as a result of the procedures in RHA 2.7.14.8.2, unless:

2.7.14.7.4.2.1 A procedure for defining sub-lot size, independence, and additional testing procedures is contained in the license issued under RHA 2.7.14; and

2.7.14.7.4.2.2 Each individual sub-lot is sampled, tested, and accepted in accordance with RHA 2.7.14.8.2 and RHA 2.7.14.10.2.1 and any other criteria that may be required as a condition of the license issued under RHA 2.7.14.

2.7.14.8 Material transfer reports for luminous safety devices for use in aircraft.

2.7.14.8.1 Each person licensed under RHA 2.7.14 shall file an annual report with the Director, Division of Radioactive Material, Bureau of Radiological Health, which must state the total quantity of tritium or promethium-147 transferred to persons generally licensed under RHA 2.4.4. The report must identify each general licensee by name, state the kinds and numbers of luminous devices transferred, and specify the quantity of tritium or promethium-147 in each kind of device. Each report must cover the year ending June 30 and must be filed within thirty (30) days thereafter. If no transfers have been made to persons generally licensed under RHA 2.4.4 during the reporting period, the report must so indicate.

2.7.14.8.2 Each person licensed under RHA 2.7.14 shall report annually all transfers of devices to persons for use under a general license in an NRC or Agreement State's regulations that are equivalent to RHA 2.4.4 to the NRC or responsible Agreement State agency. The report must state the total quantity of tritium or promethium-147 transferred, identify each general licensee by name, state the kinds and numbers of luminous devices transferred, and specify the quantity of tritium or promethium-147 in each kind of device. If no transfers have been made to a particular NRC licensee or Agreement State during the reporting period, this information must be reported to the NRC or responsible Agreement State agency upon request of the Department.

2.7.15 Ice detection devices containing strontium-90; requirements for license to manufacture or initially transfer. An application for a specific license to manufacture or initially transfer ice detection devices containing strontium-90 for distribution to persons generally licensed under RHA 2.4.7 will be approved if:

2.7.15.1 The applicant satisfies the general requirements specified in RHA 2.6

2.7.15.2 The applicant submits sufficient information regarding each type of device pertinent to evaluation of the potential radiation exposure, including:

2.7.15.2.1 Chemical and physical form and maximum quantity of strontium-90 in the device;

2.7.15.2.2 Details of construction and design of the source of radiation and its shielding;

2.7.15.2.3 Radiation profile of a prototype device;

2.7.15.2.4 Procedures for and results of prototype testing of devices to demonstrate that the strontium-90 contained in each device will not be released or be removed from the device under the most severe conditions likely to be encountered in normal handling and use;

2.7.15.2.5 Details of quality control procedures to be followed in manufacture of the device;

2.7.15.2.6 Description of labeling to be affixed to the device;

2.7.15.2.7 Instructions for handling and installation of the device;

2.7.15.2.8 Any additional information, including experimental studies and tests, required by the Department to facilitate a determination of the safety of the device;

2.7.15.3 Each device will contain no more than 50 microcuries of strontium-90 in an insoluble form;

2.7.15.4 Each device will bear durable, legible labeling which includes the radiation caution symbol prescribed by Part 3, a statement that the device contains strontium-90 and the quantity thereof, instructions for disposal and statements that the device may be possessed pursuant to a general license, that the manufacturer or civil authorities should be notified if the device is found, that removal of the labeling is prohibited and that disassembly and repair of the device may be performed only by a person holding a specific license to manufacture or service such devices;

2.7.15.5 The Department determines that:

2.7.15.5.1 The method of incorporation and binding of the strontium-90 in the device is such that the strontium-90 will not be released from the device under the most severe conditions which are likely to be encountered in normal use and handling of the device;

2.7.15.5.2 The strontium-90 is incorporated or enclosed so as to preclude direct physical contact by any individual with it and is shielded so that no individual will receive a radiation exposure to a major portion of his body in excess of 0.5 rem in a year under ordinary circumstances of use;

2.7.15.5.3 The device is so designed that it cannot be easily disassembled;

2.7.15.5.4 Prototypes of the device have been subjected to and have satisfactorily passed the tests required by RHA 2.7.15.6 of this section.

2.7.15.5.5 Quality control procedures have been established to satisfy the requirements of 10 CFR 32.62.

2.7.15.6 The applicant shall subject at least five prototypes of the device to tests as follows:

2.7.15.6.1 The devices are subjected to tests that adequately take into account the individual, aggregate, and cumulative effects of environmental conditions expected in service that could adversely affect the effective containment of strontium-90, such as temperature, moisture, absolute pressure, water immersion, vibration, shock, and weathering.

2.7.15.6.2 The devices are inspected for evidence of physical damage and for loss of strontium- 90 after each stage of testing, using methods of inspection adequate for determining compliance with the criteria in RHA 2.7.15.6.3.

2.7.15.6.3 Device designs are rejected for which the following has been detected for any unit:

2.7.15.6.3.1 A leak resulting in a loss of 0.1 percent or more of the original amount of strontium-90 from the device; or

2.7.15.6.3.2 Surface contamination of strontium-90 on the device of more than 2,200 disintegrations per minute per 100 square centimeters of surface area; or

2.7.15.6.3.3 Any other evidence of physical damage.

2.7.15.7 The device has been registered in the Sealed Source and Device Registry.

2.7.16 Requirements for license to initially transfer source material for use under the ‘small quantities of source material’ general license

2.7.16.1 An application for a specific license to initially transfer source material for use under RHA 2.3, or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State, will be approved if:

2.7.16.1.1 The applicant satisfies the general requirements specified in RHA 2.6; and

2.7.16.1.2 The applicant submits adequate information on, and the Department approves the methods to be used for quality control, labeling, and providing safety instructions to recipients.

2.7.16.2 Conditions of licenses to initially transfer source material for use under the ‘small quantities of source material’ general license: Quality control, labeling, safety instructions, and records and reports

2.7.16.2.1 Each person licensed under RHA 2.7.16 shall label the immediate container of each quantity of source material with the type of source material and quantity of material and the words, “radioactive material.”

2.7.16.2.2 Each person licensed under RHA 2.7.16 shall ensure that the quantities and concentrations of source material are as labeled and indicated in any transfer records.

2.7.16.2.3 Each person licensed under RHA 2.7.16 shall provide the information specified in this paragraph to each person to whom source material is transferred for use under RHA 2.3, or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State provisions. This information must be transferred before the source material is transferred for the first time in each calendar year to the particular recipient. The required information includes:

2.7.16.2.3.1 A copy of RHA 2.3 and RHA 2.18, or relevant equivalent regulations of the Agreement State.

2.7.16.2.3.2 Appropriate radiation safety precautions and instructions relating to handling, use, storage, and disposal of the material.

2.7.16.2.4 Each person licensed under RHA 2.7.16 shall report transfers as follows:

2.7.16.2.4.1 File a report with the Department. The report shall include the following information:

2.7.16.2.4.1.1 The name, address, and license number of the person who transferred the source material;

2.7.16.2.4.1.2 For each general licensee under RHA 2.3,or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State provisions, to whom greater than 50 grams (0.11 lb) of source material has been transferred in a single calendar quarter, the name and address of the general licensee to whom source material is distributed; a responsible agent, by name and/or position and phone number, of the general licensee to whom the material was sent; and the type, physical form, and quantity of source material transferred; and

2.7.16.2.4.1.3 The total quantity of each type and physical form of source material transferred in the reporting period to all such generally licensed recipients.

2.7.16.2.4.2 File a report with each responsible Agreement State agency that identifies all persons, operating under provisions equivalent to RHA 2.3, to whom greater than 50 grams (0.11 lb) of source material has been transferred within a single calendar quarter. The report shall include the following information specific to those transfers made to the Agreement State being reported to:

2.7.16.2.4.2.1 The name, address, and license number of the person who transferred the source material; and

2.7.16.2.4.2.2 The name and address of the general licensee to whom source material was distributed; a responsible agent, by name and/or position and phone number, of the general licensee to whom the material was sent; and the type, physical form, and quantity of source material transferred.

2.7.16.2.4.2.3 The total quantity of each type and physical form of source material transferred in the reporting period to all such generally licensed recipients within the Agreement State.

2.7.16.2.4.3 Submit each report by January 31 of each year covering all transfers for the previous calendar year. If no transfers were made to persons generally licensed under RHA 2.3, or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State provisions, during the current period, a report shall be submitted to the Department indicating so. If no transfers have been made to general licensees during the reporting period, this information shall be reported to the Department upon request.

2.7.16.2.5 Each person licensed under RHA 2.7.16 shall maintain all information that supports the reports required concerning each transfer to a general licensee for a period of 1 year after the event is included in a report to the Department.

RHA 2.8. Special Requirements for Specific License of Broad Scope.

This section prescribes requirements for the issuance of specific licenses of broad scope for radioactive material ("broad licenses") and certain regulations governing holders of such licenses.[5]

2.8.1 The Different Types of Board Licenses are Set Forth Below.

2.8.1.1 A "Type A specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use and transfer of any chemical or physical form of the radioactive material specified in the license, but not exceeding quantities specified in the license, for any authorized purpose. The quantities specified are usually in the multicurie range.

2.8.1.2 A "Type B specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use and transfer of any chemical or physical form of radioactive material specified in Schedule E, RHA 2.27 for any authorized purpose. The possession limit for a Type B broad license, if only one radionuclide is possessed thereunder, is the quantity specified for that radionuclide in RHA 2.27 Schedule E, Column I, If two or more radionuclides are possessed thereunder, the possession limit for each is determined as follows: For each radionuclide, determine the ratio of the quantity possessed to the applicable quantity specified in RHA 2.27 Schedule E, Column I, for that radionuclide. The sum of the ratios for all radionuclides possessed under the license shall not exceed unity.

2.8.1.3 A "Type C specific license of broad scope" is a specific license authorizing receipt, acquisition, ownership, possession, use and transfer of any chemical or physical form of radioactive material specified in RHA 2.27 Schedule E, for any authorized purpose. The possession limit for a Type C broad license, if only one radionuclide is possessed thereunder, is the quantity specified for that radionuclide in RHA 2.27 Schedule E, Column II. If two or more radionuclides are possessed thereunder, the possession limit is determined for each as follows: For each radionuclide determined the ratio of the quantity possessed to the applicable quantity specified in RHA 2.27, Schedule E, Column II, for that radionuclide. The sum of the ratios for all radionuclides possessed under the license shall not exceed unity.

[5]Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing source material or byproduct material whose subsequent possession, use, transfer, and disposal by all other persons are exempted from regulatory requirements may be obtained only from the U. S. Nuclear Regulatory Commission, Washington, D. C. 20545.

2.8.2 An application for a Type A specific license of broad scope will be approved if:

2.8.2.1 The applicant satisfies the general requirements specified in RHA 2.6 and;

2.8.2.2 The applicant has engaged in a reasonable number of activities involving the use of radioactive material; and

2.8.2.3 The applicant has established administrative controls and provisions relating to organization and management, procedures, record keeping, material control and accounting, and management review that are necessary to assure safe operations, including:

2.8.2.3.1 The establishment of a radiation safety committee composed of such persons as a radiological safety officer, a representative of management, and persons trained and experienced in the safe use of radioactive materials;

2.8.2.3.2 The appointment of a radiological safety officer who is qualified by training and experienced in radiation protection, and who is available for advice and assistance on radiological safety matters; and

2.8.2.3.3 The establishment of appropriate administrative procedures to assure:

2.8.2.3.3.1 Control of procurement and use of radioactive material;

2.8.2.3.3.2 Completion of safety evaluation of proposed uses of radioactive material which take into consideration such matters as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures; and

2.8.2.3.3.3 Review, approval, and recording by the radiation safety committee of safety evaluation of proposed uses prepared in accordance with 2.8.2.3.3.2 of this subparagraph 2.8.2.3.3 prior to use of the radioactive material.

2.8.3 An Application for a Type B Specific License of Broad Scope will be Approved if:

2.8.3.1 The applicant satisfies the general requirements specified in RHA 2.6; and

2.8.3.2 The applicant has established administrative controls and provisions relating to organization and management, procedures, record keeping, material control and accounting, and management review that are necessary to assure safe operations, including:

2.8.3.2.1 The appointment of a radiological safety officer who is qualified by training experience in radiation protection, and who is available for advice and assistance on radiological safety matters; and

2.8.3.2.2 The establishment of appropriate administrative procedures to assure:

2.8.3.2.2.1 Control of procurement and use of radioactive material;

2.8.3.2.2.2 Completion of safety evaluations of proposed uses of radioactive material which take into consideration such matters as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures; and

2.8.3.2.2.3 Review, approval, and recording by the radiological safety officer of safety evaluations of proposed uses prepared in accordance with 2.8.3.2.2.2 of this subparagraph 2.8.3.2.2 prior to use of the radioactive material.

2.8.4 An Application for a Type C Specific License of Broad Scope will be Approved if:

2.8.4.1 The applicant satisfies the general requirements specified in RHA 2.6; and

2.8.4.2 The applicant submits a statement that radioactive material will be used only by, or under the direct supervision of, individuals who have received:

2.8.4.2.1 A college degree at the bachelor level, or equivalent training and experience, in the physical or biological sciences or in engineering; and

2.8.4.2.2 At least 40 hours of training and experience in the safe handling of radioactive materials, and in the characteristics of ionizing radiation, units of radiation dose and quantities, radiation detection instrumentation, and biological hazards of exposure to radiation appropriate to the type and forms of radioactive material to be used; and

2.8.4.3 The applicant has established administrative controls and provisions relating to procurement of radioactive material, procedures, record keeping, material control and accounting, and management review necessary to assure safe operations.

2.8.5 Specific Licenses of Broad Scope are Subject to the Following Conditions:

2.8.5.1 Persons licensed pursuant to RHA 2.8 shall not:

2.8.5.1.1 Conduct tracer studies in the environment involving direct release of radioactive material;

2.8.5.1.2 Receive, acquire, own, possess, use or transfer devices containing 100,000 curies or more of radioactive material in sealed sources used for irradiation of materials;

2.8.5.1.3 Conduct activities for which a specific license issued by the Department under 2.7 is required; or

2.8.5.1.4 Add or cause the addition of radioactive material to any food, beverage, cosmetic, drug, or other product designed for ingestion or inhalation by, or application to, a human being.

2.8.5.2 Each Type A specific license of broad scope issued under this part shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals approved by the licensee’s radiation safety committee.

2.8.5.3 Each Type B specific license of broad scope issued under this part shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals approved by the licensee’s radiological safety officer.

2.8.5.4 Each Type C specific license of broad scope issued under this part shall be subject to the condition that radioactive material possessed under the license may only be used by, or under the direct supervision of, individuals who satisfy the requirements of 2.8.4 of RHA 2.8.

RHA 2.9. Issuance of Specific Licenses.

2.9.1 Upon a determination that an application meets the requirements of the Act and the regulations of the Department, the Department will issue a specific license authorizing the proposed activity in such form and containing such conditions and limitations as it deems appropriate or necessary.

2.9.2 The Department may incorporate in any license at the time of issuance or thereafter, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of radioactive material subject to this Part as it deems appropriate or necessary in order to:

2.9.2.1 Protect health or to minimize danger to life and property;

2.9.2.2 Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be appropriate or necessary; and

2.9.2.3 Prevent loss or theft of license material.

RHA 2.10. Specific Terms and Conditions of Licenses.

2.10.1 Each license issued pursuant to these regulations shall be subject to all the provisions of the Act, and to all rules, regulations, and orders of the Department, now or hereafter in effect.

2.10.2 Specific license transfer requirements.

2.10.2.1 No license issued or granted pursuant to the regulations in Parts II, VII, and XI nor any right under a license shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Department shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

2.10.2.2 An application for transfer of license must include:

2.10.2.2.1 The identity, technical and financial qualifications of the proposed transferee; and

2.10.2.2.2 Financial assurance for decommissioning information required by RHA 1.15.

2.10.3 Each person licensed by the Department pursuant to these regulations shall confine his use and possession of the material licensed to the locations and purposes authorized in the license.

2.10.4 Each specific licensee authorized under 2.7.5 to distribute certain devices to generally licensed persons.

2.10.5 Each licensee shall notify the Department in writing when the licensee decides to permanently discontinue all activities involving materials authorized under the license.

2.10.6 Each general licensee that is required to register by RHA 2.4.2.3.11 of this Part and each specific licensee shall notify the Department, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code by or against:

2.10.6.1 The licensee:

2.10.6.2 An entity (as that term is defined in 11 U.S.C. 101 (15)) controlling the licensee or listing the license or licensee as property of the estate; or

2.10.6.3 An affiliate (as that term is defined in 11 U.S.C. 101 (2)) of the licensee.

2.10.7 Security requirements for portable gauges.

2.10.7.1 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.

2.10.8 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 RHA 4.38. The licensee shall record the results of each test and retain each record for 3 years after the record is made. The licensee shall report the results of any test that exceeds the permissible concentration listed in 4.38.1 of this chapter at the time of generator elution, in accordance with RHA 4.120 of this chapter.

2.10.9.1 Authorization under Part 2 of this Regulation 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 State requirements governing radioactive drugs.

2.10.9.2 Each licensee authorized under Part 2 of this Regulation to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall:

2.10.9.2.1 Satisfy the labeling requirements in Part 2 of this Regulation 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.

2.10.9.2.2 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 Part 2 of this Regulation.

2.10.9.3 A licensee that is a pharmacy authorized under Part 2 of this Regulation 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:

2.10.9.3.1 an authorized nuclear pharmacist that meets the requirements in Part 2 of this Regulation; or

2.10.9.3.2 an individual under the supervision of an authorized nuclear pharmacist as specified in Part 2 of this Regulation.

2.10.9.4 A pharmacy, authorized under Part 2 of this Regulation 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 Part 2 of this Regulation.

2.10.10 Conditions of licenses.

2.10.10.1 Each license shall contain and be subject to the following conditions:

2.10.10.1.1 [Reserved]

2.10.10.1.2 No right to the special nuclear material shall be conferred by the license except as defined by the license;

2.10.10.1.3 Neither the license nor any right under the license shall be assigned or otherwise transferred in violation of the provisions of the Act;

2.10.10.1.4 [Reserved]

2.10.10.1.5 [Reserved]

2.10.10.1.6 [Reserved]

2.10.10.1.7 [Reserved]

2.10.10.1.8 The license shall be subject to and the licensee shall observe, all applicable rules, regulations, and orders of the Department.

2.10.10.1.9 Notification of Bankruptcy.

2.10.10.1.9.1 Each licensee shall notify the Department, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapter of Title 11 (Bankruptcy) of the United States Code by or against:

2.10.10.1.9.1.1 The licensee;

2.10.10.1.9.1.2 An entity (as that term is defined in 11 U.S.C.101(15) controlling the licensee or listing the license or licensee as property of the estate; or

2.10.10.1.9.1.3 An affiliate (as that term is defined in 11 U.S.C 101(2)) of the licensee.

2.10.10.1.9.2 The notification required in 2.10.10.1.9.1 must indicate:

2.10.10.1.9.2.1 The bankruptcy court in which the petition for bankruptcy was filed; and

2.10.10.1.9.2.2 The date of the filing of the petition.

RHA 2.11. Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas.

2.11.1 Each specific license expires at midnight on the expiration date stated in the license unless the licensee has filed an application for renewal under RHA 2.12 not less than 30 days before the expiration date stated in the existing license. If an application for renewal has been filed at least 30 days prior to the expiration date stated in the existing license, the existing license expires at the end of the day on which the Department makes a final determination to deny the renewal application or, if the determination states an expiration date, the expiration date stated in the determination.

2.11.2 Each specific license revoked by the Department expires at midnight on the date of the Department's final determination to revoke the license, or on the expiration date stated in the determination, or as otherwise provided by the Department Order.

2.11.3 Each specific license continues in effect, beyond the expiration date if necessary, with respect to possession of byproduct material, source material, or special nuclear material until the Department notifies the licensee in writing that the license is terminated. During this time, the licensee shall:

2.11.3.1 Limit actions involving byproduct material, source material, or special nuclear material to those related to decommissioning; and

2.11.3.2 Continue to control entry to restricted areas until they are suitable for release in accordance with Department requirements.

2.11.4 Within 60 days of the occurrence of any of the following, consistent with administrative directions in RHA 2.32, each licensee shall provide notification to the Department in writing of such occurrence, and either begin decommissioning its site, or any separate building or outdoor area that contains residual radioactivity so that the building or outdoor area is suitable for release in accordance with Department requirements, or submit within 12 months of notification a decommissioning plan, if required by RHA 2.11.6.1, and begin decommissioning upon approval of that plan if:

2.11.4.1 The license has expired pursuant to RHA 2.11.1 or 2.11.2; or

2.11.4.2 The licensee has decided to permanently cease principal activities, as defined, at the entire site or in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with Department requirements; or

2.11.4.3 No principal activities under the license have been conducted for a period of 24 months; or

2.11.4.4 No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with Department requirements.

2.11.5 Coincident with the notification required by RHA 2.11.4, the licensee shall maintain in effect all decommissioning financial assurances established by the licensee pursuant to RHA 1.15 in conjunction with a license issuance or renewal or as required by this section. The amount of the financial assurance must be increased, or may be decreased, as appropriate, to cover the detailed cost estimate for decommissioning established pursuant to RHA 2.11.7.4.5.

2.11.5.1 Any licensee who has not provided financial assurance to cover the detailed cost estimate submitted with the decommissioning plan shall do so when this rule becomes effective November 24, 1998.

2.11.5.2 Following approval of the decommissioning plan, a licensee may reduce the amount of the financial assurance as decommissioning proceeds and radiological contamination is reduced at the site with the approval of the Department.

2.11.6 The Decommissioning Plan.

2.11.6.1 A decommissioning plan must be submitted if required by license condition or if the procedures and activities necessary to carry out decommissioning of the site or separate building or outdoor area have not been previously approved by the Department and these procedures could increase potential health and safety impacts to workers or the public, such as in any of the following cases:

2.11.6.1.1 Procedures would involve techniques not applied routinely during cleanup or maintenance operations;

2.11.6.1.2 Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

2.11.6.1.3 Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

2.11.6.1.4 Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

2.11.6.2 The Department may approve an alternate schedule for submittal of a decommissioning plan required pursuant to RHA 2.11.4 if the Department determines that the alternative schedule is necessary to the effective conduct of decommissioning operations and presents no undue risk from radiation to the public health and safety and is otherwise in the public interest.

2.11.6.3 Procedures such as those listed in RHA 2.11.6.1 with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.

2.11.6.4 The proposed decommissioning plan for the site or separate building or outdoor area must include:

2.11.6.4.1 A description of the condition of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan;

2.11.6.4.2 A description of planned decommissioning activities;

2.11.6.4.3 A description of methods used to ensure protection of workers and the environment against radiation hazards during decommissioning;

2.11.6.4.4 A description of the planned final radiation survey; and

2.11.6.4.5 An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds set aside for decommissioning, and a plan for assuring the availability of adequate funds for completion of decommissioning.

2.11.6.4.6 For decommissioning plans calling for completion of decommissioning later than 24 months after plan approval, the plan shall include a justification for the delay based on the criteria in RHA 2.11.8.

2.11.6.4.7 A description of the physical security plan and material control and accounting plan provisions in place during decommissioning.

2.11.6.5 The proposed decommissioning plan will be approved by the Department if the information therein demonstrates that the decommissioning will be completed as soon as practicable and that the health and safety of workers and the public will be adequately protected.

2.11.7 Decommissioning and Termination

2.11.7.1 Except as provided in RHA 2.11.8, licensees shall complete decommissioning of the site or separate building or outdoor area as soon as practicable but no later than 24 months following the initiation of decommissioning.

2.11.7.2 Except as provided in RHA 2.11.8, when decommissioning involves the entire site, the licensee shall request license termination as soon as practicable but no later than 24 months following the initiation of decommissioning.

2.11.8 The Department may approve a request for an alternative schedule for completion of decommissioning of the site or separate building or outdoor area, and license termination if appropriate, if the Department determines that the alternative is warranted by consideration of the following:

2.11.8.1 Whether it is technically feasible to complete decommissioning within the allotted 24-month period;

2.11.8.2 Whether sufficient waste disposal capacity is available to allow completion of decommissioning within the allotted 24-month period;

2.11.8.3 Whether a significant volume reduction in wastes requiring disposal will be achieved by allowing short-lived radionuclides to decay;

2.11.8.4 Whether a significant reduction in radiation exposure to workers can be achieved by allowing short-lived radionuclides to decay; and

2.11.8.5 Other site-specific factors which the Department may consider appropriate on a case-by-case basis, such as the regulatory requirements of other government agencies, lawsuits, ground-water treatment activities, monitored natural ground-water restoration, actions that could result in more environmental harm than deferred cleanup, and other factors beyond the control of the licensee.

2.11.9 As the final step in decommissioning, the licensee shall:

2.11.9.1 Certify the disposition of all licensed material, including accumulated wastes, in writing to the Department; and

2.11.9.2 Conduct a radiation survey of the premises where the licensed activities were carried out and submit a report of the results of this survey unless the licensee demonstrates that the premises are suitable for release in some other manner. The licensee shall, as appropriate:

2.11.9.2.1 Report levels of gamma radiation in units of millisieverts and microroentgen per hour at one meter from surfaces, and report levels of radioactivity, including alpha and beta, in units of megabecquerels and disintegrations per minute or microcuries per 100 square centimeters—removable and fixed—for surfaces, megabecquerels and microcuries per milliliter for water, and becquerels and picocuries per gram for solids such as soils or concrete; and

2.11.9.2.2 Specify the survey instrument(s) used and certify that each instrument is properly calibrated and tested.

2.11.10 Specific licenses, including expired licenses, will be terminated by written notice to the licensee when the Department determines that:

2.11.10.1 Byproduct material, source material, and special nuclear material have been properly disposed;

2.11.10.2 Reasonable effort has been made to eliminate residual radioactive contamination, if present; and

2.11.10.3 A radiation survey has been performed which demonstrates that the premises are suitable for release in accordance with Department requirements, or other information has been submitted by the licensee that will be sufficient to demonstrate that the premises are suitable for release in accordance with Department requirements. Residual contamination levels must be ALARA and must be approved by the Department.

2.11.11.4 Records required by RHA 3.34.5 and 3.34.7 have been received.

The regulations in this part apply to persons licensed by the Department to receive, possess, use, transfer, or dispose of byproduct, source, or special nuclear material. The limits in this part do not apply to doses due to background radiation, due to any medical administration the individual has received, or to voluntary participation in medical research programs.

RHA 2.12. Renewal of Specific Licenses.

2.12.1 Application for renewal of specific licenses shall be filed in accordance with RHA 2.5.

2.12.2 In any case in which a licensee, not less than thirty (30) days prior to expiration of his existing license, has filed an application in proper form for renewal or for a new license including the same activities, such existing license shall not expire until the application has been finally acted upon by the Department, or the time for seeking judicial review has elapsed.

RHA 2.13. Amendment of Licenses at Request of Licensee.

Applications for amendment of a license shall be filed in accordance with RHA 2.5 and shall specify the respects in which the licensee desires his license to be amended and the grounds for such amendment.

RHA 2.14. Department Action on Applications to Renew or Amend.

In considering an application by a licensee to renew or amend his license the Department will apply the criteria set forth in RHA 2.6, RHA 2.7, and RHA 2.8 of this Part and Parts IV, V, VII and VIII of these regulations, as applicable.

RHA 2.15. Inalienability of Licenses.

2.15.1 No license issued or granted under these regulations and no right to possess or utilize radioactive material granted by any license issued pursuant to these regulations shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, indirectly or directly through transfer of control of any license to any person unless the Department shall, after securing full information, find that the transfer is in accordance with the provisions of the Act, and shall give its consent in writing.

2.15.2 An application for transfer of license must include:

2.15.2.1 The identity, technical and financial qualifications of the proposed transferee; and

2.15.2.2 Financial assurance for decommissioning information required by RHA 1.15.

RHA 2.16. Persons Possessing a License for Source, Byproduct, or Special Nuclear Material in Quantities not Sufficient to Form a Critical Mass on Effective Date of These Regulations.

Any person, who, on the effective date of these regulations possesses a general or specific license for source, byproduct, or special nuclear material in quantities not sufficient to form a critical mass, issued by the United States Nuclear Regulatory Commission, shall be deemed to possess a like license issued under these regulations and the Act, such license to expire either ninety (90) days after receipt from the Department of a notice of expiration of such license, or on the date of expiration specified in the United States Nuclear Regulatory Commission license, whichever is earlier.

RHA 2.17. Persons Possessing Radioactive Material Other Than Agreement Material on Effective Date of These Regulations.

Any person, who, on the effective date of these regulations, possesses naturally occurring or accelerator-produced radioactive material for which a specific license is required by the Act or this Part shall be deemed to possess such a license issued under the Act and this Part. Such license shall expire ninety (90) days after the effective date of these regulations; provided, however, that if within the ninety days the person possessing such material files an application in proper form for a license, such existing license shall not expire until the application has been finally determined by the Department.

RHA 2.18. Transfer of Material.

2.18.1 No licensee shall transfer radioactive material except as authorized pursuant to this regulation (RHA 2.18).

2.18.2 Any licensee may transfer radioactive material, subject to the acceptance of the transferee:

2.18.2.1 To the Department;

2.18.2.2 To the United States Nuclear Regulatory Commission;

2.18.2.3 To any person exempt from these regulations to the extent permitted under such exemption;

2.18.2.4 To any person authorized to receive such material under terms of a general license or its equivalent, or a specific license, or equivalent licensing document, issued by the Department, the U.S. Nuclear Regulatory Commission, any Agreement State, or any Licensing State or to any person otherwise authorized to receive such material by the Federal Government or any agency thereof, the Department, any Agreement State, or a Licensing State; or

2.18.2.5 As otherwise authorized by the Department in writing.

2.18.3 Before transferring radioactive material to a specific licensee of the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State or to a general licensee who is required to register with the Department, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State prior to receipt of the radioactive material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred.

