Article Index

R12-1-721 (B)	Repealed

Article 15

R12-1-1508 (E)	Add
R12-1-1510 (A) (2) (c)	Amend
R12-1-1510 (A) (2) (d)	Add
R12-1-1510 (A) (2) (e)	Add
R12-1-1510 (B) (1) (f)	Add
R12-1-1510 (G)	Add

Article 19

R12-1-1927 (C)(1)	Amend

ARTICLE 1. GENERAL PROVISIONS

R12-1-101. Scope and Incorporated Materials

A. Except as otherwise specifically provided, this Chapter applies to all persons who receive, possess, use, transfer, own, or acquire any source of radiation.

B. This Chapter does not apply to any person that is subject to regulation by the Nuclear Regulatory Commission.

C. State control of source material, byproduct material, and special nuclear material in quantities not sufficient to form a critical mass is subject to the provisions of the agreement between the state and the U.S. Nuclear Regulatory Commission, signed March 30, 1967 and incorporated by reference. This incorporated material contains no later editions or amendments, and together with all other incorporated materials in this Chapter, is available for inspection or copying at the Arizona Radiation Regulatory Agency, 4814 S. 40th St., Phoenix, AZ 85040.

D. Federal regulations incorporated by reference in this Chapter are available from the U.S. Government Printing Office, P.O. Box 979050, St. Louis, MO 63197-9000 and http://www.gpoaccess.gov/cfr/.

Historical Note

Former Rule Section A.1; Former Section R12-1-101 repealed, new Section R12-1-101 adopted effective June 30, 1977 (Supp. 77-3). Amended effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-102. Definitions

Terms defined in A.R.S. § 30-651 have the same meanings when used in this Chapter, unless the context otherwise requires. Additional subject-specific definitions are used in other Articles.

"A1" means the maximum activity of special form radioactive material permitted in a type A package. These values are either listed in 10 CFR 71, Appendix A, Table A-1, or may be derived in accordance with the procedures prescribed in 10 CFR 71, Appendix A, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"A2" means the maximum activity of radioactive material, other than special form radioactive material, low specific activity (LSA) material, and surface contaminated object (SCO) material, permitted in a Type A package. These values are either listed in 10 CFR 71, Appendix A, Table A-1, or may be derived in accordance with the procedure prescribed in 10 CFR 71, Appendix A, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"Absorbed dose" means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the gray (Gy) and the rad.

"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 MeV. For purposes of this definition, "particle accelerator" is an equivalent term.

"Accelerator produced material" means any material made radioactive by irradiating it in a particle accelerator.

"Act" means A.R.S. Title 30, Chapter 4.

"Activity" means the rate of disintegration, transformation, or decay of radioactive material. The units of activity are the becquerel (Bq) and the curie (Ci).

"Adult" means an individual 18 or more years of age.

"Agency," or "ARRA" means the Arizona Radiation Regulatory Agency.

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

"Airborne radioactive material" means any radioactive material dispersed in the air in the form of aerosols, dusts, fumes, mists, vapors, or gases.

"Airborne radioactivity area" means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed radioactive material, exist in concentrations:

In excess of the derived air concentrations (DACs) specified in Appendix B, Table I of Article 4 of these rules; or

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.

"ALARA" means as low as is reasonably achievable, making every reasonable effort to maintain exposures to radiation as far below the dose limits in these rules as is practical, consistent with the purpose for which the licensed or registered 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 or registered sources of radiation in the public interest.

"Analytical x-ray equipment" means equipment used for x-ray diffraction or x-ray-induced fluorescence analysis.

"Analytical x-ray system" means a group of components utilizing x-rays to determine the elemental composition or to examine the microstructure of materials.

"Annual" means done or performed yearly. For purposes of Chapter 1 any required activity done or performed within plus or minus two weeks of the annual due date is considered done or performed in a timely manner.

"Approved individual" means an individual whom the licensee has determined to be trustworthy and reliable for unescorted access in accordance with subpart B of this part and who has completed the training required by § 37.43(c).

"Authorized medical physicist" means an individual who meets the requirements in R12-1-711; or is identified as an authorized medical physicist or teletherapy physicist on:

A specific medical use license issued by the Agency, NRC, or another Agreement State;

A medical use permit issued by a NRC master material licensee;

A permit issued by an Agency, NRC, or another Agreement State broad scope medical use licensee; or

A permit issued by a NRC master material license broad scope medical use permittee.

"Authorized nuclear pharmacist" means a pharmacist who meets the requirements in R12-1-712; or is identified as an authorized nuclear pharmacist on:

A specific license issued by an Agency, NRC, or another Agreement State that authorizes medical use or the practice of nuclear pharmacy;

A permit issued by a NRC master material licensee that authorizes medical use or the practice of nuclear pharmacy;

A permit issued by an Agency, NRC, or another Agreement State broad scope medical use licensee that authorizes medical use or the practice of nuclear pharmacy; or

A permit issued by a NRC master material license broad scope medical use permittee that authorizes medical use or the practice of nuclear pharmacy; or

Is identified as an authorized nuclear pharmacist by a commercial nuclear pharmacy that has been authorized to identify authorized nuclear pharmacists; or

Is designated as an authorized nuclear pharmacist in accordance with R12-1-311(G).

"Authorized user" means a physician, dentist, or podiatrist who meets the requirements in R12-1-719, R12-1-723, R12-1-727, R12-1-728, or R12-1-744; or is identified as an authorized user on:

An Agency, NRC, or another Agreement State license that authorizes the medical use of radioactive material;

A permit issued by a NRC master material licensee that is authorized to permit the medical use of radioactive material;

A permit issued by an Agency, NRC, or another Agreement State specific licensee of broad scope that is authorized to permit the medical use of radioactive material; or

A permit issued by a NRC master material license broad scope permittee that is authorized to permit the medical use of radioactive material.

"Background investigation" means the investigation conducted by a licensee or applicant to support the determination of trustworthiness and reliability.

"Background radiation" means radiation from cosmic sources; not technologically enhanced naturally occurring radioactive material, 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 or from past nuclear accidents, such as Chernobyl, that contribute to background radiation and are not under the control of a licensee. "Background radiation" does not include sources of radiation regulated by the Agency.

"Becquerel" (Bq) means the International System (SI) unit for activity and is equal to 1 disintegration per second (dps or tps).

"Bioassay" 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. For purposes of these rules, "radiobioassay" is an equivalent term.

"Brachytherapy" means a method of radiation therapy in which an encapsulated source or group of sources is utilized to deliver beta or gamma radiation at a distance of up to a few centimeters, by surface, intracavitary or interstitial application.

"Byproduct material" means:

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

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 or thorium solution extraction

processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;

Any discrete source of radium-226 that is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity; or any material that, has been made radioactive by use of a particle accelerator; and is produced, extracted, or converted after extraction, for use for a commercial, medical, or research activity; and

Any discrete source of naturally occurring radioactive material, other than source material, that the 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; before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

"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 so arranged such that no day is included in more than one calendar quarter and no day in any one year is omitted from inclusion within a calendar quarter. A licensee or registrant shall not change the method of determining calendar quarters for purposes of this Chapter except at the beginning of a calendar year.

"Calibration" means the determination of:

The response or reading of an instrument relative to a series of known radiation values over the range of the instrument, or

The strength of a source of radiation relative to a standard.

"Carrier" means a person engaged in the transportation of passengers or property by land or water as a common, contract, or private carrier, or by civil aircraft.

"Certifiable cabinet x-ray system" means an existing uncertified x-ray system that meets or has been modified to meet the certification requirements specified in 21 CFR 1020.40, revised April 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"Certificate holder" means a person who has been issued a certificate of compliance or other package approval by the Agency or NRC.

"Certificate of Compliance" (CoC) means the certificate issued by the NRC under 10 CFR 71, Subpart D, (Revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), which authorizes the design of a package for the transportation of radioactive material.

"Certified cabinet x-ray system" means an x-ray system that has been certified in accordance with 21 CFR 1010.2, as being manufactured and assembled on or after April 10, 1975, in accordance with the provisions of 21 CFR 1020.40, both sections revised April 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"CFR" means Code of Federal Regulations.

"Chelating agent" means amine polycarboxylic acids, hydroxycarboxylic acids, gluconic acid, and polycarboxylic acids.

"Civil penalty" means the monetary fine which may be imposed on licensees by the Agency, pursuant to A.R.S. § 30-687, for violations of the Act, this Chapter, or license conditions.

"Collective dose" means 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.

"Committed dose equivalent" (HT,50) 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.

"Committed effective dose equivalent" (HE,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 each of these organs or tissues (HE,50 = S wT,HT,50).

"Consortium" means an association of medical use licensees and a PET radionuclide production facility in the same geographical area that jointly own or share in the operation and maintenance cost of the PET radionuclide production facility that produces PET radionuclides for use in producing radioactive drugs within the consortium for noncommercial distributions among its associated members for medical use. The PET radionuclide production facility within the consortium must be located at an educational institution or a federal facility or a medical facility.

"Contamination" means the presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm^2 (1 × 10^{-5} µCi/cm^2) for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm^2 (1 × 10^{-6} µCi/cm^2) for all other alpha emitters.

(1)" Fixed contamination" means contamination that cannot be removed from a surface during normal conditions of transport.

(2) "Non-fixed contamination" means contamination that can be removed from a surface during normal conditions of transport.

"Criticality Safety Index (CSI)" means the dimensionless number (rounded up to the next tenth) assigned to and placed on the label of a fissile material package, to designate the degree of control of accumulation of packages, overpacks or freight containers containing fissile material during transportation. Determination of the criticality safety index is described in §§ 71.22, 71.23, and 71.59. The criticality safety index for an overpack, freight container, consignment or conveyance containing fissile material packages is the arithmetic sum of the criticality safety indices of all the fissile material packages contained within the overpack, freight container, consignment or conveyance.

"Curie" means a unit of quantity of radioactivity. One curie (Ci) is that quantity of radioactive material which decays at the rate of 3.7E + 1010 transformations per second (tps).

"Current license or registration" means a license or registration issued by the Agency and for which the licensee has paid the license or registration fee for the current year according to R12-1-1304.

"Deep-dose equivalent" (Hd), which applies to external whole body exposure, is the dose equivalent at a tissue depth of 1 centimeter (1000 mg/cm2).

"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.

"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.

"Dose" is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, total organ dose equivalent, or total effective dose equivalent. For purposes of these rules, "radiation dose" is an equivalent term.

"Dose equivalent" (HT) 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 sievert (Sv) and rem.

"Dose limits" means the permissible upper bound of radiation doses established in accordance with these rules. For purposes of these rules, "limits" is an equivalent term.

"Dosimeter" (See "Individual monitoring device")

"Effective dose equivalent" (HE) means the sum of the products of the dose equivalent to each organ or tissue (HT) and the weighting factor (wT) applicable to each of the body organs or tissues that are irradiated (HE = S wTHT).

"Effluent release" means any disposal or release of radioactive material into the ambient atmosphere, soil, or any surface or subsurface body of water.

"Embryo/fetus" means the developing human organism from conception until the time of birth.

"Enclosed beam x-ray system" means an analytical x-ray system constructed in such a way that access to the interior of the enclosure housing the x-ray source during operation is precluded except through bypassing of interlocks or other safety devices to perform maintenance or servicing.

"Enclosed radiography" means industrial radiography conducted by using cabinet radiography or shielded room radiography.

"Cabinet radiography" means industrial radiography conducted by using an x-ray machine in an enclosure not designed for human admittance and which is so shielded that every location on the exterior meets the conditions for an "unrestricted area."

"Shielded room radiography" means industrial radiography conducted using an x-ray machine in an enclosure designed for human admittance and which is so shielded that every location of the exterior meets the conditions for an "unrestricted area."

"Entrance or access point" means any opening through which an individual or extremity of an individual could gain access to radiation areas or to licensed radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

"Exhibit" for purposes of these rules, is equivalent in meaning to the word "Schedule" as found in previously issued rules, current license conditions, and regulation guide.

"Explosive material" means any chemical compound, mixture, or device which produces a substantial instantaneous release of gas and heat spontaneously or by contact with sparks or flame.

"Exposure" means:

Being subjected to ionizing radiation or radioactive materials.

The quotient of dQ by dm where "dQ" is the absolute value of the total charge of the ions of one sign produced in air when all the electrons (negatrons and positrons) liberated by photons in a volume element of air having mass "dm" are completely stopped in air. The special unit of exposure is the roentgen (R).

"Exposure rate" means the exposure per unit of time.

"External dose" means that portion of the dose equivalent received from any source of radiation outside the body.

"Extremity" means hand, elbow, arm below the elbow, foot, knee, and leg below the knee.

"Fail-safe characteristics" means a design feature which causes beam port shutters to close, or otherwise prevents emergence of the primary beam, upon the failure of a safety or warning device.

"FDA" means the United States Food and Drug Administration

.

"Field radiography" means industrial radiography, utilizing a portable or mobile x-ray system, which is not conducted in a shielded enclosure.

"Field station" means a facility where radioactive sources may be stored or used and from which equipment is dispatched to temporary job sites.

"Former U.S. Atomic Energy Commission (AEC) or U.S. Nuclear Regulatory Commission (NRC) licensed facilities" means nuclear reactors, nuclear fuel reprocessing plants, uranium enrichment plants, or critical mass experimental facilities where AEC or NRC licenses have been terminated.

"Generally applicable environmental radiation standards" means standards issued by the U.S. Environmental Protection Agency (EPA), 40 CFR 190 and 191, revised July 1, 2013, incorporated by reference, and available under R12-1-101, 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. This incorporated material contains no future editions or amendments.

"Gray" (Gy) means the International System (SI) unit of absorbed dose and is equal to 1 joule per kilogram. One gray equals 100 rad.

"Hazardous waste" means those wastes designated as hazardous in A.R.S. § 49-921(5).

"Healing arts" means the practice of medicine, dentistry, osteopathy, podiatry, chiropractic, and veterinary medicine.

"Health care institution" means every place, institution, or building which provides facilities for medical services or other health-related services, not including private clinics or offices which do not provide overnight patient care.

"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 1 mSv (0.1 rem) in one hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

"Human use" means the internal or external administration of radiation or radioactive materials to human beings.

"Impound" means to abate a radiological hazard. Actions which may be taken by the Agency in impounding a source of radiation include seizing the source of radiation, controlling access to an area, and preventing a radiation machine from being utilized.

"Indian **Tribe**" means an Indian or Alaska native **Tribe**, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian **Tribe** pursuant to the Federally Recognized Indian Tribe List Act of 1994, 25 U.S.C. 479a.

"Individual" means any human being.

"Individual monitoring" means the assessment of:

Dose equivalent

By the use of individual monitoring devices, or

By the use of survey data, or

Committed effective dose equivalent
By bioassay; or

By determination of the time-weighted air concentrations to which an individual has been exposed, that is, DAC-hours. (See the definition of DAC-hours in Article 4).

"Individual monitoring device" means a device designed to be worn by a single individual for the assessment of dose equivalent. For purposes of this Chapter, "dosimeter" and "personnel dosimeter," are equivalent terms. Examples of individual monitoring devices are film badges, thermoluminescence dosimeters (TLDs), pocket ionization chambers, optical stimulation devices, and personal ("lapel") air sampling devices.

"Individual monitoring equipment" means one or more individual monitoring devices. For purposes of this Chapter, "personnel monitoring equipment" is an equivalent term.

"Industrial radiography" means the examination of the macroscopic structure of materials by non-destructive methods utilizing sources of ionizing radiation.

"Injection tool" means a device used for controlled subsurface injection of radioactive tracer material.

"Inspection" means an examination or observation by a representative of the Agency, including but not limited to tests, surveys, and monitoring to determine compliance with rules, orders, requirements and conditions of the License or certificate of registration.

"Interlock" means a device arranged or connected such that the occurrence of an event or condition is required before a second event or condition can occur or continue to occur.

"Internal dose" means that portion of the dose equivalent received from radioactive material taken into the body.

"Irradiate" means to expose to radiation.

"Laser" (light amplification by the stimulated emission of radiation) means any device which can produce or amplify electromagnetic radiation with wave lengths in the range of 180 nanometers to 1 millimeter primarily by the process of controlled stimulated emission.

"Lens dose equivalent" (LDE) means the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeters (300 mg/cm2).

"License" means the grant of authority, issued pursuant to Articles 3 and 14 of this Chapter and A.R.S. §§ 30-671, 30-672, and 30-721 et seq., to acquire, possess, transfer, and use sources of radiation. The types of licenses issued by the Agency are described in R12-1-1302.

"Licensed material" means radioactive material received, possessed, used, transferred, or disposed of under a general or specific license issued by the Agency.

"Licensed practitioner" means a person licensed or otherwise authorized by law to practice medicine, dentistry, osteopathy, chiropractic, podiatry, or naturopathy in this state.

"Licensee" means any person who is licensed by the Agency under this Chapter to acquire, possess, transfer, or use sources of radiation.

"Licensing State" means any state having regulations equivalent to this Chapter relating to, and an effective program for the regulation of, naturally occurring and accelerator-produced radioactive material (NARM).

"Limits" (See "Dose limits")

"Local components" means those parts of an analytical x-ray system that are struck by x-rays, including radiation source housings, port and shutter assemblies, collimator, sample holders, cameras, goniometer, detectors and shielding but not including power supplies, transformers, amplifiers, readout devices, and control panels.

"Logging supervisor" means the individual who provides personal supervision of the utilization of sources of radiation at the well site.

"Logging tool" means a device used subsurface to perform well logging.

"Lost or missing licensed or registered source of radiation" means licensed or registered source of radiation the location of which is unknown. Included are licensed radioactive material or a registered radiation source that has been shipped but has not reached its planned destination and whose location cannot be readily traced or ascertained in the transportation system.

"Low-level waste" means waste material which contains radioactive nuclides in concentrations or quantities which exceed applicable standards for unrestricted release but does not include:

High-level waste, such as irradiated reactor fuel, liquid waste from reprocessing irradiated reactor fuel, or solids into which any such liquid waste has been converted;

Waste material containing transuranic elements with contamination levels greater than 10 nanocuries per gram (370 kilobecquerels per kilogram) of waste material;

The tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content.

"**Low Specific Activity (LSA) material" means radioactive material with limited specific activity which is nonfissile or is excepted under § 71.15, and which satisfies the descriptions and limits set forth in the following section. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. The LSA material must be in one of three groups:**

(1) LSA—I.

(i) Uranium and thorium ores, concentrates of uranium and thorium ores, and other ores containing naturally occurring radionuclides that are intended to be processed for the use of these radionuclides;

(ii) Natural uranium, depleted uranium, natural thorium or their compounds or mixtures, provided they are unirradiated and in solid or liquid form;

(iii) Radioactive material other than fissile material, for which the A2 value is unlimited; or

(iv) Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the value for exempt material activity concentration determined in accordance with appendix A.

(2) LSA—II.

(i) Water with tritium concentration up to 0.8 TBq/liter (20.0 Ci/liter); or

(ii) Other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10–4 A2/g for solids and gases, and 10–5 A2/g for liquids.

(3) LSA—III. Solids (e.g., consolidated wastes, activated materials), excluding powders, that satisfy the requirements of § 71.77, in which:

(i) The radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.);

(ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for 7 days will not exceed 0.1 A2; and

(iii) The estimated average specific activity of the solid, excluding any shielding material, does not exceed 2 x 10–3A2/g.

"Major processor" means a user processing, handling, or manufacturing radioactive material exceeding Type A quantities as unsealed sources or material or exceeding four times Type B quantities as sealed sources but does not include nuclear medicine programs, universities, industrial radiographers, or small industrial programs. Type A and B quantities are defined in 10 CFR 71.4, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"Medical dose" means a radiation dose intentionally delivered to an individual for medical examination, diagnosis, or treatment.

"Member of the public" means any individual except when that individual is receiving an occupational dose.

"MeV" means Mega Electron Volt which equals 1 million volts (106 eV).

"Mineral logging" means any well logging performed in a borehole drilled for the purpose of exploration for minerals other than oil or gas.

"Minor" means an individual less than 18 years of age.

"Monitoring" means the measurement of radiation, radio active material concentrations, surface area activities, or quantities of radioactive material, and the use of the results of these measurements to evaluate potential exposures and doses. For purposes of these rules, "radiation monitoring" and "radiation protection monitoring" are equivalent terms.

"Multiplier" means a letter representing a number. The use of a multiplier is based on the code given below:

Prefix	*Multiplier Symbol*	*Value*
eka	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
milli	m	10^{-3}
micro	u	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

"NARM" means any naturally occurring or accelerator-produced radioactive material. It does not include byproduct, source, or special nuclear material. This term should not be confused with "NORM" which is defined as naturally occurring radioactive material.

"Normal operating procedures" means the entire set of instructions necessary to accomplish the intended use of the source of radiation. These procedures shall include, but are not limited to, sample insertion and manipulation, equipment alignment, routine maintenance by the licensee, and data recording procedures which are related to radiation safety.

"Natural radioactivity" means the radioactivity of naturally occurring radioactive substances.

"NRC" means Nuclear Regulatory Commission, the U.S. Nuclear Regulatory Commission, or its duly authorized representatives.

"NRC Document Control Desk" means the Nuclear Regulatory Document Control Desk. ATTN: Document Control Desk, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

"Nuclear waste" means any highway route controlled quantity (defined in 49 CFR 173.403, revised October 1, 2012, incorporated by reference, and available under R12-1-101; this incorporated material contains no future editions or amendments) of source, byproduct, or special nuclear material required to be in NRC-approved packaging while transported to, through, or across state boundaries to a disposal site, or to a collection point for transport to a disposal site. Additional requirements associated with transportation of radioactive material can be found in Article 15.

"Occupational dose" means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to sources of radiation, whether in the possession of a licensee, registrant, or other person. Occupational dose does not include a dose received from background radiation, medical administration of radiation to the individual, exposure to an individual who has been administered radioactive material and released in accordance with R12-1-717, voluntary participation in a medical research program, or as a member of the public.

"Open beam system" means an analytical x-ray system in which an individual could place some body part in the primary beam path during normal operation.

"Package" means the packaging together with its radioactive contents as presented for transport.

"Particle accelerator" (See "Accelerator")

"Permanent radiographic installation" means a fixed, shielded installation or structure designed or intended for industrial radiography and in which industrial radiography is regularly performed.

"Personnel dosimeter" (See "Individual monitoring device")

"Personnel monitoring equipment" (See "Individual monitoring device")

"Personal supervision" means supervision in which the supervising individual is physically present at the site where sources of radiation and associated equipment are being used, watching the performance of the supervised individual and in such proximity that immediate assistance can be given if required.

"PET" (See Positron Emission Tomography (PET))

“Pharmacist” means an individual licensed by this state to compound and dispense drugs, prescriptions, and poisons.

“Physician” means an individual licensed pursuant to A.R.S. Title 32, Chapters 13 or 17.

“Positron Emission Tomography (PET)” means an imaging technique using radionuclides to produce high resolution images of the body’s biological functions.

“Positron Emission Tomography radionuclide production facility” means a facility operating a cyclotron or accelerator for the purpose of producing PET radionuclides.

“Preceptor” means an individual who provides, directs, or verifies training and experience required for an individual to become an authorized user, an authorized medical physicist, an authorized nuclear pharmacist, or a Radiation Safety Officer.

“Primary beam” means radiation which passes through an aperture of the source housing by a direct path from the x-ray tube or a radioactive source located in the radiation source housing.

“Public dose” means the dose received by a member of the public from radiation from radioactive material released by a licensee or registrant, or exposure to a source of radiation used in a licensed or registered operation. It does not include an occupational dose or a dose received from background radiation, medical administration of radiation to the individual, exposure to an individual who has been administered radioactive material and released in accordance with R12-1-717, or voluntary participation in a medical research program.

“Pyrophoric liquid” means any liquid that ignites spontaneously in dry or moist air at or below 130× F (54.4× C).

“Pyrophoric solid” means any solid material, other than one classed as an explosive, which under normal conditions is liable to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily and, when ignited, burns so vigorously and persistently that it creates a serious transportation, handling, or disposal hazard. Included are spontaneously combustible and water-reactive materials.

“Qualified expert” means an individual certified in the appropriate field by the American Board of Radiology or the American Board of Health Physics, or having equivalent qualifications that provide the knowledge and training to measure ionizing radiation, to evaluate safety techniques, and to advise regarding radiation protection needs; or an individual certified in Therapeutic Radiological Physics or X-ray and Radium Physics by the American Board of Radiology, or having equivalent qualifications that provide training and experience in the clinical applications of radiation physics to radiation therapy, to calibrate radiation therapy equipment. The detailed requirements for a particular qualified expert may be provided in the respective Articles of this Chapter. For clarification purposes, a qualified expert is not always an authorized medical physicist; however, an authorized medical physicist is included within the definition of “qualified expert.”

“Quality Factor” (Q) means the modifying factor, listed in Tables I and II of this Article, that is used to derive dose equivalent from absorbed dose.

“Quarter” (See “Calendar quarter”)

“Rad” means the special unit of absorbed dose. One rad equals 100 ergs per gram, or 0.01 gray.

“Radiation” means alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. For purposes of these rules, this term is synonymous with ionizing radiation. Equivalent terminology for non-ionizing radiation is defined in Article 14.

“Radiation area” means any area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.05 mSv (0.005 rem) in one hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates.

“Radiation dose” (See “Dose”)

“Radiation machine” means any device capable of producing radiation except those devices with radioactive material as the only source of radiation.

“Radiation Safety Officer” (RSO) means the individual and who for license conditions:

> Meets the requirements in 10 CFR 35.50(a) or (c)(1) and 10 CFR 35.59, (revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); or is identified as a Radiation Safety Officer on a specific medical use license issued by the NRC or an Agreement State; or a medical use permit issued by a NRC master material licensee;
>
> Or, who, for registration conditions, is designated by the registrant as the individual who has the knowledge, authority, and responsibility to apply appropriate radiation protection principles to ensure radiation safety and compliance with the Act, this Chapter and any registration conditions.

“Radiation Safety Officer” (RSO) means the individual and who for license conditions:

Meets the requirements of R12-1-407, and for a medical license meets the training requirements of R12-1-710 or is identified as a Radiation Safety Officer on a specific medical use license issued by the Agency, NRC, or another Agreement State; or a medical use permit issued by a NRC master material licensee;
Or, who meets the requirements in R12-1-512 on a specific industrial license issued by the Agency, NRC, or another Agreement State; or an industrial use permit issued by a NRC master material licensee
;

Or, who, for registration conditions, is designated by the registrant as the individual who has the knowledge, authority, and responsibility to apply appropriate radiation protection principles to ensure radiation safety and compliance with the Act, this Chapter and any registration conditions.

"Radioactive marker" means radioactive material placed subsurface or on a structure intended for subsurface use for the purpose of depth determination or direction orientation.

"Radioactive material" means any solid, liquid, or gas which emits radiation spontaneously.

"Radioactivity" means emission of electromagnetic energy or particles or both during the transformation of unstable atomic nuclei.

"Radiographer" means any individual who performs or personally supervises industrial radiographic operations and who is responsible to the licensee or registrant for assuring compliance with the requirements of this Chapter and all conditions of the license or certificate of registration.

"Radiographer's assistant" means any individual who, under the personal supervision of a radiographer, uses sources of radiation, radiographic exposure devices, related handling tools, or survey instruments in industrial radiography.

"Registrant" means any person who is registered with the Agency and is legally obligated to register with the Agency pursuant to these rules and the Act.

"Registration" is the process by which a person becomes a registrant pursuant to Article 2 of this Chapter. With the exception of registration of persons who install or service radiation machines, the types of registrations issued by the Agency are described in R12-1-1302.

"Regulations of the U.S. Department of Transportation" means the federal regulations in 49 CFR 107, 171 through 180, revised October 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

"Rem" means the special unit of dose equivalent (see "Dose equivalent"). The dose equivalent in rem is equal to the absorbed dose in rad multiplied by the quality factor (1 rem - 0.01 sievert).

"Research and Development" means exploration, experimentation, or the extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment, materials, and processes. Research and Development does not include the internal or external administration of radiation or radioactive material to human beings.

"Restricted area" means any area where the licensee or registrant controls access for purposes of protecting individuals from exposure to radiation and radioactive material. A restricted area does not include any areas used for residential quarters, although a room or separate rooms in a residential building may be set apart as a restricted area.

"Roentgen" (R) means the special unit of exposure and is equal to the quantity of x or gamma radiation which causes ionization in air equal to 258 microcoulomb per kilogram (see "Exposure").

"Safety system" means any device, program, or administrative control designed to ensure radiation safety.

"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.

"Sealed Source and Device Registry" means the national registry that contains all the registration certificates, generated by both the NRC and the Agreement States, that summarize the radiation safety information for the sealed sources and devices and describe the licensing and use conditions approved for each source or device.

"Shallow dose equivalent" (HS), 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/cm2).

"Shielded position" means the location within a radiographic exposure device or storage container which, by manufacturer's design, is the proper location for storage of the sealed source.

"Sievert" means the SI unit of dose equivalent (see "Dose equivalent"). The dose equivalent in sievert is equal to the absorbed dose in gray multiplied by the quality factor (1 Sv = 100 rem).

"Site boundary" means that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee or registrant.

"Source changer" means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those also used for transporting and storage of sealed sources.

"Source holder" means a housing or assembly into which a radioactive source is placed for the purpose of facilitating the handling and use of the source in well-logging operations.

"Source material" means:

Uranium or thorium, or any combination of uranium or thorium, in any physical or chemical form; or

Ores that contain by weight 1/20 of 1 percent (0.05 percent) or more of uranium, thorium, or any combination of uranium and thorium.

Source material does not include special nuclear material.

"Source material milling" means any activity that results in the production of byproduct material as defined by the second subsection under the definition of "Byproduct material."

"Source of radiation" or "source" means any radioactive material or any device or equipment emitting, or capable of producing, radiation.

"Special form radioactive material" means radioactive material that satisfies all of the following conditions:

It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

The piece or capsule has at least one dimension not less than 5 millimeters (0.2 inch); and

It satisfies the test requirements specified in 10 CFR 71.75, revised January 1, 2013, incorporated by reference, available under R12-1-101. This incorporated material contains no future editions or amendments. A special form encapsulation designed in accordance with the U.S. Nuclear Regulatory Commission requirements in effect on June 30, 1983, and constructed prior to July 1, 1985, may continue to be used. A special form encapsulation ~~constructed after June 30, 1985, shall meet requirements of this definition applicable at the time of its construction~~**, designed in accordance with the requirements of § 71.4 in effect on March 31, 1996 (see 10 CFR part 71, revised as of January 1, 1996), and constructed before April 1, 1998; and special form material that was successfully tested before September 10, 2015 in accordance with the requirements of § 71.75(d) of this section in effect before September 10, 2015 may continue to be used. Any other special form encapsulation must meet the specifications of this definition.**

"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 one. For example, the following quantities in combination would not exceed the limitation and

$$\frac{XgmsU235}{350} + \frac{YgmsU233}{200} + \frac{ZgmsPu}{200} \leq I$$

are within the formula:

"Storage area" means any location, facility, or vehicle which is used to store, transport, or secure a radiographic exposure device, storage container, sealed source, or other source of radiation when it is not in use.

"Storage container" means a device in which sealed sources are transported or stored.

"Subsurface tracer study" means the release of a substance tagged with radioactive material for the purpose of tracing the movement or position of the tagged substance in the well-bore or adjacent formation.

"Survey" means an evaluation of the production, use, release, disposal, or presence of sources of radiation or any combination thereof under a specific set of conditions to determine actual or potential radiation hazards. Such evaluations include, but are not limited to, tests, physical examination and measurements of levels of radiation or concentration of radioactive material present.

"TEDE" (See "Total Effective Dose Equivalent")

"Teletherapy" means therapeutic irradiation in which the source of radiation is at a distance from the body.

"Temporary job site" means any location where sources of radiation are used other than the specified locations listed on a license document. Storage of sources of radiation at a temporary jobsite shall not exceed six months unless the Agency has granted an amendment authorizing storage at that jobsite.

"Test" means the process of verifying compliance with an applicable rule, order, or license condition.

"These rules" means all Articles of 12 A.A.C. 1.

"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).

"Total Organ Dose Equivalent" (TODE) means the sum of the deep-dose equivalent and the committed dose equivalent to the organ receiving the highest dose. Determination of TODE is described in R12-1-411.

"**Uranium—natural, depleted, enriched."**

(1) Natural uranium means uranium (which may be chemically separated) with the naturally occurring distribution of uranium isotopes (approximately 0.711 weight percent uranium-235, and the remainder by weight essentially uranium-238).

(2) Depleted uranium means uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

(3) Enriched uranium means uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

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

"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 material. Any area used for residential quarters is an unrestricted area.

"U.S. Department of Energy" means the Department of Energy established by P.L. 95-91, August 4, 1977, 91 Stat. 565, 42 U.S.C. 7101 et seq., to the extent that the Department exercises functions formerly vested in the U.S. Atomic Energy Commission, its Chairman, members, officers, and components; and transferred to the U.S. Energy Research and Development Administration and to the administrator of that agency under sections 104(b), (c), and (d) of the Energy Reorganization Act of 1974 (P.L. 93-438, October 11, 1974, 88 Stat. 1233 at 1237, 42 U.S.C. 5814, effective January 19, 1975) and retransferred to the Secretary of Energy under Section 301(a) of the Department of Energy Organization Act (P.L. 95-91, August 4, 1977, 91 Stat. 565 at 577-578, 42 U.S.C. 7151, effective October 1, 1977).

"Very 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 an absorbed dose that exceeds 5 grays (500 rads) in one hour at one meter from a radiation source or one meter from any surface that the radiation penetrates.

"Waste" (See "Low-level waste")

"Waste handling licensees" means persons licensed to receive and store radioactive wastes prior to disposal and persons licensed to dispose of radioactive waste.

"Week" means seven consecutive days starting on Sunday.

"Well-bore" means a drilled hole in which wireline service operations and subsurface tracer studies are performed.

"Well-logging" means the lowering and raising of measuring devices or tools which may contain sources of radiation into well-bores or cavities for the purpose of obtaining information about the well and adjacent formations.

"Whole body" means, for purposes of external exposure, head, trunk including male gonads, arms above the elbow, or legs above the knee.

"Wireline" means an armored cable containing one or more electrical conductors which is used to lower and raise logging tools in the well-bore.

"Wireline service operation" means any evaluation or mechanical service which is performed in the well-bore using devices on a wireline.

"Worker" means any individual engaged in work under a license issued by the Agency and controlled by employment or contract with a licensee.

"WL" means working level, any combination of short-lived radon daughters in 1 liter of air that will result in the ultimate emission of 1.3E + 5 MeV of potential alpha particle energy. The short-lived radon daughters are – 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.

"WLM" means working level month, an exposure to one working level for 170 hours (2,000 working hours per year divided by 12 months per year is approximately equal to 170 hours per month).

"Workload" means the degree of use of an x-ray or gamma-ray source per unit time.

"Year" means the period of time beginning in January used to determine compliance with the provisions of these rules. The licensee or registrant may change the starting date of the year used to determine compliance by the licensee or registrant provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

Historical Note

Former Rule Section A.2. Former Section R12-1-102 repealed, new Section R12-1-102 adopted effective June 30, 1977 (Supp. 77-3). Amended effective November 19, 1982 (Supp. 82-6). Amended effective February 25, 1985 (Supp. 85-1). Amended by adding a new paragraph (31), subparagraph (w) and renumbering the former paragraph (31), subparagraphs (w) through (z) accordingly effective November 28, 1986 (Supp. 86-6). Amended by adding a new paragraph (34) and renumbering the former paragraphs (34) through (68) accordingly effective June 26, 1987 (Supp. 87-2). Amended effective April 2, 1990 (Supp. 90-2). Amended effective November 5, 1993 (Supp. 93-4). Amended effective February 18, 1994 (Supp. 94-1). Amended effective August 10, 1994 (Supp. 94-3). Amended effective January 2, 1996 (Supp. 96-1). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-103. Exemptions

A. Common and contract carriers, freight forwarders, and warehousemen who are subject to 49 CFR 107.109, 107.111, 107.113, 171.2, 171.3, 172.200, 173.1, 173.3, 173.4, 173.401, 175.3, 175.10, 176.3, 176.5, 176.11, 176.24, 176.27, and 177.801, revised October 1, 2007, of the U.S. Department of Transportation, or 39 CFR 111.1 of the U.S. Postal Service, revised July 1, 2007, incorporated by reference, and available under R12-1-101, and who if need be, store radioactive material, for periods of less than 72 hours, in the regular course of their carriage for another, are exempt from this Chapter. The incorporated materials above contain no future editions or amendments.

B. 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 this state are exempt from this Chapter to the extent that such contractor or subcontractor under the contract receives, possesses, uses, transfers, or acquires sources of radiation:

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;
2. Prime contractors of the Department of Energy performing research or development, manufacture, storage, testing or transportation of nuclear weapons or components thereof;
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
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:
   a. That the exemption of the prime contractor or subcontractor is authorized by law; and
   b. 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.

C. Any licensee who delivers to a carrier for transport any package which contains radioactive material having a specific activity of 74 kBq/kg (2 nanocuries per gram) or less, is exempt from the provisions of this Chapter with respect to that package.

D. Any physician licensed by a State to dispense drugs in the practice of medicine is exempt from 10 CFR 71.5 with respect to transport by the physician of licensed material for use in the practice of medicine. However, any physician operating under this exemption must be licensed under 10 CFR part 35 and/or R12-1-703.

Historical Note

Former Rule Section A.3; Former Section R12-1-103 repealed, new Section R12-1-103 adopted effective June 30, 1977 (Supp. 77-3). Amended effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-104. Prohibited Uses

A. A person shall not use the following fluoroscopic devices:

1. Hand-held fluoroscopic screens,
2. Shoe-fitting fluoroscopic devices.

B. Except as specifically authorized by law, a person shall not use sources of ionizing radiation for the purpose of screening an individual or inspecting an individual for:

1. Concealed weapons,
2. Hazardous materials,
3. Stolen property, or
4. Contraband.

C. Unless there is a medical or dental indication for the exposure and the exposure is prescribed by a licensed practitioner, a person shall not deliberately expose an individual to the useful beam from:
1. An ionizing radiation machine; or
2. A non-ionizing radiation source, having a radiation beam known to be harmful to human tissue.

Historical Note

Former Rule Section A.4; Former Section R12-1-104 repealed, new Section R12-1-104 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-104 repealed, new Section R12-1-104 renumbered from R12-1-112 and amended effective April 2, 1990 (Supp. 90-2). Amended effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

R12-1-105. Quality Factors for Converting Absorbed Dose to Dose Equivalent

A. As used in these rules, the quality factors for converting absorbed dose to dose equivalent are shown in Table I.

TABLE I
QUALITY FACTORS AND ABSORBED DOSE EQUIVALENCIES

TYPE OF RADIATION	Quality Factor (Q)	Absorbed Dose Equal to a Dose Equivalent[a]	Unit
X, gamma, or beta radiation and high-speed electrons	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	

[a]The absorbed dose in gray is equal to 1 Sv or the absorbed dose in rad is equal to 1 rem.

B. If it is more convenient to measure the neutron fluence rate than to determine the neutron dose equivalent rate in sievert per hour or rem per hour, 0.01 Sv (1 rem) of neutron radiation of unknown energies may, for purposes of these rules, 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 or registrant may use the fluence rate per unit dose equivalent or the appropriate Q value from Table II to convert a measured tissue dose in gray or rad to dose equivalent in sievert or rem.

TABLE II
MEAN QUALITY FACTORS, Q, AND FLUENCE PER UNIT DOSE EQUIVALENT FOR MONOENERGETIC NEUTRONS

	Neutron Energy (meV)	Quality Factor (Q)	Fluence per Unit Dose Equivalent[b] (neutrons cm^{-2} $^{r}em^{-1}$)	Fluence per Unit Dose Equivalent[b] (neutrons cm^{-2} $^{S}v^{-1}$)
(thermal)	2.5E-8	2	980E+6	980E+8
	1E-7	2	980E+6	980E+8
	1E-6	2	810E+6	810E+8
	1E-5	2	810E+6	810E+8

1E-4	2	840E+6	840E+8
1E-3	2	980E+6	980E+8
1E-2	2.5	1010E+6	1010E+8
1E-1	7.5	170E+6	170E+8
5E-1	11	39E+6	39E+8
1	11	27E+6	27E+8
2.5	9	29E+6	29E+8
5	8	23E+6	23E+8
7	7	24E+6	24E+8
10	6.5	24E+6	24E+8
14	7.5	17E+6	17E+8
20	8	16E+6	16E+8
40	7	14E+6	14E+8
60	5.5	16E+6	16E+8
1E+2	4	20E+6	20E+8
2E+2	3.5	19E+6	19E+8
3E+2	3.5	16E+6	16E+8
4E+2	3.5	14E+6	14E+8

[a] Value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-centimeter diameter cylinder tissue-equivalent phantom.
[b] Monoenergetic neutrons incident normally on a 30-centimeter diameter cylinder tissue-equivalent phantom.

Historical Note
Former Rule Section A.5; Former Section R12-1-105 repealed, new Section R12-1-105 adopted effective June 30, 1977 (Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2). New Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

R12-1-106. Units of Activity
For purposes of these rules, activity is expressed in the SI unit of becquerel (Bq) or in the special unit of curie (Ci), or their multiples, or disintegrations or transformations per unit of time. The definitions for these units are located in R12-1-102.

Historical Note
Former Rule Section A.6; Former Section R12-1-1-6 repealed, new Section R12-1-106 adopted effective June 30, 1977 (Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2). New Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

R12-1-107. Misconduct
A. A licensee, registrant, applicant for a license or certificate of registration, or employee of a licensee, registrant, or applicant; or any contractor (including a supplier or consultant), subcontractor, or employee of a contractor or subcontractor of any licensee or certificate of registration holder who provides to any licensee, registrant, applicant, contractor, or subcontractor, any components, equipment, materials, or other goods or services that relate to a licensee's, registrant's, or applicant's activities in this Chapter, shall not:
1. Knowingly engage in conduct that violates or will result in a violation by a licensee, registrant, or applicant, of any statute, rule, regulation, or order; or any term, condition, or limitation of any license or registration issued by the Agency; or
2. Knowingly submit to the Agency, or a licensee, registrant, or applicant, or a licensee's, registrant's, or applicant's contractor or subcontractor, information that is incomplete or inaccurate.

B. The Board shall impose the applicable civil penalty listed in R12-1-1216 on a person who violates subsection (A)(1) or (A)(2). For this purpose the person is classified as a Division II licensee and the violation is classified as a Severity II violation.
C. For the purposes of this Section, "misconduct" means conduct prohibited under subsection (A).
D. A person who is not a licensee, registrant, or applicant and knowingly violates a rule for the safe use of radiation sources in 12 A.A.C.1 is subject to the enforcement actions in 12 A.A.C. 1, Article 12.

Historical Note
Former Rule Section A.7; Former Section R12-1-107 repealed, new Section R12-1-107 adopted effective June 30, 1977

(Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2). New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-108. Repealed

Historical Note

Former Rule Section A.8; Former Section R12-1-108 repealed, new Section R12-1-108 adopted effective June 30, 1977 (Supp. 77-3). Change of address (Supp. 85-6). Section repealed effective April 2, 1990 (Supp. 90-2).

R12-1-109. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2).

R12-1-110. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2).

R12-1-111. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Section repealed effective April 2, 1990 (Supp. 90-2).

R12-1-112. Renumbered

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-112 renumbered to R12-1-104 effective April 2, 1990 (Supp. 90-2).

Appendix A. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective August 10, 1994 (Supp. 94-3).

Appendix B. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective August 10, 1994 (Supp. 94-3).

ARTICLE 3. RADIOACTIVE MATERIAL LICENSING

R12-1-301. Ownership, Control, or Transfer of Radioactive Material

A. In addition to the requirements of this Article, all licensees are subject to the requirements of 12 A.A.C. 1, Article 1, Article 4, and Article 10. Licensees engaged in industrial radiographic operations are subject to the requirements of 12 A.A.C. 1, Article 5; licensees using radioactive material in the practice of medicine are subject to the requirements of 12 A.A.C. 1, Article 7; licensees transporting radioactive material are subject to the requirements contained in 12 A.A.C. 1, Article 15; and licensees using radioactive material in well logging operations are subject to the requirements in 12 A.A.C. 1, Article 17.

B. Notwithstanding any other provisions of this Article, any person may own radioactive material, provided that the ownership does not include the actual possession, custody, use, or physical transfer of radioactive material or the manufacture or production of any article that contains radioactive material without the applicable certification, license, or registration.

C. A manufacturer, processor, or producer of any equipment, device, commodity, or other product that contains source material or radioactive material whose subsequent possession, use, transfer, or disposal by all other persons is exempt from regulatory requirements may only obtain authority to transfer possession or control of the material from the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

Historical Note

Former Rule Section C.1. Former Section R12-1-301 repealed, new Section R12-1-301 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-301 renumbered to R12-1-322, new Section R12-1-301 adopted effective February 18, 1994 (Supp. 94-1). Former Section R12-1-301 repealed; new Section R12-1-301 renumbered from R12-1-302 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-302. Source Material; Exemptions

A. Any person is exempt from this Article to the extent the person receives, possesses, uses, delivers or transfers source material in any chemical mixture, compound, solution, or alloy in which the source material is by weight less than 1/20th of 1 percent (0.0005) of the mixture, compound, solution, or alloy.

B. Any person is exempt from this Article to the extent the person receives, possesses, uses, or transfers unrefined and unprocessed ore containing source material, provided that, the person does not refine or process the ore except as authorized in a specific license.

C. Any person is exempt from this Article if the person receives, possesses, uses, or transfers:

1. Any quantities of thorium contained in:
   a. Incandescent gas mantles;
   b. Vacuum tubes;
   c. Welding rods;
   d. Electric lamps for illuminating purposes provided that each lamp does not contain more than 50 milligrams of thorium;
   e. Germicidal lamps, sunlamps, and lamps for outdoor or industrial lighting, provided that each lamp does not contain more than 2 grams of thorium;
   f. Rare earth metals, compounds, mixtures, or products containing not more than 0.25 percent by weight thorium, uranium, or any combination of thorium and uranium; or
   g. Individual neutron dosimeters, provided that each dosimeter does not contain more than 50 milligrams of thorium;
2. Source material contained in the following products:
   a. Glazed ceramic tableware **manufactured before August 27, 2013**, provided that the glaze contains not more than 20 percent source material by weight;
   b. Glassware **containing not more than 2 percent by weight source material**, glass enamel and glass enamel frit containing not more than 10 percent source material by weight, but not including commercially manufactured glass brick, pane glass, ceramic tile or other glass, glass enamel or ceramic used in construction; or
   c. Piezoelectric ceramic containing not more than 2 percent source material by weight;
3. Photographic film, negatives, and prints containing uranium or thorium;
4. Any finished product or part fabricated of, or containing, tungsten-thorium 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 subsection does not authorize the chemical, physical, or metallurgical treatment or processing of the finished product or part;
5. Uranium contained in counterweights installed in aircraft, rockets, projectiles, and missiles, or stored or handled in connection with installation or removal of counterweights, provided that:
   a. The counterweights are manufactured in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission, authorizing distribution by the licensee according to 10 CFR 40;
   b. Each counterweight has been impressed with the following legend clearly legible through any plating or other covering: "DEPLETED URANIUM";
   c. Each counterweight is durably and legibly labeled or marked with the identification of the manufacturer and the statement: "UNAUTHORIZED ALTERATIONS PROHIBITED"; and
   d. The exemption contained in this item does not authorize the chemical, physical, or metallurgical treatment or processing of any counterweight other than repair or restoration of any plating or other covering; and
   e. The requirements specified in subsections (C)(5)(b) and (c) do not apply to counterweights manufactured prior to December 31, 1969; provided, that these counterweights are impressed with the legend, "CAUTION – RADIOACTIVE MATERIAL – URANIUM."
6. Natural or depleted uranium metal used as shielding and constituting part of any shipping container; provided that:
   a. The shipping container is conspicuously and legibly impressed with the legend "CAUTION – RADIOACTIVE SHIELDING – URANIUM," and
   b. The uranium metal is encased in mild steel or equally fire resistant metal with minimum wall thickness of 1/8 inch (3.2 mm).
7. Thorium contained in finished optical lenses, provided that each lens does not contain more than 30 percent of thorium by weight, and that the exemption contained in this item does not authorize either:
   a. The shaping, grinding, or polishing of a thoriated lens or manufacturing processes other than the assembly of a thoriated lens into optical systems and devices without any alteration of the lens; or
   b. The receipt, possession, use, or transfer of thorium contained in contact lenses, spectacles, or the eyepieces of binoculars or other optical instruments;
8. Uranium contained in detector heads of fire detection units, provided that each detector head contains not more than 5 nanocuries (185 Bq) of uranium; or
9. Thorium contained in any finished aircraft engine part containing nickel-thoria alloy, provided that:
   a. The thorium is dispersed in the nickel-thoria alloy in the form of finely divided thoria (thorium dioxide), and
   b. The thorium content in the nickel-thoria alloy does not exceed 4 percent by weight.

D. The exemptions in subsection (C) do not authorize the manufacture of any of the products described.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Amended subsection (C) effective November 22, 1988 (Supp. 88-4). Former Section R12-1-302 renumbered to R12-1-303, new Section R12-1-302 renumbered from R12-1-301 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-302 renumbered to R12-1-301; new Section R12-1-302 renumbered from R12-1-303 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August

R12-1-303. Radioactive Material Other Than Source Material; Exemptions

A. Exempt concentrations

1. Except as provided in subsection (A)(3) and (A)(4), any person is exempt from this Article if the person receives, possesses, uses, transfers, owns, or acquires products or materials containing radioactive material in concentrations not in excess of those listed in Exhibit A.
2. This Section shall not be deemed to authorize the import of radioactive material or products containing radioactive material.
3. A manufacturer, processor, or producer of a product or material is exempt from the requirements for a license issued under R12-1-311(A) or the requirements of this Article to the extent that this person transfers radioactive material contained in a product or material in concentrations not in excess of those specified in Exhibit A of this Article 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.
4. A person shall not introduce radioactive material into a product or material knowing or having reason to believe that it will be transferred to persons exempt under subsection (A)(1) or equivalent Regulations of the U.S. Nuclear Regulatory Commission or any Agreement State or Licensing State, except in accordance with a license issued under 10 CFR 32.11.

B. Exempt items

1. 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, a person is exempt from this Chapter to the extent that the person receives, possesses, uses, transfers, owns, or acquires the following products:
   a. Timepieces, hands, or dials containing not more than the following specified quantities of radioactive material and not exceeding the following specified levels of radiation:
      i. 925 megabecquerels (25 millicuries) of tritium per timepiece,
      ii. 185 megabecquerels (5 millicuries) of tritium per hand,
      iii. 555 megabecquerels (15 millicuries) of tritium per dial (bezels when used shall be considered part of the dial),
      iv. 3.7 megabecquerels (100 microcuries) of promethium-147 per watch or 7.4 megabecquerels (200 microcuries) of promethium-147 per any other timepiece,
      v. 740 kBq (20 microcuries) of promethium-147 per watch hand or 1.48 megabecquerels (40 microcuries) of promethium-147 per other timepiece hand,
      vi. 2.22. megabecquerels (60 microcuries) of promethium-147 per watch dial or 4.44 MBq (120 microcuries) of promethium-147 per other timepiece dial (bezels, when used, shall be considered part of the dial),
      vii. The levels of radiation from hands and dials containing promethium-147 shall not exceed, when measured through 50 milligrams per square centimeter of absorber:
         (1) For wrist watches, 1.0 µGy (0.1 millirad) per hour at 10 centimeters from any surface of the watch;
         (2) For pocket watches, (0.1 millirad) per hour at 1 centimeter from any surface;
         (3) For any other timepiece, 2.0 µGy (0.2 millirad) per hour at 10 centimeters from any surface;
      viii. 37 kBq (1 microcurie) of radium-226 per timepiece in intact timepieces manufactured prior to November 30, 2007;
   b. Static elimination devices which contain, as a sealed source or sources, radioactive material consisting of a total of not more than 18.5 MBq (500 µCi) of polonium-210 per device.
      i. Ion generating tubes designed for ionization of air that contain, as a sealed source or sources, radioactive 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.
      ii. Such devices authorized before October 23, 2012 for use under the general license then provided in R12-1-306 and equivalent regulations of the NRC or Agreement State and manufactured, tested, and labeled by the manufacturer in accordance with the specifications contained in a specific license issued by the NRC.
   c. Balances of precision containing not more than 37 megabecquerels (1 millicurie) of tritium per balance or not more than 18.5 megabecquerels (0.5 millicurie) of tritium per balance part manufactured before December 17, 2007;
   d. Marine compasses containing not more than 27.75 gigabecquerels (750 millicuries) of tritium gas and other marine navigational instruments containing not more than 9.25 gigabecquerels (250 millicuries) of tritium gas manufactured before December 17, 2007;
   e. Ionization chamber smoke detectors containing not more than 37 kBq (1 microcurie) of americium-241 per detector in the form of a foil and designed to protect life and property from fires;
   f. Electron tubes: Provided that each tube does not contain more than one of the following specified quantities of radioactive material:
      i. 5.55 GBq (150 millicuries) of tritium per microwave receiver protector tube or 370 megabecquerels (10 millicuries) of tritium per any other electron tube;
      ii. 37 kBq (1 microcurie) of cobalt 60;
      iii. 185 kBq (5 microcuries) of nickel 63;
      iv. 1.11 megabecquerels (30 microcuries) of krypton 85;
      v. 185 kBq (5 microcuries) of cesium 137;

vi. 1.11 megabecquerels (30 microcuries) of promethium-147;
vii. And provided further, that the level of radiation due to radioactive material contained in each electron tube does not exceed 10 μGy (1 millirad) per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber. The term "electron tubes" includes spark gap tubes, power tubes, gas tubes, including glow lamps, receiving tubes, microwave tubes, indicator tubes, pick-up tubes, radiation detection tubes, and any other completely sealed tube that is designed to conduct or control electrical current;

g. Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of radioactive material provided that:
i. Each source contains no more than one exempt quantity set forth in Exhibit B of this Article; and
ii. Each instrument contains no more than 10 exempt quantities. For the purposes of this subsection, an instrument's source or sources may contain either one type or different types of radionuclide and an individual exempt quantity may be composed of fractional parts of one or more of the exempt quantities in Exhibit B of this Article, provided the sum of the fractions do not exceed unity;
iii. For the purposes of subsection (B)(1)(h) only, 185 kBq (50 nanocurie) of americium-241 is considered an exempt quantity under Exhibit B of this Article;

h. Any person who desires to apply radioactive material to, or to incorporate radioactive material into, the products exempted in subsection (B)(1)(a), or who desires to initially transfer for sale or distribution such products containing radioactive material, should apply for a specific license pursuant to R12-1-311 of this Article, which license states that the product may be distributed by the licensee to persons exempt from the rules pursuant R12-1-303 (A)(1).

2. Self-luminous products **containing tritium, krypton-85, or promethium-147**
a. Except for persons who manufacture, process, initially transfer for sale or distribution, or produce self-luminous products containing tritium, krypton-85, or promethium-147, a person is exempt from this Chapter if the person receives, possesses, uses, owns, transfers or acquires tritium, krypton-85 or promethium-147 in self-luminous products manufactured, processed, produced, imported, initially transferred for sale or distribution, or transferred under a specific license issued by the U.S. Nuclear Regulatory Commission and described in 10 CFR 32.22, and the license authorizes the transfer of the products to persons who are exempt from regulatory requirements. This exemption does not apply to tritium, krypton-85, or promethium-147 used in products for frivolous purposes or in toys or adornments.
b. A person is exempt from this Chapter if the person receives, possesses, uses, or transfers articles containing less than 3.7 kBq (100 nanocuries) of radium-226, manufactured prior to October 1, 1978.

3. Gas and aerosol detectors containing ~~**radioactive**~~ **byproduct** material
a. Except for persons who manufacture, process, initially transfer for sale or distribution, or produce gas and aerosol detectors containing radioactive material, a person is exempt from this Chapter if the person receives, possesses, uses, transfers, owns, or acquires radioactive material in gas and aerosol detectors designed to protect life or property from fires and airborne hazards, provided that detectors containing radioactive material shall be manufactured, imported, or transferred according to a specific license issued by the U.S. Nuclear Regulatory Commission and described in 10 CFR 32.26, or equivalent regulations of an Agreement or Licensing State, this exemption also covers gas and aerosol detectors manufactured or distributed before November 30, 2007 in accordance with a specific license issued by the U.S. Nuclear Regulatory Commission, or equivalent regulations of an Agreement or Licensing State and the license authorizes the transfer of the detectors to persons who are exempt from regulatory requirements.
b. Gas and aerosol detectors previously manufactured and distributed to general licensees in accordance with a specific license issued by an Agreement State are exempt under subsection (B)(4)(a), provided that the device is labeled in accordance with the specific license authorizing distribution of the general licensed device, and that the detectors meet the requirements of the regulations of the U.S. Nuclear Regulatory Commission.

4. Certain industrial devices
a. 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 set forth in this Chapter 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 under R12-1-311 of this Article, 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.
b. Any person who desires to manufacture, process, produce, or initially transfer, for sale or distribution, industrial devices containing byproduct material for use under paragraph (1) of this subsection, shall apply for a license described in R12-1-311 **and for a certificate of registration in accordance with 32.210 of this chapter in order to meet the Compatibility Category B designation assigned to 10 CFR 30.19(b), 30.20 and 30.22.**

C. Exempt quantities

1. Except as provided in subsections (C)(2), (3), and (7), a person is exempt from this Chapter if the 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 Exhibit B of this Article.
2. This subsection does not authorize the production, packaging, or repackaging or transfer of radioactive material for purposes of commercial distribution, or the incorporation of radioactive material into products intended for commercial distribution.
3. Except as specified in this subsection, a person shall not, for purposes of commercial distribution, transfer radioactive material in the individual quantities set forth in Exhibit B of this Article, knowing or having reason to believe the described quantities of radioactive material will be transferred to persons exempt under subsection (C) or equivalent regulations of the U.S. Nuclear Regulatory Commission or any Agreement State or Licensing State. A person may transfer radioactive material for commercial distribution under a specific license issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.18 which license states that the radioactive material may be transferred by the licensee to persons exempt under this subsection or the equivalent regulations of the U.S. Nuclear Regulatory Commission or any Agreement State or Licensing State.
4. Sources containing exempt quantities of radioactive material shall not be bundled or placed in close proximity for the purpose of using the radiation from the combined sources in place of a single source, containing a licensable quantity of radioactive material.
5. Possession and use of bundled or combined sources containing exempt quantities of radioactive material in unregistered devices by persons exempt from licensing is prohibited.
6. Any person, who possesses radioactive material received or acquired before September 25, 1971, under the general license issued under R12-1-311(A) of this Article or similar general license of an Agreement State or the NRC, is exempt from the requirements for a license issued under R12-1-311(A) of this Article to the extent that this person possesses, uses, transfers, or owns radioactive material.
7. No person may, for purposes of producing an increased radiation level, combine quantities of radioactive material covered by the exemption described in subsection (C)(6) so that the aggregate quantity exceeds the limits set forth in Exhibit B, except for radioactive material combined within a device placed in use before May 3, 1999, or as otherwise permitted by the rules in this Section.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-303 renumbered to R12-1-304, new Section R12-1-303 renumbered from R12-1-302 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-303 renumbered to R12-1-302; new Section R12-1-303 renumbered from R12-1-304 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-304. License Types

A. Activities requiring license. Except as provided in 10 CFR 30.3 (revised January 1, 2013, incorporated by reference, and available under R12-1-101; this incorporated material contains no future editions or amendments) this Section and for persons exempt as provided in R12-1-302 and R12-1-303 of this Article, no person shall manufacture, produce, transfer, receive, acquire, own, possess, or use byproduct material except as authorized in a specific or general license issued in accordance with the regulations in this chapter and in accordance with 10 CFR 30.3.

B. Licenses for radioactive materials are of two types: general and specific.
1. A general license is provided by rule, grants authority to a person for certain activities involving radioactive material, and is effective without the filing of an application with the Agency or the issuance of a licensing document to a particular person. However, registration with the Agency may be required by the particular general license.
2. The Agency issues a specific license to a named person who has filed an application for a license under the applicable provision of this Chapter. A specific licensee is subject to all of the applicable rules in this Chapter and any limitation contained in the license document.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-304 renumbered to R12-1-305, new Section R12-1-304 renumbered from R12-1-303 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-304 renumbered to R12-1-303; new Section R12-1-304 renumbered from R12-1-305 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-305. General Licenses – Source Material

A. This subsection grants a general license that authorizes commercial and industrial firms; research, educational, and medical institutions; and state and local government agencies to use, and transfer not more than 6.8 kg (15 pounds) of source material at any one time for research, development, educational, commercial, or operational purposes. A person authorized under this subsection shall not receive more than 68.2 kg (150 pounds) of source material in one calendar year.

B. A person who receives, possesses, uses, or transfers source material under a general license granted under subsection (A) is exempt from the provisions of 12 A.A.C. 1, Article 4 and Article 10, provided the receipt, possession, use, or transfer is within the terms of the general license. This exemption does not apply to any person who is also in possession of source material under a specific license issued under this Article.