2.18.4 The following methods for the verification required by RHA 2.18.3 are acceptable:

2.18.4.1 The transferor may have in his possession, and read, a current copy of the transferee's specific license or registration certificate;

2.18.4.2 The transferor may have in his possession a written certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date;

2.18.4.3 For emergency shipments the transferor may accept oral certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of radioactive material to be transferred, specifying the license or registration certificate number, issuing agency, and expiration date; provided, that the oral certification is confirmed in writing within ten (10) days;

2.18.4.4 The transferor may obtain other sources of information compiled by a reporting service from official records of the Department, the U.S. Nuclear Regulatory Commission, the licensing agency of an Agreement State, or a Licensing State as to the identity of licensees and the scope and expiration dates of licenses and registration; or

2.18.4.5 When none of the methods of verification described in RHA 2.18.4.1 to 2.18.4.4 are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record confirmation from the Department, the U.S. Nuclear Regulatory Commission, the licensing agency of an Agreement State, or a Licensing State that the transferee is licensed to receive the radioactive material.

2.18.5 Preparation for shipment and transport of radioactive material shall be in accordance with the provisions of RHA 2.22.

RHA 2.19. Modification, Revocation, and Termination of Licenses.

2.19.1 The terms and conditions of all licenses shall be subject to amendment, revision, or modification or the license may be suspended or revoked by reason of amendments to the Act, or by reason of rules, regulations, and orders issued by the Department.

2.19.2 Any license may be revoked, suspended, or modified, in whole or in part for any material false statement in the application or any statement of fact required under provisions of the Act, or because of conditions revealed by such application or statement of fact or any report, record, or inspection or other means which would warrant the Department to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and conditions of the Act, or the license, or of any rule, regulation or order of the Department.

2.19.3 Except in cases of willful violation or those in which the public health, interest, or safety requires otherwise, no license will be modified, suspended, or revoked unless, prior to the institution of proceedings thereof, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

2.19.4 The Department may terminate a specific license upon request submitted by the licensee to the Department in writing.

RHA 2.20. Exemptions.

2.20.1 Source Material.

2.20.1.1 Any person is exempt from these regulations to the extent that such person receives, possesses, uses, or transfers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than 1⁄20 of 1 percent (0.05 percent) of the mixture, compound, solution, or alloy.

2.20.1.2 Any person is exempt from these regulations to the extent that such person receives, possesses, uses, or transfers unrefined and unprocessed ore containing source material; provided that, except as authorized in a specific license, such person shall not refine or process such ore.

2.20.1.3 Any person is exempt from the requirements for a license set forth in the Act and from the regulations in Parts III and VI of Title A to the extent that such person receives, possesses, uses, or transfers:

2.20.1.3.1 Any quantities of thorium contained in (1) incandescent gas mantles, (2) vacuum tubes, (3) welding rods, (4) electric lamps for illuminating purposes provided that each lamp does not contain more than 50 milligrams of thorium, (5) germicidal lamps, sunlamps, and lamps for outdoor or industrial lighting provided that each lamp does not contain more than 2 grams of thorium, or (6) rare earth metals and compounds, mixtures, and products containing not more than 0.25 percent by weight thorium, uranium, or any combination of these, or (7) personnel neutron dosimeters provided that each dosimeter does not contain more than 50 milligrams of thorium.

2.20.1.3.2 Source material contained in the following products; (1) glazed ceramic tableware manufactured before August 27, 2013, provided that the glaze contains not more than 20 percent by weight source material; (2) piezoelectric ceramic containing not more than 2 percent by weight source material; (3) glassware containing not more than 2 percent by weight source material or, for glassware manufactured before August 27, 2013, 10 percent by weight source material; but not including commercially manufactured glass brick, pane glass, ceramic tile or other glass or ceramic used in constructions; and (4) glass enamel or glass enamel frit containing not more than 10 percent by weight source material imported or ordered for importation into the United States, or initially distributed by manufacturers in the United States before July 25, 1983.

2.20.1.3.3 Photographic film, negatives, and prints containing uranium or thorium;

2.20.1.3.4 Any finished product or part fabricated of, or containing, tungsten or magnesium-thorium alloys; provided that the thorium content of the alloy does not exceed 4 percent by weight and that the exemption contained in this subparagraph (2.20.1.3.4) shall not be deemed to authorize the chemical, physical or metallurgical treatment or processing or any such product or part;

2.20.1.3.5 Uranium contained in counterweights installed in aircraft, rockets, projectiles, and missiles, or stored or handled in connection with installation or removal of such counterweights: provided that:

2.20.1.3.5.1 Each counterweight has been impressed with the following legend clearly legible through any plating or other covering: “DEPLETED URANIUM”;

2.20.1.3.5.2 Each counterweight is durably and legibly labeled or marked with the identification of the manufacturer, and the statement: “UNAUTHORIZED ALTERATIONS PROHIBITED”;[6] and

2.20.1.3.5.3 The exemption contained in this subparagraph (2.20.1.3.5) shall not be deemed to authorize the chemical, physical, or metallurgical treatment or processing of any such counterweights other than repair or restoration of any plating or other covering.

2.20.1.3.6 Natural or depleted uranium metal used as shielding constituting part of any shipping container, provided that:

2.20.1.3.6.1 The shipping container is conspicuously and legibly impressed with the legend: “CAUTION - RADIOACTIVE SHIELDING - URANIUM.” and

2.20.1.3.6.2 The uranium metal is encased in mild steel or equally fire resistant metal of minimum wall thickness of one-eighth inch (3.2 mm);

2.20.1.3.6.3 The shipping container meets the specifications for containers for radioactive materials prescribed by Section 178.250. Specification 55, Part 178, of the regulations published by the Department of Transportation (49 CFR 178.250).

[6]The requirements specified in subdivisions RHA 2.20.1.3.5.1 and 2.20.1.3.5.2 need not be met by counterweights manufactured prior to December 31, 1969; provided, that such counterweights were manufactured under a specific license issued by the Atomic Energy Commission and were impressed with the legend required by RHA 2.20.1.3.5.2 in effect on June 30, 1969.

2.20.1.3.7 Thorium or uranium contained in or on finished optical lenses and mirrors, provided that each lens or mirror does not contain more than 10 percent by weight of thorium or uranium or, for lenses manufactured before August 27, 2013, 30 percent by weight of thorium. The exemption contained in this subparagraph (2.20.1.3.7) shall not be deemed to authorize either:

2.20.1.3.7.1 The shaping, grinding, or polishing of such lenses or mirror or manufacturing processes other than the assembly of such lens or mirror into optical systems and devices without any alteration of the lens or mirror; or

2.20.1.3.7.2 The receipt, possession, use or transfer of uranium or thorium contained in contact lenses, or in spectacles, or in eyepieces in binoculars or other optical instruments.

2.20.1.3.8 Uranium contained in detector heads for use in fire detection units, provided that each detector head contains not more than 0.005 microcurie of uranium.

2.20.1.3.9 Thorium contained in any finished aircraft engine part containing nickel-thoria alloy, provided that:

2.20.1.3.9.1 The thorium is dispersed in the nickel-thoria alloy in the form of finely divided thoria (thorium dioxide); and

2.20.1.3.9.2 The thorium content in the nickel-thoria alloy does not exceed 4 percent by weight.

2.20.1.3.10 No person may initially transfer for sale or distribution a product containing source material to persons exempt under RHA 2.20.1.3, or equivalent regulations unless authorized by a specific license to initially transfer such products for sale or distribution.

2.20.1.3.10.1 Persons initially distributing source material in products covered by the exemptions in RHA 2.20.1.3 before August 27, 2013, without specific authorization may continue such distribution for 1 year beyond this date. Initial distribution may also be continued until the Department takes final action on a pending application for license or license amendment to specifically authorize distribution submitted no later than 1 year beyond this date.

2.20.1.3.10.2 Persons authorized to manufacture, process, or produce these materials or products containing source material by the NRC or an Agreement State, and persons who import finished products or parts, for sale or distribution must be authorized by a specific license for distribution only and are exempt from the requirements of Parts III and VI of Title A, and RHA 2.6.1 and 2.6.2.

2.20.1.4 The exemptions in this subsection (2.20.1) do not authorize the manufacture, processing, or production of any of the products described herein.

2.20.2 Radioactive Materials Other Than Source Material.

2.20.2.1 Exempt concentrations.

2.20.2.1.1 Except as provided in RHA 2.20.2.1.3 and 2.20.2.1.4, any person is exempt from this part to the extent that such person receives, possesses, uses, transfers, owns or acquires products or materials containing radioactive material in concentrations not in excess of those listed in Schedule C of this part.

2.20.2.1.2 This section shall not be deemed to authorize the import of radioactive material or products containing radioactive material.

2.20.2.1.3 A manufacturer, processor, or producer of a product or material is exempt from this part 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 C of this part 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.

2.20.2.1.4 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 this section or equivalent NRC or Agreement State regulations, except in accordance with a license issued under RHA 2.7.2.

2.20.2.2 Certain items containing radioactive material. Except for persons who apply radioactive material to, or persons who incorporate radioactive material into, the following products, or persons who initially transfer for sale or distribution the following products containing radioactive material, any person is exempt from these regulations to the extent that he receives, possesses, uses, transfers, owns, or acquires the following products:[7]

2.20.2.2.1 Timepieces or hands or dials containing radium or not more than the following specified quantities of radioactive material and not exceeding the following specified levels of radiation:

2.20.2.2.1.1 25 millicuries of tritium per timepiece;

2.20.2.2.1.2 5 millicuries of tritium per hand;

2.20.2.2.1.3 15 millicuries of tritium per dial (bezels when used shall be considered as part of the dial);

2.20.2.2.1.4 100 microcuries of promethium 147 per watch or 200 microcuries of promethium 147 per any other timepiece.

2.20.2.2.1.5 20 microcuries of Promethium-147 per watch hand or 40 microcuries of Promethium-147 per other timepiece hand and;

2.20.2.2.1.6 60 microcuries of promethium 147 per watch dial or 120 microcuries of promethium 147 per other timepiece dial (bezels when used shall be considered as part of the dial);

2.20.2.2.1.7 The levels of radiation from hands and dials containing promethium 147 will not exceed, when measured through 50 milligrams per square centimeter of absorber:

(a) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface.

[7]Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing source material or byproduct material whose subsequent possession, use, transfer, and disposal by all other persons are exempted from regulatory requirements may be obtained only from the U.S. Nuclear Regulatory Commission, Washington, D.C. 20545.

(b) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surfaces;

(c) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.

2.20.2.2.1.8 1 microcurie (37 kBq) of Radium-226 timepiece in intact timepieces manufactured prior to November 30, 2007.

2.20.2.2.2 Reserved.

2.20.2.2.3 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.

2.20.2.2.4 Reserved.

2.20.2.2.5 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.

2.20.2.2.6 Reserved.

2.20.2.2.7 Electron tubes: Provided, that each tube does not contain more than one of the following specified quantities of radioactive material:

2.20.2.2.7.1 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube;

2.20.2.2.7.2 1 microcurie of cobalt 60;

2.20.2.2.7.3 5 microcuries of nickel 63;

2.20.2.2.7.4 30 microcuries of krypton 85;

2.20.2.2.7.5 5 microcuries of cesium 137;

2.20.2.2.7.6 30 microcuries of promethium 147; And provided further, that the level of radiation due to radioactive material contained in each electron tube does not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.[8]

2.20.2.2.8 Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of radioactive material; provided that:

2.20.2.2.8.1 Each source contains no more than one exempt quantity set forth in RHA 2.24, Schedule B.

[8]For purpose of this paragraph, 2.20.2.2.7 “electron tubes” 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.

2.20.2.2.8.2 Each instrument contains no more than 10 exempt quantities. For purposes of paragraph 2.20.2.2.8, instrument 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 RHA 2.24, Schedule D, provided that the sum of such fractions shall not exceed unity; and

2.20.2.2.8.3 For purposes of paragraph 2.20.2.2.8, 0.05 microcuries of Americium-241 is considered an exempt quantity under RHA 2.24, Schedule B.

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

2.20.2.2.10 Static elimination devices which contain, as a sealed source or sources, byproduct material consisting of a total of not more than 18.5 MBq (500 μCi) of polonium-210 per device.

2.20.2.2.11 Ion generating tubes designed for ionization of air that contain, as a sealed source or sources, byproduct material consisting of a total of not more than 18.5 MBq (500 μCi) of polonium-210 per device or of a total of not more than 1.85 GBq (50 mCi) of hydrogen-3 (tritium) per device.

2.20.2.2.12 Such devices authorized before October 23, 2012 for use under the general license then provided in 10 CFR 31.3 and equivalent regulations of Agreement States and manufactured, tested, and labeled by the manufacturer in accordance with the specifications contained in a specific license issued by the Department.

2.20.2.2.13 Any person who desires to apply byproduct material to, or to incorporate byproduct material into, the products exempted in RHA 2.20.2.2, or who desires to initially transfer for sale or distribution such products containing byproduct material, should apply for a specific license pursuant to RHA 2.5, which license states that the product may be distributed by the licensee to persons exempt from the regulations pursuant to RHA 2.20.2.2.

2.20.2.3 Gas and aerosol detectors containing byproduct material. Except for persons who manufacture, possess, produce, or initially transfer for sale or distribution gas and aerosol detectors containing byproduct material, any person is exempt from the requirements for a license of Parts II, III, IV, V, VI, VIII, and XI in these regulations to the extent that such person receives, possesses, uses, transfers, owns, or acquires byproduct material in gas and aerosol detectors designed to protect health, safety, or property, and manufactured, processed, produced, or initially transferred in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to Section 32.26 of 10 CFR Part 32 which license authorizes the initial transfer of the product for use under this section. This exemption also covers gas and aerosol detectors manufactured or distributed before November 30, 2007, in accordance with a specific license issued by a Licensing State with comparable provisions to 10 CFR 32.26 authorizing distribution to persons exempt from regulatory requirements.

Any person who desires to manufacture, process, or produce gas and aerosol detectors containing byproduct material, or to initially transfer such products for use under RHA 2.20.2.3, should apply for a license under 10 CFR 32.26 and for a certificate of registration in accordance with RHA 2.29.

2.20.2.3.1 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 2.20.2.3, provided that the device is labeled in accordance with the specific license authorizing distribution, and provided further that they meet the requirements of 2.28.4.

2.20.2.4 Self-luminous products containing Tritium, Krypton-85, Promethium-147 or Radium except for persons who manufacture, process, produce, or initially transfer for sale of distribution 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, or Promethium-147 in self-luminous products manufactured, processed, produced, or initially 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. The exemption in this paragraph 2.20.2.4 does not apply to Tritium, Krypton-85, or Promethium-147 used in products for frivolous purposes or in toys or adornments.

2.20.2.4.1 Any person who desires to manufacture, process, or produce, or initially transfer for sale or distribution self-luminous products containing tritium, krypton-85, or promethium-147 for use under RHA 2.20.2.4, should apply for a license pursuant to Section 32.22 of 10 CFR Part 32, and for a certificate of registration in accordance with RHA 2.29.

2.20.2.5 Exempt quantities.

2.20.2.5.1 Except as provided in subparagraphs 2.20.2.5.3 through 2.20.2.5.5, 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 RHA 2.24, Schedule B.

2.20.2.5.2 Any person, who possesses byproduct material received or acquired before September 25, 1971, under the general license formerly provided in Paragraph 2.4.1 is exempt from the requirements for a license set forth in this Part to the extent that this person possesses, uses, transfers, or owns byproduct material.

2.20.2.5.3 This paragraph 2.20.2.5 does not authorize the production, packaging, or repackaging of radioactive material for purposes of commercial distribution, or the incorporation of radioactive material into products intended for commercial distribution.

2.20.2.5.4 No person may, for purposes of commercial distribution, transfer radioactive material in the individual quantities set forth in RHA 2.24 Schedule B, knowing or having reason to believe that such quantities of radioactive material will be transferred to persons exempt under this paragraph or equivalent regulations of the U.S. Nuclear Regulatory Commission, any Agreement State, or a Licensing State except in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission pursuant to Section 32.18 of 10 CFR Part 32 which license states that the radioactive material may be transferred by the licensee to persons exempt under this paragraph 2.20.2.5 or the equivalent regulations of the U.S. Nuclear Regulatory Commission or any Agreement State.

2.20.2.5.5 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 RHA 2.24, Schedule B, except for radioactive material combined within a device placed in use before May 3, 1999, or as otherwise permitted by the regulations in this part.

2.20.2.5.6.1 Except for persons who manufacture, process, produce, or initially transfer for sale or distribution industrial devices containing byproduct material designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation,

leakage, or qualitative or quantitative chemical composition, or for producing an ionized atmosphere, any person is exempt from the requirements for a license of Parts II, III, IV, V, VI, VIII, and XI set forth in Regulation 61-63, Radioactive Materials (Title A) to the extent that such person receives, possesses, uses, transfers, owns, or acquires byproduct material, in these certain detecting, measuring, gauging, or controlling devices and certain devices for producing an ionized atmosphere, and manufactured, processed, produced, or initially transferred in accordance with a specific license issued pursuant to Section 32.30 of 10 CFR Part 32, which license authorizes the initial transfer of the device for use under this section. This exemption does not cover sources not incorporated into a device, such as calibration and reference sources.

2.20.2.5.6.2 Any person who desires to manufacture, process, produce, or initially transfer for sale or distribution industrial devices containing byproduct material for use under 2.20.2.5.6.1, should apply for a license pursuant to Section 32.30 of 10 CFR Part 32, and for a certificate of registration in accordance with RHA 2.29.

2.20.2.6 Reserved.

2.20.2.7 Radioactive drug: Capsules containing Carbon-14 urea for “in vivo” diagnostic use for humans.

2.20.2.7.1 Except as provided in 2.20.2.7.2 and 2.20.2.7.3, any person is exempt from these regulations to the extent that such person receives, possesses, uses, transfers, owns or acquires capsules containing luCi(37kBq) Carbon-14 urea (allowing for nominal variation that may occur during the manufacturing process) each, for “in vivo” diagnostic use for humans.

2.20.2.7.2 Any person who desires to use the capsules for research involving human subjects shall apply for and receive a specific license pursuant to Part IV of these regulations.

2.20.2.7.3 Any person who desires to manufacture, prepare, process, produce, package, repackage, or transfer for commercial distribution such capsules shall apply for and receive a specific license pursuant to RHA 2.7.5.

2.20.2.7.4 Nothing in this section relieves persons from complying with applicable FDA, Federal, and other State requirements governing receipt, administration, and use of drugs.

2.20.2.8 Any person who desires to apply byproduct material to, or to incorporate byproduct material into, the products exempted in RHA 2.20.2.2, or who desires to initially transfer for sale or distribution such products containing byproduct 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 the regulations pursuant to RHA 2.20.2.2.

RHA 2.21. Reciprocal Recognition of Licenses.

2.21.1 Subject to these regulations, any person who holds a specific license from the U.S. Nuclear Regulatory Commission, any Agreement State, or Licensing State, and issued by the agency having jurisdiction where the licensee maintains an office for directing the licensed activity and at which radiation safety records are normally maintained, is hereby granted a general license to conduct the activities authorized in such licensing document within the State of South Carolina for a period not in excess of 180 days in any calendar year provided that:

2.21.1.1 The licensing document does not limit the activity authorized by such document to specified installations or locations; and

2.21.1.2 The out-of-state licensee notifies the Department in writing at least three (3) days prior to engaging in such activity. Such notification shall indicate the location, period, and type of proposed possession and use within the State, and shall be accompanied by a copy of the pertinent licensing document. If, for a specific case, the three (3) day period would impose an undue hardship on the out-of-state licensee, he may, upon application to the Department, obtain permission to proceed sooner; and

2.21.1.3 The out-of-state licensee complies with all applicable regulations of the Department and with all terms and conditions of his licensing document, except any such terms and conditions which may be inconsistent with applicable regulations of the Department; and

2.21.1.4 The out-of-state licensee supplies such other information as the Department may reasonably request.

2.21.1.5 The out-of-state licensee shall not transfer or dispose of radioactive material possessed or used under the general license provided in this section except by transfer to a person specifically licensed by the Department or by the U.S. Nuclear Regulatory Commission to receive such material.

2.21.1.6 The general license granted in RHA 2.21.1 concerning activities in offshore waters authorizes that person to possess or use radioactive materials, or engage in the activities authorized, for an unlimited period of time.

2.21.2 Notwithstanding the provisions of 2.21 any person who holds a specific license or equivalent licensing document issued by the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State authorizing the holder to manufacture, transfer, install, or service a device described in 2.4.2.1 within areas subject to the jurisdiction of the licensing body is hereby granted a general license to install, transfer, and service such a device in this State.

2.21.2.1 Such person shall satisfy the requirements of 2.10.4.1 and 2.10.4.2.

2.21.2.2 The device has been manufactured, labeled, installed and serviced in accordance with applicable provisions of the specific license issued to such person by the U.S. Nuclear Regulatory Commission, an Agreement State or a Licensing State; and

2.21.2.3 Such person shall assure that any labels required to be affixed to the device under regulations of the authority which licensed manufacture of the device bear a statement that “Removal of this Label is Prohibited.”

2.21.2.4 The holder of the specific license shall furnish to each general licensee to whom he transfers such device or on whose premises he installs such device a copy of the general license contained in Section 2.4.2.

2.21.2.5 The Department may withdraw, limit, or qualify its acceptance of any specific license or equivalent licensing document issued by another agency or Licensing State, or any product distributed pursuant to such licensing document, upon determining that such action is necessary in order to protect health or minimize danger to life or property.

RHA 2.22. Transportation of Radioactive Materials

2.22.1 The transportation of radioactive material shall be in accordance with the requirements in 10 CFR Part 71, which is incorporated by reference, with the exception of the following sections: 71.2, 71.6, 71.11, 71.14(b), 71.17, 71.19, 71.21, 71.31, 71.33, 71.35, 71.37, 71.38, 71.39, 71.41, 71.43, 71.45, 71.51, 71.52, 71.53, 71.55, 71.59, 71.61, 71.63, 71.64, 71.65, 71.70, 71.71, 71.73, 71.74, 71.75, 71.77, 71.85(a)-(c), 71.91(b), 71.91(c), 71.91(d), 71.99, 71.100, 71.101(a), 71.101(b), 71.101(c)(1), 71.101(c)(2), 71.101(d), 71.101,(e), 71.103(a), 71.106, 71.107, 71.109, 71.111, 71.113, 71.115, 71.117. 71.119, 71.121, 71.123, 71.125, and 71.135. The provisions of this section apply to the transportation of radioactive material, or delivery of radioactive material to a carrier for transportation, regardless of whether or not the carrier is also subject to the rules and regulations of the Nuclear Regulatory Commission contained in Title 10 CFR Part 71 and other agencies of the United States having jurisdiction.

2.22.1.1 No person shall deliver radioactive material to a carrier for transport or transport radioactive material except as authorized in a general or specific license issued by the Department or as exempted in 2.22.1.2.

2.22.1.2 Exemptions

2.22.1.2.1 Common and contract carriers, freight forwarders, and warehousemen, who are subject to the rules and regulations of the U.S. Department of Transportation or the U.S. Postal Service (39 CFR Parts 14 and 15), are exempt from RHA 2.22.1.1 to the extent that they transport or store radioactive material in the regular course of their carriage for another or storage incident thereto. Common and contract carriers who are not subject to the rules and regulations of the U.S. Department of Transportation or U.S. Postal Service are subject to RHA 2.22.1.1.

2.22.1.2.2 Physicians as defined in RHA 1.2.17 are exempt from the requirements of RHA 2.22.1.1 to the extent that they transport radioactive material for use in the practice of medicine.

2.22.1.2.3 Specific licensees are exempt from 2.22.1.1 to the extent that they deliver to a carrier for transport packages each of which contains no radioactive material having a specific activity in excess of .002 microcuries per gram.

2.22.1.2.4 Any licensee who delivers radioactive material to a carrier for transport where such transport is subject to the regulations of the U.S. Postal Service is exempt from the provisions of 2.22.1.1.

2.22.2 Preparation of Radioactive Material for Transport

2.22.2.1 A general license is hereby issued to deliver radioactive material to a carrier[9] for transport provided that:

2.22.2.2 The person complies with the applicable requirements of the regulations, appropriate to the mode of transport, of the U.S. Department of Transportation and the U.S. Postal Service insofar as such regulations relate to the packaging of radioactive material, marking and labeling of packages, loading and storage of packages, placarding of the transporting vehicle, monitoring requirements and accident reporting; and

[9]For the purposes of this regulation, a licensee who transports his own licensed material as a private carrier is considered to have delivered such material to a carrier for transport.

2.22.2.3 The person has established procedures for opening and closing packages in which radioactive material is transported to provide safety and to assure that, prior to delivery to a carrier for transport, each package is properly closed for transport; and

2.22.2.4 Prior to delivery of a package to a carrier for transport, the person shall assure that any special instruments needed to safely open the package are sent to, or have been made available to, the consignee.

2.22.3 Intrastate Transport

2.22.3.1 A general license is hereby issued to any common or contract carrier to transport and store radioactive material in the regular course of their carriage for another or storage incident thereto, provided the transportation and storage is in accordance with the applicable requirements of the regulations, appropriate to the mode of transport, of the U.S. Department of Transportation insofar as such regulations relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.[10]

2.22.3.2 A general license is hereby issued to any private carrier to transport radioactive material, provided the transportation is in accordance with regulations, appropriate to the mode of transport, of the U.S. Department of Transportation insofar as such regulations relate to the loading and storage of packages, placarding of the transporting vehicle, and incident reporting.

2.22.3.3 Persons who transport radioactive material pursuant to the general licenses in 2.22.3.1 and 2.22.3.2 are exempt from the requirements of Part III and Part VI of these regulations to the extent that they transport radioactive material.

2.22.4 Advance Notification of Nuclear Waste[11]

2.22.4.1 Prior to the transport of any nuclear waste outside of the confines of the licensee's facility or other place of use or storage, or prior to the delivery of any nuclear waste to a carrier for transport, each licensee shall provide advance notification of such transport to the governor (or governor's designee) of each State through which the waste will be transported.

2.22.4.2 Each advance notification required by 2.22.4.1 shall contain the following information:

2.22.4.2.1 The name, address, and telephone number of the shipper, carrier, and receiver of the shipment.

2.22.4.2.2 A description of the nuclear waste contained in the shipment as required by the regulations of the U.S. Department of Transportation in 49 CFR 172.202 and 172.203(d);

2.22.4.2.3 The point of origin of the shipment and the seven-day period during which departure of the shipment is estimated to occur;

2.22.4.2.4 The seven-day period during which arrival of the shipment at State boundaries is estimated to occur;

[10]Any notification of incidents referred to in the requirements shall be filed with, or made to, the Department.

[11]For the purpose of this section, "nuclear waste" means any large quantity of source, byproduct, or special nuclear material required to be in Type B packaging while transported to, through or across State boundaries to a disposal site, or to a collection point for transport to a disposal site.

2.22.4.2.5 The destination of the shipment, and the seven-day period during which arrival of the shipment is estimated to occur; and

2.22.4.2.6 A point of contact with a telephone number for current shipment information.

2.22.4.3 The notification required by 2.22.4.1 shall be made in writing to the office of each appropriate governor (or governor's designee) and to the Department. A notification delivered by mail must be postmarked at least seven days before the beginning of the seven-day period during which departure of the shipment is estimated to occur. A notification delivered by messenger must reach the office of the governor (or governor's designee) at least four days before the beginning of the seven-day period during which departure of the shipment is estimated to occur. A copy of the notification shall be retained by the licensee for one year.

2.22.4.4 The licensee shall notify each appropriate governor (or governor's designee) and the Department of any changes to schedule information provided pursuant to 2.22.4.1. Such notification shall be by telephone to a responsible individual in the office of the governor (or governor's designee) of the appropriate State. The licensee shall maintain for one year a record of the name of the individual contacted.

2.22.4.5 Each licensee who cancels a nuclear waste shipment for which advance notification has been sent shall send a cancellation notice to the governor (or governor's designee) of each appropriate State and to the Department. A copy of the notice shall be retained by the licensee for one year.

2.22.7 Records.

2.22.7.1 The licensee shall make available to the Department for inspections, upon reasonable notice, all records required by this part. Records are only valid if stamped, initialed, or signed and dated by authorized personnel, or otherwise authenticated.

2.22.7.2 The licensee shall maintain sufficient written records to furnish evidence of the quality of packaging. The records to be maintained include results of the determinations required by 10 CFR 71.85; design, fabrication, and assembly records; results of reviews, inspections, tests, and audits; results of monitoring work performance and materials analyses; and results of maintenance, modification, and repair activities. Inspection, test, and audit records must identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. These records must be retained for three (3) years after the life of the packaging to which they apply.

2.22.8 Quality assurance requirements.

2.22.8.1 Purpose. This subpart describes quality assurance requirements applying to design, purchase, fabrication, handling, shipping, storing, cleaning, assembly inspection, testing, operation, maintenance, repair, and modification of components of packaging that are important to safety. As used in this subpart, "Quality Assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service. Quality Assurance includes quality control, which comprises those quality assurance actions related to control of the physical characteristics and quality of the material or component to predetermined requirements. Each licensee is

responsible for satisfying the quality assurance requirements that apply to its use of a packaging for the shipment of licensed material subject to this subpart.

2.22.8.2 Establishment of program. Each licensee shall establish, maintain, and execute a quality assurance program satisfying each of the applicable criteria of 10 CFR 71.101 through 71.137 and satisfying any specific provisions that are applicable to the licensee's activities including procurement of packaging. The licensee shall execute the applicable criteria in a graded approach to an extent that is commensurate with the quality assurance requirement's importance to safety.

2.22.8.3 Approval of program. Before the use of any package for the shipment of licensed material subject to this subpart, each licensee shall obtain Department approval of its quality assurance program. Each licensee shall file a description of its quality assurance program, including a discussion of which requirements of this subpart are applicable and how they will be satisfied, by submitting the description to: ATTN: South Carolina Department of Health and Environmental Control, Division of Waste Management, 2600 Bull Street, Columbia, South Carolina 29201.

2.22.9 Quality assurance organization.

2.22.9.1 The licensee shall be responsible for the establishment and execution of the quality assurance program. The licensee may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part of the quality assurance program, but shall retain responsibility for the program. These activities include performing the functions associated with attaining quality objectives and the quality assurance functions.

2.22.10 Changes to quality assurance program.

2.22.10.1 Each quality assurance program approval holder shall submit a description of a proposed change to its Department-approved quality assurance program that will reduce commitments in the program description as approved by the Department. The quality assurance program approval holder shall not implement the change before receiving Department approval.