C. This subsection grants a general license that authorizes a person to receive acquire, possess, use, or transfer depleted uranium contained in industrial products and devices provided:

1. The depleted uranium is contained in the industrial product or device for the purpose of providing a concentrated mass in a small volume of the product or device;
2. The industrial products or devices have been manufactured or initially transferred in accordance with a specific license governed by R12-1-311(M), or a specific license issued by the U.S. Nuclear Regulatory Commission or an Agreement State that authorizes manufacture of the products or devices for distribution to persons generally licensed by the U.S. Nuclear Regulatory Commission or an Agreement State;
3. The person files an ARRA 23 "Registration Certificate -- Use of Depleted Uranium Under General License" with the Agency. The person shall provide the information requested on the certificate and listed in Exhibit E. The person shall submit the information within 30 days after first receipt or acquisition of the depleted uranium, returning the completed registration certificate to the Agency. The person shall report in writing to the Agency any change in information originally submitted to the Agency on ARRA 23. The person shall submit the change report within 30 days after the effective date of the described change.

D. A person who receives, acquires, possesses, or uses depleted uranium according to the general license provided under subsection (C) shall:

1. Not introduce 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. Not abandon the depleted uranium;
3. Transfer the depleted uranium as prescribed in R12-1-318. If the transferee receives the depleted uranium under a general license established by subsection (C), the transferor shall furnish the transferee with a copy of this Section and a copy of the registration certificate. If the transferee receives the depleted uranium under a general license governed by a regulation of the U.S. Nuclear Regulatory Commission or an Agreement State that is equivalent to subsection (C), the transferor shall furnish the transferee a copy of the equivalent rule and a copy of the registration certificate, accompanied by a letter explaining that use of the product or device is regulated by the U.S. Nuclear Regulatory Commission or an Agreement State under requirements substantially similar to those in this Section;
4. Within 30 days of any transfer, report in writing to the Agency the name and address of the person receiving the depleted uranium; and
5. Not export depleted uranium except under a license issued by the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 110.

E. A person who receives, acquires, possesses, uses, or transfers depleted uranium in accordance with a general license granted under subsection (C) is exempt from the requirements of 12 A.A.C. 1, Articles 4 and 10 with respect to the depleted uranium covered by that general license.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-305 renumbered to R12-1-306, new Section R12-1-305 renumbered from R12-1-304 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-305 renumbered to R12-1-304; new Section R12-1-305 renumbered from R12-1-306 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3).

R12-1-306. General License – Radioactive Material Other Than Source Material

A. This subsection grants a general license that authorizes a commercial or industrial firm, to transfer, receive, acquire, own, possess, and use radioactive material incorporated in the following devices or equipment manufactured, tested, and labeled by the manufacturer in accordance with a specific license issued to the manufacturer by the U.S. Nuclear Regulatory Commission under 10 CFR 31.3. The devices regulated by this subsection include:

1. Devices designed for use as static eliminators that contain, as a sealed source or sources, radioactive material, consisting of a total of not more than 18.5 MBq (500 microcuries) of polonium-210 per device; or
2. Devices designed for ionization of air that contain, as a sealed source or sources, radioactive material, consisting of a total of not more than 18.5 MBq (500 microcuries) of polonium-210 per device or 1.85 GBq (50 millicuries) of hydrogen-3 (tritium) per device.

B. Certain measuring, gauging or controlling devices and certain devices for producing light or an ionized atmosphere.

1. This subsection grants a general license to a commercial or industrial firm; a research, educational or medical institution; an individual conducting business; or a state or local government agency to receive, acquire, possess, use, or transfer radioactive 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, according to the provisions of 10 CFR 31.5(b), (c), and

(d), (Revised January 1, 2013, incorporated by reference, and available under R12-1-101. The incorporated material contains no future editions or amendments.

2. A general licensee shall receive a device from one of the specific licensees described in this Section or through a transfer made under subsection (B)(4)(k).
3. A general license in subsection (B)(1) applies only to radioactive material contained in devices that have been manufactured or initially transferred and labeled in accordance with the requirements contained in:
   a. A specific license issued under R12-1-311(A), or
   b. An equivalent specific license issued by the NRC or another Agreement State.
   c. An equivalent specific license issued by a State with rules or regulations comparable to this Section.
4. A person who acquires, receives, possesses, uses, or transfers radioactive material in a device licensed under subsection (B)(1) or through a transfer made under subsection (B)(4)(h), shall:
   a. Ensure that all labels and safety statements affixed to a device at the time of receipt and bearing a statement that removal of the label is prohibited are maintained and not removed, and comply with all instructions and precautions on the labels.
   b. Ensure 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 other intervals as specified on the label.
      i. A general licensee need not test a device that contains only krypton for leakage of radioactive material; and
      ii. A general licensee need not test a device for leakage of radioactive material if the device contains only tritium, not more than 3.7 megabecquerels (100 microcuries) of other beta and/or gamma emitting material, or 370 kilobecquerels (10 microcuries) of alpha emitting material, or the device is held in storage, in the original shipping container, before initial installation.
   c. Ensure that the tests required by subsection (B)(4)(b) and other testing, installation, servicing, and removal from installation involving the radioactive material or its shielding or containment, are performed:
      i. In accordance with the device label instructions, or
      ii. By a person holding a specific license under R12-1-311(A) or in accordance with the provisions of a specific license issued by the NRC or an Agreement State which authorizes distribution of devices to persons generally licensed by the NRC or an Agreement State.
   d. Maintain records of compliance with the requirements in subsections (B)(4)(b) and (c) that show the results of tests; the dates that required activities were performed, and the names of persons performing required activities involving radioactive material from the installation and its shielding or containment. The records shall be maintained for three years from the date of the recorded event or until transfer or disposal of the device.
   e. Immediately suspend operation of a 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 185 becquerel (0.005 microcurie) or more of removable radioactive material.
      i. A general licensee shall not operate the device until it has been repaired by the manufacturer or another person holding a specific license to repair this type of device that was issued by the Agency under R12-1-311(A), the NRC, or an Agreement State which authorizes distribution of devices to persons generally licensed by the NRC or an Agreement State.
      ii. If necessary the general licensee shall dispose of the device and any radioactive material from the device by transfer to a person authorized by a specific license to receive the radioactive material in the device or as otherwise approved by the Agency.
      iii. Within 30 days of an event governed by subsection (B)(4)(e) the general licensee shall furnish a report that contains a brief description of the event and the remedial action taken and, in the case of detection of 185 Becquerel (0.005 microcurie) or more of removable radioactive material or failure of or damage to a source likely to result in contamination of the general licensee's facility or the surrounding area, if applicable, a plan for ensuring that the general licensee's facility and surrounding area, if applicable, are acceptable for unrestricted use. The radiological criteria for unrestricted use in R12-1-452 may be used to prepare the plan, as determined by the Agency, on a case-by-case basis.
   f. Not abandon a device that contains radioactive material.
   g. Not export a device that contains radioactive material except in accordance with 10 CFR 110, revised January 1, 2013, incorporated by reference, and available under R12-1-101. The incorporated material contains no future editions or amendments.
   h. Transfer or dispose of a device that contains radioactive material only by export as authorized in subsection (B)(4)(g), transfer to another general licensee as authorized in subsection (B)(4)(k) or a person who is authorized to receive the device by a specific license issued by the Agency, the NRC, or an Agreement State, or collection as waste if authorized by equivalent regulations of an Agreement State, or the NRC, or as otherwise approved under subsection (B)(4)(j).
   i. Within 30 days after the transfer or export of a device to a specific licensee, furnish a report to the Agency. The report shall:
      i. Identify the device by manufacturer's (or initial transferor's) name, model number, and serial number;

ii. Provide the name, address, and license number of the person receiving the device (license number not applicable if exported); and
iii. Provide the date of transfer or export.

j. Obtain written Agency approval before transferring a device to any other specific licensee that is not authorized in accordance with subsection (B)(4)(h).

k. Transfer a device to another general licensee only:
i. If the device remains in use at a particular location. The transferor shall provide the transferee with a copy of this Section, a copy of R12-1-443, R12-1-445, and R12-1-448 and any safety documents identified on the device label. Within 30 days of the transfer, the transferor shall report to the Agency 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 telephone number of the responsible individual appointed by the transferee in accordance with subsection (B)(4)(n); or
ii. If the device is held in storage in the original shipping container at its intended location of use before initial use by a general licensee, and by a person that is not a party to the transaction.

l. Comply with the provisions of R12-1-443, R12-1-444, R12-1-445, R12-1-447, and R12-1-448 for reporting and notification of radiation incidents, theft or loss of licensed material, and is exempt from the other requirements of 12 A.A.C. 1, Articles 4 and 10.

m. Respond to written requests from the Agency to provide information relating to the general license within 30 days from the date on the request, or a longer time period specified in the request. If the general licensee cannot provide the requested information within the specified time period, the general licensee shall request a longer period to supply the information before expiration of the time period, providing the Agency with a written justification for the request.

n. Appoint an individual responsible for knowledge of applicable laws and possessing the authority to take actions required to comply with applicable radiation safety laws. The general licensee, through this individual, shall ensure the day-to-day compliance with applicable radiation safety laws. This provision does not relieve the general licensee of responsibility.

o. Register, in accordance with subsections (B)(4)(p) and (q), any device that contains at least 370 megabecquerels (10 millicuries) of cesium-137, 3.7 megabecquerels (0.1 millicuries) of strontium-90, 37 megabecquerels (1 millicurie) of cobalt-60, or 37 megabecquerels (1 millicurie) 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 subsection (B)(4)(q)(iv), represents a separate general licensee and requires a separate registration and fee.

p. Register each device annually with the Agency and pay the fee required by R12-1-1306, Category D4, if in possession of a device that meets the criteria in subsection (B)(4)(o). The general licensee shall register by verifying, correcting, and adding to the information provided in a request for registration received from the Agency. The registration information shall be submitted to the Agency within 30 days from the date on the request for registration. In addition, a general licensee holding devices meeting the criteria of subsection (B)(4)(o) is subject to the bankruptcy notification requirements in R12-1-313(D).

q. In registering a device, furnish the following information and any other registration information specifically requested by the Agency:
i. Name and mailing address of the general licensee;
ii. Information about each device, including the manufacturer (or initial transferor), model number, serial number, radioisotope, and activity (as indicated on the label);
iii. Name, title, and telephone number of the responsible individual appointed by the general licensee under subsection (B)(4)(n);
iv. Address or location at which each device is used and stored. For a portable device, the address of the primary place of storage;
v. Certification by the responsible individual that the information concerning each device has been verified through a physical inventory and review of label information; and
vi. Certification by the responsible individual that the individual is aware of the requirements of the general license.

r. Report a change in mailing address for the location of use or a change in the name of the general licensee to the Agency 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.

s. Not use a device if the device has not been used for a period of two years. If a device with shutters is not being used, the general licensee shall ensure that the shutters are locked in the closed position. The testing required by subsection (B)(4)(b) need not be performed during a period of storage. However, if a device is put back into service or transferred to another person, and has not been tested during the required test interval, the general licensee shall ensure that the device is tested for leakage before use or transfer and that the shutter is tested before use. A device kept in standby for future use is excluded from the two-year time limit in this subsection if the general licensee performs a quarterly physical inventory regarding the standby devices.

5. A person that is generally licensed by an Agreement State with respect to a device that meets the criteria in subsection (B)(4)(o) is exempt from registration requirements if the device is used in an area subject to Agency jurisdiction for a period less than 180 days in any calendar year. The Agency does not request registration information from a general licensee if the device is exempted from licensing requirements in subsection (B)(4)(o).
6. The general license granted under subsection (B)(1) is subject to the provisions of 12 A.A.C. 1, Articles 1, 3, 12, and 15, and A.R.S. §§ 30-654(B)(13), 30-657(A) and (B), 30-681, and 30-685 through 30-689.
7. The general license in subsection (B)(1) of this Section does not authorize the manufacture or import of devices containing byproduct material.

C. Luminous safety devices for aircraft

1. This subsection grants a general license that authorizes a person to own, receive, acquire, possess, and use tritium or promethium-147 contained in luminous safety devices for use in aircraft, provided that each device contains not more than 370 gigabecquerels (10 curies) of tritium or 11.1 gigabecquerels (300 millicuries) of promethium-147; and each device has been manufactured, assembled, initially transferred, or imported according to a specific license issued by the U.S. Nuclear Regulatory Commission, or each device has been manufactured or assembled according to the specifications contained in a specific license issued to the manufacturer or assembler of the device by the Agency or any Agreement State or Licensing State in accordance with licensing requirements equivalent to those in 10 CFR 32.53.
2. A person who owns, receives, acquires, possesses, or uses a luminous safety device according to the general license granted in subsection (C)(1) is:
   a. Exempt from the requirements of 12 A.A.C. 1, Article 4 and Article 10 except that the person shall comply with the reporting and notification provisions of R12-1-443, R12-1-444, R12-1-445, R12-1-447, and R12-1-448;
   b. Not authorized to manufacture, assemble, repair, or import a luminous safety device that contains tritium or promethium-147;
   c. Not authorized to export luminous safety devices containing tritium or promethium-147;
   d. Not authorized to own, receive, acquire, possess, or use radioactive material contained in instrument dials; and
   e. Subject to the provisions of 12 A.A.C. 1, Articles 1, 3, 12, and 15 and A.R.S. §§ 30-654(B)(13), 30-657(A) and (B), 30-681, and 30-685 through 30-689.

D. This subsection grants a general license that authorizes a person who holds a specific license to own, receive, possess, use, and transfer radioactive material if the Agency issues the license; or special nuclear material if the NRC issues the license. For americium-241, radium-226, and plutonium contained in calibration or reference sources, this subsection grants a general license in accordance with the provisions of subsections (D)(1), (2), and (3). For plutonium, ownership is included in the licensed activities.

1. This subsection grants a general license for calibration or reference sources that have been manufactured according to the specifications contained in a specific license issued to the manufacturer or importer of the sources by the U.S. Nuclear Regulatory Commission under 10 CFR 32.57 or 10 CFR 70.39. This general license also governs calibration or reference sources that have been manufactured according to specifications contained in a specific license issued to the manufacturer by the Agency, an Agreement State, or a Licensing State, according to licensing requirements equivalent to those contained in 10 CFR 32.57 or 10 CFR 70.39, revised January 1, 2013, incorporated by reference, and available under R12-1-101. The incorporated material contains no future editions or amendments.
2. A general license granted under subsection (D) or (D)(1) is subject to the provisions of 12 A.A.C. 1, Articles 1, 3, 4, 10, 12, and 15 and A.R.S. §§ 30-654(B)(13), 30-657(A) and (B), 30-681, and 30-685 through 30-689. In addition, a person who owns, receives, acquires, possesses, uses, or transfers one or more calibration or reference sources under a general license granted under subsection (D) or (D)(1) shall:
   a. Not possess at any one time, at any location of storage or use, more than 185 kBq (5 microcuries) of americium-241, plutonium, or radium-226 in calibration or reference sources;
   b. Not receive, possess, use, or transfer a calibration or reference source unless the source, or the storage container, bears a label that includes one of the following statements, as applicable, or a substantially similar statement that contains the same information:
      i. 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 or 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 (name of the appropriate material) – DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

      _____
      Name of manufacturer or importer

      ii. The receipt, possession, use and transfer of this source, Model _____, Serial No. _____, are subject to a general license and the regulations of any Licensing State. Do not remove this label.
      CAUTION – RADIOACTIVE MATERIAL – THIS SOURCE CONTAINS RADIUM-226. DO NOT TOUCH RADIOACTIVE PORTION OF THIS SOURCE.

      _____
      Name of manufacturer or importer

c. Not transfer, abandon, or dispose of a calibration or reference source except by transfer to a person authorized to receive the source by a license from the Agency, the U.S. Nuclear Regulatory Commission, an Agreement State, or a Licensing State;
d. Store a calibration0 or reference source, except when the source is being used, in a closed container designed, constructed, and approved for containment of americium-241, plutonium, or radium-226 which might otherwise escape during storage; and
e. Not use a calibration or reference source for any purpose other than the calibration of radiation detectors or the standardization of other sources.

3. The general license granted under subsection (D) or (D)(1) does not authorize the manufacture or import of calibration or reference sources that contain americium-241, plutonium, or radium-226.
4. The general license granted under subsections (D) or (D)(1) does not authorize the manufacture or export of calibration or reference sources that contain americium-241, plutonium, or radium-226.

E. This subsection grants a general license that authorizes a person to receive, possess, use, transfer, own, or acquire carbon-14 urea capsules, which contain one microcurie of carbon-14 urea for "in vivo" human diagnostic use:
1. Except as provided in subsections (E)(2) and (3), a physician is exempt from the requirements for a specific license, provided that each carbon-14 urea capsule for "in vivo" diagnostic use contains no more than 1 microcurie.
2. A physician who desires to use the capsules for research involving human subjects shall obtain a specific license issued according to the specific licensing requirements in this Article.
3. A physician who desires to manufacture, prepare, process, produce, package, repackage, or transfer carbon-14 urea capsules for commercial distribution shall obtain a specific license from the Agency, issued according to the requirements in 10 CFR 32.21, (Revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
4. Nothing in this subsection relieves physicians from complying with applicable FDA and other federal and state requirements governing receipt, administration, and use of drugs.

F. This subsection grants a general license that authorizes any physician, clinical laboratory, or hospital to use radioactive material for certain "in vitro" clinical or laboratory testing.
1. The general licensee is authorized to receive, acquire, possess, transfer, or use, for any of the following stated tests, the following radioactive materials in prepackaged units:
   a. Iodine-125, in units not exceeding 370 kilobecquerel (10 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or radiation from such material, to human beings or animals.
   b. Iodine-131, in units not exceeding 370 kilobecquerel (10 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
   c. Carbon-14, in units not exceeding 370 kilobecquerel (10 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
   d. Hydrogen-3 (tritium), in units not exceeding 1.85 megabecquerel (50 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
   e. Iron-59, in units not exceeding 740 kilobecquerel (20 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
   f. Cobalt-57 or selenium-75, in units not exceeding 370 kilobecquerels (10 microcuries) each for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
   g. Mock iodine-125 reference or calibration sources, in units not exceeding 1.85 kBq (50 nanocurie) of iodine-129 and 185 becquerel (5 nanocurie) of americium-241 each, for use in "in vitro" clinical or laboratory tests not involving internal or external administration of radioactive material, or the radiation from such material, to human beings or animals.
2. A person shall not acquire, receive, possess, use, or transfer radioactive material according to the general license established by this subsection until the person has filed with the Agency ARRA-9, "Certificate -- "In Vitro" Testing with Radioactive Material Under General License," provided the information listed in Exhibit E, and received a validated copy of ARRA-9, which indicates the assigned certification number. The physician, clinical laboratory, or hospital shall furnish on ARRA-9 the following information:
   a. Name, telephone number, and address of the physician, clinical laboratory, or hospital; and
   b. A statement that the physician, clinical laboratory, or hospital has radiation measuring instruments to carry out "in vitro" clinical or laboratory tests with radioactive material and that tests will be performed only by personnel competent to use the instruments and handle the radioactive material.
3. A person who receives, acquires, possesses, or uses radioactive material according to the general license granted under this subsection shall:

a. Not possess at any one time, in storage or use, a combined total of not more than 7.4 megabecquerels (200 microcuries) of iodine-125, iodine-131, iron-59, cobalt-57, or selenium-75 in excess of 7.4 megabecquerels (200 microcuries), or acquire or use in any one calendar month more than 18.5 megabecquerels (500 microcuries) of these radionuclides.
b. Store the radioactive material, until used, in the original shipping container or in a container that provides equivalent radiation protection.
c. Use the radioactive material only for the uses authorized by subsection (F).
d. Not transfer radioactive material to a person who is not authorized to receive it according to a license issued by the Agency, the U.S. Nuclear Regulatory Commission, or any Agreement State or Licensing State, or in any manner other than in an unopened, labeled shipping container received from the supplier.
e. Not dispose of a mock iodine-125 reference or calibration source described subsection (F)(1) except as authorized by R12-1-434.
f. Package or prepackage a unit bearing a durable, clearly visible label: identifying the radioactive contents as to chemical form and radionuclide, and indicating that the amount of radioactivity does not exceed 0.37 megabecquerel (10 microcuries) of iodine-131, iodine-125, selenium-75, or carbon-14; 1.85 megabecquerels (50 microcuries) of hydrogen-3 (tritium); or 0.74 megabecquerel (20 microcuries) of iron-59; or Mock Iodine-125 in units not exceeding 1.85 kilobecquerels (0.05 microcurie) of iodine-129 and 0.185 kilobecquerel (0.005 microcurie) of americium-241 each; or cobalt-57 in units not exceeding 0.37 megabecquerel (10 microcuries).
g. Package to display the radiation caution symbol and the words, "Caution, Radioactive Material", and "Not for Internal or External Use in Humans or Animals."

4. The general licensee shall not receive, acquire, possess, transfer, or use radioactive material according to subsection (F)(1):
   a. Except as prepackaged units that are labeled according to the provisions of a specific license issued by the U.S. Nuclear Regulatory Commission, or any Agreement State that authorizes the manufacture and distribution of iodine-125, iodine-131, carbon-14, hydrogen-3 (tritium), iron-59, cobalt-57, selenium-75, or mock iodine-125 for distribution to persons generally licensed under subsection (F) or its equivalent federal law; and
   b. Unless one of the following statements, or a substantially similar statement that contains the same information, appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure that accompanies the package:
      i. This radioactive material may be acquired, received, possessed, and used only by physicians, 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 from such material, to human beings or animals. The acquisition, receipt, possession, use, and transfer are subject to the regulations and a general license of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into an agreement for the exercise of regulatory authority.

         _____
         Name of manufacturer

      ii. This radioactive material shall be acquired, received, possessed, and used only by physicians, 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 from such material, to human beings or animals. The receipt, acquisition, possession, use, and transfer are subject to the regulations and a general license of a Licensing State.

         _____
         Name of manufacturer

5. A physician, clinical laboratory or hospital that possesses or uses radioactive material under a general license granted by subsection (F):
   a. Shall report to the Agency in writing, any change in the information furnished on the ARRA-9. The report shall be furnished within 30 days after the effective date of the change; and
   b. Is exempt from the requirements of 12 A.A.C. 1, Article 4 and Article 10 with respect to radioactive material covered by the general license, except that a person using mock iodine-125 sources, described in subsection (F)(1)(g), shall comply with the provisions of R12-1-434, R12-1-443, and R12-1-444 of this Chapter.
6. For the purposes of subsection (F), a licensed veterinary care facility is considered a "clinical laboratory."

G. This subsection grants a general license that authorizes a person to own, receive, acquire, possess, use, and transfer strontium-90, contained in ice detection devices, provided each device contains not more than 1.85 megabecquerels (50 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 according to the specifications contained in a specific license issued by the Agency or any Agreement State to the manufacturer of the device under licensing requirements equivalent to those in 10 CFR 32.61. A person who receives, owns, acquires, possesses, uses, or transfers strontium-90 contained in ice detection devices under a general license in accordance with subsection (G):

1. Shall, upon occurrence of visually observable damage, such as a bend or crack or discoloration from overheating, discontinue use of the device until it has been inspected, tested for leakage, and repaired by a person who holds a specific license from the U.S. Nuclear Regulatory Commission or an Agreement State to manufacture or service ice detection devices; or dispose of the device according to the provisions of R12-1-434;

2. Shall assure that each label, affixed to the device at the time of receipt, which bears a statement that prohibits removal of the labels, maintained on the device; and
3. Is exempt from the requirements of 12 A.A.C. 1, Article 4 and Article 10, except that the user of an ice detection device shall comply with the provisions of R12-1-434, R12-1-443 and R12-1-444.
4. Shall not manufacture, assemble, disassemble, repair, or import an ice detection device that contains strontium-90.
5. Is subject to the provisions of 12 A.A.C. 1, Articles 1, 3, 12, and 15, and A.R.S. §§ 30-654(B), 30-657(A) and (B), 30-681, and 30-685 through 30-689.

H. This subsection grants a general license that authorizes a person to acquire, receive, possess, use, or transfer, in accordance with the provisions of subsections (I) and (J), radium-226 contained in the following products manufactured prior to November 30, 2007.
1. Antiquities originally intended for use by the general public. For the purposes of this paragraph, antiquities mean products originally intended for use by the general public and distributed in the late 19th and early 20th centuries, such as radium emanator jars, revigators, radium water jars, radon generators, refrigerator cards, radium bath salts, and healing pads.
2. Intact timepieces containing greater than 0.037 megabecquerel (1 microcurie), nonintact timepieces, and timepiece hands and dials no longer installed in timepieces.
3. Luminous items installed in air, marine, or land vehicles.
4. All other luminous products, provided that no more than 100 items are used or stored at the same location at any one time.
5. Small radium sources containing no more than 0.037 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.

I. Persons who acquire, receive, possess, use, or transfer byproduct material under the general license issued in subsection (H) are exempt from the provisions 12 A.A.C. 1, Articles 1, 3, 4, 7, 10, 12, and 15 and A.R.S. §§ 30-654(B)(13), 30-657(A) and (B), 30-681, and 30-685 through 30-689, 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. Any person who acquires, receives, possesses, uses, or transfers byproduct material in accordance with the general license in subsection (H):
1. Shall notify the Agency 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 Agency within 30 days.
2. Shall not abandon products containing radium-226. The product, and any radioactive material from the product, may only be disposed of according to Article 4 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 Agency.
3. Shall not export products containing radium-226 except in accordance with 10 CFR 110 revised January 1, 2013, incorporated by reference, and available under R12-1-101. The incorporated material contains no future editions or amendments.
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 Article 3, equivalent regulations of an Agreement State, or the NRC.
5. Shall respond to written requests from the Agency 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 Agency Director a written justification for the request.

J. The general license in subsection (H) does not authorize the manufacture, assembly, disassembly, repair, or import of products containing radium-226, except that timepieces may be disassembled and repaired.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-306 renumbered to R12-1-307, new Section R12-1-306 renumbered from R12-1-305 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-306 renumbered to R12-1-305; new Section R12-1-306 renumbered from R12-1-307 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-307. Repealed

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Repealed effective December 20, 1985 (Supp. 85-6). Former Section R12-1-307 renumbered to R12-1-308, new Section R12-1-307 renumbered from R12-1-306 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-307 renumbered to R12-1-306; new Section R12-1-307 renumbered from R12-1-308 and repealed by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-308. Filing Application for Specific Licenses

A. An applicant for a specific license shall file an Agency application. The applicant shall prepare the application in duplicate, one copy for the Agency and the other for the applicant.

B. The Agency 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 Agency to determine whether the application should be granted or denied or whether a license should be modified or revoked.

C. Each application shall contain the information specified in Exhibit (E) of this Article and be signed by the applicant, licensee, or person duly authorized to act for the applicant or licensee.

D. Unless R12-1-1302 precludes combination with a license of another category, an application for a specific license may include a request for a license that authorizes more than one activity.

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

F. The Agency shall make applications and documents submitted to the Agency available for public inspection, but may withhold any document or part of a document from public inspection if disclosure of its content is not required in the public interest and would adversely affect the interest of a person concerned.

G. Except as provided in subsections (G)(1), (2), and (3), 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 identify the source or device by manufacturer and model number as registered with the Agency, NRC, or with an Agreement State, or, for a source or a device containing radium-226 or accelerator-produced radioactive material, with the Agency, NRC, or an Agreement State under 10 CFR 32.210(c) revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

1. For sources or devices manufactured before October 23, 2012, that are not licensed under R12-1-306, R12-1-310, R12-1-311 or registered with the NRC or with an Agreement State, and for which the applicant is unable to provide all categories of information specified in 10 CFR 32.210(c) the application must include:
   a. All available information identified in 10 CFR 32.210(c) concerning the source, and, if applicable, the device; and
   b. 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. For sealed sources and devices allowed to be distributed without registration of safety information, the applicant may supply only the manufacturer, model number, and radionuclide and quantity.
3. 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.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-308 renumbered to R12-1-309, new Section R12-1-308 renumbered from R12-1-307 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-308 renumbered to R12-1-307; new Section R12-1-308 renumbered from R12-1-309 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-309. General Requirements for Issuance of Specific Licenses

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

1. The applicant is qualified by reason of training and experience to use the material in question for the purpose requested according to these rules, in a manner that will minimize danger to public health and safety or property;
2. The applicant's proposed equipment, facilities, and procedures are adequate to minimize danger to public health and safety or property;
3. The issuance of the license will not be inimical to the health and safety of the public;
4. The applicant satisfies all applicable special requirements in R12-1-310, R12-1-311, R12-1-322, R12-1-323, 12 A.A.C. 1, Articles 5, 7, and 17; and
5. The applicant demonstrates that a letter has been sent, return receipt requested, to the Mayor's office of the city, town, or, if not within an incorporated community, to the County Board of Supervisors of the county in which the applicant proposes to operate which describes:
   a. The nature of the proposed activity involving radioactive material; and
   b. The facility, including use and storage areas.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-309 renumbered to R12-1-310, new Section R12-1-309 renumbered from R12-1-308 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-309 renumbered to R12-1-308; new Section R12-1-309 renumbered from R12-1-310 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-310. Special Requirements for Issuance of Specific Broad Scope Licenses

A. The Agency shall issue three classes of academic and industrial broad scope licenses, and only a single class A medical broad scope license.

1. The license may authorize the radioactive materials in multi-curie quantities, and may authorize other radioactive materials and forms in addition to those listed in subsection (A)(1)(a). A license is a broad scope class A license if it:
   a. Contains the exact wording "Any radioactive material with Atomic Number 3 through 83" or "Any radioactive material with Atomic Number 84 through 92" in License Item 6; and
   b. Contains the word "any" to authorize the chemical or physical form of the materials in License Item 7;
2. A broad scope class B license is any specific license which authorizes the acquisition, possession, use, and transfer of the radioactive materials specified in Exhibit C of 12 A.A.C. 1, Article 3 in any chemical or physical form and in quantities determined as follows:
   a. The possession limit, if only one radionuclide is possessed, is the quantity specified for that radionuclide in Exhibit C, Column I; or
   b. The possession limit for multiple radionuclides is determined as follows: The sum of the ratios for all radionuclides possessed under the license shall not exceed unity (1). The ratio for each radionuclide is determined by dividing the quantity possessed by the applicable quantity in Exhibit C, Column I.
3. A broad scope class C license is any specific license authorizing the possession and use of the radioactive materials specified in Exhibit C of 12 A.A.C. 1, Article 3 in any chemical or physical form and in quantities determined as follows:
   a. The possession limit, if only one radionuclide is possessed, is the quantity specified for that radionuclide in Exhibit C, Column II; or
   b. The possession limit for multiple radionuclides is determined as follows: The sum of the ratios for all radionuclides possessed under the license shall not exceed unity (1). The ratio for each radionuclide is determined by dividing the quantity possessed by the applicable quantity in Exhibit C, Column II.

B. The Agency shall approve:

1. An application for a class A broad scope license if:
   a. The applicant satisfies the general requirements specified in R12-1-309;
   b. The applicant has engaged in a reasonable number of activities involving the use of radioactive material. For purposes of this subsection, the requirement of "reasonable number of activities" can be satisfied by showing that the applicant has five years of experience in the use of radioactive material. The Agency may accept less than five years of experience if the applicant's qualifications are adequate for the scope of the proposed license; and
   c. The applicant has established administrative controls and provisions relating to organization, management, procedures, recordkeeping, material control, accounting, and management review that are necessary to assure safe operations, including:
      i. Establishment of a radiation safety committee composed of a radiation safety officer, a representative of management, and persons trained and experienced in the safe use of radioactive material;
      ii. Appointment of a radiation safety officer who is qualified by training and experience in radiation protection, and who is available for advice and assistance on radiation safety matters; and
      iii. Establishment of appropriate administrative procedures to assure:
         (1) Control of procurement and use of radioactive material;
         (2) Completion of safety evaluations of proposed uses of radioactive material which take into consideration matters such as the adequacy of facilities and equipment, training and experience of the user, and operating or handling procedures; and
         (3) Review, approval, and recording by the radiation safety committee of safety evaluations of proposed uses prepared in accordance with this subsection prior to use of the radioactive material.
2. An application for a class B broad scope license if:
   a. The applicant satisfies the general requirements specified in R12-1-309; and
   b. The applicant has established administrative controls and provisions relating to organization, management, procedures, recordkeeping, material control, accounting, and management review that are necessary to assure safe operations, including:
      i. Appointment of a radiation safety officer who is qualified by training and experience in radiation protection, and available for advice and assistance on radiation safety matters; and
      ii. Establishment of appropriate administrative procedures to assure:
         (1) Control of procurement and use of radioactive material;
         (2) Completion of safety evaluations of proposed uses of radioactive material which take into consideration matters such as the adequacy of facilities and equipment, training and experience of the user, and the operating or handling procedures; and
         (3) Review, approval, and recording by the radiation safety officer of safety evaluations of proposed uses prepared according to subsection (B)(2)(b)(ii) prior to use of the radioactive material.
3. An application for a class C broad scope license if:
   a. The applicant satisfies the general requirements specified in R12-1-309; and
   b. The applicant submits a statement that radioactive material will be used only by, or under the direct supervision of, individuals who have received:

i. A college degree at the bachelor level, or equivalent training and experience, in the physical or biological sciences or in engineering; and
ii. At least 40 hours of training and experience in the safe handling of radioactive material, the characteristics of ionizing radiation, units of 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

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

C. Unless specifically authorized, broad-scope licensees shall not:
1. Conduct tracer studies in the environment involving direct release of radioactive material;
2. Acquire, receive, possess, use, own, import, or transfer devices containing 3.7 petabecquerels (100,000 curies) or more of radioactive material in sealed sources used for irradiation of materials;
3. Conduct activities for which a specific license is issued under R12-1-311, and 12 A.A.C. 1, Articles 5, 7, or 17; or
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.

D. Radioactive material possessed under the class A broad scope license shall only be used by, or under the direct supervision of, individuals approved by the licensee's radiation safety committee.

E. Radioactive material possessed under the class B broad scope license shall only be used by, or under the direct supervision of, individuals approved by the licensee's radiation safety officer.

F. Radioactive material possessed under the class C broad scope license shall only be used by, or under the direct supervision of, individuals who satisfy the requirements of R12-1-310(B)(3)(b).

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Amended effective November 5, 1993 (Supp. 93-4). Former Section R12-1-310 renumbered to R12-1-311, new Section R12-1-310 renumbered from R12-1-309 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-310 renumbered to R12-1-309; new Section R12-1-310 renumbered from R12-1-311 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3).

R12-1-311. Special Requirements for a Specific License to Manufacture, Assemble, Repair, or Distribute Commodities, Products, or Devices that Contain Radioactive Material

A. Licensing the manufacture and distribution of devices to persons generally licensed under R12-1-306(B).
1. The Agency shall grant a specific license to manufacture or distribute each device that contains radioactive material, excluding special nuclear material, to persons generally licensed under R12-1-306(B) or equivalent regulations of the U.S. NRC, an Agreement State, or the Licensing State if:
   a. The applicant satisfies the requirements of R12-1-309;
   b. 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:
      i. The device can be safely operated by persons not having training in radiological protection;
      ii. 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 a dose in excess of 10 percent of the limits specified in R12-1-408; and
      iii. Under accident conditions (such as fire and explosion) associated with handling, storage, and 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:
         (1) Whole body; head and trunk; active blood-forming organs; gonads; or lens of eye: 150 mSv (15 rem)
         (2) Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than 1 square centimeter; 2 Sv (200 rem)
         (3) Other organs: 500 mSv (50 rem)
   c. Each device bears a durable, legible, clearly visible label or labels that contain in a clearly identified and separate statement:
      i. Instructions and precautions necessary to assure safe installation, operating, and servicing of the device (documents such as operating and service manuals may be identified in the label and used to provide this information);
      ii. The requirement, or lack of requirement, for leak testing, or for testing any on-off mechanism and indicator, including the maximum time interval for the testing, and the identification of radioactive material by isotope, quantity of radioactivity, and date of determination of the quantity; and
      iii. The information called for in one of the following statements in the same or substantially similar form:
      The receipt, possession, use, and transfer of this device, Model _____, Serial No. _____, are subject to a general license or the equivalent and the regulations of the U.S. Nuclear Regulatory Commission or a state with which

the Nuclear Regulatory Commission has entered into an agreement for the exercise of regulatory authority. 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 distributor)
The receipt, possession, use and transfer of this device, Model _____, Serial No. _____, are subject to a general license or the equivalent, and the regulations of 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 distributor)

d. The model, serial number, and name of manufacturer or distributor may be omitted from the label if the information location is specified in labeling affixed to the device;
e. Each device with a separable source housing that provides the primary shielding for the source also bears, on the source housing, a durable label that provides the device model number and serial number, the isotope and quantity, the words, "Caution-Radioactive Material," the radiation symbol described in R12-1-428, and the name of the manufacturer or initial distributor; and
f. Each device meets the criteria in 10 CFR 31.5(c)(13)(i) (revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments) and 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 R12-1-428.

2. In the event the applicant desires that the device undergo mandatory testing 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, the application shall contain sufficient information to demonstrate that the 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 Agency shall consider information which includes, but is not limited to:
   a. Primary containment (source capsule),
   b. Protection of primary containment,
   c. Method of sealing containment,
   d. Containment construction materials,
   e. Form of contained radioactive material,
   f. Maximum temperature withstood during prototype tests,
   g. Maximum pressure withstood during prototype tests,
   h. Maximum quantity of contained radioactive material,
   i. Radiotoxicity of contained radioactive material, and
   j. Operating experience with identical devices or similarly designed and constructed devices.
3. In the event the applicant desires that the general licensee under R12-1-306(B), or under equivalent regulations of the NRC or an Agreement State or 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, the application shall include written instructions to be followed by the general licensee, estimated calendar quarter doses associated with the activity or activities, and bases for the estimates. The submitted information shall demonstrate that performance of the 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 dose in excess of 10 percent of the limits specified in R12-1-408.
4. A licensee authorized under subsection (A) to distribute a device to a generally licensed person shall provide, if a device that contains radioactive material is to be transferred for use under the general license granted in R12-1-306(B), the name of each person that is licensed under R12-1-311(A) and the information specified in this subsection for each person to whom a device will be transferred. The licensee shall provide this information before the device may be transferred. In the case of transfer through another person, the licensee shall provide the listed information to the intended user before initial transfer to the other person.
   a. The licensee shall provide:
      i. A copy of the general license, issued under R12-1-306(B),
      ii. A copy of R12-1-443 and R12-1-445,
      iii. A list of the services that can only be performed by a specific licensee,
      iv. Information on authorized disposal options, including estimated costs of disposal, and
      v. A list of civil penalties for improper disposal.
   b. The licensee shall:
      i. Report on a quarterly basis to the responsible Agreement State or NRC all transfers of devices to persons for use under a general license in accordance with 10 CFR 32.52, revised January 1, 2013, incorporated by

reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

ii. Maintain all information concerning transfers and receipts of devices that supports the reports required by subsection (A)(4)(b).

iii. Maintain records required by subsection (A)(4)(b) for a period of three years following the date of the recorded event.

5. If radioactive material is to be transferred in a device for use under an equivalent general license of the NRC or another Agreement State, each person that is licensed under R12-1-304(B) shall provide the information specified in this subsection to each person to whom a device will be transferred. The licensee shall provide this information before the device is transferred. In the case of transfer through another person, the licensee shall provide the listed information to the intended user before initial transfer to the other person. The licensee shall provide:
   a. A copy of the Agreement State's requirements that are equivalent to R12-1-306(A) and (B), and A.R.S. §§ 30-657, R12-1-443, and R12-1-445. If a copy of NRC regulations is provided to a prospective general licensee in lieu of the Agreement State's requirements, the licensee shall explain in writing that use of the device is regulated by the Agreement State. If certain requirements do not apply to a particular device, the licensee may omit the requirement from the material provided;
   b. A list of the services that can only be performed by a specific licensee;
   c. Information on authorized disposal options, including estimated costs of disposal; and
   d. The name, title, address, and telephone number of the individual at the Agreement State regulatory agency who can provide additional information.
6. A licensee may propose to the Agency an alternate method of informing the customer.
7. If a licensee has notified the Agency of bankruptcy under R12-1-313(E) or is terminating under R12-1-319, the licensee shall provide, upon request, to the Agency, the NRC, or another Agreement State, records of the disposition as required under A.R.S. § 30-657.
8. A licensee authorized to transfer a device to a generally licensed person, shall comply with the following requirements:
   a. The person licensed under subsection (A) shall report all transfers of devices to persons for use under a general license obtained under R12-1-306(B), and all receipts of devices from persons licensed under R12-1-306(B) to the Agency, NRC, or other affected Agreement State. The report shall be submitted on a quarterly basis, in a clear and legible form, and contain the following information:
      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, the person licensed under subsection (A) shall submit an alternate address for the general licensee, along with information on the actual location of use;
      ii. The name, title, and telephone number of a person identified by the general licensee as having knowledge of and authority to take required actions to ensure compliance with the applicable laws;
      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.
   b. If one or more intermediaries will temporarily possess the device at the intended place of use before its possession by the intended user, the report shall include the information required of the general licensee in subsection (A)(4) for both the intended user and each intermediary, clearly identifying the intended user and each intermediary.
   c. For devices received from a general licensee, licensed under R12-1-306(B), the report shall include:
      i. The identity of the general licensee by name and address;
      ii. The type, model number, and serial number of the device received;
      iii. The date of receipt; and
      iv. In the case of a device not initially transferred by the reporting licensee, the name of the manufacturer or initial transferor.
   d. If the person licensed under subsection (A) makes a change to a device possessed by a general licensee so that the label must be changed to update required information, the report shall identify the general licensee, the device, and the changes to information on the device label.
   e. The report shall cover a calendar quarter, be filed within 30 days of the end of each calendar quarter, and clearly indicate the period covered by the report.
   f. The report shall clearly identify the person licensed under subsection (A) submitting the report and include the license number of the license.
   g. If no transfers are made to or from persons generally licensed under R12-1-306(B) during a reporting period, the person licensed under subsection (A) shall submit a report indicating the lack of activity.
9. The licensee shall maintain records of all transfers for Agency inspection. Records shall be maintained for three years after termination of the license to manufacture the generally licensed devices regulated under R12-1-306(B).

B. The Agency shall grant a specific license to manufacture, assemble, repair, or initially transfer luminous safety devices that contain tritium or promethium-147 for use in aircraft, for distribution to persons generally licensed under R12-1-306(C), if the applicant satisfies:

1. The general requirements specified in R12-1-309; and

2. The requirements of 10 CFR 32.53 through 32.56 revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. The Agency shall grant a specific license to manufacture or initially transfer calibration or reference sources that contain americium-241, radium-226, or plutonium for distribution to persons generally licensed under R12-1-306(D) if the applicant satisfies:

1. The general requirements of R12-1-309; and
2. The requirements of 10 CFR 32.57, 32.58, 32.59, and 70.39, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

D. The Agency shall grant a specific license to distribute radioactive material for use by a physician under the general license in R12-1-306(E) if:

1. The applicant submits evidence that the radioactive material is to be manufactured, labeled, and packaged under a new drug application that the Commissioner of Food and Drugs, U.S. Food and Drug Administration has approved, or according to a license for a biologic product issued by the FDA; and
2. One of the following statements, or a substantially similar statement that contains the information called for in the following statements, appears on the label affixed to the container or appears in the leaflet or brochure that accompanies the package:
   a. 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 general license or its equivalent of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into agreement for the exercise of regulatory authority.

      _____
      Name of Manufacturer

   b. 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 its equivalent of a Licensing State.

      _____
      Name of Manufacturer

E. The Agency shall grant for a specific license to manufacture or distribute radioactive material for use under the general license of R12-1-306(F) if:

1. The applicant satisfies the general requirements specified in R12-1-309.
2. The radioactive material is to be prepared for distribution in prepackaged units of:
   a. Iodine-125 in units not exceeding 370 kBq (10 microcuries) each;
   b. Iodine-131 in units not exceeding 370 kBq (10 microcuries) each;
   c. Carbon-14 in units not exceeding 370 kBq (10 microcuries) each;
   d. Hydrogen-3 (tritium) in units not exceeding 1.85 MBq (50 microcuries) each;
   e. Iron-59 in units not exceeding 740 kBq (20 microcuries) each;
   f. Cobalt-57 or selenium-75 in units not exceeding 370 kilobecquerels (10 microcuries) each;
   g. Mock iodine-125 in units not exceeding 1.85 kBq (50 nanocuries) of iodine-129 and 185 Bq (5 nanocuries) of americium-241 each.
3. Each prepackaged unit bears a durable, clearly visible label:
   a. Identifying the radioactive contents as to chemical form and radionuclide and indicating that the amount of radioactivity does not exceed 370 kilobecquerels (10 microcuries) of iodine-125, iodine-131, cobalt-57, selenium-75, or carbon-14; 1.85 megabecquerels (50 microcuries) of hydrogen-3 (tritium); 740 kilobecquerels (20 microcuries) of iron-59; or mock iodine-125 in units not exceeding 1.85 kilobecquerels (0.05 microcurie) of iodine-129 and 185 becquerels (0.005 microcurie) of americium-241 each; and
   b. Displaying the radiation caution symbol described in R12-1-428, the words, "CAUTION, RADIOACTIVE MATERIAL," and the phrase "Not for Internal or External Use in Humans or Animals."
4. One of the following statements, or a substantially similar statement that contains the information called for in the following statements appears on a label affixed to each prepackaged unit or appears in a leaflet or brochure that accompanies the package:
   a. This radioactive material may be received, acquired, possessed, and used only by physicians, 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 from the radioactive material, to human beings or animals. Its receipt, acquisition, possession, use, and transfer are subject to the regulations and a general license of the U.S. Nuclear Regulatory Commission or of a state with which the Commission has entered into an agreement for the exercise of regulatory authority.

      _____
      Name of Manufacturer

   b. This radioactive drug may be received, acquired, possessed, and used only by physicians, 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 from the radioactive material, to human beings or animals. Its receipt, acquisition, possession, use and transfer are subject to the regulations and a general license of a Licensing State.

_____
Name of Manufacturer

5. The label affixed to the unit, or the leaflet or brochure that accompanies the package, contains adequate information about the precautions to be observed in handling and storing the specified 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 R12-1-434.

F. The Agency shall grant for a specific license to manufacture and distribute ice detection devices to persons generally licensed under R12-1-306(G) if the applicant satisfies:

1. The general requirements of R12-1-309; and
2. The criteria of 10 CFR 32.61 and 32.62, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

G. The Agency shall grant a specific license to manufacture, prepare, or transfer for commercial distribution radioactive drugs that contain radioactive material for use by a person authorized in accordance with Article 7 of this Chapter, if the applicant meets all of the requirements in 10 CFR 30.32(j) or 10 CFR 32.72, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

1. Authorization under this Section 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. Each licensee authorized under this Section to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall:
   a. Satisfy the labeling requirements in R12-1-431 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.
   b. 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 R12-1-449.
3. A licensee that is a pharmacy authorized under this Section to produce PET radioactive drugs for noncommercial transfer to medical use licensees in its consortium shall require that any individual who prepares PET radioactive drugs be an:
   a. Authorized nuclear pharmacist that meets the requirements in § R12-1-712, or
   b. Individual under the supervision of an authorized nuclear pharmacist as specified in R12-1-706.
4. A pharmacy, authorized under this Section 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 R12-1-712.

H. The Agency shall grant a specific license to manufacture and distribute generators or reagent kits that contain radioactive material for preparation of radiopharmaceuticals by persons licensed according to 12 A.A.C. 1, Article 7 if:

1. The applicant satisfies the general requirements of R12-1-309;
2. The applicant submits evidence that:
   a. The generator or reagent kit is to be manufactured, labeled and packaged according to the Federal Food, Drug, and Cosmetic Act or the Public Health Service Act, 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
   b. 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.
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;
4. The label affixed to the generator or reagent kit contains information on the radionuclide, including quantity, and date of assay; and
5. The label affixed to the generator or reagent kit, or the leaflet or brochure that accompanies the generator or reagent kit, contains:
   a. Adequate information, from a radiation safety stand point, 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
   b. A statement that this generator or reagent kit (as appropriate) is approved for use by persons licensed by the Agency under 12 A.A.C. 1, Article 7 or equivalent licenses of the U.S. Nuclear Regulatory Commission or an Agreement State or Licensing State. The labels, leaflets or brochures required by this subsection supplement the labeling required by FDA and they may be separate from or, with the approval of FDA, combined with the labeling required by FDA.

I. The Agency shall grant a specific license to manufacture and distribute sources and devices that contain radioactive material to a person licensed in accordance with Article 7 of this Chapter for use as a calibration, transmission, or reference source or for medical purposes, if the applicant meets all of the requirements in 10 CFR 32.74, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

J. Requirements for license to manufacture and distribute industrial products containing depleted uranium for mass volume applications.

1. The Agency shall grant a specific license to manufacture industrial products and devices that contain depleted uranium for use under R12-1-305(C) or equivalent regulations of the U.S. Nuclear Regulatory Commission or an Agreement State if:
   a. The applicant satisfies the general requirements in R12-1-309;
   b. The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control procedures, labeling or marking, proposed uses, and potential hazards of the industrial product or device to provide reasonable assurance that possession, use, or transfer of the depleted uranium in the product or device is not likely to cause any individual to receive a radiation dose in excess of 10 percent of the limits specified in R12-1-408.
   c. 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. In the case of an industrial product or device whose unique benefits are questionable, the Agency shall approve an application for a specific license under this subsection 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.
3. The Agency may deny any application for a specific license under this subsection if the end use or uses of the industrial product or device cannot be reasonably foreseen.
4. Each person licensed under subsection (J)(1) shall:
   a. Maintain the level of quality control required by the license in the manufacture of the industrial product or device and the installation of the depleted uranium into the product or device;
   b. Label or mark each unit to:
      i. Identify the manufacturer of the product or device, the number of the license under which the product or device was manufactured or initially transferred, the fact that the product or device contains depleted uranium, and the quantity of depleted uranium in each product or device; and
      ii. State that 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 an Agreement State;
   c. 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";
   d. Furnish a copy of the general license contained in R12-1-305(C) and a copy of ARRA-23 to each person to whom depleted uranium in a product or device is transferred for use under a general license contained in R12-1-305(C); or
   e. Furnish a copy of the general license contained in the U.S. Nuclear Regulatory Commission's or Agreement State's regulation equivalent to R12-1-305(C) 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 R12-1-305(C) and a copy of ARRA-23 to each person to whom depleted uranium in a product or device is transferred for use under a general license of the U.S. Nuclear Regulatory Commission or an Agreement State, with a document explaining that use of the product or device is regulated by the U.S. Nuclear Regulatory Commission or an Agreement State under requirements substantially the same as those in R12-1-305(C);
   f. Report to the Agency all transfers of industrial products or devices to persons for use under the general license in R12-1-305(C). The report shall identify each general licensee by name and address, an individual by name or position who serves as the point of contact person for 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 a product or device is transferred to the generally licensed person. If no transfers have been made to persons generally licensed under R12-1-305(C) during the reporting period, the report shall so indicate;
      i. 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 10 CFR 40.25; or
      ii. Report to the responsible state agency all transfers of devices manufactured and distributed under subsection (J)(4)(f) for use under a general license in that state's regulations equivalent to R12-1-305(C);
      iii. The report required in subsection (J)(4)(f)(i) or (ii) shall identify each general licensee by name and address, an individual by name or position who serves as the contact person for the general licensee, the type and model number of the 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 a product or device is transferred to the generally licensed person;
      iv. If no transfers have been made to U.S. Nuclear Regulatory Commission licensees during the reporting period, this information shall be reported to the U.S. Nuclear Regulatory Commission;
      v. If no transfers have been made to general licensees within a particular Agreement State during the reporting period, this information shall be reported to the responsible Agreement state agency; and
      vi. Keep records showing the name, address, and contact person for each general licensee to whom depleted uranium in industrial products or devices is transferred for use under a general license provided in R12-1-305(C) or equivalent regulations of the U.S. Nuclear Regulatory Commission or of an Agreement State. The

records shall be maintained for a period of three years and show the date of each transfer, the quantity of depleted uranium in each product or device transferred, and compliance with the reporting requirements of this Section.

K. A licensee who manufactures nationally tracked sources, as defined in Article 4, shall:

1. Serialize the sources in accordance with 10 CFR 32.201, revised January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments; and
2. Report manufacturing activities in accordance with R12-1-454.

Historical Note

Former Rule Section C.101. Former Section R12-1-311 repealed, new Section R12-1-311 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-311 renumbered to R12-1-312, new Section R12-1-311 renumbered from R12-1-310 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-311 renumbered to R12-1-310; new Section R12-1-311 renumbered from R12-1-312 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-312. Issuance of Specific Licenses

A. Upon determination that a license application meets the requirements of the Act and Agency rules, the Agency shall grant a specific license that may contain conditions or limitations if the Agency has determined that additional requirements regarding the proposed activity will protect health and safety.

B. The Agency may incorporate in any license at the time of issuance, or thereafter by rule or order, additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of radioactive material in order to:

1. Minimize danger to public health and safety or property;
2. Require reports and recordkeeping, and provide for inspections of activities under the license as may be necessary to protect health and safety; and
3. Prevent loss or theft of material subject to this Article.

C. The Agency may verify information contained in an application and secure additional information necessary to make a determination on issuance of a license and whether any special conditions should be attached to the license. The Agency may inspect the facility or location where radioactive materials would be possessed or used, and discuss details of the proposed possession or use of the radioactive materials with the applicant or representatives designated by the applicant.

Historical Note

Former Rule Section C.102; Former Section R12-1-312 repealed, new Section R12-1-312 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-312 renumbered to R12-1-313, new Section R12-1-312 renumbered from R12-1-311 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-312 renumbered to R12-1-311; new Section R12-1-312 renumbered from R12-1-313 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-313. Specific Terms and Conditions

A. Each license issued under this Article is subject to all provisions of A.R.S. Title 30, Chapter 4 and to all rules, regulations, and orders of the Agency.

B. A licensee shall not transfer, assign, or in any manner dispose of a license issued or granted under this Article or a right to possess or utilize radioactive material granted by any license issued under this Article unless the Agency finds that the transfer is consistent with the Agency's statutes and rules, and gives its consent in writing.

C. Each person licensed by the Agency under this Article shall confine the use and possession of the material licensed to the locations and purposes authorized in the license.

D. Each person licensed under this Section and each general licensee that is required to register under R12-1-306(B)(4)(o) shall notify the Agency in writing if the licensee decides to permanently discontinue any or all activities involving materials authorized under the license. A specific licensee or general licensee shall notify the Agency, in writing:

1. Immediately following the filing of a petition for bankruptcy under any Chapter of Title 11 of the United States Code if the petition for bankruptcy is by or against:
   a. The licensee;
   b. An entity (as defined in the bankruptcy code) controlling the licensee or listing the license or licensee as property of the estate; or
   c. An affiliate (as defined in the bankruptcy code) of the licensee.
2. Providing the following information:
   a. The bankruptcy court in which the petition for bankruptcy was filed,
   and
   b. The bankruptcy case title and number, and
   c. The date the petition was filed.

E. 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 R12-1-720. The licensee shall record the results of each test and retain each record for three years after the record is made.

F. Inalienability of Licenses

(1) No license issued or granted pursuant to the regulations in this part 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 Agency shall, after securing full information, find that the transfer is in accordance with the provisions of this act, and shall give its consent in writing.

(2) An application for transfer of license must include:

(a) The identity, technical and financial qualifications of the proposed transferee; and

(b) Financial assurance for decommissioning information required by R12-1-323.

Historical Note

Former Rule Section C.103; Former Section R12-1-313 repealed, new Section R12-1-313 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Amended effective June 20, 1990 (Supp. 90-2). Former Section R12-1-313 renumbered to R12-1-314, new Section R12-1-313 renumbered from R12-1-312 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-313 renumbered to R12-1-312; new Section R12-1-313 renumbered from R12-1-314 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-314. Expiration of License

Except as provided in R12-1-315(B), each specific license expires at the end of the day, in the month and year stated on the license.

Historical Note

Former Rule Section C.104; Former Section R12-1-314 repealed, new Section R12-1-314 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-314 renumbered to R12-1-315, new Section R12-1-314 renumbered from R12-1-313 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-314 renumbered to R12-1-313; new Section R12-1-314 renumbered from R12-1-315 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-315. Renewal of License

A. An applicant shall file an application for renewal of a specific license according to R12-1-308.

B. If a licensee files a renewal application not less than 30 days before the license expiration date and the existing license and associated renewal application is in proper form, the existing license does not expire until a final renewal determination is made by the Agency.

Historical Note

Former Rule Section C.105; Former Section R12-1-315 repealed, new Section R12-1-315 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-315 renumbered to R12-1-316, new Section R12-1-315 renumbered from R12-1-314 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-315 renumbered to R12-1-314; new Section R12-1-315 renumbered from R12-1-316 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-316. Amendment of Licenses at Request of Licensee

An applicant shall file an application for amendment of a specific license by complying with R12-1-308 and specifying the grounds for the amendment.

Historical Note

Former Rule Section C.106; Former Section R12-1-316 repealed, new Section R12-1-316 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-316 renumbered to R12-1-317, new Section R12-1-316 renumbered from R12-1-315 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-316 renumbered to R12-1-315; new Section R12-1-316 renumbered from R12-1-317 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-317. ARRA Action on Applications to Renew or Amend

In considering an application by a licensee to renew or amend a specific license, the Agency shall apply the criteria set forth in R12-1-309, R12-1-310, or R12-1-311 as applicable.

Historical Note

Former Rule Section C.107; Former Section R12-1-317 repealed, new Section R12-1-317 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-317 renumbered to R12-1-318, new Section R12-1-317 renumbered from R12-1-316 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-317 renumbered to R12-1-316; new Section R12-1-317 renumbered from R12-1-318 and amended by final

rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-318. Transfer of Radioactive Material

A. A licensee shall not transfer radioactive material except as authorized under this Section.

B. Except as otherwise provided in the license and subject to the provisions of subsections (C) and (D), any licensee may transfer radioactive material:
1. To the Agency; after receiving prior approval from the Agency;
2. To the Department of Energy;
3. To any person exempt from the rules in this Article to the extent permitted under the exemption;
4. To any person authorized to receive radioactive material under terms of a general license or its equivalent, or a specific license or equivalent licensing document, issued by the Agency, the U.S. Nuclear Regulatory Commission, or any Agreement State or Licensing State, or to any person otherwise authorized to receive radioactive material by the Federal Government or any agency of the Federal Government, the Agency, any Agreement State or Licensing State; or
5. As otherwise authorized by the Agency in writing.

C. Before transferring radioactive material to a specific licensee of the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State or Licensing State, or to a general licensee who is required to register with the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State or 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.

D. The transferor shall use one or more of the following methods for the verification required by subsection (C):
1. The transferor shall possess, and read, a current copy of the transferee's specific license or registration certificate;
2. The transferor shall possess a written certification by the transferee that the transferee 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;
3. For emergency shipments the transferor shall accept oral certification by the transferee that the transferee 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 the oral certification is confirmed in writing within 10 days;
4. The transferor shall obtain information equivalent to that in subsection (D)(1) to (3) compiled by a reporting service from official records of the Agency, the U.S. Nuclear Regulatory Commission, or the licensing agency of an Agreement State or Licensing State regarding the identity of any licensee and the scope and expiration date of any license, registration, or certificate; or
5. When none of the methods of verification described in subsections (D)(1) to (4) are readily available or when a transferor desires to verify that information received by one of the above methods is correct or up-to-date, the transferor shall obtain and record confirmation from the Agency, the U.S. Nuclear Regulatory Commission, or the licensing agency of an Agreement State or Licensing State that the transferee is licensed to receive the radioactive material.

E. A transferor shall prepare and transport radioactive material as prescribed in the provisions of 12 A.A.C. 1, Article 15.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-318 renumbered to R12-1-319, new Section R12-1-318 renumbered from R12-1-317 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-318 renumbered to R12-1-317; new Section R12-1-318 renumbered from R12-1-319 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-319. Modification, Revocation, or Termination of a License

A. The terms and conditions of all licenses are subject to amendment, revision, or modification, and a license may be suspended or revoked by reason of amendments to the Agency's statutes or rules and orders issued by the Agency.

B. The Agency may revoke, suspend, or modify any license, in whole or in part, for any material false statement in the application; any omission or misstatement of fact required by statute, rule, or order, or because of conditions revealed by the application or any report, record, or inspection or other means that would cause the Agency to refuse to grant a license; or any violation of license terms and conditions, or the Agency's statutes, rules, or orders.

C. Except in cases of willfulness or those in which the public health, interest, or safety requires otherwise, the Agency shall not modify, suspend, or revoke a license unless, before the institution of proceedings, facts or conduct that may warrant action have been called to the attention of the licensee in writing and the licensee has been accorded an opportunity to demonstrate or achieve compliance.

D. The Agency may terminate a specific license upon a written request by the licensee that provides evidence the licensee has met the termination criteria in R12-1-451, R12-1-452, and the decommissioning requirements in R12-1-323.