2.22.10.1.1 The description of a proposed change to the Department-approved quality assurance program must identify the change, the reason for the change, and the basis for concluding that the revised program incorporating the change continues to satisfy the applicable requirements of subpart H of 10 CFR 71.

2.22.10.1.2 Reserved.

2.22.10.2 Each quality assurance program approval holder may change a previously approved quality assurance program without prior Department approval, if the change does not reduce the commitments in the quality assurance program previously approved by the Department. Changes to the quality assurance program that do not reduce the commitments shall be submitted to the Department every twenty-four (24) months. In addition to quality assurance program changes involving administrative improvements and clarifications, spelling corrections, and non-substantive changes to punctuation or editorial items, the following changes are not considered reductions in commitment:

2.22.10.2.1 The use of a quality assurance standard approved by the Department that is more recent than the quality assurance standard in the licensee's current quality assurance program at the time of the change;

2.22.10.2.2 The use of generic organizational position titles that clearly denote the position function, supplemented as necessary by descriptive text, rather than specific titles, provided that there is no substantive change to either the functions of the position or reporting responsibilities;

2.22.10.2.3 The use of generic organizational charts to indicate functional relationships, authorities, and responsibilities, or alternatively, the use of descriptive text, provided that there is no substantive change to the functional relationships, authorities, or responsibilities;

2.22.10.2.4 The elimination of quality assurance program information that duplicates language in quality assurance regulatory guides and quality assurance standards to which the quality assurance program approval holder has committed to on record; and

2.22.10.2.5 Organizational revisions that ensure that persons and organizations performing quality assurance functions continue to have the requisite authority and organizational freedom, including sufficient independence from cost and schedule when opposed to safety considerations.

2.22.10.3 Each quality assurance program approval holder shall maintain records of quality assurance program changes.

2.22.11 Quality assurance records.

2.22.11.1 The licensee shall maintain sufficient written records to describe the activities affecting quality. These records must include changes to the quality assurance program as required by 2.22.10 of this part, the instructions, procedures, and drawings required by 10 CFR 71.111 to prescribe quality assurance activities, and closely related specifications such as required qualifications or personnel, procedures, and equipment. The records must include the instructions or procedures that establish a records retention program that is consistent with applicable regulations and designates factors such as duration, location, and assigned responsibility. The licensee shall retain these records for three (3) years beyond the date when the licensee last engaged in the activity for which the quality assurance program was developed. If any portion of the quality assurance program, written procedures, or instructions is superseded, the licensee shall retain the superseded material for three (3) years after it is superseded.

RHA 2.23. Schedule A. Generally Licensed Equipment when Manufactured in Accordance with the Specifications Contained in a Specific License.

2.23.1 Static Elimination Device. Devices designed for use as static eliminators which contain, as a sealed source or sources, radioactive material consisting of a total of not more than 500 microcuries of polonium 210 per device.

2.23.2 Ion Generating Tube. Devices designed for ionization of air which contain, as a sealed source or sources, radioactive material consisting of a total of not more than 500 microcuries of polonium 210 per device or a total of not more than 50 millicuries of hydrogen 3 (tritium) per device.

RHA 2.24. Schedule B. Exempt Quantities.

Byproduct Material	Microcuries
Antimony 122 (Sb 122)	100
Antimony 124 (Sb 124)	10
Antimony 125 (Sb 125)	10
Arsenic 73 (As 73)	100
Arsenic 74 (As 74)	10
Arsenic 76 (As 76)	10
Arsenic 77 (As 77)	100
Barium 131 (Ba 131)	10
Barium 133 (Ba 133)	10
Barium 140 (Ba 140)	10
Bismuth 210 (Bi 210)	1
Bromine 82 (Br 82)	10
Cadmium 109 (Cd 109)	10
Cadmium 115m (Cd 115m)	10
Cadmium 115 (Cd 115)	100
Calcium 45 (Ca 45)	10
Calcium 47 (Ca 47)	10
Carbon 14 (C 14)	100
Carbon 11 (C 11)	10
Cerium 141 (Ce 141)	100
Cerium 143 (Ce 143)	100
Cerium 144 (Ce 144)	1
Cesium-129 (Cs-129)	100
Cesium 131 (Cs 131)	1,000
Cesium 134m (Cs 134m)	100
Cesium 134 (Cs 134)	1
Cesium 135 (Cs 135)	10
Cesium 136 (Cs 136)	10
Cesium 137 (Cs 137)	10
Chlorine 36 (Cl 36)	10
Chlorine 38 (Cl 38)	10
Chromium 51 (Cr 51)	1,000
Cobalt 57 (Co 57)	100
Cobalt 58m (Co 58m)	10
Cobalt 58 (Co 58)	10
Cobalt 60 (Co 60)	1
Copper 64 (Cu 64)	100
Dysprosium 165 (Dy 165)	10
Dysprosium 166 (Dy 166)	100
Erbium 169 (Er 169)	100
Erbium 171 (Er 171)	100
Europium 152 (Eu 152)	100
9.2h	
Europium 152 (Eu 152)	1
13 yr	

Byproduct Material	Microcuries
Europium 154 (Eu 154)	1
Europium 155 (Eu 155)	10
Flourine 18 (F 18)	1,000
Gadolinium 153 (Gd 153)	10
Gadolinium 159 (Gd 159)	100
Gallium 67 (Ga 67)	100
Gallium 72 (Ga 72)	10
Germanium-68 (Ge-68)	10
Germanium 71 (Ge 71)	100
Gold 195 (Au 195)	20
Gold 198 (Au 198)	100
Gold 199 (Au 199)	100
Hefnium 181 (Hf 181)	10
Holmium 166 (Ho 166)	100
Hydrogen 3 (H 3)	1,000
Indium 111 (In 111)	100
Indium 113m (In 113m)	100
Indium 114m (In 114m)	10
Indium 115m (In 115m)	100
Indium 115 (In 115)	10
Iodine 123 (I 123)	100
Iodine 125 (I 125)	1
Iodine 126 (I 126)	1
Iodine 129 (I 129)	0.1
Iodine 131 (I 131)	1
Iodine 132 (I 132)	10
Iodine 133 (I 133)	10
Iodine 134 (I 134)	10
Iodine 135 (I 135)	10
Iridium 192 (Ir 192)	10
Iridium 194 (Ir 194)	100
Iron 52 (Fe 52)	10
Iron 55 (Fe 55)	100
Iron 59 (Fe 59)	10
Krypton 85 (Kr 85)	100
Krypton 87 (Kr 87)	10
Lanthanum 140 (La 140)	10
Lutetium 177 (Lu 177)	100
Manganese 52 (Mn 52)	10
Manganese 54 (Mn 54)	10
Manganese 56 (Mn 56)	10
Mercury 197m (Hg 197m)	100
Mercury 197 (Hg 197)	100
Mercury 203 (Hg 203)	10
Molybdenum 99 (Mo 99)	100

Byproduct Material	Microcuries
Neodymium 147 (Nd 147)	100
Neodymium 149 (Nd 149)	100
Nickel 59 (Ni 59)	100
Nickel 63 (Ni 63)	10
Nickel 65 (Ni 65)	100
Niobium 93m (Nb 93m)	10
Niobium 95 (Nb 95)	10
Niobium 97 (Nb 97)	10
Nitrogen 13 (N 13)	10
Osmium 185 (Os 185)	10
Osmium 191m (Os 191m)	100
Osmium 191 (Os 191)	100
Osmium 193 (Os 193)	100
Oxygen 15 (O 15)	10
Palladium 103 (Pd 103)	100
Palladium 109 (Pd 109)	100
Phosphorus 32 (P 32)	10
Platinum 191 (Pt 191)	100
Platinum 193m (Pt 193m)	100
Platinum 193 (Pt 193)	100
Platinum 197m (Pt 197m)	100
Platinum 197 (Pt 197)	100
Polonium 210 (Po 210)	0.1
Potassium 42 (K 42)	10
Potassium 43 (K 43)	10
Praseodymium 142 (Pr 142)	100
Praseodymium 143 (Pr 143)	100
Promethium 147 (Pm 147)	10
Promethium 149 (Pm 149)	10
Radium 226 (Ra 226)	0.1
Rhenium 186 (Re 186)	100
Rhenium 188 (Re 188)	100
Rhodium 103m (Rh 103m)	100
Rhodium 105 (Rh 105)	100
Rubidium 81 (Rb 81)	10
Rubidium 86 (Rb 86)	10
Rubidium 87 (Rb 87)	10
Ruthenium 97 (Ru 97)	100
Ruthenium 103 (Ru 103)	10
Ruthenium 105 (Ru 105)	10
Ruthenium 106 (Ru 106)	1
Samarium 151 (Sm 151)	10
Samarium 153 (Sm 153)	100
Scandium 46 (Sc 46)	10
Scandium 47 (Sc 47)	100

Byproduct Material	Microcuries
Scandium 48 (Sc 48)	10
Selenium 75 (Se 75)	10
Silicon 31 (Si 31)	100
Silver 105 (Ag 105)	10
Silver 110m (Ag 110m)	1
Silver 111 (Ag 111)	100
Sodium 22 (Na 22)	10
Sodium 24 (Na 24)	10
Strontium 85 (Sr 85)	10
Strontium 89 (Sr 89)	1
Strontium 90 (Sr 90)	0.1
Strontium 91 (Sr 91)	10
Strontium 92 (Sr 92)	10
Sulfur 35 (S 35)	100
Tantalum 182 (Ta 182)	10
Technetium 96 (Tc 96)	10
Technetium 97m (Tc 97m)	100
Technetium 97 (Tc 97)	100
Technetium 97m (Tc 97m)	100
Technetium 99m (Tc 99m)	10
Tellurium 125m (Te 125m)	10
Tellurium 127m (Te 127m)	10
Tellurium 127 (Te 127)	100
Tellurium 129m (Te 129m)	10
Tellurium 129 (Te 129)	100
Tellurium 131m (Te 131m)	10
Tellurium 132 (Te 132)	10
Terbium 160 (Tb 160)	10
Thallium 200 (Tl 200)	100
Thallium 201 (Tl 201)	100
Thallium 202 (Tl 202)	100
Thallium 204 (Tl 204)	10
Thulium 170 (Tm 170)	10
Thulium 171 (Tm 171)	10
Tin 113 (Sn 113)	10
Tin 125 (Sn 125)	10
Tungsten 181 (W 181)	10
Tungsten 185 (W 185)	10
Tungsten 187 (W 187)	100
Vanadium 48 (V 48)	10
Xenon 131m (Xe 131m)	1,000
Xenon 133 (Xe 133)	100
Xenon 135 (Xe 135)	100
Ytterbium 175 (Yb 175)	100
Yttrium 87 (Y 87)	10

Byproduct Material	Microcuries
Yttrium-88 (Y-88)	10
Yttrium 90 (Y 90)	10
Yttrium 91 (Y 91)	10
Yttrium 92 (Y 92)	100
Yttrium 93 (Y 93)	100
Zinc 65 (Zn 65)	10
Zinc 69m (Zn 69m)	100
Zinc 69 (Zn 69)	1,000
Zirconium 93 (Zr 93)	10
Zirconium 95 (Zr 95)	10
Zirconium 97 (Zr 97)	10
Any radioactive material	
not listed above other	
than alpha emitting	
radioactive material	0.1

RHA 2.25. Schedule C—Exempt Concentrations.

Element (Atomic Number)	Isotope	Column I Gas concentration uc/ml[1]	Column II Liquid and solid concentration uc/ml[2]
Antimony (51)	Sb 122		3×10^{-4}
	Sb 124		2×10^{-5}
	Sb 125		1×10^{-3}
Argon (18)	A 37	1×10^{-3}	
	A 41	4×10^{-7}	
Arsenic (33)	As 73		5×10^{-4}
	As 74		5×10^{-4}
	As 76		2×10^{-4}
	As 77		8×10^{-4}
Barium (56)	Ba 131		2×10^{-3}
	Ba 140		3×10^{-4}
Beryllium (4)	Be 7		2×10^{-2}
Bismuth (83)	Bi 206		4×10^{-4}
Bromine (35)	Br 82	4×10^{-7}	3×10^{-3}
Cadmium (85)	Cd 109		2×10^{-3}
	Cd 115m		3×10^{-4}
	Cd 115		3×10^{-4}
Calcium (20)	Ca 45		9×10^{-5}
	Ca 47		5×10^{-4}
Carbon (6)	C 14	1×10^{-6}	8×10^{-3}
Cerium (58)	Ce 141		9×10^{-4}

Element (Atomic Number)	Isotope	Column I Gas concentration uc/ml[1]	Column II Liquid and solid concentration uc/ml[2]
	Ce 143		4×10^{-4}
	Ce 144		1×10^{-4}
Cesium (55)	Cs 131		2×10^{-2}
	Cs 134m		6×10^{-2}
	Cs 134		9×10^{-5}
Chlorine (17)	Cl 38	9×10^{-7}	4×10^{-3}
Chromium (24)	Cr 51		2×10^{-2}
Cobalt (27)	Co 57		5×10^{-3}
	Co 58		1×10^{-3}
	Co 60		5×10^{-4}
Copper (29)	Cu 64		3×10^{-3}
Dysprosium (66)	Dy 165		4×10^{-3}
	Dy 166		4×10^{-4}
Erbium (68)	Er 169		9×10^{-4}
	Er 171		1×10^{-3}
Europium (63)	Eu 152		6×10^{-4}
	(T/2=9.2 Hrs)		
	Eu 155		2×10^{-3}
Fluorine (9)	F 18	2×10^{-6}	8×10^{-3}
Gadolinium (64)	Gd 153		2×10^{-3}
	Gd 159		8×10^{-4}
Gallium (31)	Ga 72		4×10^{-4}
Germanium (32)	Ge 71		2×10^{-2}
Gold (79)	Au 196		2×10^{-3}
	Au 198		5×10^{-4}
	Au 199		2×10^{-5}
Hafnium (72)	Hf 181		7×10^{-4}
Hydrogen (1)	H 3	5×10^{-6}	3×10^{-2}
Indium (49)	In 113m		1×10^{-2}
	In 114m		2×10^{-4}
Iodine (53)	I 126	3×10^{-9}	2×10^{-5}
	I 131	3×10^{-9}	2×10^{-5}
	I 132	8×10^{-8}	6×10^{-4}
	I 133	1×10^{-8}	7×10^{-5}
	I 134	2×10^{-7}	1×10^{-3}
Iridium (77)	Ir 190		2×10^{-3}
	Ir 192		4×10^{-4}
	Ir 194		3×10^{-4}
Iron (26)	Fe 55		8×10^{-3}
	Fe 59		6×10^{-4}

Element (Atomic Number)	Isotope	Column I Gas concentration uc/ml[1]	Column II Liquid and solid concentration uc/ml[2]
Krypton (36)	Kr 85m	1×10^{-6}	
	Kr 85	3×10^{-6}	
Lanthanum (57)	La 140		2×10^{-4}
Lead (82)	Pb 203		4×10^{-3}
Lutetium (71)	Lu 177		1×10^{-3}
Manganese (25)	Mn 52		3×10^{-4}
	Mn 54		1×10^{-3}
	Mn 56		1×10^{-3}
Mercury (80)	Hg 197m		2×10^{-3}
	Hg 197		3×10^{-3}
	Hg 203		2×10^{-4}
Molybdenum (42)	Mo 99		2×10^{-3}
Neodymium (60)	Nd 149		3×10^{-3}
	Nd 147		6×10^{-4}
Nickel (28)	Ni 65		1×10^{-3}
Niobium (Columbium) (41)	Nb 95		1×10^{-3}
	Nb 97		9×10^{-3}
Osmium (76)	Os 185		7×10^{-4}
	Os 191m		3×10^{-2}
	Os 191		2×10^{-3}
	Os 193		6×10^{-4}
Palladium (46)	Pd 103		3×10^{-3}
	Pd 109		9×10^{-4}
Phosphorus (15)	P 32		2×10^{-4}
Platinum (78)	Pt 191		1×10^{-3}
	Pt 193m		1×10^{-2}
	Pt 197m		1×10^{-2}
	Pt 197		1×10^{-3}
Polonium (84)	Po 210	2×10^{-10}	7×10^{-6}
Potassium (19)	K 42		3×10^{-3}
Praseodymium (59)	Pr 142		3×10^{-4}
	Pr 143		5×10^{-4}
Promethium (61)	Pm 147		2×10^{-3}
	Pm 149		4×10^{-4}
Radium (88)	Ra 226	1×10^{-11}	1×10^{-7}
	Ra 228	2×10^{-11}	3×10^{-7}
Rhenium (75)	Re 183		6×10^{-3}
	Re 186		9×10^{-4}
	Re 188		6×10^{-4}
Rhodium (45)	Rh 103m		1×10^{-1}
	Rh 105		1×10^{-3}

Element (Atomic Number)	Isotope	Column I Gas concentration uc/ml[1]	Column II Liquid and solid concentration uc/ml[2]
Rubidium (37)	Rb 86		7×10^{-4}
Ruthenium (44)	Ru 97		4×10^{-3}
	Ru 103		8×10^{-4}
	Ru 105		1×10^{-3}
	Ru 106		1×10^{-4}
Samarium (62)	Sm 153		8×10^{-4}
Scandium (21)	Sc 46		4×10^{-4}
	Sc 47		9×10^{-4}
	Sc 48		3×10^{-4}
Selenium (34)	Se 75		3×10^{-3}
Silicon (14)	Si 31		9×10^{-3}
Silver (47)	Ag 105		1×10^{-3}
	Ag 110m		3×10^{-4}
	Ag 111		4×10^{-4}
Sodium (11)	Na 24		2×10^{-3}
Strontium (38)	Sr 89		1×10^{-4}
	Sr 91		7×10^{-4}
	Sr 92		7×10^{-4}
Sulfur (16)	S 35	9×10^{-8}	6×10^{-4}
Tantalum (73)	Ta 182		4×10^{-4}
Technetium (43)	Tc 96m		1×10^{-1}
	Tc 96		1×10^{-3}
Tellurium (52)	Te 125m		2×10^{-3}
	Te 127m		6×10^{-4}
	Te 127		3×10^{-3}
	Te 129m		3×10^{-4}
	Te 131m		6×10^{-4}
	Te 132		3×10^{-4}
Terbium (65)	Tb 160		4×10^{-4}
Thallium (81)	Tl 200		4×10^{-3}
	Tl 201		3×10^{-3}
	Tl 202		1×10^{-3}
	Tl 204		1×10^{-3}
Thulium (69)	Tm 170		5×10^{-4}
	Tm 171		5×10^{-3}
Tin (50)	Sn 113		9×10^{-4}
	Sn 125		2×10^{-4}
Tungston (Wolfram) (74)	W 181		4×10^{-3}
	W 187		7×10^{-4}
Vanadium (23)	V 48		3×10^{-4}
Xenon (54)	Xe 131m	4×10^{-6}	

Element (Atomic Number)	Isotope	Column I Gas concentration uc/ml[1]	Column II Liquid and solid concentration uc/ml[2]
	Xe 133	3×10^{-6}	
	Xe 135	1×10^{-6}	
Ytterbium (70)	Yb 175		1×10^{-3}
Yttrium (39)	Y 90		2×10^{-4}
	Y 91m		3×10^{-2}
	Y 91		3×10^{-4}
	Y 92		6×10^{-4}
	Y 93		3×10^{-4}
Zinc (30)	Zn 65		1×10^{-3}
	Zn 69m		7×10^{-4}
	Zn 69		2×10^{-2}
Zirconium (40)	Zr 95		6×10^{-4}
	Zr 97		2×10^{-4}
Beta and/or gamma emitting radioactive material not listed above with half-life less than 3 years.		1×10^{-10}	1×10^{-6}
NOTE 1: Many radioisotopes disintegrate into isotopes which are also radioactive. In expressing the concentrations in Schedule C, the activity stated is that of the parent isotope and takes into account the daughters.			
NOTE 2: For purposes of 2.19.2.1 where there is involved a combination of isotopes, the limit for the combination should be derived as follows: Determine for each isotope in the product the ratio between the concentration present in the product and the exempt concentration established in Schedule C for the specific isotope when not in combination. The sum of such ratios may not exceed "1" (i.r., unity).			

Example:
Concentration of Isotope A in Product × Exempt concentration of Isotope A Concentration of Isotope B in Product

<

Exempt concentration of Isotope B = 1

[1] Values are given only for those materials normally used as gases.
[2] uc/gm for solids.

RHA 2.26. Schedule D—Groups of Medical Uses of Radioactive Material.

Group I. Use of prepared radiopharmaceuticals for certain diagnostic studies involving measurements of uptake, dilution and excretion. This group does not include uses involving imaging and tumor localizations.

1. Iodine-131 as sodium iodide (Na^{131} I) for measurement of thyroid uptake;

2. Iodine-125 as sodium iodide (Na^{125} I) for measurement of thyroid uptake;

3. Iodine-131 as iodinated human serum albumin (IHSA) for determinations of blood and blood plasma volume and for studies of cardiovascular function and protein turnover;

4. Iodine-125 as iodinated human serum albumin (IHSA) for determination of blood and blood plasma volume and for studies of cardiovascular function and protein turnover;

5. Iodine-131 as labeled rose bengal for liver function studies;

6. Iodine-125 as labeled rose bengal for liver function studies;

7. Iodine-131 as labeled fats or fatty acids for fat absorption studies;

8. Iodine-125 as labeled fats or fatty acids for fat absorption studies;

9. Iodine-131 as labeled iodopyracet, sodium iodohippurate, sodium diatrizoate, diatrizoate methylglucamine, sodium diprotrizoate, sodium acetrizoate, or sodium iothalamate for kidney function studies;

10. Iodine-125 as labeled iodopyracet, sodium iodohippurate, sodium diatrizoate, diatrizoate methylglucamine, sodium diprotrizoate, sodium acetrizoate, or sodium iothalamate for kidney function studies;

11. Cobalt-57 as labeled cyanocobalamin for intestinal absorption studies;

12. Cobalt-58 as labeled cyanocobalamin for intestinal absorption studies;

13. Cobalt-60 as labeled cyanocobalamin for intestinal absorption studies;

14. Chromium-51 as sodium chromate for determination of red blood cell volume and studies of red blood cell survival time and gastrointestinal blood loss;

15. Chromium-51 as labeled human serum albumin for gastrointestinal protein loss studies;

16. Iron-59 as chloride, citrate, or sulfate for iron turnover studies;

17. Potassium-42 as chloride for potassium space determinations;

18. Sodium-24 as chloride for sodium space determinations;

19. Technetium-99m as pertechnetate for blood flow studies;

20. Mercury-203 as chlormerodrin for kidney function studies;

21. Any radioactive material in a radiopharmaceutical and for a diagnostic use involving measurements of uptake, dilution, or excretion for which a "Notice of Claimed Investigational Exemption for a New Drug" (IND) has been accepted by the Food and Drug Administration (FDA) or for which an NDA is in effect.

Group II. Use of prepared radiopharmaceuticals for diagnostic studies involving imaging and tumor localizations.

1. Iodine-131 as sodium iodide (Na^{131} I) for thyroid imaging;

2. Iodine-125 as sodium iodide (Na^{125} I) for thyroid imaging;

3. Iodine-125 fibrinogen for detection and monitoring of developing deep vein thrombosis.

4. Iodine-131 as iodinated human serum albumin (IHSA) for brain tumor localizations and cardiac imaging;

5. Iodine-131 as macroaggregated iodinated human serum albumin for lung imaging;

6. Iodine-131 as colloidal (microaggregated) iodinated human serum albumin for liver imaging;

7. Iodine-131 as labeled rose bengal for liver imaging;

8. Iodine-131 as iodopyracet, sodium iodohippurate, sodium diatrizoate, diatrizoate methyglucamine, sodium diprotrizoate or sodium acetrizoate for kidney imaging;

9. Iodine-131 as sodium iodipamide for cardiac imaging;

10. Iodine-131 as iodinated human serum albumin (IHSA) for placenta localization;

11. Indium-113m as choride for blood pool imaging, including placenta localization.

12. Chromium-51 as sodium chromate for spleen imaging;

13. Chromium-51 as labeled human serum albumin for placenta localization;

14. Gallium-67 as gallium citrate to demonstrate the presence and extent of Hodgken's disease, lymphomas and bronchogenic carcinoma.

15. Gold-198 in colloidal form for liver imaging;

16. Mercury-197 as labeled chlormerodrin for kidney and brain imaging;

17. Mercury-203 as labeled chlormerodrin for brain imaging;

18. Selenium-75 as labeled selenomethionine for pancreas imaging;

19. Strontium-85 as nitrate or chloride for bone imaging in patients with suspected or diagnosed cancer;

20. Technetium-99m as pertechnetate for brain imaging;

21. Technetium-99m as pertechnetate for thyroid imaging;

22. Technetium-99m as pertechnetate for salivary gland imaging;

23. Technetium-99m as pertechnetate for blood pool imaging, including placenta localization;

24. Technetium-99m as labeled sulfur colloid for liver, spleen, and bone marrow imaging;

25. Technetium-99m as labeled macroaggregated human serum albumin for lung imaging;

26. Thallium-201 as thallous chloride for myocardial perfusion imaging for the diagnosis and localization of myocardial infarction.

27. Fluorine-18 in solution for bone imaging;

28. Strontium-87m for bone imaging;

29. Ytterbium-169 as labeled diethylenetriaminepentaacetic acid (DTPA) for cisternography;

30. Iodine-123 a sodium iodide (Na^{123} I) for thyroid imaging;

31. Any radioactive material in a radiopharmaceutical prepared from a reagent kit listed in Section (3) of Group III;

32. Any radioactive material in a radiopharmaceutical and for a diagnostic use involving imaging for which a “Notice of Claimed Investigational Exemption for a New Drug” (IND) has been accepted by the Food and Drug Administration (FDA) or for which an NDA is in effect.

Group III. Use of generators and reagent kits for the preparation and use of radiopharmaceuticals containing radioactive material for certain diagnostic uses.

1) Molybdenum-99/technetium-99m generators for the elution of technetium-99m as pertechnetate for:

(i) Brain imaging;

(ii) Thyroid imaging;

(iii) Salivary gland imaging;

(iv) Blood pool imaging including placenta localization;

(v) Blood flow studies;

(vi) Use with reagent kits for preparation and use of radiopharmaceuticals containing technetium-99m as provided in Sections (3) and (4) of this Group.

2) Technetium-99m as pertechnetate for use with reagent kits for preparation and use of radiopharmaceuticals containing technetium-99m as provided in Sections (3) and (4) of this Group.

3) Reagent kits for preparation of technetium-99m labeled:

(i) Sulfur colloid for liver and spleen imaging;

(ii) Iron-ascorbate-diethylenetriamine pentaacetic acid complex for kidney imaging;

(iii) Diethylenetriamine pentaacetic acid (Sn) for kidney imaging and kidney function studies;

(iv) Diethylenetriamine pentaacetic acid (Sn) for brain imaging;

(v) Human serum albumin microspheres for lung imaging;

(vi) Polyphosphates for bone imaging;

(vii) Maroaggregated human serum albumin for lung imaging;

(viii) Distannous etidronate complex for bone imaging;

(ix) Stannous pyrophosphate for bone imaging;

(x) Human serum albumin for heart blood pool imaging;

(xi) Medronate sodium for bone imaging;

(xii) Gluceptate sodium for brain and renal perfusion imaging;

(xiii) Oxidronate sodium for skeletal imaging;

(xiv) Disofenin for hepatobiliary imaging;

(xv) Succimer (DMSA) for renal imaging;

(xvi) Pentetate as an aerosol for lung function studies;

(xvii) Sulphur colloid for gastroesophageal imaging;

(xviii) Sulphur colloid for Le Veen shunt imaging;

(xix) Pertechnetate for Le Veen shunt imaging;

(xx) Macroaggregated human serum albumin for Le Veen shunt imaging;

(xxi) Pertechnetate for cystography.

(xxii) Pertechnetate for dacryocystography.

4) Tin-113/Indium-113m generators for the elution of Indium-113m as chloride for:

(i) Blood pool imaging including placenta localization.

5) Yttrium-87/Strontium-87m generators for the elution of Strontium-87m for bone imaging.

6) Any generator or reagent kit for preparation and diagnostic use of a radiopharmaceutical containing radioactive material for which generator or reagent kit a "Notice of Claimed Investigational Exemption for a New Drug" (IND) has been accepted by the Food and Drug Administration (FDA) or for which an NDA is in effect.

Group IV. Use of prepared radiopharmaceuticals for certain therapeutic uses that do not normally require hospitalization for purposes of radiation safety:

(1) Iodine-131 as iodide for treatment of hyperthyroidism and cardiac dysfunction;

(2) Phosphorus-32 as soluble phosphorus for treatment of polycythemia vera, leukemia, and bone metastases;

(3) Phosphorus-32 as colloidal chromic phosphate for intracavitary treatment of malignant effusions;

(4) Any radioactive material in a radiopharmaceutical and for a therapeutic use not normally requiring hospitalization for purposes of radiation safety for which a "Notice of Claimed Investigational Exemption for a New Drug." (IND) has been accepted by the Food and Drug Administration (FDA) or for which an NDA is in effect.

Group V. Use of prepared radiopharmaceuticals for certain therapeutic uses that normally require hospitalization for purposes of radiation safety:

(1) Gold-198 as colloid for intracavitary treatment of malignant effusions;

(2) Iodine-131 as iodide for treatment of thyroid carcinoma;

(3) Any radioactive material in a radiopharmaceutical and for a therapeutic use normally requiring hospitalization for radiation safety reasons for which a "Notice of Claimed Investigational Exemption for a New Drug" (IND) has been accepted by the Food and Drug Administration (FDA) or for which an NDA is in effect.

Group VI. Use of sources and devices containing radioactive material for certain medical uses.

1. Americium-241 as a sealed source in a device for bone mineral analysis;

2. Cesium-137 encased in needles and applicator cells for topical, interstitial, and intracavitary treatment of cancer;

3. Cobalt-60 encased in needles and applicator cells for topical, interstitial, and intracavitary treatment of cancer;

4. Gold-198 as seeds for interstitial treatment of cancer;

5. Iodine-125 as a sealed source in a device for bone mineral analysis;

6. Iridium-192 as seeds encased in nylon ribbon for interstitial treatment of cancer;

7. Strontium-90 sealed in an applicator for treatment of superficial eye conditions.

8. Iodine-125 as seeds for interstitial treatment of cancer.

9. Radium-226 encased in needles and applicator cells for topical, interstitial, and intracavitary treatment of cancer.

10. Radon-222 as seeds for interstitial treatment of cancer.

RHA 2.27. Requirements for License to Manufacture and Distribute Industrial Products Containing Depleted Uranium for Mass-Volume Applications.

2.27.1 An application for a specific license to manufacture industrial products and devices containing depleted uranium for use pursuant to RHA 2.3.4 or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State will be approved if:

2.27.1.1 The applicant satisfies the requirements specified in RHA 2.6.

2.27.1.2 The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labeling and marking, proposed uses, and potential hazards of the industrial product or service to provide reasonable assurance that possession, use, and transfer of the depleted uranium in the product or device is not likely to cause any individual to receive in any period of one calendar quarter a radiation dose in excess of 10 percent of the limits specified in the table in RHA 3.2.1.

2.27.1.3 The applicant submits sufficient information regarding the industrial product or device and the presence of depleted uranium for a mass-volume application in the product or device to provide reasonable assurance that unique benefits will accrue to the public because of the usefulness of the product or device.

2.27.2 In the case of an industrial product or device whose unique benefits are questionable, the Department will approve an application for a specific license under RHA 2.27 only if the product or device is found to combine a high degree of utility and low probability of uncontrolled disposal and dispersal of significant quantities of depleted uranium into the environment.

2.27.3 The Department may deny any application for a specific license under RHA 2.27 if the end use of the industrial product or device cannot be reasonably foreseen.

2.27.4 Each person licensed pursuant to RHA 2.27.1 shall:

2.27.4.1 Maintain the level of quality control required by the license in the manufacture of the industrial product or device, and in the installation of the depleted uranium into the product or device;

2.27.4.2 Label or mark each unit to: (a) identify the manufacturer of the product or device and the number of the license under which the product or device was manufactured, the fact that the product or device contains depleted uranium, and the quantity of depleted uranium in each product or device; and (b) state the receipt, possession, use, and transfer of the product or device are subject to a general license or the equivalent and the regulations of the U.S. Nuclear Regulatory Commission or of an Agreement State;

2.27.4.3 Assure that the depleted uranium before being installed in each product or device has been impressed with the following legend clearly legible through any plating or other covering: "DEPLETED URANIUM";

2.27.4.4 (a) Furnish a copy of the general license contained in RHA 2.3.4 and a copy of Department Form RHA-100-2 to each person to whom he transfers depleted uranium in a product or device for use pursuant to the general license contained in RHA 2.3.4; or (b) furnish a copy of the general license contained in the U.S. Nuclear Regulatory Commission's or Agreement State's regulation equivalent to RHA 2.3.4 and a copy of the U.S. Nuclear Regulatory Commission's or Agreement State's certificate, or alternatively, furnish a copy of the general license contained in RHA 2.3.4 and a copy of Department Form RHA-100-2 to each person to whom he transfers depleted uranium in a product or device for use pursuant to the general license of the U.S. Nuclear Regulatory Commission or an Agreement State, with a note explaining the use of the product or device is regulated by the U.S. Regulatory Commission or an Agreement State under requirements substantially the same as those in RHA 2.3.4.

2.27.4.5 Report to the Department all transfers of industrial products or devices to persons for use under the general license in RHA 2.3.4. Such reports 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 Department and the general licensee, the type and model number of device transferred, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within 30 days after the end of each calendar quarter in which such a product or device is transferred to the generally licensed person. If no transfers have been made to persons generally licensed under RHA 2.3.4 during the reporting period, the report shall so indicate;

2.27.4.6 Report to the U.S. Nuclear Regulatory Commission all transfers of industrial products or devices to persons for use under the U.S. Nuclear Regulatory Commission general license in Section 40.25 of 10 CFR Part 40. Report to the responsible agreement state agency all transfers of devices manufactured and distributed pursuant to RHA 2.27 for use under a general license in that state's regulations equivalent to RHA 2.3.4. Such reports 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 Department and the general licensee, and the quantity of depleted uranium contained in the product or device. The report shall be submitted within 30 days after the end of each calendar quarter in which such product or device is transferred to the generally licensed person. If no transfers have been made to the U.S. Nuclear Regulatory Commission licensee during the reporting period, this information shall be reported to the U.S. Nuclear Regulatory Commission. If no transfers have been made to the general licensees within a particular agreement state during the reporting period, this information shall be reported to the responsible agreement state agency.

2.27.4.7 Keep records showing the name, address, and point of contact for each general licensee to whom he transfers depleted uranium in industrial products or devices for use pursuant to the general licenses provided in RHA 2.3.4 or equivalent regulations of the U.S. Nuclear Regulatory Commission or of an

Agreement State. The records shall show the date of each transfer, the quantity of depleted uranium in each product or device transferred, and compliance with the report requirements of this section.

RHA 2.28. Requirements for Specific License to Manufacture, Assemble, Repair, or Distribute Commodities, Products or Devices Which Contain Naturally Occurring or Accelerator-Produced Radioactive Material (NARM)

2.28.1 Licensing the Distribution of NARM in Exempt Quantities.[12] An application for a specific license to distribute NARM in exempt quantities to persons exempted from these regulations pursuant to 2.20.2.5 will be approved if:

2.28.1.1 the radioactive material is not contained in any food, beverage, cosmetic, drug, or other commodity designed for ingestion or inhalation by, or application to, a human being;

2.28.1.2 the radioactive material is in the form of processed chemical elements, compounds, or mixtures, tissue samples, bioassay samples, counting standards, plated or encapsulated sources, or similar substances, identified as radioactive and to be used for its radioactive properties, but is not incorporated into any manufactured or assembled commodity, product, or device intended for commercial distribution; and

2.28.1.3 the applicant submits copies of prototype labels and brochures and the Department approves such labels and brochures.

2.28.2 The license issued under 2.28.1 is subject to the following conditions:

2.28.2.1 no more that 10 exempt quantities shall be sold or transferred in any single transaction. However, an exempt quantity may be composed of fractional parts of one or more of the exempt quantities provided the sum of the fractions shall not exceed unity.

2.28.2.2 each exempt quantity shall be separately and individually packaged. No more than 10 such packaged exempt quantities shall be contained in any outer package for transfer to persons exempt pursuant to 2.20.2.5. The outer package shall be such that the dose rate at the external surface of the package does not exceed 0.5 millirem per hour.

2.28.2.3 the immediate container of each quantity or separately packaged fractional quantity of radioactive material shall bear a durable, legible label which:

2.28.2.3.1 identifies the radionuclide and the quantity of radioactivity, and

2.28.2.3.2 bears the words “Radioactive Material”

2.28.2.4 in addition to the labeling information required by 2.28.2.3, the label affixed to the immediate container, or an accompanying brochure, shall:

2.28.2.4.1 state that the contents are exempt from Licensing State requirements,

[12]Authority to transfer possession or control by the manufacturer, processor, or producer of any equipment, device, commodity, or other product containing radioactive material whose subsequent possession, use, transfer, and disposal by all other persons are exempted from regulatory requirements may be obtained only from the U.S. Nuclear Regulatory Commission, Wash., D.C. 20555.

2.28.2.4.2 bear the words “Radioactive Material—Not for Human Use—Introduction into Foods, Beverages, Cosmetics, Drugs, or Medicinals, or into Products Manufactured for Commercial Distribution is Prohibited—Exempt Quantities Should Not Be Combined”, and,

2.28.2.4.3 set forth appropriate additional radiation safety precautions and instructions relating to the handling, use, storage, and disposal of the radioactive material.

2.28.3 Each person licensed under 2.28.1 shall maintain records identifying, by name and address, each person to whom radioactive material is transferred for use under 2.20.2.5 or the equivalent regulations of a Licensing State, and stating the kinds and quantities of radioactive material transferred. An annual summary report stating the total quantity of each radionuclide transferred under the specific license shall be filed with the Department. Each report shall cover the year ending June 30, and shall be filed within 30 days thereafter. If no transfers of radioactive material have been made pursuant to 2.28.1 during the reporting period, the report shall so indicate.

2.28.4 Licensing the 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 2.20.2.3 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.

2.28.5 Special Requirements for License to Manufacture Calibration Sources Containing Americium 241, Plutonium or Radium 226 for Distribution to Persons Generally Licensed Under 2.4.5. An application for a specific license to manufacture calibration and reference sources containing americium 241, plutonium or radium 226 to persons generally licensed under 2.4.5 will be approved if:

2.28.5.1 the applicant satisfies the general requirements of 2.6, and

2.28.5.2 the applicant satisfies 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.

RHA 2.29. Registration of Sealed Sources and Devices Containing Sealed Sources

2.29.1 Any manufacturer or initial distributor of a sealed source or device containing a sealed source may submit a request to the Department for evaluation of radiation safety information about its product and for its registration.

2.29.2 The request for review must be sent to the Department. The request for a review of a sealed source or a device must include sufficient information about the design, manufacture, prototype testing, quality control program, labeling, proposed uses and leak testing and for a device, the request must also include sufficient information about installation, service and maintenance, operating and safety instructions, and its potential hazards, to provide reasonable assurance that the radiation safety properties of the source or device are adequate to protect health and minimize danger to life and property.

2.29.3 The Department normally evaluates a sealed source or a device using radiation safety criteria in accepted industry standards. If these standards and criteria do not readily apply to a particular case, the Department formulates reasonable standards and criteria with the help of the manufacturer or distributor. The Department shall use criteria and standards sufficient to ensure that the radiation safety properties of

the device or sealed source are adequate to protect health and minimize danger to life and property. RHA 2.20 of this part includes specific criteria that apply to certain exempt products and RHA 2.4 includes specific criteria applicable to certain generally licensed devices. RHA 2.7 includes specific provisions that apply to certain specifically licensed items.

2.29.4 After completion of the evaluation, the Department issues a certificate of registration to the person making the request. The certificate of registration acknowledges the availability of the submitted information for inclusion in an application for a specific license proposing use of the product, or concerning use under an exemption from licensing or general license as applicable for the category of certificate.

2.29.5 The person submitting the request for evaluation and registration of safety information about the product shall manufacture and distribute the product in accordance with:

2.29.5.1 The statements and representations, including quality control program, contained in the request; and

2.29.5.2 The provisions of the registration certificate.

2.29.6 Authority to manufacture or initially distribute a sealed source or device to specific licensees may be provided in the license without the issuance of a certificate of registration in the following cases:

2.29.6.1 Calibration and reference sources containing no more than:

2.29.6.1.1 37 MBq (1 mCi), for beta and/or gamma emitting radionuclides; or

2.29.6.1.2 0.37 MBq (10 μCi), for alpha emitting radionuclides; or

2.29.6.2 The intended recipients are qualified by training and experience and have sufficient facilities and equipment to safely use and handle the requested quantity of radioactive material in any form in the case of unregistered sources or, for registered sealed sources contained in unregistered devices, are qualified by training and experience and have sufficient facilities and equipment to safely use and handle the requested quantity of radioactive material in unshielded form, as specified in their licenses; and

2.29.6.2.1 The intended recipients are licensed under RHA 2.8, or comparable regulation; or

2.29.6.2.2 The recipients are authorized for research and development; or

2.29.6.2.3 The sources and devices are to be built to the unique specifications of the particular recipient and contain no more than 740 GBq (20 Ci) of tritium or 7.4 GBq (200 mCi) of any other radionuclide.

2.29.7 After the certificate is issued, the Department may conduct an additional review as it determines is necessary to ensure compliance with current regulatory standards. In conducting its review, the Department will complete its evaluation in accordance with criteria specified in this section. The Department may request such additional information as it considers necessary to conduct its review and the certificate holder shall provide the information as requested.

2.29.8 Inactivation of certificates of registration of sealed sources and devices.

2.29.8.1 A certificate holder who no longer manufactures or initially transfers any of the sealed source(s) or device(s) covered by a particular certificate issued by the Department shall request inactivation of the registration certificate. Such a request must be made to the Department and must normally be made no later than two years after initial distribution of all of the source(s) or device(s) covered by the certificate has ceased. However, if the certificate holder determines that an initial transfer was in fact the last initial transfer more than two years after that transfer, the certificate holder shall request inactivation of the certificate within 90 days of this determination and briefly describe the circumstances of the delay.

2.29.8.2 If a distribution license is to be terminated in accordance with RHA 2.11, the licensee shall request inactivation of its registration certificates associated with that distribution license before the Department will terminate the license. Such a request for inactivation of certificate(s) must indicate that the license is being terminated and include the associated specific license number.

2.29.8.3 A specific license to manufacture or initially transfer a source or device covered only by an inactivated certificate no longer authorizes the licensee to initially transfer such sources or devices for use. Servicing of devices must be in accordance with any conditions in the certificate, including in the case of an inactive certificate.

RHA 2.30. Emergency Plan for Large Quantity Users.

2.30.1 Each application to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in RHA 2.31 "Schedule E - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release," must contain either:

2.30.1.1 An evaluation showing that the maximum dose to a person offsite due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or

2.30.1.2 An emergency plan for responding to a release of radioactive material.

2.30.2 One or more of the following factors may be used to support an evaluation submitted under RHA 2.30.1.1 of this section:

2.30.2.1 The radioactive material is physically separated so that only a portion could be involved in an accident;

2.30.2.2 All or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

2.30.2.3 The release fraction in the respirable size range would be lower than the release fraction shown in RHA 2.31 due to the chemical or physical form of the material;

2.30.2.4 The solubility of the radioactive material would reduce the dose received;

2.30.2.5 Facility design or engineered safety features in the facility would cause the release fraction to be lower than shown in RHA 2.31, Schedule E.

2.30.2.6 Operating restrictions or procedures would prevent a release fraction as large as that shown in RHA 2.31, Schedule E; or

2.30.2.7 Other factors appropriate for the specific facility.

2.30.3 An emergency plan for responding to a release of radioactive material submitted under RHA 2.30.1.2 of this section must include the following information.

2.30.3.1 Facility description. A brief description of the licensee's facility and area near the site.

2.30.3.2 Types of accidents. An identification of each type of radioactive materials accident for which protective actions may be needed.

2.30.3.3 Classification of accidents. A classification system for classifying accidents as alerts or site area emergencies.

2.30.3.4 Detection of accidents. Identification of the means of detecting each type of accident in a timely manner.

2.30.3.5 Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers on site, and a description of the program for maintaining the equipment.

2.30.3.6 Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.

2.30.3.7 Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the Department; also responsibilities for developing, maintaining, and updating the plan.

2.30.3.8 Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established. The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the Department immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.[1]

2.30.3.9 Information to be communicated. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the Department.

2.30.3.10 Training. A brief description of the frequency, performance objectives and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instruction and orientation tours the licensee would offer to fire, police, medical and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

[1]These requirements do not supersede or release licensees of complying with the requirements under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Pub.L. 99-499 or other state or federal reporting requirements.

2.30.3.11 Safe shutdown. A brief description of the means of restoring the facility to safe condition after an accident.

2.30.3.12 Exercises. Provision for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite offsite response organizations to participate in the biennial exercises. Participation of offsite response organizations in biennial exercises although recommended is not required.

Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

2.30.3.13 Hazardous chemicals. A certification that the applicant has met its responsibilities under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Pub. L.99-499, if applicable to the applicant's activities at the proposed place of use of the byproduct material.

2.30.4 The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to the Department. The licensee shall provide any comments received within the 60 days to the Department with the emergency plan.

RHA 2.31. Schedule E - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release.

Radioactive Material	Release fraction	Quantity (curies)
Actinium-228	0.001	4,000
Americium-241	.001	2
Americium-242	.001	2
Americium-243	.001	2
Antimony-124	.01	4,000
Antimony-126	.01	6,000
Barium-133	.01	10,000
Barium-140	.01	30,000
Bismuth-207	.01	5,000
Bismuth-210	.01	600
Cadmium-109	.01	1,000
Cadmium-113	.01	80
Calcium-45	.01	20,000
Californium-252	.001	9(20 mg)
Carbon-14	.01	50,000
	Non CO	

Radioactive Material	Release fraction	Quantity (curies)
Cerium-141	.01	10,000
Cerium-144	.01	300
Cesium-134	.01	2,000
Cesium-137	.01	3,000
Chlorine-36	.5	100
Chromium-51	.01	300,000
Cobalt-60	.001	5,000
Copper-64	.01	20,000
Curium-242	.001	60
Curium-243	.001	3
Curium-244	.001	4
Curium-245	.001	2
Europium-152	.01	500
Europium-154	.01	400
Europium-155	.01	3,000
Germanium-68	.01	2,000
Gadolinium-153	.01	5,000
Gold-198	.01	30,000
Hafnium-172	.01	400
Holmium-166m	.01	7,000
Hydrogen-3	.5	100
Iodine-125	.5	20,000
Iodine-131	.5	10
Indium-114m	.01	1,000
Iridium-192	.001	40,000
Iron-55	.01	40,000
Iron-59	.01	7,000
Krypton-85	1.0	6,000,000
Lead-210	.01	8
Manganese-56	.01	60,000
Mercury-203	.01	10,000
Molybdenum-99	.01	30,000
Neptunium-237	.001	2
Nickel-63	.01	20,000
Niobium-94	.01	300
Phosphorus-32	.5	100
Phosphorus-33	.5	1,000
Polonium-32	.01	10
Potassium-42	.01	9,000
Promethium-145	.01	4,000
Promethium-147	.01	4,000
Radium-226	0.001	100
Ruthenium-106	.01	200
Samarium-151	.01	4,000
Scandium-46	.01	3,000

Radioactive Material	Release fraction	Quantity (curies)
Selenium-75	.01	10,000
Silver-110m	.01	1,000
Sodium-22	.01	9,000
Sodium-24	.01	10,000
Strontium-89	.01	3,000
Strontium-90	.01	90
Sulfur-35	.5	900
Technetium-99	.01	10,000
Technetium-99m	.01	400,000
Tellurium-127m	.01	5,000
Tellurium-129m	.01	5,000
Terbium-160	.01	4,000
Thulium-170	.01	4,000
Tin-13	.01	10,000
Tin-123	.01	3,000
Tin-126	.01	1,000
Titanium-44	.01	100
Vanadium-48	.01	7,000
Xenon-133	1.0	900,000
Yttrium-91	.01	2,000
Zinc-65	.01	5,000
Zirconium-93	.01	400
Zirconium-95	.01	5,000
Any other beta-gamma emitter	.01	10,000
Mixed fission products	.01	1,000
Contaminated equipment beta gamma	.001	10,000
Irradiated material, any form other than solid noncombustible	.01	1,000
Mixed radioactive waste, beta gamma	.01	1,000
Packaged mixed waste, beta gamma[2]	.001	10,000
Any other alpha emitter	.001	2
Contaminated equipment, alpha	.0001	20
Packaged waste, alpha[2]	.0001	20
Combinations of radioactive materials listed above[1]		
[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 Schedule E exceeds one.		
[2] Waste packaged in Type B containers does not require an emergency plan.		

RHA 2.32. Reporting Requirements.

2.32.1 Immediate report. Each licensee shall notify the Department as soon as possible but not later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid

exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).

2.32.2 Twenty-four hour report. Each licensee shall notify the Department within 24 hours after the discovery of any of the following events involving licensed material:

2.32.2.1 An unplanned contamination event that:

2.32.2.1.1 Requires access to the contaminated area, by workers or the public, to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area;

2.32.2.1.2 Involves a quantity of material greater than five times the lowest annual limit on intake specified in RHA 3.53, appendix b for the material; and

2.32.2.1.3 Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.

2.32.2.2 An event in which equipment is disabled or fails to function as designed when:

2.32.2.2.1 The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;

2.32.2.2.2 The equipment is required to be available and operable when it is disabled or fails to function; and

2.32.2.2.3 No redundant equipment is available and operable to perform the required safety function.

2.32.2.3 An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.

2.32.2.4 An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:

2.32.2.4.1 The quantity of material involved is greater than five times the lowest annual limit on intake specified in RHA 3.53 appendix B for the material; and

2.32.2.4.2 The damage affects the integrity of the licensed material or its container.

2.32.3 Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:

2.32.3.1 Licensees shall make reports required by RHA 2.32.1 & 2.32.2 of this section by telephone to the Bureau of Radiological Health. to the extent that the information is available at the time of notification, the information provided in these reports must include:

2.32.3.1.1 The caller's name and call back telephone number;

2.32.3.1.2 A description of the event, including date and time;

2.32.3.1.3 The exact location of the event;

2.32.3.1.4 The isotopes, quantities, and chemical and physical form of the licensed material involved; and

2.32.3.1.5 Any personnel radiation exposure data available.

2.32.3.2 Written report. Each licensee who makes a report required by RHA 2.32.1. or 2.32.2 of this section shall submit a written follow-up report within 30 days of the initial report. Written reports prepared pursuant to other regulations may be submitted to fulfill this requirement if the reports contain all of the necessary information and appropriate distribution is made. These written reports must be sent to the S.C. Department of Health & Environmental Control, Bureau of Radiological Health, 2600 Bull Street, Columbia, S.C. 29201. The reports must include the following.

2.32.3.2.1 A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;

2.32.3.2.2 The exact location of the event;

2.32.3.2.3 The isotopes, quantities, and chemical and physical form of the licensed material involved;

2.32.3.2.4 Date and time of the event;

2.32.3.2.5 Corrective actions taken or planned and the results of any evaluations or assessments; and;

2.32.3.2.6 The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

PART III
Standards for Protection Against Radiation

RHA 3.1. Purpose and Scope.

It is the purpose of the regulations in this part to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this part. However, nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety.

The regulations in this part apply to persons licensed by the Department to receive, possess, use, transfer, or dispose of radioactive material. The limits in this part do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, to exposure from individuals administered radioactive material and released under RHA 4.32, or to exposure from voluntary participation in medical research programs.

RHA 3.2. Definitions.

As used in this part:

3.2.1 “Absorbed dose” means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

3.2.2 “Activity” is the rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

3.2.3 “Adult” means an individual 18 or more years of age.

3.2.4 “Airborne radioactivity” area means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations—

i) In excess of the derived air concentrations (DACs) specified in Appendix B, RHA 3.53, or

ii) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

3.2.5 “Air-purifying respirator” means a respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

3.2.6 “ALARA” (acronym for “as low as is reasonably achievable”) means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

3.2.7 “Annual limit on intake” (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table 1, Columns 1 and 2, of Appendix B, RHA 3.53).

3.2.8 “Assigned protection factor” (APF) means the expected workplace level of respiratory protection that would be provided by a properly functioning respirator or a class of respirators to properly fitted and trained users. Operationally, the inhaled concentration can be estimated by dividing the ambient airborne concentration by the APF.

3.2.9 “Atmosphere-supplying respirator” means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

3.2.10 “Background radiation” means radiation from cosmic sources; naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material) and global

fallout as it exists in the environment from the testing of nuclear explosive devices. “Background radiation” does not include radiation from source, byproduct, or special nuclear materials regulated by the Department.

3.2.11 “Bioassay” (radiobioassay) means the determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

3.2.12 “Chelating agent” means amine polycarboxylic acids, hydrocarboxylic, gluconic acid, and polycarboxylic acids.

3.2.13 “Chemical description” means a description of the principal chemical characteristics of a low-level radioactive waste.

3.2.14 “Class” (or lung class or inhalation class) means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (Days) of less than 10 days, for Class W (Weeks) from 10 to 100 days, and for Class Y (Years) of greater than 100 days.

3.2.15 “Collective dose” is the sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

3.2.16 “Committed dose equivalent” (H) means the dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

3.2.17 “Committed effective dose equivalent” ($H_{E,50}$) is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues ($H_{E,50} = \Sigma W_T H_{T,50}$).

3.2.18 “Computer-readable medium” means a medium selected from the available technologies, as authorized by the Department, that can be used to transfer the information to the Department’s computer.

3.2.19 “Consignee” means the designated receiver of the shipment of low-level radioactive waste.

3.2.20 “Constraint (dose constraint)” means a value above which specified licensee actions are required.

3.2.21 “Controlled area” means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

3.2.22 “Critical Group” means the group of individuals reasonably expected to receive the greatest exposure to residual radiation for any applicable set of circumstances.

3.2.23 “Declared pregnant woman” means a woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

3.2.24 “Decommission” means to remove a facility or site safely from service and reduce residual radioactivity to level that permits 1) release of the property for unrestricted use and termination of the license; or 2) release of the property under restricted conditions and termination of the license.

3.2.25 “Decontamination facility” means a facility operating under a license whose principal purpose is decontamination of equipment or materials to accomplish recycle, reuse, or other waste management objectives, and, for purposes of this part, is not considered to be a consignee for LLW shipments.

3.2.26 “Deep-dose equivalent” (H_d), which applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2).

3.2.27 “Demand respirator” means an atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

3.2.28 “Derived air concentration” (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in Table 1, Column 3, of Appendix B, RHA 3.53.

3.2.29 “Derived air concentration-hour” (DAC-hour) is the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 Sv).

3.2.30 “Disposal container” means a container principally used to confine low-level radioactive waste during disposal operations at a land disposal facility (also see “high integrity container”). Note that for some shipments, the disposal container may be the transport package.

3.2.31 “Disposable respirator” means a respirator for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent exhaustion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of respirator are a disposable half-mask respirator or a disposable escape-only self-contained breathing apparatus (SCBA).

3.2.32 “Distinguishable from Background” means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

3.2.33 “Dose or radiation dose” is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined in other paragraphs of this section.

3.2.34 “Dose equivalent” (H_T) means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

3.2.35 “Effective dose equivalent” (H_E) is the sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E = \Sigma W_T H_T$).

3.2.36 “Embryo/fetus” means the developing human organism from conception until the time of birth.

3.2.37 “Entrance or access point” means any location through which an individual could gain access to radiation areas or to radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

3.2.38 “EPA identification number” means the number received by a transporter following application to the administrator of EPA as required by 40 CFR Part 263.

3.2.39 “Exposure” means being exposed to ionizing radiation or to radioactive material.

3.2.40 “External dose” means that portion of the dose equivalent received from radiation sources outside the body.

3.2.41 “Extremity” means hand, elbow, arm below the elbow, foot, knee, and leg below the knee.

3.2.42 “Filtering facepiece” (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

3.2.43 “Fit factor” means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

3.2.44 “Fit test” means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

3.2.45 “Generally applicable environmental radiation standards” means standards issued by the Environmental Protection Agency (EPA) under the authority of the Atomic Energy Act of 1954, as amended, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outside the boundaries of locations under the control of persons possessing or using radioactive material.

3.2.46 “Generator” means a licensee operating under a Commission or Agreement State license who (1) is a radioactive waste generator as defined in this part, or (2) is the licensee to whom waste can be attributed within the context of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (e.g. waste generated as a result of decontamination or recycle activities).

3.2.47 “Helmet” means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

3.2.48 “High Integrity Container (HIC)” means a container commonly designed to meet the structural stability requirements of Appendix E, RHA 3.56.2.2, and to meet Department of Transportation requirements for a Type A package.

3.2.49 “High radiation area” means an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of

0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

3.2.50 “Hood” means a respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

3.2.51 “Individual monitoring” means:

(1) The assessment of dose equivalent by the use of devices designed to be worn by an individual;

(2) The assessment of committed effective dose equivalent by bioassay (see Bioassay) or by determination of the time-weighted air concentrations to which an individual has been exposed, i.e., DAC-hours; or

(3) The assessment of dose equivalent by the use of survey data.

3.2.52 “Individual monitoring devices (individual monitoring equipment)” means devices designed to be worn by a single individual for the assessment of dose equivalent such as film badges, thermoluminescence dosimeters (TLDs), pocket ionization chambers, and personal (lapel) air sampling devices.

3.2.53 “Internal dose” means that portion of the dose equivalent received from radioactive material taken into the body.

3.2.54 “Land disposal facility” means the land buildings and structures, and equipment which are intended to be used for the disposal of radioactive wastes.

3.2.55 “Lens dose equivalent (LDE)” applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeter (300 mg/cm^2).

3.2.56 “Licensed material” means source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the Department.

3.2.57 “Limits (dose limits)” means the permissible upper bounds of radiation doses.

3.2.58 “Loose-fitting facepiece” means a respiratory inlet covering that is designed to form a partial seal with the face.

3.2.59 “Lost or missing licensed material” means licensed material whose location is unknown. It includes material that has been shipped but has not reached its destination and whose location cannot be readily traced in the transportation system.

3.2.60 “Member of the public” means any individual except when that individual is receiving an occupational dose.

3.2.61 “Minor” means an individual less than 18 years of age.

3.2.62 “Monitoring” (radiation monitoring, radiation protection monitoring) means the measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

3.2.63 “Nationally tracked source” means a sealed source containing a quantity equal to or greater than Category 1 or 2 levels of any radioactive material listed in Appendix G to Part 3 of these Regulations. In this context a sealed source is defined as radioactive material that is sealed in a capsule or closely bonded, in a solid form and which is not exempt from regulatory control. It does not mean material encapsulated solely for disposal, or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet. Category 1 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 1 threshold. Category 2 nationally tracked sources are those containing radioactive material at a quantity equal to or greater than the Category 2 threshold but less than the Category 1 threshold.

3.2.64 “Negative pressure respirator” (tight fitting) means a respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

3.2.65 “Nonstochastic effect” means health effects, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect (also called a deterministic effect).

3.2.66 “NRC Forms 540, 540A, 541, 541A, 542, and 542A” are official NRC forms referenced in this regulation. Licensees need not use originals of these NRC Forms as long as any substitute forms are equivalent to the original documentation in respect to content, clarity, size, and location of information. Upon agreement between the shipper and consignee, NRC Forms 541 (and 541A) and NRC Forms 542 (and 542A) may be completed, transmitted, and stored in electronic media. The electronic media must have the capability for producing legible, accurate, and complete records in the format of the uniform manifest.

3.2.67 “Occupational dose” means the dose received by an individual in the course of employment in which the individual’s assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released under RHA 4.32, or from voluntary participation in medical research programs, or as a member of the public.