E. Specific licenses, including expired licenses, continue in effect until terminated by written notice to the licensee, when the Agency determines that the licensee has:
1. Properly disposed of all radioactive material;
2. Made a reasonable effort to eliminate residual radioactive contamination, if present;
3. Performed an accurate radiation survey that demonstrates the premises are suitable for release in accordance with the criteria for decommissioning in R12-1-323;

4. Submitted other information that is sufficient to demonstrate that the premises are suitable for release in accordance with the criteria for decommissioning in R12-1-323.
5. Provided records to the Agency that detail the disposal of all radioactive material in unsealed form with a half-life greater than 120 days, and copies of the records required by 10 CFR 30.35(g), January 1, 2004, which is incorporated by reference and on file with the Agency. This incorporation by reference contains no future editions or amendments.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-319 renumbered to R12-1-320, new Section R12-1-319 renumbered from R12-1-318 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-319 renumbered to R12-1-318; new Section R12-1-319 renumbered from R12-1-320 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-320. Reciprocal Recognition of Licenses

A. This subsection grants a general license to perform specific licensed activities in Arizona for a period not to exceed 180 days in any calendar year to any person who holds a specific license from an Agreement State, where the licensee maintains an office for directing the licensed activity and retaining radiation safety records, is granted a general license to conduct the same activity involving the use of radioactive material from the U.S. Nuclear Regulatory Commission, Licensing State, or any Agreement State, provided that:
1. The license does not limit the activity to specific installations or locations;
2. Following the first notification, application, and payment of fees, the licensee shall notify the agency three days prior to entering the state and prior to each non-consecutive visit while reciprocity remains in effect.
3. The out-of-state licensee complies with all applicable statutes, now or hereafter in effect, rules, and orders of the Agency and with all the terms and conditions of the license, except those terms and conditions inconsistent with applicable statutes, rules and orders of the Agency;
4. The out-of-state licensee supplies any other information the Agency requests; and
5. The out-of-state licensee does not transfer or dispose of radioactive material possessed or used under the general license provided in this Section except by transfer to a person:
   a. Specifically licensed by the Agency, or by the U.S. Nuclear Regulatory Commission to receive the radioactive material; or
   b. Exempt under R12-1-303(A).

B. Notwithstanding the provisions of subsection (A)(1), this subsection grants a general license to manufacture, install, transfer, demonstrate, or service a device described in R12-1-306(B)(1) to any person who holds a specific license issued by the U.S. Nuclear Regulatory Commission, Licensing State, or an Agreement State authorizing the same activities within areas subject to the jurisdiction of the licensing body, provided that:
1. The person files a report with the Agency within 30 days after the end of each calendar quarter in which any device is transferred to or installed in this State. Each report shall identify the general licensee to whom the device is transferred by name and address, the type of device transferred, and the quantity and type of radioactive material contained in the device;
2. The device has been manufactured, labeled, installed, and serviced according to the applicable provisions of the specific license issued to the person by the U.S. Nuclear Regulatory Commission or an Agreement State;
3. The person entering the state ensures that any labels required to be affixed to the device under rules of the authority which licensed manufacture of the device bear the following statement: “Removal of this label is prohibited”; and
4. The holder of the specific license furnishes a copy of the general license contained in R12-1-306(B), or equivalent rules of the agency having jurisdiction over the manufacture or distribution of the device, to each general licensee to whom the licensee transfers the device or on whose premises the device is installed.

C. The Agency may withdraw, limit, or qualify the acceptance of any specific license or equivalent licensing document issued by another agency, or any product distributed under a license, upon determining that an action is necessary to prevent undue hazard to public health and safety, or property.

D. Before radioactive material can be used at a temporary job site within the state at any federal facility, a specific licensee shall determine the jurisdictional status of the job site. If the jurisdictional status is unknown, the specific licensee shall contact the controlling federal agency to determine whether the job site is under exclusive federal jurisdiction.

E. Before using radioactive material at a job site under exclusive federal jurisdiction, a specific licensee shall:
1. Obtain authorization from the NRC; and
2. Use the radioactive material in accordance with applicable NRC regulations and orders, and be able to demonstrate to the Agency that the correct license fee was paid to the NRC.

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

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-

320 renumbered to R12-1-321, new Section R12-1-320 renumbered from R12-1-319 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-320 renumbered to R12-1-319; new Section R12-1-320 renumbered from R12-1-321 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-321. Repealed

Historical Note

Former Rule Section C.201; Former Section R12-1-321 repealed, new Section R12-1-321 adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Section R12-1-321 renumbered to R12-1-322, new Section R12-1-321 renumbered from R12-1-320 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-321 renumbered to R12-1-320; new Section R12-1-321 renumbered from R12-1-322 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-322. The Need for an Emergency Plan for Response to a Release of Radioactive Material

A. For purposes of this rule, "Emergency Plan" means a procedure that will be followed when an accident occurs involving licensed radioactive materials for which an offsite response may be needed from organizations, such as police, fire, or medical organizations.

B. Each application to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in Exhibit D, "Radioactive Material Quantities Requiring Consideration for an Emergency Plan" shall contain either:
1. An evaluation showing that the maximum dose to a person off-site due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or
2. An emergency plan for responding to a release of radioactive material.

C. One or more of the following factors may be used to support an evaluation submitted under subsection (B)(1):
1. The radioactive material is physically separated so that only a portion could be involved in an accident.
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;
3. The release fraction in the respirable size range would be lower than the release fraction shown in Exhibit D due to the chemical or physical form of the material;
4. The solubility of the radioactive material would reduce the dose received;
5. Facility design or engineered safety features in the facility would cause the release fraction to be lower than shown in Exhibit D;
6. Operating restrictions or procedures would prevent a release fraction as large as that shown in Exhibit D; or
7. Other factors appropriate for the specific facility.

D. An emergency plan for responding to a release of radioactive material submitted under subsection (B)(2) shall include the following information:
1. A brief description of the licensee's facility and areas near the site that could expose a member of the public to a dose equal to or greater than the levels expressed in subsection (B)(1).
2. An identification of each type of radioactive materials accident for which protective actions may be needed.
3. A classification system for classifying accidents as alerts or site area emergencies.
4. Identification of the means of detecting each type of accident in a timely manner.
5. A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.
6. A brief description of the methods and equipment to assess releases of radioactive materials.
7. A brief description of the responsibilities of licensee personnel responsible for promptly notifying offsite response organizations and the Agency; also responsibilities for developing, maintaining, and updating the plan.
8. A commitment to and a brief description of the means to promptly notify offsite response organizations and request off-site assistance, including medical assistance for the treatment of contaminated and injured onsite workers when appropriate. A control point shall be established. The notification and coordination shall 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 Agency immediately after notification of the appropriate off-site response organizations and not later than one hour after the licensee declares an emergency.
9. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to off-site response organizations and to the Agency.
10. 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 instructions 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.
11. A brief description of the means of restoring the facility to a safe condition after an accident.

12. Provisions for conducting quarterly communications checks with off-site response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with off-site response organizations shall include the verifying and updating of all necessary telephone numbers. The licensee shall invite off-site response organizations to participate in the biennial exercises. Their participation is not required. Exercises shall 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 without direct implementation responsibility for the plan. Critiques of exercises shall evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques shall be corrected.
13. A certification that the applicant has met its responsibilities in A.R.S. §§ 26-341 through 26-353 (emergency Planning and Community Right-to-Know Act of 1986), if applicable to the applicant's activities at the proposed place of use of the radioactive material.

E. The licensee shall allow 60 days for the off-site response organizations, expected to respond in case of an accident, to comment on the licensee's emergency plan before submitting it to the Agency. The licensee shall provide any comments received within the 60 days to the Agency with the emergency plan.

Historical Note

Former Section R12-1-322 repealed effective June 30, 1977 (Supp. 77-3). New Section R12-1-322 renumbered from R12-1-321 effective February 18, 1994 (Supp. 94-1). Former Section R12-1-322 renumbered to R12-1-321; new Section R12-1-322 renumbered from R12-1-323 and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

R12-1-323. Financial Assurance and Recordkeeping for Decommissioning

A. For purposes of terminating specific licensed activities:
1. "Decommissioning" means to remove a radioactive material use facility safely from service and to reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the radioactive material use license.
2. "Byproduct material" as used in 10 CFR 30, means "radioactive material" which is defined in A.R.S. § 30-651.
3. "Facility" means the entire site of radioactive material use, or any separate building or outdoor area where it is used.
4. "Appendix B to Part 30" as used in 10 CFR 30, means Appendix E in 12 A.A.C. 1, Article 4.
5. "Financial security" means having a net worth of not less than $10,000.

B. When applying, each non-government applicant for a specific license that authorizes the possession and use of radioactive material, and each non-government holder of a license to possess and use radioactive material issued before the effective date of this Section, shall submit to the Agency a decommissioning funding plan or certification of financial security, as required in A.R.S. § 30-672(H). A licensee required to meet the requirements in subsection (C) is exempt from the requirements in this subsection.

C. When applying, each applicant for a specific license that authorizes the possession and use of radioactive material, and each holder of a license to possess and use radioactive material issued before the effective date of this Section, shall submit to the Agency a decommissioning funding plan or certification of financial assurance that meets the requirements in 10 CFR 30.35, 40.36, and 70.25, revised January1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

Each decommissioning funding plan shall be submitted to the Agency for review and approval and shall contain:

1. A detailed cost estimate for decommissioning, in an amount reflecting:
   a. The cost of an independent contractor to perform all decommissioning activities;
   b. The cost of meeting the R12-1-452(B) criteria for unrestricted use, provided that, if the applicant or licensee can demonstrate its ability to meet the provisions of R12-1-453(C), the cost estimate may be based on meeting the R12-1-453(C) criteria;
   c. The volume of onsite subsurface material containing residual radioactivity that will require remediation to meet the criteria for license termination; and
   d. **Demonstrate its ability to meet the provisions of R12-1-323, the cost estimate may be based on meeting the R12-1-323 criteria;**
   e. An adequate contingency factor;

~~2.~~ i. Identification of and justification for using the key assumptions contained in the DCE;
~~3.~~ ii. A description of the method of assuring funds for decommissioning including means for adjusting cost estimates and associated funding levels periodically over the life of the facility;
~~4.~~ iii. A certification by the licensee that financial assurance for decommissioning has been provided in the amount of the cost estimate for decommissioning; and
~~5.~~ iv. An original signed copy of the financial instrument obtained to satisfy the requirements of subsection (F) unless a previously submitted and accepted financial instrument continues to cover the cost estimate for decommissioning).

D. Each licensee required to provide financial assurance for decommissioning a radioactive material facility under this Section shall maintain records of information important to the safe and effective decommissioning of the facility in an identified location until the license is terminated by the Agency. The licensee shall maintain the following records during the decommissioning process:

1. Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, and 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. The licensee shall keep records identifying the involved radionuclides and associated quantities, forms, and concentrations.
2. As-built drawings showing modifications of structures and equipment in restricted areas where radioactive materials are used and stored, and locations of possible inaccessible contamination. If drawings are not available, the licensee shall provide appropriate records describing each location of possible contamination.
3. 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.

E. Decommissioning procedures:

1. Upon expiration or termination of principal activities a licensee shall notify the Agency in writing whether the licensee is discontinuing licensed activities. The licensee shall begin decommissioning its facility within 60 days after the Agency receives notice of the decision to permanently terminate principal activities, or within 12 months after receipt of notice, submit to the Agency a decommissioning plan, as prescribed in 10 CFR 30.36(g)(1), 40.42(g)(1), and 70.38(g)(1), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. The licensee shall begin decommissioning upon approval of the plan if the license has expired or no licensed activities have been conducted at the licensee's facility for a period of 24 months.
2. In addition to the notification requirements in subsection (E)(1), the licensee shall maintain in effect all decommissioning financial assurances required by this Section. The financial assurances shall be increased or may be decreased as appropriate to cover the cost estimate established for decommissioning in subsection (E)(1). The licensee may reduce the amount of the financial assurance following approval of the decommissioning plan, provided the radiological hazard is decreasing and the licensee has the approval of the Agency.
3. The Agency shall extend the time periods established in subsection (E)(1) if a new time period is in the best interest of public health and safety.
    a. The licensee shall submit a request for an extension no later than 30 days after the Agency receives the notice required in subsection (E)(1).
    b. If a licensee has requested an extension, the licensee is not required to commence decommissioning activities required in subsection (E)(1), until the Agency has made a determination on the request submitted to the Agency under subsection (E)(3)(a).
4. Except as provided in subsection (E)(5), the licensee shall complete decommissioning of a facility as soon as practicable but no later than 24 months following the initiation of decommissioning; and except as provided in subsection (E)(5), when decommissioning involves the entire facility, the licensee shall request license termination as soon as practicable but no later than 24 months following initiation of decommissioning.
5. The Agency shall approve a request for an alternate schedule for completion of decommissioning and license termination if the Agency determines that the alternative is warranted by consideration of the conditions specified in 10 CFR 30.36(i), 40.42(i), and 70.38(i), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
6. As a final step in decommissioning, the licensee shall meet the requirements specified in 10 CFR 30.36(j), 40.42(j), and 70.38(j), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

Historical Note

Former Section R12-1-323 repealed effective June 30, 1977 (Supp. 77-3). New Section R12-1-323 adopted effective February 18, 1994 (Supp. 94-1). Former Section R12-1-323 renumbered to R12-1-322; new Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-324. Public Notification and Public Participation

Upon the receipt of a license termination plan (LTP) or decommissioning plan from a licensee, or a proposal by a licensee for decommissioning of a site in accordance with R12-1-452(C) and (D) or for other events when the Agency deems a notice to be in the public interest, the Agency shall:

1. Notify and solicit comments from:
    a. State and local governments and any Indian Nation or other indigenous people who have legal rights that could be affected by the decommissioning, and
    b. The Arizona Department of Environmental Quality for cases in which the licensee proposes to decommission a site in accordance with R12-1-452(D).
2. Publish the notice in the *Arizona Administrative Register* and use other methods of publication such as local newspapers, letters to local organizations, or any other method that is reasonably calculated to provide notice, and solicit comments from affected parties.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). New Section made by final rulemaking at 10 A.A.R. 4588, effective December 4, 2004 (Supp. 04-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-325. Timeliness in Decommissioning Facilities

A. "Principal activities," as used in this Section, means activities authorized by the license that are essential to achieving the purposes for which the license was issued or amended. Storage, during which licensed material is not accessed for use, or disposal and other activities incidental to decontamination or decommissioning are not principal activities.

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

C. Each specific license continues in effect, beyond the expiration date if necessary, with respect to possession of radioactive material, until the Agency notifies the licensee in writing that the license is terminated. During this time, the licensee shall:

1. Limit actions involving radioactive material to those related to decommissioning;
2. Continue to control entry to restricted areas until they are suitable for release in accordance with NRC requirements; and
3. Pay the applicable annual fee for the license category listed in R12-1-1306.

D. Within 60 days of the occurrence of any of the following, each licensee shall notify the Agency in writing of the 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 Agency requirements, or submit within 12 months of notification a decommissioning plan, if required by R12-1-323, and begin decommissioning upon approval of that plan if:

1. The license expires in accordance with subsection (B) or R12-1-314, unless the licensee submits a renewal application in accordance with R12-1-315;
2. The licensee decides to permanently terminate principal activities 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 Agency requirements;
3. No principal activities under the license have been conducted for a period of 24 months; or
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 Agency requirements.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). New Section made by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-326. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-327. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-328. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-329. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-330. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-331. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-332. Repealed

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-333. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-334. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-335. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-336. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-337. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-338. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-339. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-340. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-341. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-342. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-343. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-344. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-345. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-346. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-347. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

R12-1-348. Repealed

Historical Note
Repealed effective June 30, 1977 (Supp. 77-3).

Exhibit A. Exempt Concentrations

Element (atomic number)	Isotope	Column I Gas Concentration (μCi/ml)[1]/	Column II Liquid and Solid Concentration (μCi/ml)[2]/
Antimony (51)	Sb-122		$3X10^{-4}$
	Sb-124		$2X10^{-4}$
	Sb-125		$1X10^{-3}$
Argon (18)	Ar-37	$1X10^{-3}$	
	Ar-41	$4X10^{-7}$	
Arsenic (33)	As-73		$5X10^{-3}$
	As-74		$5X10^{-4}$
	As-76		$2X10^{-4}$
	As-77		$8X10^{-4}$
Barium (56)	Ba-131		$2X10^{-3}$
	Ba-140		$3X10^{-4}$
Beryllium (4)	Be-7		$2X10^{-2}$
Bismuth (83)	Bi-206		$4X10^{-4}$
Bromine (35)	Br-82	$4X10^{-7}$	$3X10^{-3}$
Cadmium (48)	Cd-109		$2X10^{-3}$
	Cd-115m		$3X10^{-4}$
	Cd-115		$3X10^{-4}$
Calcium (20)	Ca-45		$9X10^{-5}$
	Ca-47		$5X10^{-4}$
Carbon (6)	C-14	$1X10^{-6}$	$8X10^{-3}$
Cerium (58)	Ce-141		$9X10^{-4}$
	Ce-143		$4X10^{-4}$
	Ce-144		$1X10^{-4}$
Cesium (55)	Cs-131		$2X10^{-2}$
	Cs-134m		$6X10^{-2}$
	Cs-134		$9X10^{-5}$
Chlorine (17)	Cl-38	$9X10^{-7}$	$4X10^{-3}$
Chromium (24)	Cr-51		$2X10^{-2}$
Cobalt (27)	Co-57		$5X10^{-3}$
	Co-58		$1X10^{-3}$
	Co-60		$5X10^{-4}$
Copper (29)	Cu-64		$3X10^{-3}$
Dysprosium (66)	Dy-165		$4X10^{-3}$
	Dy-166		$4X10^{-4}$
Erbium (68)	Er-169		$9X10^{-4}$
	Er-171		$1X10^{v}$
Europium (63)	Eu-152 (T_r=9.2 h)		$6X10^{-4}$
	Eu-155		$2X10^{-3}$
Fluorine (9)	F-18	$2X10^{-6}$	$8X10^{-3}$
Gadolinium (64)	Gd-153		$2X10^{-3}$
	Gd-159		$8X10^{-4}$
Gallium (31)	Ga-72		$4X10^{-4}$
Germanium (32)	Ge-71		$2X10^{-2}$
Gold (79)	Au-196		$2X10^{-3}$
	Au-198		$5X10^{-4}$
	Au-199		$2X10^{-3}$
Hafnium (72)	Hf-181		$7X10^{-4}$
Hydrogen (1)	H-3	$5X10^{-6}$	$3X10^{-2}$
Indium (49)	In-113m		$1X10^{-2}$

	In-114m		$2X10^{-4}$
Iodine	I-126	$3X10^{-9}$	$2X10^{-5}$
	I-131	$3X10^{-9}$	$2X10^{-5}$
	I-132	$8X10^{-8}$	$6X10^{-4}$
	I-133	$1X10^{-8}$	$7X10^{-5}$
	I-134	$2X10^{-7}$	$1X10^{-3}$
Iridium (77)	Ir-190		$2X10^{-3}$
	Ir-192		$4X10^{-4}$
	Ir-194		$3X10^{-4}$
Iron (26)	Fe-55		$8X10^{-3}$
	Fe-59		$6X10^{-4}$
Krypton (36)	Kr-85m	$1X10^{-6}$	
	Kr-85	$3X10^{-6}$	
Lanthanum (57)	La-140		$2X10^{-4}$
Lead (82)	Pb-203		$4X10^{-3}$
Lutetium (71)	Lu-177		$1X10^{-3}$
Manganese (25)	Mn-52		$3X10^{-4}$
	Mn-54		$1X10^{-3}$
	Mn-56		$1X10^{-3}$
Mercury (80)	Hg-197m		$2X10^{-3}$
	Hg-197		$3X10^{-3}$
	Hg-203		$2X10^{-4}$
Molybdenum (42)	Mo-99		$2X10^{-3}$
Neodymium (60)	Nd-147		$6X10^{-4}$
	Nd-149		$3X10^{-3}$
Nickel (28)	Ni-65		$1X10^{-3}$
Niobium (Columbium) (41)	Nb-95		$1X10^{-3}$
	Nb-97		$9X10^{-3}$
Osmium (76)	Os-185		$7X10^{-4}$
	Os-191m		$3X10^{-2}$
	Os-191		$2X10^{-3}$
	Os-193		$6X10^{-4}$
Palladium (46)	Pd-103		$3X10^{-3}$
	Pd-109		$9X10^{-4}$
Phosphorus (15)	P-32		$2X10^{-4}$
Platinum (78)	Pt-191		$1X10^{-3}$
	Pt-193m		$1X10^{-2}$
	Pt-197m		$1X10^{-2}$
	Pt-197		$1X10^{-3}$
Potassium (19)	K-42		$3X10^{-3}$
Praseodymium (59)	Pr-142		$3X10^{-4}$
	Pr-143		$5X10^{-4}$
Promethium (61)	Pm-147		$2X10^{-3}$
	Pm-149		$4X10^{-4}$
Rhenium (75)	Re-183		$6X10^{-3}$
	Re-186		$9X10^{-4}$
	Re-188		$6X10^{-4}$
Rhodium (45)	Rh-103m		$1X10^{-1}$
	Rh-105		$1X10^{-3}$
Rubidium (37)	Rb-86		$7X10^{-4}$
Ruthenium (44)	Ru-97		$4X10^{-3}$
	Ru-103		$8X10^{-4}$
	Ru-105		$1X10^{-3}$
	Ru-106		$1X10^{-4}$
Samarium (62)	Sm-153		$8X10^{-4}$
Scandium (21)	Sc-46		$4X10^{-4}$
	Sc-47		$9X10^{-4}$
	Sc-48		$3X10^{-4}$
Selenium (34)	Se-75		$3X10^{-3}$
Silicon (14)	Si-31		$9X10^{-3}$
Silver (47)	Ag-105		$1X10^{-3}$
	Ag-110m		$3X10^{-4}$

	Ag-111		$4X10^{-4}$
Sodium (11)	Na-24		$2X10^{-3}$
Strontium (38)	Sr-85		$1X10^{-3}$
	Sr-89		$1X10^{-4}$
	Sr-91		$7X10^{-4}$
	Sr-92		$7X10^{-4}$
Sulfur (16)	S-35	$9X10^{-8}$	$6X10^{-4}$
Tantalum (73)	Ta-182		$4X10^{-4}$
Technetium (43)	Tc-96m		$1X10^{-1}$
	Tc-96		$1X10^{-3}$
Tellurium (52)	Te-125m		$2X10^{-3}$
	Te-127m		$6X10^{-4}$
	Te-127		$3X10^{-3}$
	Te-129m		$3X10^{-4}$
	Te-131m		$6X10^{-4}$
	Te-132		$3X10^{-4}$
Terbium (65)	Tb-160		$4X10^{-4}$
Thallium (81)	Tl-200		$4X10^{-3}$
	Tl-201		$3X10^{-3}$
	Tl-202		$1X10^{-3}$
	Tl-204		$1X10^{-3}$
Thulium (69)	Tm-170		$5X10^{-4}$
	Tm-171		$5X10^{-3}$
Tin (50)	Sn-113		$9X10^{-4}$
	Sn-125		$2X10^{-4}$
Tungsten (Wolfram) (74)	W-181		$4X10^{-3}$
	W-187		$7X10^{-4}$
Vanadium (23)	V-48		$3X10^{-4}$
Xenon (54)	Xe-131m	$4X10^{-6}$	
	Xe-133	$3X10^{-6}$	
	Xe-135	$1X10^{-6}$	
Ytterbium (70)	Yb-175		$1X10^{-3}$
Yttrium (39)	Y-90		$2X10^{-4}$
	Y-91m		$3X10^{-2}$
	Y-91		$3X10^{-4}$
	Y-92		$6X10^{-4}$
	Y-93		$3X10^{-4}$
Zinc (30)	Zn-65		$1X10^{-3}$
	Zn-69m		$7X10^{-4}$
	Zn-69		$2X10^{-2}$
Zirconium (40)	Zr-95		$6X10^{-4}$
	Zr-97		$2X10^{-4}$
	(See notes at end of appendix)		
Beta and/or gamma emitting radioactive material not listed above with half-life less than three years		$1X10^{-10}$	$1X10^{-6}$

NOTE 1: Many radioisotopes disintegrate into isotopes which are also radioactive. In expressing the concentrations in Schedule A the activity stated is that of the parent isotope and takes into account the daughters.

1/ Values are given in Column I only for those materials normally used as gases

2/ µCi/gm are for solids

NOTE 2: For purposes of Section 303 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 A for the specific isotope when not in combination. The sum of such ratios may not exceed "1" (i.e., unity).

EXAMPLE:

$$\frac{\text{Concentration of Isotope A in Product}}{\text{Exempt concentration of Isotope A}} + \frac{\text{Concentration of Isotope B in Product}}{\text{Exempt concentration of Isotope B}} \leq 1$$

Historical Note

Appendix A repealed, Schedule A adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

Exhibit B. Exempt Quantities

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
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) (9.2 h)	100
Europium-152 (Eu-152) (13 yr)	1
Europium-154 (Eu-154)	1
Europium-155 (Eu-155)	10
Fluorine-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)	10
Gold-198 (Au-198)	100
Gold-199 (Au-199)	100
Hafnium-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)	1
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
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
Osmium-185 (Os-185)	10
Osmium-191m (Os-191m)	100
Osmium-191(Os-191)	100
Osmium-193 (Os-193)	100
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
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
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-99m (Tc-99m)	100
Technetium-99 (Tc-99)	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-43 (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
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 radionuclide material not listed above other than alpha-emitting radioactive material	0.1

Historical Note

Adopted effective June 30. 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Exhibit B amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

Exhibit C. Limits for Class B and C Broad Scope Licenses (R12-1-310)

Col. I Radioactive Material	Col. I curies	II curies
Antimony-122	1	0.01
Antimony-124	1	0.01
Antimony-125	1	0.01
Arsenic-73	10	0.1
Arsenic-74	1	0.01
Arsenic-76	1	0.01
Arsenic-77	10	0.1
Barium-131	10	0.1
Barium-140	1	0.01
Beryllium-7	10	0.1
Bismuth-210	0.1	0.001
Bromine-82	10	0.1
Cadmium-109	1	0.01
Cadmium-115m	1	0.01
Cadmium-115	10	0.1
Calcium-45	1	0.01
Calcium-47	10	0.1
Carbon-14	100	1.
Cerium-141	10	0.1
Cerium-143	10	0.1
Cerium-144	0.1	0.001
Cesium-131	100	1.
Cesium-134m	100	1.
Cesium-134	0.1	0.001
Cesium-135	1	0.01
Cesium-136	10	0.1
Cesium-137	0.1	0.001
Chlorine-36	1	0.01
Chlorine-38	100	1.
Chromium-51	100	1.
Cobalt-57	10	0.1

Cobalt-58m	100	1.
Cobalt-58	1	0.01
Cobalt-60	0.1	0.001
Copper-64	10	0.1
Dysprosium-165	100	1.
Dysprosium-166	10	0.1
Erbium-169	10	0.1
Erbium-171	10	0.1
Europium-152 (9.2 h)	10	0.1
Europium-152 (13 yr)	0.1	0.001
Europium-154	0.1	0.001
Europium-155	1	0.01
Fluorine-18	100	1.
Gadolinium-153	1	0.1
Gadolinium-159	10	0.1
Gallium-72	10	0.1
Germanium-71	100	1.
Gold-198	10	0.1
Gold-199	10	0.1
Hafnium-181	1	0.1
Holmium-166	10	0.1
Hydrogen-3	100	1.
Indium-113m	100	1.
Indium-114m	1	0.1
Indium-115m	100	1.
Indium-115	1	0.1
Iodine-125	0.1	0.001
Iodine-126	0.1	0.001
Iodine-129	0.1	0.001
Iodine-131	0.1	0.001
Iodine-132	10	0.1
Iodine-133	1	0.1
Iodine-134	10	0.1
Iodine-135	1	0.1
Iridium-192	1	0.1
Iridium-194	10	0.1
Iron-55	10	0.1
Iron-59	1	0.1
Krypton-85	100	1.
Krypton-87	10	0.1
Lanthanum-140	1	0.1
Lutetium-177	10	0.1
Manganese-52	1	0.1
Manganese-54	1	0.1
Manganese-56	10	0.1
Mercury-197m	10	0.1
Mercury-197	10	0.1
Mercury-203	1	0.1
Molybdenum-99	10	0.1
Neodymium-147	10	0.1
Neodymium-149	10	0.1
Nickel-59	10	0.1
Nickel-63	1	0.1
Nickel-65	10	0.1
Niobium-93m	1	0.1
Niobium-95	1	0.1
Niobium-97	100	1.
Osmium-185	1	0.1
Osmium-191m	100	1.
Osmium-191	10	0.1
Osmium-193	10	0.1
Palladium-103	10	0.1

Palladium-109	10	0.1
Phosphorus-32	1	0.01
Platinum-191	10	0.1
Platinum-193m	100	1.
Platinum-193	10	0.1
Platinum-197m	100	1.
Platinum-197	10	0.1
Polonium-210	0.01	0.0001
Potassium-42	1	0.01
Praseodymium-142	10	0.1
Praseodymium-143	10	0.1
Promethium-147	1	00.1
Promethium-149	10	0.1
Radium-226	0.01	0.0001
Rhenium-186	10	0.1
Rhenium-188	10	0.1
Rhodium-103m	1,000	10
Rhodium-105	10	0.1
Rubidium-86	1	0.01
Rubidium-87	1	0.01
Ruthenium-97	100	1.
Ruthenium-103	1	0.01
Ruthenium-105	10	0.1
Ruthenium-106	0.1	0.001
Samarium-151	1	0.01
Samarium-153	10	0.1
Scandium-46	1	0.01
Scandium-47	10	0.1
Scandium-48	1	0.01
Selenium-75	1	0.01
Silicon-31	10	0.1
Silver-105	1	0.01
Silver-110m	0.1	0.001
Silver-111	10	0.1
Sodium-22	0.1	0.001
Sodium-24	1	0.01
Strontium-85	1,000	10
Strontium-85	1	0.01
Strontium-89	1	0.01
Strontium-90	0.01	0.0001
Strontium-91	10	0.1
Strontium-92	10	0.1
Sulfur-35	100	0.1
Tantalum-182	1	0.01
Technetium-96	10	0.1
Technetium-97m	10	0.1
Technetium-97	10	0.1
Technetium-99m	100	1.
Technetium-99	1	0.01
Tellurium-125m	1	0.01
Tellurium-127m	1	0.01
Tellurium-127	10	0.1
Tellurium-129m	1	0.01
Tellurium-129	100	1.
Tellurium-131m	10	0.1
Tellurium-132	1	0.01
Terbium-160	1	0.01
Thallium-200	10	0.1
Thallium-201	10	0.1
Thallium-202	10	0.1
Thallium-204	1	0.01
Thulium-170	1	0.01

Thulium-171	1	0.01
Tin-113	1	0.01
Tin-125	1	0.01
Tungsten-181	1	0.01
Tungsten-185	1	0.01
Tungsten-197	10	0.1
Vanadium-43	1	0.01
Xenon-131m	1,000	10
Xenon-133	100	1.
Xenon-135	100	1.
Ytterbium-175	10	0.1
Yttrium-90	1	0.01
Yttrium-91	1	0.01
Yttrium-92	10	0.1
Yttrium-93	1	0.01
Zinc-65	1	0.01
Zinc-69m	10	0.1
Zinc-69	100	1.
Zirconium-93	1	0.01
Zirconium-95	1	0.01
Zirconium-97	1	0.01
Any radioactive material other than source material, special nuclear material, or alpha emitting radioactive material not listed above.	0.1	0.001

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective December 20, 1985 (Supp. 85-6). Former Schedule C repealed; new Exhibit C renumbered from Exhibit D and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

Exhibit D. Radioactive Material Quantities Requiring Consideration for an Emergency Plan (R12-1-322)

Radioactive Material	Release Fraction	Quantity (Ci)		
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 (Non CO)				.01 50,000
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	200,000	
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		
Gadolinium-153			.01	5,000	
Germanium-68			.01	2,000	
Gold-198	.01	30,000			
Hafnium-172		.01	400		
Hafnium-181		.01	7,000		
Holmium-166m			.01	100	
Hydrogen-3		.5	20,000		
Indium-114m		.01	1,000		
Iodine-125		.5	10		
Iodine-131		.5	10		
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-210		.01	10		
Potassium-42		.01	9,000		
Promethium-145			.01	4,000	
Promethium-147			.01	4,000	
Radium-226		.001	100		
Ruthenium-106			.01	200	
Samarium-151		.01	4,000		
Scandium-46		.01	3,000		
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-113	.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
Mixed corrosion products				.01	10,000
Contaminated equipment					
beta-gamma		.001	10,000		

Irradiated material, any form other than solid non-combustible	.01	1,000	
Irradiated material, solid noncombustible	.001	10,000	
Mixed radioactive waste, beta-gamma	.01	1,000	
Packaged mixed waste, beta gamma	.001	10,000	
Any other alpha emitter		.001	2
Contaminated equipment, alpha		.0001	20
Packaged waste, alpha		.0001	20

Combinations of radioactive materials listed above:

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 Exhibit D exceeds 1.

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

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Former Schedule D renumbered to Exhibit C; new Exhibit D renumbered from Schedule E and amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Exhibit D amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

Exhibit E. Application Information

1. Radioactive Material (RAM) Specific License Application Information

An applicant shall provide the following information in a specific license application before a license is issued to the applicant. The Agency shall provide an application form to an applicant with a guide, when possible, to ensure that correct information is provided in the application:

Name and mailing address of applicant
Use location
Contact person
Telephone number
Users of RAM
Training of users
Radiation Safety Officer identity (RSO)
Duties of RSO
Description of RAM and uses
Description of radiation detection/measurement instruments and their calibration
Personnel monitoring
Bioassay program
Facility description
Survey program
Leak test program
Records management program
Instruction to personnel
Waste disposal program
Emergency procedures
Procedures for ordering, receiving, and opening packages
Description of animal use
Licensing fee provided with application
Copy of letter-of-intent to local governing body
Description of ALARA and quality management programs
Description of transportation procedures
Certifying signature
Legal structure of licensee's operation

Other licensing requirements listed in: R12-1-310, R12-1-311, R12-1-312, R12-1-511, R12-1-703, and R12-1-1721

2. Radioactive Material (RAM) General License Application Information

An applicant shall provide the following information on a registration certificate. The certificate will be validated and returned to the applicant if the information provided is complete.

Name and address
Telephone number
Where will the radioactive material be used
Address of use location
Description of radioactive material use
Date
Authorizing signature and printed name
Position of person signing the form

Historical Note

Adopted effective February 18, 1994 (Supp. 94-1). Former Schedule E renumbered to Exhibit D; new Exhibit adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2).

ARTICLE 4. STANDARDS FOR PROTECTION AGAINST IONIZING RADIATION

R12-1-401. Purpose

A. Article 4 establishes standards for protection against ionizing radiation resulting from activities conducted according to licenses or registrations issued by the Agency. These rules are issued according to A.R.S. Title 30, Chapter 4, as amended.

B. The requirements of Article 4 are designed to control the receipt, possession, use, transfer, and disposal of sources of radiation by any licensee or registrant so the total dose equivalent to an individual, including radiation exposure resulting from all sources of radiation other than radiation prescribed by a physician in the practice of medicine, radiation received while voluntarily participating in a medical research program, and background radiation, does not exceed the standards for protection against radiation prescribed in this Article. However, this Article does not limit actions that may be necessary to protect health and safety.

Historical Note

Former Rule Section D.1; Former Section R12-1-401 repealed, new Section R12-1-401 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-402. Scope

Except as specifically provided in other Articles of these rules, Article 4 applies to persons licensed or registered by the Agency to receive, possess, use, transfer, or dispose of sources of ionizing radiation.

Historical Note

Former Rule Section D.2; Former Section R12-1-402 repealed, new Section R12-1-402 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended subsection (A) effective June 26, 1987 (Supp. 87-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-403. Definitions

The following definitions apply in this Article, unless the context otherwise requires:

"Air-purifying respirator" means respiratory protective equipment with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

"ALI" means annual limit on intake, 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 0.05 Sv (5 rem) or a committed dose equivalent of 0.5 Sv (50 rem) to any individual organ or tissue. ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Appendix B, Table I, Columns 1 and 2.

"Assigned protection factor" or "APF" means the expected workplace level of respirator 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.

"Atmosphere-supplying respirator" means respiratory protective equipment that supplies the equipment 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.

"Class" means a classification scheme for inhaled material according to the material's rate of clearance from 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 (see Introduction, Appendix B). For purposes of these rules, "lung class" and "inhalation class" are equivalent terms.

“Constraint” or “dose constraint” means a value above which specified licensee or registrant actions are required.

“Critical group” means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

“DAC” means derived air concentration, the concentration of a given radionuclide in air which, if breathed by Reference Man for a working year of 2,000 hours under conditions of light work, results in an intake of one ALI. For purposes of these rules, the condition of light work is an inhalation rate of 1.2 cubic meters of air per hour for 2,000 hours in a year. DAC values are given in Appendix B, Table I, Column 3.

“DAC-hour” means derived air concentration-hour, 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 or registrant may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 0.05 Sv (5 rem).

“Declared pregnant woman” means a woman who has voluntarily informed the licensee or registrant 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.

“Decommission” means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license or release of the property under restricted conditions and the termination of the license.

“Demand respirator” means an atmosphere-supplying respiratory protective equipment that admits breathing air to the face piece only when a negative pressure is created inside the face piece by inhalation.

“Deterministic effect” (See “Nonstochastic effect”)

“Disposable respirator” means respiratory protective equipment for which maintenance is not intended and that is designed to be discarded after excessive breathing resistance, sorbent depletion, physical damage, or end-of-service-life renders it unsuitable for use. Examples of this type of device include a disposable half-mask respirator or a disposable, escape-only, self-contained breathing apparatus (SCBA).

“Distinguishable from background” means that the detectable concentration of a radionuclide is statistically greater than the background concentration of that radionuclide in the vicinity of a site or, in the case of structures, in similar materials using accepted measurement, survey, and statistical techniques.

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

“Filtering face piece (dust mask)” means a particulate respirator that operates under a negative pressure with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium, not equipped with elastomeric sealing surfaces and adjustable straps.

“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.

“Fit test” means the use of protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

“Helmet” means a rigid respiratory inlet covering that also provides head protection against impact and penetration.

“Hood” means a respiratory inlet covering that completely covers the head, neck, and may also cover portions of the shoulders and torso.

“Inhalation class” (See “Class”)

“Loose-fitting face piece” means a respiratory inlet covering that is designed to form a partial seal with the face.

“Lung class” (See “Class”)

“Nationally tracked source” means a sealed source that contains a quantity equal to or greater than Category 1 or Category 2 levels of radioactive material listed in 10 CFR 20, Appendix E, revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. In this context sealed source does not mean material encapsulated solely for disposal, or nuclear material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet.

“Negative pressure respirator (tight fitting)” means respiratory protective equipment in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.

“Nonstochastic effect” means a health effect, 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. For purposes of these rules,

"deterministic effect" is an equivalent term and "threshold" means that which if not exceeded, poses no risk or likelihood of an effect to occur.

"Planned special exposure" means an infrequent exposure to radiation received while employed, but separate from and in addition to the annual occupational dose limits.

"Positive pressure respirator" means respiratory protective equipment in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

"Powered air-purifying respirator" or "PAPR" means an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

"Pressure demand respirator" means a positive pressure, atmosphere-supplying respirator that admits breathing air to the face piece when the positive pressure is reduced inside the face piece by inhalation.

"Probabilistic effect" (See "Stochastic effect")

"Qualitative fit test" or "QLFT" means a pass or fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

"Quantitative fit test" or "QNFT" means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

"Reference Man" means a hypothetical aggregation of human physical and physiological characteristics determined 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. A description of Reference Man is contained in the International Commission on Radiological Protection report, ICRP Publication 23, "Report of the Task Group on Reference Man," published in 1975 by Pergammon Press, incorporated by reference and on file with the Agency and the Office of the Secretary of State. This incorporation by reference contains no future editions or amendments.

"Residual radioactivity" means radioactivity in structures, materials, soils, groundwater, or other media at a site, resulting from activities under a 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 that remain at the site because of routine or accidental release of radioactive material at the site or a previous burial at the site, even if the licensee complied with reagent provisions of 12 A.A.C. 1.

"Respiratory protective equipment" means an apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive materials.

"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 or registrant.

"Self-contained breathing apparatus" or "SCBA" means an atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

"Stochastic effect" means a health effect that occurs randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without a threshold. Hereditary effects and cancer incidence are examples of stochastic effects. For purposes of these rules, "probabilistic effect" is an equivalent term.

"Supplied-air respirator" or "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.

"Tight-fitting face piece" means a respiratory inlet covering that forms a complete seal with the face.

"User seal check" or "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.

"Very-high radiation area" means an area, accessible to individuals, in which radiation levels from radiation sources external to an individual's body could result in the individual receiving an absorbed dose in excess of 5 Gy (500 rad) in one hour at one meter from a radiation source or one meter from any surface that the radiation penetrates. (At very high doses received at high dose rates, units of absorbed dose, the gray and rad should be used, rather than units of dose equivalent, the sievert and rem).

"Weighting factor" wT for an organ or tissue (T) means 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 wT 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	0.30[a]
Whole Body	1.00[b]

[a] 0.30 results from 0.06 for each of five "remainder" organs, excluding the skin and the lens of the eye, that receive the highest doses.

[b] 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 by the Agency on a case-by-case basis.

Historical Note

Former Rule Section D.3, Former Section R12-1-403 repealed, new Section R12-1-403 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-404. Units and Quantities

A. Each licensee or registrant shall use the Standard International (SI) units becquerel, gray, sievert, and coulomb per kilogram, or the special units curie, rad, rem, and roentgen, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by this Article.

B. The licensee or registrant shall make a clear distinction among the quantities entered on the records required by this Article, such as, total effective dose equivalent, total organ dose equivalent, shallow dose equivalent, lens dose equivalent, deep dose equivalent, or committed effective dose equivalent.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-405. Form of Records

A. A licensee or registrant shall ensure that each record required by this Article is legible throughout the specified retention period. The record shall be the original, 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. As an alternative the record may be stored in electronic media capable of producing legible records during the required retention period. Records, such as letters, drawings, and specifications, shall include all pertinent information, such as stamps, initials, and signatures. A licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

B. In the records required by this Article, a licensee or registrant may record quantities in SI units in parentheses following each of the required units, curie, rad, and rem, and include multiples and subdivisions.

C. Notwithstanding subsection (B), the licensee or registrant shall ensure that information is recorded in the International System of Units (SI) or in SI and the units specified in subsection (B) on each shipment manifest as required in R12-1-439(A).

D. A licensee or registrant shall make a clear distinction among the quantities entered on the records required by this Section (e.g., total effective dose equivalent, shallow-dose equivalent, lens dose equivalent, deep-dose equivalent, committed effective dose equivalent).

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new

Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-406. Implementation

Any existing license or registration condition that is more restrictive than this Article remains in force until amendment or renewal of the license or registration.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-407. Radiation Protection Programs

A. Each licensee or registrant shall develop, document, and implement a radiation protection program sufficient to ensure compliance with the provisions of Article 4.

B. The licensee or registrant shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).

C. The licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation.

D. To implement the ALARA requirements in subsection (B), and notwithstanding the requirements in R12-1-416, each licensee or registrant governed by A.A.C. Title 12, Chapter 1, Article 3 shall limit air emissions of radioactive material to the environment so that individual members of the public likely to receive the highest dose will not receive a total effective dose equivalent in excess of 0.1mSv (10 mrem) per year from the emissions. If a licensee or registrant subject to this requirement exceeds this limit, the licensee or registrant shall report the incident to the Agency, in accordance with R12-1-444, and take prompt corrective action to prevent additional violations.

E. Records.

1. Each licensee or registrant shall maintain records of the radiation protection program, including:
   a. The provisions of the program; and
   b. Audits and other reviews of program content and implementation.
2. A licensee or registrant shall retain the records required by subsection (E)(1)(a) for three years after the termination of the license or registration. The licensee or registrant shall retain the records required by subsection (E)(1)(b) for three years after the record is made.
3. The following licensees and registrants are exempt from the record requirements contained in this subsection:
   B6-General Medical
   C9-Gas Chromatograph
   C10-General Industrial
   D15-Possession Only
   E2-X-ray Machine class B
   E3-X-ray Machine class C

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25. 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-408. Occupational Dose Limits for Adults

A. Each licensee or registrant shall control the occupational dose to individual adults, except for planned special exposures required in R12-1-413, to the following dose limits:

1. An annual limit, which is the more limiting of:
   a. The total effective dose equivalent being equal to 0.05 Sv (5 rem): or
   b. 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 0.5 Sv (50 rem).
2. The annual limits to the lens of the eye, to the skin, and to the extremities which are:
   a. A lens dose equivalent of 0.15 Sv (15 rem), and
   b. A shallow dose equivalent of 0.5 Sv (50 rem) to the skin of the whole body or to the skin of any extremity.

B. Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, shall be subtracted from the limits for planned special exposures that the individual may receive during the current year and during the individual's lifetime. See R12-1-413.

C. The assigned deep-dose equivalent and shallow-dose equivalent are, for the portion of the body receiving the highest exposure, determined as follows:

1. 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.

2. If a protective apron is worn and monitoring is conducted as specified in R12-1-419(B), the effective dose equivalent for external radiation shall be determined as follows:
   a. If only one individual monitoring device is used and it is located at the neck outside the protective apron, and the reported dose exceeds 25% of the limit specified in R12-1-408(A), the reported deep-dose equivalent value multiplied by 0.3 is the effective dose equivalent for external radiation; or
   b. When individual monitoring devices are worn, both under the protective apron at the waist and outside the protective apron at the neck, the effective dose equivalent for external radiation is assigned the value of the sum of the deep-dose equivalent reported for the individual monitoring device located at the waist under the protective apron multiplied by 1.5 and the deep-dose equivalent reported for the individual monitoring device located at the neck outside the protective apron multiplied by 0.04.
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 Agency. The assigned deep-dose equivalent shall be determined for the part of the body that receives the highest exposure. The assigned shallow-dose equivalent is the dose averaged over the contiguous 10 square centimeters of skin that receives 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.

D. Derived air concentration (DAC) and annual limit on intake (ALI) values are presented in Table I of Appendix B and may be used to determine the individual's dose and to demonstrate compliance with the occupational dose limits.

E. Notwithstanding 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.

F. The licensee or registrant shall reduce the dose that an individual may receive in the current year by the amount of occupational dose received while employed occupationally as a radiation worker by all previous employers. See R12-1-412.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-409. Summation of External and Internal Doses

A. If a licensee or registrant is required to monitor according to both R12-1-419(B) and (C), the licensee or registrant shall add external and internal doses, and use the sum to demonstrate compliance with dose limits. If the licensee or registrant is required to monitor only according to R12-1-419(B) or only according to R12-1-419(C), summation is not required to demonstrate compliance with dose limits. The licensee or registrant may demonstrate compliance with the requirements for summation of external and internal doses according to subsections (B), (C), and (D). 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 (see R12-1-408(A)(2)).

B. 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 (1):
1. The sum of the fractions of the inhalation ALI for each radionuclide, or
2. The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by 2,000, or
3. The sum of the calculated committed effective dose equivalents to all significantly irradiated organs or tissues (T) calculated from bioassay data using applicable biological models and expressed as a fraction of the annual limit. For purposes of this requirement, 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, $H_{T,50}$, per unit intake is greater than 10% of the maximum weighted value of $H_{T,50}$, that is, $w_T H_{T,50}$, per unit intake for any organ or tissue.

C. If the occupationally exposed individual also receives an intake of radionuclides by oral ingestion greater than 10% of the applicable oral ALI, the licensee or registrant shall account for this intake and include it in demonstrating compliance with the limits.

D. The licensee or registrant shall evaluate and, to the extent practical, account for intakes through wounds or skin absorption. The intake through intact skin has been included in the calculation of DAC for Hydrogen-3 and does not need to be evaluated or accounted for according to this subsection.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-410. Determination of External Dose from Airborne Radioactive Material

A. Each licensee 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, footnotes 1 and 2.

B. Airborne radioactivity measurements and DAC values shall 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 shall be based upon measurements using instruments or individual monitoring devices.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended effective June 20, 1990 (Supp. 90-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-411. Determination of Internal Exposure

A. For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, each licensee or registrant shall, when required according to R12-1-419, take suitable and timely measurements of:
1. Concentrations of radioactive materials in air in work areas,
2. Quantities of radionuclides in the body,
3. Quantities of radionuclides excreted from the body, or
4. Combinations of these measurements,

B. Unless respiratory protective equipment is used, as provided in R12-1-425, or the assessment of intake is based on bioassays, the licensee or registrant shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.

C. When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior of the material in an individual is known, the licensee or registrant may:
1. Use that information to calculate the committed effective dose equivalent, and, if used, the licensee or registrant shall document that information in the individual's record;
2. Upon prior approval of the Agency, adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material, for example, aerosol size distribution or density; and
3. Separately assess the contribution of fractional intakes of Class D, W, or Y compounds of a given radionuclide to the committed effective dose equivalent. See Appendix B.

D. If the licensee or registrant chooses to assess intakes of Class Y material using the measurements given in subsection (A)(2) or (3), the licensee or registrant may delay the recording and reporting of the assessments for periods up to seven months, unless otherwise required by R12-1-444 or R12-1-445. This delay permits the licensee or registrant to make additional measurements basic to the assessments.

E. 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 is either:
1. The sum of the ratios of the concentration to the appropriate DAC value, that is, D, W, or Y from Appendix B for each radionuclide in the mixture; or
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.

F. 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 is the most restrictive DAC of any radionuclide in the mixture.

G. If a mixture of radionuclides in air exists, a licensee may disregard certain radionuclides in the mixture if:
1. The licensee uses the total activity of the mixture to demonstrate compliance with the dose limits in R12-1-408 and complies with the monitoring requirements in R12-1-419;
2. The concentration of any radionuclide disregarded is less than 10% of its DAC; and
3. The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed 30%.

H. When determining the committed effective dose equivalent, the following information may be considered:
1. In order to calculate the committed effective dose equivalent, the licensee may assume that the inhalation of 1 ALI, or an exposure of 2,000 DAC-hours, results in a committed effective dose equivalent of 0.05 Sv (5 rem) for radionuclides that have their ALIs or DACs based on the committed effective dose equivalent.
2. For an ALI and the associated DAC determined by the nonstochastic organ dose limit of 0.5 Sv (50 rem), the intake of radionuclides that would result in a committed effective dose equivalent of 0.05 Sv (5 rem), that is, the stochastic ALI, is listed in parentheses in Table I of Appendix B. The licensee may, as a simplifying assumption, use the stochastic ALI to determine committed effective dose equivalent. However, if the licensee or registrant uses the stochastic ALI, the licensee shall also demonstrate that the limit in R12-1-408(A)(1)(b) is met.

Historical Note

Former Rule Section D.101; Former Section R12-1-411 repealed, new Section R12-1-411 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Amended subsection (F) effective June 26, 1987 (87-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-412. Determination of Prior Occupational Dose

A. For each individual who is likely to receive in a year an occupational dose that requires monitoring according to R12-1-419 the licensee shall:
1. Determine the occupational radiation dose received during the current year, and
2. Attempt to obtain the records of lifetime cumulative occupational radiation dose.

B. Before permitting an individual to participate in a planned special exposure, the licensee or registrant shall determine:
1. The internal and external doses from all previous planned special exposures; and
2. All doses in excess of the limits received during the lifetime of the individual, including doses received during accidents and emergencies; and
3. All lifetime, cumulative, occupational radiation doses.

C. In complying with the requirements of subsection (A), a licensee or registrant shall:
1. Accept, as a record of the occupational dose that the individual received during the current year, a written and 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 received during the current year; and
2. Accept, as the record of lifetime cumulative radiation dose, an up-to-date Agency Form Y (available from the Agency) or equivalent, signed by the individual and countersigned 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 or registrant; and
3. Obtain reports of the individual's dose equivalent 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 or registrant, by telephone, telegram, facsimile, or letter. The licensee or registrant shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

D. Records.
1. The licensee or registrant shall record the exposure history, as required by subsection (A), on Agency Form Y (available from the Agency) or a similar clear and legible record of all the information required by this subsection. The form or record shall show each period in which the individual received occupational exposure to radiation or radioactive material and shall be signed by the individual who received the exposure. For each period for which the licensee or registrant obtains reports, the licensee or registrant shall use the dose shown in the report for preparing Agency Form Y or its equivalent. For any period in which the licensee or registrant does not obtain a report, the licensee or registrant shall place a notation on Agency Form Y or its equivalent indicating each period of time for which there is no data.
2. The licensee or registrant is not required to reevaluate the separate external dose equivalents and internal committed dose equivalents or intakes of radionuclides assessed according to the rules in Article 4 in effect before January 1, 1994. Occupational exposure histories obtained and recorded on Agency Form Y or its equivalent 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.
3. If the licensee or registrant is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee or registrant shall:
   a. In establishing administrative controls under R12-1-408(F) for the current year, reduce the allowable dose limit for the individual by 12.5 mSv (1.25 rem) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and
   b. Not subject the individual to planned special exposures.
4. The licensee or registrant shall retain current and prior records on Agency Form Y or its equivalent for three years after the Agency terminates each pertinent license or registration requiring this record. The licensee or registrant shall retain records used in preparing Agency Form Y or its equivalent for three years after the record is made.

Historical Note

Former Rule Section D.102; Former Section R12-1-412 repealed, new Section R12-1-412 adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-413. Planned Special Exposures

A. A licensee or registrant may authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits specified in R12-1-408, provided that each of the following conditions is satisfied:
1. The licensee or registrant authorizes a planned special exposure only in an exceptional situation when alternatives that might avoid the dose estimated from the planned special exposure are unavailable or impractical.
2. The licensee or registrant, and employer if the employer is not the licensee or registrant, specifically authorizes the planned special exposure, in writing, before the exposure occurs.
3. Before a planned special exposure, the licensee or registrant ensures that each individual involved is:
   a. Informed in writing of the purpose of the planned special exposure;
   b. Informed in writing of the estimated doses, associated potential risks, and specific radiation levels or other conditions that might be involved in performing the task; and
   c. Instructed in the measures to be taken to keep the dose ALARA, considering other risks that may be present.

4. Before permitting an individual to participate in a planned special exposure, the licensee or registrant shall ascertain prior doses as required by R12-1-412(B) for each individual involved.
5. Subject to R12-1-408(B), the licensee or registrant shall not authorize a planned special exposure that would cause an individual to receive a dose from all planned special exposures and all doses that exceed:
   a. The numerical value of any of the dose limits in R12-1-408(A) in any year, and
   b. Five times the annual dose limits in R12-1-408(A) during the individual's lifetime.
6. The licensee or registrant shall maintain records of a planned special exposure in accordance with subsections (B) and (C) and submit a written report to the Agency within 30 days after the date of any planned special exposure conducted in accordance with this Section, informing the Agency that a planned special exposure was conducted and indicating the date the planned special exposure occurred and the information required by subsection (B).
7. The licensee or registrant shall record the best estimate of the dose resulting from the planned special exposure in the individual's record and inform the individual, in writing, of the dose within 30 days after the date of the planned special exposure. The dose from a planned special exposure shall not be considered in controlling future occupational dose of the individual according to R12-1-408(A) but shall be included in evaluations required by subsections (A)(4) and (A)(5).

B. Records.
1. For each planned special exposure, the licensee or registrant shall maintain records that describe:
   a. The exceptional circumstances requiring the use of a planned special exposure,
   b. The name of the management official who authorized the planned special exposure and a copy of the signed authorization,
   c. What actions were necessary,
   d. Why the actions were necessary,
   e. What precautions were taken to assure that doses were minimized in accordance with R12-1-407(B),
   f. What individual and collective doses were expected,
   g. The doses actually received in the planned special exposure, and
   h. The process through which the employee involved in the planned special exposure has been informed in writing of the information contained in subsection (A)(3).
2. The licensee or registrant shall retain the records for three years after the Agency terminates each pertinent license or registration.

C. A licensee shall submit a report to the Agency no later than 30 days after a planned special exposure conducted in accordance with subsection (A). The report shall contain the date of the planned exposure and the information required by subsection (B).

Historical Note

Former Rule Section D.103. Former Section R12-1-413 repealed, new Section R12-1-413 adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-414. Occupational Dose Limits for Minors

The annual occupational dose limits for minors are 10% of the annual occupational dose limits specified for adult workers in R12-1-408.

Historical Note

Former Rule Section D. 104; Former Section R12-1-414 repealed, new Section R12-1-414 adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3).

R12-1-415. Dose Equivalent to an Embryo or Fetus

A. A licensee or registrant shall ensure that the dose equivalent to an embryo or fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 5 mSv (0.5 rem). Records shall be maintained according to R12-1-419(D)(4) and (5).

B. The licensee or registrant shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman to satisfy the limit in subsection (A).

C. For purposes of this Section, the dose equivalent to the embryo or fetus is the sum of:
1. The deep-dose equivalent to the declared pregnant woman; and
2. The dose equivalent to the embryo or fetus resulting from radionuclides in the embryo or fetus and radionuclides in the declared pregnant woman.

D. If the dose equivalent to the embryo or fetus is found to have exceeded 5 mSv (0.5 rem) or is within 0.5 mSv (0.05 rem) of this dose by the time the woman declares the pregnancy to the licensee or registrant, the licensee or registrant shall be deemed to be in compliance with subsection (A) if the additional dose equivalent to the embryo or fetus does not exceed 0.5 mSv (0.05 rem) during the remainder of the pregnancy.

Historical Note

Former Rule Section D. 105; Former Section R12-1-415 repealed, new Section R12-1-415 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2).

Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-416. Dose Limits for Individual Members of the Public

A. Each licensee or registrant shall conduct operations so that:
1. The total effective dose equivalent to any individual member of the public from the licensed or registered operation does not exceed 1 mSv (0.1 rem) in a year, excluding the dose contribution from background radiation, medical administration of radiation, exposure to an individual who has been administered radioactive material and released in accordance with R12-1-719, voluntary participation in a medical research program, and the licensee's or registrant's disposal of radioactive material into sanitary sewerage in accordance with R12-1-436; and
2. The dose in any unrestricted area from an external source excluding the dose contribution from an individual who has been administered radioactive material and released in accordance with R12-1-719, does not exceed 0.02 mSv (0.002 rem) in any one hour.

B. Registrants possessing radiation machines in operation before August 10, 1994, are exempt from the requirement in subsection (A)(1). Operation of these machines shall be conducted so that the total effective dose equivalent to any individual member of the public does not exceed 5 mSv (0.5 rem) in a year.

C. A licensee, registrant, or an applicant for a license or registration may apply for Agency authorization to operate with an annual dose limit of 5 mSv (0.5 rem) for an individual member of the public. The application shall include the following information:
1. An explanation of the need for and the expected duration of operations in excess of the limit in subsection (A), and
2. The licensee's or registrant's program to assess and control dose within the 5 mSv (0.5 rem) annual limit; and
3. The procedures to be followed to maintain the dose in accordance with R12-1-407(B).

D. A licensee or registrant shall comply with the U.S. Environmental Protection Agency's applicable environmental radiation standards in 40 CFR 190, 2003 edition, published July 1, 2003, by the Office of the Federal Register, National Archives and Records Administration, Washington, D.C. 20408, which are incorporated by reference, on file with the Agency and contain no future editions or amendments.

E. The Agency may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee or registrant may release in effluents in order to restrict the collective dose.

F. Each licensee or registrant shall make or cause to be made surveys of radiation levels in unrestricted areas and radioactive materials contained in effluents released to unrestricted areas.

G. Each licensee or registrant shall:
1. Demonstrate by measurement or calculation that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed or registered operation does not exceed the annual dose limit; or
2. Demonstrate that:
   a. 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 Appendix B, Table II; and
   b. If an individual were continually present in an unrestricted area, the dose from external sources would not exceed 0.02 mSv (0.002 rem) in an hour and 0.5 mSv (0.05 rem) in a year.

H. Upon approval from the Agency, the licensee or registrant may adjust the effluent concentration values in Appendix B, Table II for members of the public, to take into account the actual physical and chemical characteristics of the effluents, such as aerosol size distribution, solubility, density, radioactive decay equilibrium, and chemical form.

I. Each licensee or registrant shall maintain records sufficient to demonstrate compliance with the dose limit for individual members of the public and shall retain the records for three years after the Agency terminates each pertinent license or registration.

Historical Note

Former Rule Section D. 106; Former Section R12-1-416 repealed, new Section R12-1-416 adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-417. Testing for Leakage or Contamination of Sealed Sources

A. A licensee in possession of any sealed source shall ensure that:
1. Each sealed source, except as specified in subsection (B), is tested for leakage or contamination and the test results are received before the sealed source is put into use unless the licensee has a certificate from the transferor indicating that the sealed source was tested within six months before transfer to the licensee or registrant.
2. Each sealed source that is not designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed six months or at alternative intervals approved by the Agency, after evaluation of information specified by R12-1-311(D)(2) and (D)(3), or equivalent information specified by an Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission.
3. Each sealed source that is designed to emit alpha particles is tested for leakage or contamination at intervals not to exceed three months or at alternative intervals approved by the Agency, after evaluation of information specified by R12-1-311(D)(2) and (D)(3), or equivalent information specified by an Agreement State, a Licensing State, or the Nuclear Regulatory Commission.