3.2.68 “Package” means the assembly of components necessary to ensure compliance with the packaging requirements of DOT regulations, together with its radioactive contents, as presented for transport.

3.2.69 “Physical description” means the items called for on NRC Form 541 to describe a low-level radioactive waste.

3.2.70 “Planned special exposure” means an infrequent exposure to radiation, separate from and in addition to the annual dose limits.

3.2.71 “Positive pressure respirator” means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

3.2.72 “Powered air-purifying respirator” (PAPR) means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

3.2.73 “Pressure demand respirator” means a positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

3.2.74 “Public dose” means the dose received by a member of the public from exposure to radiation or to radioactive material released by a licensee, or to any other source of radiation under the control of the licensee. Public dose does not include occupational dose or doses received from background radiation, from any medical administration the individual had received, from exposure to individuals administered radioactive material and released under RHA 4.32, or from voluntary participation in medical research programs.

3.2.75 “Qualitative fit test” (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual’s response to the test agent.

3.2.76 “Quality Factor” (Q) means the modifying factor (listed in tables 1 and 2 of RHA 3.3) that is used to derive dose equivalent from absorbed dose.

3.2.77 “Quantitative fit test” (QNFT) means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

3.2.78 “Reference man” means a hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological insult to a common base.

3.2.79 “Residual Radioactivity” means radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the licensee’s control. This includes radioactivity from all licensed and unlicensed sources used by the licensee but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with this Regulation.

3.2.80 “Residual waste” means low-level radioactive waste resulting from processing or decontamination activities that cannot be easily separated into distinct batches attributable to specific waste generators. This waste is attributable to the processor or decontamination facility, as applicable.

3.2.81 “Respiratory protective device” means an apparatus, such as a respirator, used to reduce the individual’s intake of airborne radioactive materials.

3.2.82 “Sanitary sewerage” means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee.

3.2.83 “Self-contained breathing apparatus” (SCBA) means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

3.2.84 “Shallow-dose equivalent” (H^s), which applies to the external exposure of the skin of the whole body or the skin of an extremity, is taken as the dose equivalent at a tissue depth of 0.007 centimeter (7 mg/cm^2).

3.2.85 “Shipper” means the licensed entity (i.e. the waste generator, waste collector, or waste processor) who offers low-level radioactive waste for transportation, typically consigning this type of waste to a licensed waste collector, waste processor, or land disposal facility operator.

3.2.86 “Shipping paper” means NRC Form 540 and if required, NRC Form 540A which includes the information required by DOT in 49 CFR Part 172.

3.2.87 “Source material” means (1) uranium or thorium, or any combination thereof, in any physical or chemical form, or (2) ores which contain by weight one-twentieth of one percent (0.05 percent) or more of (a) uranium, (b) thorium, or (c) any combination thereof. Source material does not include special nuclear material (SNM).

3.2.88 “Special nuclear material” means (1) plutonium, uranium-233, uranium-enriched in the isotope-233 or the isotope-235, or (2) any material artificially enriched by any of the foregoing. This definition does not include source material.

3.2.89 “Stochastic effects” means health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

3.2.90 “Supplied-air respirator” (SAR) or airline respirator means an atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

3.2.91 “Tight-fitting facepiece” means a respiratory inlet covering that forms a complete seal with the face.

3.2.92 “Total Effective Dose Equivalent” (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

3.2.93 “Type A quantity” means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material, where A_1 and A_2 are given in Appendix A 10 CFR Part 71 or may be determined by procedures described in Appendix A 10 CFR Part 71.

3.2.94 “Uniform Low-Level Radioactive Waste Manifest or uniform manifest” means the combination of NRC Forms 540, 541, and, if necessary, 542, and their respective continuation sheets as needed, or equivalent.

3.2.95 “User seal check” (fit check) means an action conducted by the respirator user to determine if the respirator is properly seated to the face. Examples include negative pressure check, positive pressure check, irritant smoke check, or isoamyl acetate check.

3.2.96 “Very high radiation area” means an area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source or from any surface that the radiation penetrates.

[Note: At very high doses received at high dose rates, units of absorbed dose (e.g., rads and grays) are appropriate, rather than units of dose equivalent (e.g., rems and sieverts).]

3.2.97 "Waste collector" means an entity, operating under a license issued by the Department, the U.S. Nuclear Regulatory Commission, or another Agreement State, whose principal purpose is to collect and consolidate waste generated by others, and to transfer this waste, without processing or repackaging the collected waste, to another licensed waste collector, licensed waste processor, or licensed land disposal facility.

3.2.98 "Waste description" means the physical, chemical and radiological description of a low-level radioactive waste as called for on NRC Form 541.

3.2.99 "Waste generator" means an entity, operating under a license issued by the Department, the U.S. Nuclear Regulatory Commission, or another Agreement State, who possesses any material or component that contains radioactivity or is radioactively contaminated for which the licensee foresees no further use, and transfers this material or component to a licensed land disposal facility or to a licensed waste collector or processor for handling or treatment prior to disposal. A licensee performing processing or decontamination services may be a "waste generator" if the transfer of low-level radioactive waste from its facility is defined as "residual waste."

3.2.100 "Waste processor" means an entity, operating under a license issued by the Department, the U.S. Nuclear Regulatory Commission, or another Agreement State, whose principal purpose is to process, repackage, or otherwise treat low-level radioactive material or waste generated by others prior to eventual transfer of waste to a licensed low-level radioactive waste land disposal facility.

3.2.101 "Waste type" means a waste within a disposal container having a unique physical description (i.e., a specific waste descriptor code or description; or a waste solidified in a specifically defined media).

3.2.102 "Weighting factor, W_T," for an organ or tissue (T) is the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of W_T are:

ORGAN DOSE WEIGHTING FACTORS	
Organ or Tissue	W_T
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	[1]0.30
Whole Body	[2]1.00

[1]0.30 results from 0.06 for each of 5 "remainder" organs (excluding the skin and the lens of the eye) that receive the highest doses.

[2]For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor, $W_T = 1.0$, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

3.2.103 "Working level" (WL) is any combination of short-lived radon daughters (for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214; and for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212) in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha particle energy.

3.2.104 "Working level month" (WLM) means an exposure to 1 working level for 170 hours (2,000 working hours per year/12 months per year = approximately 170 hours per month).

3.2.105 "Year" means the period of time beginning in January used to determine compliance with the provisions of this part. The licensee may change the starting date of the year used to determine compliance by the licensee provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

RHA 3.3. Units of Radiation Dose.

3.3.1 Definitions. As used in this part, the units of radiation dose are:

3.3.1.1 Gray (Gy) is the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 Joule/kilogram (100 rads).

3.3.1.2 Rad is the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray).

3.3.1.3 Rem is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

3.3.1.4 Sievert is the SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rems).

3.3.2 As used in this part, the quality factors for converting absorbed dose to dose equivalent are shown in Table 1.

TABLE 1: QUALITY FACTORS AND ABSORBED DOSE EQUIVALENCIES

TYPE OF RADIATION	Quality Factor (Q)	Absorbed dose equal to a unit dose equivalent[2]
X-, gamma, or beta radiation	1	1
Alpha particles, multiple-charged particles, fission fragments and heavy particles of unknown charge	20	0.05
Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

[2] Absorbed dose in rad equal to 1 rem or the absorbed dose in gray equal to 1 sievert.

3.3.3 If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in rems per hour or sieverts per hour, as provided in paragraph 3.3.2 of this section, 1 rem (0.01 Sv) of neutron radiation of unknown energies may, for purposes of the regulations in this part, be assumed to result from a total fluence of 25 million neutrons per square centimeter incident upon the body. If sufficient information exists to estimate the approximate energy distribution of the neutrons, the licensee may use the fluence rate per unit dose equivalent or the appropriate Q value from Table 2 to convert a measured tissue dose in rads to dose equivalent in rems.

TABLE 2: MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE EQUIVALENT FOR MONOENERGETIC NEUTRONS

	Neutron Energy (MeV)	Quality Factor[a] (Q)	Fluence per Unit Dose Equivalent[b] (neutrons cm^{-2} rem^{-1})
(thermal)…..	2.5×10^{-8}	2	980×10^6
	1×10^{-7}	2	980×10^6
	1×10^{-6}	2	810×10^6
	1×10^{-5}	2	810×10^6
	1×10^{-4}	2	840×10^6
	1×10^{-3}	2	980×10^6
	1×10^{-2}	2.5	1010×10^6
	1×10^{-1}	7.5	170×10^6
	5×10^{-1}	11	39×10^6
	1	11	27×10^6
	2.5	9	29×10^6
	5	8	23×10^6
	7	7	24×10^6
	10	6.5	24×10^6
	14	7.5	17×10^6
	20	8	16×10^6
	40	7	14×10^6
	60	5.5	16×10^6
	1×10^2	4	20×10^6
	2×10^2	3.5	19×10^6
	3×10^2	3.5	16×10^6
	4×10^2	3.5	14×10^6

[a] Value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-cm diameter cylinder tissue-equivalent phantom.

[b] Monoenergetic neutrons incident normally on a 30-cm diameter cylinder tissue-equivalent phantom.

RHA 3.4. Radiation Protection Programs.

3.4.1 Each licensee shall develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of this part. (See RHA 3.35 for recordkeeping requirements relating to these programs.)

3.4.2 The licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

3.4.3 The licensee shall periodically (at least annually) review the radiation protection program content and implementation.

3.4.4 To implement the ALARA requirements of RHA 3.4.2, and notwithstanding the requirements in RHA 3.13, a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established by licensees, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in RHA 3.46 and promptly take appropriate corrective action to ensure against recurrence.

RHA 3.5. Occupational Dose Limits for Adults.

3.5.1 The licensee shall control the occupational dose to individual adults, except for planned special exposures under RHA 3.10 to the following dose limits.

3.5.1.1 An annual limit, which is the more limiting of—

3.5.1.1.1 The total effective dose equivalent being equal to 5 rems (0.05 Sv); or

3.5.1.1.2 The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 Sv).

3.5.1.2 The annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:

3.5.1.2.1 A lens dose equivalent of 15 rems (0.15 Sv), and

3.5.1.2.2 A shallow-dose equivalent of 50 rems (0.50 Sv) to the skin of the whole body or to the skin of any extremity.

3.5.2 Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, must be subtracted from the limits for planned special exposures that the individual may receive during the current year (see 3.10.5.1) and during the individual's lifetime (see 3.10.5.2).

3.5.3 When the 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 Department. The assigned deep-dose equivalent must be for the part of the body receiving the highest exposure. The assigned shallow-dose equivalent must be the dose averaged over the contiguous 10 square centimeters of skin receiving the highest exposure. The deep-dose equivalent, lens dose equivalent and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are unavailable.

3.5.4 Derived air concentration (DAC) and annual limit on intake (ALI) values are presented in table 1 of appendix B, RHA 3.53 and may be used to determine the individual's dose (see RHA 3.39) and to demonstrate compliance with the occupational dose limits.

3.5.5 In addition to the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity (see footnote 3 of Appendix B, RHA 3.53).

3.5.6 The licensee shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person (see 3.37.2.5).

RHA 3.6. Compliance with Requirements for Summation of External and Internal Doses.

3.6.1 If the licensee is required to monitor under both 3.17.1 and 3.17.2, the licensee shall demonstrate compliance with the dose limits by summing external and internal doses. If the licensee is required to monitor only under 3.17.1 or only under 3.17.2, then summation is not required to demonstrate compliance with the dose limits. The licensee may demonstrate compliance with the requirements for summation of external and internal doses by meeting one of the conditions specified in paragraph 3.6.1.1 of this section and the conditions in paragraphs 3.6.1.2 and 3.6.1.3 of this section.

(Note: The dose equivalents for the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to separate limits.)

3.6.1.1 Intake by inhalation. If the only intake of radionuclides is by inhalation, the total effective dose equivalent limit is not exceeded if the sum of the deep-dose equivalent divided by the total effective dose equivalent limit, and one of the following, does not exceed unity:

3.6.1.1.1 The sum of the fractions of the inhalation ALI for each radionuclide, or

3.6.1.1.2 The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by 2,000, or

3.6.1.1.3 The sum of the calculated committed effective dose equivalents to all significantly irradiated[1] organs or tissues (T) calculated from bioassay data using appropriate biological models and expressed as a fraction of the annual limit.

3.6.1.2 Intake by oral ingestion. If the occupationally exposed individual also receives an intake of radionuclides by oral ingestion greater than 10 percent of the applicable oral ALI, the licensee shall account for this intake and include it in demonstrating compliance with the limits.

3.6.1.3 Intake through wounds or absorption through skin. The licensee shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption. (NOTE: The intake through intact skin has been included in the calculation of DAC for hydrogen-3 and does not need to be further evaluated.)

[1]An organ or tissue is deemed to be significantly irradiated if, for that organ or tissue, the product of the weighting factors, W_T, and the committed dose equivalent, H_{50}, per unit intake is greater than 10 percent of the maximum weighted value of $H_{5,0}$ (i.e., $W_T H_{50,T}$) per unit intake for any organ or tissue.

RHA 3.7. Determination of External Dose from Airborne Radioactive Material.

3.7.1 Licensees shall, when determining the dose from airborne radioactive material, include the contribution to the deep-dose equivalent, lens dose equivalent, and shallow-dose equivalent from external exposure to the radioactive cloud (see Appendix B, RHA 3.53 footnotes 1 and 2).

NOTE: Airborne radioactivity measurements and DAC values should not be used as the primary means to assess the deep-dose equivalent when the airborne radioactive material includes radionuclides other than noble gases or if the cloud of airborne radioactive material is not relatively uniform. The determination of the deep-dose equivalent to an individual should be based upon measurements using instruments or individual monitoring devices.

RHA 3.8. Determination of Internal Exposure.

3.8.1 For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee shall, when required under RHA 3.17, take suitable and timely measurements of—

3.8.1.1 Concentrations of radioactive materials in air in work areas;

3.8.1.2 Quantities of radionuclides in the body; or

3.8.1.3 Quantities of radionuclides excreted from the body; or

3.8.1.4 Combinations of these measurements.

3.8.2 Unless respiratory protective equipment is used, as provided in 3.19.3, or the assessment of intake is based on bioassays, the licensee shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.

3.8.3 When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior or the material in an individual is known, the licensee may—

3.8.3.1 Use that information to calculate the committed effective dose equivalent, and, if used, the licensee shall document that information in the individual's record; and

3.8.3.2 Upon prior approval of the Department, adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material (e.g., aerosol size distribution or density); and

3.8.3.3 Separately assess the contribution of fractional intakes of Class D, W, or Y compounds of a given radionuclide (see Appendix B, RHA 3.53) to the committed effective dose equivalent.

3.8.4 If the licensee chooses to assess intakes of Class Y material using the measurements given in 3.8.1.2 or 3.8.1.3, the licensee may delay the recording and reporting of the assessments for periods up to 7 months, unless otherwise required by RHA 3.45 or RHA 3.46, in order to permit the licensee to make additional measurements basic to the assessments.

3.8.5 If the identity and concentration of each radionuclide in a mixture are known, the fraction of the DAC applicable to the mixture for use in calculating DAC-hours must be either—

3.8.5.1 The sum of the ratios of the concentration to the appropriate DAC value (e.g., D, W, Y) from Appendix B, RHA 3.53 for each radionuclide in the mixture; or

3.8.5.2 The ratio of the total concentration for all radionuclides in the mixture to the most restrictive DAC value for any radionuclide in the mixture.

3.8.6 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 must be the most restrictive DAC of any radionuclide in the mixture.

3.8.7 When a mixture of radionuclides in air exists, licensees may disregard certain radionuclides in the mixture if—

3.8.7.1 The licensee uses the total activity of the mixture in demonstrating compliance with the dose limits in RHA 3.5 and in complying with the monitoring requirements in 3.17.2, and

3.8.7.2 The concentration of any radionuclide disregarded is less than 10 percent of its DAC, and

3.8.7.3 The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed 30 percent.

3.8.8 In order to calculate the committed effective dose equivalent, the licensee may assume that the inhalation of one ALI, or an exposure of 2,000 DAC-hours, results in a committed effective dose equivalent of 5 rems (0.05 Sv) for radionuclides that have their ALIs or DACs based on the committed effective dose equivalent.

3.8.9 When the ALI (and the associated DAC) is determined by the nonstochastic organ dose limit of 50 rems (0.5 Sv), the intake of radionuclides that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) (the stochastic ALI) is listed in parentheses in Table 1 of Appendix B, RHA 3.53. In this case, the licensee may, as a simplifying assumption, use the stochastic ALIs to determine committed effective dose equivalent. However, if the licensee uses the stochastic ALIs, the licensee must also demonstrate that the limit in 3.5.1.1.2 is met.

RHA 3.10. Planned Special Exposures.

A licensee may authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in RHA 3.5 provided that each of the following conditions is satisfied—

3.10.1 The licensee authorizes a planned special exposure only in an exceptional situation when alternatives that might avoid the dose estimated to result from the planned special exposure are unavailable or impractical.

3.10.2 The licensee (and employer if the employer is not the licensee) specifically authorizes the planned special exposure, in writing, before the exposure occurs.

3.10.3 Before a planned special exposure, the licensee ensures that the individuals involved are-

3.10.3.1 Informed of the purpose of the planned operation;

3.10.3.2 Informed of the estimated doses and associated potential risks and specific radiation levels or other conditions that might be involved in performing the task; and

3.10.3.3 Instructed in the measures to be taken to keep the dose ALARA considering other risks that may be present.

3.10.4 Prior to permitting an individual to participate in a planned special exposure, the licensee ascertains prior doses as required by RHA 3.37.2 during the lifetime of the individual for each individual involved.

3.10.5 Subject to RHA 3.5.2, the licensee does not authorize a planned special exposure that would cause an individual to receive a dose from all planned special exposures and all doses in excess of the limits to exceed—

3.10.5.1 The numerical values of any of the dose limits in RHA 3.5.1 in any year; and

3.10.5.2 Five times the annual dose limits in RHA 3.5.1 during the individual's lifetime.

3.10.6 The licensee maintains records of the conduct of a planned special exposure in accordance with RHA 3.38 and submits a written report in accordance with RHA 3.47.

3.10.7 The licensee records the best estimate of the dose resulting from the planned special exposure in the individual's record and informs the individual, in writing, of the dose within 30 days from the date of the planned special exposure. The dose from planned special exposures is not to be considered in controlling future occupational dose of the individual under RHA 3.5.1 but is to be included in evaluations required by RHA 3.10.4 and 3.10.5.

RHA 3.11. Occupational Dose Limits for Minors.

The annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adult workers in RHA 3.5.

RHA 3.12. Dose to an Embryo/Fetus.

3.12.1 The licensee shall ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). (For recordkeeping requirements, see RHA 3.39)

3.12.2 The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph 3.12.1 of this section.

3.12.3 The dose equivalent to the embryo/fetus is the sum of—

3.12.3.1 The deep-dose equivalent to the declared pregnant woman; and

3.12.3.2 The dose equivalent to the embryo/fetus resulting from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

3.12.4 If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with paragraph 3.12.1 of this section if the additional dose equivalent to the embryo/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

RHA 3.13. Dose Limits for Individual Members of the Public.

3.13.1 Each licensee shall conduct operations so that—

3.13.1.1 The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contribution from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released, under RHA 4.32, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with RHA 3.29, and

3.13.1.2 The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with RHA 4.8.12, does not exceed 0.002 rem (0.02 mSv) in any one hour.

3.13.2 If the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals.

3.13.3 Notwithstanding paragraph 3.13.1.1 of this section, a licensee may permit visitors to an individual who cannot be released, under RHA 4.32, to receive a radiation dose greater than 0.1 rem (1 mSv) if—

3.13.3.1 The radiation dose received does not exceed 0.5 rem (5 mSv); and

3.13.3.2 The authorized user, as defined in Part IV of these regulations, has determined before the visit that it is appropriate.

3.13.4 A licensee or license applicant may apply for prior Department authorization to operate up to an annual dose limit for an individual member of the public of 0.5 rem (5 mSv). The licensee or license applicant shall include the following information in this application:

3.13.4.1 Demonstration of the need for and the expected duration of operations in excess of the limit in paragraph 3.13.1 of this section;

3.13.4.2 The licensee's program to assess and control dose within the 0.5 rem (5 mSv) annual limit; and

3.13.4.3 The procedures to be followed to maintain the dose as low as is reasonably achievable.

3.13.5 In addition to the requirements of this part, a licensee subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR Part 190 shall comply with those standards.

3.13.6 The Department may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee may release in effluents in order to restrict the collective dose.

RHA 3.14. Compliance with Dose Limits for Individual Members of the Public.

3.14.1 The licensee shall make or cause to be made, as appropriate, surveys of radiation levels in unrestricted and controlled areas and radioactive materials in effluents released to unrestricted and controlled areas to demonstrate compliance with the dose limits for individual members of the public in RHA 3.13.

3.14.2 A licensee shall show compliance with the annual dose limit in RHA 3.13 by—

3.14.2.1 Demonstrating by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual dose limit; or

3.14.2.2 Demonstrating that—

3.14.2.2.1 The annual average concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in Table 2 of Appendix B, RHA 3.53 and

3.14.2.2.2 If an individual were continually present in an unrestricted area, the dose from external sources would not exceed 0.002 rem (0.02 mSv) in an hour and 0.05 rem (0.5 mSv) in a year.

3.14.3 Upon approval from the Department, the licensee may adjust the effluent concentration values in Appendix B, RHA 3.53 Table 2, for members of the public, to take into account the actual physical and chemical characteristics of the effluents (e.g., aerosol size distribution, solubility, density, radioactive decay equilibrium, chemical form).

RHA 3.16. Surveys and Monitoring.

3.16.1 Each licensee shall make or cause to be made, surveys of areas, including the subsurface, that—

3.16.1.1 May be necessary for the licensee to comply with the regulations in this part; and

3.16.1.2 Are reasonable under the circumstances to evaluate—

3.16.1.2.1 The magnitude and extent of radiation levels; and

3.16.1.2.2 Concentrations or quantities of residual radioactivity; and

3.16.1.2.3 The potential radiological hazards of the radiation levels and residual radioactivity detected.

3.16.2 Notwithstanding RHA 3.36.1, records from surveys describing the location and amount of subsurface residual radioactivity identified at the site must be kept with records important for decommissioning, and such records must be retained in accordance with RHA 1.15.13.

3.16.3 The licensee shall ensure that instruments and equipment used for quantitative radiation measurements (e.g., dose rate and effluent monitoring) are calibrated at least annually for the radiation measured.

3.16.4 All personnel dosimeters (except for direct and indirect reading pocket dosimeters and those dosimeters used to measure the dose to the extremities) that require processing to determine the radiation dose and that are used by licensees to comply with RHA 3.5, with other applicable provisions of this chapter, or with conditions specified in a license must be processed and evaluated by a dosimetry processor—

3.16.4.1 Holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology; and

3.16.4.2 Approved in this accreditation process for the type of radiation or radiations included in the NVLAP program that most closely approximates the type of radiation or radiations for which the individual wearing the dosimeter is monitored.

RHA 3.17. Conditions Requiring Individual Monitoring of External and Internal Occupational Dose.

Each licensee shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits of this part. As a minimum—

3.17.1 Each licensee shall monitor occupational exposure to radiation from licensed and unlicensed radiation sources under the control of the licensee and shall supply and require the use of individual monitoring devices by—

3.17.1.1 Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits in RHA 3.5.1,

3.17.1.2 Minors likely to receive, in 1 year from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv), a lens dose equivalent in excess of 0.15 rem (1.5 mSv), or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem (5 mSv);

3.17.1.3 Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem (1 mSv). (Note: All of the occupational doses in RHA 3.5 continue to be applicable to the declared pregnant worker as long as the embryo/fetus dose limit is not exceeded.)

3.17.1.4 Individuals entering a high or very high radiation area.

3.17.2 Each licensee shall monitor (see RHA 3.8) the occupational intake of radioactive material by and assess the committed effective dose equivalent to—

3.17.2.1 Adults likely to receive, in 1 year, an intake in excess of 10 percent of the applicable ALI(s) in Table 1, Columns 1 and 2, of Appendix B, RHA 3.53;

3.17.2.2 Minors likely to receive, in 1 year, a committed effective dose equivalent in excess of 0.1 rem (1 mSv); and

3.17.2.3 Declared pregnant women likely to receive, during the entire pregnancy, a committed effective dose equivalent in excess of 0.1 rem (1 mSv).

RHA 3.18. Control of Exposure from External Sources in Restricted Areas.

3.18.1 CONTROL OF ACCESS TO HIGH RADIATION AREAS.

3.18.1.1 The licensee shall ensure that each entrance or access point to a high radiation area has one or more of the following features—

3.18.1.1.1 A control device that, upon entry into the area, causes the level of radiation to be reduced below that level at which an individual might receive a deep-dose equivalent of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates;

3.18.1.1.2 A control device that energizes a conspicuous visible or audible alarm signal so that the individual entering the high radiation area and the supervisor of the activity are made aware of the entry; or

3.18.1.1.3 Entryways that are locked, except during periods when access to the areas is required, with positive control over each individual entry.

3.18.1.2 In place of the controls required by paragraph 3.18.1.1 of this section for a high radiation area, the licensee may substitute continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

3.18.1.3 A licensee may apply to the Department for approval of alternative methods for controlling access to high radiation areas.

3.18.1.4 The licensee shall establish the controls required by paragraphs 3.18.1.1 and 3.18.1.3 of this section in a way that does not prevent individuals from leaving a high radiation area.

3.18.1.5 Control is not required for each entrance or access point to a room or other area that is a high radiation area solely because of the presence of radioactive materials prepared for transport and packaged and labeled in accordance with the regulations of the Department of Transportation provided that—

3.18.1.5.1 The packages do not remain in the area longer than 3 days; and

3.18.1.5.2 The dose rate at 1 meter from the external surface of any package does not exceed 0.01 rem (0.1 mSv) per hour.

3.18.1.6 Control of entrance or access to rooms or other areas in hospitals is not required solely because of the presence of patients containing radioactive material, provided that there are personnel in attendance who will take the necessary precautions to prevent the exposure of individuals to radiation or radioactive material in excess of the limits established in this part and to operate within the ALARA provisions of the licensee’s radiation protection program.

3.18.2 CONTROL OF ACCESS TO VERY HIGH RADIATION AREAS.

In addition to the requirements in 3.18.1, the licensee shall institute additional measures to ensure that an individual is not able to gain unauthorized or inadvertent access to areas in which radiation levels could be encountered at 500 rads (5 grays) or more in 1 hour at 1 meter from a radiation source or any surface through which the radiation penetrates.

3.18.3 [3.18.3-3.18.3.3 Reserved]

RHA 3.19. Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas.

3.19.1 USE OF PROCESS OR OTHER ENGINEERING CONTROLS.

3.19.1.1 The licensee shall use, to the extent practical, process or other engineering controls (e.g., containment, decontamination or ventilation) to control the concentrations of radioactive material in air.

3.19.2 USE OF OTHER CONTROLS.

When it is not practical to apply process or other engineering controls to control the concentrations of radioactive material in air to values below those that define an airborne radioactivity area, the licensee shall, consistent with maintaining the total effective dose equivalent ALARA, increase monitoring and limit intakes by one or more of the following means:

3.19.2.1 Control of access;

3.19.2.2 Limitation of exposure times;

3.19.2.3 Use of respiratory protection equipment; or

3.19.2.4 Other controls.

If the licensee performs an ALARA analysis to determine whether or not respirators should be used, the licensee may consider safety factors other than radiological factors. The licensee should also consider the impact of respirator use on workers' industrial health and safety.

3.19.3 USE OF INDIVIDUAL RESPIRATORY PROTECTION EQUIPMENT.

3.19.3.1 If the licensee uses respiratory protection equipment to limit intakes pursuant to 3.19.2—

3.19.3.1.1 The licensee shall use only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health (NIOSH), except as otherwise noted in this regulation.

3.19.3.1.2 If the licensee wishes to use equipment that has not been tested or certified by NIOSH or for which there is no schedule for testing or certification, the licensee shall submit an application for authorized use of that equipment, except as provided in this regulation, including a demonstration by testing, or a demonstration on the basis of reliable test information, that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use.

3.19.3.1.3 The licensee shall implement and maintain a respiratory protection program that includes—

3.19.3.1.3.1 Air sampling sufficient to identify the potential hazard, permit proper equipment selection, and estimate doses;

3.19.3.1.3.2 Surveys and bioassays, as appropriate, to evaluate actual intakes;

3.19.3.1.3.3 Testing of respirators for operability (user seal check for face sealing devices and functional check for others) immediately prior to each use;

3.19.3.1.3.4 Written procedures regarding selection, fitting, issuance, maintenance, and testing of respirators, including testing for operability immediately prior to each use; supervision and training of personnel; breathing air quality; storage; inventory and control; repair; quality assurance of respiratory protection equipment; limitations on periods of respirator use and relief from respirator use; monitoring, including air sampling and bioassays; and recordkeeping; and

3.19.3.1.3.5 Determination by a physician prior to initial fitting of face sealing respirators or before the first field use of non-face sealing respirators, and either every 12 months thereafter or periodically at a frequency determined by a physician, that the individual user is medically fit to use the respiratory protection equipment.

3.19.3.1.3.6 Fit testing, with fit factor ⩾10 times the APF for negative pressure devices, and a fit factor ⩾500 for any positive pressure, continuous flow, and pressure-demand devices, before the first field use of tight fitting, face-sealing respirators and periodically thereafter at a frequency not to exceed 1 year. Fit testing must be performed with the facepiece operating in the negative pressure mode.

3.19.3.1.4 The licensee shall advise each respirator user that the user may leave the area at any time for relief from respirator use in the event of equipment malfunction, physical or psychological distress, procedural or communication failure, significant deterioration of operating conditions, or any other conditions that might require such relief.

3.19.3.1.5 The licensee shall use equipment within limitations for type and mode of use and shall provide proper visual, communication, and other special capabilities (such as low temperature work environments) when needed. The licensee shall also provide for the concurrent use of other safety or radiological protection equipment. The licensee shall use equipment in such a way as not to interfere with the proper operation of the respirator.

3.19.3.1.6 Standby rescue persons are required whenever one-piece atmosphere-supplying suits, or any combination of supplied air respiratory protection device and personnel protective equipment are used from which an unaided individual would have difficulty extricating himself or herself. The standby persons must be equipped with respiratory protection devices or other apparatus appropriate for the potential hazards. The standby rescue persons shall observe or otherwise maintain continuous communication with the workers (visual, voice, signal line, telephone, radio, or other suitable means), and be immediately available to assist them in case of a failure of the air supply or for any other reason that requires relief from distress. A sufficient number of standby rescue persons must be immediately available to assist all users of this type of equipment and to provide effective emergency rescue if needed.

3.19.3.1.7 Atmosphere-supplying respirators must be supplied with respirable air of grade D quality or better as defined by the Compressed Gas Association in publication G-7.1, "Commodity Specification for Air," 1997 and included in the regulations of the Occupational Safety and Health Administration (29 CFR 1910.134 (i) (1) (ii) (A) through (E)). Grade D quality air criteria include:

(1) Oxygen content (v/v) of 19.5-23.5%;

(2) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

(3) Carbon monoxide (CO) content of 10 ppm or less;

(4) Carbon dioxide content of 1,000 ppm or less; and

(5) Lack of noticeable odor.

3.19.3.1.8 The licensee shall ensure that no objects, materials or substances, such as facial hair, or any conditions that interfere with the face—facepiece seal or valve function, and that are under the control of the respirator wearer, are present between the skin of the wearer's face and the sealing surface of a tight-fitting respirator facepiece.

3.19.3.2 In estimating the dose to individuals from intake of airborne radioactive materials, the concentration of radioactive material in the air that is inhaled when respirators are worn is initially assumed to be the ambient concentration in air without respiratory protection, divided by the assigned protection factor. If the dose is later found to be greater than the estimated dose, the corrected value must be used. If the dose is later found to be less than the estimated dose, the corrected value may be used.

3.19.4 Further restrictions on the use of respiratory protection equipment.

The Department may impose restrictions in addition to those in 3.19.2, 3.19.3 and Appendix A, RHA 3.52 to—

3.19.4.1 Ensure that the respiratory protection program of the licensee is adequate to limit doses to individuals from intakes of airborne radioactive materials consistent with maintaining total effective dose equivalent ALARA; and

3.19.4.2 Limit the extent to which a licensee may use respiratory protection equipment instead of process or other engineering controls.

3.19.5 Application for use of higher assigned protection factors.

The licensee shall obtain authorization from the Department before using assigned protection factors in excess of those specified in Appendix A, RHA 3.52. The Department may authorize a licensee to use higher assigned protection factors on receipt of an application that—

3.19.5.1 Describes the situation for which a need exists for higher protection factors; and

3.19.5.2 Demonstrates that the respiratory protection equipment provides these higher protection factors under the proposed conditions of use.

RHA 3.20. Storage and Control of Licensed Material.

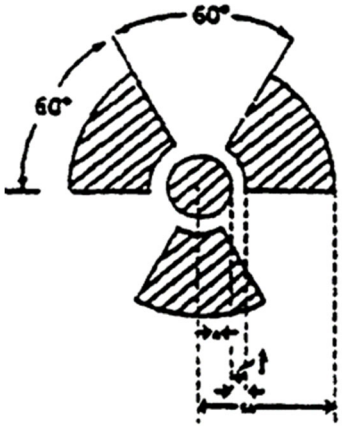
3.20.1 Security of stored material. The licensee shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas.

3.20.2 Control of material not in storage. The licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

RHA 3.21. Caution Signs.

3.21.1 Standard radiation symbol. Unless otherwise authorized by the Department, the symbol prescribed by this part shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed by this part is the three-bladed design:

RADIATION SYMBOL



3.21.1.1 Cross-hatched area is to be magenta, or purple, or black, and

3.21.1.2 The background is to be yellow.

3.21.1.2.1 Exception to color requirements for standard radiation symbol. Notwithstanding the requirements of paragraph 3.21.1 of this section, licensees are authorized to label sources, source holders, or device components containing sources of licensed materials that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without a color requirement.

3.21.1.2.2 Additional information on signs and labels. In addition to the contents of signs and labels prescribed in this part, the licensee may provide, on or near the required signs and labels, additional information, as appropriate, to make individuals aware of potential radiation exposures and to minimize the exposures.

RHA 3.22. Posting Requirements.

3.22.1 Posting of radiation areas. The licensee shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words “CAUTION, RADIATION AREA.”

3.22.2 Posting of high radiation areas. The licensee shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words “CAUTION, HIGH RADIATION AREA” or “DANGER, HIGH RADIATION AREA.”

3.22.3 Posting of very high radiation areas. The licensee shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words “GRAVE DANGER, VERY HIGH RADIATION AREA.”

3.22.4 Posting of airborne radioactivity areas. The licensee shall post each airborne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words “CAUTION, AIRBORNE RADIOACTIVITY AREA” or “DANGER, AIRBORNE RADIOACTIVITY AREA.”

3.22.5 Posting of areas or rooms in which licensed material is used or stored. The licensee shall post each area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in Appendix C, RHA 3.54 with a conspicuous sign or signs bearing the radiation symbol and the words “CAUTION, RADIOACTIVE MATERIAL(S)” or “DANGER, RADIOACTIVE MATERIAL(S).”

RHA 3.23. Exceptions to Posting Requirements.

3.23.1 A licensee is not required to post caution signs in areas or rooms containing radioactive materials for periods of less than 8 hours, if each of the following conditions is met:

3.23.1.1 The materials are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to radiation or radioactive materials in excess of the limits established in this part; and

3.23.1.2 The area or room is subject to the licensee’s control.

3.23.2 Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to RHA 3.22 provided that the patient could be released from licensee control pursuant to RHA 4.8.12.

3.23.3 A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level at 30 centimeters from the surface of the source container or housing does not exceed 0.005 rem (0.05 mSv) per hour.

3.23.4 Rooms in hospitals or clinics that are used for teletherapy are exempt from the requirement to post caution signs under RHA 3.22 if—

3.23.4.1 Access to the room is controlled pursuant to RHA 4.14.6; and

3.23.4.2 Personnel in attendance take necessary precautions to prevent the inadvertent exposure of workers, other patients, and members of the public to radiation in excess of the limits established in this part.

RHA 3.24. Labeling Containers.

3.24.1 The licensee shall ensure that each container of licensed material bears a durable, clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The label must also provide sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

3.24.2 Each licensee shall, prior to removal or disposal of empty uncontaminated containers to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

RHA 3.25. Exemptions to Labeling Requirements.

A licensee is not required to label—

3.25.1 Containers holding licensed material in quantities less than the quantities listed in Appendix C, RHA 3.54; or

3.25.2 Containers holding licensed material in concentrations less than those specified in Table 3 of Appendix B, RHA 3.53 or

3.25.3 Containers attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established by this part; or

3.25.4 Containers when they are in transport and packaged and labeled in accordance with the regulations of the Department of Transportation[3], or

3.25.5 Containers that are accessible only to individuals authorized to handle or use them, or to work in the vicinity of the containers, if the contents are identified to these individuals by a readily available written record (examples of containers of this type are containers in locations such as water-filled canals, storage vaults, or hot cells). The record must be retained as long as the containers are in use for the purpose indicated on the record; or

3.25.6 Installed manufacturing or process equipment, such as reactor components, piping, and tanks.

[3]Labeling of packages containing radioactive materials is required by the Department of Transportation (DOT) if the amount and type of radioactive material exceeds the limits for an excepted quantity or article as defined and limited by DOT regulations 49 CFR 173.403 (m) and (w) and 173.421-424.

RHA 3.26. Procedures for Receiving and Opening Packages.

3.26.1 Each licensee who expects to receive a package containing quantities of radioactive material in excess of a Type A quantity, as defined in RHA 3.2.43 and Appendix A, 10 CFR Part 71, shall make arrangements to receive—

3.26.1.1 The package when the carrier offers it for delivery; or

3.26.1.2 Notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

3.26.2 Each licensee shall—

3.26.2.1 Monitor the external surfaces of a labeled[3a] package for radioactive contamination unless the package contains only radioactive material in the form of a gas or in special form as defined in 10 CFR 71.4;

3.26.2.2 Monitor the external surfaces of a labeled[3a] package for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the Type A quantity, as defined in RHA 3.2.43, and Appendix A, 10 CFR Part 71[3b]; and

3.26.2.3 Monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or damaged.

3.26.3 The licensee shall perform the monitoring required by paragraph 3.26.2 of this section as soon as practicable after receipt of the package, but not later than 3 hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours, or not later than 3 hours from the beginning of the next working day if it is received after working hours.

3.26.4 The licensee shall immediately notify the final delivery carrier and the S.C. Department of Health & Environmental Control, Bureau of Land and Waste Management, (803-545-4400) or (888-481-0125) by telephone, when:

3.26.4.1 Removable radioactive surface contamination exceeds the limits of 10 CFR 71.87(i) or

3.26.4.2 External radiation levels exceed the limits of 10 CFR 71.47.

3.26.5 Each licensee shall—

3.26.5.1 Establish, maintain, and retain written procedures for safely opening packages in which radioactive material is received; and

3.26.5.2 Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

3.26.6 Licensees transferring special form sources in licensee-owned or licensee-operated vehicles to and from a work site are exempt from the contamination monitoring requirements of paragraph 3.26.2 of this section, but are not exempt from the survey requirement in paragraph 3.26.2 of this section for measuring radiation levels that is required to ensure that the source is still properly lodged in its shield.

[3a]Labeled with a Radioactive White I, Yellow II, or Yellow III label as specified in U.S. Department of Transportation regulations, 49 CFR 172.403 and 172.438-440.

[3b]A copy of 10 CFR Part 71 may be obtained from the Superintendent of Documents, Government Printing Office, Washington, DC 20402 (Telephone 202-512-1800).

RHA 3.27. Waste Disposal - General Requirements.

3.27.1 A licensee shall dispose of licensed material only—

3.27.1.1 By transfer to an authorized recipient as provided in RHA 3.32 or in the regulations in Parts II and VII; or

3.27.1.2 By decay in storage; or

3.27.1.3 By release in effluents within the limits in RHA 3.13 or

3.27.1.4 As authorized under RHA 3.28, 3.29, 3.30, or 3.31.

3.27.2 A person must be specifically licensed to receive waste containing licensed material from other persons for:

3.27.2.1 Treatment prior to disposal; or

3.27.2.2 Treatment or disposal by incineration; or

3.27.2.3 Decay in storage; or

3.27.2.4 Disposal at a land disposal facility licensed under Part VII of these regulations.

RHA 3.28. Method for Obtaining Approval of Proposed Disposal Procedures.

A licensee or applicant for a license may apply to the Department for approval of proposed procedures, not otherwise authorized in the regulations in this chapter, to dispose of licensed material generated in the licensee's activities. Each application shall include:

3.28.1 A description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal; and

3.28.2 An analysis and evaluation of pertinent information on the nature of the environment; and

3.28.3 The nature and location of other potentially affected licensed and unlicensed facilities; and

3.28.4 Analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this part.

RHA 3.29. Disposal by Release into Sanitary Sewerage.

3.29.1 A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:

3.29.1.1 The material is readily soluble (or is readily dispersible biological material) in water; and

3.29.1.2 The quantity of licensed or other radioactive material that the licensee releases into the sewer in 1 month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in Table 3 of Appendix B, RHA 3.53 and

3.29.1.3 If more than one radionuclide is released, the following conditions must also be satisfied:

3.29.1.3.1 The licensee shall determine the fraction of the limit in Table 3 of Appendix B, RHA 3.53 represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee into the sewer by the concentration of that radionuclide listed in Table 3 of Appendix B, RHA 3.53 and

3.29.1.3.2 The sum of the fractions for each radionuclide required by paragraph 3.29.1.3.1 of this section does not exceed unity; and

3.29.1.4 The total quantity of licensed and other radioactive material that the licensee releases into the sanitary sewerage system in a year does not exceed 5 curies (185 GBq) of hydrogen-3, 1 curie (37 GBq) of carbon-14, and 1 curie (37 GBq) of all other radioactive materials combined.

3.29.2 Excreta from individuals undergoing medical diagnosis or therapy with radioactive material is not subject to the limitations contained in paragraph 3.29.1 of this section.

RHA 3.30. Treatment or Disposal by Incineration.

A licensee may treat or dispose of licensed material by incineration only in the amounts and forms specified in RHA 3.31 or as specifically approved by the Department pursuant to RHA 3.28.

RHA 3.31. Disposal of Specific Wastes and Certain Byproduct Material.

3.31.1 A licensee may dispose of the following licensed material as if it were not radioactive:

3.31.1.1 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of medium used for liquid scintillation counting; and

3.31.1.2 0.05 microcurie (1.85 kBq), or less, of hydrogen-3 or carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.

3.31.2 A licensee may not dispose of tissue under paragraph 3.31.1.2 of this section in a manner that would permit its use either as food for humans or as animal feed.

3.31.3 Licensed material as defined in paragraphs (3) and (4) of the definition of byproduct material set forth in RHA 1.2.6 may be disposed of in accordance with Part 3 of this Regulation, 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 authorized to dispose of such material, must meet the requirements of RHA 3.32.

3.31.4 A licensee may dispose of byproduct material, as defined in paragraphs (3) and (4) of the definition of byproduct material set forth in RHA 1.2.6, 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.

3.31.5 The licensee shall maintain records in accordance with RHA 3.41.

RHA 3.32. Transfer for Disposal and Manifests.

3.32.1 The requirements of this section and Appendix D, RHA 3.55 are designed to control transfers of low-level radioactive waste by any waste generator, waste collector, or waste processor, as defined in this part, who ship low-level waste either directly, or indirectly through a waste collector or waste processor, to a low-level waste land disposal facility (as defined in Part VII of these regulations), establish a manifest tracking system, and supplement existing requirements concerning transfers and recordkeeping for those wastes.

3.32.2 Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee in accordance with Section 3.55.1 of Appendix D, RHA 3.55.

3.32.3 Each shipment manifest must include a certification by the waste generator as specified in Section 3.55.2 of Appendix D, RHA 3.55.

3.32.4 Each person involved in the transfer for disposal and disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in Section 3.55.3 of Appendix D, RHA 3.55.

3.32.5 Any licensee shipping byproduct material as defined in paragraphs 3 and 4 of the definition of byproduct material set forth in RHA 1.2.6 intended for ultimate disposal at a land disposal facility licensed under Part 7 of this Regulation must document the information required on the NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee in accordance with Appendix D to this part.

RHA 3.33. Compliance with Environmental and Health Protection Regulations.

Nothing in this subpart relieves the licensee from complying with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of materials that may be disposed of under this subpart.

RHA 3.34. Records - General Provisions.

3.34.1 Each licensee shall use the units: curie, rad, rem, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this part.

3.34.2 In the records required by this part, the licensee may record quantities in SI units in parentheses following each of the units specified in RHA 3.34.1. However, all quantities must be recorded as stated in RHA 3.34.1.

3.34.3 Not withstanding the requirements of 3.34.1 of this section, when recording information on shipment manifests, as required in 3.32.2 information must be recorded in the International System of Units(SI) or in SI and units as specified in 3.34.1 of this section.

3.34.4 The licensee shall make a clear distinction among the quantities entered on the records required by this part (e.g., total effective dose equivalent, shallow-dose equivalent, lens dose equivalent, deep-dose equivalent, committed effective dose equivalent).

3.34.5 Prior to license termination, each licensee authorized to possess radioactive material with a half-life greater than 120 days or source material, in an unsealed form, shall forward the following records to the Department:

3.34.5.1 Records of disposal of licensed material made under RHA 3.28 thru 3.31; and

3.34.5.2 Records required by RHA 3.36.2.4.

3.34.6 If licensed activities are transferred or assigned in accordance with RHA 2.10.2, each licensee authorized to possess radioactive material with a half-life greater than 120 days or source material, in an unsealed form, shall transfer the following records to the new licensee and the new licensee will be responsible for maintaining these records until the license is terminated:

3.34.6.1 Records of disposal of licensed material made under RHA 3.28 thru 3.31; and

3.34.6.2 Records required by RHA 3.36.2.4.

3.34.7 Prior to license termination, each licensee shall forward the records required by RHA 1.15.13 to the Department.

RHA 3.35. Records of Radiation Protection Programs.

3.35.1 Each licensee shall maintain records of the radiation protection program, including:

3.35.1.1 The provisions of the program; and

3.35.1.2 Audits and other reviews of program content and implementation.

3.35.2 The licensee shall retain the records required by paragraph 3.35.1.1 of this section until the Department terminates each pertinent license requiring the record. The licensee shall retain the records required by paragraph 3.35.1.2 of this section for 3 years after the record is made.

RHA 3.36. Records of Surveys.

3.36.1 Each licensee shall maintain records showing the results of surveys and calibrations required by RHA 3.16 and 3.26.2. The licensee shall retain these records for 3 years after the record is made.

3.36.2 The licensee shall retain each of the following records until the Department terminates each pertinent license requiring the record:

3.36.2.1 Records of the results of surveys to determine the dose from external sources and used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents; and

3.36.2.2 Records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose; and

3.36.2.3 Records showing the results of air sampling, surveys, and bioassays required pursuant to RHA 3.19.3.1.3.1 and 3.19.3.1.3.2; and

3.36.2.4 Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.

RHA 3.37. Determination of Prior Occupational Dose.

3.37.1 For each individual who is likely to receive in a year, an occupational dose requiring monitoring pursuant to RHA 3.17, the licensee shall—

3.37.1.1 Determine the occupational radiation dose received during the current year; and

3.37.1.2 Attempt to obtain the records of lifetime cumulative occupational radiation dose.

3.37.2 Prior to permitting an individual to participate in a planned special exposure, the licensee shall determine—

3.37.2.1 The internal and external doses from all previous planned special exposures; and

3.37.2.2 All doses in excess of the limits (including doses received during accidents and emergencies) received during the lifetime of the individual.

3.37.3 In complying with the requirements of paragraph 3.37.1 of this section, a licensee may—

3.37.3.1 Accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most recent employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual may have received during the current year;

3.37.3.2 Accept, as the record of lifetime cumulative radiation dose, an up-to-date S.C. Form 4, or equivalent, signed by the individual and counter-signed by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer (if the individual is not employed by the licensee); and

3.37.3.3 Obtain reports of the individual's dose equivalent(s) from the most recent employer for work involving radiation exposure, or the individual's current employer (if the individual is not employed by the licensee) by telephone, telegram, electronic media, or letter. The licensee shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

3.37.4 The licensee shall record the exposure history, as required by paragraph 3.37.1 of this section, on S.C. Form 4, or other clear and legible record, of all the information required on that form.[4] The form or record must show each period in which the individual received occupational exposure to radiation or radioactive material and must be signed by the individual who received the exposure. For each period for which the licensee obtains reports, the licensee shall use the dose shown in the report in preparing S.C. Form 4. For any period in which the licensee does not obtain a report, the licensee shall place a notation on S.C. Form 4 indicating the periods of time for which data is not available.

3.37.5 If the licensee is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee shall assume—

3.37.5.1 In establishing administrative controls under 3.5.6 for the current year, that the allowable dose limit for the individual is reduced by 1.25 rems (12.5 mSv) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and

3.37.5.2 That the individual is not available for planned special exposures.

3.37.6 The licensee shall retain the records on S.C. Form 4 or equivalent until the Department terminates each pertinent license requiring this record. The licensee shall retain records used in preparing S.C. Form 4 for 3 years after the record is made.

RHA 3.38. Records of Planned Special Exposures.

3.38.1 For each use of the provisions of RHA 3.10 for planned special exposures, the licensee shall maintain records that describe—

3.38.1.1 The exceptional circumstances requiring the use of a planned special exposure; and

3.38.1.2 The name of the management official who authorized the planned special exposure and a copy of the signed authorization; and

3.38.1.3 What actions were necessary; and

3.38.1.4 Why the actions were necessary; and

3.38.1.5 How doses were maintained ALARA; and

3.38.1.6 What individual and collective doses were expected to result, and the doses actually received in the planned special exposure.

3.38.2 The licensee shall retain the records until the Department terminates each pertinent license requiring these records.

[4]Licensees are not required to reevaluate the separate external dose equivalents and internal committed dose equivalents or intakes of radionuclides assessed under the regulations in Part III in effect before January 1, 1994. Further, occupational exposure histories obtained and recorded on S.C. Form 4 before January 1, 1994, would not have included effective dose equivalent but may be used in the absence of specific information on the intake of radionuclides by the individual.

RHA 3.39. Records of Individual Monitoring Results.

3.39.1 Recordkeeping requirement. Each licensee shall maintain records of doses received by all individuals for whom monitoring was required pursuant to RHA 3.17, and records of doses received during planned special exposures, accidents, and emergency conditions. These records must include, when applicable—

3.39.1.1 The deep-dose equivalent to the whole body, lens dose equivalent, shallow-dose equivalent to the skin, and shallow-dose equivalent to the extremities; and

3.39.1.2 The estimated intake of radionuclides (see RHA 3.6); and

3.39.1.3 The committed effective dose equivalent assigned to the intake of radionuclides; and

3.39.1.4 The specific information used to assess the committed effective dose equivalent pursuant to RHA 3.8.1 and RHA 3.8.3, and when required by RHA 3.17, and

3.39.1.5 The total effective dose equivalent when required by RHA 3.6 and

3.39.1.6 The total of the deep-dose equivalent and the committed dose to the organ receiving the highest total dose.

3.39.2 Recordkeeping frequency. The licensee shall make entries of the records specified in paragraph 3.39.1 of this section at least annually.

3.39.3 Recordkeeping format. The licensee shall maintain the records specified in paragraph 3.39.1 of this section on S.C. Form 5, in accordance with the instructions for S.C. Form 5, or in clear and legible records containing all the information required by S.C. Form 5.

3.39.4 Privacy protection. The records required under this section should be protected from public disclosure because of their personal privacy nature. These records are protected by most State privacy laws.

3.39.5 The licensee shall maintain the records of dose to an embryo/fetus with the records of dose to the declared pregnant woman. The declaration of pregnancy shall also be kept on file, but may be maintained separately from the dose records.

3.39.6 The licensee shall retain each required form or record until the Department terminates each pertinent license requiring the record.

RHA 3.40. Records of Dose to Individual Members of the Public.

3.40.1 Each licensee shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public (see RHA 3.13).

3.40.2 The licensee shall retain the records required by paragraph 3.40.1 of this section until the Department terminates each pertinent license requiring the record.

RHA 3.41. Records of Waste Disposal.

3.41.1 Each licensee shall maintain records of the disposal of licensed materials made under RHA 3.28, 3.29, 3.30, 3.31 and disposal by burial in soil.

3.41.2 The licensee shall retain the records required by paragraph RHA 3.41.1 of this section until the Department terminates each pertinent license requiring the record. Requirements for disposition of these records, prior to license termination, are located in Section 3.34 for activities licensed under these parts.

RHA 3.42. Vacating Premises.

Before a licensee vacates any location which may have been contaminated by radioactive material as a result of the licensee's activities the licensee shall, not less than 30 days prior to such vacating, notify the Department in writing of intent to vacate. The licensee shall decontaminate or have decontaminated the location to a degree consistent with subsequent use as an unrestricted area, in accordance with Appendix F, RHA 3.57.

RHA 3.43. Form of Records.

Each record required by this part must be legible throughout the specified retention period. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of producing a clear copy throughout the required retention period. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, must include all pertinent information, such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

RHA 3.44. Reports of Theft or Loss of Licensed Material.

3.44.1 Telephone reports. Each licensee shall report by telephone to the S.C. Department of Health and Environmental Control, Bureau of Radiological Health, 2600 Bull Street, Columbia, S.C. 29201, as follows:

3.44.1.1 Immediately after its occurrence becomes known to the licensee, any lost, stolen, or missing licensed material in an aggregate quantity equal to or greater than 1,000 times the quantity specified in Appendix C RHA 3.55 under such circumstances that it appears to the licensee that an exposure could result to persons in unrestricted areas; or

3.44.1.2 Within 30 days after the occurrence of any lost, stolen, or missing licensed material becomes known to the licensee, all licensed material in a quantity greater than 10 times the quantity specified in Appendix C RHA 3.55 that is still missing at this time.

3.44.2 Reports must be made as follows:

3.44.2.1 Written reports. Each licensee required to make a report under paragraph 3.44.1 of this section shall, within 30 days after making the telephone report, make a written report setting forth the following information:

3.44.2.1.1 A description of the licensed material involved, including kind, quantity, and chemical and physical form; and

3.44.2.1.2 A description of the circumstances under which the loss or theft occurred; and

3.44.2.1.3 A statement of disposition, or probable disposition, of the licensed material involved; and

3.44.2.1.4 Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas; and

3.44.2.1.5 Actions that have been taken, or will be taken, to recover the material; and

3.44.2.1.6 Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

3.44.3 Subsequent to filing the written report, the licensee shall also report any additional substantive information on the loss or theft within 30 days after the licensee learns of such information.

3.44.4 The licensee shall prepare any report filed with the Department pursuant to this section so that names of individuals who may have received exposure to radiation are stated in a separate and detachable part of the report.

RHA 3.45. Notification of Incidents.

3.45.1 Immediate notification. Notwithstanding any other requirements for notification, each licensee shall immediately notify the S.C. Department of Health & Environmental Control, Bureau of Land and Waste Management, 2600 Bull Street, Columbia, SC 29201, by telephone (803-545-4400) and confirming letter of any event involving radioactive material possessed by the licensee that may have caused or threatens to cause any of the following conditions—

3.45.1.1 An individual to receive—

3.45.1.1.1 A total effective dose equivalent of 25 rems (0.25 Sv) or more;

3.45.1.1.2 A lens dose equivalent of 75 rems (0.75 Sv) or more;

3.45.1.1.3 A shallow-dose equivalent to the skin or extremities of 250 rads (2.5 Gy) or more; or

3.45.1.2 The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the occupational annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures).

3.45.2 Twenty-four hour notification. Each licensee shall, within 24 hours of discovery of the event, report any event involving loss of control of licensed material possessed by the licensee that may have caused, or threatens to cause, any of the following conditions:

3.45.2.1 An individual to receive, in a period of 24 hours—

3.45.2.1.1 A total effective dose equivalent exceeding 5 rems (0.05 Sv);

3.45.2.1.2 A lens dose equivalent exceeding 15 rems (0.15 Sv);

3.45.2.1.3 A shallow-dose equivalent to the skin or extremities exceeding 50 rems (0.5 Sv); or

3.45.2.2 The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures).

3.45.3 The licensee shall prepare any report filed with the Department pursuant to this section so that names of individuals who have received exposure to radiation or radioactive material are stated in a separate and detachable part of the report.

3.45.4 Licensees shall make the reports required by RHA 3.45.1 and 3.45.2 of this section by telephone to S.C. Department of Health & Environmental Control, Bureau of Land and Waste Management (803-545-4400 or 888-481-0125).

3.45.5 The provisions of this section do not include doses that result from planned special exposures, that are within the limits for planned special exposures, and that are reported under RHA 3.47.

RHA 3.46. Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Limits.

3.46.1 Reportable events. In addition to the notification required by RHA 3.45, each licensee shall submit a written report within 30 days after learning of any of the following occurrences:

3.46.1.1 Any incident for which notification is required by RHA 3.45; or

3.46.1.2 Doses in excess of any of the following:

3.46.1.2.1 The occupational dose limits for adults in RHA 3.5; or

3.46.1.2.2 The occupational dose limits for a minor in RHA 3.11; or

3.46.1.2.3 The limits for an embryo/fetus of a declared pregnant woman in RHA 3.12; or

3.46.1.2.4 The limits for an individual member of the public in RHA 3.13; or

3.46.1.2.5 Any applicable limit in the license; or

3.46.1.2.6 The ALARA constraints for air emissions established under RHA 3.4.4; or

3.46.1.3 Levels of radiation or concentrations of radioactive material in—

3.46.1.3.1 A restricted area in excess of any applicable limit in the license; or

3.46.1.3.2 An unrestricted area in excess of 10 times any applicable limit set forth in this part or in the license (whether or not involving exposure of any individual in excess of the limits in RHA 3.13);

3.46.2 Contents of reports. Each report required by paragraph 3.46.1 of this section must describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:

3.46.2.1 Estimates of each individual's dose; and

3.46.2.2 The levels of radiation and concentrations of radioactive material involved; and

3.46.2.3 The cause of the elevated exposures, dose rates, or concentrations; and

3.46.2.4 Corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards, and associated license conditions.

3.46.3 Each report filed pursuant to paragraph RHA 3.46.1 of this section must include for each occupationally overexposed[5] individual: the name, Social Security account number, and date of birth. The report must be prepared so that this information is stated in a separate and detachable part of the report.

3.46.4 All licensees, who make reports under paragraph 3.46.1 of this section shall submit the report in writing to the S.C. Department of Health & Environmental Control, Bureau of Radiological Health, 2600 Bull Street, Columbia, SC.

RHA 3.47. Reports of Planned Special Exposures.

The licensee shall submit a written report to S.C. Department of Health & Environmental Control, Bureau of Radiological Health, 2600 Bull Street, Columbia, SC 29201 within 30 days following any planned special exposure conducted in accordance with RHA 3.10, informing the Department that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by RHA 3.38.

RHA 3.48. Reports to Individuals of Exceeding Dose Limits.

When a licensee is required, pursuant to the provisions of RHA 3.46, 3.47, and 3.49, to report to the Department any exposure of an identified occupationally exposed individual, or an identified member of the public, to radiation or radioactive material, the licensee shall also provide the individual a report on his or her exposure data included in the report to the Department. This report must be transmitted at a time no later than the transmittal to the Department.

[5]With respect to the limit for the embryo-fetus (RHA 3.12), the identifiers should be those of the declared pregnant woman.

RHA 3.49. Reports of Individual Monitoring.