4. Each sealed source suspected of damage or leakage is tested for leakage or contamination before further use.
5. Tests for leakage for all sealed sources, except brachytherapy sources manufactured to contain radium, are capable of detecting the presence of 185 Bq (0.005 µCi) of radioactive material on a test sample. The person conducting the test shall take test samples from the sealed source or from the surfaces of the container in which the sealed source is stored or mounted on which contamination could accumulate. For a sealed source contained in a device, the person conducting the test shall obtain test samples when the source is in the "off" position.
6. The test for leakage from brachytherapy sources containing radium is capable of detecting an absolute leakage rate of 37 Bq (0.001 µCi) of Radon-222 in a 24-hour period when the collection efficiency for Radon-222 and its daughters has been determined with respect to collection method, volume, and time.
7. Tests for contamination from radium daughters are taken on the interior surface of brachytherapy source storage containers and are capable of detecting the presence of 185 Bq (0.005 µCi) of a radium daughter which has a half-life greater than four days.

B. A licensee need not perform tests for leakage or contamination on the following sealed sources:
1. Sealed sources containing only radioactive material with a half-life of less than 30 days;
2. Sealed sources containing only radioactive material as a gas;
3. Sealed sources containing 3.7 MBq (100 µCi) or less of beta or photon-emitting material or 370 kBq (10 µCi) or less of alpha-emitting material;
4. Sealed sources containing only Hydrogen-3;
5. Seeds of Iridium-192 encased in nylon ribbon; and
6. Sealed sources, except teletherapy and brachyherapy sources, which are stored, not being used, and identified as in storage. The licensee shall test each sealed source for leakage or contamination and receive the test results before any use or transfer unless it has been tested for leakage or contamination within six months before the date of use or transfer.

C. Persons specifically authorized by the Agency, an Agreement State, a Licensing State, or the U.S. Nuclear Regulatory Commission shall perform tests for leakage or contamination from sealed sources.

D. A licensee shall maintain for Agency inspection test results in units of becquerel or microcurie.

E. The following is considered evidence that a sealed source is leaking:
1. The presence of 185 Bq (0.005 µCi) or more of removable contamination on any test sample.
2. Leakage of 37 Bq (0.001 µCi) of Radon-222 per 24 hours for brachytherapy sources manufactured to contain radium.
3. The presence of removable contamination resulting from the decay of 185 Bq (0.005 µCi) or more of radium.

F. A licensee shall immediately withdraw a leaking sealed source from use and shall take action to prevent the spread of contamination. The leaking sealed source shall be repaired or disposed of in accordance with this Article.

G. A licensee shall file a report with the Agency within five days if the test for leakage or contamination indicates a sealed source is leaking or contaminated. The report shall include the equipment involved, the test results, and the corrective action taken.

H. A licensee shall maintain records of the tests for leakage required in subsection (A) for three years after the records are made.

Historical Note

Former Rule Section D. 107; Former Section R12-1-417 repealed, new Section R12-1-417 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-418. Surveys and Monitoring

A. Each licensee or registrant shall make, or cause to be made, surveys if surveys are:
1. Necessary for the licensee or registrant to comply with Article 4, and
2. Reasonable under the circumstances to evaluate:
   a. The magnitude and extent of radiation levels, and
   b. Concentrations or quantities of residual radioactivity, and
   c. The potential radiological hazards of the radiation levels and residual radioactivity detected.

B. All personnel dosimeters, except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to any extremity, that require processing to determine the radiation dose and that are used by licensees and registrants to comply with R12-1-408, with other applicable provisions of these rules, or with conditions specified in a license or registration shall be processed and evaluated by a dosimetry processor:
1. Holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology, according to NVLAP procedures published March 1994 as NIST Handbook 150, and NIST Handbook 150-4, published August 1994, which is incorporated by reference, published by the U.S. Government Printing Office, Washington D.C. 20402-9325, and on file with the Agency. The material incorporated by reference contains no future editions or amendments; and
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.
3. **Film badges must be replaced at periods not to exceed one month; other personnel dosimeters processed and evaluated by an accredited NVLAP processor must be replaced at periods not to exceed three months.**

C. The licensee or registrant shall ensure that adequate precautions are taken to prevent a deceptive exposure of an individual monitoring device and that personnel monitoring devices are issued to, and used by only the individual to whom the monitoring device has been first issued during any reporting period.

D. A licensee shall ensure that survey instruments and personnel dosimeters that are used to make quantitative measurements are calibrated in accordance with R12-1-449.

E. Records.

1. Each licensee or registrant shall maintain records showing the results of surveys required by this Section and R12-1-433(B). The licensee or registrant shall retain these records for three years after the record is made.
2. The licensee or registrant shall retain each of the following records for three years after the Agency terminates the license or registration:
   a. Records of the survey results used to determine the dose from external sources of radiation, in the absence of or in combination with individual monitoring data, and provide an assessment of individual dose equivalents;
   b. Records of the results of measurements and calculations used to determine individual intakes of radioactive material and to assess an internal dose;
   c. Records showing the results of air sampling, surveys, and bioassays required according to R12-1-425(A)(3)(a) and (b); and
   d. Records of the measurement and calculation results used to evaluate the release of radioactive effluents to the environment.
   e. Notwithstanding R12-1-418(A) of this part, 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 R12-1-323, as applicable.

Historical Note

Former Rule Section D. 108; Former Section R12-1-418 repealed, new Section R12-1-418 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-419. Conditions Requiring Individual Monitoring of External and Internal Occupational Dose

A. Each licensee or registrant shall monitor exposures from sources of radiation at levels sufficient to demonstrate compliance with the occupational dose limits of this Article.

B. At minimum each licensee or registrant shall supply and require the use of individual monitoring devices by the following personnel:

1. Adults likely to receive, in one year, an intake in excess of 10% of the applicable ALI in Table I, Columns 1 and 2, of Appendix B;
2. Minors and declared pregnant women likely to receive, in one year, a committed effective dose equivalent in excess of 0.5 mSv (0.05 rem);
3. Adults likely to receive, in one year from radiation sources external to the body, a dose in excess of 10 percent of the limits in R12-1-408(A);
4. Minors likely to receive, in one year, from radiation sources external to the body, a deep dose equivalent in excess of 1 mSv (0.1 rem), a lens dose equivalent in excess of 1.5 mSv (0.15 rem), or a shallow dose equivalent to the skin or to the extremities in excess of 5 mSv (0.5 rem);
5. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 1 mSv (0.1 rem) (Note: All of the occupational doses in R12-1-408 continue to be applicable to the declared pregnant worker as long as the embryo/fetus dose limit is not exceeded.); and
6. Individuals entering a high or very high radiation area;
7. Individuals operating mobile x-ray equipment, except dental intraoral systems, as described in R12-1-~~608~~ **610**;
8. Individuals holding animals for diagnostic x-ray procedures, as described in R12-1-613;
9 Individuals servicing enclosed beam x-ray systems with bypassed interlocks, as described in R12-1-803;
10. Individuals operating open beam fluoroscopic systems and ancillary personnel working in the room when the fluoroscopic system is in use, except when relieved of this requirement by registration condition;
11. Individuals performing well logging, as described in Article 17; and
12. Individuals, wearing a finger or wrist individual monitoring device, during the operation of an open-beam or hand held analytical x-ray system or equipment with no safety devices as described in R12-1-806(C) and (F).
13. Individuals, wearing a finger or wrist individual monitoring device, performing repairs that require the presence of a primary beam of the analytical x-ray system or equipment, as described in R12-1-806(C) and (F).

C. Each licensee shall monitor the occupational intake of radioactive material by and assess the committed effective dose equivalent to:

1. Adults likely to receive, in one year, an intake in excess of 10 percent of the applicable ALI in Table 1, Columns 1 and 2, of Appendix B;
2. Minors likely to receive, in one year, a committed effective dose equivalent in excess of 1 mSv (0.1 rem); and
3. Declared pregnant women likely to receive, during the entire pregnancy, a committed effective dose equivalent in excess of 1 mSv (0.1 rem).

D. Each licensee or registrant shall require that all individual monitoring devices be located on individuals according to the following requirements:

1. An individual monitoring device, used to obtain the dose equivalent to an embryo or fetus of a declared pregnant woman according to R12-1-415, shall be located under the protective apron at the waist. A qualified expert shall be consulted to determine the dose equivalent to the embryo or fetus if this individual monitoring device has a monthly reported dose equivalent value that exceeds 0.5 millisieverts (50 millirem). For purposes of this subsection, the value for determining the dose equivalent to an embryo or fetus under R12-1-415(C), for occupational exposure to radiation from medical fluoroscopic equipment, is the value reported by the individual monitoring device worn at the waist underneath the protective apron, which has been corrected for the particular individual and the work environment by a qualified expert.
2. An individual monitoring device used for lens dose equivalent shall be located at the neck or an unshielded location closer to the eye, outside the protective apron.
3. If only one individual monitoring device is used to determine the effective dose equivalent for external radiation, according to R12-1-408(C)(2)(a), the device shall be located at the neck outside the protective apron. If a second individual monitoring device is used for the same purpose, it shall be located under the protective apron at the waist. A second individual monitoring device is required for a declared pregnant woman.
4. An individual, wearing an extremity personnel monitoring device, during the operation of an open-beam or hand-held analytical x-ray system with no safety devices or an individual performing repairs in the presence of a primary beam of the analytical x-ray system or equipment, as described in R12-1-806(C) and (F), shall wear the device on the individual's finger or wrist.

E. Records.

1. Each licensee or registrant shall maintain records of doses received by all individuals for whom monitoring is required according to this Section, and records of doses received during planned special exposures, accidents, and emergency conditions. Assessments of dose equivalent and records made using units in effect before January 1, 1994, need not be changed. These records shall include, when applicable:
   a. The deep-dose equivalent to the whole body, lens dose equivalent, shallow-dose equivalent to the skin, and shallow-dose equivalent to the extremities;
   b. The estimated intake of radionuclides;
   c. The committed effective dose equivalent assigned to the intake of radionuclides;
   d. The specific information used to assess the committed effective dose equivalent according to R12-1-411(A) and (C), and when required R12-1-419.
   e. The total effective dose equivalent when required by R12-1-409; and
   f. The total of the deep-dose equivalent and the committed dose to the organ receiving the highest total dose;
2. The licensee or registrant shall make entries of the records specified in subsection (D)(1), at intervals not to exceed one year;
3. The licensee or registrant shall maintain at the inspection site the records specified in ~~subsection (D)(1)~~ **this article**, ~~or~~ ~~Agency Form Z~~ ~~(available from the Agency), in accordance with the instructions for Agency Form Z, or~~ in a clear and legible method which contains all the information required by this subsection;
4. The licensee or registrant shall maintain the records of dose to an embryo or fetus with the records of dose to the declared pregnant woman. The declaration of pregnancy, including the estimated date of conception, shall also be kept on file but may be maintained separately from the dose records;
5. The licensee or registrant shall retain each required form or record for three years after the Agency terminates each pertinent license or registration requiring the record.

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Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-420. Control of Access to High Radiation Areas

A. A licensee or registrant shall ensure that each entrance or access point to a high radiation area has one or more of the following features:

1. A control device that, upon entry into the area, causes the level of radiation to be reduced below the level at which an individual might receive a deep-dose equivalent of 1 mSv (0.1 rem) in one hour at 30 centimeters from the source from any surface that the radiation penetrates;
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. Entryways that are locked, except during periods when access to the areas is required, with positive control over each individual entity.

B. In place of the controls required by subsection (A) for a high radiation area, the licensee or registrant may substitute continuous direct or electronic surveillance that is capable of preventing unauthorized entry.

C. The licensee or registrant may apply to the Agency for approval of alternative methods for controlling access to high radiation areas.

D. The licensee or registrant shall establish the controls required by subsections (A) and (C) in a way that does not prevent individuals from leaving a high radiation area.

E. The licensee or registrant is not required to control 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 U.S. Department of Transportation, provided that:

1. The packages do not remain in the area longer than three days, and
2. The dose rate at 1 meter from the external surface of any package does not exceed 0.1 mSv (0.01 rem) per hour.

F. The licensee or registrant is not required to control entrance or access to rooms or other areas in hospitals solely because of the presence of patients containing radioactive material, provided that there are personnel in attendance who are taking the necessary precautions to prevent the exposure of individuals to radiation or radioactive material in excess of the established limits in Article 4 and operate in accordance with R12-1-407(B) and the provisions of the licensee's or registrant's radiation protection program.

G. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a high radiation area if the registrant has met all the specific requirements for access and control specified in other applicable Articles of these rules, such as Article 5 for industrial radiography, Article 6 for x-rays in the healing arts, and Article 9 for particle accelerators.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-421. Control of Access to Very-high Radiation Areas

A. In addition to the requirements in R12-1-420, a licensee or registrant shall institute 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 5 Gy (500 rad) or more in one hour at 1 meter from a source or from any surface that the radiation penetrates. This requirement does not apply to rooms or areas in which diagnostic x-ray systems are the only source of radiation or non-self-shielded irradiators.

B. The registrant is not required to control entrance or access to rooms or other areas containing sources of radiation capable of producing a very high radiation area, described in subsection (A), if the registrant has met all requirements for access and control specified in other applicable Articles of these rules, such as Article 5 for industrial radiography, Article 6 for x-rays in the healing arts, and Article 9 for particle accelerators.

C. Each licensee or registrant shall maintain records of tests made according to R12-1-422(B)(9) on entry control devices for very-high radiation areas. These records shall include the date, time, and results of each test of function.

D. The licensee or registrant shall retain the records required by this Section for three years after the record is made.

Historical Note

Former Rule Section D.201; Former Section R12-1-421 repealed, new Section R12-1-421 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-422. Control of Access to Irradiators (Very-high Radiation Areas)

A. This Section applies to licensees or registrants with sources of radiation in non-self-shielded irradiators. This Section does not apply to sources of radiation that are used in teletherapy, industrial radiography, or completely self-shielded irradiators in which the source of radiation is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the irradiator, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual.

B. A licensee or registrant shall ensure that each area in which radiation levels may exceed 5 Gy (500 rad) in one hour at 1 meter from a source that is used to irradiate materials meets the following requirements:

1. Each entrance or access point shall be equipped with entry control devices that:
   a. Function automatically to prevent any individual from inadvertently entering a very high radiation area;
   b. Permit deliberate entry into the area only after a control device is actuated that causes the radiation level within the area, from the source of radiation, to be reduced below that at which it would be possible for an individual to receive a deep-dose equivalent in excess of 1 mSv (0.1 rem) in one hour; and
   c. Prevent operation of the source of radiation if it would produce radiation levels in the area that could result in a deep-dose equivalent to an individual in excess of 1 mSv (0.1 rem) in one hour.
2. If the control devices required in subsection (B)(1) fail to function, additional control devices shall be provided so that:
   a. The radiation level within the area, from the source of radiation, is reduced below that at which it would be possible for an individual to receive a deep-dose equivalent in excess of 1 mSv (0.1 rem) in one hour; and
   b. Conspicuous visible and audible alarm signals are generated so that an individual entering the area is aware of the hazard. The individual who enters the very-high radiation area after an alarm signals shall be familiar with the

process and equipment. Before entering, the individual shall ensure that a second individual is present and aware of the first person's actions.

3. The licensee or registrant shall provide control devices so that, upon failure or removal of physical radiation barriers other than the sealed source's shielded storage container:
   a. The radiation level from the source of radiation is reduced below that at which it would be possible for an individual to receive a deep-dose equivalent in excess of 1 mSv (0.1 rem) in one hour, and
   b. Conspicuous visible and audible alarm signals are generated so that potentially affected individuals are aware of the hazard. Potentially affected individuals shall notify the licensee or registrant of the failure or removal of the physical barriers.
4. When the shield for stored sealed sources is a liquid, the licensee or registrant shall provide means to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding.
5. Physical radiation barriers that comprise permanent structural components, such as walls, that have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of subsections (B)(3) and (4).
6. The licensee or registrant shall equip each area with devices that will automatically generate conspicuous visible and audible alarm signals to alert personnel in the area before the source of radiation can be put into operation and in time for any individual in the area to operate a clearly identified control device, installed in the area, and which can prevent the source of radiation from being put into operation.
7. The licensee or registrant shall control each area by use of administrative procedures and devices necessary to ensure that the area is cleared of personnel before each use of the source of radiation.
8. The licensee or registrant shall check each area by radiation measurement to ensure that, before the first individual's entry into the area after any use of the source of radiation, the radiation level from the source of radiation in the area will not expose an individual to a deep-dose equivalent in excess of 1 millisievert (0.1 rem) in one hour.
9. The licensee or registrant shall test the entry control devices required in subsection (B)(1) for proper functioning and keep records according to R12-1-421.
   a. Testing shall be conducted before initial operation with the source of radiation on any day, unless operations were continued uninterrupted from the previous day;
   b. Testing shall be conducted before resumption of operation of the source of radiation after any unintentional interruption;
   c. The licensee or registrant shall submit to the Agency a schedule of testing; and
   d. The licensee or registrant shall include in the schedule a listing of the periodic testing that will be followed.
10. The licensee or registrant shall not conduct operations, other than those necessary to place the source of radiation in a safe condition or effect repairs on controls, unless control devices are functioning properly.
11. The licensee or registrant shall control entry and exit portals that are used in transporting materials to and from the irradiation area, and that are not intended for use by personnel, with devices and administrative procedures necessary to physically protect and warn against inadvertent entry by an individual through one of the portals. Exit portals for irradiated materials shall be equipped to detect and signal the presence of any uncontained radioactive material that is carried toward an exit and automatically prevent contained radioactive material from being carried out of the area.

C. A licensee, registrant, or applicant seeking a license or registration for a source of radiation within the purview of subsection (B) that will be used in a variety of positions or in locations, such as open fields or forests, that make it impractical to comply with certain requirements of subsection (B) may apply to the Agency for approval of alternative safety measures. Alternative safety measures shall provide personnel protection at least equivalent to that specified in subsection (B). At least one of the alternative measures shall be an entry-preventing interlock control, based on a measurement of the radiation that ensures the absence of high radiation levels before an individual can gain access to the area where the sources of radiation are used.

D. A licensee or registrant shall provide the entry control devices required by subsections (B) and (C) in such a way that no individual will be prevented from leaving the area.

E. Records.

1. Each licensee or registrant shall maintain records of tests made according to subsection (B)(9) on entry control devices for very-high radiation areas. These records shall include the date and results of each test of function.
2. The licensee or registrant shall retain the records for three years from the date the record is made.

Historical Note

Former Rule Section D.202; Former Section R12-1-422 repealed, new Section R12-1-422 adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-423. Use of Process or Other Engineering Controls

A licensee shall use, to the extent practicable, process or other engineering controls, such as containment, decontamination, or ventilation, to control the concentration of radioactive material in air.

Historical Note

Former Rule Section D.203. Former Section R12-1-423 repealed, new Section R12-1-423 adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

R12-1-424. Use of Other Controls

A. If it is not practical to apply process or other engineering controls to control concentrations of radioactive material in the air to values below those that define an airborne radioactivity area, the licensee shall, consistent with maintaining the total effective dose equivalent according to R12-1-407(B), increase monitoring and limit intakes by one or more of the following means:
1. Control access,
2. Limit exposure times,
3. Use respiratory protection equipment, or
4. Use other controls.

B. 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 shall also consider the impact of respirator use on workers' industrial health and safety.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

R12-1-425. Use of Individual Respiratory Protection Equipment

A. If a licensee assigns or permits the use of respiratory protection equipment to limit the intake of radioactive material,
1. Except as provided in subsection (A)(2), the licensee shall use only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health (NIOSH).
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 to the Agency and request authorization for use of this equipment, except as otherwise provided in this Section. The licensee shall provide evidence with the application that the material and performance characteristics of the equipment provide the asserted degree of protection under anticipated conditions of use. The licensee shall demonstrate the degree of protection by providing reliable test information.
3. The licensee shall implement and maintain a respiratory protection program that includes:
   a. Air sampling sufficient to identify the potential hazard, permit proper equipment selection, and estimate doses;
   b. Surveys and bioassays, as necessary, to evaluate actual intakes;
   c. Testing of respirators for operability (user seal check for face sealing devices and functional check for other devices) immediately before each use;
   d. Written procedures regarding:
      i. Monitoring, including air sampling and bioassays;
      ii. Supervision and training of respirator users;
      iii. Fit testing;
      iv. Respirator selection;
      v. Breathing air quality;
      vi. Inventory and control;
      vii. Storage, issuance, maintenance, repair, testing, and quality assurance of respiratory protection equipment;
      viii. Recordkeeping; and
      ix. Limitations on periods of respirator use and relief from respirator use;
   e. Determination by a physician that each individual user is able to use respiratory protection equipment:
      i. Before the initial fitting of a face-sealing respirator;
      ii. Before the first field use of a non-face-sealing respirator, and
      iii. Every 12 months after initial fitting or first use, or periodically at a frequency determined by a physician.
   f. Fit testing, with a fit factor ≥ 10 times the APF for a negative pressure device and a fit factor ≥ 500 for any positive pressure, continuous flow, and pressure-demand device, before the first field use of tight-fitting, face-sealing respirators and periodically after first use at least yearly. The licensee shall perform fit testing with the face piece operating in the negative pressure mode.
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 condition that might require relief.
5. The licensee shall consider manufacturer limitations regarding respirator type and mode of use. When selecting a respiratory device, the licensee shall provide for vision correction, adequate communication, low temperature work environments, and the concurrent use of other safety or radiological protection equipment. The licensee shall use equipment in a manner that does not interfere with the proper operation of the respirator.
6. The licensee shall provide standby rescue persons 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 licensee shall equip standby rescue persons with respiratory protection devices or other apparatus designed for potential hazards and anticipated conditions of use. 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. The licensee shall provide at least one standby rescue person for every five workers, who is immediately available to assist any worker using this type of equipment and provide effective emergency rescue if needed.

7. The licensee shall supply atmosphere-supplying respirators 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 OSHA (29 CFR 1910.134(i)(1)(ii)(A) through (E), July 1, 2003, incorporated by reference and on file with the Agency, containing no future editions or amendments). Grade D quality air criteria include:
   a. Oxygen content (v/v) of 19.5-23.5%;
   b. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
   c. Carbon monoxide (CO) content of 10 ppm or less;
   d. Carbon dioxide content of 1,000 ppm or less; and
   e. Lack of noticeable odor.
8. The licensee shall ensure that no objects, materials, or substances, such as facial hair, or any conditions that interfere with the face-to-face piece 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 face piece.
9. In estimating the dose to individuals from intake of airborne radioactive materials, the licensee shall use the concentration of radioactive material in the air that is inhaled when respirators are worn, which is determined by dividing the ambient concentration in air without respiratory protection by the assigned protection factor. If the dose is later found to be greater than the estimated dose, the licensee shall modify the calculation using the corrected value. If the dose is later found to be less than the estimated dose, the licensee may modify the calculation using the corrected value.

B. The licensee shall use Appendix A to select equipment and associated assigned protection factors.

C. A licensee shall apply to the Agency for authorization to use assigned protection factors in excess of those specified in Appendix A. To apply for authorization the licensee shall:
1. State the reason for the higher protection factors; and
2. Demonstrate that the requested respiratory protective equipment provides the higher protection factors under the proposed conditions of use.

D. The licensee shall notify the Agency in writing at least 30 days before the date that respiratory protective equipment is first used according to subsection (A) or (C).

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4).

R12-1-426. Security of Stored Sources of Radiation

A licensee or registrant shall secure from unauthorized removal or access licensed or registered sources of radiation that are stored in unrestricted areas.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Amended effective February 25, 1985 (Supp. 85-1). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-427. Control of Sources of Radiation Not in Storage

A. A licensee shall control and maintain constant surveillance of licensed radioactive material that is in an unrestricted area and is not in storage or in a patient.

B. A registrant shall maintain control of radiation machines that are in an unrestricted area and not in storage.

Historical Note

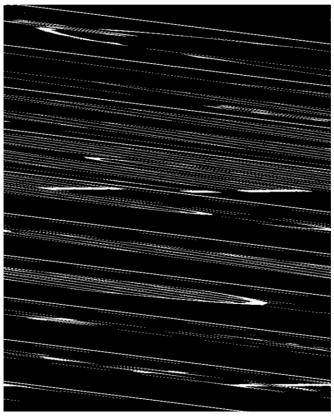
Adopted effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-428. Caution Signs

A. Unless otherwise authorized by the Agency, a licensee or registrant shall use the symbol prescribed by this Section with the colors magenta, or purple, or black on yellow background as the standard radiation symbol. The symbol prescribed is the three-bladed design as follows:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta, purple, or black; and



2. The background is to be yellow.

B. Notwithstanding the requirements of subsection (A), licensees or registrants are authorized to label sources of radiation, source holders, or device components containing sources of radiation that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols that lack the color scheme required in subsection A.

C. In addition to the contents of signs and labels prescribed in this Article, the licensee or registrant shall provide, on or near the required signs and labels, additional information to make individuals aware of potential radiation exposures and to minimize the exposures.

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-428 repealed, new Section R12-1-428 adopted effective June 26, 1987 (Supp. 87-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-429. Posting

A. A licensee or registrant shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA."

B. The licensee or registrant 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."

C. The licensee or registrant shall post each very-high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "GRAVE DANGER, VERY HIGH RADIATION AREA."

D. 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."

E. 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 licensed material specified in Appendix C with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)."

Historical Note

Former Section R12-1-429 repealed effective June 30, 1977 (Supp. 77-3). New Section 12-1-429 adopted effective June 26, 1987 (Supp. 87-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-430. Exceptions to Posting Requirements

A. A licensee or registrant is not required to post caution signs in areas or rooms containing sources of radiation for periods of less than eight hours, if each of the following conditions is met:

1. The sources of radiation are constantly attended during these periods by an individual who takes precautions necessary to prevent exposure of individuals to sources of radiation in excess of limits established in this Article; and
2. The area or room is subject to the licensee's or registrant's control.

B. A licensee or registrant is not required to post a caution sign in a room or other area in a hospital that is occupied by an individual who has been administered radioactive material, if the individual meets the criteria for release in R12-1-719.

C. A licensee or registrant is not required to post a caution sign in a room or area because of the presence of a sealed source, provided the radiation level at 30 centimeters from the surface of the sealed source container or housing does not exceed 0.05 mSv (0.005 rem) per hour.

D. A hospital or clinic licensee is exempt from the posting requirements in R12-1-429 for a teletherapy room if:

1. Access to the room is controlled according to R12-1-731; and

2. Personnel in attendance take necessary precautions to prevent the inadvertent exposure of workers, other patients, and members of the public to radiation that exceeds the limits established in this Chapter.

E. A registrant is not required to post a caution sign in a room or area because of the presence of radiation machines used solely for diagnosis in the healing arts.

Historical Note

Former Section R12-1-430 repealed effective June 30, 1977 (Supp. 77-3). New Section R12-1-430 adopted effective June 26, 1987 (Supp. 87-2). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-431. Labeling Containers and Radiation Machines

A. A licensee shall ensure that each container of licensed material is labeled with a durable, clearly visible radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL." The label shall also provide information, such as the radionuclides present, an estimate of the quantity of radioactivity, the date for which the radioactivity is estimated, radiation level, kind of material, and mass enrichment, to permit an individual handling or using a container, or working in the vicinity of a container, to take precautions to avoid or minimize exposure.

B. Before removal or disposal of an empty, uncontaminated container to an unrestricted area, each licensee shall remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

C. Each registrant shall ensure that each radiation machine is labeled in a conspicuous manner to caution an individual that radiation is produced when it is energized.

D. A licensee shall label each syringe and vial that contains a radiopharmaceutical used in the practice of medicine with the radiopharmaceutical content. Each syringe shield and vial shield shall be labeled, unless the label on the syringe or vial is visible when shielded. The label shall contain the radiopharmaceutical name or its abbreviation, the clinical procedure to be performed, or the name of the person being administered the radiopharmaceutical. Color-coding syringe shields and vial shields does not meet the labeling requirement.

Historical Note

Former Section R12-1-431 repealed effective June 30, 1977 (Supp. 77-3). New Section R12-1-431 adopted effective June 26, 1987 (Supp. 87-2). Amended effective November 5, 1993 (Supp. 93-4). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-432. Labeling Exemptions

A licensee is not required to label:

1. Containers holding licensed material in quantities less than the quantities listed in Appendix C;
2. Containers holding licensed material in concentrations less than those specified in Table III of Appendix B;
3. Containers attended by an individual who takes precautions necessary to prevent exposure of individuals to radiation in excess of the limits established in this Article;
4. Containers holding radioactive material that do not exceed the limits for excepted quantity or article as defined and limited in 49 CFR 173.403, and 173.421 through 173.424, and are transported, packaged, and labeled in accordance with 49 CFR 172.436 through 172.440 (Revised October 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
5. Containers that are accessible only to individuals authorized to handle, use, or work in the vicinity of the containers, if the contents are identified to these individuals by a readily available written record, retained as long as the container is in use for the purpose indicated on the record. (Examples of containers of this type are containers in locations such as water-filled canals, storage vaults, or hot cells.); or
6. Installed manufacturing or process equipment, such as piping and tanks.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-433. Procedures for Receiving and Opening Packages

A. Each licensee who expects to receive a package containing quantities of radioactive material in excess of a Type A quantity, as defined in 10 CFR 71.4, January 1, 2005, which is incorporated by reference, published by the Office of the Federal Register, National Archives and Records Administration, Washington, D.C. 20408, and on file with the Agency. The material incorporated by reference contains no future editions or amendments. The licensee shall make arrangements to receive:

1. The package when the carrier offers it for delivery; or
2. The notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

B. Each licensee shall:

1. Monitor the external surfaces of a package, labeled with a Radioactive White I, Yellow II, or Yellow III as specified in 49 CFR 172.403 and 172.436 through 172.440, October 1, 2004, which are incorporated by reference, published by the

Office of Federal Register, National Archives and Records Administration, Washington, D.C. 20408, and on file with the Agency. The material incorporated by reference contains no future editions or amendments. The licensee shall test the package for radioactive contamination, unless the package contains only radioactive material in the form of gas or in special form, as defined in R12-1-102; and

2. Monitor the external surfaces of a package, labeled with a Radioactive White I, Yellow II, or Yellow III as specified in subsection (B)(1), for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the Type A quantity, defined in 10 CFR 71, and referenced in subsection (A); and
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.

C. The licensee shall perform the monitoring required by subsection (B) as soon as practical after receipt of the package, but not later than three 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 three hours from the beginning of the next working day if it is received after working hours.

D. The licensee shall immediately notify the final delivery carrier and the Agency by telephone when:
1. Removable radioactive surface contamination exceeds 22 dpm/cm^2 for beta-gamma emitting radionuclides or 2.2 dpm/cm^2 for alpha-emitting radionuclides, wiping a minimum surface area of 300 square centimeters (46 square inches), or the entire surface if less than 300 square centimeters (46 square inches); or
2. External radiation levels exceed the limits of 2 millisieverts (200 millirem) per hour.

E. Each licensee shall:
1. Establish, maintain, and retain written procedures for safely opening packages that contain radioactive material, and
2. Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

F. Licensees transferring special form sources in vehicles owned or operated by the licensee to and from a work site are exempt from the contamination monitoring requirements of subsection (B) but are not exempt from the monitoring requirement in subsection (B) for measuring radiation levels that ensures that the source of radiation is still properly lodged in its shield.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-434. General Requirements for Waste Disposal

A. A licensee shall dispose of licensed material only:
1. By transfer to an authorized recipient as provided in R12-1-439 or in Article 3 of these rules, or to the U.S. Department of Energy;
2. By decay in storage, according to R12-1-438(C)
3. By release in effluents within the limits in R12-1-416; or
4. As authorized according to R12-1-435, R12-1-436, R12-1-437, R12-1-438, or R12-1-438.01;

B. To receive waste that contains licensed material from other persons, a person shall be specifically licensed for:
1. Treatment prior to disposal,
2. Treatment or disposal by incineration,
3. Decay in storage,
4. Disposal at a land disposal facility licensed according to Article 3 of these rules, or
5. Storage until transferred to a storage or disposal facility authorized to receive the waste.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). Section repealed, new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-435. Method for Obtaining Approval of Proposed Disposal Procedures

For disposal of licensed material generated in the licensee's operations, a licensee or applicant for a license may apply to the Agency for approval of proposed disposal procedures, not otherwise authorized in this Chapter. Each application shall include:
1. A description of the waste containing licensed material to be disposed of, including the physical and chemical properties that have an impact on risk evaluation;
2. The proposed manner and conditions of waste disposal;
3. An analysis and evaluation of pertinent information on the nature of the environment;
4. The nature and location of other potentially affected facilities; and
5. An analysis and procedure to ensure that doses comply with R12-1-407(B), and are within the dose limits in this Article.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-436. Disposal by Release into Sanitary Sewerage System

A. A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:
1. The material is readily soluble or is readily dispersible biological material, in water;
2. The quantity of licensed radioactive material that the licensee releases into the sewer in one month divided by the average monthly volume of water released into the sewer by the licensee or registrant does not exceed the concentration listed in Appendix B, Table III,
3. If more than one radionuclide is released, the following conditions shall also be satisfied:
   a. The licensee shall determine the fraction of the limit in Appendix B, Table III represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of each radionuclide released by the licensee or registrant into the sewer by the concentration of that radionuclide listed in Appendix B, Table III, and
   b. The sum of the fractions for each radionuclide required by subsection (A)(3)(a) does not exceed unity; and
   c. The total quantity of licensed radioactive material that the licensee releases into the sanitary sewerage in a year does not exceed 185 GBq (5 Ci) of Hydrogen-3, 37 GBq (1 Ci) of Carbon-14, and 37 GBq (1 Ci) of all other radioactive materials combined.

B. Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in subsection (A).

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-437. Treatment or Disposal by Incineration

A licensee shall treat or dispose of licensed material by incineration only in the amounts and forms specified in R12-1-438 or as specifically approved by the Agency according to R12-1-435.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-438. Disposal of Specific Wastes

A. A licensee may dispose of the following licensed material as if it were not radioactive:
1. 1.85 kBq (0.05 µCi), or less, of Hydrogen-3 or Carbon-14 per gram of medium used for liquid scintillation counting; and
2. 1.85 kBq (0. 05 µCi), or less, of Hydrogen-3 or Carbon-14 per gram of animal tissue, averaged over the weight of the entire animal.
3. 1.85 kBq (0.05 µCi), or less, of Iodine-125 per gram of medium used in analyzing in vitro laboratory samples and associated sample holders contaminated during the laboratory procedure.

B. A licensee shall not dispose of tissue, contaminated with radioactive material, according to subsection (A)(2) in a manner that would permit its use either as food for humans or as animal feed.

C. A licensee may hold radioactive material with a physical half-life of less than or equal to 120 days for decay in storage before disposal without regard to its radioactivity, and is exempt from the requirements of R12-1-434, provided:
1. The licensee monitors the radioactive material at the surface before disposal and determines that its radioactivity cannot be distinguished from the background radiation level with an appropriate radiation detection survey meter set on its most sensitive scale and with no interposed shielding; and
2. The licensee removes or obliterates all radiation labels, except for radiation labels on materials that are within containers and that will be managed as biomedical waste after they have been released from the licensee.

D. The licensee shall maintain records in accordance with R12-1-441.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-438.01 Disposal of Certain Radioactive Material

A. Licensed material as defined in the definition of radioactive material in R12-1-102 may be disposed of in accordance with this Article, even though it is not defined as low-level radioactive waste. Therefore, any licensed radioactive material being disposed of at a facility, or transferred for ultimate disposal at a facility licensed by the Agency, must meet the requirements of R12-1-439.

B. A licensee may dispose of radioactive material, as defined in the definition of radioactive material in R12-1-102, 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.

Historical Note

Section R12-1-438.01 made by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-439. Transfer for Disposal and Manifests

A. Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility (for purposes of this rule "land disposal facility" means the land, buildings, structures, and equipment that are intended to be used for the disposal of radioactive waste. A geologic repository is not a land disposal facility) shall comply with 10 CFR 20.2006 and 10 CFR 20 Appendix G, published January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

B. An authorized representative of the waste generator shall provide the certification required in 10 CFR 20, Appendix G, Section II, which is incorporated by reference under subsection (A).

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-440. Compliance with Environmental and Health Protection Regulations

Nothing in R12-1-434, R12-1-435, R12-1-436, R12-1-437, R12-1-438, or R12-1-439 relieves the licensee from complying with other applicable federal, state, and local rules or regulations governing any other toxic or hazardous properties of materials that may be disposed of according to the rules listed in Article 4 of this Chapter.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-441. Records of Waste Disposal

A. Each licensee shall maintain records of the disposal of licensed materials made in accordance with R12-1-435, R12-1-436, R12-1-437, R12-1-438, and disposal by burial in soil, including burials authorized before February 25, 1985.

B. The licensee shall retain the records required by subsection (A) until the Agency terminates each pertinent license requiring the record. The licensee shall provide for the disposition of these records prior to license termination.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-442. Agency Inspection of Shipments of Waste

Each shipment of waste to a disposal facility, licensed under R12-1-1302(D)(11), is subject to inspection by the Agency before shipment or transportation. The waste shipper shall notify the Agency not less than five working days before the scheduled shipment or transportation of waste to a licensed disposal facility.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 5 A.A.R. 1812, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2).

R12-1-443. Reports of Stolen, Lost, or Missing Licensed or Registered Sources of Radiation

A. Each licensee or registrant shall report to the Agency by telephone as follows:

1. Immediately after it becomes known to the licensee that licensed radioactive material in an aggregate quantity equal to or greater than 1,000 times the quantity specified in Appendix C is stolen, lost, or missing under circumstances that indicate to the licensee that an exposure could result to individuals in unrestricted areas;
2. Within 30 days after it becomes known to the licensee that licensed radioactive material in an aggregate quantity greater than 10 times the quantity specified in Appendix C is stolen, lost, or missing, and is still missing.
3. Immediately after it becomes known to the registrant that a radiation machine is stolen, lost, or missing.

B. Each licensee or registrant required to make a report according to subsection (A) shall, within 30 days after making the telephone report, make a written report to the Agency that contains the following information:

1. A description of the licensed or registered source of radiation involved, including, for radioactive material, the kind, quantity, and chemical and physical form; and, for radiation machines, the manufacturer, model, serial number, type, and maximum energy of radiation emitted;
2. A description of the circumstances under which the loss or theft occurred;
3. A statement of disposition, or probable disposition, of the licensed or registered source of radiation;
4. Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas;
5. Actions that have been taken, or will be taken, to recover the source of radiation; and
6. Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed or registered sources of radiation.

C. After filing the written report, the licensee or registrant shall also report additional substantive information on the loss or theft within 30 days after the licensee or registrant learns of the information.

D. The licensee or registrant shall provide the Agency with the names of individuals who may have received an exposure to radiation as a result of an incident reported to the Agency under subsection (B).

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-444. Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Limits

A. In addition to the notification required by R12-1-445, each licensee or registrant shall submit a written report within 30 days after learning of any of the following:

1. Incidents for which notification is required by R12-1-445;
2. Doses in excess of any of the following:
   a. The occupational dose limits for adults in R12-1-408;
   b. The occupational dose limits for a minor in R12-1-414;
   c. The limits for an embryo or fetus of a declared pregnant woman in R12-1-415;
   d. The limits for an individual member of the public in R12-1-416;
   e. Any applicable limit in the license or registration; or
   f. The ALARA limit on air emissions in R12-1-407;
3. Levels of radiation or concentrations of radioactive material in:
   a. A restricted area in excess of applicable limits in the license or registration, or
   b. An unrestricted area in excess of 10 times the applicable limit in this Article or in the license or registration, whether or not this involves an exposure of any individual to a dose in excess of the limits in R12-1-416;
4. Radiation levels or concentrations of radioactive material in excess of the standards in 40 CFR 190, 2003 edition, published July 1, 2003, by the Office of the Federal Register, National Archives and Records Administration, Washington, D.C. 20408 which is incorporated by reference and on file with the Agency, if the licensee is subject to these federal standards, or there is a license condition referencing the 40 CFR 190 standards. This incorporation by reference contains no future editions or amendments.

B. Contents of reports.

1. Each report shall contain a description of each individual's exposure to radiation and radioactive material, including as applicable:
   a. Estimates of each individual's dose;
   b. The levels of radiation and concentrations of radioactive material involved;
   c. The cause of the elevated exposures, dose rates, or concentrations; and
   d. Corrective steps taken or planned to ensure against a recurrence, including the schedule for achieving conformance with applicable limits, generally applicable environmental standards, and associated license or registration conditions.
2. Each report filed according to subsection (A) shall include for each occupationally overexposed individual: name, Social Security number, and date of birth. With respect to the limit for an embryo or fetus in R12-1-415, the identifiers in the report should be those of the declared pregnant woman. The report shall be prepared so that information regarding each overexposed individual is stated in a separate and detachable part of the report.

C. All licensees or registrants who make reports according to subsection (A) shall submit the report in writing to the Agency.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-445. Notification of Incidents

A. Immediate notification: Each licensee or registrant shall immediately report to the Agency any event involving a radiation source that may have caused or threatens to cause any of the following conditions:

1. An individual to receive:
   a. A total effective dose equivalent of 0.25 Sv (25 rem) or more;
   b. A lens dose equivalent of 0.75 Sv (75 rem) or more; or
   c. A shallow-dose equivalent to the skin or extremities of 2.5 Gy (250 rads) or more; or
2. The release of radioactive material, inside or outside of a restricted area, so if an individual had been present for 24 hours, the individual could have received five times the annual limit on intake (this subsection do not apply to a location where personnel are not normally stationed during routine operations, such as a hot-cell or process enclosure).

B. Twenty-four hour notification: Each licensee or registrant shall, within 24 hours of discovery of the event, report to the Agency any event involving loss of control of a radiation source possessed by the licensee or registrant that may have caused, or threatens to cause, any of the following conditions:

1. An individual to receive, in a period of 24 hours
   a. A total effective dose equivalent exceeding 0.05 Sv (5 rem);
   b. A lens dose equivalent exceeding 0.15 Sv (15 rem); or
   c. A shallow-dose equivalent to the skin or extremities exceeding 0.5 Gy (50 rads); or
2. The release of radioactive material, inside or outside of a restricted area, so, if an individual had been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit of intake (this subsection does not apply to a location where personnel are not normally stationed during routine operations, such as a hot-cell or process enclosure).

C. A licensee or registrant shall prepare any report filed with the Agency according 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.
D. A licensee or registrant shall report to the Agency by telephone in response to the requirements of this Section.
E. If the Agency does not respond to the initial telephone call, the licensee or registrant shall report to the Department of Public Safety and continue with reasonable efforts to contact the Agency Duty Officer until contact is made.
F. The provisions of this Section do not apply to a dose that results from a planned special exposure, if the dose is within the limits for planned special exposures and reported according to R12-1-413(C).

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-446. Notifications and Reports to Individuals

A. Requirements for notification and reports to individuals of exposure to radiation or radioactive material are specified in R12-1-1004.
B. In addition to the reporting requirements in R12-1-444 and R12-1-445, each licensee or registrant shall notify the individual exposed to radiation or radioactive material. The notice to the exposed individual shall be provided no later than the date the report is submitted to the Agency and shall comply with R12-1-1004(A).

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-447. Vacating Premises

A. If a facility has been used for activities involving radioactive material a licensee shall notify the Agency in writing of the intent to vacate the facility no less than 45 days before relinquishing possession or control of the facility.
B. If a facility is contaminated with radioactive material, a licensee vacating the facility shall decontaminate it using Agency-approved procedures.
C. The Agency shall inspect a vacated facility to determine whether it is contaminated with radioactive material.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-448. Additional Reporting

A. Each licensee shall notify the Agency as soon as possible, but not later than four hours after the discovery of an event, and take immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed the limits specified in this Chapter or releases of licensed material that could exceed the limits specified in this Chapter. For purposes of this Section, event means a radiation accident involving a fire, explosion, gas release, or similar occurrence.
B. Each licensee shall notify the Agency within 24 hours after discovering any of the following events involving licensed material:
1. A contamination event that:
   a. Requires that anyone having access to the contaminated area be restricted for more than 24 hours by the imposition of additional radiological controls to prohibit entry into the area; and
   b. Involves a quantity of radioactive material greater than five times the lowest annual limit on intake specified in Appendix B of this Article; and
   c. Results in access to the contaminated area being restricted for a reason other than to allow radionuclides with a half-life of less than 24 hours to decay prior to decontamination.
2. An event in which equipment is disabled or fails to function as designed when:
   a. The equipment is part of a system designed to prevent releases exceeding the limits specified in this Chapter, to prevent exposures to radiation and radioactive materials exceeding limits specified in this Chapter, or to mitigate the consequences of an accident; and
   b. The equipment performs a safety function; and
   c. No redundant equipment is available and operable to perform the required safety function.
3. An event that requires urgent medical treatment of an individual with radioactive contamination on the individual's clothing or body.
4. A fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:
   a. The quantity of material involved is greater than five times the lowest annual limit on intake specified in Appendix B of this Article, and
   b. The damage affects the integrity of the licensed material or its container.

C. Each licensee shall make reports required by subsections (A) and (B) above by telephone to the Agency. To the extent that the information is available at the time of notification, the information provided in these reports shall include:
1. The callers's name, official title and call back telephone number;

2. A description of the event, including date and time;
3. The exact location of the event;
4. The isotopes, quantities, and chemical and physical form of the licensed material involved; and
5. Any personnel radiation exposure data available.

D. Each licensee who makes a report required by subsection (A) or (B) shall submit to the Agency a written follow-up report within ~~**30**~~ **60** days of the initial report. Written reports prepared as required by other rules may be submitted to fulfill this requirement if the reports contain all of the required information in this subsection. The report shall include the following:
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. The exact location of the event;
3. The isotopes, quantities, and chemical and physical form of the licensed material involved;
4. Date and time of the event;
5. Corrective actions taken or planned and the results of any evaluations or assessments; and
6. The extent of personnel exposure to radiation or to radioactive materials without identification of each exposed individual by name.

E. Each licensee that makes a report required by subsection (A) or (B) shall submit a written follow-up report within 60 days of the initial report. The written report must be sent to the Agency.

Historical Note

Adopted effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-449. Survey Instruments and Pocket Dosimeters

A. Each licensee or registrant shall ensure that survey instruments used to show compliance with this Article have been calibrated before first use, annually, and following repair, unless otherwise specified in this Chapter.

B. To satisfy the requirements of subsection (A), the licensee or registrant shall:
1. For each scale to be calibrated, calibrate two readings separated by at least 50 percent of scale rating; and
2. Conspicuously note on the instrument the apparent radiation level, in appropriate units for the type of survey instrument being used and the date of calibration.

C. Each licensee or registrant shall check each survey instrument for proper operation with the dedicated check source after calibration and before each use.

D. The licensee or registrant shall retain a record of each calibration required in subsection (A) for three years. The record shall include:
1. A description of the calibration procedure; and
2. A description of the source used, the certified dose rates from the source, the rates indicated by the instrument being calibrated, the correction factors deduced from the calibration data, the signature of the individual who performed the calibration, and the date of calibration.

E. To meet the requirements of subsections (A), (B), and (C), the licensee or registrant may obtain the services of persons licensed or registered by the Agency, the NRC, an Agreement State, or a Licensing State to perform calibrations of survey instruments. Licensing records of the service person authorization shall be maintained for three years by the licensee or registrant obtaining the service.

F. Each licensee or registrant shall ensure that pocket dosimeters used to show compliance with this Article:
1. Have been evaluated for proper operation annually and following repair, using a procedure acceptable to the Agency, unless a more frequent evaluation is required by license condition (Unless the dosimeter is electronic, the evaluation of the dosimeter shall include a drift test over a 24-hour period.); and
2. Meet the performance criteria listed in R12-1-523(C) and R12-1-1130(C).

G. Records of personnel dosimeter operational checks shall be maintained for three years.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-450. Sealed Sources

A. A licensee shall only receive, possess, and use radioactive materials contained in a sealed source that has been manufactured, labeled, packaged, and distributed in accordance with a specific license for its manufacture and distribution. The license to manufacture and distribute a sealed source shall be issued by the Agency, U.S. Nuclear Regulatory Commission, a Licensing State, or another Agreement State.

B. A licensee who possesses and uses a sealed source, or any device or equipment that contains a sealed source, shall follow the radiation safety and handling instructions approved by the Agency or follow the radiation safety and handling instructions furnished by the manufacturer on the label attached to the source, on the permanent container of the source, or in a leaflet or brochure that accompanies the source, and maintain the instructions in a legible and conveniently available form. If the handling instructions, leaflet, or brochure is no longer available and a copy cannot be obtained from the manufacturer, the licensee shall notify the Agency that the source handling information is no longer available.

C. Inventories:
1. An inventory shall be conducted at intervals not to exceed six months, unless a shorter interval is specified by license condition.
2. The records of the inventory shall be maintained for three years from the date of the inventory, and shall be available for inspection by the Agency.
3. The information recorded shall include:
   a. The kind and quantity of radioactive material,
   b. The model and serial number of the source or the device in which it is mounted,
   c. The location of the sealed source,
   d. The date of the inventory, and
   e. The signature of the person performing the inventory.

D. Any licensee who possesses and uses sealed sources in the practice of medicine shall conduct a physical inventory according to the requirements in 12 A.A.C. 1, Article 7.

E. Sealed sources, containing radioactive material, shall not be opened unless authorized by license condition.

F. Sealed sources and machines, devices, or equipment containing sealed sources shall be used in accordance with procedures described in the manufacturer's instructions and the safety precautions described in the Nuclear Regulatory Commission Sealed Sources and Device Registry, unless the instructions or precautions conflict with these rules or license condition.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-451. Termination of a Radioactive Material License or a Licensed Activity

A. As the final step before terminating a radioactive material use program licensed under R12-1-312, the licensee shall:
1. Certify to the Agency the disposition of all licensed material, including accumulated wastes, by submitting a complete description of a disposal plan with signed receipts from all licensed persons receiving the licensed material; and
2. Conduct a radiation survey of the premises where the licensed activities were carried out to demonstrate that the premises are suitable for release in accordance with the criteria for decommissioning in R12-1-452 and submit to the Agency a report of the results of this survey, unless the licensee demonstrates in some other manner acceptable to the Agency that the premises are suitable for release in accordance with the criteria for decommissioning in R12-1-452.

B. Before terminating a licensed program, each licensee authorized to possess radioactive material with a half-life greater than 120 days, in any unsealed form, shall forward the following records to the Agency:
1. Records of disposal of the licensed material required by R12-1-435, R12-1-436, R12-1-437, and R12-1-438; and
2. Records required by R12-1-418(D)(2)(d).

C. If a licensed activity is transferred or assigned in accordance with subsection (E), each licensee authorized to possess radioactive material with a half-life greater than 120 days, in any unsealed form, shall transfer the following records to the new licensee and the new licensee shall maintain these records until the license is terminated:
1. Records of disposal of licensed material required by R12-1-435, R12-1-436, R12-1-437, and R12-1-438; and
2. Records required by R12-1-418(D)(2)(d).

D. Before the Agency terminates a license, each licensee shall forward the records required by subsection (E) to the Agency.

E. A person licensed under R12-1-312 shall maintain required records regarding decommissioning of a facility in a location identified on the license until the Agency releases the site for unrestricted use. Before transfer or assignment of licensed activities, a licensee shall transfer all records required by this Section to the transferee. If records relating to facility decommissioning are kept for other purposes, the transferee shall refer to these records and provide their location on the transferee's application for a license. The transferee shall maintain the records until the Agency terminates the transferee's new license. The new licensee shall maintain the following decommissioning records for Agency review:
1. Records of spills or other occurrences involving the spread of contamination in and around the facility, equipment, or site. The licensee shall maintain a record of any instance when contamination remains after cleanup procedures or there is a reasonable likelihood that a contaminant has spread to an inaccessible area, as in the case of possible seepage into porous material such as concrete. These records shall include any known information that identifies any radionuclide involved and its quantity, form, and concentration.
2. As-built drawings showing modifications of structures and equipment in restricted areas where radioactive materials are used or stored, and locations of possible inaccessible contamination, such as buried pipes. If as-built drawings are referenced, the licensee need not index each relevant document individually. If drawings are not available, the licensee shall provide records with known information concerning these areas and locations, as prescribed in subsection (E)(1).
3. Except for areas that contain depleted uranium used only for shielding or as penetrators in unused munitions, a list, contained in a single document and updated every two years, of the following:
   a. Any area designated or formerly designated as a restricted area as defined under R12-1-102;
   b. Any area outside of a restricted area for which documentation is required under subsection (B)(1);
   c. Any area outside of a restricted area where wastes have been buried;

d. Any area outside of a restricted area that contains regulated radioactive material that will require the licensee to either decontaminate the area for decommissioning under R12-1-452 or obtain disposal approval under R12-1-435; and
e. Any restricted area where wastes have been buried.

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

Historical Note

New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-452. Radiological Criteria for License Termination

A. General provisions and scope:

1. The criteria in this Section apply to the decommissioning of facilities licensed under Article 3 of this Chapter. The criteria do not apply to uranium and thorium recovery facilities already subject to 10 CFR 40, Appendix A, or to uranium solution extraction facilities.
2. The criteria in this Section do not apply to sites that:
   a. Have been decommissioned before the effective date of this Section; or
   b. Have previously submitted and received Agency approval of a license termination plan (LTP) or decommissioning plan.
3. If a site has been decommissioned and the license terminated in accordance with the criteria in this Section, the Agency shall not require additional cleanup unless, based on new information, the Agency determines that the criteria of this Section were not met and residual radioactivity at the site is a threat to public health and safety.
4. When calculating the TEDE for the average member of the critical group, a licensee shall use the peak annual dose expected within the first 1000 years after decommissioning.

B. Radiological criteria for unrestricted use. The Agency considers a site acceptable for unrestricted use if the licensee reduces residual radioactivity, distinguishable from background radiation, to a TEDE for an average member of the critical group that does not exceed 0.15 mSv (15 mrem) per year, including radiation from groundwater sources of drinking water, and the residual radioactivity is as low as reasonably achievable (ALARA). To determine the level that is ALARA, the Agency and the licensee shall take into account any detriment, such as deaths from transportation accidents, that is likely to result from decontamination and waste disposal.

C. Criteria for license termination under restrictive conditions. The Agency considers a site acceptable for license termination if the licensee meets all of the following restrictive conditions:

1. The licensee demonstrates that a reduction in residual radioactivity, necessary to comply with subsection (B), will result in net public or environmental harm or is not being made because the residual level of radioactivity is ALARA. To determine the level that is ALARA, the Agency and the licensee shall take into account any detriment, such as deaths from transportation accidents, that is likely to result from decontamination and waste disposal;
2. The licensee establishes one or more legally enforceable institutional controls that reduce residual radioactivity, distinguishable from background radiation, to a TEDE for the average member of the critical group that does not exceed (0.15 mSv) 15 mrem per year, including radiation from groundwater sources of drinking water;
3. The licensee demonstrates financial assurance that complies with R12-1-323(C), which enables an independent third party, including a governmental custodian of the site, to assume and carry out responsibilities for control and maintenance of the site and funds placed into a trust segregated from the licensee's assets and outside the licensee's administrative control, and in which the adequacy of the trust funds is to be assessed based on an assumed annual 1 percent real rate of return on investment;
4. The licensee submits a decommissioning plan or License Termination Plan (LTP) to the Agency, indicating the licensee's intent to decommission in accordance with R12-1-323 and specifying that the licensee intends to decommission by restricting use of the site. The licensee shall document in the LTP or decommissioning plan how comments from individuals and institutions in the community, who may be affected by the decommissioning, have been sought and addressed after analysis.
   a. If a licensee is restricting use of the site, the licensee shall seek comments from the public concerning the proposed decommissioning, regarding all of the following matters:
      i. Whether the institutional controls proposed by the licensee will reduce residual radioactivity, distinguishable from background radiation, to a TEDE for the average member of the critical group that does not exceed 0.15 mSv (15 mrem) per year; are enforceable; and do not impose an unreasonable burden on the local community or other affected parties; and
      ii. Whether the licensee has provided financial assurance that complies with R12-1-323(C), which enables an independent third party, including a governmental custodian of the site, to assume and carry out responsibilities for control and maintenance of the site;
   b. In seeking comments on the issues identified in subsection (C)(4)(a), the licensee shall provide for:
      i. Participation by representatives of a broad cross section of community interests that may be affected by the decommissioning;
      ii. An opportunity for a comprehensive discussion of the issues by all of the community representatives; and

iii. A publicly available document that contains or access to each oral and written comment that reflects the viewpoints of community representatives on each issue and the extent of agreement or disagreement among representatives on each issue; and

5. The licensee reduces residual radioactivity, distinguishable from background radiation, at the site so that if the institutional controls are no longer in effect, the TEDE for the average member of the critical group is as low as reasonably achievable and does not exceed 1 mSv (100 mrem) per year; unless the licensee:
   a. Demonstrates that a further reduction in residual radioactivity necessary to comply with subsection (C)(5) is not technically achievable or economically feasible, or will result in net public or environmental harm;
   b. Provides for durable institutional controls; and
   c. Provides financial assurance that complies with R12-1-323(C), which enables an independent third party, including a governmental custodian of the site, to carry out periodic rechecks of the site, no less frequently than every five years; assures that each institutional control remains in place according to subsection (C)(3); and assumes and carries out responsibilities for maintenance of the institutional control.

D. Alternate criteria for license termination:
1. Based on circumstances that relate to a specific license, the Agency may terminate the license using the following alternate criteria for subsections (B) or (C)(2), if the licensee demonstrates that the TEDE from residual radioactivity, distinguishable from background radiation, for an average member of the critical group does not exceed 0.15 mSv (15 mrem) per year, and if the licensee:
   a. Ensures that public health and safety is protected by submitting an analysis of possible sources of exposure, prepared by a independent qualified expert, which indicates whether it is likely that the dose from all human-made sources combined, other than medical sources, is more than the 1 mSv/y (100 mrem/y) limit in R12-1-416;
   b. Employs to the extent practicable, restrictions on site use, according to the provisions of subsection (C) to minimize exposures at the site;
   c. Reduces doses to ALARA levels, taking into consideration any detriments such as traffic accidents expected to potentially result from decontamination and waste disposal; and
   d. Submits a decommissioning plan or License Termination Plan (LTP) to the Agency that indicates the licensee's intent to decommission in accordance with R12-1-323, and specifies that the licensee proposes to decommission by use of alternate criteria. The licensee shall document in the decommissioning plan or LTP how comments from individuals and institutions in the community, who may be affected by the decommissioning, have been sought and addressed after analysis. In seeking comments, the licensee shall provide for:
      i. Participation by representatives of a broad cross section of community interests that may be affected by the decommissioning;
      ii. An opportunity for a comprehensive discussion of the issues by all of the community representatives; and
      iii. A publicly available document that contains or access to each oral and written comment that reflects viewpoints of community representatives on each issue and the extent of agreement and disagreement among the representatives on each issue.
   e. Has provided sufficient financial assurance in the form of a trust fund to enable an independent third party, including a governmental custodian of a site, to assume and carry out responsibilities for any necessary control and maintenance of the site.
2. The use of alternate criteria to terminate a license requires approval by the Agency after consideration of any comments provided by the U.S. Environmental Protection Agency and any public comments submitted under subsection (E).

E. Public notification and public participation:
1. Upon the receipt of an LTP or decommissioning plan from a licensee, or a proposal by a licensee for release of a site under subsection (C) or (D), or whenever the Agency determines that notice will serve the public interest, the Agency shall notify and solicit comments from:
   a. Local and state governments in the vicinity of the site and any Indian Nation or other indigenous people that have treaty or statutory rights that could be affected by the decommissioning; and
   b. The U.S. Environmental Protection Agency.
2. To comply with subsection(E)(1) the Agency shall publish a notice in a local newspaper, send letters to state or local organizations on its mailing list, hold a public hearing that is readily accessible to individuals in the vicinity of the site, and solicit comments from the public.

F. Minimization of contamination. After the effective date of this Section, an applicant for a license, other than a renewal, shall describe in the application how facility design and procedures for operation will facilitate eventual decommissioning and minimize, to the extent practicable, the generation of radioactive waste and contamination of the facility and the environment.
1. Applicants for standard design certifications, standard design approvals, and manufacturing licenses shall describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.
2. Licensees shall, to the extent practical, conduct operations to minimize the introduction of residual radioactivity into the site, including the subsurface, in accordance with the existing radiation protection requirements in this Article and radiological criteria for license termination in this Article.

G. The Agency considers a site acceptable for unrestricted use if the residual radioactivity, distinguishable from background radiation, is equal to or less than the values in Table 1.

Historical Note
New Section made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

Table 1
. Acceptable Surface Contamination1 Levels

Radionuclide[1]	**Average[2,3]**	**Maximum[2,4]**	**Removable[2,5]**
U-nat, U-235, U-238, and associated decay products	5,000 dpm/100 cm^2	15,000 dpm/100cm^2	1,000 dpm/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Pa-231, Ac-227, I-125, I-129	100dpm/100c m^2	300 dpm/100cm^2	20dpm/100cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232 , I-126, I-131, I-133	1000 dpm/100cm^2	3000 dpm/100cm^2	200 dpm/100cm^2
Beta-gamma (Exceptions noted above)	5,000 dpm/100 cm^2	15,000 dpm/100cm^2	1,000 dpm/100 cm^2

[1] Where surface contamination by both alpha-and beta-gamma- emitting radionuclides exists, the limits established for alpha-and beta-gamma-emitting radionuclides apply independently.
[2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed on an instrument calibrated for background, efficiency, and geometric factors associated with the instrumentation, in accordance with R12-1-449.
[3] Measurements of average contamination level shall not be averaged over more than one square meter. For objects of less surface area, the average shall be derived for each object.
[4] The maximum contamination level applies to an area of not more than 100 cm^2.
[5] The amount of removable radioactive material per 100 cm^2 of surface area shall be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an instrument calibrated in accordance with R12-1-449. When removable contamination on objects of surface area A (where A is less than 100 sq. cm) is determined, the entire surface shall be wiped and the contamination level multiplied by 100/A to convert to a "per 100 sq. cm" basis.

Historical Note
Table 1 made by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2).

R12-1-453. Reports to Individuals of Exceeding Dose Limits
Any licensee or registrant that reports a personnel exposure to the Agency in accordance with R12-1-413(A)(6), R12-1-444, or R12-1-452 shall:
1. Notify the exposed individual of the exposure addressed in the report; and
2. Transmit the report to the exposed individual at the same time the Agency is notified of the exposure.

Historical Note
New Section made by final rulemaking at 12 A.A.R. 75, effective February 7, 2006 (Supp. 05-4).

R12-1-454. Nationally Tracked Sources
A. A licensee who manufactures, receives, transfers, disassembles, or disposes of a nationally tracked source shall complete and submit to the Nuclear Regulatory Commission's National Source Tracking System and the Agency, a National Source Tracking Transaction Report that contains the information required in 10 CFR 20.2207(a) through (e), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. The report shall be submitted by the close of the next business day after the transaction using a reporting method

specified in 10 CFR 20.2207(f), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

B. The initial National Source Tracking Transaction Report shall contain the information required in subsection (A), be submitted using a method specified in 10 CFR 20.2207(f) and include the additional information required by 10 CFR 20.2207(h)(1) through (6), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. A licensee shall correct any error in previously filed National Source Tracking Transaction Reports or file a new report for any missed transaction within five business days of the discovery of the error or missed transaction in accordance with 10 CFR 20.2207(g), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

D. A licensee who receives a nationally tracked sealed source shall not disassemble the source unless specifically authorized to do so by the Agency.

Historical Note

New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-455. Security Requirements for Portable Gauges

A. A licensee that uses a portable gauge shall use a minimum of two independent controls to maintain security while:

1. Transporting a portable gauge; and
2. Storing a portable gauge.

B. Each control shall form a tangible barrier that will prevent unauthorized removal whenever a portable gauge is not under the control and constant surveillance of the licensee.

C. A licensee shall employ controls approved by the Agency.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

Appendix A. Assigned Protection Factors for Respirators[a]

	Operating mode	Assigned Protection Factors
I. Air Purifying Respirators [Particulate [b] only] [c]:		
Filtering face piece disposable [d]	Negative	([d])
Face piece, half [e]	Negative Pressure	10
Face piece, full	Negative Pressure	100
Face piece, half	Powered Air-purifying Respirators	50
Face piece, full	Powered Air-purifying Respirators	1000
Helmet/hood	Powered Air-purifying Respirators	1000
Face piece, loose-fitting	Powered Air-purifying Respirators	25
II. Atmosphere supplying respirators [particulate, gases and vapors[f]]:		
1. Air-line respirator:		
Face piece, half	Demand	10
Face piece, half	Continuous Flow	50
Face piece, half	Pressure Demand	50
Face piece, full	Demand	100
Face piece, full	Continuous Flow	1000
Face piece, full	Pressure Demand	1000
Helmet/hood	Continuous Flow	1000
Face piece, loose-fitting	Continuous Flow	25
Suit	Continuous Flow	([g])
2. Self-contained breathing Apparatus (SCBA):		
Face piece, full	Demand	[h]100
Face piece, full	Pressure Demand	[i]10,000
Face piece, full	Demand, Recirculating	[h]100
Face piece, full	Positive Pressure Recirculating	[i]10,000
III. Combination Respirators:		
Any combination of air-purifying and atmosphere-supplying respirators	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 Article. They are applicable only to airborne radiological hazards and may not be appropriate if chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. A licensee shall comply with Department of Labor regulations, regarding selection and use of respirators for those circumstances.

Radioactive contaminants for which the concentration values in Table 1, Column 3 of Appendix B 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] A licensee shall equip air purifying respirators of APF<100 with particulate filters that are at least 95 percent efficient. The licensee shall equip air purifying respirators of APF=100 with particulate filters that are at least 99 percent efficient. The licensee shall equip air purifying respirators of APF>100 with particulate filters that are at least 99.97 percent efficient.

[c] A licensee may apply to the Commission for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors, similar to radioiodine.

[d] A Licensee may permit an individual to use this type of respirator if the individual has not been medically screened or fit tested on the device, provided that no credit is taken for use of these respirators in estimation of 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 10 CFR 20.1703, January 2000 Edition, and published January 1, 2000, apply and are incorporated by reference and available for review at the Agency and Secretary of State. This incorporation by reference contains no future editions or amendments. There is no assigned protection factor for these devices. However, a licensee may use an APF equal to 10 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 face piece (disposable or reusable disposable). Both types are acceptable as long as the seal area of the latter contains some substantial type of seal-enhancing material, such as rubber or plastic, two or more suspension straps are adjustable, the filter medium is at least 95 percent efficient, and all other requirements of this Article 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. The minimum program requirements are provided in 10 CFR 20.1703.

[h] The licensee shall 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.

Historical Note

Former Appendix A repealed; new Appendix A adopted effective June 30, 1977 (Supp. 77-3). Section repealed; new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1).

Appendix B. Annual Limits on Intake (ALI) and Derived Air Concentrations (DAC) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sanitary Sewerage

Introduction

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

Note:

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

Table I "Occupational Values"

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

The ALIs in this Appendix are the annual intakes of given radionuclide by "Reference Man" which would result in either (1) a committed effective dose equivalent of 0.05 Sv (5 rem), stochastic ALI, or (2) a committed dose equivalent of 0.5 Sv (50 rem) to an organ or tissue, nonstochastic ALI. The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues,

comparable to the risk associated with deep-dose equivalent to the whole body of 0.05 Sv (5 rem). The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, W_T. This weighting factor is the proportion of the risk of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of W_T are listed under the definition of weighting factor in R12-1-403. The nonstochastic ALIs were derived to avoid nonstochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of $W_T = 0.06$ is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalents, and the dose equivalents of all other remaining tissues may be disregarded. The following portions of the GI tract -- stomach, small intestine, upper large intestine, and lower large intestine -- are to be treated as four separate organs.

Note that the dose equivalents for an extremity, skin, and lens of the eye are not considered in computing the committed effective dose equivalent but are subject to limits that shall 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 nonstochastic 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 nonstochastic ALIs, will ensure that nonstochastic 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 nonstochastic ALI is limiting, use of that nonstochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 0.5 Sv (50 rem) dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep-dose equivalent plus the internal committed dose equivalent to that organ, not the effective dose. For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the nonstochastic ALIs (ALI_{ns}) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity, that is, Σ (intake (in µCi) of each radionuclide/ALI_{ns}) ≤ 1.0. If there is an external deep dose equivalent contribution of H_d, then this sum must be less than $1 - (H_d/50)$, instead of ≤ 1.0.

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

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

DAC = ALI(in µCi)/(2000 hours per working year x 60 minutes/hour x 2 x 10^4 ml per minute) = [ALI/2.4 x 10^9] µCi/ml, where 2 x 10^4 ml is the volume of air breathed per minute at work by Reference Man under working conditions of light work.

The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. DACs based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide separately.

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

The values of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external irradiation. See R12-1-407. When an individual is exposed to radioactive materials which fall under several of the translocation classifications of the same radionuclide, such as Class D, Class W, or Class Y, the exposure may be evaluated as if it were a mixture of different radionuclides.

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

Table II "Effluent Concentrations"

The columns in Table II of this Appendix captioned "Effluents," "Air," and "Water" are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of R12-1-415. The concentration values given in Columns 1 and 2 of Table II are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.5 mSv (0.05 rem).

Consideration of nonstochastic limits has not been included in deriving the air and water effluent concentration limits because nonstochastic effects are presumed not to occur at or below the dose levels established for individual members of the public. For radionuclides, where the nonstochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table II. For this reason, the DAC and airborne effluent limits are not always proportional as they were in earlier versions of Appendix A of Article 4.

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

For those radionuclides for which submersion, that is external dose, is limiting, the occupational DAC in Table I, Column 3 was divided by 219. The factor of 219 is composed of a factor of 50, as described above, and a factor of 4.38 relating occupational exposure for 2,000 hours 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 7.3×10^7. The factor of 7.3×10^7 (ml) includes the following components: the factors of 50 and 2 described above and a factor of 7.3×10^5 (ml) which is the annual water intake of Reference Man.

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

Table III “Releases to Sewers”
The monthly average concentrations for release to sanitary sewerage are applicable to the provisions in R12-1-435. The concentration values were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by 7.3×10^6 (ml). The factor of 7.3×10^6 (ml) is composed of a factor of 7.3×10^5 (ml), the annual water intake by Reference Man, and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a Reference Man during a year, would result in a committed effective dose equivalent of 0.5 rem.

LIST OF ELEMENTS

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

Name	Symbol	Atomic Number
Mendelevium	Md	101
Mercury	Hg	80
Molybdenum	Mo	42
Neodymium	Nd	60
Neptunium	Np	93
Nickel	Ni	28
Niobium	Nb	41
Nitrogen	N	7
Osmium	Os	76

Oxygen	O	8
Palladium	Pd	46
Phosphorus	P	15
Platinum	Pt	78
Plutonium	Pu	94
Polonium	Po	84
Potassium	K	19
Praseodymium	Pr	59
Promethium	Pm	61
Protactinium	Pa	91
Radium	Ra	88
Radon	Rn	86
Rhenium	Re	75
Rhodium	Rh	45
Rubidium	Rb	37
Ruthenium	Ru	44
Samarium	Sm	62
Scandium	Sc	21
Selenium	Se	34
Silicon	Si	14
Silver	Ag	47
Sodium	Na	11
Strontium	Sr	38
Sulfur	S	16
Tantalum	Ta	73
Technetium	Tc	43
Tellurium	Te	52
Terbium	Tb	65
Thallium	Tl	81
Thorium	Th	90
Thulium	Tm	69
Tin	Sn	50
Titanium	Ti	22
Tungsten	W	74
Uranium	U	92
Vanadium	V	23
Xenon	Xe	54
Ytterbium	Yb	70
Yttrium	Y	39
Zinc	Zn	30
Zirconium	Zr	40

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
			Col. 1	Col. 2	Col.3	Col.	1
	Col. 2		Oral				
	Monthly		Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	Concentration (μCi) ALI	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml) Air (μCi/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	4E+4	2E+4 9E-6	3E-8		6E-4
	6E-3						
			those given for Y				
		Y,	oxides,		halides,		and
			nitrates	- 2E+4	8E-6	3E-8	-
	-						
4	Beryllium-10	W, see ^{7}Be	1E+3	2E+2 6E-8	2E-10		-
	-		-				
			LLI wall				
			(1E+3)	- -	-		2E-5
	2E-4						
		Y, see ^{7}Be	-	1E+1 6E-9	2E-11		-
	-						
6	Carbon-11[2]	Monoxide	-	1E+6 5E-4	2E-6		-
	-						
		Dioxide	-	6E+5 3E-4	9E-7		-
	-						
		Compounds	4E+5	4E+ 5 2E-4	6E-7		6E-3
	6E-2						
6	Carbon-14	Monoxide	-	2E+6 7E-4	2E-6		-
	-						
		Dioxide	-	2E+5 9E-5	3E-7		-
	-						
		Compounds	2E+3	2E+3 1E-6	3E-9		3E-5
	3E-4						
7	Nitrogen-13[2]	Submersion[1]	-	- 4E-6	2E-8		-
	-						
8	Oxygen-15[2]	Submersion[1]	-	- 4E-6	2E-8		-
	-						
9	Fluorine-18[2]	D,	fluorides	of	H,	Li,	Na,
			K, Rb, Cs, and Fr	5E+4 7E+4	3E-5	1E-7	-
	-						
			St wall				
			(5E+4)	- -	-		7E-4
				7E-3			
		W,	fluorides	of	Be,	Mg,	Ca,
			Sr, Ba, Ra, Al, Ga, In, Tl, As, Sb, Bi, Fe, Ru, Os, Co, Ni, Pd, Pt, Cu, Ag, Au, Zn, Cd, Hg, Sc, Y, Ti, Zr, V, Nb, Ta, Mn,				

			Tc, and Re	-	9E+4	4E-5	1E-7	-
-								
		Y, Lanthanum fluoride	-	8E+-4	3E-5	1E-7		-
-								
11	Sodium-22	D, all compounds	4E+2	6E+2	3E-7	9E-10		6E-6
6E-5								
11	Sodium-24	D, all compounds	4E+3	5E+3	2E-6	7E-9		5E-5
5E-4								
12	Magnesium-28	D, all compounds except						
		those given for W	7E+2	2E+3	7E-7	2E-9		9E-6
9E-5								
		W, oxides, hydroxides, carbides, halides, and						
		nitrates	-	1E+3	5E-7	2E-9		-
-								
13	Aluminum-26	D, all compounds except						
		those given for W	4E+2	6E+1	3E-8	9E-11		6E-6
6E-5								
		W, oxides, hydroxides, carbides, halides, and nitrates	-	9E+1	4E-8	1E-10		-
-								
14	Silicon-31	D, all compounds except						
		those given for W and Y		9E+3	3E+4	1E-5		4E-8
1E-4	1E-3							
		W, oxides, hydroxides, carbides, and nitrates	-	3E+4	1E-5	5E-8		-
-								
		Y, aluminosilicate glass	-	3E+4	1E-5	4E-8		-
-								
14	Silicon-32	D. see ^{31}Si	2E+3	2E+2	1E-7	3E-10		-
-								
		LLI wall						
			(3E+3)	-	-	-		4E-5
4E-4								
		W, see ^{31}Si	-	1E+2	5E-8	2E-10		-
-								
		Y, see ^{31}Si	-	5E+0	2E-9	7E-12		-
-								

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

18	Argon-37	Submersion[1]	-	-	1E+0	6E-3	-	-
18	Argon-39	Submersion[1]	-	-	2E-4	8E-7	-	-
18	Argon-41	Submersion[1]	-	-	3E-6	1E-8	-	-
19	Potassium-40	D, all compounds	3E+2	4E+2	2E-7	6E-10		4E-6
	4E-5							
19	Potassium-42	D, all compounds	5E+3	5E+3	2E-6	7E-9		6E-5
	6E-4							
19	Potassium-43	D, all compounds	6E+3	9E+3	4E-6	1E-8		9E-5
	9E-4							
19	Potassium-44[2]	D, all compounds	2E+4	7E+4	3E-5	9E-8		-
	-							
			St wall					
			(4E+4)	-	-	-		5E-4
	5E-3							
19	Potassium-45[2]	D, all compounds	3E+4	1E+5	5E-5	2E-7		-
	-							
			St watt					
			(5E+4)	-	-	-		7E-4
	7E-3							

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

			(3E+4)	-	-	-		4E-4	4E-3
		W,			oxides,			hydroxides,	
		carbides, and halides-			1E+5	4E-5	1E-7	-	-
23	Vanadium-48	D, see ^{47}V	6E+2	1E+3	5E-7	2E-9		9E-6	9E-5
		W, see ^{47}V	-	6E+2	3E-7	9E-10		-	-
23	Vanadium-49	D, see ^{47}V	7E+4	3E+4	1E-5	-		-	-
			LLI wall	Bone surf					
			(9E+4)	(3E+4)	-	5E-8		1E-3	1E-2
		W, see^{47}V	-	2E+4	8E-6	2E-8		-	-
24	Chromium-48	D,	all			compounds			except
		those given for W and Y			6E+3	1E+4	5E-6	2E-8	8E-5
		W, halides and nitrates	-	7E+3	3E-6	1E-8		-	8E-4 -
		Y, oxides and hydroxides	-	7E+3	3E-6	1E-8		-	-
24	Chromium-49[2]	D, see ^{48}Cr	3E+4	8E+4	4E-5	1E-7		4E-4	4E-3
		W, see ^{48}Cr	-	1E+5	4E-5	1E-7		-	-
		Y, see ^{48}Cr	-	9E+4	4E-5	1E-7		-	-
24	Chromium-51	D, see ^{48}Cr	4E+4	5E+4	2E-5	6E-8		5E-4	5E-3
		W, see ^{48}Cr	-	2E+4	1E-5	3E-8		-	-
		Y, see ^{48}Cr	-	2E+4	8E-6	3E-8		-	-
25	Manganese-51[2]	D,	all			compounds			except
		those given for W			2E+4	5E+4	2E-5	7E-8	3E-4
		W,			oxides,			hydroxides,	3E-3
		halides, and nitrates	-		6E+4	3E-5	8E-8	-	-

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
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		-
	-							
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	Cob9alt-55	W, all those given for Y	1E+3	3E+3	1E-6	4E-9	compounds except 2E-5	2E-4
		Y, oxides, halides, and nitrates	-	3E+3	1E-6	4E-9	hydroxides, -	-
27	Cobalt-56	W, see ^{55}Co	5E+2	3E+2	1E-7	4E-10	6E-6	6E-5
		Y, see ^{55}Co	4E+2	2E+2	8E-8	3E-10	-	-
27	Cobalt-57	W, see ^{55}Co	8E+3	3E+3	1E-6	4E-9	6E-5	6E-4
		Y, see ^{55}Co	4E+3	7E+2	3E-7	9E-10	-	-
27	Cobalt-58m	W, see ^{55}Co	6E+4	9E+4	4E-5	1E-7	8E-4	8E-3
		Y, see ^{55}Co	-	6E+4	3E-5	9E-8	-	-
27	Cobalt-58	W, see ^{55}Co	2E+3	1E+3	5E-7	2E-9	2E-5	2E-4
		Y, see ^{55}Co	1E+3	7E+2	3E-7	1E-9	-	-
27	Cobalt-60m[2]	W, see ^{55}Co	1E+6	4E+6	2E-3	6E-6	-	-
			St wall (1E+6)	-	-	-	2E-2	2E-1
		Y, see ^{55}Co	-	3E+6	1E-3	4E-6	-	-
27	Cobalt-60	W, see ^{55}Co	5E+2	2E+2	7E-8	2E-10	3E-6	3E-5
		Y, see ^{55}Co	2E+2	3E+1	1E-8	5E-11	-	-
27	Cobalt-61[2]	W, see ^{55}Co	2E+4	6E+4	3E-5	9E-8	3E-4	3E-3
		Y, see ^{55}Co	2E+4	6E+4	2E-5	8E-8	-	-

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
27	Cobalt-62m[2]	W, see ^{55}Co	4E+4	2E+5	7E-5	2E-7		-
	-	St wall						
			(5E+4)	-	-	-		7E-4
	7E-3							
		Y, see ^{55}Co	-	2E+5	6E-5	2E-7		-
	-							
28	Nickel-56	D,	all			compounds		except
			those given for W	1E+3	2E+3	8E-7	3E-9	2E-5
	2E-4							
		W,			oxides,			hydroxides,
			and carbides	-	1E+3	5E-7	2E-9	-
	-							
		Vapor	-	1E+3	5E-7	2E-9		-
	-							
28	Nickel-57	D, see ^{56}Ni	2E+3	5E+3	2E-6	7E-9		2E-5
	2E-4							
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9		-
	-							
		Vapor	-	6E+3	3E-6	9E-		-
	-							
28	Nickel-59	D, see ^{56}Ni	2E+4	4E+3	2E-6	5E-9		3E-4
	3E-3							
		W, see ^{56}Ni	-	7E+3	3E-6	1E-8		-
	-							
		Vapor	-	2E+3	8E-7	3E-9		-
	-							
28	Nickel-63	D, see ^{56}Ni	9E+3	2E+3	7E-7	2E-9		1E-4
	1E-3							
		W, see ^{56}Ni	-	3E+3	1E-6	4E-9		-
	-							
		Vapor	-	8E+2	3E-7	1E-9		-
	-							
28	Nickel-65	D, see ^{56}Ni	8E+3	2E+4	1E-5	3E-8		1E-4
	1E-3							
		W, see ^{56}Ni	-	3E+4	1E-5	4E-8		-
	-							
		Vapor	-	2E+4	7E-6	2E-8		-
	-							
28	Nickel-66	D, see ^{56}Ni	4E+2	2E+3	7E-7	2E-9		-
	-							
		LLI wall						
			(5E+2)	-	-	-		6E-6
	6E-5							

		W, see ^{56}Ni	-	6E+2	3E-7	9E-10		-	
	-								
		Vapor	-	3E+3	1E-6	4E-9		-	
	-								
29	Copper-60[2]	D,	all			compounds			except
			those given for W and Y		3E+4	9E+4	4E-5	1E-7	
	-	-							
		St wall							
			(3E+4)	-	-	-		4E-4	
	4E-3								
		W,			sulfides,				halides,
			and nitrates	-	1E+5	5E-5	2E-7	-	
	-								
		Y, oxides and hydroxides	-	1E+5	4E-5	1E-7		-	
	-								
29	Copper-61	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8		2E-4	
	2E-3								
		W, see ^{60}Cu	-	4E+4	2E-5	6E-8		-	
	-								
		Y, see ^{60}Cu	-	4E+4	1E-5	5E-8		-	
	-								
29	Copper-64	D, see ^{60}Cu	1E+4	3E+4	1E-5	4E-8		2E-4	
	2E-3								
		W, see ^{60}Cu	-	2E+4	1E-5	3E-8		-	
	-								
		Y, see ^{60}Cu	-	2E+4	9E-6	3E-8		-	
	-								
29	Copper-67	D, see ^{60}Cu	5E+3	8E+3	3E-6	1E-8		6E-5	
	6E-4								
		W, see ^{60}Cu	-	5E+3	2E-6	7E-9		-	
	-								
		Y, see ^{60}Cu	-	5E+3	2E-6	6E-9		-	
	-								
30	Zinc-62	Y, all compounds	1E+3	3E+3	1E-6	4E-9		2E-5	
	2E-4								
30	Zinc-63[2]	Y, all compounds	2E+4	7E+4	3E-5	9E-8		-	
	-								
		St wall							
			(3E+4)	-	-	-		3E-4	
	3E-3								

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

		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 wait (4E+4)	-	-	-		6E-4
	6E-3							
		W, see ^{66}Ge	-	1E+5	4E-5	1E-7		-
	-							
32	Germanium-68	D, see ^{66}Ge	5E+3	4E+3	2E-6	5E-9		6E-5
	6E-4							
		W, see ^{66}Ge	-	1E+2	4E-8	1E-10		-
	-							
32	Germanium-69	D, see ^{66}Ge	1E+4	2E+4	6E-6	2E-8		2E-4
	2E-3							
		W, see ^{66}Ge	-	8E+3	3E-6	1E-8		-
	-							
32	Germanium-71	D, see ^{66}Ge	5E+5	4E+5	2E-4	6E-7		7E-3
	7E-2							
		W, see ^{66}Ge	-	4E+4	2E-5	6E-8		-
	-							
32	Germanium-75[2]	D, see ^{66}Ge	4E+4	8E+4	3E-5	1E-7		-
	-							
			St wall (7E+4)	-	-	-		9E-4
	9E-3							
		W, see ^{66}Ge	-	8E+4	4E-5	1E-7		-
	-							
32	Germanium-77	D, see ^{66}Ge	9E+3	1E+4	4E-6	1E-8		1E-4
	1E-3							
		W, see ^{66}Ge	-	6E+3	2E-6	8E-9		-
	-							

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

		W, see ^{70}Se	-	2E+4	7E-6	2E-8		-	
	-								
34	Selenium-75	D, see ^{70}Se	5E+2	7E+2	3E-7	1E-9		7E-6	
	7E-5								
		W, see ^{70}Se	-	6E+2	3E-7	8E-10		-	
	-								
34	Selenium-79	D, see ^{70}Se	6E+2	8E+2	3E-7	1E-9		8E-6	
	8E-5								
		W, see ^{70}Se	-	6E+2	2E-7	8E-10		-	
	-								
34	Selenium-81m[2]	D, see ^{70}Se	4E+4	7E+4	3E-5	9E-8		3E-4	
	3E-3								
		W, see ^{70}Se	2E+4	7E+4	3E-5	1E-7		-	
	-								
34	Selenium-81[2]	D, see ^{70}Se	6E+4	2E+5	9E-5	3E-7		-	
	-								
			St wall (8E+4)	-	-	-		1E-3	
	1E-2								
		W, see ^{70}Se	-	2E+5	1E-4	3E-7		-	
	-								
34	Selenium-83[2]	D, see ^{70}Se	4E+4	1E+5	5E-5	2E-7		4E-4	
	4E-3								
		W, see ^{70}Se	3E+4	1E+5	5E-5	2E-7		-	
	-								
35	Bromine-74m[2]	D,	bromides		of		H,		Li,
			Na, K, Rb, Cs, and Fr	1E+4	4E+4	2E-5	5E-8	-	
	-								
			St wall (2E+4)	-	-	-		3E-4	
	3E-3								

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

35	Bromine-83	D, see ^{74m}Br	5E+4	6E+4	3E-5	9E-8	-
			St wall (7E+4)	-	-	-	9E-4
	9E-3						
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-
	-						
35	Bromine-84[2]	D, see ^{74m}Br	2E+4	6E+4	2E-5	8E-8	-
	-						
			St wall (3E+4)	-	-	-	4E-4
	4E-3						
		W, see ^{74m}Br	-	6E+4	3E-5	9E-8	-
	-						
36	Krypton-74[2]	Submersion[1]	-	-	3E-6	1E-8	-
	-						
36	Krypton-76	Submersion[1]	-	-	9E-6	4E-8	-
	-						
36	Krypton-77[2]	Submersion[1]	-	-	4E-6	2E-8	-
	-						
36	Krypton-79	Submersion[1]	-	-	2E-5	7E-8	-
	-						
36	Krypton-81	Submersion[1]	-	-	7E-4	3E-6	-
	-						
36	Krypton-83m[2]	Submersion[1]	-	-	1E-2	5E-5	-
	-						
36	Krypton-85m	Submersion[1]	-	-	2E-5	1E-7	-
	-						
36	Krypton-85	Submersion[1]	-	-	1E-4	7E-7	-
	-						
36	Krypton-87[2]	Submersion[1]	-	-	5E-6	2E-8	-
	-						
36	Krypton-88	Submersion[1]	-	-	2E-6	9E-9	-
	-						

Occupational Values			Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
37	Rubidium-79[2] -	D, all compounds	4E+4	1E+5	5E-5	2E-7		-
			St wall (6E+4)	-	-	-		8E-4
	8E-3							
37	Rubidium-81m[2] -	D, all compounds	2E+5	3E+5	1E-4	5E-7		-
			St wall (3E+5)	-	-	-		4E-3
	4E-2							
37	Rubidium-81 5E-3	D, all compounds	4E+4	5E+4	2E-5	7E-8		5E-4
37	Rubidium 82m 2E-3	D, all compounds	1E+4	2E+4	7E-6	2E-8		2E-4
37	Rubidium-83 9E-5	D, all compounds	6E+2	1E+3	4E-7	1E-9		9E-6
37	Rubidium-84 7E-5	D, all compounds	5E+2	8E+2	3E-7	1E-9		7E-6
37	Rubidium-86 7E-5	D, all compounds	5E+2	8E+2	3E-7	1E-9		7E-6
37	Rubidium-87 1E-4	D, all compounds	1E+3	2E+3	6E-7	2E-9		1E-5
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] 6E-4	D, all soluble compounds except SrTi0	4E+3	1E+4	5E-6	2E-8		6E-5
	-	Y, all insoluble compounds and SrTi0	-	1E+4	5E-6	2E-8		-
38	Strontium-81[2] 3E-3	D, see ^{80}Sr	3E+4	8E+4	3E-5	1E-7		3E-4
	-	Y, see ^{80}Sr	2E+4	8E+4	3E-5	1E-7		-
38	Strontium-82 -	D, see ^{80}Sr	3E+2	4E+2	2E-7	6E-10		-
			LLI wall					

			(2E+2)	-	-	-	3E-6
	3E-5						
		Y, see ^{80}Sr	2E+2	9E+1	4E-8	1E-10	-
	-						
38	Strontium-83	D, see ^{80}Sr	3E+3	7E+3	3E-6	1E-8	3E-5
	3E-4						
		Y, see ^{80}Sr	2E+3	4E+3	1E-6	5E-9	-
	-						
38	Strontium-85m[2]	D, see ^{80}Sr	2E+5	6E+5	3E-4	9E-7	3E-3
	3E-2						
		Y, see ^{80}Sr	-	8E+5	4E-4	1E-6	-
	-						
38	Strontium-85	D, see ^{80}Sr	3E+3	3E+3	1E-6	4E-9	4E-5
	4E-4						
		Y, see ^{80}Sr	-	2E+3	6E-7	2E-9	-
	-						
38	Strontium-87m	D, see ^{80}Sr	5E+4	1E+5	5E-5	2E-7	6E-4
	6E-3						
		Y, see ^{80}Sr	4E+4	2E+5	6E-5	2E-7	-
	-						
38	Strontium-89	D, see ^{80}Sr	6E+2	8E+2	4E-7	1E-9	-
	-						
			LLI wall (6E+2)	-	-	-	8E-6
	8E-5						
		Y, see ^{80}Sr	5E+2	1E+2	6E-8	2E-10	-
	-						
38	Strontium-90	D, see ^{80}Sr	3E+1	2E+1	8E-9	-	-
	-						
			Bone surf (4E+1)	Bone surf (2E+1)	-	3E-11	5E-7
	5E-6						
		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	-
	-						

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

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col. 1
	Monthly		Oral				
			Ingestion		Inhalation		
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
40	Zirconium-89	D, see ^{86}Zr	2E+3	4E+3	1E-6	5E-9		2E-5
	2E-4							
		W, see ^{86}Zr	-	2E+3	1E-6	3E-9		-
	-							
		Y, see ^{86}Zr	-	2E+3	1E--6	3E-9		-
	-							
40	Zirconium-93	D, see ^{86}Zr	1E+3	6E+0	3E-9	-		-
	-							
			Bone surf	Bone surf				
			(3E+3)	(2E+1)	-	2E-11		4E-5
	4E-4							
		W, see ^{86}Zr	-	2E+1	1E-8	-		-
	-							
				Bone surf				
			-	(6E+1)	-	9E-11		-
	-							
		Y, see ^{86}Zr	-	6E+1	2E-8	-		-
	-							
				Bone surf				
			-	(7E+1)	-	9E-11		-
	-							
40	Zirconium-95	D, see ^{86}Zr	1E+3	1E+2	5E-8	-		2E-5
	2E-4							
				Bone surf				
			-	(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-89[2] (66 min)	W, see ^{88}Nb	1E+4	4E+4	2E-5	6E-8		1E-4
		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
		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
		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
		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
		Y, see ^{88}Nb	-	2E+1	6E-9	2E-11		-
41	Niobium-95m	W, see ^{88}Nb	2E+3	3E+3	1E-6	4E-9		-
			LLI wall (2E+3)	-	-	-		3E-5
		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
		Y, see ^{88}Nb	-	1E+3	5E-7	2E-9	-	-

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

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/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							
		Y, oxides and hydroxides	-	6E+4	2E-5	8E-8		-
	-							
		W, see ^{94}Ru	-	1E+4	5E-6	2E-8		-
	-							

44	Ruthenium-103	D, see ^{94}Ru	2E+3	2E+3	7E-7	2E-9	3E-5
3E-4							
		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	-
-							

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral Ingestion		Inhalation			
	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
45	Rhodium-100 2E-4	D, see ^{99m}Rh	2E+3	5E+3	2E-6	7E-9		2E-5
	-	W, see ^{99m}Rh	-	4E+3	2E-6	6E-9		-
	-	Y, see ^{99m}Rh	-	4E+ 3	2E-6	5E-9		-
45	Rhodium-101m 8E-4	D, see ^{99m}Rh	6E+3	1E+4	5E-6	2E-8		8E-5
	-	W, see ^{99m}Rh	-	8E+3	4E-6	1E-8		-
	-	Y, see ^{99m}Rh	-	8E+3	3E-6	1E-8		-
45	Rhodium-101 3E-4	D, see ^{99m}Rh	2E+3	5E+2	2E-7	7E-10		3E-5
	-	W, see ^{99m}Rh	-	8E+2	3E-7	1E-9		-
	-	Y, see ^{99m}Rh	-	2E+2	6E-8	2E-10		-
45	Rhodium-102m -	D, see ^{99m}Rh	1E+3	5E+2	2E-7	7E-10		-
	2E-4		LLI wall (1E+3)	-	-	-		2E-5
	-	W, see ^{99m}Rh	-	4E+2	2E-7	5E-10		-
	-	Y, see ^{99m}Rh	-	1E+2	5E-8	2E-10		-
45	Rhodium-102 8E-5	D, see ^{99m}Rh	6E+2	9E+1	4E-8	1E-10		8E-6
	-	W, see ^{99m}Rh	-	2E+2	7E-8	2E-10		-
	-	Y, see ^{99m}Rh	-	6E+1	2E-8	8E-11		-
45	Rhodium-103m[2] 6E-2	D, see ^{99m}Rh	4E+5	1E+6	5E-4	2E-6		6E-3
	-	W, see ^{99m}Rh	-	1E+6	5E-4	2E-6		-
	-	Y, see ^{99m}Rh	-	1E+6	5E-4	2E-6		-
45	Rhodium-105 -	D, see ^{99m}Rh	4E+3	1E+4	5E-6	2E-8		-
	5E-4		LLI wall (4E+3)	-	-	-		5E-5

		W, see ^{99m}Rh	-	6E+3	3E-6	9E-9	-
	-						
		Y, see ^{99m}Rh	-	6E+3	2E-6	8E-9	-
	-						
45	Rhodium-106m	D, see ^{99m}Rh	8E+3	3E+4	1E-5	4E-8	1E-4
	1E-3						
		W, see ^{99m}Rh	-	4E+4	2E-5	5E-8	-
	-						
		Y, see ^{99m}Rh	-	4E+4	1E-5	5E-8	-
	-						
45	Rhodium-107[2]	D, see ^{99m}Rh	7E+4	2E+5	1E-4	3E-7	-
	-						
			St wall (9E+4)	-	-	-	1E-3
	1E-2						
		W, see ^{99m}Rh	-	3E+5	1E-4	4E-7	-
	-						
		Y, see ^{99m}Rh	-	3E+5	1E-4	3E-7	-
	-						
46	Palladium-100	D, all compounds except those given for W and Y	1E+3	1E+3	6E-7	2E-9	2E-5
	2E-4						
		W, nitrates	-	1E+3	5E-7	2E-9	-
	-						
		Y, oxides and hydroxides	-	1E+3	6E-7	2E-9	-
	-						
46	Palladium-101	D, see ^{100}Pd	1E+4	3E+4	1E-5	5E-8	2E-4
	2E-3						
		W, see ^{100}Pd	-	3E+4	1E-5	5E-8	-
	-						
		Y, see ^{100}Pd	-	3E+4	1E-5	4E-8	-
	-						

Occupational Values			Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	ALI (μCi)		ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
			Concentration (μCi)					
46	Palladium-103 - 1E-3	D, see ^{100}Pd	6E+3	6E+3	3E-6	9E-9		-
			LLI wall (7E+3)	-	-	-		1E-4
		W, see ^{100}Pd	-	4E+3	2E-6	6E-9		-
		Y, see ^{100}Pd	-	4E+3	1E-6	5E-9		-
46	Palladium-107 - 5E-3	D, see ^{100}Pd	3E+4	2E+4	9E-6	-		-
			LLI wall (4E+4)	Kidneys (2E+4)	-	3E-8		5E-4
		W, see ^{100}Pd	-	7E+3	3E-6	1E-8		-
		Y, see ^{100}Pd	-	4E+2	2E-7	6E-10		-
46	Palladium-109 - 3E-4	D, see ^{100}Pd	2E+3	6E+3	3E-6	9E-9		3E-5
		W, see ^{100}Pd	-	5E+3	2E-6	8E-9		-
		Y, see,^{100}Pd	-	5E+3	2E-6	6E-9		-
47	Silver-102[2] - 9E-3	D, all compounds except those given for W and Y	5E+4	2E+5	8E-5	2E-7		-
			St wall (6E+4)	-	-	-		9E-4
		W, nitrates and sulfides	-	2E+5	9E-5	3E-7		-
		Y, oxides and hydroxides	-	2E+5	8E-5	3E-7		-
47	Silver-103[2] - 5E-3	D, see ^{102}Ag	4E+4	1E+5	4E-5	1E-7		5E-4
		W, see ^{102}Ag	-	1E+5	5E-5	2E-7		-
		Y, see ^{102}Ag	-	1E+5	5E-5	2E-7		-
47	Silver-104m[2] - 4E-3	D, see ^{102}Ag	3E+4	9E+4	4E-5	1E-7		4E-4

		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	-
	-						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
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	Liver				
			(1E+3)	(2E+3)	-	2E-9		2E-5
	2E-4							
		W, see ^{102}Ag	-	9E+2	4E-7	1E-9		-
	-							
		Y, see ^{102}Ag	-	9E+2	4E-7	1E-9		-
	-							
47	Silver-112	D, see ^{102}Ag	3E+3	8E+3	3E-6	1E-8		4E-5
	4E-4							
		W, see ^{102}Ag	-	1E+4	4E-6	1E-8		-
	-							
		Y, see ^{102}Ag	-	9E+3	4E-6	1E-8		-
	-							
47	Silver-115[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	-
	-						
48	Cadmium-113m	D, see ^{104}Cd	2E+1	2E+0	1E-9	-	-
	-		Kidneys (4E+1)	Kidneys (4E+0)	-	5E-12	5E-7
	5E-6						
		W, see ^{104}Cd	-	8E+0	4E-9	-	-
	-		-	Kidneys (1E+1)	-	2E-11	-
	-						
		Y, see ^{104}Cd	-	1E+1	5E-9	2E-11	-
	-						
48	Cadmium-113	D, see ^{104}Cd	2E+1	2E+0	9E-10	-	-
	-		Kidneys (3E+1)	Kidneys (3E+0)	-	5E-12	4E-7
	4E-6						
		W, see ^{104}Cd	-	8E+0	3E-9	-	-
	-		-	Kidneys (1E+1)	-	2E-11	-
	-						
		Y, see ^{104}Cd	-	1E+1	6E-9	2E-11	-
	-						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
48	Cadmium-115m	D, see ^{104}Cd	3E+2	5E+1	2E-8	-		4E-6
	4E-5							
				Kidneys				
			-	(8E+1)	-	1E-10		-
	-							
		W, see ^{104}Cd	-	1E+2	5E-8	2E-10		-
	-							
		Y, see ^{104}Cd	-	1E+2	6E-8	2E-10		-
	-							
48	Cadmium-115	D, see ^{104}Cd	9E+2	1E+3	6E-7	2E-9		-
	-							
			LLI wall					
			(1E+3)	-	-	-		1E-5
	1E-4							
		W, see ^{104}Cd	-	1E+3	5E-7	2E-9		-
	-							
		Y, see ^{104}Cd	-	1E+3	6E-7	2E-9		-
	-							
48	Cadmium-117m	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8		6E-5
	6E-4							
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8		-
	-							
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8		-
	-							
48	Cadmium-117	D, see ^{104}Cd	5E+3	1E+4	5E-6	2E-8		6E-5
	6E-4							
		W, see ^{104}Cd	-	2E+4	7E-6	2E-8		-
	-							
		Y, see ^{104}Cd	-	1E+4	6E-6	2E-8		-
	-							
49	Indium-109	D, all compounds except those given for W	2E+4	4E+4	2E-5	6E-8		3E-4
	3E-3							
		W, oxides, hydroxides, halides, and nitrates	-	6E+4	3E-5	9E-8		-
	-							
49	Indium-110[2]	D, see ^{109}In	2E+4	4E+4	2E-5	6E-8		2E-4
	2E-3							
	(69.1 min)	W, see ^{109}In	-	6E+4	2E-5	8E-8		-
	-							
49	Indium-110	D, see ^{109}In	5E+3	2E+4	7E-6	2E-8		7E-5
	7E-4							
	(4.9 h)	W, see ^{109}In	-	2E+4	8E-6	3E-8		-
	-							

49	Indium-111	D, see ^{109}In	4E+3	6E+3	3E-6	9E-9	6E-5
6E-4							
		W, see ^{109}In	-	6E+3	3E-6	9E-9	-
-							
49	Indium-112[2]	D, see ^{109}In	2E+5	6E+5	3E-4	9E-7	2E-3
2E-2							
	-	W, see ^{109}In	-	7E+5	3E-4	1E-6	-
-							
49	Indium-113m[2]	D, see ^{109}In	5E+4	1E+5	6E-5	2E-7	7E-4
7E-3							
	-	W, see ^{109}In	-	2E+5	8E-5	3E-7	-
-							
49	Indium-114m	D, see ^{109}In	3E+2	6E+1	3E-8	9E-11	-
-							
			LLI wall (4E+2)	-	-	-	5E-6
5E-5							
		W, see ^{109}In	-	1E+2	4E-8	1E-10	-
-							
49	Indium-115m	D, see ^{109}In	1E+4	4E+4	2E-5	6E-8	2E-4
2E-3							
	-	W, see ^{109}In	-	5E+4	2E-5	7E-8	-
-							
49	Indium-115	D, see ^{109}In	4E+1	1E+0	6E-10	2E-12	5E-7
5E-6							
	-	W, see ^{109}In	-	5E+0	2E-9	8E-12	-
-							
49	Indium-116m[2]	D, see ^{109}In	2E+4	8E+4	3E-5	1E-7	3E-4
3E-3							
		W, see ^{109}In	-	1E+5	5E-5	2E-7	-
-							
49	Indium-117m[2]	D, see ^{109}In	1E+4	3E+4	1E-5	5E-8	2E-4
2E-3							
	-	W, see ^{109}In	-	4E+4	2E-5	6E-8	-
-							
49	Indium-117[2]	D, see ^{109}In	6E+4	2E+5	7E-5	2E-7	8E-4
8E-3							
		W, see ^{109}In	-	2E+5	9E-5	3E-7	-
-							

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly Average		Oral Ingestion		Inhalation			
	Water	Radionuclide	Class	ALI		ALI	DAC	Air
	(μCi/ml)		Concentration (μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
49	Indium-119m[2]	D, see ^{109}In	4E+4	1E+5	5E-5	2E-7		-
	-		St wall (5E+4)	-	-	-		7E-4
	7E-3	W, see ^{109}In	-	1E+5	6E-5	2E-7		-
	-							
50	Tin-110	D, all compounds except those given for W	4E+3	1E+4	5E-6	2E-8		5E-5
	5E-4	W, sulfides, oxides, hydroxides, halides, nitrates, and stannic phosphate	-	1E+4	5E-6	2E-8		-
	-							
50	Tin-111[2]	D, see ^{110}Sn	7E+4	2E+5	9E-5	3E-7		1E-3
	1E-2	W, see ^{110}Sn	-	3E+5	1E-4	4E-7		-
	-							
50	Tin-113	D, see ^{110}Sn	2E+3	1E+3	5E-7	2E-9		-
	-		LLI wall (2E+3)	-	-	-		3E-5
	3E-4	W, see ^{110}Sn	-	5E+2	2E-7	8E-10		-
	-							
50	Tin-117m	D, see ^{110}Sn	2E+3	1E+3	5E-7	-		-
	-		LLI wall (2E+3)	Bone surf (2E+3)	-	3E-9		3E-5
	3E-4	W, see ^{110}Sn	-	1E+3	6E-7	2E-9		-
	-							
50	Tin-119m	D, see ^{110}Sn	3E+3	2E+3	1E-6	3E-9		-
	-		LLI wall (4E+3)	-	-	-		6E-5
	6E-4	W, see ^{110}Sn	-	1E+3	4E-7	1E-9		-
	-							
50	Tin-121m	D, see ^{110}Sn	3E+3	9E+2	4E-7	1E-9		-
	-		LLI wall (4E+3)	-	-	-		5E-5
	5E-4							

		W, see ^{110}Sn	-	5E+2	2E-7	8E-10	-
	-						
50	Tin-121	D, see ^{110}Sn	6E+3	2E+4	6E-6	2E-8	-
	-						
			LLI wall (6E+3)	-	-	-	8E-5
	8E-4						
		W, see ^{110}Sn	-	1E+4	5E-6	2E-8	-
	-						
50	Tin-123m^2	D, see ^{110}Sn	5E+4	1E+5	5E-5	2E-7	7E-4
	7E-3						
		W, see ^{110}Sn	-	1E+5	6E-5	2E-7	-
	-						
50	Tin-123	D, see ^{110}Sn	5E+2	6E+2	3E-7	9E-10	-
	-						
			LLI wall (6E+2)	-	-	-	9E-6
	9E-5						
		W, see ^{110}Sn	-	2E+2	7E-8	2E-10	-
	-						
50	Tin-125	D, see ^{110}Sn	4E+2	9E+2	4E-7	1E-9	-
	-						
			LLI wall (5E+2)	-	-	-	6E-6
	6E-5						
		W, see ^{110}Sn	-	4E+2	1E-7	5E-10	-
	-						
50	Tin-126	D, see ^{110}Sn	3E+2	6E+1	2E-8	8E-11	4E-6
	4E-5						
		W, see ^{110}Sn	-	7E+1	3E-8	9E-11	-
	-						
50	Tin-127	D, see ^{110}Sn	7E+3	2E+4	8E-6	3E-8	9E-5
	9E-4						
		W, see ^{110}Sn	-	2E+4	8E-6	3E-8	-
	-						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
50	Tin-128[2]	D, see ^{110}Sn	9E+3	3E+4	1E-5	4E-8		1E-4
	1E-3	W, see ^{110}Sn	-	4E+4	1E-5	5E-8		-
	-							
51	Antimony-115[2]	D, all compounds except those given for W	8E+4	2E+5	1E-4	3E-7		1E-3
	1E-2	W, oxides, hydroxides, halides, sulfides, sulfates, and nitrates	-	3E+5	1E-4	4E-7		-
	-							
51	Antimony-116m[2]	D, see ^{115}Sb	2E+4	7E+4	3E-5	1E-7		3E-4
	3E-3	W, see ^{115}Sb	-	1E+5	6E-5	2E-7		-
	-							
51	Antimony-116[2]	D, see ^{115}Sb	7E+4	3E+5	1E-4	4E-7		-
	-		St wall (9E+4)	-	-	-		1E-3
	1E-2	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]	D, see ^{115}Sb	1E+5	4E+5	2E-4	6E-7		-
	-		St wall (2E+5)	-	-	-		2E-3
	(16 min)							
	2E-2	W, see ^{115}Sb	-	5E+5	2E-4	7E-7		-
	-							
51	Antimony-120	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		-
	(5.76 d)							
	-							

51	Antimony-122	D, see ^{115}Sb	8E+2	2E+3	1E-6	3E-9	-
	-		LLI wall (8E+2)	-	-	-	1E-5
	1E-4						
		W, see ^{115}Sb	7E+2	1E+3	4E-7	2E-9	-
	-						
51	Antimony-124m^{2}	D, see ^{115}Sb	3E+5	8E+5	4E-4	1E-6	3E-3
	3E-2						
		W, see ^{115}Sb	2E+5	6E+5	2E-4	8E-7	-
	-						
51	Antimony-124	D, see ^{115}Sb	6E+2	9E+2	4E-7	1E-9	7E-6
	7E-5						
		W, see ^{115}Sb	5E+2	2E+2	1E-7	3E-10	-
	-						
51	Antimony-125	D, see ^{115}Sb	2E+3	2E+3	1E-6	3E-9	3E-5
	3E-4						
		W, see ^{115}Sb	-	5E+2	2E-7	7E-10	-
	-						
51	Antimony-126m^{2}	D, see ^{115}Sb	5E+4	2E+5	8E-5	3E-7	-
	-		St wall (7E+4)	-	-	-	9E-4
	9E-3						
		W, see ^{115}Sb	-	2E+5	8E-5	3E-7	-
	-						
51	Antimony-126	D, see ^{115}Sb	6E+2	1E+3	5E-7	2E-9	7E-6
	7E-5						
		W, see ^{115}Sb	5E+2	5E+2	2E-7	7E-10	-
	-						
51	Antimony-127	D, see ^{115}Sb	8E+2	2E+3	9E-7	3E-9	-
	-		LLI wall (8E+2)	-	-	-	1E-5
	1E-4						
		W, see ^{115}Sb	7E+2	9E+2	4E-7	1E-9	-
	-						

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

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col. 1
	Monthly		Oral				
			Ingestion		Inhalation		
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration					
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
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	4E+2	2E-7	-		-
	-							
			Thyroid	Thyroid				
			(6E+2)	(1E+3)	-	2E-9		8E-6
	8E-5							
		W, see ^{116}Te	-	4E+2	2E-7	-		-
	-							
				Thyroid				
			-	(9E+2)	-	1E-9		-
	-							
52	Tellurium-131[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-		-
	-							
			Thyroid	Thyroid				
			(6E+3)	(1E+4)	-	2E-8		8E-5
	8E-4							
		W, see ^{116}Te	-	5E+3	2E-6	-		-
	-							
				Thyroid				
			-	(1E+4)	-	2E-8		-
	-							
52	Tellurium-132	D, see ^{116}Te	2E+2	2E+2	9E-8	-		-
	-							
			Thyroid	Thyroid				
			(7E+2)	(8E+2)	-	1E-9		9E-6
	9E-5							
		W, see ^{116}Te	-	2E+2	9E-8	-		-
	-							
				Thyroid				
			-	(6E+2)	-	9E-10		-
	-							
52	Tellurium-133m[2]	D, see ^{116}Te	3E+3	5E+3	2E-6	-		-
	-							
			Thyroid	Thyroid				
			(6E+3)	(1E+4)	-	2E-8		9E-5
	9E-4							

		W, see ^{116}Te	-	5E+3	2E-6	-	-
	-						
			-	Thyroid (1E+4)	-	2E-8	-
	-						
52	Tellurium-133[2]	D, see ^{116}Te	1E+4	2E+4	9E-6	-	-
	-						
			Thyroid (3E+4)	Thyroid (6E+4)	-	8E-8	4E-4
	4E-3						
		W, see ^{116}Te	-	2E+4	9E-6	-	-
	-						
			-	Thyroid (6E+4)	-	8E-8	-
	-						
52	Tellurium-134[2]	D, see ^{116}Te	2E+4	2E+4	1E-5	-	-
	-						
			Thyroid (2E+4)	Thyroid (5E+4)	-	7E-8	3E-4
	3E-3						
		W, see ^{116}Te	-	2E+4	1E-5	-	-
	-						
			-	Thyroid (5E+4)	-	7E-8	-
	-						
53	Iodine-120m[2]	D, all compounds	1E+4	2E+4	9E-6	3E-8	-
	-						
			Thyroid (1E+4)	-	-	-	2E-4
	2E-3						
53	Iodine-120[2]	D, all compounds	4E+3	9E+3	4E-6	-	-
	-						
			Thyroid (8E+3)	Thyroid (1E+4)	-	2E-8	1E-4
	1E-3						

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
			Col. 1	Col. 2	Col.3	Col.	1
	Col. 2 Monthly		Oral Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	ALI Concentration (μCi)	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
53	Iodine-121	D, all compounds	1E+4	2E+4	8E-6	-		-
	4E-3		Thyroid (3E+4)	Thyroid (5E+4)	-	7E-8		4E-4
53	Iodine-123	D, all compounds	3E+3	6E+3	3E-6	-		-
	1E-3		Thyroid (1E+4)	Thyroid (2E+4)	-	2E-8		1E-4
53	Iodine-124	D, all compounds	5E+1	8E+1	3E-8	-		-
	2E-5		Thyroid (2E+2)	Thyroid (3E+2)	-	4E-10		2E-6
53	Iodine-125	D, all compounds	4E+1	6E+1	3E-8	-		-
	2E-5		Thyroid (1E+2)	Thyroid (2E+2)	-	3E-10		2E-6
53	Iodine-126	D, all compounds	2E+1	4E+1	1E-8	-		-
	1E-5		Thyroid (7E+1)	Thyroid (1E+2)	-	2E-10		1E-6
53	Iodine-128[2]	D, all compounds	4E+4	1E+5	5E-5	2E-7		-
	8E-3		St wall (6E+4)	-	-	-		8E-4
53	Iodine-129	D, all compounds	5E+0	9E+0	4E-9	-		-
	2E-6		Thyroid (2E+1)	Thyroid (3E+1)	-	4E-11		2E-7
53	Iodine-130	D, all compounds	4E+2	7E+2	3E-7	-		-
	2E-4		Thyroid (1E+3)	Thyroid (2E+3)	-	3E-9		2E-5
53	Iodine-131	D, all compounds	3E+1	5E+1	2E-8	-		-
	1E-5		Thyroid (9E+1)	Thyroid (2E+2)	-	2E-10		1E-6

53	Iodine-132m[2]	D, all compounds	4E+3	8E+3	4E-6	-	-
	-		Thyroid (1E+4)	Thyroid (2E+4)	-	3E-8	1E-4
	1E-3						
53	Iodine-132	D, all compounds	4E+3	8E+3	3E-6	-	-
	-		Thyroid (9E+3)	Thyroid (1E+4)	-	2E-8	1E-4
	1E-3						
53	Iodine-133	D, all compounds	1E+2	3E+2	1E-7	-	-
	-		Thyroid (5E+2)	Thyroid (9E+2)	-	1E-9	7E-6
	7E-5						
53	Iodine-134[2]	D, all compounds	2E+4	5E+4	2E-5	6E-8	-
	-		Thyroid (3E+4)	-	-	-	4E-4
	4E-3						
53	Iodine-135	D, all compounds	8E+2	2E+3	7E-7	-	-
	-		Thyroid (3E+3)	Thyroid (4E+3)	-	6E-9	3E-5
	3E-4						
54	Xenon-120[2]	Submersion[1]	-	-	1E-5	4E-8	-
	-						
54	Xenon-121[2]	Submersion[1]	-	-	2E-6	1E-8	-
	-						
54	Xenon-122	Submersion[1]	-	-	7E-5	3E-7	-
	-						
54	Xenon-123	Submersion[1]	-	-	6E-6	3E-8	-
	-						
54	Xenon-125	Submersion[1]	-	-	2E-5	7E-8	-
	-						
54	Xenon-127	Submersion[1]	-	-	1E-5	6E-8	-
	-						
54	Xenon-129m	Submersion[1]	-	-	2E-4	9E-7	-
	-						

Occupational Values			Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
54	Xenon-131m -	Submersion[1]	-	-	4E-4	2E-6		-
54	Xenon-133m -	Submersion[1]	-	-	1E-4	6E-7		-
54	Xenon-133 -	Submersion[1]	-	-	1E-4	5E-7		-
54	Xenon-135m[2] -	Submersion[1]	-	-	9E-6	4E-8		-
54	Xenon-135 -	Submersion[1]	-	-	1E-5	7E-8		-
54	Xenon-138[2] -	Submersion[1]	-	-	4E-6	2E-8		-
55	Cesium-125[2] -	D, all compounds	5E+4	1E+5	6E-5	2E-7		-
	1E-2		St wall (9E+4)	-	-	-		1E-3
55	Cesium-127 9E-3	D, all compounds	6E+4	9E+4	4E-5	1E-7		9E-4
55	Cesium-129 3E-3	D, all compounds	2E+4	3E+4	1E-5	5E-8		3E-4
55	Cesium-130[2] -	D, all compounds	6E+4	2E+5	8E-5	3E-7		-
	1E-2		St wall (1E+5)	-	-	-		1E-3
55	Cesium-131 3E-3	D, all compounds	2E+4	3E+4	1E-5	4E-8		3E-4
55	Cesium-132 4E-4	D, all compounds	3E+3	4E+3	2E-6	6E-9		4E-5
55	Cesium-134m -	D, all compounds	1E+5	1E+5	6E-5	2E-7		-
	2E-2		St wall (1E+5)	-	-	-		2E-3
55	Cesium-134 9E-6	D, all compounds	7E+1	1E+2	4E-8	2E-10		9E-7
55	Cesium-135m[2] 1E-2	D, all compounds	1E+5	2E+5	8E-5	3E-7		1E-3
55	Cesium-135 1E-4	D, all compounds	7E+2	1E+3	5E-7	2E-9		1E-5
55	Cesium-136 6E-5	D, all compounds	4E+2	7E+2	3E-7	9E-10		6E-6
55	Cesium-137 1E-5	D, all compounds	1E+2	2E+2	6E-8	2E-10		1E-6

55	Cesium-138[2]	D, all compounds	2E+4	6E+4	2E-5	8E-8	-
	-						
			St wall (3E+4)	-	-	-	4E-4
	4E-3						
56	Barium-126[2]	D, all compounds	6E+3	2E+4	6E-6	2E-8	8E-5
	8E-4						
56	Barium-128	D, all compounds	5E+2	2E+3	7E-7	2E-9	7E-6
	7E-5						
56	Barium-131m[2]	D, all compounds	4E+5	1E+6	6E-4	2E-6	-
	-						
			St wall (5E+5)	-	-	-	7E-3
	7E-2						
56	Barium-131	D, all compounds	3E+3	8E+3	3E-6	1E-8	4E-5
	4E-4						
56	Barium-133m	D, all compounds	2E+3	9E+3	4E-6	1E-8	-
	-						
			LLI wall (3E+3)	-	-	-	4E-5
	4E-4						
56	Barium-133	D, all compounds	2E+3	7E+2	3E-7	9E-10	2E-5
	2E-4						
56	Barium-135m	D, all compounds	3E+3	1E+4	5E-6	2E-8	4E-5
	4E-4						
56	Barium-139[2]	D, all compounds	1E+4	3E+4	1E-5	4E-8	2E-4
	2E-3						
56	Barium-140	D, all compounds	5E+2	1E+3	6E-7	2E-9	-
	-						
			LLI wall (6E+2)	-	-	-	8E-6
	8E-5						
56	Barium-141[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4
	3E-3						
56	Barium-142[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4
	7E-3						
57	Lanthanum-131[2]	D, all compounds except those given for W	5E+4	1E+5	5E-5	2E-7	6E-4
	6E-3						
		W, oxides and hydroxides	-	2E+5	7E-5	2E-7	-
	-						

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col. 1
	Monthly		Oral Ingestion		Inhalation		
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	ALI Concentration (μCi)	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
57	Lanthanum-132	D, see ^{131}La	3E+3	1E+4	4E-6	1E-8		4E-5
	4E-4							
		W, see ^{131}La	-	1E+4	5E-6	2E-8		-
	-							
57	Lanthanum-135	D, see ^{131}La	4E+4	1E+5	4E-5	1E-7		5E-4
	5E-3							
		W, see ^{131}La	-	9E+4	4E-5	1E-7		-
	-							
57	Lanthanum-137	D, see ^{131}La	1E+4	6E+1	3E-8	-		2E-4
	2E-3							
				Liver				
			-	(7E+1)	-	1E-10		-
	-							
		W, see ^{131}La	-	3E+2	1E-7	-		-
	-							
				Liver				
			-	(3E+2)	-	4E-10		-
	-							
57	Lanthanum-138	D, see ^{131}La	9E+2	4E+0	1E-9	5E-12		1E-5
	1E-4							
		W, see ^{131}La	-	1E+1	6E-9	2E-11		-
	-							
57	Lanthanum-140	D, see ^{131}La	6E+2	1E+3	6E-7	2E-9		9E-6
	9E-5							
		W, see ^{131}La	-	1E+3	5E-7	2E-9		-
	-							
57	Lanthanum-141	D, see ^{131}La	4E+3	9E+3	4E-6	1E-8		5E-5
	5E-4							
		W, see ^{131}La	-	1E+4	5E-6	2E-8		-
	-							
57	Lanthanum-142[2]	D, see ^{131}La	8E+3	2E+4	9E-6	3E-8		1E-4
	1E-3							
		W, see ^{131}La	-	3E+4	1E-5	5E-8		-
	-							
57	Lanthanum-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		-
	-							
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		-
	-							

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

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

61	Promethium-146	W, see ^{141}Pm	2E+3	5E+1	2E-8	7E-11	2E-5
2E-4							
		Y see ^{141}Pm	-	4E+1	2E-8	6E-11	-
-							
61	Promethium-147	W see ^{141}Pm	4E+3	1E+2	5E-8	-	-
-							
			LLI wall (5E+3)	Bone surf (2E+2)	-	3E-10	7E-5
7E-4							
		Y, see ^{141}Pm	-	1E+2	6E-8	2E-10	-
-							
61	Promethium-148m	W, see ^{141}Pm	7E+2	3E+2	1E-7	4E-10	1E-5
1E-4							
		Y, see ^{141}Pm	-	3E+2	1E-7	5E-10	-
-							
61	Promethium-148	W, see ^{141}Pm	4E+2	5E+2	2E-7	8E-10	-
-							
			LLI wall (5E+2)	-	-	-	7E-6
7E-5							
		Y, see ^{141}Pm	-	5E+2	2E-7	7E-10	-
-							
0			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							