3.49.1 This section applies to each person licensed by the Department to—

3.49.1.1 Possess or use radioactive material for purposes of industrial radiography pursuant to Part V of these regulation; or

3.49.1.2 Receive radioactive waste from other persons for disposal under Part VII of these regulations; or

3.49.1.3 Possess or use at any time, for processing or manufacturing for distribution pursuant to Parts II or IV, of these regulations, radioactive material in quantities exceeding any one of the following quantities:

Radionuclide	Quantity of Radionuclide[1] in curies
Cesium-137	1
Cobalt-60	1
Gold-198	100
Iodine-131	1
Iridium-192	10
Krypton-85	1,000
Promethium-147	10
Technetium-99m	1,000

[1] The Department may require as a license condition, or by rule, regulation, or order pursuant to RHA 3.52, reports from licensees who are licensed to use radionuclides not on this list, in quantities sufficient to cause comparable radiation levels.

3.49.2 Each licensee in a category listed in paragraph 3.49.1 of this section shall submit an annual report of the results of individual monitoring carried out by the licensee for each individual for whom monitoring was required by RHA 3.17 during that year. The licensee may include additional data for individuals for whom monitoring was provided but not required. The licensee shall use S.C. Form 5 or electronic media containing all the information required by Form S.C. Form 5.

3.49.3 The licensee shall file the report required by 3.49.2, covering the preceding year, on or before April 30 of each year. The licensee shall submit the report to S.C. Department of Health & Environmental Control, Bureau of Radiological Health, 2600 Bull Street, Columbia, SC, 29201.

RHA 3.50. Applications for Exemptions.

The Department may, upon application by a licensee or upon its own initiative, grant an exemption from the requirements of the regulations in this part if it determines the exemption is authorized by law and would not result in undue hazard to life or property.

RHA 3.51. Additional Requirements.

The Department may, by rule, regulation, or order, impose requirements on a licensee, in addition to those established in the regulations in this part, as it deems appropriate or necessary to protect health or to minimize danger to life or property.

RHA 3.52. [Appendix A] Protection Factors for Respirators.

APPENDIX A-RHA 3.52 PROTECTION FACTORS FOR RESPIRATORS[a]			
		Operating Mode	Assigned Protection Factors
I.	Air Purifying Respirators (Particulate[b] only)[c]		
	Filtering facepiece disposable[d]	Negative Pressure	([d])
	Facepiece, half[e]	Negative Pressure	10
	Facepiece, full	Negative Pressure	100
	Facepiece, half	Powered air-purifying respirators	50
	Facepiece, full	Powered air-purifying respirators	1000
	Helmet/hood	Powered air-purifying respirators	1000
	Facepiece, loose-fitting	Powered air-purifying respirators	25
II.	Atmosphere supplying respirators (particulate, gases and vapors[f])		
	1. Air-line respirator:		
	Facepiece, half	Demand	10
	Facepiece, half	Continuous Flow	50
	Facepiece, half	Pressure Demand	50
	Facepiece, full	Demand	100
	Facepiece, full	Continuous Flow	1000
	Facepiece, full	Pressure Demand	1000
	Helmet/hood	Continuous Flow	1000
	Facepiece, loose-fitting	Continuous Flow	25
	Suit	Continuous Flow	([g])
	2. Self-contained breathing Apparatus (SCBA):		
	Facepiece, full	Demand	[h]100
	Facepiece, full	Pressure Demand	[i]10,000
	Facepiece, full Demand,	Recirculating	[h]100
	Facepiece, full	Positive Pressure Recirculating	[i]10,000
III.	Combination Respirators		
	Any combination of air-purifying and atmosphere-supplying respirators	(1) Assigned protection factor for type and mode of operation as listed above.	

[a]These assigned protection factors apply only in a respiratory protection program that meets the requirements of this Part. They are applicable only to airborne radiological hazards and may not be appropriate to circumstances when chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. Selection and use of respirators for such circumstances must also comply with Department of Labor regulations.

Radioactive contaminants for which the concentration values in Table 1, Column 3 of Appendix B, RHA 3.53 are based on internal dose due to inhalation may, in addition, present external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.

[b]Air purifying respirators with APF <100 must be equipped with particulate filters that are at least 95 percent efficient. Air purifying respirator's with APF = 100 must be equipped with particulate filters that

are at least 99 percent efficient. Air purifying respirators with APFs <100 must be equipped with particulate filters that are at least 99.97 percent efficient.

[c]The licensee may apply to the Department for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine).

[d]Licensees may permit individuals to use this type of respirator who have not been medically screened or fit tested on the device provided that no credit be taken for their use in estimating intake or dose. It is also recognized that it is difficult to perform an effective positive or negative pressure pre-use user seal check on this type of device. All other respiratory protection program requirements listed in RHA 3.19.3 apply. An assigned protection factor has not been assigned for these devices. However, an APF equal to 10 may be used if the licensee can demonstrate a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.

[e]Under-chin type only. No distinction is made in this Appendix between elastomeric half-masks with replaceable cartridges and those designed with the filter medium as an integral part of the facepiece (e.g., disposable or reusable disposable). Both types are acceptable so long as the seal area of the latter contains some substantial type of seal-enhancing material such as rubber or plastic, the two or more suspension straps are adjustable, the filter medium is at least 95 percent efficient and all other requirements of this Part are met.

[f]The assigned protection factors for gases and vapors are not applicable to radioactive contaminants that present an absorption or submersion hazard. For tritium oxide vapor, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of 3 is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide. Exposure to radioactive noble gases is not considered a significant respiratory hazard, and protective actions for these contaminants should be based on external (submersion) dose considerations.

[g]No NIOSH approval schedule is currently available for atmosphere supplying suits. This equipment may be used in an acceptable respiratory protection program as long as all the other minimum program requirements, with the exception of fit testing, are met (i.e., RHA 3.19.3).

[h]The licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health (IDLH).

[i]This type of respirator may be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure such as skin absorption shall be taken into account in these circumstances. This device may not be used by any individual who experiences perceptible outward leakage of breathing gas while wearing the device.

RHA 3.53. [Appendix B] Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage.

Introduction

For each radionuclide, Table 1 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 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 halftimes for 0 of less than 10 days, for W from 10 to 100 days, and for Y greater than 100 days. Table 2 provides concentration limits for airborne and liquid effluents released to the general environment. Table 3 provides concentration limits for discharges to sanitary sewer systems.

Note:

The values in Tables 1, 2, and 3 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 $6 \times 1O^{2}$ or 600, and 6E+0 represents 6×10^{0} or 6.

Table 1 "Occupational Values"

Note that the columns in Table 1 of this appendix captioned "Oral Ingestion ALI," "Inhalation ALI," and "DAC," are applicable to occupational exposure to radioactive material.

The ALIs in this appendix are the annual intakes of given radionuclide by "Reference Man" which would result in either (1) a committed effective dose equivalent of 5 rems (stochastic ALI) or (2) a committed dose equivalent of 50 rems 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 5 rems. The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, wT. 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 wT are listed under the definition of weighting factor in RHA 3.2. 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 wT = 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 parts 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 extremities (hands and forearms, feet and lower legs), skin, and lens of the eye are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

When an ALI is defined by the stochastic dose limit, this value alone, is given. When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tissue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. (Abbreviated organ or tissue designations are used: LLI wall = lower large intestine wall; St. wall = stomach wall; Blad wall = bladder wall; and Bone surf = bone surface.)

The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 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 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 (ALIns) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity (i.e., (intake (in Ci) of each radionuclide/ALIins) 1.0). If there is an external deep dose equivalent contribution of Hd then this sum must be less than 1 -(Hd/50) instead of being 1.0.

Note that the dose equivalents for extremities (hand and forearms, feet and lower legs), skin, and lens of the are are not considered in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

The derived air concentration (DAC) values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by: DAC = ALI(in Ci)/(2000 hours per working year × 60 minutes/hour × 2 × 10 ml per minute) = [ALI/2.4 × 10] Ci/ml, where 2 × 10 ml per minute is the volume of air breathed per minute at work by "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. Derived air concentrations 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 relate to exposure to the single radionuclide named, but also include contributions from the in-growth of any daughter radionuclide produced in the body by the 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 value 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 RHA 3.6). When an individual is exposed to radioactive materials which fall under several of the translocation classifications (i.e., Class D, Class W, or Class Y) of the same radionuclide, 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 2 "Effluent Concentrations"

The columns in Table 2 of this appendix captioned "Effluents," "Air," and "Water," are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of RHA 3.14. The concentration values given in Columns 1 and 2 of Table 2 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 0.05 rem (50 millirem or 0.5 millisieverts).

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 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 2. For this reason, the DAC and airborne effluent limits are not always proportional as was the case in Appendix A of Part III of the July 1990 edition of Radioactive Materials Regulation 61-63, Title A.

The air concentration values listed in Table 2, 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, 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 5-rem annual occupational dose limit to the 0.1-rem limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values (derived for adults) so that they are applicable to other age groups.

For those radionuclides for which submersion (external dose) is limiting, the occupational DAC in Table 1, 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 2 for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3 × 10. The factor of 7.3 × 10 (ml) includes the following components: the factors of 50 and 2 described above and a factor of 7.3 × 10 (ml) which is the annual water intake of "Reference Man."

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings (including occupational inhalation ALIs and DACs, air and water effluent concentrations and sewerage) require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknown mixture is defined when the presence of the 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 3 "Releases to Sewers"

The monthly average concentrations for release to sanitary sewers are applicable to the provisions in RHA 3.29. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3 × 10(ml). The factor of 7.3 × 10(ml) is composed of a factor of 7.3 × 10(ml), the annual water intake by "Reference Man," and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of 0.5 rem.

List of Elements

Name	Symbol	Atomic No.
Actinium	Ac	89
Aluminium	Al	13
Americium	Am	95
Antimony	Sb	51
Argon	Ar	18
Arsenic	As	33
Astatine	At	85
Barium	Ba	56
Berkelium	Bk	97
Beryllium	Be	4
Bismuth	Bi	83
Bromine	Br	35

List of Elements

Name	Symbol	Atomic No.
Cadmium	Cd	48
Calcium	Ca	20
Californium	Cf	98
Carbon	C	6
Cerium	Ce	58
Cesium	Cs	55
Chlorine	Cl	17
Chromium	Cr	24
Cobalt	Co	27
Copper	Cu	29
Curium	Cm	96
Dysprosium	Dy	66
Einsteinium	Es	99
Erbium	Er	68
Europium	Eu	63
Fermium	Fm	100
Fluorine	F	9
Francium	Fr	87
Gadolinium	Gd	64
Gallium	Ga	31
Germanium	Ge	32
Gold	Au	79
Hafnium	Hf	72
Holmium	Ho	67
Hydrogen	H	1
Indium	In	49
Iodine	I	53
Iridium	Ir	77
Iron	Fe	26
Krypton	Kr	36
Lanthanum	La	57
Lead	Pb	82
Lutetium	Lu	71
Magnesium	Mg	12
Manganese	Mn	25
Mendelevium	Md	101
Mercury	Hg	80
Molybdenum	Mo	42
Neodymium	Nd	60
Neptunium	Np	93
Nickel	Ni	28
Niobium	Nb	41
Nitrogen	N	7
Osmium	Os	76
Oxygen	O	8
Palladium	Pd	46

List of Elements

Name	Symbol	Atomic No.
Phosphorus	P	15
Platinum	Pt	78
Plutonium	Pu	94
Polonium	Po	84
Potassium	K	19
Praseodymium	Pr	59
Promethium	Pm	61
Protactinium	Pa	91
Radium	Ra	88
Radon	Rn	86
Rhenium	Re	75
Rhodium	Rh	45
Rubidium	Rb	37
Ruthenium	Ru	44
Samarium	Sm	62
Scandium	Sc	21
Selenium	Se	34
Silicon	Si	14
Silver	Ag	47
Sodium	Na	11
Strontium	Sr	38
Sulfur	S	16
Tantalum	Ta	73
Technetium	Tc	43
Tellurium	Te	52
Terbium	Tb	65
Thullium	Tl	81
Thorium	Th	90
Thulium	Tm	69
Tin	Sn	50
Titanium	Ti	22
Tungsten	W	74
Uranium	U	92
Vanadium	V	23
Xenon	Xe	54
Ytterbium	Yb	70
Yttrium	Y	39
Zinc	Zn	30
Zirconium	Zr	40

RHA 3.53 [Appendix B] Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage.

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/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+6	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	-	-
	(5E+4)	-	-	-	7E-4	7E-3	
	W, fluorides of Be,	-	9E+4	4E-5	1E-7	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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						
	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, & 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,& 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, & nitrates	-	3E+4	1E-5	5E-8	-	-
	Y, aluminosilicate glass	-	3E+4	1E-5	4E-8	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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	-	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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
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, & 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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	W, see ^{44}Ti	-	4E+4	1E-5	5E-8	-	-
	Y, see ^{44}Ti	-	3E+4	1E-5	4E-8	-	-
23 Vanadium-472	D, all compounds except those given for W	3E+4 St. wall (3E+4)	8E+4 -	3E-5 -	1E-7 -	- 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 LLI wall (9E+4)	3E+4 Bone surf (3E+4)	1E-5 -	- 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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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, & 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	-	-
	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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	8	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 St. wall	2E+5	7E-5	2E-7	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(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	-	-
	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 LLI wall (5E+2)	2E+3	7E-7	2E-9	-	-
			-	-	-	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 St. wall	9E+4	4E-5	1E-7	-	-

Atomic No.	Radionuclide	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
			(3E+4)	-	-	-	4E-4	4E-3
		W, sulfides, halides and nitrates	-	1E+5	5E-5	2E-7	-	-
		Y, oxides and hydroxides	-	1E+5	5E-5	2E-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 St. wall	2E+5	7E-5	2E-7	-	-

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Monthly Average Conc. (uCi/ml)
		(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
	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Monthly Average Conc. (uCi/ml)
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	5E-8	1E-4	1E-3
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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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}mBr	2E+4	7E+4	3E-5	1E-7	-	-
		St. wall (4E+4)	-	-	-	5E-4	5E-3
	W, see ^{74}mBr	-	8E+4	4E-5	1E-7	-	-
35 Bromine-75[2]	D, see ^{74}mBr	3E+4	5E+4	2E-5	7E-8	-	-
		St. wall (4E+4)	-	-	-	5E-4	5E-3
	W, see ^{74}mBr	-	5E+4	2E-5	7E-8	-	-
35 Bromine-76	D, see ^{74}mBr	4E+3	5E+3	2E-6	7E-9	5E-5	5E-4
	W, see ^{74}mBr	-	4E+3	2E-6	6E-9	-	-
35 Bromine-77	D, see ^{74}mBr	2E+4	2E+4	1E-5	3E-8	2E-4	2E-3
	W, see ^{74}mBr	-	2E+4	8E-6	3E-8	-	-
35 Bromine-80m	D, see ^{74}mBr	2E+4	2E+4	7E-6	2E-8	3E-4	3E-3
	W, see ^{74}mBr	-	1E+4	6E-6	2E-8	-	-
35 Bromine-80[2]	D, see ^{74}mBr	5E+4 St. wall	2E+5	8E-5	3E-7	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(9E+4)	-	-	-	1E-3	1E-2
	W, see ^{74}mBr	-	2E+5	9E-5	3E-7	-	-
35 Bromine-82	D, see ^{74}mBr	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
	W, see ^{74}mBr	-	4E+3	2E-6	5E-9	-	-
35 Bromine-83	D, see ^{74}mBr	5E+4	6E+4	3E-5	9E-8	-	-
		St. wall (7E+4)	-	-	-	9E-4	9E-3
	W, see ^{74}mBr	-	6E+4	3E-5	9E-8	-	-
35 Bromine-84[2]	D, see ^{74}mBr	2E+4	6E+4	2E-5	8E-8	-	-
		St. wall (3E+4)	-	-	-	4E-4	4E-3
	W, see ^{74}mBr	-	6E+4	3E-5	9E-8	-	-
36 Krypton-74[2]	Sumbersion[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	3E-6	-	-
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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		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
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 LLI	4E+2	2E-7	6E-10	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		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
	Y, see ^{80}Sr	-	4E+0	2E-9	6E-12	-	-
38 Strontium-91	D, see ^{80}Sr	2E+3	6E+3	2E-6	8E-9	2E-5	2E-4
	Y, see ^{80}Sr	-	4E+3	1E-6	5E-9	-	-
38 Strontium-92	D, see ^{80}Sr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
	Y, see ^{80}Sr	-	7E+3	3E-6	9E-9	-	-
39 Yttrium-86m[2]	W, all compounds except those given for Y	2E+4	6E+4	2E-5	8E-8	3E-4	3E-3

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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	-	-
39 Yttrium-90	W, see ^{86m}Y	4E+2	7E+2	3E-7	9E-10	-	-
		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
	Y, see ^{86m}Y	-	2E+5	7E-5	2E-7	-	-
39 Yttrium-91	W, see ^{86m}Y	5E+2	2E+2	7E-8	2E-10	-	-
		LLI wall (6E+2)	-	-	-	8E-6	8E-5
	Y, see ^{86m}Y	-	1E+2	5E-8	2E-10	-	-
39 Yttrium-92	W, see ^{86m}Y	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
	Y, see ^{86m}Y	-	8E+3	3E-6	1E-8	-	-
39 Yttrium-93	W, see ^{86m}Y	1E+3	3E+3	1E-6	4E-9	2E-5	2E-4
	Y, see ^{86m}Y	-	2E+3	1E-6	3E-9	-	-
39 Yttrium-94[2]	W, see ^{86m}Y	2E+4	8E+4	3E-5	1E-7	-	-
		St. wall (3E+4)	-	-	-	4E-4	4E-3

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	Y, see ^{86m}Y	-	8E+4	3E-5	1E-7	-	-
39 Yttrium-95[2]	W, see ^{86m}Y	4E+4	2E+5	6E-5	2E-7	-	-
		St. wall (5E+4)	-	-	-	7E-4	7E-3
	Y, see ^{86m}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	-	-
	Y, see ^{86}Zr	-	6E+1	2E-8	-	-	-
			Bone surf (7E+1)	-	9E-11	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
40 Zirconium-95	D, see ^{86}Zr	1E+3	1E+2	5E-8	-	2E-5	2E-4
		-	Bone surf (3E+2)	-	4E-10	-	-
	W, see ^{86}Zr	-	4E+2	2E-7	5E-10	-	-
	Y, see ^{86}Zr	-	3E+2	1E-7	4E-10	-	-
40 Zirconium-97	D, see ^{86}Zr	6E+2	2E+3	8E-7	3E-9	9E-6	9E-5
	W, see ^{86}Zr	-	1E+3	6E-7	2E-9	-	-
	Y, see ^{86}Zr	-	1E+3	5E-7	2E-9	-	-
41 Niobium-88[2]	W, all compounds except those given for Y	5E+4	2E+5	9E-5	3E-7	-	-
		St. wall (7E+4)	-	-	-	1E-3	1E-2
	Y, oxides and hydroxides	-	2E+5	9E-5	3E-7	-	-
41 Niobium-89m[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	-	-
		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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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, hydroxides, and MoS_2	2E+3	5E+3	2E-6	6E-9	-	-
42 Molybdenum-93m	D, see ^{90}Mo	9E+3	2E+4	7E-6	2E-8	-	-
	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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	-	-
	W, see ^{93m}Tc	-	1E+3	5E-7	2E-9	-	-

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
43 Technetium-97	D, see ^{93m}Tc	4E+4	5E+4	2E-5	7E-8	5E-4	5E-3
	W, see ^{93m}Tc	-	6E+3	2E-6	8E-9	-	-
43 Technetium-98	D, see ^{93m}Tc	1E+3	2E+3	7E-7	2E-9	1E-5	1E-4
	W, see ^{93m}Tc	-	3E+2	1E-7	4E-10	-	-
43 Technetium-99m	D, see ^{93m}Tc	8E+4	2E+5	6E-5	2E-7	1E-3	1E-2
	W, see ^{93m}Tc	-	2E+5	1E-4	3E-7	-	-
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, all 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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
44 Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5	3E-4
	W, see ^{94}Ru	-	1E+3	4E-7	1E-9	-	-
	Y, see ^{94}Ru	-	6E+2	3E-7	9E-10	-	-
44 Ruthenium-105	D, see ^{94}Ru	5E+3	1E+4	6E-6	2E-8	7E-5	7E-4
	W, see ^{94}Ru	-	1E+4	6E-6	2E-8	-	-
	Y, see ^{94}Ru	-	1E+4	5E-6	2E-8	-	-
44 Ruthenium-106	D, see ^{94}Ru	2E+2	9E+1	4E-8	1E-10	-	-
		LLI wall (2E+2)	-	-	-	3E-6	3E-5
	W, see ^{94}Ru	-	5E+1	2E-8	8E-11	-	-
	Y, see ^{94}Ru	-	1E+1	5E-9	2E-11	-	-
45 Rhodium-99m	D, all compounds except those given for W and Y	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
	W, halides	-	8E+4	3E-5	1E-7	-	-
	Y, oxides and hydroxides	-	7E+4	3E-5	9E-8	-	-
45 Rhodium-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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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	-	-
		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 ^{99}mRh	-	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	1E+3	1E+3	6E-7	2E-9	2E-5	2E-4

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	for W and Y						
	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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
	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	-	-
	Y, see ^{102}Ag	-	2E+5	8E-5	3E-7	-	-
47 Silver-108m	D, see ^{102}Ag	6E+2	2E+2	8E-8	3E-10	9E-6	9E-5
	W, see ^{102}Ag	-	3E+2	1E-7	4E-10	-	-
	Y, see ^{102}Ag	-	2E+1	1E-8	3E-11	-	-
47 Silver-110m	D, see ^{102}Ag	5E+2	1E+2	5E-8	2E-10	6E-6	6E-5
	W, see ^{102}Ag	-	2E+2	8E-8	3E-10	-	-
	Y, see ^{102}Ag	-	9E+1	4E-8	1E-10	-	-
47 Silver-111	D, see ^{102}Ag	9E+2	2E+3	6E-7	-	-	-
		LLI wall (1E+3)	Liver (2E+3)	-	2E-9	2E-5	2E-4

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	W, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
	Y, see ^{102}Ag	-	9E+2	4E-7	1E-9	-	-
47 Silver-112	D, see ^{102}Ag	3E+3	8E+3	3E-6	1E-8	4E-5	4E-4
	W, see ^{102}Ag	-	1E+4	4E-6	1E-8	-	-
	Y, see ^{102}Ag	-	9E+3	4E-6	1E-8	-	-
47 Silver-115[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	-	-
	Y, see ^{102}Ag	-	8E+4	3E-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	-	-	-
		Kidneys -	(1E+2)	-	2E-10	-	-
	Y, see ^{104}Cd	-	1E+2	5E-8	2E-10	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
48 Cadmium-113m	D, see ^{104}Cd	2E+1 Kidneys (4E+1)	2E+0 Kidneys (4E+0)	1E-9 -	- 5E-12	- 5E-7	- 5E-6
	W, see ^{104}Cd	- -	8E+0 Kidneys (1E+1)	4E-9 -	- 2E-11	- -	- -
	Y, see ^{104}Cd	-	1E+1	5E-9	2E-11	-	-
48 Cadmium-113	D, see ^{104}Cd	2E+1 Kidneys (3E+1)	2E+0 Kidneys (3E+0)	9E-10 -	- 5E-12	- 4E-7	- 4E-6
	W, see ^{104}Cd	- -	8E+0 Kidneys (1E+1)	3E-9 -	- 2E-11	- -	- -
	Y, see ^{104}Cd	-	1E+1	6E-9	2E-11	-	-
48 Cadmium-115m	D, see ^{104}Cd	3E+2 -	5E+1 Kidneys (8E+1)	2E-8 -	- 1E-10	4E-6 -	4E-5 -
	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 LLI wall (1E+3)	1E+3 -	6E-7 -	2E-9 -	- 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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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 109In	5E+3	2E+4	7E-6	2E-8	7E-5	7E-4
	W, see 109In	-	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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-119[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	-	-
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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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
	W, see ^{115}Sb	-	3E+5	1E-4	5E-7	-	-
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	4E-7	-	-
51 Antimony-118m	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		-	Thyroid (4E+4)	-	6E-8	-	-
52 Tellurium-116	D, all compounds except those given for W	8E+3	2E+4	9E-6	3E-8	1E-4	1E-3
	W, oxides, hydroxides, and nitrates	-	3E+4	1E-5	4E-8	-	-
52 Tellurium-121m	D, see ^{116}Te	5E+2 Bone surf (7E+2)	2E+2 Bone surf (4E+2)	8E-8 -	- 5E-10	- 1E-5	- 1E-4
	W, see ^{116}Te	-	4E+2	2E-7	6E-10	-	-
52 Tellurium-121	D, see ^{116}Te	3E+3	4E+3	2E-6	6E-9	4E-5	4E-4
	W, see ^{116}Te	-	3E+3	1E-6	4E-9	-	-
52 Tellurium-123m	D, see ^{116}Te	6E+2 Bone surf (1E+3)	2E+2 Bone surf (5E+2)	9E-8 -	- 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 Bone surf (1E+3)	2E+2 Bone surf (5E+2)	8E-8 -	- 7E-10	- 2E-5	- 2E-4
	W, see ^{116}Te	- -	4E+2 Bone surf (1E+3)	2E-7 -	- 2E-9	- -	- -
52 Tellurium-125m	D, see ^{116}Te	1E+3 Bone surf	4E+2 Bone surf	2E-7	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(1E+3)	(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
	W, see ^{116}Te	-	2E+4	7E-6	2E-8	-	-
52 Tellurium-129m	D, see ^{116}Te	5E+2	6E+2	3E-7	9E-10	7E-6	7E-5
	W, see ^{116}Te	-	2E+2	1E-7	3E-10	-	-
52 Tellurium-129[2]	D, see ^{116}Te	3E+4	6E+4	3E-5	9E-8	4E-4	4E-3
	W, see ^{116}Te	-	7E+4	3E-5	1E-7	-	-
52 Tellurium-131m	D, see ^{116}Te	3E+2 Thyroid	4E+2 Thyroid	2E-7	-	-	-
		(6E+2)	(1E+3)	-	2E-9	8E-6	8E-5
	W, see ^{116}Te	-	4E+2 Thyroid	2E-7	-	-	-
		-	4E+2 Thyroid	2E-7	-	-	-
		-	(9E+2)	-	1E-9	-	-
52 Tellurium-131[2]	D, see ^{116}Te	3E+3 Thyroid	5E+3 Thyroid	2E-6	-	-	-
		(6E+3)	(1E+4)	-	2E-8	8E-5	8E-4
	W, see ^{116}Te	-	5E+3 Thyroid	2E-6	-	-	-
		-	(1E+4)	-	2E-8	-	-
52 Tellurium-132	D, see ^{116}Te	2E+2 Thyroid	2E+2 Thyroid	9E-8	-	-	-

Atomic No.	Radionuclide	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
			(7E+2)	(8E+2)	-	1E-9	9E-6	9E-5
		W, see ^{116}Te	-	2E+2 Thyroid	9E-8	-	-	-
			-	(6E+2)	-	9E-10	-	-
52	Tellurium-133m[2]	D, see ^{116}Te	3E+3 Thyroid	5E+3 Thyroid	2E-6	-	-	-
			(6E+3)	(1E+4)	-	2E-8	9E-5	9E-4
		W, see ^{116}Te	-	5E+3 Thyroid	2E-6	-	-	-
			-	(1E+4)	-	2E-8	-	-
52	Tellurium-133[2]	D, see ^{116}Te	1E+4 Thyroid	2E+4 Thyroid	9E-6	-	-	-
			(3E+4)	(6E+4)	-	8E-8	4E-4	4E-3
		W, see ^{116}Te	-	2E+4 Thyroid	9E-6	-	-	-
			-	(6E+4)	-	8E-8	-	-
52	Tellurium-134[2]	D, see ^{116}Te	2E+4 Thyroid	2E+4 Thyroid	1E-5	-	-	-
			(2E+4)	(5E+4)	-	7E-8	3E-4	3E-3
		W, see ^{116}Te	-	2E+4 Thyroid	1E-5	-	-	-
			-	(5E+4)	-	7E-8	-	-
53	Iodine-120m[2]	D, all compounds	1E+4 Thyroid	2E+4	9E-6	3E-8	-	-
			(1E+4)	-	-	-	2E-4	2E-3
53	Iodine-120[2]	D, all compounds	4E+3 Thyroid	9E+3 Thyroid	4E-6	-	-	-
			(8E+3)	(1E+4)	-	2E-8	1E-4	1E-3
53	Iodine-121	D, all compounds	1E+4 Thyroid	2E+4 Thyroid	8E-6	-	-	-
			(3E+4)	(5E+4)	-	7E-8	4E-4	4E-3

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Monthly Average Conc. (uCi/ml)
53 Iodine-123	D, all compounds	3E+3 Thyroid (1E+4)	6E+3 Thyroid (2E+4)	3E-6 -	- 2E-8	- 1E-4	- 1E-3
53 Iodine-124	D, all compounds	5E+1 Thyroid (2E+2)	8E+1 Thyroid (3E+2)	3E-8 -	- 4E-10	- 2E-6	- 2E-5
53 Iodine-125	D, all compounds	4E+1 Thyroid (1E+2)	6E+1 Thyroid (2E+2)	3E-8 -	- 3E-10	- 2E-6	- 2E-5
53 Iodine-126	D, all compounds	2E+1 Thyroid (7E+1)	4E+1 Thyroid (1E+2)	1E-8 -	- 2E-10	- 1E-6	- 1E-5
53 Iodine-128[2]	D, all compounds	4E+4 St. wall (6E+4)	1E+5 -	5E-5 -	2E-7 -	- 8E-4	- 8E-3
53 Iodine-129	D, all compounds	5E+0 Thyroid (2E+1)	9E+0 Thyroid (3E+1)	4E-9 -	- 4E-11	- 2E-7	- 2E-6
53 Iodine-130	D, all compounds	4E+2 Thyroid (1E+3)	7E+2 Thyroid (2E+3)	3E-7 -	- 3E-9	- 2E-5	- 2E-4
53 Iodine-131	D, all compounds	3E+1 Thyroid (9E+1)	5E+1 Thyroid (2E+2)	2E-8 -	- 2E-10	- 1E-6	- 1E-5
53 Iodine-132m[2]	D, all compounds	4E+3 Thyroid (1E+4)	8E+3 Thyroid (2E+4)	4E-6 -	- 3E-8	- 1E-4	- 1E-3
53 Iodine-132	D, all compounds	4E+3 Thyroid (9E+3)	8E+3 Thyroid (1E+4	3E-6 -	- 2E-8	- 1E-4	- 1E-3