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col. 1
	Monthly		Oral				
			Ingestion		Inhalation		
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
62	Samarium-141[2] - 8E-3	W, all compounds	5E+4 St wall (6E+4)	2E+5 -	8E-5 -	2E-7 -		- 8E-4
62	Samarium-142[2] 1E-3	W, all compounds	8E+3	3E+4	1E-5	4E-8		1E-4
62	Samarium-145 8E-4	W, all compounds	6E+3	5E+2	2E-7	7E-10		8E-5
62	Samarium-146 - 3E-6	W, all compounds	1E+1 Bone surf (3E+1)	4E2 Bone surf (6E-2)	1E-11 -	- 9E-14		- 3E-7
62	Samarium-147 - 4E-6	W, all compounds	2E+1 Bone surf (3E+1)	4E2 Bone surf (7E-2)	2E-11 -	- 1E-13		- 4E-7
62	Samarium-151 - 2E-3	W, all compounds	1E+4 LLI wall (1E+4)	1E+2 Bone surf (2E+2)	4E-8 -	- 2E-10		- 2E-4
62	Samarium-153 - 3E-4	W, all compounds	2E+3 LLI wall (2E+3)	3E+3 -	1E-6 -	4E-9 -		- 3E-5
62	Samarium-155[2] - 1E-2	W, all compounds	6E+4 St wall (8E+4)	2E+5 -	9E-5 -	3E-7 -		- 1E-3
62	Samarium-156 7E-4	W, all compounds	5E+3	9E+3	4E-6	1E-8		7E-5
63	Europium-145 2E-4	W, all compounds	2E+3	2E+3	8E-7	3E-9		2E-5
63	Europium-146 1E-4	W, all compounds	1E+3	1E+3	5E-7	2E-9		1E-5
63	Europium-147 4E-4	W, all compounds	3E+3	2E+3	7E-7	2E-9		4E-5
63	Europium-148 1E-4	W, all compounds	1E+3	4E+2	1E-7	5E-10		1E-5

63	Europium-149	W, all compounds	1E+4	3E+3	1E-6	4E-9	2E-4
2E-3							
63	Europium-150	W, all compounds	3E+3	8E+3	4E-6	1E-8	4E-5
4E-4							
	(12.62 h)						
63	Europium-150	W, all compounds	8E+2	2E+1	8E-9	3E-11	1E-5
1E-4							
	(34.2 y)						
63	Europium-152m	W, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5
4E-4							
63	Europium-152	W, all compounds	8E+2	2E+1	1E-8	3E-11	1E-5
1E-4							
63	Europium-154	W, all compounds	5E+2	2E+1	8E-9	3E-11	7E-6
7E-5							
63	Europium-155	W, all compounds	4E+3	9E+1	4E-8	-	5E-5
5E-4							
				Bone surf			
			-	(1E+2)	-	2E-10	-
-							
63	Europium-156	W, all compounds	6E+2	5E+2	2E-7	6E-10	8E-6
8E-5							
63	Europium-157	W, all compounds	2E+3	5E+3	2E-6	7E-9	3E-5
3E-4							
63	Europium-158[2]	W, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4
3E-3							
64	Gadolinium-145[2]	D, all compounds except					
		those given for W	5E+4	2E+5	6E-5	2E-7	-
-							
			St wall				
			(5E+4)	-	-	-	6E-4
6E-3							
		W, oxides, hydroxides,					
		and fluorides	-	2E+5	7E-5	2E-7	-
-							
64	Gadolinium-146	D, see ^{145}Gd	1E+3	1E+2	5E-8	2E-10	2E-5
2E-4							
		W, see ^{145}Gd	-	3E+2	1E-7	4E-10	-
-							
64	Gadolinium-147	D, see ^{145}Gd	2E+3	4E+3	2E-6	6E-9	3E-5
3E-4							
		W, see ^{145}Gd	-	4E+3	1E-6	5E-9	-
-							

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
			Col. 1	Col. 2	Col.3	Col.	1
	Col. 2		Oral				
	Monthly		Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
64	Gadolinium-148	D, see ^{145}Gd	1E+1	8E+3	3E-12	-	-
	-		Bone surf (2E+1)	Bone surf (2E+2)	-	2E-14	3E-7
	3E-6	W, see ^{145}Gd	-	3E-2	1E-11	-	-
	-		-	Bone surf (6E-2)	-	8E-14	-
	-						
64	Gadolinium-149	D, see ^{145}Gd	3E+3	2E+3	9E-7	3E-9	4E-5
	4E-4	W, see ^{145}Gd	-	2E+3	1E-6	3E-9	-
	-						
64	Gadolinium-151	D, see ^{145}Gd	6E+3	4E+2	2E-7	-	9E-5
	9E-4		-	Bone surf (6E+2)	-	9E-10	-
	-	W, see ^{145}Gd	-	1E+3	5E-7	2E-9	-
	-						
64	Gadolinium-152	D, see ^{145}Gd	2E+1	1E-2	4E-12	-	-
	-		Bone surf (3E+1)	Bone surf (2E-2)	-	3E-14	4E-7
	4E-6	W, see ^{145}Gd	-	4E-2	2E-11	-	-
	-		-	Bone surf (8E-2)	-	1E-13	-
	-						
64	Gadolinium-153	D, see ^{145}Gd	5E+3	1E+2	6E-8	-	6E-5
	6E-4		-	Bone surf (2E+2)	-	3E-10	-
	-	W, see ^{145}Gd	-	6E+2	2E-7	8E-10	-
	-						
64	Gadolinium-159	D, see ^{145}Gd	3E+3	8E+3	3E-6	1E-8	4E-5
	4E-4	W, see ^{145}Gd	-	6E+3	2E-6	8E-9	-
	-						
65	Terbium-147[2]	W, all compounds	9E+3	3E+4	1E-5	5E-8	1E-4
	1E-3						

65	Terbium-149	W, all compounds	5E+3	7E+2	3E-7	1E-9	7E-5
7E-4							
65	Terbium-150	W, all compounds	5E+3	2E+4	9E-6	3E-8	7E-5
7E-4							
65	Terbium-151	W, all compounds	4E+3	9E+3	4E-6	1E-8	5E-5
5E-4							
65	Terbium-153	W, all compounds	5E+3	7E+3	3E-6	1E-8	7E-5
7E-4							
65	Terbium-154	W, all compounds	2E+3	4E+3	2E-6	6E-9	2E-5
2E-4							
65	Terbium-155	W, all compounds	6E+3	8E+3	3E-6	1E-8	8E-5
8E-4							
65	Terbium-156m	W, all compounds	2E+4	3E+4	1E-5	4E-8	2E-4
2E-3							
(5.0 h)							
65	Terbium-156m	W, all compounds	7E+3	8E+3	3E-6	1E-8	1E-4
1E-3							
(24.4 h)							
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	Bone surf			
			(5E+4)	(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							

Occupational Values			Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
66	Dysprosium-166	W, all compounds	6E+2	7E+2	3E-7	1E-9		-
			LLI wall (8E+2)	-	-	-		1E-5
	1E-4							
67	Holmium-155[2]	W, all compounds	4E+4	2E+5	6E-5	2E-7		6E-4
	6E-3							
67	Holmium-157[2]	W, all compounds	3E+5	1E+6	6E-4	2E-6		4E-3
	4E-2							
67	Holmium-159[2]	W, all compounds	2E+5	1E+6	4E-4	1E-6		3E-3
	3E-2							
67	Holmium-161	W, all compounds	1E+5	4E+5	2E-4	6E-7		1E-3
	1E-2							
67	Holmium-162m[2]	W, all compounds	5E+4	3E+5	1E-4	4E-7		7E-4
	7E-3							
67	Holmium-162[2]	W, all compounds	5E+5	2E+6	1E-3	3E-6		-
			St wall (8E+5)	-	-	-		1E-2
	1E-1							
67	Holmium-164m[2]	W, all compounds	1E+5	3E+5	1E-4	4E-7		1E-3
	1E-2							
67	Holmium-164[2]	W, all compounds	2E+5	6E+5	3E-4	9E-7		-
			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 (E+3)	-	-	-	2E-5
	2E-4						
69	Thulium-162[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-
	-						
			St wall (7E+4)	-	-	-	1E-3
	1E-2						
69	Thulium-166	W, all compounds	4E+3	1E+4	6E-6	2E-8	6E-5
	6E-4						
69	Thulium-167	W, all compounds	2E+3	2E+3	8E-7	3E-9	-
	-						
			LLI wall (2E+3)	-	-	-	3E-5
	3E-4						
69	Thulium-170	W, all compounds	8E+2	2E+2	9E-8	3E-10	-
	-						
			LLI wall (1E+3)	-	-	-	1E-5
	1E-4						
69	Thulium-171	W, all compounds	1E+4	3E+2	1E-7	-	-
	-						
			LLI wall (1E+4)	Bone surf (6E+2)	-	8E-10	2E-4
	2E-3						
69	Thulium-172	W, all compounds	7E+2	1E+3	5E-7	2E-9	-
	-						
			LLI wall (8E+2)	-	-	-	1E-5
	1E-4						
69	Thulium-173	W, all compounds	4E+3	1E+4	5E-6	2E-8	6E-5
	6E-4						
69	Thulium-175[2]	W, all compounds	7E+4	3E+5	1E-4	4E-7	-
	-						
			St wall (9E+4)	-	-	-	1E-3
	1E-2						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class	ALI		ALI	DAC	Air
			Concentration (μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
70	Ytterbium-162[2]	W, all compounds except those given for Y	7E+4	3E+5	1E-4	4E-7		1E-3
	1E-2							
		Y, oxides, hydroxides, and fluorides	-	3E+5	1E-4	4E-7		-
	-							
70	Ytterbium-166	W, see ^{162}Yb	1E+3	2E+3	8E-7	3E-9		2E-5
	2E-4							
		Y, see ^{162}Yb	-	2E+3	8E-7	3E-9		-
	-							
70	Ytterbium-167[2]	W, see ^{162}Yb	3E+5	8E+5	3E-4	1E-6		4E-3
	4E-2							
		Y, see ^{162}Yb	-	7E+5	3E-4	1E-6		-
	-							
70	Ytterbium-169	W, see ^{162}Yb	2E+3	8E+2	4E-7	1E-9		2E-5
	2E-4							
		Y, see ^{162}Yb	-	7E+2	3E-7	1E-9		-
	-							
70	Ytterbium-175	W, see ^{162}Yb	3E+3	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	1E-7	-	7E-5
	7E-4						
			-	Bone surf (5E+2)	-	6E-10	-
	-						
		Y, see ^{169}Lu	-	3E+2	1E-7	4E-10	-
	-						
71	Lutetium-174m	W, see ^{169}Lu	2E+3	2E+2	1E-7	-	-
	-						
			LLI wall (3E+3)	Bone surf (3E+2)	-	5E-10	4E-5
	4E-4						
		Y, see ^{169}Lu	-	2E+2	9E-8	3E-10	-
	-						
71	Lutetium-174	W, see ^{169}Lu	5E+3	1E+2	5E-8	-	7E-5
	7E-4						
			-	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-1	-
	-						

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

			-	Bone surf (6E+1)	-	8E-11	-
72	Hafnium-173	D, see ^{170}Hf	5E+3	1E+4	5E-6	2E-8	7E-5
		W, see ^{170}Hf	-	1E+4	5E-6	2E-8	-
72	Hafnium-175	D, see ^{170}Hf	3E+3	9E+2	4E-7	-	4E-5
			-	Bone surf (1E+3)	-	1E-9	-
		W, see ^{170}Hf	-	1E+3	5E-7	2E-9	-
72	Hafnium-177m[2]	D, see ^{170}Hf	2E+4	6E+4	2E-5	8E-8	3E-4
		W, see ^{170}Hf	-	9E+4	4E-5	1E-7	-
72	Hafnium-178m	D, see ^{170}Hf	3E+2	1E+0	5E-10	-	3E-6
			-	Bone surf (2E+0)	-	3E-12	-
		W, see ^{170}Hf	-	5E+0	2E-9	-	-
			-	Bone surf (9E+0)	-	1E-11	-
72	Hafnium-179m	D, see ^{170}Hf	1E+3	3E+2	1E-7	-	1E-5
			-	Bone surf (6E+2)	-	8E-10	-
		W, see ^{170}Hf	-	6E+2	3E-7	8E-10	-

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

		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
		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
		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
		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
		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
		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
		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
		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
		Y, see ^{172}Ta	-	2E+1	1E-8	3E-11	-

Atomic No.	Occupational Values Col. 2 Monthly Water (μCi/ml)	Average Radionuclide	Table I Table III Effluent Concentrations Col. 1 Oral Ingestion Class Concentration (μCi)	ALI	Col. 2 Inhalation (μCi)	Table II Releases to Sewers Col.3 ALI (μCi/ml)	Col. DAC (μCi/ml)	1 Air (μCi/ml)
73	Tantalum-182m[2] -	W, see [172]Ta	2E+5	5E+5	2E-4	8E-7		-
			St wall (2E+5)	-	-	-		3E-3
	3E-2							
		Y, see [172]Ta	-	4E+5	2E-4	6E-7		-
	-							
73	Tantalum-182 1E-4	W, see [172]Ta	8E+2	3E+2	1E-7	5E-10		1E-5
		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 3E-4	W, see [172]Ta	2E+3	5E+3	2E-6	8E-9		3E-5
		Y, see [172]Ta	-	5E+3	2E-6	7E-9		-
	-							
73	Tantalum-185[2] 4E-3	W, see [172]Ta	3E+4	7E+4	3E-5	1E-7		4E-4
		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 1E-3	D, all compounds	1E+4	5E+4	2E-5	7E-8		1E-4
74	Tungsten-177 3E-3	D, all compounds	2E+4	9E+4	4E-5	1E-7		3E-4
74	Tungsten-178 7E-4	D, all compounds	5E+3	2E+4	8E-6	3E-8		7E-5
74	Tungsten-179[2] 7E-2	D, all compounds	5E+5	2E+6	7E-4	2E-6		7E-3
74	Tungsten-181 2E-3	D, all compounds	2E+4	3E+4	1E-5	5E-8		2E-4
74	Tungsten-185 -	D, all compounds	2E+3	7E+3	3E-6	9E-9		-

			LLI wall (3E+3)	-	-	-	4E-5
	4E-4						
74	Tungsten-187	D, all compounds	2E+3	9E+3	4E-6	1E-8	3E-5
	3E-4						
74	Tungsten-188	D, all compounds	4E+2	1E+3	5E-7	2E-9	-
	-						
			LLI wall (5E+2)	-	-	-	7E-6
	7E-5						
75	Rhenium-177[2]	D, all compounds except those given for W	9E+4	3E+5	1E-4	4E-7	-
	-						
			St wall (1E+5)	-	-	-	2E-3
	2E-2						
		W, oxides, hydroxides, and nitrates	-	4E+5	1E-4	5E-7	-
	-						
75	Rhenium-178[2]	D, see ^{177}Re	7E+4	3E+5	1E-4	4E-7	-
	-						
			St wall (1E+5)	-	-	-	1E-3
	1E-2						
		W, see ^{177}Re	-	3E+5	1E-4	4E-7	-
	-						
75	Rhenium-181	D, see ^{177}Re	5E+3	9E+3	4E-6	1E-8	7E-5
	7E-4						
		W, see ^{177}Re	-	9E+3	4E-6	1E-8	-
	-						
75	Rhenium-182	D, see ^{177}Re	7E+3	1E+4	5E-6	2E-8	9E-5
	9E-4						
	(12.7 h)	W, see ^{177}Re	-	2E+4	6E-6	2E-8	-
	-						
75	Rhenium-182	D, see ^{177}Re	1E+3	2E+3	1E-6	3E-9	2E-5
	2E-4						
	(64.0 h)	W, see ^{177}Re	-	2E+3	9E-7	3E-9	-
	-						

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

76	Osmium-181[2]	D, see ^{180}Os	1E+4	4E+4	2E-5	6E-8	2E-4
2E-3							
		W, see ^{180}Os	-	5E+4	2E-5	6E-8	-
-							
		Y, see ^{180}Os	-	4E+4	2E-5	6E-8	-
-							
76	Osmium-182	D, see ^{180}Os	2E+3	6E+3	2E-6	8E-9	3E-5
3E-4							
		W, see ^{180}Os	-	4E+3	2E-6	6E-9	-
-							
		Y, see ^{180}Os	-	4E+3	2E-6	6E-9	-
-							
76	Osmium-185	D, see ^{180}Os	2E+3	5E+2	2E-7	7E-10	3E-5
3E-4							
		W, see ^{180}Os	-	8E+2	3E-7	1E-9	-
-							
		Y, see ^{180}Os	-	8E+2	3E-7	1E-9	-
-							
76	Osmium-189m	D, see ^{180}Os	8E+4	2E+5	1E-4	3E-7	1E-3
1E-2							
		W, see ^{180}Os	-	2E+5	9E-5	3E-7	-
-							
		Y, see ^{180}Os	-	2E+5	7E-5	2E-7	-
-							
76	Osmium-191m	D, see ^{180}Os	1E+4	3E+4	1E-5	4E-8	2E-4
2E-3							
		W, see ^{180}Os	-	2E+4	8E-6	3E-8	-
-							
		Y, see ^{180}Os	-	2E+4	7E-6	2E-8	-
-							
76	Osmium-191	D, see ^{180}Os	2E+3	2E+3	9E-7	3E-9	-
-							
			LLI wall (3E+3)	-	-	-	3E-5
3E-4							
		W, see ^{180}Os	-	2E+3	7E-7	2E-9	-
-							
		Y, see ^{180}Os	-	1E+3	6E-7	2E-9	-
-							

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

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

78	Platinum-193m	D, all compounds	3E+3	6E+3	3E-6	8E-9	-
	-						
			LLI wall (3E+4)	-	-	-	4E-5
	4E-4						
78	Platinum-193	D, all compounds	4E+4	2E+4	1E-5	3E-8	-
	-						
			LLI wall (5E+4)	-	-	-	6E-4
	6E-3						
78	Platinum-195m	D, all compounds	2E+3	4E+3	2E-6	6E-9	-
	-						
			LLI wall (2E+3)	-	-	-	3E-5
	3E-4						
78	Platinum-197m[2]	D, all compounds	2E+4	4E+4	2E-5	6E-8	2E-4
	2E-3						
78	Platinum-197	D, all compounds	3E+3	1E+4	4E-6	1E-8	4E-5
	4E-4						
78	Platinum-199[2]	D, all compounds	5E+4	1E+5	6E-5	2E-7	7E-4
	7E-3						
78	Platinum-200	D, all compounds	1E+3	3E+3	1E-6	5E-9	2E-5
	2E-4						
79	Gold-193	D, all compounds except those given for W and Y	9E+3	3E+4	1E-5	4E-8	1E-4
	1E-3						
		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	-
	-						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
	Water	Average Radionuclide	Class Concentration	ALI		ALI	DAC	Air
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml)	(μCi/ml)	(μCi/ml)
79	Gold-198m	D see ^{193}Au	1E+3	3E+3	1E-6	4E-9		1E-5
	1E-4							
		W see ^{193}Au	-	1E+3	5E-7	2E-9		-
	-							
		Y see ^{193}Au	-	1E+3	5E-7	2E-9		-
	-							
79	Gold-198	D see ^{193}Au	1E+3	4E+3	2E-6	5E-9		2E-5
	2E-4							
		W see ^{193}Au	-	2E+3	8E-7	3E-9		-
	-							
		Y see ^{193}Au	-	2E+3	7E-7	2E-9		-
	-							
79	Gold-199	D see ^{193}Au	3E+3	9E+3	4E-6	1E-8		-
	-							
			LLI wall (3E+3)	-	-	-		4E-5
	4E-4							
		W, see ^{193}Au	-	4E+3	2E-6	6E-9		-
	-							
		Y, see ^{193}Au	-	4E+3	2E-6	5E-9		-
	-							
79	Gold-200m	D, see ^{193}Au	1E+3	4E+3	1E-6	5E-9		2E-5
	2E-4							
		W, see ^{193}Au	-	3E+3	1E-6	4E-9		-
	-							
		Y, see ^{193}Au	-	2E+4	1E-6	3E-9		-
	-							
79	Gold-200[2]	D, see ^{193}Au	3E+4	6E+4	3E-5	9E-8		4E-4
	4E-3							
		W, see ^{193}Au	-	8E+4	3E-5	1E-7		-
	-							
		Y, see ^{193}Au	-	7E+4	3E-5	1E-7		-
	-							
79	Gold-201[2]	D, see ^{193}Au	7E+4	2E+5	9E-5	3E-7		-
	-							
			St wall (9E+4)	-	-	-		1E-3
	1E-2							
		W, see ^{193}Au	-	2E+5	1E-4	3E-7		-
	-							
		Y, see ^{193}Au	-	2E+5	9E-5	3E-7		-
	-							
80	Mercury-193m	Vapor	-	8E+3	4E-6	1E-8		-
	-							

		Organic D	4E+3	1E+4	5E-6	2E-8	6E-5
	6E-4						
		D, sulfates	3E+3	9E+3	4E-6	1E-8	4E-5
	4E-4						
		W, oxides, hydroxides, halides, nitrates, and sulfides	-	8E+3	3E-6	1E-8	-
	-						
80	Mercury-193	Vapor	-	3E+4	1E-5	4E-8	-
	-						
		Organic D	2E+4	6E+4	3E-5	9E-8	3E-4
	3E-3						
		D, see ^{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	-
	-						
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	-
	-						

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

81	Thallium-195[2]	D, all compounds	6E+4	1E+5	5E-5	2E-7	9E-4
	9E-3						
81	Thallium-197	D, all compounds	7E+4	1E+5	5E-5	2E-7	1E-3
	1E-2						
81	Thallium-198m[2]	D, all compounds	3E+4	5E+4	2E-5	8E-8	4E-4
	4E-3						
81	Thallium-198	D, all compounds	2E+4	3E+4	1E-5	5E-8	3E-4
	3E-3						
81	Thallium-199	D, all compounds	6E+4	8E+4	4E-5	1E-7	9E-4
	9E-3						
81	Thallium-200	D, all compounds	8E+3	1E+4	5E-6	2E-8	1E-4
	1E-3						
81	Thallium-201	D, all compounds	2E+4	2E+4	9E-6	3E-8	2E-4
	2E-3						
81	Thallium-202	D, all compounds	4E+3	5E+3	2E-6	7E-9	5E-5
	5E-4						
81	Thallium-204	D, all compounds	2E+3	2E+3	9E-7	3E-9	2E-5
	2E-4						
82	Lead-195m[2]	D, all compounds	6E+4	2E+5	8E-5	3E-7	8E-4
	8E-3						
82	Lead-198	D, all compounds	3E+4	6E+4	3E-5	9E-8	4E-4
	4E-3						
82	Lead-199[2]	D, all compounds	2E+4	7E+4	3E-5	1E-7	3E-4
	3E-3						
82	Lead-200	D, all compounds	3E+3	6E+3	3E-6	9E-9	4E-5
	4E-4						
82	Lead-201	D, all compounds	7E+3	2E+4	8E-6	3E-8	1E-4
	1E-3						
82	Lead-202m	D, all compounds	9E+3	3E+4	1E-5	4E-8	1E-4
	1E-3						
82	Lead-202	D, all compounds	1E+2	5E+1	2E-8	7E-11	2E-6
	2E-5						
82	Lead-203	D, all compounds	5E+3	9E+3	4E-6	1E-8	7E-5
	7E-4						
82	Lead-205	D, all compounds	4E+3	1E+3	6E-7	2E-9	5E-5
	5E-4						
82	Lead-209	D, all compounds	2E+4	6E+4	2E-5	8E-8	3E-4
	3E-3						
82	Lead-210	D, all compounds	6E1	2E1	1E-10	-	-
	-						
			Bone surf (1E+0)	Bone surf (4E-1)	-	6E-13	1E-8
	1E-7						
82	Lead-211[2]	D, all compounds	1E+4	6E+2	3E-7	9E-10	2E-4
	2E+3						

Occupational Values			Table I Table III Effluent Concentrations			Table II Releases to Sewers		
	Col. 2		Col. 1		Col. 2	Col.3	Col.	1
	Monthly		Oral					
			Ingestion		Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	ALI Concentration (μCi)	(μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
82	Lead-212 - 2E-5	D, all compounds	8E+1	3E+1	1E-8	5E-11		-
			Bone surf					
			(1E+2)	-	-	-		2E-6
82	Lead-214[2] 1E-3	D, all compounds	9E+3	8E+2	3E-7	1E-9		1E-4
83	Bismuth-200[2] 4E-3	D, nitrates	3E+4	8E+4	4E-5	1E-7		4E-4
		W, all other compounds	-	1E+5	4E-5	1E-7		-
83	- Bismuth-201[2] 2E-3	D, see ^{200}Bi	1E+4	3E+4	1E-5	4E-8		2E-4
		W, see ^{200}Bi	-	4E+4	2E-5	5E-8		-
83	- Bismuth-202[2] 2E-3	D, see ^{200}Bi	1E+4	4E+4	2E-5	6E-8		2E-4
		W, see ^{200}Bi	-	8E+4	3E-5	1E-7		-
83	- Bismuth-203 3E-4	D, see ^{200}Bi	2E+3	7E+3	3E-6	9E-9		3E-5
		W, see ^{200}Bi	-	6E+3	3E-6	9E-9		-
83	- Bismuth-205 2E-4	D, see ^{200}Bi	1E+3	3E+3	1E-6	3E-9		2E-5
		W, see ^{200}Bi	-	1E+3	5E-7	2E-9		-
83	- Bismuth-206 9E-5	D, see ^{200}Bi	6E+2	1E+3	6E-7	2E-9		9E-6
		W, see ^{200}Bi	-	9E+2	4E-7	1E-9		-
83	- Bismuth-207 1E-4	D, see ^{200}Bi	1E+3	2E+3	7E-7	2E-9		1E-5
		W, see ^{200}Bi	-	4E+2	1E-7	5E-10		-
83	- Bismuth-210m - 8E-6	D, see ^{200}Bi	4E+1	5E+0	2E-9	-		-
			Kidneys	Kidneys				
			(6E+1)	(6E+0)	-	9E-12		8E-7
		W, see ^{200}Bi	-	7E-1	3E-10	9E-13		
83	Bismuth-210 1E-4	D, see ^{200}Bi	8E+2	2E+2	1E-7	-		1E-5
				Kidneys				

			-	(4E+2)	-	5E-10	-
	-	W, see ^{200}Bi	-	3E+1	1E-8	4E-11	-
83	Bismuth-212[2]	D, see ^{200}Bi	5E+3	2E+2	1E-7	3E-10	7E-5
	7E-4	W, see ^{200}Bi	-	3E+2	1E-7	4E-10	-
83	- Bismuth-213[2]	D, see ^{200}Bi	7E+3	3E+2	1E-7	4E-10	1E-4
	1E-3	W, see ^{200}Bi	-	4E+2	1E-7	5E-10	-
83	- Bismuth-214[2]	D, see ^{200}Bi	2E+4	8E+2	3E-7	1E-9	-
	-		St wall (2E+4)	-	-	-	3E-4
	3E-3	W, see ^{200}Bi	-	9E-2	4E-7	1E-9	-
84	- Polonium-203[2]	D, all compounds except those given for W	3E+4	6E+4	3E-5	9E-8	3E-4
	3E-3	W, oxides, hydroxides, and nitrates	-	9E+4	4E-5	1E-7	-
84	- Polonium-205[2]	D, see ^{203}Po	2E+4	4E+4	2E-5	5E-8	3E-4
	3E-3	W, see ^{203}Po	-	7E+4	3E-5	1E-7	-
84	- Polonium-207	D, see ^{203}Po	8E+3	3E+4	1E-5	3E-8	1E-4
	1E-3	W, see ^{203}Po	-	3E+4	1E-5	4E-8	-
84	- Polonium-210	D, see ^{203}Po	3E+0	6E-1	3E-10	9E-13	4E-8
	4E-7	W, see ^{203}Po	-	6E-1	3E-10	9E-13	-
	-						

Atomic No.	Occupational Values		Table I Table III Effluent Concentrations			Table II Releases to Sewers	
	Col. 2		Col. 1		Col. 2	Col.3	Col. 1
	Monthly		Oral				
			Ingestion		Inhalation		
	Water	Average Radionuclide	Class	ALI		ALI DAC	Air
			Concentration				
	(μCi/ml)		(μCi)		(μCi)	(μCi/ml) (μCi/ml)	(μCi/ml)
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	9E-9	3E-11	-
-							
				(or 12 working level months)		(or 1.0 working level)	
86	Radon-222	With daughters removed	-	1E+4	4E-6	1E-8	-
-							
		With daughters present	-	1E+2	3E-8	1E-10	-
-							
				(or 4 working level months)		(or 0.33 working level)	
87	Francium-222[2]	D, all compounds	2E+3	5E+2	2E-7	6E-10	3E-5
3E-4							
87	Francium-223[2]	D, all compounds	6E+2	8E+2	3E-7	1E-9	8E-6
8E-5							
88	Radium-223	W, all compounds	5E+0	7E-1	3E-10	9E-13	-
-							
			Bone surf (9E+0)	-	-	-	1E-7
1E-6							
88	Radium-224	W, all compounds	8E+0	2E+0	7E-10	2E-12	-
-							
			Bone surf (2E+1)	-	-	-	2E-7
2E-6							
88	Radium-225	W, all compounds	8E+0	7E-1	3E-10	9E-13	-
-							
			Bone surf (2E+1)	-	-	-	2E-7
2E-6							
88	Radium-226	W, all compounds	2E+0	6E-1	3E-10	9E-13	-
-							
			Bone surf				

			(5E+0)	-	-	-	6E-8
	6E-7						
88	Radium-227[2]	W, all compounds	2E+4	1E+4	6E-6	-	-
	-						
			Bone surf (2E+4)	Bone surf (2E+4)	-	3E-8	3E-4
	3E-3						
88	Radium-228	W, all compounds	2E+0	1E+0	5E-10	2E-12	-
	-						
			Bone surf (4E+0)	-	-	-	6E-8
	6E-7						
89	Actinium-224	D, all compounds except those given for W and Y	2E+3	3E+1	1E-8	-	-
	-						
			LLI wall (2E+3)	Bone surf (4E+1)	-	5E-11	3E-5
	3E-4						
		W, halides and nitrates	-	5E+1	2E-8	7E-11	-
	-						
		Y, oxides and hydroxides	-	5E+1	2E-8	6E-11	-
	-						
89	Actinium-225						
		D, see ^{224}Ac	5E+1	3E-1	1E-10	-	-
	-						
			LLI wall (5E+1)	Bone surf (5E-1)	-	7E-13	7E-7
	7E-6						
		W, see ^{224}Ac	-	6E-1	3E-10	9E-13	-
	-						
		Y, see ^{224}Ac	-	6E-1	3E-10	9E-13	-
	-						

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

		Y, see ^{226}Th	-	3E-1	1E-10	5E-13		-
	-							
90	Thorium-228	W, see ^{226}Th	6E+0	1E-2	4E-12	-		-
	-							
			Bone surf (1E+1)	Bone surf (2E-2)	-	3E-14		2E-7
	2E-6							
		Y, see ^{226}Th	-	2E-2	7E-12	2E-14		-
	-							
90	Thorium-229	W, see ^{226}Th	6E-1	9E-4	4E-13	-		-
	-							
			Bone surf (1E+0)	Bone surf (2E-3)	-	3E-15		2E-8
	2E-7							
		Y, see ^{226}Th	-	2E-3	1E-12	-		-
	-							
			-	Bone surf (3E-3)	-	4E-15	-	-
90	Thorium-230	W, see ^{226}Th	4E+0	6E-3	3E-12	-		-
	-							
			Bone surf (9E+0)	Bone surf (2E-2)	-	2E-14	1E-7	1E-6
		Y, see ^{226}Th	-	2E-2	6E-12	-		-
	-							
			-	Bone surf (2E-2)	-	3E-14	-	-
90	Thorium-231	W, see ^{228}Th	4E+3	6E+3	3E-6	9E-9		5E-5
	5E-4							
		Y, see ^{228}Th	-	6E+3	3E-6	9E-9	-	-

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1	Col. 2	Col.3	Col.	1
	Monthly		Oral				
			Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
90	Thorium-232	W, see ^{228}Th	7E-1	1E-3	5E-13	-	-
	-		Bone surf (2E+0)	Bone surf (3E-3)	-	4E-15	3E-8
	3E-7	Y, see ^{228}Th	-	3E-3	1E-12	-	-
	-		-	Bone surf (4E-3)	-	6E-15	-
	-						
90	Thorium-234	W, see ^{228}Th	3E+2	2E+2	8E-8	3E-10	-
	-		LLI wall (4E+2)	-	-	-	5E-6
	5E-5	Y, see ^{228}Th	-	2E+2	6E-8	2E-10	-
	-						
91	Protactinium-227[2]	W, all compounds except those given for Y	4E+3	1E+2	5E-8	2E-10	5E-5
	5E-4	Y, oxides and hydroxides	-	1E+2	4E-8	1E-10	-
	-						
91	Protactinium-228	W, see ^{227}Pa	1E+3	1E+1	5E-9	-	2E-5
	2E-4		Bone surf				
			-	Bone surf (2E+1)	-	3E-11	-
	-	Y, see ^{227}Pa	-	1E+1	5E-9	2E-11	-
	-						
91	Protactinium-230	W, see ^{227}Pa	6E+2	5E+0	2E-9	7E-12	-
	-		Bone surf (9E+2)	-	-	-	1E-5
	1E-4	Y, see ^{227}Pa	-	4E+0	1E-9	5E-12	-
	-						
91	Protactinium-231	W, see ^{227}Pa	2E-1	2E-3	6E-13	-	-
	-		Bone surf (5E-1)	Bone surf (4E-3)	-	6E-15	6E-9
	6E-8	Y, see ^{227}Pa	-	4E-3	2E-12	-	-
	-			Bone surf			

			-	(6E-3)	-	8E-15	-
	-						
91	Protactinium-232	W, see ^{227}Pa	1E+3	2E+1	9E-9	-	2E-5
	2E-4						
				Bone surf			
			-	(6E+1)	-	8E-11	-
	-						
		Y, see ^{227}Pa	-	6E+1	2E-8	-	-
	-						
				Bone surf			
			-	(7E+1)	-	1E-10	-
	-						
91	Protactinium-233	W, see ^{227}Pa	1E+3	7E+2	3E-7	1E-9	-
	-						
			LLI wall				
			(2E+3)	-	-	-	2E-5
	2E-4						
		Y, see ^{227}Pa	-	6E+2	2E-7	8E-10	-
	-						
91	Protactinium-234	W, see ^{227}Pa	2E+3	8E+3	3E-6	1E-8	3E-5
	3E-4						
		Y, see ^{227}Pa	-	7E+3	3E-6	9E-9	-
	-						
92	Uranium-230	D, UF, UOF, UO(NO)	4E+0	4E-1	2E-10	-	-
	-						
			Bone surf	Bone surf			
			(6E+0)	(6E-1)	-	8E-13	8E-8
	8E-7						
		W, UO, UF, UCl	-	4E-1	1E-10	5E-13	-
	-						
		Y, UO, UO	-	3E-1	1E-10	4E-13	-
	-						

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

92	Uranium-236	D, see ^{230}U	1E+1	1E+0	5E-10	-	-
	-		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7
	3E-6						
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-
	-						
		Y, see ^{230}U	-	4E-2	2E-11	6E-14	-
	-						
92	Uranium-237	D, see ^{230}U	2E+3	3E+3	1E-6	4E-9	-
	-		LLI wall (2E+3)	-	-	-	3E-5
	3E-4						
		W, see ^{230}U	-	2E+3	7E-7	2E-9	-
	-						
		Y, see ^{230}U	-	2E+3	6E-7	2E-9	-
	-						
92	Uranium-238[3]	D, see ^{230}U	1E+1	1E+0	6E-10	-	-
	-		Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7
	3E-6						
		W, see ^{230}U	-	8E-1	3E-10	1E-12	-
	-						
		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	-
	-						

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1	Col. 2	Col.3	Col. 1	
	Monthly		Oral				
			Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
			Concentration (μCi)				
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	1E+0	5E-10	-	-
	-						
			Bone surf (2E+1)	Bone surf (2E+0)	-	3E-12	3E-7
	3E-6						
		W, see ^{230}U	-	8E-1	3E-10	9E-13	-
	-						
		Y, see ^{230}U	-	5E-2	2E-11	9E-24	-
	-						
93	Neptunium-232[2]	W, all compounds	1E+5	2E+3	7E-7	-	2E-3
	2E-2						
			-	(5E+2)	-	6E-9	-
	-						
93	Neptunium-234	W, all compounds	2E+3	3E+3	1E-6	4E-9	3E-5
	3E-4						
93	Neptunium-235	W, all compounds	2E+4	8E+2	3E-7	-	-
	-						
			LLI wall (2E+4)	Bone surf (1E+3)	-	2E-9	3E-4
	3E-3						
93	Neptunium-236	W, all compounds	3E+0	2E-2	9E-12	-	-
	-						
	(1.15E+5 y)		Bone surf (6E+0)	Bone surf (5E-2)	-	8E-14	9E-8
	9E-7						
93	Neptunium-236	W, all compounds	3E+3	3E+1	1E-8	-	-
	-						
	(22.5 h)		Bone surf (4E+3)	Bone surf (7E+1)	-	1E-10	5E-5
	5E-4						
93	Neptunium-237	W, all compounds	5E-1	4E-3	2E-12	-	-
	-						
			Bone surf (1E+0)	Bone surf (1E-2)	-	1E-14	2E-8
	2E-7						

93	Neptunium-238	W, all compounds	1E+3	6E+1	3E-8	-	2E-5
2E-4							
				Bone surf			
			-	(2E+2)	-	2E-10	-
-							
93	Neptunium-239	W, all compounds	2E+3	2E+3	9E-7	3E-9	-
-							
			LLI wall				
			(2E+3)	-	-	-	2E-5
2E-4							
93	Neptunium-240[2]	W, all compounds	2E+4	8E+4	3E-5	1E-7	3E-4
3E-3							
94	Plutonium-234	W, all compounds except					
		PuO	8E+3	2E+2	9E-8	3E-10	1E-4
1E-3							
		Y, PuO	-	2E+2	8E-8	3E-10	-
-							
94	Plutonium-235[2]	W, see ^{234}Pu	9E+5	3E+6	1E-3	4E-6	1E-2
1E-1							
		Y, see ^{234}Pu	-	3E+6	1E-3	3E-6	-
-							
94	Plutonium-236	W, see ^{234}Pu	2E+0	2E-2	8E-12	-	-
-							
			Bone surf	Bone surf			
			(4E+0)	(4E-2)	-	5E-14	6E-8
6E-7							
		Y, see ^{234}Pu	-	4E-2	2E-11	6E-14	-
-							
94	Plutonium-237	W, see ^{234}Pu	1E+4	3E+3	1E-6	5E-9	2E-4
2E-3							
		Y, see ^{234}Pu	-	3E+3	1E-6	4E-9	-
-							
94	Plutonium-238	W, see ^{234}Pu	9E-1	7E-3	3E-12	-	-
-							
			Bone surf	Bone surf			
			(2E+0)	(1E-2)	-	2E-14	2E-8
2E-7							
		Y, see ^{234}Pu	-	2E-2	8E-12	2E-14	-
-							

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

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

			-	(4E+1)	-	5E-11	-
	-						
96	Curium-242	W, all compounds	3E+1	3E-1	1E-10	-	-
	-						
			Bone surf	Bone surf			
			(5E+1)	(3E-1)	-	4E-13	7E-7
	7E-6						
96	Curium-243	W, all compounds	1E+0	9E-3	4E-12	-	-
	-						
			Bone surf	Bone surf			
			(2E+0)	(2E-2)	-	2E-14	3E-8
	3E-7						
96	Curium-244	W, all compounds	1E+0	1E-2	5E-12	-	-
	-						
			Bone surf	Bone surf			
			(3E+0)	(2E-2)	-	3E-14	3E-8
	3E-7						
96	Curium-245	W, all compounds	7E-1	6E-3	3E-12	-	-
	-						
			Bone surf	Bone surf			
			(1E+0)	(1E-2)	-	2E-14	2E-8
	2E-7						
96	Curium-246	W, all compounds	7E-1	6E-3	3E-12	-	-
	-						
			Bone surf	Bone surf			
			(1E+0)	(1E-2)	-	2E-14	2E-8
	2E-7						
96	Curium-247	W, all compounds	8E-1	6E-3	3E-12	-	-
	-						
			Bone surf	Bone surf			
			(1E+0)	(1E-2)	-	2E-14	2E-8
	2E-7						
96	Curium-248	W, all compounds	2E-1	2E-3	7E-13	-	-
	-						
			Bone surf	Bone surf			
			(4E-1)	(3E-3)	-	4E-15	5E-9
	5E-8						

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

		Y, see ^{244}Cf	-	1E-1	4E-11	1E-13	-
	-						
98	Californium-249	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-
	-						
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8
	2E-7						
		Y, see ^{244}Cf	-	1E-2	4E-12	-	-
	-						
				Bone surf			
98	Californium-250	W, see ^{244}Cf	1E+0	9E-3	4E-12	-	-
	-						
			(2E+0)	(2E-2)	-	3E-14	3E-8
	3E-7						
98	Californium-251	W, see ^{244}Cf	5E-1	4E-3	2E-12	-	-
	-						
			Bone surf (1E+0)	Bone surf (9E-3)	-	1E-14	2E-8
	2E-7						
		Y, see ^{244}Cf	-	1E-2	4E-12		-
	-						
			-	Bone surf (1E-2)	-	2E-14	-
	-						
98	Californium-252	W, see ^{244}Cf	2E+0	2E-2	8E-12	-	-
	-						
			Bone surf (5E+0)	Bone surf (4E-2)	-	5E-14	7E-8
	7E-7						
		Y, see ^{244}Cf	-	3E-2	1E-11	5E-14	-
	-						

Occupational Values			Table I Table III Effluent Concentrations		Table II Releases to Sewers		
	Col. 2		Col. 1	Col. 2	Col.3	Col.	1
	Monthly		Oral Ingestion	Inhalation			
Atomic No.	Water (μCi/ml)	Average Radionuclide	Class Concentration (μCi)	ALI (μCi)	ALI (μCi/ml)	DAC (μCi/ml)	Air (μCi/ml)
98	Californium-253	W, see ^{244}Cf	2E+2	2E+0	8E-10	3E-12	-
	-		Bone surf				
			(4E+2)	-	-	-	5E-6
	5E-5						
		Y, see ^{244}Cf	-	2E+0	7E-10	2E-12	-
	-						
98	Californium-254	W, see ^{244}Cf	2E+0	2E-2	9E-12	3E-14	3E-8
	3E-7						
		Y, see ^{244}Cf	-	2E-2	7E-12	2E-14	-
	-						
99	Einsteinium-250	W, all compounds	4E+4	5E+2	2E-7	-	6E-4
	6E-3						
				Bone surf			
99	Einsteinium-251	W, all compounds	7E+3	9E+2	4E-7	-	1E-4
	1E-3						
			-	(1E+3)	-	2E-9	-
	-						
99	Einsteinium-253	W, all compounds	2E+2	1E+0	6E-10	2E-12	2E-6
	2E-5						
99	Einsteinium-254m	W, all compounds	3E+2	1E+1	4E-9	1E-11	-
	-						
			LLI wall				
			(3E+2)	-	-	-	4E-6
	4E-5						
99	Einsteinium-254	W, all compounds	8E+0	7E-2	3E-11	-	-
	-						
			Bone surf	Bone surf			
			(2E+1)	(1E-1)	-	2E-13	2E-7
	2E-6						
100	Fermium-252	W, all compounds	5E+2	1E+1	5E-9	2E-11	6E-6
	6E-5						
100	Fermium-253	W, all compounds	1E+3	1E+1	4E-9	1E-11	1E-5
	1E-4						
100	Fermium-254	W, all compounds	3E+3	9E+1	4E-8	1E-10	4E-5
	4E-4						
100	Fermium-255	W, all compounds	5E+2	2E+1	9E-9	3E-11	7E-6
	7E-5						
100	Fermium-257	W, all compounds	2E+1	2E-1	7E-11	-	-
	-						
			Bone surf	Bone surf			

			(4E+1)	(2E-1)	-	3E-13		5E-7	5E-6
101	Mendelevium-257	W, all compounds	7E+3	8E+1	4E-8	-		1E-4	1E-3
			-	Bone surf (9E+1)	-	1E-10		-	-
101	Mendelevium-258	W, all compounds	3E+1	2E-1	1E-10	-		-	-
			Bone surf (5E+1)	Bone surf (3E-1)	-	5E-13		6E-7	6E-6
-	Any radionuclide with half-life less than 2 hours	not listed above	decay mode other than	alpha emission or	spontaneous fission and	with radioactive			-
			Submersion[1]	-	2E+2	1E-7	1E-9	-	-
-	Any radionuclide with half-life greater than 2 hours	not listed above	decay mode other than	alpha emission or	spontaneous fission and	with radioactive			1E-7
		.	. . .	-	2E-1	1E-10	1E-12	1E-8	

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

FOOTNOTES:

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

[2] These radionuclides have radiological half-lives of less than 2 hours. The total effective dose equivalent received during operations with these radionuclides might include a significant contribution from external exposure. The DAC values for all radionuclides, other than those designated Class "Submersion," are based upon the committed effective dose equivalent due to the intake of the radionuclide into the body and do NOT include potentially significant contributions to dose equivalent from external exposures. The licensee may substitute 1E-7 μCi/ml for the listed DAC to account for the submersion dose prospectively but shall use individual monitoring devices or other radiation-measuring instruments that measure external exposure to demonstrate compliance with the limits. (See R12-1-410)

[3] For soluble mixtures of U-238, U-234, and U-235 in air, chemical toxicity may be the limiting factor (see R12-1-408(E)). If the percent by weight (enrichment) of U-235 is not greater than 5, the concentration value for a 40-hour work week is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour work week shall not exceed 8E-3 (SA) μCi-hr/ml, where SA is the specific activity of the uranium inhaled. The specific activity for natural uranium is 6.77E-7 curies per gram U. The specific activity for other mixtures of U-238, U-235, and U-234, if not known, shall be:

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

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

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

NOTE:

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

Occupational Values	Table I		Table II	Table III
	Effluent Concentrations		Releases to Sewers	
	Col. 1	Col. 2	Col.3	Col. 1 Col. 2
	Oral			Monthly

Atomic No.	Average Radionuclide	Ingestion Class	ALI	Inhalation	ALI	DAC	Air
	Water Concentration (μCi/ml)		(μCi)		(μCi/ml)	(μCi/ml)	(μCi/ml)
	If it is known that Ac-227-D and Cm-250-W are not present	-	-		7E-4	3E-13	-
	If, in addition, it is known that Ac-227-W,Y, Th-229-W,Y, Th-230-W, Th-232-W,Y, Pa-231-W,Y, Np-237-W, Pu-239-W, Pu-240-W, Pu-242-W, Am-241-W, Am-242m-W, Am-243-W, Cm-245-W, Cm-246-W, Cm-247-W, Cm-248-W, Bk-247-W, Cf-249-W, and Cf-251-W are not present	-	-		-	7E-3	3E-12

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

Po-210-D,W, Ra-223-W, Ra-225-W,
Ra-226-W, Ac-225-D,W,Y, Th-227-W,Y,
U-230-D,W,Y, U-232-D,W, U-Nat-W,
Pu-241-W, Cm-240-W, Cm-242-W,
Cf-248-W,Y, Es-254-W, Fm-257-W,
and Md-258-W are not present - - - -
1E-12 -

If, in addition it is known that Fe-60,
Sr-90, Cd-113m, Cd-113, In-115, I-129,
Cs-134, Sm-145, Sm-147, Gd-148, Gd-152,
Hg-194 (organic), Bi-210m, Ra-223, Ra-224,
Ra-225, Ac-225, Th-228, Th-230, U-233,
U-234, U-235, U-236, U-238, U-Nat, Cm-242,
Cf-248, Es-254, Fm-257, and Md-258
are not present - - - -
1E-6 1E-5

3. If a mixture of radionuclides consists of Uranium and its daughters in ore dust (10 µm AMAD particle distribution assumed) prior to chemical separation of the Uranium from the ore, the following values may be used for the DAC of the mixture: 6E-11 µCi of gross alpha activity from Uranium-238, Uranium-234, Thorium-230, and Radium-226 per milliliter of air; 3E-11 µCi of natural uranium per milliliter of air; or 45 micrograms of natural uranium per cubic meter of air.
4. If the identity and concentration of each radionuclide in a mixture are known, the limiting values should be derived as follows: determine, for each radionuclide in the mixture, the ratio between the concentration present in the mixture and the concentration otherwise established in Appendix B to Article 4 for the specific radionuclide when not in a mixture. The sum of such ratios for all of the radionuclides in the mixture may not exceed "1" (i.e., "unity").

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

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

Historical Note

Adopted effective June 30, 1977 (Supp. 77-3). Section repealed; new Section adopted effective August 10, 1994 (Supp. 94-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

APPENDIX C. QUANTITIES[1] OF LICENSED OR REGISTERED MATERIAL REQUIRING LABELING

Radionuclide	Quantity (μCi)	
Hydrogen-3	1,000	
Beryllium-7	1,000	
Beryllium-10	1	
Carbon-11	1,000	
Carbon-14	1,000	
Fluorine-18	1,000	
Sodium-22	10	
Sodium-24	100	
Magnesium-28	100	
Aluminum-26	10	
Silicon-31	1,000	
Silicon-32	1	
Phosphorus-32	10	
Phosphorus-33	100	
Sulfur-35	100	
Chlorine-36	10	
Chlorine-38	1,000	
Chlorine-39	1,000	
Argon-39	1,000	
Argon-41	1,000	
Potassium-40	100	
Potassium-42	1,000	
Potassium-43	1,000	
Potassium-44	1,000	
Potassium-45	1,000	
Calcium-41	100	
Calcium-45	100	
Calcium-47	100	
Scandium-43	1,000	
Scandium-44m	100	
Scandium-44	100	
Scandium-46	10	
Scandium-47	100	
Scandium-48	100	
Scandium-49	1,000	
Titanium-44	1	
Titanium-45	1,000	
Vanadium-47	1,000	
Vanadium-48	100	
Vanadium-49	1,000	
Chromium-48	1,000	
Chromium-49	1,000	
Chromium-51	1,000	
Manganese-51	1,000	
Manganese-52m	1,000	
Manganese-52	100	
Manganese-53	1,000	
Manganese-54	100	
Manganese-56	1,000	
Iron-52		100
Iron-55		100
Iron-59		10
Iron-60		1
Cobalt-55	100	
Cobalt-56	10	
Cobalt-57	100	
Cobalt-58m	1,000	
Cobalt-58	100	
Cobalt-60m	1,000	

Cobalt-60	1
Cobalt-61	1,000
Cobalt-62m	1,000
Radionuclide	**Quantity (μCi)**
Nickel-56	100
Nickel-57	100
Nickel-59	100
Nickel-63	100
Nickel-65	1,000
Nickel-66	10
Copper-60	1,000
Copper-61	1,000
Copper-64	1,000
Copper-67	1,000
Zinc-62	100
Zinc-63	1,000
Zinc-65	10
Zinc-69m	100
Zinc-69	1,000
Zinc-71m	1,000
Zinc-72	100
Gallium-65	1,000
Gallium-66	100
Gallium-67	1,000
Gallium-68	1,000
Gallium-70	1,000
Gallium-72	100
Gallium-73	1,000
Germanium-66	1,000
Germanium-67	1,000
Germanium-68	10
Germanium-69	1,000
Germanium-71	1,000
Germanium-75	1,000
Germanium-77	1,000
Germanium-78	1,000
Arsenic-69	1,000
Arsenic-70	1,000
Arsenic-71	100
Arsenic-72	100
Arsenic-73	100
Arsenic-74	100
Arsenic-76	100
Arsenic-77	100
Arsenic-78	1,000
Selenium-70	1,000
Selenium-73m	1,000
Selenium-73	100
Selenium-75	100
Selenium-79	100
Selenium-81m	1,000
Selenium-81	1,000
Selenium-83	1,000
Bromine-74m	1,000
Bromine-74	1,000
Bromine-75	1,000
Bromine-76	100
Bromine-77	1,000
Bromine-80m	1,000
Bromine-80	1,000
Bromine-82	100

Bromine-83	1,000
Bromine-84	1,000
Krypton-74	1,000
Krypton-76	1,000
Krypton-77	1,000

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**
Krypton-79	1,000
Krypton-81	1,000
Krypton-83m	1,000
Krypton-85m	1,000
Krypton-85	1,000
Krypton-87	1,000
Krypton-88	1,000
Rubidium-79	1,000
Rubidium-81m	1,000
Rubidium-81	1,000
Rubidium-82m	1,000
Rubidium-83	100
Rubidium-84	100
Rubidium-86	100
Rubidium-87	100
Rubidium-88	1,000
Rubidium-89	1,000
Strontium-80	100
Strontium-81	1,000
Strontium-83	100
Strontium-85m	1,000
Strontium-85	100
Strontium-87m	1,000
Strontium-89	10
Strontium-90	0.1
Strontium-91	100
Strontium-92	100
Yttrium-86m	1,000
Yttrium-86	100
Yttrium-87	100
Yttrium-88	10
Yttrium-90m	1,000
Yttrium-90	10
Yttrium-91m	1,000
Yttrium-91	10
Yttrium-92	100
Yttrium-93	100
Yttrium-94	1,000
Yttrium-95	1,000
Zirconium-86	100
Zirconium-88	10
Zirconium-89	100
Zirconium-93	1
Zirconium-95	10
Zirconium-97	100
Niobium-88	1,000
Niobium-89m (66 min)	1,000
Niobium-89 (122 min)	1,000
Niobium-90	100
Niobium-93m	10
Niobium-94	1
Niobium-95m	100

Niobium-95	100
Niobium-96	100
Niobium-97	1,000
Niobium-98	1,000
Molybdenum-90	100
Molybdenum-93m	100
Molybdenum-93	10
Molybdenum-99	100
Molybdenum-101	1,000

Radionuclide	**Quantity (μCi)**
Technetium-93m	1,000
Technetium-93	1,000
Technetium-94m	1,000
Technetium-94	1,000
Technetium-96m	1,000
Technetium-96	100
Technetium-97m	100
Technetium-97	1,000
Technetium-98	10
Technetium-99m	1,000
Technetium-99	100
Technetium-101	1,000
Technetium-104	1,000
Ruthenium-94	1,000
Ruthenium-97	1,000
Ruthenium-103	100
Ruthenium-105	1,000
Ruthenium-106	1
Rhodium-99m	1,000
Rhodium-99	100
Rhodium-100	100
Rhodium-101m	1,000
Rhodium-101	10
Rhodium-102m	10
Rhodium-102	10
Rhodium-103m	1,000
Rhodium-105	100
Rhodium-106m	1,000
Rhodium-107	1,000
Palladium-100	100
Palladium-101	1,000
Palladium-103	100
Palladium-107	10
Palladium-109	100
Silver-102	1,000
Silver-103	1,000
Silver-104m	1,000
Silver-104	1,000
Silver-105	100
Silver-106m	100
Silver-106	1,000
Silver-108m	1
Silver-110m	10
Silver-111	100
Silver-112	100
Silver-115	1,000
Cadmium-104	1,000
Cadmium-107	1,000
Cadmium-109	1
Cadmium-113m	0.1
Cadmium-113	100

Cadmium-115m	10	
Cadmium-115	100	
Cadmium-117m	1,000	
Cadmium-117	1,000	
Indium-109	1,000	
Indium-110m (69.1m)		1,000
Indium-110 (4.9h)		1,000
Indium-111	100	
Indium-112	1,000	
Indium-113m	1,000	

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**	
Indium-114m	10	
Indium-115m	1,000	
Indium-115	100	
Indium-116m	1,000	
Indium-117m	1,000	
Indium-117	1,000	
Indium-119m	1,000	
Tin-110	100	
Tin-111	1,000	
Tin-113	100	
Tin-117m	100	
Tin-119m	100	
Tin-121m	100	
Tin-121	1,000	
Tin-123m	1,000	
Tin-123	10	
Tin-125	10	
Tin-126	10	
Tin-127	1,000	
Tin-128	1,000	
Antimony-115	1,000	
Antimony-116m	1,000	
Antimony-116	1,000	
Antimony-117	1,000	
Antimony-118m	1,000	
Antimony-119	1,000	
Antimony-120 (16m)	1,000	
Antimony-120 (5.76d)	100	
Antimony-122	100	
Antimony-124m	1,000	
Antimony-124	10	
Antimony-125	100	
Antimony-126m	1,000	
Antimony-126	100	
Antimony-127	100	
Antimony-128 (10.4m)	1,000	
Antimony-128 (9.01h)	100	
Antimony-129	100	
Antimony-130	1,000	
Antimony-131	1,000	
Tellurium-116	1,000	
Tellurium-121m	10	
Tellurium-121	100	

Tellurium-123m	10
Tellurium-123	100
Tellurium-125m	10
Tellurium-127m	10
Tellurium-127	1,000
Tellurium-129m	10
Tellurium-129	1,000
Tellurium-131m	10
Tellurium-131	100
Tellurium-132	10
Tellurium-133m	100
Tellurium-133	1,000
Tellurium-134	1,000
Iodine-120m	1,000
Iodine-120	100
Iodine-121	1,000

Radionuclide	**Quantity (μCi)**
Iodine-123	100
Iodine-124	10
Iodine-125	1
Iodine-126	1
Iodine-128	1,000
Iodine-129	1
Iodine-130	10
Iodine-131	1
Iodine-132m	100
Iodine-132	100
Iodine-133	10
Iodine-134	1,000
Iodine-135	100
Xenon-120	1,000
Xenon-121	1,000
Xenon-122	1,000
Xenon-123	1,000
Xenon-125	1,000
Xenon-127	1,000
Xenon-129m	1,000
Xenon-131m	1,000
Xenon-133m	1,000
Xenon-133	1,000
Xenon-135m	1,000
Xenon-135	1,000
Xenon-138	1,000
Cesium-125	1,000
Cesium-127	1,000
Cesium-129	1,000
Cesium-130	1,000
Cesium-131	1,000
Cesium-132	100
Cesium-134m	1,000
Cesium-134	10
Cesium-135m	1,000
Cesium-135	100
Cesium-136	10
Cesium-137	10
Cesium-138	1,000
Barium-126	1,000
Barium-128	100
Barium-131m	1,000
Barium-131	100
Barium-133m	100

Barium-133	100
Barium-135m	100
Barium-139	1,000
Barium-140	100
Barium-141	1,000
Barium-142	1,000
Lanthanum-131	1,000
Lanthanum-132	100
Lanthanum-135	1,000
Lanthanum-137	10
Lanthanum-138	100
Lanthanum-140	100
Lanthanum-141	100
Lanthanum-142	1,000
Lanthanum-143	1,000
Cerium-134	100
Cerium-135	100
Cerium-137m	100
Cerium-137	1,000

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**
Cerium-139	100
Cerium-141	100
Cerium-143	100
Cerium-144	1
Praseodymium-136	1,000
Praseodymium-137	1,000
Praseodymium-138m	1,000
Praseodymium-139	1,000
Praseodymium-142m	1,000
Praseodymium-142	100
Praseodymium-143	100
Praseodymium-144	1,000
Praseodymium-145	100
Praseodymium-147	1,000
Neodymium-136	1,000
Neodymium-138	100
Neodymium-139m	1,000
Neodymium-139	1,000
Neodymium-141	1,000
Neodymium-147	100
Neodymium-149	1,000
Neodymium-151	1,000
Promethium-141	1,000
Promethium-143	100
Promethium-144	10
Promethium-145	10
Promethium-146	1
Promethium-147	10
Promethium-148m	10
Promethium-148	10
Promethium-149	100
Promethium-150	1,000
Promethium-151	100
Samarium-141m	1,000
Samarium-141	1,000
Samarium-142	1,000
Samarium-145	100
Samarium-146	1
Samarium-147	100
Samarium-151	10

Samarium-153	100
Samarium-155	1,000
Samarium-156	1,000
Europium-145	100
Europium-146	100
Europium-147	100
Europium-148	10
Europium-149	100
Europium-150 (12.62h)	100
Europium-150 (34.2y)	1
Europium-152m	100
Europium-152	1
Europium-154	1
Europium-155	10
Europium-156	100
Europium-157	100
Europium-158	1,000
Gadolinium-145	1,000
Gadolinium-146	10
Gadolinium-147	100
Gadolinium-148	0.001

Radionuclide	**Quantity (μCi)**
Gadolinium-149	100
Gadolinium-151	10
Gadolinium-152	100
Gadolinium-153	10
Gadolinium-159	100
Terbium-147	1,000
Terbium-149	100
Terbium-150	1,000
Terbium-151	100
Terbium-153	1,000
Terbium-154	100
Terbium-155	1,000
Terbium-156m (5.0h)	1,000
Terbium-156m (24.4h)	1,000
Terbium-156	100
Terbium-157	10
Terbium-158	1
Terbium-160	10
Terbium-161	100
Dysprosium-155	1,000
Dysprosium-157	1,000
Dysprosium-159	100
Dysprosium-165	1,000
Dysprosium-166	100
Holmium-155	1,000
Holmium-157	1,000
Holmium-159	1,000
Holmium-161	1,000
Holmium-162m	1,000
Holmium-162	1,000
Holmium-164m	1,000
Holmium-164	1,000
Holmium-166m	1
Holmium-166	100
Holmium-167	1,000

Erbium-161	1,000
Erbium-165	1,000
Erbium-169	100
Erbium-171	100
Erbium-172	100
Thulium-162	1,000
Thulium-166	100
Thulium-167	100
Thulium-170	10
Thulium-171	10
Thulium-172	100
Thulium-173	100
Thulium-175	1,000
Ytterbium-162	1,000
Ytterbium-166	100
Ytterbium-167	1,000
Ytterbium-169	100
Ytterbium-175	100
Ytterbium-177	1,000
Ytterbium-178	1,000
Lutetium-169	100
Lutetium-170	100
Lutetium-171	100
Lutetium-172	100
Lutetium-173	10
Lutetium-174m	10

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**
Lutetium-174	10
Lutetium-176m	1,000
Lutetium-176	100
Lutetium-177m	10
Lutetium-177	100
Lutetium-178m	1,000
Lutetium-178	1,000
Lutetium-179	1,000
Hafnium-170	100
Hafnium-172	1
Hafnium-173	1,000
Hafnium-175	100
Hafnium-177m	1,000
Hafnium-178m	0.1
Hafnium-179m	10
Hafnium-180m	1,000
Hafnium-181	10
Hafnium-182m	1,000
Hafnium-182	0.1
Hafnium-183	1,000
Hafnium-184	100
Tantalum-172	1,000
Tantalum-173	1,000
Tantalum-174	1,000
Tantalum-175	1,000
Tantalum-176	100
Tantalum-177	1,000
Tantalum-178	1,000
Tantalum-179	100
Tantalum-180m	1,000
Tantalum-180	100
Tantalum-182m	1,000
Tantalum-182	10

Tantalum-183	100	
Tantalum-184	100	
Tantalum-185	1,000	
Tantalum-186	1,000	
Tungsten-176	1,000	
Tungsten-177	1,000	
Tungsten-178	1,000	
Tungsten-179	1,000	
Tungsten-181	1,000	
Tungsten-185	100	
Tungsten-187	100	
Tungsten-188	10	
Rhenium-177	1,000	
Rhenium-178	1,000	
Rhenium-181	1,000	
Rhenium-182 (12.7h)	1,000	
Rhenium-182 (64.0h)		100
Rhenium-184m	10	
Rhenium-184	100	
Rhenium-186m	10	
Rhenium-186	100	
Rhenium-187	1,000	
Rhenium-188m	1,000	
Rhenium-188	100	
Rhenium-189	100	
Osmium-180	1,000	
Osmium-181	1,000	
Osmium-182	100	
Radionuclide	**(μCi)**	**Quantity**
Osmium-185	100	
Osmium-189m	1,000	
Osmium-191m	1,000	
Osmium-191	100	
Osmium-193	100	
Osmium-194	1	
Iridium-182	1,000	
Iridium-184	1,000	
Iridium-185	1,000	
Iridium-186	100	
Iridium-187	1,000	
Iridium-188	100	
Iridium-189	100	
Iridium-190m	1,000	
Iridium-190	100	
Iridium-192m (1.4m)	10	
Iridium-192 (73.8d)	1	
Iridium-194m	10	
Iridium-194	100	
Iridium-195m	1,000	
Iridium-195	1,000	
Platinum-186	1,000	
Platinum-188	100	
Platinum-189	1,000	
Platinum-191	100	
Platinum-193m	100	
Platinum-193	1,000	
Platinum-195m	100	

Platinum-197m	1,000
Platinum-197	100
Platinum-199	1,000
Platinum-200	100
Gold-193	1,000
Gold-194	100
Gold-195	10
Gold-198m	100
Gold-198	100
Gold-199	100
Gold-200m	100
Gold-200	1,000
Gold-201	1,000
Mercury-193m	100
Mercury-193	1,000
Mercury-194	1
Mercury-195m	100
Mercury-195	1,000
Mercury-197m	100
Mercury-197	1,000
Mercury-199m	1,000
Mercury-203	100
Thallium-194m	1,000
Thallium-194	1,000
Thallium-195	1,000
Thallium-197	1,000
Thallium-198m	1,000
Thallium-198	1,000
Thallium-199	1,000
Thallium-201	1,000
Thallium-200	1,000
Thallium-202	100
Thallium-204	100

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**
Lead-195m	1,000
Lead-198	1,000
Lead-199	1,000
Lead-200	100
Lead-201	1,000
Lead-202m	1,000
Lead-202	10
Lead-203	1,000
Lead-205	100
Lead-209	1,000
Lead-210	0.01
Lead-211	100
Lead-212	1
Lead-214	100
Bismuth-200	1,000
Bismuth-201	1,000
Bismuth-202	1,000
Bismuth-203	100
Bismuth-205	100
Bismuth-206	100
Bismuth-207	10
Bismuth-210m	0.1
Bismuth-210	1
Bismuth-212	10
Bismuth-213	10
Bismuth-214	100

Polonium-203	1,000
Polonium-205	1,000
Polonium-207	1,000
Polonium-210	0.1
Astatine-207	100
Astatine-211	10
Radon-220	1
Radon-222	1
Francium-222	100
Francium-223	100
Radium-223	0.1
Radium-224	0.1
Radium-225	0.1
Radium-226	0.1
Radium-227	1,000
Radium-228	0.1
Actinium-224	1
Actinium-225	0.01
Actinium-226	0.1
Actinium-227	0.001
Actinium-228	1
Thorium-226	10
Thorium-227	0.01
Thorium-228	0.001
Thorium-229	0.001
Thorium-230	0.001
Thorium-231	100
Thorium-232	100
Thorium-234	10
Thorium-natural	100
Protactinium-227	10
Protactinium-228	1
Protactinium-230	0.1
Protactinium-231	0.001
Protactinium-232	1
Protactinium-233	100
Protactinium-234	100

Radionuclide	**Quantity (μCi)**
Uranium-230	0.01
Uranium-231	100
Uranium-232	0.001
Uranium-233	0.001
Uranium-234	0.001
Uranium-235	0.001
Uranium-236	0.001
Uranium-237	100
Uranium-238	100
Uranium-239	1,000
Uranium-240	100
Uranium-natural	100
Neptunium-232	100
Neptunium-233	1,000
Neptunium-234	100
Neptunium-235	100
Neptunium-236 (1.15E + 5)	0.001
Neptunium-236 (22.5h)	1
Neptunium-237	0.001
Neptunium-238	10
Neptunium-239	100

Neptunium-240	1,000
Plutonium-234	10
Plutonium-235	1,000
Plutonium-236	0.001
Plutonium-237	100
Plutonium-238	0.001
Plutonium-239	0.001
Plutonium-240	0.001
Plutonium-241	0.01
Plutonium-242	0.001
Plutonium-243	1,000
Plutonium-244	0.001
Plutonium-245	100
Americium-237	1,000
Americium-238	100
Americium-239	1,000
Americium-240	100
Americium-241	0.001
Americium-242m	0.001
Americium-242	10
Americium-243	0.001
Americium-244m	100
Americium-244	10
Americium-245	1,000
Americium-246m	1,000
Americium-246	1,000
Curium-238	100
Curium-240	0.1
Curium-241	1
Curium-242	0.01
Curium-243	0.001
Curium-244	0.001
Curium-245	0.001
Curium-246	0.001
Curium-247	0.001
Curium-248	0.001
Curium-249	1,000
Berkelium-245	100
Berkelium-246	100
Berkelium-247	0.001

*To convert µCi to kBq, multiply the µCi value by 37.

Radionuclide	**Quantity (µCi)**
Berkelium-249	0.1
Berkelium-250	10
Californium-244	100
Californium-246	1
Californium-248	0.01
Californium-249	0.001
Californium-250	0.001
Californium-251	0.001
Californium-252	0.001
Californium-253	0.1
Californium-254	0.001
Einsteinium-250	100
Einsteinium-251	100
Einsteinium-253	0.1
Einsteinium-254m	1
Einsteinium-254	0.01
Fermium-252	1
Fermium-253	1

Radionuclide	Quantity (μCi)
Fermium-254	10
Fermium-255	1
Fermium-257	0.01
Mendelevium-257	10
Mendelevium-258	0.01
Any alpha-emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition	0.001
Any radionuclide other than alpha-emitting radionuclides not listed above, or mixtures of beta emitters of unknown composition	0.01

* To convert μCi to kBq, multiply the μCi value by 37.

NOTE: For purposes of R12-1-428(E), R12-1-432(A), and R12-1-443(A) where there is involved a combination of radionuclides in known amounts, the limit for the combination shall be derived as follows: determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific radionuclide when not in combination. The sum of such ratios for all radionuclides in the combination may not exceed "1" -- that is, unity.
[1] The quantities listed above were derived by taking 1/10 of the most restrictive ALI listed in Table I, Columns 1and 2, of Appendix B to Article 4, rounding to the nearest factor of 10, and constraining the values listed between 37 Bq and 37 MBq (0.001 and 1,000 μCi). Values of 3.7 MBq (100 μCi) have been assigned for radionuclides having a radioactive half-life in excess of E+9 years, except rhenium, 37 MBq (1,000 μCi), to take into account their low specific activity.

Historical Note
Adopted effective August 10, 1994 (Supp. 94-3).

APPENDIX D. CLASSIFICATION AND CHARACTERISTICS OF LOW-LEVEL RADIOACTIVE WASTE

I. Classification of Radioactive Waste for Land Disposal
   a) Considerations. Determination of the classification of radioactive waste involves two considerations. First, consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors) whose potential hazard will persist long after such precautions as institutional controls, improved waste form, and deeper disposal have ceased to be effective. These precautions delay the time when long-lived radio nuclides could cause exposures. In addition, the magnitude of the potential dose is limited by the concentration and availability of the radionuclide at the time of exposure. Second, consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.
   b) Classes of waste.
      1) Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and characteristics of Class A waste must meet the minimum requirements set forth in Section II(a). If Class A waste also meets the stability requirements set forth in Section II(b), it is not necessary to segregate the waste for disposal.
      2) Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in Section II.
      3) Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in Section II.
   c) Classification determined by long-lived radionuclides. If the radioactive waste contains only radionuclides listed in Table I, classification shall be determined as follows:
      1) If the concentration does not exceed 0.1 times the value in Table I, the waste is Class A.

2) If the concentration exceeds 0.1 times the value in Table I but does not exceed the value in Table I, the waste is Class C.
3) If the concentration exceeds the value in Table I, the waste is not generally acceptable for land disposal.
4) For wastes containing mixtures of radionuclides listed in Table I, the total concentration shall be determined by the sum of fractions rule described in Section I(g).

TABLE I
Concentration

Radionuclide	curie/cubic meter[a]	nanocuries/gram[b]
C-14	8	
C-14 in activated metal	80	
Ni-59 in activated metal	220	
Nb-94 in activated metal	0.2	
Tc-99	3	
I-129	0.08	
Alpha-emitting transuranic radionuclides with half-life greater than five years	100	
Pu-241		3,500
Cm-242		20,000
Ra-226		100

[a]To convert the Ci/m^3 values to gigabecquerel (GBq) per cubic meter, multiply the Ci/m^3 value by 37.
[b]To convert the nCi/g values to becquerel (Bq) per gram, multiply the nCi/g value by 37.

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d) Classification determined by short-lived radionuclides. If the waste does not contain any of the radionuclides listed in Table I, classification shall be determined based on the concentrations shown in Table II. However, as specified in Section I(f), if radioactive waste does not contain any nuclides listed in either Table I or II, it is Class A.
   1) If the concentration does not exceed the value in Column 1, the waste is Class A.
   2) If the concentration exceeds the value in Column 1 but does not exceed the value in Column 2, the waste is Class B.
   3) If the concentration exceeds the value in Column 2 but does not exceed the value in Column 3, the waste is Class C.
   4) If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.
   5) For wastes containing mixtures of the radionuclides listed in Table II, the total concentration shall be determined by the sum of fractions rule described in Section I(g).

TABLE II

Radionuclide	Concentration, curie/cubic meter*		
	Column 1	Column 2	Column 3
Total of all radionuclides with less than 5-year half-life	700	*	*
H-3	40	*	*
Co-60	700	*	*
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7000
Sr-90	0.04	150	7000
Cs-137	1	44	4600

*AGENCY NOTE: To convert the Ci/m^3 value to gigabecquerel (GBq) per cubic meter, multiply the Ci/m^3 value by 37. There are no limits established for these radionuclides in Class B or C wastes. Practical considerations such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes shall be Class B unless the concentrations of other radionuclides in Table II determine the waste to be Class C independent of these radionuclides.

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e) Classification determined by both long- and short-lived radionuclides. If the radioactive waste contains a mixture of radionuclides, some of which are listed in Table I and some of which are listed in Table II, classification shall be determined as follows:
   1) If the concentration of a radionuclide listed in Table I is less than 0.1 times the value listed in Table I, the class shall be that determined by the concentration of radionuclides listed in Table II.
   2) If the concentration of a radionuclide listed in Table I exceeds 0.1 times the value listed in Table I, but does not exceed the value in Table II, the waste shall be Class C, provided the concentration of radionuclides listed in Table II does not exceed the value shown in Column 3 of Table II.

f) Classification of wastes with radionuclides other than those listed in Tables I and II. If the waste does not contain any radionuclides listed in either Table I or II, it is Class A.

g) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits shall all be taken from the same column of the same table. The sum of the fractions for the column shall be less than 1.0 if the waste class is to be determined by that column. Example: A waste contains Sr-90 in a concentration of 1.85 TBq/m^3 (50 Ci/m^3) and Cs-137 in a concentration of 814 GBq/m^3 (22 Ci/m^3). Since the concentrations both exceed the values in Column 1, Table II, they shall be compared to Column 2 values. For Sr-90 fraction, 50/150 = 0.33, for Cs-137 fraction, 22/44 = 0.5; the sum of the fractions = 0.83. Since the sum is less than 1.0, the waste is Class B.

h) Determination of concentrations in wastes. The concentration of a radionuclide may be determined by indirect methods such as use of scaling factors which relate the inferred concentration of one radionuclide to another that is measured, or radionuclide material accountability, if there is reasonable assurance that the indirect methods can be correlated with actual measurements. The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as becquerel (nanocurie) per gram.

II. Radioactive Waste Characteristics

a) The following are minimum requirements for all classes of waste and are intended to facilitate handling and provide protection of health and safety of personnel at the disposal site.

1) Wastes shall be packaged in conformance with the conditions of the license issued to the site operator to which the waste will be shipped. Where the conditions of the site license are more restrictive than the provisions of Article 4, the site license conditions shall govern.
2) Wastes shall not be packaged for disposal in cardboard or fiberboard boxes.
3) Liquid waste shall be packaged in sufficient absorbent material to absorb twice the volume of the liquid.
4) Solid waste containing liquid shall contain as little free-standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume.
5) Waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reaction with water.
6) Waste shall not contain, or be capable of generating, quantities of toxic oases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste. This does not apply to radioactive gaseous waste packaged in accordance with Section II(a)(8).
7) Waste shall not be pyrophoric. Pyrophoric materials contained in wastes shall be treated, prepared, and packaged to be nonflammable *****
8) Wastes in a gaseous form shall be packaged at an absolute pressure that does not exceed 1.5 atmospheres at 20° C. Total activity shall not exceed 3.7 TBq (100 Ci) per container.
9) Wastes containing hazardous, biological, pathogenic, or infectious material shall be treated to reduce to the maximum extent practicable the potential hazard from the non-radiological materials.

b) The following requirements are intended to provide stability of the waste. Stability is intended to ensure that the waste does not degrade and affect overall stability of the site through slumping, collapse, or other failure of the disposal unit and thereby lead to water infiltration. Stability is also a factor in limiting exposure to an inadvertent intruder, since it provides a recognizable and nondispersible waste.

1) Waste shall have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, and microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
2) Notwithstanding the provisions in Section II(a)(3) and (4), liquid wastes, or wastes containing liquid, shall be converted into a form that contains as little free-standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1% of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5% of the volume of the waste for waste processed to a stable form.
3) Void spaces within the waste and between the waste and its package shall be reduced to the extent practicable.

III. Labeling

Each package of waste shall be clearly labeled to identify whether it is Class A, Class B, or Class C waste, in accordance with Section I.

*****See (A)(4) of these regulations for definition of pyrophoric.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3).

APPENDIX E. QUANTITIES FOR USE WITH DECOMMISSIONING

Material	Microcurie	
Americium-241	0.01	
Antimony-122	100	
Antimony-124	10	
Antimony-125	10	
Arsenic-73	100	
Arsenic-74	10	
Arsenic-76	10	
Arsenic-77	100	
Barium-131	10	
Barium-133	10	
Barium-140	10	
Bismuth-210	1	
Bromine-82	10	
Cadmium-109	10	
Cadmium-115m	10	
Cadmium-115	100	
Calcium-45	10	
Calcium-47	10	
Carbon-14	100	
Cerium-141	100	
Cerium-143	100	
Cerium-144	1	
Cesium-131	1,000	
Cesium-134m	100	
Cesium-134	1	
Cesium-135	10	
Cesium-136	10	
Cesium-137	10	
Chlorine-36	10	
Chlorine-38	10	
Chromium-51	1,000	
Cobalt-58m	10	
Cobalt-58	10	
Cobalt-60	1	
Copper-64	100	
Dysprosium-165	10	
Dysprosium-166	100	
Erbium-169	100	
Erbium-171	100	
Europium-152 (9.2 h)	100	
Europium-152 (13 yr)	1	
Europium-154	1	
Europium-155	10	
Fluorine-18	1,000	
Gadolinium-153	10	
Gadolinium-159	100	
Gallium-72	10	
Germanium-71	100	
Gold-198		100
Gold-199		100
Hafnium-181	10	
Holmium-166	100	
Hydrogen-3	1,000	
Indium-113m	100	
Indium-114m	10	
Indium-115m	100	
Indium-115	10	
Iodine-125	1	
Iodine-126	1	
Iodine-129	0.1	

Iodine-131	1
Iodine-132	10
Iodine-133	1

Material	**Microcurie**
Iodine-134	10
Iodine-135	10
Iridium-192	10
Iridium-194	100
Iron-55	100
Iron-59	10
Krypton-85	100
Krypton-87	10
Lanthanum-140	10
Lutetium-177	100
Manganese-52	10
Manganese-54	10
Manganese-56	10
Mercury-197m	100
Mercury-197	100
Mercury-203	10
Molybdenum-99	100
Neodymium-147	100
Neodymium-149	100
Nickel-59	100
Nickel-63	10
Nickel-65	100
Niobium-93m	10
Niobium-95	10
Niobium-97	10
Osmium-185	10
Osmium-191m	100
Osmium-191	100
Osmium-193	100
Palladium-103	100
Palladium-109	100
Phosphorus-32	10
Platinum-191	100
Platinum-193m	100
Platinum-193	100
Platinum-197m	100
Platinum-197	100
Plutonium-239	0.01
Polonium-210	0.1
Potassium-42	10
Praseodymium-142	100
Praseodymium-143	100
Promethium-147	10
Promethium-149	10
Radium-226	0.01
Rhenium-186	100
Rhenium-188	100
Rhodium-103m	100
Rhodium-105	100
Rubidium-86	10
Rubidium-87	10
Ruthenium-97	100
Ruthenium-103	10
Ruthenium-105	10
Ruthenium-106	1
Samarium-151	10
Samarium-153	100
Scandium-46	10

Scandium-47	100
Scandium-48	10
Selenium-75	10
Silicon-31	100
Silver-105	10

* To convert µCi to kBq, multiply the µCi value by 37.

Material	**Microcurie**
Silver-110m	1
Silver-111	100
Sodium-22	1
Sodium-24	10
Strontium-85	10
Strontium-89	1
Strontium-90	0.1
Strontium-91	10
Strontium-92	10
Sulfur-35	100
Tantalum-182	10
Technetium-96	10
Technetium-97m	100
Technetium-97	100
Technetium-99m	100
Technetium-99	10
Tellurium-125m	10
Tellurium-127m	10
Tellurium-127	100
Tellurium-129m	10
Tellurium-129	100
Tellurium-131m	10
Tellurium-132	10
Terbium-160	10
Thallium-200	100
Thallium-201	100
Thallium-202	100
Thallium-204	10
Thorium (natural)**	100
Thulium-170	10
Thulium-171	10
Tin-113	10
Tin-125	10

Material	**Microcurie**
Tungsten-181	10
Tungsten-185	10
Tungsten-187	100
Uranium (natural)**	100
Uranium-233	0.01
Uranium-234	0.01
Uranium-235	0.01
Vanadium-48	10
Xenon-131m	1,000
Xenon-133	100
Xenon-135	100
Ytterbium-175	100
Yttrium-90	10
Yttrium-91	10
Yttrium-92	100
Yttrium-93	100
Zinc-65	10
Zinc-69m	100
Zinc-69	1,000

Zirconium-93	10
Zirconium-95	10
Zirconium-97	10
Any alpha emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition	0.01
Any radionuclide other than alpha emitting radionuclides, not listed above or mixtures of beta emitters of unknown composition	0.1

*To convert µCi to kBq, multiply the µCi value by 37.
** Based on alpha disintegration rate of Th-232, Th-230 and their daughter products.
*** Based on alpha disintegration rate of U-238, U-234, and U-235.

NOTE: Where there is involved a combination of isotopes in known amounts, the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" - that is, unity.

Historical Note

Adopted effective August 10, 1994 (Supp. 94-3).

ARRA-6. Repealed

Historical Note

Adopted effective February 25, 1985 (Supp. 85-1). Form repealed, new form adopted in Article 10 effective August 10, 1994 (Supp. 94-3).

ARRA-7. Repealed

Historical Note

Adopted effective February 25, 1985 (Supp. 85-1). Repealed effective August 10, 1994 (Supp. 94-3).

ARRA-8. Repealed

Historical Note

Adopted effective February 25, 1985 (Supp. 85-1). Repealed effective August 10, 1994 (Supp. 94-3).

ARTICLE 7. MEDICAL USES OF RADIOACTIVE MATERIAL

R12-1-701. License Required

A. A person may manufacture, produce, acquire, receive, possess, prepare, use, or transfer radioactive material for medical use only in accordance with a specific license issued by the Agency, the NRC, or another Agreement State, or as allowed in subsection (B)(1) or (B)(2)

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B. A specific license is not needed for an individual who:

1. Receives, possesses, uses, or transfers radioactive material in accordance with the rules in this Chapter under the supervision of an authorized user as provided in R12-1-706, unless prohibited by license condition; or
2. Prepares unsealed radioactive material for medical use in accordance with the rules in this Chapter under the supervision of an authorized nuclear pharmacist or authorized user.

Historical Note

Former Rule Section G.1. Former Section R12-1-701 repealed, new Section R12-1-701 adopted effective June 30, 1977 (Supp. 77-3). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (07-1).

R12-1-702. Definitions

"Authorized medical physicist" means an individual who meets the requirements in R12-1-711. For purposes of ensuring that personnel are adequately trained, an authorized medical physicist is a "qualified expert" as defined in Article 1.

"Authorized nuclear pharmacist" means a pharmacist who meets the requirements in R12-1-712.

"Authorized user" means a physician, dentist, or podiatrist who meets the requirements in R12-1-719, R12-1-721, R12-1-723, R12-1-727, R12-1-728, or R12-1-744.

"Brachytherapy" means a method of radiation therapy in which a sealed source or group of sealed sources is utilized to deliver beta or gamma radiation at a distance of up to a few centimeters, by surface, intracavitary, intraluminal, or interstitial application.

"CT" means computerized tomography.

"High dose rate afterloading brachytherapy" means the treating of human disease using the radiation from a radioactive sealed source containing more than 1 curie of radioactive material. The radioactive material is introduced into a patient's body using a device that allows the therapist to indirectly handle the radiation source during the treatment. For purposes of the requirements in this Article "pulse dose rate afterloading brachytherapy" is included in this definition.

"Human research subject" means an individual who is or becomes a participant in research overseen by an IRB, either as a recipient of the test article or as a control. A subject may be either a healthy human, in research overseen by the RDRC, or a patient.

"Institutional review board" (IRB) is defined in R12-1-704(B).

"Manual brachytherapy" means a type of brachytherapy in which the brachytherapy sources (e.g., seeds, ribbons) are manually placed topically on or inserted either into the body cavities that are in close proximity to a treatment site or directly into the tissue volume.

"Medical event" means an event that meets the criteria in R12-1-745.

"Medical institution" means an organization in which several medical disciplines are practiced.

"Medical use" means the intentional internal or external administration of radioactive material, or the radiation from it, to an individual under the supervision of an authorized user.

"Nuclear cardiology" means the diagnosis of cardiac disease using radiopharmaceuticals.

"PET" means positron emission tomography.

"Physically present" means that a supervising medical professional is in proximity to the patient during a radiation therapy procedure so that immediate emergency orders can be communicated to ancillary staff, should the occasion arise.

"Prescribed dosage" means the specified activity or range of activity of unsealed radioactive material as documented:

In a written directive; or
In accordance with the directions of the authorized user for procedures performed in accordance with the uses described in Exhibit A.

"Prescribed dose" means:

For gamma stereotactic radiosurgery, the total dose as documented in the written directive;
For teletherapy, the total dose and dose per fraction as documented in the written directive;
For manual brachytherapy, either the total source strength and exposure time or the total dose, as documented in the written directive; or
For remote brachytherapy afterloaders, the total dose and dose per fraction as documented in the written directive.

"Radiation Safety Officer" (RSO) for purposes of this Article, and in addition to the definition in Article 1 means an individual who:

Meets the requirements in R12-1-710, or
Is identified as a radiation safety officer on:
A specific medical use license issued by the NRC or Agreement State; or
A medical use permit issued by a NRC master material license.

"Radioactive drug" is defined in 21 CFR 310.3(c) and includes a "radioactive biological product" as defined in 21 CFR 600.3, April 1, 2006, both of which are incorporated by reference, published by the Office of Federal Register, National Archives and Records Administration, Washington, DC 20408, and on file with the Agency. These incorporated materials contain no future editions or amendments.

"Radioactive Drug Research Committee" (RDRC) means the committee established by the licensee to review all basic research involving the administration of a radioactive drug to human research subjects, taken from 21 CFR 361.1, April 1, 2006, which is incorporated by reference, published by the Office of Federal Register, National Archives and Records Administration, Washington, DC 20408, and on file with the Agency. This incorporation by reference contains no future editions or amendments. Research is considered basic research if it is done for the purpose of advancing scientific knowledge, which includes basic

information regarding the metabolism (including kinetics, distributions, dosimetry, and localization) of a radioactive drug or regarding human physiology, pathophysiology, or biochemistry. Basic research is not intended for immediate therapeutic or diagnostic purposes and is not intended to determine the safety and effectiveness of a radioactive drug in humans.

"Radiopharmaceutical" means any drug that exhibits spontaneous disintegration of unstable nuclei with the emission of nuclear particles or photons and includes any nonradioactive reagent kit or nuclide generator that is intended to be used in the preparation of any such substance. For purposes of this Article radiopharmaceutical is equivalent to radioactive drug.

"Remote afterloading brachytherapy device" means a device used in radiation therapy that allows the authorized user to insert, from a remote location, a radiation source into an applicator that has been previously inserted in an individual requiring treatment.

"Sealed Source and Device Registry" means the national registry that contains all the registration certificates, generated by both NRC and the Agreement States, that summarize the radiation safety information for the sealed sources and devices and describe the licensing and use conditions approved for the product.

"Stereotactic radiosurgery" means the use of external radiation in conjunction with a stereotactic guidance device to very precisely deliver a dose.

"Teletherapy" means therapeutic irradiation in which the sealed source of radiation is at a distance from the body.

"Therapeutic dosage" means a dosage of unsealed radioactive material that is intended to deliver a

radiation dose to a patient or human research subject for palliative or curative treatment.

"Therapeutic dose" means a radiation dose delivered from a source containing radioactive material to a patient or human research subject for palliative or curative treatment.

"Treatment site" means the anatomical description of the tissue intended to receive a radiation dose, as described in a written directive.

"Unit dosage" means a dosage prepared for medical use for administration as a single dosage to a patient or human research subject without any further manipulation of the dosage after it is initially prepared.

"Written directive" means an authorized user's written order for the administration of radioactive material or radiation from radioactive material to a specific patient or human research subject, as specified in R12-1-707.

Historical Note

Former Rule Section G.2; Former Section R12-1-702 repealed, new Section R12-1-702 adopted effective June 30, 1977 (Supp. 77-3). Former Section R121-702 renumbered and amended as Section R12-1-703, new Section R12-1-702 adopted effective December 20, 1985 (Supp. 85-6). Amended by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-703. License for Medical Use of Radioactive Material

A. In addition to the requirements set forth in R12-1-309, the Agency shall issue a specific license for medical use of radioactive material if:
1. The applicant has appointed a radiation safety committee, meeting the requirements in R12-1-705, that will oversee the use of licensed material throughout the licensee's facility and associated radiation safety program;
2. The applicant possesses facilities for the clinical care of patients or human research subjects; and
3. The individual designated on the application as an authorized user has met the training and experience requirements in R12-1-719, R12-1-721, R12-1-723, R12-1-727, R12-1-728, or R12-1-744.

B. Specific licenses to individual authorized users for medical use of radioactive material:
1. The Agency shall approve an application by a prospective individual authorized user or prospective group of authorized users for a specific license governing the medical use of radioactive material if:
   a. The applicant satisfies the general requirements in R12-1-309;
   b. The application is for use in the applicant's practice at an office outside of a medical institution;
   c. The applicant meets the training and experience requirements in subsection (A)(3); and
   d. The applicant has a radiation safety committee, if the criteria in R12-1-705 are applicable and a RDRC, if the use is basic research involving humans.
2. The Agency shall not approve an application by a prospective authorized user or group of prospective authorized users for a specific license to receive, possess, or use radioactive material on the premises of a medical institution unless:
   a. The use of radioactive material is limited to:
      i. The administration of radiopharmaceuticals for diagnostic or therapeutic purposes;
      ii. The performance of diagnostic studies on patients or human research subjects to whom a radiopharmaceutical has been administered;
      iii. The performance of in vitro diagnostic studies; or
      iv. The calibration and quality control checks of radioactive assay instrumentation, radiation safety instrumentation, or diagnostic instrumentation;
   b. The authorized user brings the radioactive material and removes the radioactive material upon departure; and

c. The medical institution does not hold a radioactive materials license under subsection (A).

C. Specific licenses for certain groups of medical uses of radioactive material:

1. The Agency shall approve an application for a specific license under subsections (A) or (B), for any medical use or uses of radioactive material specified in Groups 100 through 1,000, in Exhibit A of this Article, for all of the materials within each group requested in the application if:
   a. The applicant satisfies the requirements of subsections (A) and (B);
   b. Each person involved in the preparation and use of the radioactive material is an authorized user, an authorized nuclear pharmacist, or certified as a nuclear medicine technologist by the Medical Radiologic Technology Board of Examiners (MRTBE);
   c. The applicant's radiation detection and measuring instrumentation is adequate for conducting the procedures involved in the authorized uses selected from Group 100 through Group 1,000; and
   d. The applicant's radiation safety operating procedures are adequate for handling and disposal of the radioactive material involved in the authorized uses selected from Group 100 through Group 1,000.
2. Any licensee who is authorized to use radioactive material:
   a. In unsealed form under Groups 100, 200, 300 or 1,000 listed in Exhibit A of this Article, shall do so using radiopharmaceuticals prepared in accordance with R12-1-311(I); or
   b. In sealed source form under Groups 400, 500, 600, or 1,000 listed in Exhibit A of this Article, shall do so using sealed sources that have been manufactured and distributed in accordance with R12-1-311(K);
   c. In any form under group 1,000 listed in Exhibit A of this Article, shall do so using sealed and unsealed sources that have been manufactured and distributed in accordance with the specific license issued by the Agency.
3. Any licensee who is licensed according to subsection (C)(1), for one or more of the medical use groups in Exhibit A also is authorized to use radioactive material under the general license in R12-1-306(F) for the specified in vitro uses without filing Form ARRA-9 as required by R12-1-306(F)(2); provided, that the licensee is subject to the other provisions of R12-1-306(F).

D. In addition to the other license application requirements in this Section, each applicant shall include in the radiation safety program required under subsection (A)(1) a system for ensuring that each syringe and vial that contains unsealed radioactive material is labeled in accordance with R12-1-431(D).

Historical Note

Former Rule Section G.3; Former Section R12-1-703 repealed, new Section R12-1-703 adopted effective June 30, 1977 (Supp. 77-3). Former Section R12-1-703 renumbered and amended as Section R12-1-704, former Section R12-1-702 renumbered and amended as Section R12-1-703 effective December 20, 1985 (Supp. 85-6). Section repealed and new Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Amended by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-704. Provisions for the Protection of Human Research Subjects

A. A licensee may conduct basic research involving human research subjects and research involving patients receiving investigational new drugs or devices if the licensee only uses the radioactive material specified on the license for the uses authorized on the license.

B. If research is conducted, funded, supported, or regulated by a federal agency that has implemented the federal Policy for Protection of Human Research Subjects (45 CFR 46, June 23, 2005, which is incorporated by reference, published by the Office of Federal Register, National Archives and Records Administration, Washington, DC 20408, on file with the Agency, and contains no future editions or amendments), the licensee shall:

1. Obtain review and approval of the research from an Institutional Review Board (IRB); and
2. Obtain informed consent from the human research subject.

C. If research will not be conducted, funded, supported, or regulated by a federal agency that has implemented the federal policy in subsection (B), a medical licensee shall, before conducting research, apply for and receive a specific amendment to its use license. The amendment request shall include a written commitment that the licensee will, before conducting research:

1. Obtain review and approval of the research from an IRB, as defined and described in the federal policy; and
2. Obtain informed consent from the human research subject.

D. Before conducting the research described in subsection (A) the licensee shall apply to the Agency for and receive a specific amendment to its medical use license. The amendment request shall include a written commitment that the licensee will, before conducting research:

1. Obtain any review and approval required by this Section, and
2. Obtain informed consent from the human research subject if applicable.

E. Nothing in this Section relieves a licensee from complying with the other requirements in this Article.

Historical Note

Repealed effective June 30, 1977 (Supp. 77-3). Former Section R12-1-703 renumbered and amended as Section R12-1-704 effective December 20, 1985 (Supp. 85-6). Section repealed and new Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed;

new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-705. Authority and Responsibilities for the Radiation Protection Program

A. A licensee's management shall appoint in writing a radiation safety officer, who agrees, in writing, to be responsible for implementing the radiation protection program. The licensee, through the RSO, shall ensure that radiation safety activities are being performed in accordance with licensee-approved procedures and regulatory requirements. Each time the RSO is changed, the licensee shall provide to the Agency within 30 days an amendment request and a copy of the correspondence between the licensee's management and the candidate, accepting the position of RSO.

B. Licensees that are authorized for two or more different types of uses of radioactive material listed in Groups 300, 400, 600, and 1,000, or two or more types of units under group 600 or 1,000, shall establish a Radiation Safety Committee (RSC) to oversee all uses of radioactive material permitted by the license. At a minimum, the RSC shall include an authorized user of each type of use permitted by the license, the RSO, a representative of the nursing service, and a representative of management who is neither an authorized user nor a RSO.

C. If a licensee or applicant is not a health care institution and is unable to meet the RSC membership requirements in subsection (B), the licensee or applicant may request an exemption in accordance with A.R.S. § 30-654(B)(13). The request for exemption shall be made to the Agency in writing and list the reasons why the health care institution is unable to meet the requirements.

D. A licensee shall ensure that the RSC meets, at a minimum, on an annual basis and maintain the RSC meeting minutes for Agency review for three years after the date of the RSC meeting.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-706. Supervision

A. For purposes of this rule, "supervision" means the exercise of control over or direction of the use of radioactive material in the practice of medicine by an authorized user named on a radioactive material license. Supervision does not require a supervising physician's constant physical presence if the supervising physician can be easily contacted by radio, telephone, or telecommunication.

B. A physician may use radioactive material if the person is licensed by the Arizona Medical Board or Board of Osteopathic Examiners in Medicine and Surgery and is listed as an authorized user on the Arizona radioactive material license under which the radioactive material is obtained.

C. A licensee that permits the receipt, possession, use, or transfer of radioactive material by an individual under the supervision of an authorized user, shall:

1. Instruct the supervised individual in the licensee's written radiation protection procedures, written directive procedures, rules, and license conditions with respect to the use of radioactive material; and
2. Require the supervised individual to follow the instructions of the supervising authorized user for medical uses of radioactive material, written radiation protection procedures established by the licensee, written directive procedures, rules, and license conditions with respect to the medical use of radioactive material.

D. A licensee that permits the preparation of radioactive material for medical use by an individual who is supervised by an authorized nuclear pharmacist or a physician, who is an authorized user, shall:

1. Instruct the supervised individual in the preparation of radioactive material for medical use, as appropriate to that individual's involvement with radioactive material; and
2. Require the supervised individual to follow the instructions of the supervising authorized user or authorized nuclear pharmacist regarding the preparation of radioactive material for medical use, written radiation protection procedures established by the licensee, the rules, and license conditions.

E. A licensee that permits supervised activities under subsections (C) and (D) is responsible for the acts and omissions of the supervised individual.

F. A limited-service nuclear pharmacy licensee shall dispense radiopharmaceuticals only to a physician listed as an authorized user on a valid radioactive material license issued by the Agency, an Agreement State, or the NRC. For purposes of this rule "limited-service nuclear pharmacy" is defined in R4-23-110.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-707. Written Directives

A. A licensee shall ensure that a written directive is dated and signed by an authorized user before the administration of I-131 sodium iodide greater than 1.11 MBq (30 microcuries (μCi)), any therapeutic dosage of unsealed radioactive material or any therapeutic dose of radiation from radioactive material. If, because of the emergent nature of the patient's condition, a delay in order to provide a written directive would jeopardize the patient's health, an oral directive is acceptable. The information contained in the oral directive shall be documented as soon as possible in writing in the patient's record. A written directive shall be prepared within 48 hours of the oral directive.

B. A written directive shall contain the patient or human research subject's name and the following information:

1. For any administration of quantities greater than 1.11 MBq (30 µCi) of sodium iodide I-131: the dosage;
2. For an administration of a therapeutic dosage of unsealed radioactive material other than sodium iodide I-131: the radiopharmaceutical, dosage, and route of administration;
3. For gamma stereotactic radiosurgery: the total dose, treatment site, and values for the target coordinate settings per treatment for each anatomically distinct treatment site;
4. For teletherapy: the total dose, dose per fraction, number of fractions, and treatment site;
5. For high dose-rate remote afterloading brachytherapy: the radionuclide, treatment site, dose per fraction, number of fractions, and total dose; or
6. For all other brachytherapy, including low, medium, and pulsed dose rate remote afterloaders:
   a. Before implantation: treatment site, the radionuclide, and dose; and
   b. After implantation but before completion of the procedure: the radionuclide, treatment site, number of sources, and total source strength and exposure time (or the total dose).

C. The licensee shall retain a copy of the written directive for three years after creation of the record.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-708. Procedures for Administrations Requiring a Written Directive

For any administration requiring a written directive, the licensee shall develop, implement, and maintain written procedures to provide high confidence that:

1. The patient's or human research subject's identity is verified before each administration; and
2. Each administration is in accordance with the written directive.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-709. Sealed Sources or Devices for Medical Use

A licensee may only use:

1. Sealed sources, including teletherapy sources, or devices manufactured, labeled, packaged, and distributed in accordance with a license issued under Article 3 of this Chapter, equivalent regulations of the NRC or equivalent requirements of an Agreement State; or
2. Sealed sources or devices noncommercially transferred from another medical licensee; or
3. Teletherapy sources manufactured and distributed in accordance with a license issued by the Agency, the NRC, or another Agreement State.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-710. Radiation Safety Officer Training

A. A licensee shall require an individual fulfilling the responsibilities of the radiation safety officer, described in R12-1-705, to be an individual who:

1. Is certified by a specialty board whose certification process includes all of the requirements in subsection (A)(2) and whose certification has been recognized by the Agency, NRC, or an Agreement State. To have its certification process recognized, a specialty board shall require all candidates for certification to:
   a. Meet the following minimum requirements:
      i. Hold a bachelor's or graduate degree from an accredited college or university in physical science or engineering or biological science with a minimum of 20 college credits in physical science;
      ii Have five or more years of professional experience in health physics (graduate training may be substituted for no more than two years of the required experience) including at least three years in applied health physics; and
      iii. Pass an examination administered by diplomates of the specialty board, which evaluates knowledge and competence in radiation physics and instrumentation, radiation protection, mathematics pertaining to the use and measurement of radioactivity, radiation biology, and radiation dosimetry; or
   b. Meet the following minimum requirements:
      i. Hold a master's or doctor's degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university;
      ii. Have two years of full-time practical training and/or supervised experience in medical physics;
         (1) Under the supervision of a medical physicist who is certified in medical physics by a specialty board recognized by the Commission or an Agreement State; or
         (2) In clinical nuclear medicine facilities providing diagnostic and/or therapeutic services under the direction of physicians who meet the requirements for authorized users qualified under section R12-1-710(B), R12-1-721, or R12-1-723;

iii. Pass an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in clinical diagnostic radiological or nuclear medicine physics and in radiation safety; or

2. Has completed a structured educational program consisting of both:
   a. 200 hours of didactic and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Radiation biology; and
      v. Radiation dosimetry; and
   b. One year of full-time radiation safety experience under the supervision of the individual identified as the radiation safety officer on an Agency, NRC, or an Agreement State license or permit issued by a NRC master material licensee that authorizes similar type(s) of use(s) of radioactive material involving the following:
      i. Shipping, receiving, and performing related radiation surveys;
      ii. Using and performing checks for proper operation of instruments used to determine the activity of dosages, survey meters, and instruments used to measure radionuclides;
      iii. Securing and controlling radioactive material;
      iv. Using administrative controls to avoid mistakes in the administration of radioactive material;
      v. Using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures;
      vi. Using emergency procedures to control radioactive material; and
      vii. Disposing of radioactive material; or
   c. Has obtained written certification, signed by a preceptor radiation safety officer, that the individual has satisfactorily completed the requirements in subsection (A)(2)(a) and (A)(2)(b) and has achieved a level of radiation safety knowledge sufficient to function independently as a radiation safety officer for a medical use licensee; or

3. Is an authorized user, authorized medical physicist, or authorized nuclear pharmacist identified on the licensee's license and has experience with the radiation safety aspects of similar types of use of radioactive material for which the individual has radiation safety officer responsibilities.

B. Exceptions.

1. An individual identified as a radiation safety officer on an Agency, a NRC, or an Agreement State license or a permit issued by the NRC or an Agreement State broad scope licensee or master material license permit or by a master material license permittee of broad scope before the effective date of these rules need not comply with the training requirements in subsections (A)(1) through (A)(3).
2. A physician, dentist, or podiatrist identified as an authorized user for the medical use of radioactive material on a license issued by the Agency, NRC, or Agreement State, a permit issued by a NRC master material licensee, a permit issued by an Agency, NRC, or Agreement State broad scope licensee, or a permit issued by a NRC master material license broad scope permittee before the effective date of these rules need not comply with the training requirements in this Article.

C. The training and experience required in this Section shall be obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

D. Individuals who, under subsection (B), need not comply with training requirements described in this Section may serve as preceptors for, and supervisors of, applicants seeking authorization on Agency licenses for the same uses for which these individuals are authorized.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-711. Authorized Medical Physicist Training

A. A licensee shall require an authorized medical physicist to be an individual who:

1. Is certified by a specialty board whose certification process includes all of the training and experience requirements in subsection (A)(3)(b) and (A)(3)(c) and whose certification has been recognized by the Agency, NRC or an Agreement State; or
2. Training requirements.
   a. Hold a master's or doctor's degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university;
   b. Have two years of full-time practical training and/or supervised experience in medical physics:
      i. Under the supervision of a medical physicist who is certified in medical physics by a specialty board recognized by the NRC or an Agreement State; or
      ii. In clinical radiation facilities providing high-energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services under the direction of

physicians who meet the requirements for authorized users in R12-1-710, R12-1-719, R12-1-721, R12-1-723, R12-1-727, R12-1-728, or R12-1-744; and

c. Pass an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in clinical radiation therapy, radiation safety, calibration, quality assurance, and treatment planning for external beam therapy, brachytherapy, and stereotactic radiosurgery; or

3. Training requirements alternative.

a. Holds a master's or doctor's degree in physics, medical physics, other physical science, engineering, or applied mathematics from an accredited college or university; and has completed one year of full-time training in medical physics and an additional year of full-time work experience under the supervision of an individual who meets the requirements for an authorized medical physicist for the type(s) of use for which the individual is seeking authorization. This training and work experience must be conducted in clinical radiation facilities that provide high-energy, external beam therapy (photons and electrons with energies greater than or equal to 1 million electron volts) and brachytherapy services and must include:

i. Performing sealed source leak tests and inventories;

ii. Performing decay corrections;

iii. Performing full calibration and periodic spot checks of external beam treatment units, stereotactic radiosurgery units, and remote afterloading units as applicable; and

iv. Conducting radiation surveys around external beam treatment units, stereotactic radiosurgery units, and remote afterloading units as applicable; and

b. Has obtained written attestation that the individual has satisfactorily completed the requirements in subsection (A)(3)(c) and (A)(2)(a) and (A)(2)(b) and (A)(3)(c), or (A)(3)(a) and (A)(3)(c); and has achieved a level of competency sufficient to function independently as an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status. The written attestation must be signed by a preceptor authorized medical physicist who meets the requirements in section, or equivalent Agreement State requirements for an authorized medical physicist for each type of therapeutic medical unit for which the individual is requesting authorized medical physicist status; and

c. Has training for the type(s) of use for which authorization is sought that includes hands-on device operation, safety procedures, clinical use, and the operation of a treatment planning system. This training requirement may be satisfied by satisfactorily completing either a training program provided by the vendor or by training supervised by an authorized medical physicist authorized for the type(s) of use for which the individual is seeking authorization.

B. Exceptions. An individual identified as a teletherapy or medical physicist on an Agency, a NRC, or an Agreement State license or a permit issued by the NRC or an Agreement State broad scope licensee or master material license permit or by a master material license permittee of broad scope before the effective date of these rules need not comply with the training requirements in subsection (A).

C. The training and experience required in this Section shall be obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

D. Individuals who, under subsection (B), need not comply with training requirements described in this Section may serve as preceptors for, and supervisors of, applicants seeking authorization on Agency licenses for the same uses for which these individuals are authorized.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-712. Authorized Nuclear Pharmacist Training

A. A licensee shall require the authorized nuclear pharmacist to be a pharmacist who:

1. Is certified as a nuclear pharmacist by a specialty board whose certification process has been recognized by the Agency, NRC, or an Agreement State. To have its certification process recognized, a specialty board shall require all candidates for certification to:

a. Have graduated from a pharmacy program accredited by the American Council on Pharmaceutical Education (ACPE) or have passed the Foreign Pharmacy Graduate Examination Committee (FPGEC) examination;

b. Hold a current, active license to practice pharmacy in Arizona;

c. Provide evidence of having acquired at least 4000 hours of training/experience in nuclear pharmacy practice. Academic training may be substituted for no more than 2000 hours of the required training and experience; and

d. Pass an examination in nuclear pharmacy administered by diplomates of the specialty board, that assesses knowledge and competency in procurement, compounding, quality assurance, dispensing, distribution, health and safety, radiation safety, provision of information and consultation, monitoring patient outcomes, research and development; or

2. Has completed 700 hours in a structured educational program consisting of both:

a. 200 hours of classroom and laboratory training in the following areas:

i. Radiation physics and instrumentation;

ii. Radiation protection;
iii. Mathematics pertaining to the use and measurement of radioactivity;
iv. Chemistry of radioactive material for medical use; and
v. Radiation biology; and

b. Supervised practical experience in a nuclear pharmacy involving:
i. Shipping, receiving, and performing related radiation surveys;
ii. Using and performing checks for proper operation of instruments used to determine the activity of dosages, survey meters, and, if appropriate, instruments used to measure alpha- or beta-emitting radionuclides;
iii. Calculating, assaying, and safely preparing dosages for patients or human research subjects;
iv. Using administrative controls to avoid medical events in the administration of radioactive material; and
v. Using procedures to prevent or minimize radioactive contamination and using proper decontamination procedures; and

3. Has obtained written attestation, signed by a preceptor authorized nuclear pharmacist, that the individual has satisfactorily completed the requirements in subsection (A)(2) and has achieved a level of competency sufficient to function independently as an authorized nuclear pharmacist.

B. Exceptions. An individual identified as a nuclear pharmacist on an Agency, a NRC or an Agreement State license or a permit issued by the NRC or an Agreement State broad scope licensee or master material license permit or by a master material license permittee of broad scope before the effective date of these rules need not comply with the training requirements in subsections (A)(1) through (A)(3).

C. The training and experience required in this Section shall be obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

D. Individuals who, under subsection (B), need not comply with training requirements described in this Section may serve as preceptors for, and supervisors of, applicants seeking authorization on Agency licenses for the same uses for which these individuals are authorized.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-713. Determination of Prescribed Dosages, and Possession, Use, and Calibration of Instruments

A. A licensee shall determine and record the activity of each dosage before medical use.

B. For a unit dosage, this determination shall be made by:
1. Direct measurement of radioactivity; or
2. Decay correction, based on the activity or activity concentration determined by
:
a. A manufacturer or preparer licensed under R12-1-311 or equivalent NRC or Agreement State requirements; or
b. An Agency, NRC, or Agreement State licensee for use in research in accordance with a Radioactive Drug Research Committee-approved protocol or an Investigational New Drug (IND) protocol accepted by FDA or;
c. A PET radioactive drug producer licensed under R12-1-311 or equivalent NRC or Agreement State requirements.

C. For other than unit dosages, this determination shall be made by:
1. Direct measurement of radioactivity;
2. Combination of measurement of radioactivity and mathematical calculations; or
3. Combination of volumetric measurements and mathematical calculations based on the measurement made by a manufacturer or preparer licensed under R12-1-311, or equivalent NRC or Agreement State requirements.

D. Unless otherwise directed by the authorized user, a licensee may not use a dosage if the dosage does not fall within the prescribed dosage range or if the dosage differs from the prescribed dosage by more than 20 percent.

E. A licensee shall retain a record of the dosage determination required by this Section for Agency inspection for three years.

F. For direct measurements performed in accordance with subsection (B)(1), a licensee shall possess and use instrumentation to measure the activity of the dosage before it is administered to each patient or human research subject.

G. A licensee shall calibrate the instrumentation required in subsection (F) in accordance with nationally recognized standards, the manufacturer's instructions, or the following procedures.
1. The procedures that may be followed are:
a. Check each dose calibrator for constancy with a dedicated check source at the beginning of each day of use;
b. Test each dose calibrator for accuracy upon installation and at least annually thereafter by assaying at least two sealed sources containing different radionuclides whose activity the manufacturer has determined within 5 percent of its stated activity, whose activity is at least 10 microcuries for radium-226 and 50 microcuries for any other photon-emitting radionuclide, and at least one of which has a principal photon energy between 100 keV and 500 keV;

c. Test each dose calibrator for linearity upon installation and at least quarterly thereafter over a range from the highest dosage that will be administered to a patient or human research subject to 1.1 megabecquerels (30 microcuries);
d. Test each dose calibrator for geometry dependence upon installation over the range of volumes and volume configurations for which it will be used. The licensee shall keep a record of this test for the duration of the use of the dose calibrator.
e. Perform appropriate checks and tests required by this Section following adjustment or repair of the dose calibrator; and
f. Mathematically correct dosage readings for any geometry or linearity error that exceeds 10 percent if the dosage is greater than 10 microcuries and shall repair or replace the dose calibrator if the accuracy or constancy error exceeds 10 percent.

2. A licensee shall maintain the dose calibrator in accordance with this subsection, even though the dose calibrator is only used to "verify" a dosage prepared by a supplier authorized in subsection (B)(2).
3. A licensee shall maintain on file for Agency review nationally recognized standards or manufacturer's instructions used to maintain a dose calibrator and meet the requirements of subsection (G).

H. A licensee shall calibrate the survey instruments before first use, annually, and following a repair that affects the calibration. A licensee shall:
1. Calibrate all scales with readings up to 10 mSv (1000 mrem) per hour with a radiation source;
2. Calibrate two separated readings on each scale or decade that will be used to show compliance; and
3. Conspicuously note on the instrument the date of calibration.

I. A licensee may not use survey instruments if the difference between the indicated exposure rate and the calculated exposure rate is more than 20 percent.

J. A licensee shall retain records of instrument calibration for three years following the calibration.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-714. Authorization for Calibration, Transmission, and Reference Sources

Any person authorized by R12-1-703 for medical use of radioactive material may receive, possess, and use any of the following radioactive material for check, calibration, transmission, and reference use.

1. Sealed sources, not exceeding 1.11 GBq (30 mCi) each, manufactured and distributed by a person licensed under Article 3 of this Chapter or equivalent NRC or Agreement State regulations.
2. Sealed sources, not exceeding 1.11 GBq (30 mCi) each, redistributed by a licensee authorized to redistribute the sealed sources manufactured and distributed by a person licensed under Article 3 of this Chapter, providing the redistributed sealed sources are in the original packaging and shielding and are accompanied by the manufacturer's approved instructions.
3. Any radioactive material with a half-life not longer than 120 days in individual amounts not to exceed 0.56 GBq (15 mCi).
4. Any radioactive material with a half-life longer than 120 days in individual amounts not to exceed the smaller of 7.4 MBq (200 µCi) or 1000 times the quantities in Article 4, Appendix B of this Chapter.
5. Technetium-99m in amounts as needed.
6. A licensee is limited to five sources of radiation authorized under subsections (1) through (3), unless otherwise specified in the licensee's radioactive material license.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-715. Requirements for Possession of Sealed Sources and Brachytherapy Sources

A. A licensee in possession of any sealed source or brachytherapy source shall follow the radiation safety and handling instructions supplied by the manufacturer.

B. A licensee in possession of a sealed source shall test the source for leakage in accordance with R12-1-417.

C. A licensee in possession of sealed sources or brachytherapy sources, except for gamma stereotactic radiosurgery sources, shall conduct a physical inventory every six months of all sources in its possession. During the period of time between the inventories, the licensee shall add each acquired sealed source to the inventory record and remove from the inventory record each source that leaves the licensee's control.

D. A licensee shall document the inventories conducted under subsection (C) and maintain inventory records in accordance with R12-1-450.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). New Section made by

final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-716. Surveys of Ambient Radiation Exposure Rate, Surveys for Contamination, and PET Radiation Exposure Concerns

A. In addition to the surveys required in Article 4 of this Chapter, a licensee shall survey with a radiation detection survey instrument at the end of each day of use all areas where unsealed radioactive material, requiring a written directive, is prepared for use or administered. In areas of routine use, that are to be released for unrestricted use, a licensee shall perform a survey of the area using an instrument appropriate for detecting contamination before releasing the area for unrestricted use.

B. A licensee shall obtain the services of a person, experienced in the principles of radiation protection and installation design, to design a PET facility and perform a radiation survey when the facility is ready for patient imaging. The licensee shall provide a copy of the installation radiation survey to the Agency within 30 days of imaging the first patient.

C. The licensee shall use engineering controls or shield each PET use area with protective barriers necessary to comply with the radiation exposure limits in R12-1-408 and R12-1-416.

1. At the time of application for a new license or amendment to an existing license, and before imaging of the first patient, the licensee shall provide to the Agency a copy of the installation report signed by the contractor who installed the shielding material recommended by a person meeting the requirements in subsection (B) and a copy of the installation radiation survey required in subsection (B).
2. The licensee shall perform shielding calculations in accordance with *AAPM Task Group 108: PET and PET/CT Shielding Requirements*, in Medical Physics, Vol. 33, No. 1, January 2006, which is incorporated by reference, published by the American Association of Physicists in Medicine, One Physics Ellipse, College Park, MD 20740, and on file with the Agency. This incorporation by reference contains no future editions or amendments. In lieu of these procedures, the licensee may use equivalent calculations approved by the Agency.

D. As part of the annual ALARA review required in R12-1-407, the licensee shall document a review of the PET patient workload and associated change, if any, in public exposure resulting from the installed facility shielding and other public radiation exposure controls in use at the time of the review.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-717. Release of Individuals Containing Radioactive Material or Implants Containing Radioactive Material

A. A licensee may authorize the release from its control of any individual who has been administered unsealed radioactive material or implants containing radioactive material, if the total effective dose equivalent to any other individual from exposure to the released individual is not likely to exceed 5 millisieverts (0.5 rem).

B. A licensee shall provide the released individual, or the individual's parent or guardian, with instructions, including written instructions, on actions recommended to maintain doses to other individuals as low as is reasonably achievable if the total effective dose equivalent to any other individual is likely to exceed 1 millisievert (0.1 rem). If the total effective dose equivalent to a nursing infant or child could exceed 1 millisievert (0.1 rem) assuming there were no interruption of breast-feeding, the instructions shall also include:

1. Guidance on the interruption or discontinuation of breast-feeding; and
2. Information on the potential consequences, if any, of failure to follow the guidance.

C. A licensee shall maintain a record of the basis for authorizing the release of an individual and instructions provided to a breast-feeding female for three years from the date of the administration performed under subsection (A). Nothing in this rule relieves the licensee from the personnel exposure requirements in Article 4.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-718. Mobile Medical Service

A. A licensee providing mobile medical service shall:

1. Obtain a letter signed by the management of each client for which services are rendered that permits the use of radioactive material at the client's address and clearly delineates the authority and responsibility of the licensee and the client;
2. Check instruments used to measure the activity of unsealed radioactive material for proper function before medical use at each client's address or on each day of use, whichever is more frequent. At a minimum, the check for proper function required by this subsection shall include a constancy check;
3. Check survey instruments for proper operation with a dedicated check source before use at each client's address; and
4. Before leaving a client's address, survey all areas of use to ensure compliance with the requirements in Article 4 of this Chapter.

B. A mobile medical service may not have radioactive material delivered from the manufacturer or the distributor to the client unless the client has a license allowing its possession. If applicable, radioactive material delivered to the client shall be received and handled in conformance with the client's license.

C. A licensee providing mobile medical services shall retain the letter required in subsection (A)(1) and the record of each survey required in subsection (A)(4) for three years from the date of the survey.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-719. Training for Uptake, Dilution, and Excretion Studies

A. Except as provided in R12-1-710, the licensee shall require an authorized user of unsealed radioactive material for the uses authorized under Group 100 to be a physician who:

1. Is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsection (A)(3). To have its certification process recognized, a specialty board shall require all candidates for certification to:
   a. Complete 60 hours of training and experience in basic radionuclide handling techniques and radiation safety applicable to the medical use of unsealed radioactive material for uptake, dilution, and excretion studies as described in subsection (A)(3); and
   b. Pass an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in radiation safety, radionuclide handling, and quality control; or
2. Is an authorized user under R12-1-721, R12-1-723, NRC, or equivalent Agreement State requirements; or
3. Has completed 60 hours of training and experience, including a minimum of eight hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for uptake, dilution, and excretion studies. The training and experience must include:
   a. Classroom and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Chemistry of radioactive material for medical use; and
      v. Radiation biology; and
   b. Work experience, under the supervision of an authorized user who meets the requirements in this Article, NRC, or equivalent Agreement State requirements, involving:
      i. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
      ii. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters;
      iii. Calculating, measuring, and safely preparing patient or human research subject dosages;
      iv. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material;
      v. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures; and
      vi. Administering dosages of radioactive drugs to patients or human research subjects; and
   c. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements ~~of R12-1-710~~, R12-1-719, R12-1-721, or R12-1-723, NRC, or equivalent Agreement State requirements; that the individual has satisfactorily completed the requirements in subsection (A)(1) or (A)(3) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Exhibit A of this Article.

B. The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

C. Individuals who, under R12-1-710(B), need not comply with training requirements described in this Section may serve as preceptors for, and supervisors of, applicants seeking authorization on Agency licenses for the same uses for which these individuals are authorized.

Historical Note

New Section adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-720. Permissible Molybdenum-99, Strontium-82, and Strontium-85 Concentrations

A. A licensee may not administer to humans a radiopharmaceutical that contains more than 0.15 kilobecquerel of molybdenum-99 per megabecquerel of technetium-99m (0.15 microcurie of molybdenum-99 per millicurie of technetium-99m) or, more than 0.02 kilobecquerel of strontium-82 per megabecquerel of rubidium-82 chloride injection (0.02 microcurie of strontium-82 per millicurie of rubidium-82 chloride); or more than 0.2 kilobecquerel of strontium-85 per megabecquerel of rubidium-82 chloride injection (0.2 microcurie of strontium-85 per millicurie of rubidium-82).