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
53 Iodine-133	D, all compounds	1E+2 Thyroid (5E+2)	3E+2 Thyroid (9E+2)	1E-7 -	1E-9	7E-6	7E-5
53 Iodine-134[2]	D, all compounds	2E+4 Thyroid (3E+4)	5E+4 -	2E-5 -	6E-8 -	4E-4	4E-3
53 Iodine-135	D, all compounds	8E+2 Thyroid (3E+3)	2E+3 Thyroid (4E+3)	7E-7 -	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	-	-
54 Xenon-135	Submersion[1]	-	-	1E-5	7E-8	-	-
54 Xenon-138[2]	Submersion[1]	-	-	4E-6	2E-8	-	-
54 Xenon-125[2]	D, all compounds	5E+4 St. wall	1E+5	6E-5	2E-7	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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-143[2]	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7	-	-
		St. wall (4E+4)	-	-	-	5E-4	5E-3
	W, see ^{131}La	-	9E+4	4E-5	1E-7	-	-
58 Cerium-134	W, all compounds except those given for Y	5E+2	7E+2	3E-7	1E-9	-	-
		LLI wall (6E+2)	-	-	-	8E-6	8E-5
	Y, oxides, hydroxides, and fluorides	-	7E+2	3E-7	9E-10	-	-
58 Cerium-135	W, see ^{134}Ce	2E+3	4E+3	2E-6	5E-9	2E-5	2E-4
	Y, see ^{134}Ce	-	4E+3	1E-6	5E-9	-	-
58 Cerium-137m	W, see ^{134}Ce	2E+3	4E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	3E-5	3E-4
	Y, see ^{134}Ce	-	4E+3	2E-6	5E-9	-	-
58 Cerium-137	W, see ^{134}Ce	5E+4	1E+5	6E-5	2E-7	7E-4	7E-3
	Y, see ^{134}Ce	-	1E+5	5E-5	2E-7	-	-
58 Cerium-139	W, see ^{134}Ce	5E+3	8E+2	3E-7	1E-9	7E-5	7E-4
	Y, see ^{134}Ce	-	7E+2	3E-7	9E-10	-	-

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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	Y, see ^{136}Pr	-	2E+3	8E-7	3E-9	-	-
59 Praseodymium-143	W, see ^{136}Pr	9E+2	8E+2	3E-7	1E-9	-	-
		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
	Y, see ^{136}Pr	-	1E+5	5E-5	2E-7	-	-
59 Praseodymium-145	W, see ^{136}Pr	3E+3	9E+3	4E-6	1E-8	4E-5	4E-4
	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-5	7E-4
	Y, see ^{141}Pm	-	1E+2	6E-8	2E-10	-	-
61 Promethium-148m	W, see ^{141}Pm	7E+2	3E+2	1E-7	4E-10	1E-5	1E-4
	Y, see ^{141}Pm	-	3E+2	1E-7	5E-10	-	-
61 Promethium-148	W, see ^{141}Pm	4E+2	5E+2	2E-7	8E-10	-	-
		LLI wall (5E+2)	-	-	-	7E-6	7E-5
	Y, see ^{141}Pm	-	5E+2	2E-7	7E-10	-	-
61 Promethium-149	W, see ^{141}Pm	1E+3	2E+3	8E-7	3E-9	-	-
		LLI wall (1E+3)	-	-	-	2E-5	2E-4
	Y, see ^{141}Pm	-	2E+3	8E-7	2E-9	-	-
61 Promethium-150	W, see ^{141}Pm	5E+3	2E+4	8E-6	3E-8	7E-5	7E-4
	Y, see ^{141}Pm	-	2E+4	7E-6	2E-8	-	-
61 Promethium-151	W, see ^{141}Pm	2E+3	4E+3	1E-6	5E-9	2E-5	2E-4
	Y, see ^{141}Pm	-	3E+3	1E-6	4E-9	-	-
62 Samarium-141m[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 Bone surf	4E-2 Bone surf	1E-11	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(3E+1)	(6E-2)	-	9E-14	3E-7	3E-6
62 Samarium-147	W, all compounds	2E+1 Bone surf	4E-2 Bone surf	2E-11	-	-	-
		(3E+1)	(7E-2)	-	1E-13	4E-7	4E-6
62 Samarium-151	W, all compounds	1E+4 LLI wall	1E+2 Bone surf	4E-8	-	-	-
		(1E+4)	(2E+2)	-	2E-10	2E-4	2E-3
62 Samarium-153	W, all compounds	2E+3 LLI wall	3E+3	1E-6	4E-9	-	-
		(2E+3)	-	-	-	3E-5	3E-4
62 Samarium-155[2]	W, all compounds	6E+4 St. wall	2E+5	9E-5	3E-7	-	-
		(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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
63 Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6	7E-5
63 Europium-155	W, all compounds	E+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	-	-
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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
65 Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5	8E-4
65 Terbium-156m (5.0h)	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4	2E-3
65 Terbium-156m (24.4h)	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

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
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	-	-
		St. wall (2E+5)	-	-	-	3E-3	3E-2
67 Holmium-166m	W, all compounds	6E+2	7E+0	3E-9	9E-12	9E-6	9E-5
67 Holmium-166	W, all compounds	9E+2	2E+3	7E-7	2E-9	-	-
		LLI wall (9E+2)	-	-	-	1E-5	1E-4
67 Holmium-167	W, all compounds	2E+4	6E+4	2E-5	8E-8	2E-4	2E-3
68 Erbium-161	W, all compounds	2E+4	6E+4	3E-5	9E-8	2E-4	2E-3
68 Erbium-165	W, all compounds	6E+4	2E+5	8E-5	3E-7	9E-4	9E-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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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
	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	-	-

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
70 Ytterbium-175	W, see ^{162}Yb	3E+3	4E+3	1E-6	5E-9	-	-
		LLI wall (3E+3)	-	-	-	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
	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 Bone surf	1E-7	-	7E-5	7E-4
		-	(5E+2)	-	6E-10	-	-
	Y, see ^{169}Lu	-	3E+2	1E-7	4E-10	-	-
71 Lutetium-174m	W, see ^{169}Lu	2E+3 LLI wall (3E+3)	2E+2 Bone surf (3E+2)	1E-7 -	- 5E-10	- 4E-5	- 4E-4
	Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
71 Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5	7E-4
		-	Bone surf (2E+2)	-	3E-10	-	-
	Y, see ^{169}Lu	-	2E+2	6E-8	2E-10	-	-
71 Lutetium-176m	W, see ^{169}Lu	8E+3	3E+4	1E-5	3E-8	1E-4	1E-3
	Y, see ^{169}Lu	-	2E+4	9E-6	3E-8	-	-
71 Lutetium-176	W, see ^{169}Lu	7E+2	5E+0	2E-9	-	1E-5	1E-4
		-	Bone surf (1E+1)	-	2E-11	-	-
	Y, see ^{169}Lu	-	8E+0	3E-9	1E-11	-	-
71 Lutetium-177m	W, see ^{169}Lu	7E+2	1E+2	5E-8	-	1E-5	1E-4
		-	Bone surf (1E+2)	-	2E-10	-	-
	Y, see ^{169}Lu	-	8E+1	3E-8	1E-10	-	-
71 Lutetium-177	W, see ^{169}Lu	2E+3	2E+3	9E-7	3E-9	-	-
		LLI wall (3E+3)	-	-	-	4E-5	4E-4
	Y, see ^{169}Lu	-	2E+3	9E-7	3E-9	-	-
71 Lutetium-178m[2]	W, see ^{169}Lu	5E+4	2E+5	8E-5	3E-7	-	-
		St. wall (6E+4)	-	-	-	8E-4	8E-3
	Y, see ^{169}Lu	-	2E+5	7E-5	2E-7	-	-
71 Lutetium-178[2]	W, see ^{169}Lu	4E+4	1E+5	5E-5	2E-7	-	-
		St. wall (4E+4)	-	-	-	6E-4	6E-3

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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 Bone surf	4E-9	-	2E-5	2E-4
		-	(2E+1)	-	3E-11	-	-
	W, see ^{170}Hf	-	4E+1 Bone surf	2E-8	-	-	-
		-	(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 Bone surf	4E-7	-	4E-5	4E-4
		-	(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 Bone surf	5E-10	-	3E-6	3E-5
		-	(2E+0)	-	3E-12	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	W, see ^{170}Hf	-	5E+0 Bone surf	2E-9	-	-	-
		-	(9E+0)	-	1E-11	-	-
72 Hafnium-179m	D, see ^{170}Hf	1E+3	3E+2 Bone surf	1E-7	-	1E-5	1E-4
		-	(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 Bone surf	7E-8	-	2E-5	2E-4
		-	(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 Bone surf (4E+2)	8E-1 Bone surf (2E+0)	3E-10	-	-	-
				-	2E-12	5E-6	5E-5
	W, see ^{170}Hf	-	3E+0 Bone surf	1E-9	-	-	-
		-	(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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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-182m[2]	W, see ^{172}Ta	2E+5	5E+5	2E-4	8E-7	-	-
		St. wall (2E+5)	-	-	-	3E-3	3E-2

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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 (12.7h)	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 (64.0h)	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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	-	-
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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	W, see ^{180}Os	-	2E+5	9E-5	3E-7	-	-
	Y, see ^{180}Os	-	2E+5	7E-5	2E-7	-	-
76 Osmium-191m	D, see ^{180}Os	1E+4	3E+4	1E-5	4E-8	2E-4	2E-3
	W, see ^{180}Os	-	2E+4	8E-6	3E-8	-	-
	Y, see ^{180}Os	-	2E+4	7E-6	2E-8	-	-
76 Osmium-191	D, see ^{180}Os	2E+3	2E+3	9E-7	3E-9	-	-
		LLI wall (3E+3)	-	-	-	3E-5	3E-4
	W, see ^{180}Os	-	2E+3	7E-7	2E-9	-	-
	Y, see ^{180}Os	-	1E+3	6E-7	2E-9	-	-
76 Osmium-193	D, see ^{180}Os	2E+3	5E+3	2E-6	6E-9	-	-
		LLI wall (2E+3)	-	-	-	2E-5	2E-4
	W, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-
	Y, see ^{180}Os	-	3E+3	1E-6	4E-9	-	-
76 Osmium-194	D, see ^{180}Os	4E+2	4E+1	2E-8	6E-11	-	-
		LLI wall (6E+2)	-	-	-	8E-6	8E-5
	W, see ^{180}Os	-	6E+1	2E-8	8E-11	-	-
	Y, see ^{180}Os	-	8E+0	3E-9	1E-11	-	-
77 Iridium-182[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	-	-
	Y, oxides and hydroxides	-	1E+5	5E-5	2E-7	-	-
77 Iridium-184	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
	W, see ^{182}Ir	-	3E+4	1E-5	5E-8	-	-

Atomic No.	Radionuclide	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-185	D, see ^{182}Ir	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
		W, see ^{182}Ir	-	1E+4	5E-6	2E-8	-	-
		Y, see ^{182}Ir	-	1E+4	4E-6	1E-8	-	-
77	Iridium-186	D, see ^{182}Ir	2E+3	8E+3	3E-6	1E-8	3E-5	3E-4
		W, see ^{182}Ir	-	6E+3	3E-6	9E-9	-	-
		Y, see ^{182}Ir	-	6E+3	2E-6	8E-9	-	-
77	Iridium-187	D, see ^{182}Ir	1E+4	3E+4	1E-5	5E-8	1E-4	1E-3
		W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
		Y, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
77	Iridium-188	D, see ^{182}Ir	2E+3	5E+3	2E-6	6E-9	3E-5	3E-4
		W, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
		Y, see ^{182}Ir	-	3E+3	1E-6	5E-9	-	-
77	Iridium-189	D, see ^{182}Ir	5E+3	5E+3	2E-6	7E-9	-	-
			LLI wall (5E+3)	-	-	-	7E-5	7E-4
		W, see ^{182}Ir	-	4E+3	2E-6	5E-9	-	-
		Y, see ^{182}Ir	-	4E+3	1E-6	5E-9	-	-
77	Iridium-190m^{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	-	-
		Y, see ^{182}Ir	-	2E+5	8E-5	3E-7	-	-
77	Iridium-190	D, see ^{182}Ir	1E+3	9E+2	4E-7	1E-9	1E-5	1E-4
		W, see ^{182}Ir	-	1E+3	4E-7	1E-9	-	-
		Y, see ^{182}Ir	-	9E+2	4E-7	1E-9	-	-
77	Iridium-192m	D, see ^{182}Ir	3E+3	9E+1	4E-8	1E-10	4E-5	4E-4
		W, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
		Y, see ^{182}Ir	-	2E+1	6E-9	2E-11	-	-
77	Iridium-192	D, see ^{182}Ir	9E+2	3E+2	1E-7	4E-10	1E-5	1E-4
		W, see ^{182}Ir	-	4E+2	2E-7	6E-10	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	Y, see ^{182}Ir	-	2E+2	9E-8	3E-10	-	-
77 Iridium-194m	D, see ^{182}Ir	6E+2	9E+1	4E-8	1E-10	9E-6	9E-5
	W, see ^{182}Ir	-	2E+2	7E-8	2E-10	-	-
	Y, see ^{182}Ir	-	1E+2	4E-8	1E-10	-	-
77 Iridium-194	D, see ^{182}Ir	1E+3	3E+3	1E-6	4E-9	1E-5	1E-4
	W, see ^{182}Ir	-	2E+3	9E-7	3E-9	-	-
	Y, see ^{182}Ir	-	2E+3	8E-7	3E-9	-	-
77 Iridium-195m	D, see ^{182}Ir	8E+3	2E+4	1E-5	3E-8	1E-4	1E-3
	W, see ^{182}Ir	-	3E+4	1E-5	4E-8	-	-
	Y, see ^{182}Ir	-	2E+4	9E-6	3E-8	-	-
77 Iridium-195	D, see ^{182}Ir	1E+4	4E+4	2E-5	6E-8	2E-4	2E-3
	W, see ^{182}Ir	-	5E+4	2E-5	7E-8	-	-
	Y, see ^{182}Ir	-	4E+4	2E-5	6E-8	-	-
78 Platinum-186	D, all compounds	1E+4	4E+4	2E-5	5E-8	2E-4	2E-3
78 Platinum-188	D, all compounds	2E+3	2E+3	7E-7	2E-9	2E-5	2E-4
78 Platinum-189	D, all compounds	1E+4	3E+4	1E-5	4E-8	1E-4	1E-3
78 Platinum-191	D, all compounds	4E+3	8E+3	4E-6	1E-8	5E-5	5E-4
78 Platinum-193m	D, all compounds	3E+3	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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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
	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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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 ^{193m}Hg	2E+4	4E+4	2E-5	6E-8	2E-4	2E-3
	W, see ^{193m}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 ^{193m}Hg	8E+2	4E+1	2E-8	6E-11	1E-5	1E-4
	W, see ^{193m}Hg	-	1E+2	5E-8	2E-10	-	-

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
80 Mercury-195m	Vapor	-	4E+3	2E-6	6E-9	-	-
	Organic D	3E+3	6E+3	3E-6	8E-9	4E-5	4E-4
	D, see ^{193m}Hg	2E+3	5E+3	2E-6	7E-9	3E-5	3E-4
	W, see ^{193m}Hg	-	4E+3	2E-6	5E-9	-	-
80 Mercury-195	Vapor	-	3E+4	1E-5	4E-8	-	-
	Organic D	2E+4	5E+4	2E-5	6E-8	2E-4	2E-3
	D, see ^{193m}Hg	1E+4	4E+4	1E-5	5E-8	2E-4	2E-3
	W, see ^{193m}Hg	-	3E+4	1E-5	5E-8	-	-
80 Mercury-197m	Vapor	-	5E+3	2E-6	7E-9	-	-
	Organic D	4E+3	9E+3	4E-6	1E-8	5E-5	5E-4
	D, see ^{193m}Hg	3E+3	7E+3	3E-6	1E-8	4E-5	4E-4
	W, see ^{193m}Hg	-	5E+3	2E-6	7E-9	-	-
80 Mercury-197	Vapor	-	8E+3	4E-6	1E-8	-	-
	Organic D	7E+3	1E+4	6E-6	2E-8	9E-5	9E-4
	D, see ^{193}mHg	6E+3	1E+4	5E-6	2E-8	8E-5	8E-4
	W, see ^{193}mHg	-	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 ^{193m}Hg	6E+4	1E+5	6E-5	2E-7	8E-4	8E-3
	W, see ^{193m}Hg	-	2E+5	7E-5	2E-7	-	-
80 Mercury-203	Vapor	-	8E+2	4E-7	1E-9	-	-
	Organic D	5E+2	8E+2	3E-7	1E-9	7E-6	7E-5
	D, see ^{193m}Hg	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	W, see ^{193m}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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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 Bone surf (1E+0)	2E-1 Bone surf (4E-1)	1E-10 -	- 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 Bone surf (1E+2)	3E+1 -	1E-8 -	5E-11 -	- 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 W, all other compounds	3E+4 -	8E+4 1E+5	4E-5 4E-5	1E-7 1E-7	4E-4 -	4E-3 -
83 Bismuth-201[2]	D, see ^{200}Bi W, see ^{200}Bi	1E+4 -	3E+4 4E+4	1E-5 2E-5	4E-8 5E-8	2E-4 -	2E-3 -
83 Bismuth-202[2]	D, see ^{200}Bi W, see ^{200}Bi	1E+4 -	4E+4 8E+4	2E-5 3E-5	6E-8 1E-7	2E-4 -	2E-3 -
83 Bismuth-203	D, see ^{200}Bi W, see ^{200}Bi	2E+3 -	7E+3 6E+3	3E-6 3E-6	9E-9 9E-9	3E-5 -	3E-4 -
83 Bismuth-205	D, see ^{200}Bi W, see ^{200}Bi	1E+3 -	3E+3 1E+3	1E-6 5E-7	3E-9 2E-9	2E-5 -	2E-4 -
83 Bismuth-206	D, see ^{200}Bi W, see ^{200}Bi	6E+2 -	1E+3 9E+2	6E-7 4E-7	2E-9 1E-9	9E-6 -	9E-5 -

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
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 Kidneys (6E+1)	5E+0 Kidneys (6E+0)	2E-9	-	-	-
				-	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 Kidneys	1E-7	-	1E-5	1E-4
		-	(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 St. wall	8E+2	3E-7	1E-9	-	-
		(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

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	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	-	2E+1 (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

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
88 Radium-225	W, all compounds	8E+0 Bone surf (2E+1)	7E-1 -	3E-10 -	9E-13 -	- 2E-7	- 2E-6
88 Radium-226	W, all compounds	2E+0 Bone surf (5E+0)	6E-1 -	3E-10 -	9E-13 -	- 6E-8	- 6E-7
88 Radium-227[2]	W, all compounds	2E+4 Bone surf (2E+4)	1E+4 Bone surf (2E+4)	6E-6 -	- 3E-8	- 3E-4	- 3E-3
88 Radium-228	W, all compounds	2E+0 Bone surf (4E+0)	1E+0 -	5E-10 -	2E-12 -	- 6E-8	- 6E-7
89 Actinium-224	D, all compounds except those given for W and Y	2E+3 LLI wall (2E+3)	3E+1 Bone surf (4E+1)	1E-8 -	- 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 LLI wall (5E+1)	3E-1 Bone surf (5E-1)	1E-10 -	- 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 LLI	3E+0 Bone	1E-9	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		wall (1E+2)	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

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
	Y, see ^{226}Th	-	3E-1	1E-10	5E-13	-	-
90 Thorium-228	W, see ^{226}Th	6E+0 Bone surf (1E+1)	1E-2 Bone surf (2E-2)	4E-12 -	- 3E-14	- 2E-7	- 2E-6
	Y, see ^{226}Th	-	2E-2	7E-12	2E-14	-	-
90 Thorium-229	W, see ^{226Th}	6E-1 Bone surf (1E+0)	9E-4 Bone surf (2E-3)	4E-13 -	- 3E-15	- 2E-8	- 2E-7
	Y, see ^{226}Th	- -	2E-3 Bone surf (3E-3)	1E-12 -	- 4E-15	- -	- -
90 Thorium-230	W, see ^{226}Th	4E+0 Bone surf (9E+0)	6E-3 Bone surf (2E-2)	3E-12 -	- 2E-14	- 1E-7	- 1E-6
	Y, see ^{226}Th	- -	2E-2 Bone surf (2E-2)	6E-12 -	- 3E-14	- -	- -
90 Thorium-231	W, see ^{226}Th Y, see ^{226}Th	4E+3 -	6E+3 6E+3	3E-6 3E-6	9E-9 9E-9	5E-5 -	5E-4 -
90 Thorium-232	W, see ^{226}Th	7E-1 Bone surf (2E+0)	1E-3 Bone surf (3E-3)	5E-13 -	- 4E-15	- 3E-8	- 3E-7
	Y, see ^{226}Th	-	3E-3 Bone surf	1E-12	-	-	-

		Table 1 Occupational Values			Table 2 Effluent Concentrations		Table 3 Releases to Sewers
		Col. 1	Col. 2	Col. 3	Col. 1	Col. 2	
		Oral Ingestion	Inhalation				Monthly Average
Atomic Radionuclide No.	Class	ALI (uCi)	ALI (uCi)	DAC (uCi/ml)	Air (uCi/ml)	Water (uCi/ml)	Conc. (uCi/ml)
		-	(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 Bone surf	5E-9	-	2E-5	2E-4
		-	(2E+1)	-	3E-11	-	-
	Y, see ^{226}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 Bone surf (5E-1)	2E-3 Bone surf (4E-3)	6E-13 -	- 6E-15	- 6E-9	- 6E-8
	Y, see ^{226}Pa	-	4E-3 Bone surf	2E-12	-	-	-
		-	(6E-3)	-	8E-15	-	-
91 Protactinium-232	W, see ^{227}Pa	1E+3	2E+1 Bone surf	9E-9	-	2E-5	2E-4

Atomic Number	Radionuclide	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
			-	(6E+1)	-	8E-11	-	-
		Y, see ^{227}Pa	-	6E+1 Bone surf	2E-8	-	-	-
			-	(7E+1)	-	1E-10	-	-
91	Protactinium-233	W, see ^{227}Pa	1E+3 LLI wall	7E+2	3E-7	1E-9	-	-
			(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, $UO_2(NO_3)_2$	4E+0 Bone surf	4E-1 Bone surf	2E-10	-	-	-
			(6E+0)	(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 LLI wall	8E+3	3E-6	1E-8	-	-
			(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 Bone surf	2E-1 Bone surf	9E-11	-	-	-
			(4E+0)	(4E-1)	-	6E-13	6E-8	6E-7
		W, see ^{230}U	-	4E-1	2E-10	5E-13	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
	Y, see $_{230}$U	-	8E-3	3E-12	1E-14	-	-
92 Uranium-233	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	- 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-234[3]	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	- 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-1	-	-
92 Uranium-235[3]	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	6E-10 -	- 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-236	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	- 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 LLI wall	3E+3	1E-6	4E-9	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Table 1 Occupational Values Col. 2 Inhalation ALI (uCi)	Table 1 Occupational Values Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Table 2 Effluent Concentrations Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(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 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	6E-10 -	- 3E-12	- 3E-7	- 3E-6
	W, see ^{230}U	-	8E-1	3E-10	1E-12	-	-
	Y, see ^{230}U	-	4E-2	2E-11	6E-14	-	-
92 Uranium-239[2]	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	-	-
	Y, see ^{230}U	-	2E+5	6E-5	2E-7	-	-
92 Uranium-240	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	-	-
	Y, see ^{230}U	-	2E+3	1E-6	3E-9	-	-
92 Uranium-natural[3]	D, see ^{230}U	1E+1 Bone surf (2E+1)	1E+0 Bone surf (2E+0)	5E-10 -	- 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 Bone surf (5E+2)	7E-7 -	- 6E-9	2E-3 -	2E-2 -
93 Neptunium-233[2]	W, all compounds	8E+5	3E+6	1E-3	4E-6	1E-2	1E-1
93 Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
93 Neptunium-235	W, all compounds	2E+4 LLI wall (2E+4)	8E+2 Bone surf (1E+3)	3E-7 -	- 2E-9	- 3E-4	- 3E-3
93 Neptunium-236 (1.15E+5y)	W, all compounds	3E+0 Bone surf (6E+0)	2E-2 Bone surf (5E-2)	9E-12 -	- 8E-14	- 9E-8	- 9E-7
93 Neptunium-236 (22.5h)	W, all compounds	3E+3 Bone surf (4E+3)	3E+1 Bone surf (7E+1)	1E-8 -	- 1E-10	- 5E-5	- 5E-4
93 Neptunium-237	W, all compounds	5E-1 Bone surf (1E+0)	4E-3 Bone surf (1E-2)	2E-12 -	- 1E-14	- 2E-8	- 2E-7
93 Neptunium-238	W, all compounds	1E+3 -	6E+1 Bone surf (2E+2)	3E-8 -	- 2E-10	2E-5 -	2E-4 -
93 Neptunium-239	W, all compounds	2E+3 LLI wall (2E+3)	2E+3 -	9E-7 -	3E-9 -	- 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 Bone	2E-2 Bone	8E-12	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		surf (4E+0)	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 Bone surf (2E+0)	7E-3 Bone surf (1E-2)	3E-12 -	- 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 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
	Y, see ^{234}Pu	- -	2E-2 Bone surf (2E-2)	7E-12 -	- 2E-14	- -	- -
94 Plutonium-240	W, see ^{234}Pu	8E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
	Y, see ^{234}Pu	- -	2E-2 Bone surf (2E-2)	7E-12 -	- 2E-14	- -	- -
94 Plutonium-241	W, see ^{234}Pu	4E+1 Bone surf (7E+1)	3E-1 Bone surf (6E-1)	1E-10 -	- 8E-13	- 1E-6	- 1E-5
	Y, see ^{234}Pu	-	8E-1	3E-10	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		-	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)	-	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)	-	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-238[2]	W, all compounds	4E+4	3E+3	1E-6	-	5E-4	5E-3
			Bone surf				

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		-	(6E+3)	-	9E-9	-	-
95 Americium-239	W, all compounds	5E+3	1E+4	5E-6	2E-8	7E-5	7E-4
95 Americium-240	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5	3E-4
95 Americium-241	W, all compounds	8E-1 Bone surf	6E-3 Bone surf	3E-12	-	-	-
		(1E+0)	(1E-2)	-	2E-14	2E-8	2E-7
95 Americium-242m	W, all compounds	8E-1 Bone surf	6E-3 Bone surf	3E-12	-	-	-
		(1E+0)	(1E-2)	-	2E-14	2E-8	2E-7
95 Americium-242	W, all compounds	4E+3	8E+1 Bone surf	4E-8	-	5E-5	5E-4
		-	(9E+1)	-	1E-10	-	-
95 Americium-243	W, all compounds	8E-1 Bone surf	6E-3 Bone surf	3E-12	-	-	-
		(1E+0)	(1E-2)	-	2E-14	2E-8	2E-7
95 Americium-244m[2]	W, all compounds	6E+4 St. wall	4E+3 Bone surf	2E-6	-	-	-
		(8E+4)	(7E+3)	-	1E-8	1E-3	1E-2
95 Americium-244	W, all compounds	3E+3	2E+2 Bone surf	8E-8	-	4E-5	4E-4
		-	(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	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		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 Bone surf (8E+1)	6E-1 Bone surf (6E-1)	2E-10 -	- 9E-13	- 1E-6	- 1E-5
96 Curium-241	W, all compounds	1E+3 -	3E+1 Bone surf (4E+1)	1E-8 -	- 5E-11	2E-5 -	2E-4 -
96 Curium-242	W, all compounds	3E+1 Bone surf (5E+1)	3E-1 Bone surf (3E-1)	1E-10 -	- 4E-13	- 7E-7	- 7E-6
96 Curium-243	W, all compounds	1E+0 Bone surf (2E+0)	9E-3 Bone surf (2E-2)	4E-12 -	- 2E-14	- 3E-8	- 3E-7
96 Curium-244	W, all compounds	1E+0 Bone surf (3E+0)	1E-2 Bone surf (2E-2)	5E-12 -	- 3E-14	- 3E-8	- 3E-7
96 Curium-245	W, all compounds	7E-1 Bone surf (1E+0)	6E-3 Bone surf (1E-2)	3E-12 -	- 2E-14	- 2E-8	- 2E-7
96 Curium-246	W, all compounds	7E-1 Bone surf	6E-3 Bone surf	3E-12	-	-	-

Atomic Radionuclide No.	Class	Table 1 Occupational Values Col. 1 Oral Ingestion ALI (uCi)	Col. 2 Inhalation ALI (uCi)	Col. 3 Inhalation DAC (uCi/ml)	Table 2 Effluent Concentrations Col. 1 Air (uCi/ml)	Col. 2 Water (uCi/ml)	Table 3 Releases to Sewers Monthly Average Conc. (uCi/ml)
		(1E+0)	(1E-2)	-	2E-14	2E-8	2E-7
96 Curium-247	W, all compounds	8E-1 Bone surf	6E-3 Bone surf	3E-12	-	-	-
		(1E+0)	(1E-2)	-	2E-14	2E-8	2E-7
96 Curium-248	W, all compounds	2E-1 Bone surf	2E-3 Bone surf	7E-13	-	-	-
		(4E-1)	(3E-3)	-	4E-15	5E-9	5E-8
96 Curium-249[2]	W, all compounds	5E+4	2E+4 Bone surf	7E-6	-	7E-4	7E-3
		-	(3E+4)	-	4E-8	-	-
96 Curium-250	W, all compounds	4E-2 Bone surf	3E-4 Bone surf	1E-13	-	-	-
		(6E-2)	(5E-4)	-	8E-16	9E-10	9E-9
97 Berkelium-245	W, all compounds	2E+3	1E+3	5E-7	2E-9	3E-5	3E-4
97 Berkelium-246	W, all compounds	3E+3	3E+3	1E-6	4E-9	4E-5	4E-4
97 Berkelium-247	W, all compounds	5E-1 Bone surf	4E-3 Bone surf	2E-12	-	-	-
		(1E+0)	(9E-3)	-	1E-14	2E-8	2E-7
97 Berkelium-249	W, all compounds	2E+2 Bone surf	2E+0 Bone surf	7E-10	-	-	-