B. A licensee that uses molybdenum-99/technetium-99m generators for preparing a technetium-99m radiopharmaceutical shall measure the molybdenum-99 concentration of the first eluate after receipt of a generator to demonstrate compliance with subsection (A).

C. A licensee that uses a strontium-82/rubidium-82 generator for preparing a rubidium-82 radiopharmaceutical shall, before the first patient use of the day, measure the concentration of radionuclides strontium-82 and strontium-85 to demonstrate compliance with subsection (A).

D. A licensee shall maintain a record of each molybdenum-99 concentration measurement or strontium-82 and strontium-85 concentrations measurements for three years following completion of the measurement.

Historical Note

New Section made by final rulemaking at 7 A.A.R. 2584, effective June 8, 2001 (Supp. 01-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-721. Training for Imaging and Localization Studies Not Requiring a Written Directive

A. Except as provided in R12-1-710, the licensee shall require an authorized user of unsealed radioactive material for the uses authorized under Group 200 to be a physician who:

1. Is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsection (A)(3). To have its certification process recognized, a specialty board shall require all candidates for certification to:
   a. Complete 700 hours of training and experience in basic radionuclide handling techniques and radiation safety applicable to the medical use of unsealed radioactive material for imaging and localization studies as described in subsection (3); and
   b. Pass an examination, administered by diplomates of the specialty board, that assesses knowledge and competence in radiation safety, radionuclide handling, and quality control; or
2. Is an authorized user under this Chapter and R12-1-723, NRC, or equivalent Agreement State requirements; or
3. Has completed 700 hours of training and experience, including a minimum of 80 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material for imaging and localization studies. The training and experience must include:
   a. Classroom and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Chemistry of radioactive material for medical use; and
      v. Radiation biology; and
   b. Work experience, under the supervision of an authorized user who meets the requirements in R12-1-710, R12-1-721, or R12-1-723 and R12-1-721(A)(3)(b)(vii), NRC, or equivalent Agreement State requirements, involving:
      i. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
      ii. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters;
      iii. Calculating, measuring, and safely preparing patient or human research subject dosages;
      iv. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material;
      v. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures; and
      vi. Administering dosages of radioactive drugs to patients or human research subjects; and
      vii. Eluting generator systems appropriate for preparation of radioactive drugs for imaging and localization studies, measuring and testing the elate for radionuclide purity, and processing the elate with reagent kits to prepare labeled radioactive drugs; and,
   c. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements as an authorized user for Exhibit A group 200 nuclides, NRC, or equivalent Agreement State requirements, that the individual has satisfactorily completed the requirements in subsection (A)(1) or (A)(3) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Exhibit A of this Article.

B. ~~The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.~~

Commented [BG3]: ???

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-722. Safety Instruction and Precautions for Use of Unsealed Radioactive Material Requiring a Written Directive

A. A licensee shall provide radiation safety instruction, initially and at least annually, for all personnel caring for the patient or human research subject receiving radiopharmaceutical therapy and hospitalized for compliance with R12-1-717. To satisfy this requirement, the instruction shall describe the licensee's procedures for:

1. Patient or human research subject control;
2. Visitor control;
3. Contamination control;

4. Waste control; and

B. For each patient or human research subject who cannot be released under R12-1-717, a licensee shall:
1. Quarter the patient or the human research subject in a private room with a private sanitary facility;
2. Visibly post the patient's or the human research subject's room with a "Radioactive Materials" sign.
3. Note on the door or in the patient's or human research subject's chart where and how long visitors may stay in the patient's or the human research subject's room; and
4. Monitor material and items removed from the patient's or the human research subject's room to determine that their radioactivity cannot be distinguished from the natural background radiation level with a radiation detection survey instrument set on its most sensitive scale and with no interposed shielding, or handle the material and items as radioactive waste.

C. A licensee shall notify the radiation safety officer, or his or her designee, and the authorized user as soon as possible if the patient or human research subject has a medical emergency or dies.

D. A licensee shall retain records of instruction and safety procedures performed under this rule for three years from the date of the activity.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-723. Training for Use of Unsealed Radioactive Material Requiring a Written Directive, Including Treatment of Hyperthyroidism, and Treatment of Thyroid Carcinoma

A. Except as provided in R12-1-710, the licensee shall require an authorized user of unsealed radioactive material for the uses authorized under Group 300 to be a physician who:
1. Is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsection (A)(2). To have its certification process recognized, a specialty board shall require all candidates for certification to:
   a. Successfully complete residency training in a radiation therapy or nuclear medicine training program or a program in a related medical specialty. These residency training programs must include 700 hours of training and experience as described in (A)(2). Eligible training programs must be approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education, the Royal College of Physicians and Surgeons of Canada, or the Committee on Post-Graduate Training of the American Osteopathic Association; and
   b. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, and quality assurance, and clinical use of unsealed radioactive material for which a written directive is required; or
2. Has completed 700 hours of training and experience, including a minimum of 200 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed radioactive material requiring a written directive. The training and experience must include:
   a. Classroom and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Chemistry of radioactive material for medical use; and
      v. Radiation biology; and
   b. Work experience, under the supervision of an authorized user who meets the requirements in this Article, NRC, or equivalent Agreement State requirements, involving:
      i. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
      ii. Performing quality control procedures on instruments used to determine the activity of dosages and performing checks for proper operation of survey meters;
      iii. Calculating, measuring, and safely preparing patient or human research subject dosages;
      iv. Using administrative controls to prevent a medical event involving the use of unsealed radioactive material;
      v. Using procedures to contain spilled radioactive material safely and using proper decontamination procedures;
      vi. Administering dosages of radioactive drugs to patients or human research subjects involving a minimum of three cases in each of the following categories for which the individual is requesting authorized user status:
         (1) Oral administration of less than or equal to 1.22 gigabecquerels (33 millicuries) of sodium iodide I-131, for which a written directive is required (Experience with at least three cases in Category (A)(2)(b)(vi)(2) also satisfies this requirement);
         (2) Oral administration of greater than 1.22 gigabecquerels (33 millicuries) of sodium iodide I-131;
         (3) Parenteral administration of any beta emitter, or a photon-emitting radionuclide with a photon energy less than 150 keV, for which a written directive is required; and/or
         (4) Parenteral administration of any other radionuclide, for which a written directive is required; and
   c. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements as an authorized user for Exhibit A group 300 nuclides, NRC, or equivalent Agreement State requirements, that the individual has satisfactorily completed the requirements in subsection (A)(1) or (A)(2) and has achieved a level of competency sufficient to function independently as an authorized user for the medical uses authorized under Exhibit A of this

Article. The written attestation must be signed by a preceptor authorized user who meets the requirements in this Section, NRC, or equivalent Agreement State requirements. The preceptor authorized user, who meets the requirements in subsection (B) must have experience in administering dosages in the same dosage category or categories as the individual requesting authorized user status.

B. Except as provided in R12-1-710, a licensee shall require an authorized user of iodine-131 for the oral administration of sodium iodide I-131 requiring a written directive in quantities less than or equal to 1.22 gigabecquerels (33 millicuries) to be a physician who has completed the training requirements in 10 CFR 35.392, January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. Except as provided in R12-1-710, a licensee shall require an authorized user of iodine-131 for the oral administration of sodium iodide I-131 requiring a written directive in quantities greater than 1.22 gigabecquerels (33 millicuries) to be a physician who has completed the training requirements in 10 CFR 35.394, January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

D. Except as provided in R12-1-710, a licensee shall require an authorized user for the parenteral administration of unsealed radioactive material requiring a written directive to be a physician who has completed the training requirements in 10 CFR 35.396, January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

E. The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-724. Surveys after Brachytherapy Source Implant and Removal; Accountability

A. A licensee shall make a survey to locate and account for all sources that have not been implanted immediately after implanting sources in a patient or a human research subject.

B. A licensee shall make a survey of the patient or the human research subject with a radiation detection survey instrument immediately after removing the last temporary implant source to confirm that all sources have been removed.

C. A licensee shall maintain accountability at all times for all sources in storage or use.

D. A licensee shall return brachytherapy sources to a secure storage area as soon as possible after removing sources from a patient or a human research subject.

E. A licensee shall record the procedures performed in subsections (A) through (D) and retain the records for three years following completion of the record.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-725. Safety Instructions and Precautions for Brachytherapy Patients that Cannot be Released Under R12-1-717

A. In addition to the training requirements in Article 10, a licensee shall provide radiation safety instruction, initially and at least annually, to personnel caring for patients or human research subjects who are receiving brachytherapy and cannot be released under R12-1-717. To satisfy this requirement, the instruction shall be commensurate with the duties of the personnel and include the:

1. Size and appearance of the brachytherapy sources;
2. Safe handling and shielding instructions;
3. Patient or human research subject control;
4. Visitor control, including both:
   a. Routine visitation of hospitalized individuals in accordance with Article 4 of this Chapter,
   b. Visitation authorized in accordance with Article 4 of this Chapter, and
5. Notification of the radiation safety officer, or his or her designee, and an authorized user if the patient or the human research subject has a medical emergency or dies.

B. For each patient or human research subject who is receiving brachytherapy and cannot be released under R12-1-717, a licensee shall:

1. Not quarter the patient or the human research subject in the same room as an individual who is not receiving brachytherapy;
2. Visibly post the patient's or human research subject's room with a "Radioactive Materials" sign; and
3. Note on the door or in the patient's or human research subject's chart where and how long visitors may stay in the patient's or human research subject's room.

C. A licensee shall have applicable emergency response equipment available near each treatment room to respond to a source:

1. Dislodged from the patient; and
2. Lodged within the patient following removal of the source applicators.

D. A licensee shall notify the radiation safety officer, or the RSO's designee, and an authorized user as soon as possible if the patient or human research subject has a medical emergency or dies.

E. A licensee shall record the instructions given under subsection (A) and retain the records for three years after recording the instructions.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-726. Calibration Measurements of Brachytherapy Sources, Decay of Sources Used for Ophthalmic Treatments, and Computerized Treatment Planning Systems

A. Before the first medical use of a brachytherapy source after the effective date of this rule, a licensee shall have:
1. Determined the source output or activity using a dosimetry system that meets the requirements of R12-1-733(A);
2. Determined source positioning accuracy within applicators; and
3. Used published protocols currently accepted by nationally recognized bodies to meet the requirements of subsections (A)(1) and (A)(2).

B. A licensee may use measurements provided by the source manufacturer or by a calibration laboratory accredited by the American Association of Physicists in Medicine that are made in accordance with subsection (A).

C. A licensee shall mathematically correct the outputs or activities determined in subsection (A) for physical decay at intervals consistent with one percent physical decay.

D. Only an authorized medical physicist shall calculate the activity of each strontium-90 source that is used to determine the treatment times for ophthalmic treatments. The decay shall be based on the activity determined under subsection (A).

E. A licensee shall perform acceptance testing on the treatment planning system of therapy-related computer systems in accordance with published protocols accepted by nationally recognized bodies. At a minimum, the acceptance testing shall include, as applicable, verification of:
1. The source-specific input parameters required by the dose calculation algorithm;
2. The accuracy of dose, dwell time, and treatment time calculations at representative points;
3. The accuracy of isodose plots and graphic displays; and
4. The accuracy of the software used to determine sealed source positions from radiographic images.

F. A licensee shall retain records of each source activity determination and ophthalmic source decay correction, and documentation of the acceptance testing protocol required under subsection (E) for three years after the date of the procedure required in subsections (A) and (D), and for the records created in conjunction with subsection (E), the record shall be maintained for three years from the last date of the protocol's use.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-727. Training for Use of Manual Brachytherapy Sources and Training for the Use of Strontium-90 Sources for Treatment of Ophthalmic Disease

A. Except as provided in R12-1-710, the licensee shall require an authorized user of a manual brachytherapy source for the uses authorized under this Article to be a physician who:
1. Is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsection (A)(2). To have its certification process recognized, a specialty board shall require all candidates for certification to:
   a. Successfully complete a minimum of three years of residency training in a radiation oncology program approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on Post-Graduate Training of the American Osteopathic Association; and
   b. Pass an examination, administered by diplomates of the specialty board, that tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of manual brachytherapy; or
2. Has completed a structured educational program in basic radionuclide handling techniques applicable to the use of manual brachytherapy sources that includes:
   a. 200 hours of classroom and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Radiation biology; and
   b. 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this Section, or equivalent NRC or Agreement State requirements at a medical institution, involving:
      i. Ordering, receiving, and unpacking radioactive materials safely and performing the related radiation surveys;
      ii. Checking survey meters for proper operation;
      iii. Preparing, implanting, and removing brachytherapy sources;
      iv. Maintaining running inventories of material on hand;
      v. Using administrative controls to prevent a medical event involving the use of radioactive material;
      vi. Using emergency procedures to control radioactive material; and
   c. Has completed three years of supervised clinical experience in radiation oncology, under an authorized user who meets the requirements in this Section, or equivalent Agreement State requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on

Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subsection (A)(2)(b); and

d. Has obtained written attestation, signed by a preceptor authorized user who meets the requirements in this Section, NRC, or equivalent Agreement State requirements, that the individual has satisfactorily completed the requirements in subsection (A)(1) or (A)(2) and has achieved a level of competency sufficient to function independently as an authorized user of manual brachytherapy sources for the medical uses authorized under Exhibit A of this Article.

B. Except as provided in R12-1-710, a licensee shall require an authorized user of strontium-90 for ophthalmic radiotherapy to be a physician who has completed the training requirements in 10 CFR 35.491, January 1, 2013, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-728. Training for Use of Sealed Sources for Diagnosis

A. Except as provided in R12-1-710, the licensee shall require the authorized user of a diagnostic sealed source for use in a device authorized under Group 500 to be a physician, dentist, or podiatrist who

is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsections (A)(1) and (2); or

1. Has completed eight hours of classroom and laboratory training in basic radionuclide handling techniques specifically applicable to the use of the device. The training must include:
   a. Radiation physics and instrumentation;
   b. Radiation protection;
   c. Mathematics pertaining to the use and measurement of radioactivity;
   d. Radiation biology; and
2. Has completed training in the use of the device for the uses requested.

B. The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-729. Surveys of Patients and Human Research Subjects Treated with a Remote Afterloader Unit

A. Before releasing a patient or a human research subject from licensee control, a licensee shall survey the patient or the human research subject and the remote afterloader unit with a portable radiation detection survey instrument to confirm that each source has been removed from the patient or human research subject and returned to the safe shielded position.

B. A licensee shall make records of these surveys conducted under subsection (A) and retain them for three years from the date of each survey.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-730. Installation, Maintenance, Adjustment, and Repair of an Afterloader Unit, Teletherapy Unit, or Gamma Stereotactic Radiosurgery Unit

A. Only a person specifically licensed by the Agency, NRC, or an Agreement State shall install, maintain, adjust, or repair a remote afterloader unit, teletherapy unit, or gamma stereotactic radiosurgery unit that involves work on any source shielding, the source's driving unit, or other electronic or mechanical component that could expose a source, reduce the shielding around a source, or compromise the radiation safety of a unit or a source.

B. Except for low dose-rate remote afterloader units, only a person specifically licensed by the Agency, NRC, or an Agreement State shall install, replace, relocate, or remove a sealed source or source contained in other remote afterloader units, teletherapy units, or gamma stereotactic radiosurgery units.

C. For a low dose-rate remote afterloader unit, only a person specifically licensed by the Agency, NRC, or an Agreement State or an authorized medical physicist shall install, replace, relocate, or remove a sealed source contained in the unit.

D. A licensee shall retain a record of the installation, maintenance, adjustment, and repair of remote afterloader units, teletherapy units, and gamma stereotactic radiosurgery units for three years from the completion date of the activity listed in this Section.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-731. Safety Procedures and Instructions for Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units

A. A licensee shall:

1. Secure the unit, the console, the console keys, and the treatment room when not in use or unattended;

2. Permit only individuals approved by the authorized user, radiation safety officer, or authorized medical physicist to be present in the treatment room during treatment with a source;
3. Prevent dual operation of more than one radiation producing device in a treatment room if applicable; and
4. Develop, implement, and maintain written procedures for responding to an abnormal situation when the operator is unable to place a source in the shielded position, or remove the patient or human research subject from the radiation field with controls from outside the treatment room. These procedures shall include:
   a. Instructions for responding to equipment failures and the names of the individuals responsible for implementing corrective actions;
   b. The process for restricting access to and posting of the treatment area to minimize the risk of inadvertent exposure; and
   c. The names and telephone numbers of the authorized users, the authorized medical physicist, and the radiation safety officer to be contacted if the unit or console operates abnormally.

B. A licensee shall post instructions at the unit console to inform the operator of:
1. The location of the procedures required by subsection (A)(4); and
2. The names and telephone numbers of the authorized users, the authorized medical physicist, and the radiation safety officer to be contacted if the unit or console operates abnormally.

C. A licensee shall provide instruction, initially and at least annually, to all individuals who operate the unit, as appropriate to the individual's assigned duties, in:
1. The procedures identified in subsection (A)(4); and
2. The operating procedures for the unit.

D. A licensee shall ensure that operators, authorized medical physicists, and authorized users participate in drills of the emergency procedures, initially and at least annually.

E. A licensee shall retain a record of individuals receiving instruction required by subsection (C) for three years from the date of the instruction.

F. A licensee shall maintain a copy of the procedures required by subsections (A)(4) and (C)(2) for Agency review. The copy shall be maintained for three years beyond the termination date of the activities for which the procedures were written.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-732. Safety Precautions for Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units

A. A licensee shall control access at each entrance to a treatment room.

B. A licensee shall equip each entrance to the treatment room with an electrical interlock system that will:
1. Prevent the operator from initiating the treatment cycle unless each treatment room entrance door is closed;
2. Cause each source to be shielded when an entrance door is opened; and
3. Prevent any source from being exposed following an interlock interruption until all treatment room entrance doors are closed and the source's on-off control is reset at the console.

C. A licensee shall require any individual entering the treatment room to assure, through the use of appropriate radiation monitors, that radiation levels have returned to ambient levels.

D. Except for low-dose remote afterloader units, a licensee shall construct or equip each treatment room with viewing and intercom systems to permit continuous observation of the patient or the human research subject from the treatment console during irradiation.

E. For licensed activities where sources are placed within the patient's or human research subject's body, a licensee shall only conduct treatments which allow for expeditious removal of a decoupled or jammed source.

F. In addition to the requirements specified in subsections (A) through (E), a licensee shall:
1. For medium dose-rate and pulsed dose-rate remote afterloader units, require:
   a. An authorized medical physicist and either an authorized user or a physician, under the supervision of an authorized user, who has been trained in the operation and emergency response for the unit, to be physically present during the initiation of all patient treatments involving the unit; and
   b. An authorized medical physicist and either an authorized user or an individual, under the supervision of an authorized user, who has been trained to remove each source applicator in the event of an emergency involving the unit, to be immediately available during continuation of all patient treatments involving the unit.
2. For high dose-rate remote afterloader units, require:
   a. An authorized user and an authorized medical physicist to be physically present during the initiation of all patient treatments involving the unit; and
   b. An authorized medical physicist and either an authorized user or a physician, under the supervision of an authorized user, who has been trained in the operation and emergency response for the unit, to be physically present during continuation of all patient treatments involving the unit.
3. For gamma stereotactic radiosurgery units, require an authorized user and an authorized medical physicist to be physically present throughout all patient treatments involving the unit. As used in this provision, physically present means to be within hearing distance of normal voice, and does not include the use of portable communication devices, intercoms, or other devices that could be used to amplify the human voice.

4. Notify the radiation safety officer, or radiation safety officer's designee, and an authorized user as soon as possible if the patient or human research subject has a medical emergency or dies.

G. A licensee shall have applicable emergency response equipment available near each treatment room to respond to a source:
1. Remaining in the unshielded position; or
2. Lodged within the patient following completion of the treatment.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-733. Dosimetry Equipment

A. Except for low dose-rate remote afterloader sources where the source output or activity is determined by the manufacturer, a licensee shall have a calibrated dosimetry system available for use. To satisfy this requirement, one of the following two conditions shall be met.
1. The system shall have been calibrated using a system or source traceable to the National Institute of Science and Technology (NIST) and published protocols accepted by nationally recognized bodies; or by a calibration laboratory accredited by the American Association of Physicists in Medicine (AAPM). The calibration shall have been performed within the previous two years and after any servicing that may have affected system calibration; or
2. The system shall have been calibrated within the previous four years. Eighteen to 30 months after that calibration, the system shall have been intercompared with another dosimetry system that was calibrated within the past 24 months by NIST or by a calibration laboratory accredited by the AAPM. The results of the intercomparison shall indicate that the calibration factor of the licensee's system had not changed by more than two percent. The licensee may not use the intercomparison result to change the calibration factor. When intercomparing dosimetry systems to be used for calibrating sealed sources for therapeutic units, the licensee shall use a comparable unit with beam attenuators or collimators, as applicable, and sources of the same radionuclide as the source used at the licensee's facility.

B. The licensee shall have a dosimetry system available for use for spot-check output measurements, if applicable. To satisfy this requirement, the system may be compared with a system that has been calibrated in accordance with subsection (A). This comparison shall have been performed within the previous year and after each servicing that may have affected system calibration. The spot-check system may be the same system used to meet the requirement in subsection (A).

C. The licensee shall retain, for three years from the date of the procedure, a record of each calibration, intercomparison, and comparison.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-734. Full Calibration Measurements on Teletherapy Units

A. A licensee authorized to use a teletherapy unit for medical use shall perform full calibration measurements on each teletherapy unit:
1. Before the first medical use of the unit; and
2. Before medical use under the following conditions:
   a. Whenever spot-check measurements indicate that the output differs by more than 5 percent from the output obtained at the last full calibration corrected mathematically for radioactive decay;
   b. Following replacement of the source or following reinstallation of the teletherapy unit in a new location;
   c. Following any repair of the teletherapy unit that includes removal of the source or major repair of the components associated with the source exposure assembly; and
3. At intervals not exceeding one year.

B. To satisfy the requirement of subsection (A), full calibration measurements shall include determination of:
1. The output within ±3 percent for the range of field sizes and for the distance or range of distances used for medical use;
2. The coincidence of the radiation field and the field indicated by the light beam localizing device;
3. The uniformity of the radiation field and its dependence on the orientation of the useful beam;
4. Timer accuracy and linearity over the range of use;
5. On-off error; and
6. The accuracy of all distance measuring and localization devices in medical use.

C. A licensee shall use the dosimetry system described in R12-1-733(A) to measure the output for one set of exposure conditions. The remaining radiation measurements required in subsection (B)(1) may be made using a dosimetry system that indicates relative dose rates.

D. A licensee shall make full calibration measurements required by subsection (A) in accordance with published protocols accepted by nationally recognized bodies.

E. A licensee shall mathematically correct the outputs determined in subsection (B)(1) for physical decay for intervals not exceeding one month for cobalt-60, six months for cesium-137, or at intervals consistent with 1 percent decay for all other nuclides.

F. Full calibration measurements required by subsection (A) and physical decay corrections required by subsection (E) shall be performed by an authorized medical physicist.

G. A licensee shall retain a record of each calibration for three years from the date it was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-735. Full Calibration Measurements on Remote Afterloader Units

A. A licensee authorized to use a remote afterloader unit for medical use shall perform full calibration measurements on each unit:
1. Before the first medical use of the unit;
2. Before medical use under the following conditions:
   a. Following replacement of the source or following reinstallation of the unit in a new location outside the facility; and
   b. Following any repair of the unit that includes removal of the source or major repair of the components associated with the source exposure assembly; and
3. At intervals not exceeding one quarter for high dose-rate, medium dose-rate, and pulsed dose-rate remote afterloader units with sources whose half-life exceeds 75 days; and
4. At intervals not exceeding one year for low dose-rate remote afterloader units.

B. To satisfy the requirement of subsection (A), full calibration measurements shall include, as applicable, determination of:
1. The output within ±5 percent;
2. Source positioning accuracy to within ±1 millimeter;
3. Source retraction with backup battery upon power failure;
4. Length of the source transfer tubes;
5. Timer accuracy and linearity over the typical range of use;
6. Length of the applicators; and
7. Function of the source transfer tubes, applicators, and transfer tube-applicator interfaces.

C. A licensee shall use the dosimetry system described in R12-1-733(A) to measure the output.

D. A licensee shall make full calibration measurements required by subsection (A) in accordance with published protocols accepted by nationally recognized bodies.

E. In addition to the requirements for full calibrations for low dose-rate remote afterloader units in subsection (B), a licensee shall perform an autoradiograph of the sources to verify inventory and source arrangement at intervals not exceeding one quarter.

F. For low dose-rate remote afterloader units, a licensee may use measurements provided by the source manufacturer that are made in accordance with subsections (A) through (E).

G. A licensee shall mathematically correct the outputs determined in subsection (B)(1) for physical decay at intervals consistent with 1 percent physical decay.

H. Full calibration measurements required by subsection (A) and physical decay corrections required by subsection (G) shall be performed by an authorized medical physicist.

I. A licensee shall retain a record of each calibration for three years from the date it was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-736. Full Calibration Measurements on Gamma Stereotactic Radiosurgery Units

A. A licensee authorized to use a gamma stereotactic radiosurgery unit for medical use shall perform full calibration measurements on each unit:
1. Before the first medical use of the unit;
2. Before medical use under the following conditions:
   a. Whenever spot-check measurements indicate that the output differs by more than 5 percent from the output obtained at the last full calibration corrected mathematically for radioactive decay;
   b. Following replacement of the sources or following reinstallation of the gamma stereotactic radiosurgery unit in a new location; and
   c. Following any repair of the gamma stereotactic radiosurgery unit that includes removal of the sources or major repair of the components associated with the source assembly; and
3. At intervals not exceeding one year, with the exception that relative helmet factors need only be determined before the first medical use of a helmet and following any damage to a helmet.

B. To satisfy the requirement of subsection (A), full calibration measurements shall include determination of:
1. The output within ±3 percent;
2. Relative helmet factors;
3. Isocenter coincidence;
4. Timer accuracy and linearity over the range of use;
5. On-off error;
6. Trunnion centricity;
7. Treatment table retraction mechanism, using backup battery power or hydraulic backups with the unit off;
8. Helmet microswitches;
9. Emergency timing circuits; and
10. Stereotactic frames and localizing devices (trunnions).

C. A licensee shall use the dosimetry system described in R12-1-733(A) to measure the output for one set of exposure conditions. The remaining radiation measurements required in subsection (B)(1) may be made using a dosimetry system that indicates relative dose rates.

D. A licensee shall make full calibration measurements required by subsection (A) in accordance with published protocols accepted by nationally recognized bodies.

E. A licensee shall mathematically correct the outputs determined in subsection (B)(1) at intervals not exceeding one month for cobalt-60 and at intervals consistent with 1 percent physical decay for all other radionuclides

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F. Full calibration measurements required by subsection (A) and physical decay corrections required by subsection (E) shall be performed by an authorized medical physicist.

G. A licensee shall retain a record of each calibration for three years from the date of the procedure.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-737. Periodic Spot-checks for Teletherapy Units

A. A licensee authorized to use teletherapy units for medical use shall perform output spot-checks on each teletherapy unit once in each calendar month that include determination of:

1. Timer accuracy, and timer linearity over the range of use;
2. On-off error;
3. The coincidence of the radiation field and the field indicated by the light beam localizing device;
4. The accuracy of all distance measuring and localization devices used for medical use;
5. The output for one typical set of operating conditions measured with the dosimetry system described in R12-1-733(B); and
6. The difference between the measurement made in subsection (A)(5) and the anticipated output, expressed as a percentage of the anticipated output.

B. A licensee shall perform measurements required by subsection (A) in accordance with written procedures established by an authorized medical physicist. That individual need not actually perform the spot-check measurements.

C. A licensee shall have an authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist shall notify the licensee as soon as possible in writing of the results of each spot-check.

D. A licensee authorized to use a teletherapy unit for medical use shall perform safety spot-checks of each teletherapy facility once in each calendar month and after each source installation to assure proper operation of:

1. Electrical interlocks at each teletherapy room entrance;
2. Electrical or mechanical stops installed for the purpose of limiting use of the primary beam of radiation (restriction of source housing angulation or elevation, carriage or stand travel and operation of the beam on-off mechanism);
3. Source exposure indicator lights on the teletherapy unit, on the control console, and in the facility;
4. Viewing and intercom systems;
5. Treatment room doors from inside and outside the treatment room; and
6. Electrically assisted treatment room doors with the teletherapy unit electrical power turned off.

E. If the results of the checks required in subsection (D) indicate the malfunction of any system, a licensee shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

F. A licensee shall retain a record of each spot-check required by subsections (A) and (D) for three years from the date of the procedure, and a copy of the procedures required by subsection (B) until licensee terminates all medical activities involving the teletherapy unit.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-738. Periodic Spot-checks for Remote Afterloader Units

A. A licensee authorized to use a remote afterloader unit for medical use shall perform spot-checks of each remote afterloader facility and on each unit:

1. Before the first use of a high dose-rate, medium dose-rate, or pulsed dose-rate remote afterloader unit on a given day;
2. Before each patient treatment with a low dose-rate remote afterloader unit; and
3. After each source installation.

B. A licensee shall perform the measurements required by subsection (A) in accordance with written procedures established by an authorized medical physicist. That individual need not actually perform the spot-check measurements.

C. A licensee shall have an authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist shall notify the licensee as soon as possible in writing of the results of each spot-check.

D. To satisfy the requirements of subsection (A), spot-checks shall, at a minimum, assure proper operation of:

1. Electrical interlocks at each remote afterloader unit room entrance;
2. Source exposure indicator lights on the remote afterloader unit, on the control console, and in the facility;
3. Viewing and intercom systems in each high dose-rate, medium dose-rate, and pulsed dose-rate remote afterloader facility;

4. Emergency response equipment;
5. Radiation monitors used to indicate the source position;
6. Timer accuracy;
7. Clock (date and time) in the unit's computer; and
8. Decayed source activity in the unit's computer.

E. If the results of the checks required in subsection (D) indicate the malfunction of any system, a licensee shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

F. A licensee shall retain a record of each spot-check required by subsections (A) and (D) for three years from the date of the procedure, and a copy of the procedures required by subsection (B) until licensee terminates all medical activities involving the afterloader unit.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-739. Periodic Spot-checks for Gamma Stereotactic Radiosurgery Units

A. A licensee authorized to use a gamma stereotactic radiosurgery unit for medical use shall perform spot-checks of each gamma stereotactic radiosurgery facility and on each unit:
1. Monthly;
2. Before the first use of the unit on a given day; and
3. After each source installation.

B. A licensee shall:
1. Perform the measurements required by subsection (A) in accordance with written procedures established by an authorized medical physicist. That individual need not actually perform the spot-check measurements.
2. Have the authorized medical physicist review the results of each spot-check within 15 days. The authorized medical physicist shall notify the licensee as soon as possible in writing of the results of each spot-check.

C. To satisfy the requirements of subsection (A)(1), spot-checks shall, at a minimum:
1. Assure proper operation of:
   a. Treatment table retraction mechanism, using backup battery power or hydraulic backups with the unit off;
   b. Helmet microswitches;
   c. Emergency timing circuits; and
   d. Stereotactic frames and localizing devices (trunnions).
2. Determine:
   a. The output for one typical set of operating conditions measured with the dosimetry system described in R12-1-733(B);
   b. The difference between the measurement made in subsection (C)(2)(a) and the anticipated output, expressed as a percentage of the anticipated output;
   c. Source output against computer calculation;
   d. Timer accuracy and linearity over the range of use;
   e. On-off error; and
   f. Trunnion centricity.

D. To satisfy the requirements of subsections (A)(2) and (A)(3), spot-checks shall assure proper operation of:
1. Electrical interlocks at each gamma stereotactic radiosurgery room entrance;
2. Source exposure indicator lights on the gamma stereotactic radiosurgery unit, on the control console, and in the facility;
3. Viewing and intercom systems;
4. Timer termination;
5. Radiation monitors used to indicate room exposures; and
6. Emergency off buttons.

E. A licensee shall arrange for the repair of any system identified in subsection (C) that is not operating properly as soon as possible.

F. If the results of the checks required in subsection (D) indicate the malfunction of any system, a licensee shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

G. A licensee shall retain a record of each check required by subsections (C) and (D) for three years from the date of the procedure, and a copy of the procedures required by subsection (B) until licensee terminates all medical activities involving the radiosurgery unit.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-740. Additional Requirements for Mobile Remote Afterloader Units

A. A licensee providing mobile remote afterloader service shall:
1. Check survey instruments before medical use at each address of use or on each day of use, whichever is more frequent; and

2. Account for all sources before departure from a client's address of use.

B. In addition to the periodic spot-checks required by R12-1-738, a licensee authorized to use mobile afterloaders for medical use shall perform checks on each remote afterloader unit before use at each address of use. At a minimum, checks shall be made to verify the operation of:

1. Electrical interlocks on treatment area access points;
2. Source exposure indicator lights on the remote afterloader unit, on the control console, and in the facility;
3. Viewing and intercom systems;
4. Applicators, source transfer tubes, and transfer tube-applicator interfaces;
5. Radiation monitors used to indicate room exposures;
6. Source positioning (accuracy); and
7. Radiation monitors used to indicate whether the source has returned to a safe shielded position.

C. In addition to the requirements for checks in subsection (B), a licensee shall ensure overall proper operation of the remote afterloader unit by conducting a simulated cycle of treatment before use at each address of use.

D. If the results of the checks required in subsection (B) indicate the malfunction of any system, a licensee shall lock the control console in the off position and not use the unit except as may be necessary to repair, replace, or check the malfunctioning system.

E. A licensee shall retain a record of each check required by subsection (B) for three years from the date of the procedure.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-741. Additional Radiation Surveys of Sealed Sources used in Radiation Therapy

A. In addition to the survey requirement in Article 4 of this Chapter, a person licensed to use sealed sources in the practice of radiation therapy shall make surveys to ensure that the maximum radiation levels and average radiation levels from the surface of the main source safe with each source in the shielded position do not exceed the levels stated in the Sealed Source and Device Registry.

B. A licensee shall make the survey required by subsection (A) at installation of a new source and following repairs to any source shielding, a source's driving unit, or other electronic or mechanical component that could expose the source, reduce the shielding around a source, or compromise the radiation safety of the unit or the source.

C. A licensee shall retain a record of the radiation surveys required by subsection (A) for three years from the date of each survey.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-742. Five-year Inspection for Teletherapy and Gamma Stereotactic Radiosurgery Units

A. A licensee shall have each teletherapy unit and gamma stereotactic radiosurgery unit fully inspected and serviced during source replacement or at intervals not to exceed five years, whichever comes first, to assure proper functioning of the source exposure mechanism.

B. This inspection and servicing may only be performed by persons specifically licensed to do so by the Agency, NRC, or an Agreement State.

C. A licensee shall keep a record of each five-year inspection for three years from the date of the inspection, if the inspection determined that service was unnecessary, and three years from the date of the completed service if the inspection determined that service was needed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-743. Therapy-related Computer Systems

The licensee shall perform acceptance testing on the treatment planning system of therapy-related computer systems in accordance with published protocols accepted by nationally recognized bodies. At a minimum, the acceptance testing shall include, as applicable, verification of:

1. The source-specific input parameters required by the dose calculation algorithm;
2. The accuracy of dose, dwell time, and treatment time calculations at representative points;
3. The accuracy of isodose plots and graphic displays;
4. The accuracy of the software used to determine sealed source positions from radiographic images; and
5. The accuracy of electronic transfer of the treatment delivery parameters to the treatment delivery unit from the treatment planning system.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-744. Training for Use of Remote Afterloader Units, Teletherapy Units, and Gamma Stereotactic Radiosurgery Units

A. Except as provided in R12-1-710, a licensee shall require an authorized user of a sealed source for a use authorized under Group 600 to be a physician who:

1. Is certified by a medical specialty board whose certification process has been recognized by the NRC or an Agreement State and who meets the requirements in subsection (A)(2). To have its certification process recognized, a specialty board shall require all candidates to:
   a. Successfully complete a minimum of three years of residency training in a radiation therapy program approved by the Residency Review Committee of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on Post-Graduate Training of the American Osteopathic Association; and
   b. Pass an examination, administered by diplomates of the specialty board, which tests knowledge and competence in radiation safety, radionuclide handling, treatment planning, quality assurance, and clinical use of stereotactic radiosurgery, remote afterloaders and external beam therapy; or
2. Has completed a structured educational program in basic radionuclide techniques applicable to the use of a sealed source in a therapeutic medical unit that includes:
   a. 200 hours of classroom and laboratory training in the following areas:
      i. Radiation physics and instrumentation;
      ii. Radiation protection;
      iii. Mathematics pertaining to the use and measurement of radioactivity;
      iv. Chemistry of radioactive material for medical use; and
      v. Radiation biology; and
   b. 500 hours of work experience, under the supervision of an authorized user who meets the requirements in this Section, or equivalent Agreement State or NRC requirements at a medical institution, involving:
      i. Reviewing full calibration measurements and periodic spot-checks;
      ii. Preparing treatment plans and calculating treatment doses and times;
      iii. Using administrative controls to prevent a medical event involving the use of radioactive material;
      iv. Implementing emergency procedures to be followed in the event of the abnormal operation of the medical unit or console;
      v. Checking and using survey meters; and
      vi. Selecting the proper dose and how it is to be administered; and
   c. Has completed three years of supervised clinical experience in radiation therapy, under an authorized user who meets the requirements in this Section, or equivalent Agreement State or NRC requirements, as part of a formal training program approved by the Residency Review Committee for Radiation Oncology of the Accreditation Council for Graduate Medical Education or the Royal College of Physicians and Surgeons of Canada or the Committee on Postdoctoral Training of the American Osteopathic Association. This experience may be obtained concurrently with the supervised work experience required by subsection (A)(2)(b); and
   d. Has obtained written attestation that the individual has satisfactorily completed the requirements in subsection (A)(1) or (A)(2), and has achieved a level of competency sufficient to function independently as an authorized user of each type of therapeutic medical unit for which the individual is requesting authorized user status. The written attestation must be signed by a preceptor authorized user who meets the requirements in this Section, or equivalent Agreement State or NRC requirements for an authorized user for each type of therapeutic medical unit for which the individual is requesting authorized user status; and
   e. Has received training in device operation, safety procedures, and clinical use for the type(s) of use for which authorization is sought. This training requirement may be satisfied by satisfactory completion of a training program provided by the vendor for new users or by receiving training supervised by an authorized user or authorized medical physicist, as appropriate, who is authorized for the type(s) of use for which the individual is seeking authorization.

B. The training and experience shall have been obtained within the seven years preceding the date of application or the individual shall have had related continuing education and experience since the required training and experience was completed.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

R12-1-745. Report and Notification of a Medical Event

A. A licensee shall report any "medical" event, except for an event that results from patient intervention, in which the administration of radioactive material or radiation from radioactive material results in:
1. A dose that differs from the prescribed dose or dose that would have resulted from the prescribed dosage by more than 0.05 Sv (5 rem) effective dose equivalent, 0.5 Sv (50 rem) to an organ or tissue, or 0.5 Sv (50 rem) shallow dose equivalent to the skin; and
   a. The total dose delivered differs from the prescribed dose by 20 percent or more;
   b. The total dosage delivered differs from the prescribed dosage by 20 percent or more or falls outside the prescribed dosage range; or
   c. The fractionated dose delivered differs from the prescribed dose, for a single fraction, by 50 percent or more.

2. A dose that exceeds 0.05 Sv (5 rem) effective dose equivalent, 0.5 Sv (50 rem) to an organ or tissue, or 0.5 Sv (50 rem) shallow dose equivalent to the skin from any of the following:
    a. An administration of a wrong radiopharmaceutical containing radioactive material;
    b. An administration of a radiopharmaceutical containing radioactive material by the wrong route of administration;
    c. An administration of a dose or dosage to the wrong individual or human research subject;
    d. An administration of a dose or dosage delivered by the wrong mode of treatment; or
    e. A leaking sealed source.
3. A dose to the skin or an organ or tissue other than the treatment site that exceeds by 0.5 Sv (50 rem) to an organ or tissue and 50 percent or more of the dose expected from the administration defined in the written directive (excluding, for permanent implants, seeds that were implanted in the correct site but migrated outside the treatment site).

B. A licensee shall report any event resulting from intervention of a patient or human research subject in which the administration of radioactive material or radiation from radioactive material results or will result in unintended permanent functional damage to an organ or a physiological system, as determined by a physician.

C. The licensee shall notify by telephone the Agency no later than the next calendar day after discovery of the medical event.

D. The licensee shall submit a written report to the Agency within 15 days after discovery of the medical event.
1. The written report shall include:
    a. The licensee's name;
    b. The name of the prescribing physician;
    c. A brief description of the event;
    d. Why the event occurred;
    e. The effect, if any, on each individual who received the administration;
    f. What actions, if any, have been taken or are planned to prevent recurrence; and
    g. Certification that the licensee notified each individual (or the individual's responsible relative or guardian), and if not, why not.
2. The report may not contain an individual's name or any other information that could lead to identification of the individual.

E. The licensee shall provide notification of the event to the referring physician and also notify the individual who is the subject of the medical event no later than 24 hours after its discovery, unless the referring physician personally informs the licensee either that he or she will inform the individual or that, based on medical judgment, telling the individual would be harmful. The licensee is not required to notify the individual without first consulting the referring physician. If the referring physician or the affected individual cannot be reached within 24 hours, the licensee shall notify the individual as soon as possible thereafter. The licensee may not delay any appropriate medical care for the individual, including any necessary remedial care as a result of the medical event, because of any delay in notification. To meet the requirements of this subsection, the notification of the individual who is the subject of the medical event may be made instead to that individual's responsible relative or guardian. If a verbal notification is made, the licensee shall inform the individual, or appropriate responsible relative or guardian, that a written description of the event can be obtained from the licensee upon request. The licensee shall provide such a written description if requested.

F. Aside from the notification requirement, nothing in this Section affects any rights or duties of licensees and physicians in relation to each other, to individuals affected by the medical event, or to that individual's responsible relatives or guardians.

G. A licensee shall:
1. Annotate a copy of the report provided to the Agency with the:
    a. Name of the individual who is the subject of the event; and
    b. Social Security number or other identification number, if one has been assigned, of the individual who is the subject of the event; and
2. Provide a copy of the annotated report to the referring physician, if other than the licensee, no later than 15 days after the discovery of the event.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

R12-1-746. Report and Notification of a Dose to an Embryo, Fetus, or Nursing Child

A. A licensee shall report any dose to an embryo/fetus that is greater than 50 mSv (5 rem) dose equivalent that is a result of an administration of radioactive material or radiation from radioactive material to a pregnant individual unless the dose to the embryo/fetus was specifically approved, in advance, by the authorized user.

B. A licensee shall report any dose to a nursing child that is a result of an administration of radioactive material to a breast-feeding individual that:
1. Is greater than 50 mSv (5 rem) total effective dose equivalent; or
2. Has resulted in unintended permanent functional damage to an organ or a physiological system of the child, as determined by a physician.

C. The licensee shall notify the Agency by telephone no later than the next calendar day after discovery of a dose to the embryo, fetus, or nursing child that requires a report in subsections (A) or (B).

D. The licensee shall submit a written report to the Agency within 15 days after discovery of a dose to the embryo, fetus, or nursing child that requires a report in subsections (A) or (B). The written report shall include

:

1. The licensee's name;
2. The name of the prescribing physician;
3. A brief description of the event;
4. Why the event occurred;
5. The effect, if any, on the embryo/fetus or the nursing child;
6. What actions, if any, have been taken or are planned to prevent recurrence; and
7. Certification that the licensee notified the pregnant individual or mother (or the mother's or child's responsible relative or guardian), and if not, why not.

E. The report, required in subsection (D), shall not contain the individual's or child's name or any other information that could lead to identification of the individual or child.

F. The licensee shall provide notification of the event to the referring physician and also notify the pregnant individual or mother, both hereafter referred to as the mother, no later than 24 hours after discovery of an event that would require reporting under subsections (A) or (B), unless the referring physician personally informs the licensee either that he or she will inform the mother or that, based on medical judgment, telling the mother would be harmful. The licensee is not required to notify the mother without first consulting with the referring physician. If the referring physician or mother cannot be reached within 24 hours, the licensee shall make the appropriate notifications as soon as possible thereafter. The licensee shall not delay any appropriate medical care for the embryo, fetus, or for the nursing child, including any necessary remedial care as a result of the event, because of any delay in notification. To meet the requirements of this subsection, the notification may be made to the mother's or child's responsible relative or guardian instead of the mother. If a verbal notification is made, the licensee shall inform the mother, or the mother's or child's responsible relative or guardian, that a written description of the event can be obtained from the licensee upon request. The licensee shall provide the written description upon request.

G. A licensee shall:

1. Make a copy of the report provided to the Agency and include with it the:
   a. Name of the pregnant individual or the nursing child who is the subject of the event; and
   b. Social Security number or other identification number, if one has been assigned, of the pregnant individual or the nursing child who is the subject of the event; and
2. Provide the copy of the information required in subsection (G)(1) to the referring physician, if other than the licensee, no later than 15 days after the discovery of the event.

Historical Note

New Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1).

Exhibit A. Medical Use Groups

Group 100

Included is the use of any unsealed radioactive material for use in uptake, dilution, or excretion studies and not requiring a written directive: The radioactive material in this group shall be:

1. Obtained from a manufacturer or preparer licensed under R12-1-703(C)(2)(a), or equivalent NRC or Agreement State requirements; or
2. Obtained from a PET radioactive drug producer licensed under R12-1-703 or equivalent NRC or an Agreement State license excluding production of PET radionuclides prepared by an authorized nuclear pharmacist who meets the requirements in R12-1-712, a physician who is an authorized user and who meets the requirements specified in R12-1-721, or R12-1-723 and R12-1-721(A)(3)(b)(vii), or an individual under the supervision of either as specified in R12-1-706; or
3. If a research protocol:
   a Obtained from and prepared by an Agreement State or NRC licensee for use in research in accordance with a Radioactive Drug Research Committee-approved protocol or an Investigational New Drug (IND) protocol accepted by FDA; or
   b. Prepared by the licensee for use in research in accordance with a Radioactive Drug Research Committee-approved application or an Investigational New Drug (IND) protocol accepted by FDA.

Group 200

Included is the use of any unsealed radioactive material for use in imaging and localization not requiring a written directive. PET radiopharmaceuticals may be used if the licensee meets the requirements in R12-1-716. The radioactive material in this group shall be:

1. Obtained from a manufacturer or preparer licensed under R12-1-703(C)(2)(a), or equivalent NRC or Agreement State requirements; or
2. Obtained from a PET radioactive drug producer licensed under R12-1-703 or equivalent NRC or an Agreement State license excluding production of PET radionuclides prepared by an authorized nuclear pharmacist who meets the requirements in R12-1-712, a physician who is an authorized user and who meets the requirements specified in R12-1-721 or R12-1-723 and R12-1-721(A)(3)(b)(vii), or an individual under the supervision of either as specified in R12-1-706; or
3. If a research protocol:

a. Obtained from and prepared by an Agreement State or NRC licensee for use in research in accordance with a Radioactive Drug Research Committee- approved application or an Investigational New Drug (IND) protocol accepted by FDA; or
b. Prepared by the licensee for use in research in accordance with a Radioactive Drug Research Committee-approved application or an Investigational New Drug (IND) protocol accepted by FDA.

Group 300

Included is the use of any unsealed radioactive material for medical use (radiopharmaceutical) for which a written directive is required. The radioactive material in this group shall be:

1. Obtained from a manufacturer or preparer licensed under R12-1-703(C)(2)(a) or equivalent NRC or Agreement State requirements; or
2. Obtained from a PET radioactive drug producer licensed under R12-1-703 or equivalent NRC or an Agreement State license excluding production of PET radionuclides prepared by an authorized nuclear pharmacist who meets the requirements in R12-1-712, a physician who is an authorized user and who meets the requirements specified in R12-1-721 or R12-1-723, or an individual under the supervision of either as specified in R12-1-706; or
3. If a research protocol:
   a. Obtained from and prepared by an Agreement State or NRC licensee for use in research in accordance with an Investigational New Drug (IND) protocol accepted by FDA; or
   b. Prepared by the licensee for use in research in accordance with an Investigational New Drug (IND) protocol accepted by FDA.

Group 400

Included is the use of any brachytherapy source for therapeutic medical use that is manufactured in accordance with R12-1-703(C)(2)(b) and:

1. Approved for therapeutic use in the Sealed Source and Device Registry; or
2. Part of a research protocol that is approved for therapeutic use under an active Investigational Device Exemption (IDE) application accepted by the FDA, and meets the requirements of R12-1-709.

Group 500

Included is the use of any sealed source that is manufactured in accordance with R12-1-703(C)(2)(b), and is approved for diagnostic use in the Sealed Source and Device Registry.

Group 600

Included is the use of sealed sources in photon emitting remote afterloader units, teletherapy units, or gamma stereotactic radiosurgery units that are manufactured in accordance with R12-1-703(C)(2)(b) and:

1. Approved for therapeutic use in the Sealed Source and Device Registry; or
2. Part of a research protocol that is approved for therapeutic use under an active Investigational Device Exemption (IDE) application accepted by the FDA and meets the requirements of R12-1-709.

Group 1000

A licensee may use radioactive material or a radiation source approved for medical use which is not specifically addressed in R12-1-309(A)(4) if:

1. The applicant or licensee has submitted the information required by this Article; and
2. The applicant or licensee has received written approval from the Agency in a license or license amendment and uses the material in accordance with the rules and specific conditions the Agency considers necessary for the medical use of the material.

Historical Note

New Exhibit adopted by final rulemaking at 5 A.A.R. 1817, effective May 12, 1999 (Supp. 99-2). Amended by final rulemaking at 10 A.A.R. 2122, effective July 3, 2004 (Supp. 04-2). Section repealed; new Section made by final rulemaking at 13 A.A.R. 1217, effective May 5, 2007 (Supp. 07-1). Amended by final rulemaking at 20 A.A.R. 324, effective March 8, 2014 (Supp. 14-1).

ARTICLE 15. TRANSPORTATION

R12-1-1501. Requirement for License

A. A person shall not transport radioactive material or deliver radioactive material to a carrier for transport unless the person is authorized in a general or specific license issued by the Agency or exempt under R12-1-103(A).

B. This Article applies to any licensee to transfer licensed material if the licensee delivers that material to a carrier for transport, transports the material outside the site of usage as specified in the license, or transports that material on public highways. No provision of this Article authorizes possession of licensed material.

Historical Note

New Section made by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3).

R12-1-1502. Definitions

Terms defined in Article 1 have the same meaning when used in this Article.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1503. Transportation of Licensed Material

Each licensee that transports licensed material outside the site of usage, as specified in an Agency license, or where transport is on public highways, or that delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the U.S. Department of Transportation regulations listed in 10 CFR 71.5, revised January 1, 2008, incorporated by reference and available under R12-1-101. This incorporated material contains no future editions or amendments.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Repealed effective June 13, 1997 (Supp. 97-2). New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1504. Intrastate Transportation and Storage of Radioactive Materials

A. A general license is issued to:

1. Any common or contract carrier not exempt under R12-1-103 to receive, possess, transport, and store radioactive material in the regular course of carriage for others or to store radioactive material incident to the transport activities, provided the transportation or storage is in accordance with applicable requirements for the mode of transport of the U.S. Department of Transportation, 49 CFR 171 through 180, revised October 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
2. Any private carrier or licensee who transports and stores radioactive material, provided the transportation and storage are in accordance with the requirements applicable to the mode of transport, of the U.S. Department of Transportation, 49 CFR 171 through 180, revised October 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

B. Any notification of incidents required under federal regulations in subsection (A) shall also be filed with, or made to, the Agency.

C. A person who transports or stores radioactive material according to the general license in this Section is exempt from the requirements of Article 4 and Article 10 of this Chapter to the extent that this Section applies to transportation of the radioactive material.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1505. Storage of Radioactive Material in Transport

A. A carrier shall not store, for any period in excess of 72 hours, any package that contains radioactive material bearing a Department of Transportation Yellow II or Yellow III label, unless the radioactive material is stored in an area other than, and not adjacent to, any food storage area or area that is normally occupied by an individual.

B. A carrier shall not store a package that contains radioactive material with other hazardous materials, except as authorized by U.S. Department of Transportation regulations in 49 CFR 177.848, revised October 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. Whenever a package containing radioactive material is stored in excess of 48 hours, the storage area shall be conspicuously posted according to the requirements of Article 4.

D. When transit is interrupted and storage is required for an extended period, the following requirements apply:

1. When radioactive materials are stored for longer than 48 hours during transit, the carrier shall notify the local fire department and provide the following information:
   a. Warehouse location and carrier name and telephone number;
   b. Radionuclide(s);
   c. Activity per package in curies or becquerels and number of packages;
   d. Form (solid, metallic, liquid, gas);
   e. Flammability (if flammable);
   f. Specific location in warehouse;
   g. Estimated date of departure;
   h. Toxicity (if toxic).
2. If the radioactive material will be, or has been in storage for longer than 90 days, the carrier shall notify the Agency in writing and include the information required in subsection (D)(1).
3. The licensee or carrier shall immediately notify the Department of Public Safety of an accident involving radioactive material.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1506. Preparation of Radioactive Material for Transport

A licensee shall not deliver any package that contains radioactive material to a carrier for transport or transport radioactive material, unless the licensee:

1. Complies with the U.S. Department of Transportation packaging, monitoring, manifesting, marking, and labeling regulations applicable to the mode of transport, (Contained in 49 CFR 171 through 180, revised October 1, 2007, or 39 CFR 111.1, revised July 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); and
2. Establishes procedures for safely opening and closing packages in which radioactive material is transported; and
3. Prior to delivery of a package to a carrier for transport, assures that:
   a. The package is properly closed, and
   b. Any special instructions needed to safely open the package are made available to the consignee.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 10 A.A.R. 4458, effective December 4, 2004 (Supp. 04-4). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1507. Packaging Quality Assurance

A. A licensee that transports radioactive material in the course of business or delivers radioactive material to a carrier for transport in a package for which a license, certificate of compliance, **applicant for a certificate of compliance**or other approval has been issued by the Nuclear Regulatory Commission, or meets the applicable criteria (10 CFR 71, Subpart H, revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), shall establish, maintain, and execute the quality assurance program specified in 10 CFR 71, Subpart H.

B. In addition to the requirements in subsection (A) for a quality assurance program, a licensee shall verify by procedures such as checking or inspection, that deficiencies or defective material or equipment relative to the shipment of packages containing radioactive material are promptly identified and corrected.

C. Before the first use of any Type B packaging, a licensee shall obtain approval of its quality assurance program by the Agency.

D. A licensee shall maintain sufficient written records to demonstrate compliance with the quality assurance program. Records of quality assurance pertaining to the use of a Type B package for shipment of radioactive material shall be maintained for three years after the package is used for a shipment.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1508. Advance Notification of Nuclear Waste Transportation

A. Prior to the transport of any nuclear waste, as defined in Article 1, 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 Agency.

B. Each advance notification required in subsection (A) above shall contain the following information:
1. The name, address, and telephone number of the shipper, carrier, and receiver of the shipment;
2. A description of the nuclear waste contained in the shipment as required by 49 CFR 172.202 and 172.203(d) (Revised October 1, 2007, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
3. The point of origin of the shipment and the seven-day period during which departure of the shipment will occur;
4. The seven-day period during which arrival of the shipment at state boundaries will occur;
5. The destination of the shipment, and the seven-day period during which arrival of the shipment will occur; and
6. A point of contact with a telephone number for current shipment information.

C. The licensee shall make the notification required by subsection (A) in writing to the Agency. 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. The licensee shall maintain a copy of the notification for one year.

D. The licensee shall notify the Agency of any changes in shipment plans, including cancellations, rerouting, or rescheduling, provided pursuant to subsection (A). Such notification shall be by telephoning the Agency. The licensee shall maintain for one year a record of the name of the individual contacted.

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Amended effective June 13, 1997 (Supp. 97-2). Amended by final rulemaking at 9 A.A.R. 1126, effective May 9, 2003 (Supp. 03-1). Amended by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1509. General License: Plutonium-Beryllium Special Form Material

A. A general license is issued to any licensee of the Agency to transport fissile material in the form of plutonium-beryllium (Pu-Be) special form sealed sources, or to deliver Pu-Be sealed sources to a carrier for transport, if the material is shipped in accordance with this Article. This material must be contained in a Type A package. The Type A package must also meet the DOT requirements of 49 CFR 173.417(a), revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

B. The general license applies only to a licensee who has a quality assurance program approved by the Agency as satisfying the provisions of R12-1-1507.

C. The general license applies only when a package's contents:
1. Contain no more than a Type A quantity of radioactive material; and
2. Contain less than 1000 g of plutonium, provided that: plutonium-239, plutonium-241, or any combination of these radionuclides, constitutes less than 240 g of the total quantity of plutonium in the package.

D. The general license applies only to packages labeled with a CSI which:
1. Has been determined in accordance with subsection (E) of this Section;
2. Has a value less than or equal to 100; and
3. For a shipment of multiple packages containing Pu-Be sealed sources, the sum of the CSIs must be less than or equal to 50 (for shipment on a nonexclusive use conveyance) and less than or equal to 100 (for shipment on an exclusive use conveyance).

E. The value for the CSI must be greater than or equal to the number calculated by the following equation:
1. CSI=10[(grams of ^{239}Pu + grams of ^{241}Pu)/24],
2. The calculated CSI must be rounded up to the first decimal place.

Historical Note

New Section made by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (Supp. 12-3).

R12-1-1510. Packaging

A. A general license is issued to any licensee to transport, or to deliver to a carrier for transport, licensed material in a package for which a license, certificate of compliance, or other approval has been issued by the NRC.
1. This general license applies only to a licensee that has a quality assurance program approved by the Agency as satisfying R12-1-1507;
2. This general license applies only to a licensee that:
   a. Has a copy of the license, certificate of compliance, or other approval of the package, and has the drawings and other documents referenced in the approval relating to the use and maintenance of the packaging and to the actions to be taken before shipment;
   b. Complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of this Article; and
   c. Before the licensee's first use of the package, submits in writing to the Agency **and to ATTN: Document Control Desk, Director, Division of Spent Fuel Storage and Transportation, Office of Nuclear Material Safety and**

Safeguards, using an appropriate method listed in § 71.1(a) the licensee's name, license number, and the package identification number specified in the package approval;

d. Each certificate holder shall maintain, for a period of 3 years after the life of the packaging to which they apply. Records identifying the packaging by model number, serial number and date of manufacture.

e. The licensee, certificate holder, and an applicant for a CoC 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 3 years after the life of the packaging to which they apply.

3. This general license applies only when the package approval authorizes use of the package under this general license.
4. For a Type B or fissile material package, the design of which was approved by NRC before April 1, 1996, the general license is subject to the additional restrictions of subsection (B).

B. Type B packages.

1. A Type B package previously approved by NRC but not designated as B(U) or B(M) in the identification number of the NRC Certificate of Compliance, may be used under the general license of subsection (A) with the following additional conditions:
   a. Fabrication of the packaging is satisfactorily completed by August 31, 1986, as demonstrated by application of its model number in accordance with 10 CFR 71.85(c) (Revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
   b. A package that is used for a shipment to a location outside the United States is subject to multilateral approval, as defined in 49 CFR 173.403 (Revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); and
   c. A serial number that uniquely identifies each package which conforms to the approved design and is assigned to, and legibly and durably marked on, the outside of each package.
   d. The licensee shall ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce the effectiveness of the packaging;
   e. Where the maximum normal operating pressure will exceed 35 kPa (5 lbf/in^2) gauge, the licensee shall test the containment system at an internal pressure at least 50 percent higher than the maximum normal operating pressure, to verify the capability of that system to maintain its structural integrity at that pressure; ~~and~~
   f. The licensee shall ascertain that the determinations in paragraphs (a) through (e) of this section have been made; and
2. A Type B(U) package, a Type B(M) package, a low specific activity (LSA) material package or a fissile material package, previously approved by the NRC but without the "-85" designation in the identification number of the NRC certificate of compliance, may be used under the general license of subsection (A) with the following additional conditions:
   a. Fabrication of the packaging is satisfactorily completed by April 1, 1999 as demonstrated by application of its model number in accordance with 10 CFR 71.85(c) (Revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
   b. A package that is used for a shipment to a location outside the United States is subject to multilateral approval as defined in 49 CFR 173.403 (Revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); and
   c. A serial number which uniquely identifies each package which conforms to the approved design and is assigned to, and legibly and durably marked on, the outside of each package.
3. A licensee may modify the design and authorized contents of a Type B package, or a fissile material package, previously approved by NRC, provided:
   a. The modifications of a Type B package are not significant with respect to the design, operating characteristics, or safe performance of the containment system, when the package is subjected to the tests specified in 10 CFR 71.71 and 71.73 (Revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
   b. The modifications of a fissile material package are not significant, with respect to the prevention of criticality, when the package is subjected to the tests specified in 10 CFR 71.71 and 71.73 (Revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); and
   c. The modifications to the package satisfy the requirements of this Section.
4. The NRC will revise the package identification number to designate previously approved package designs as B(U), B(M), AF, BF, or A as applicable, and with the identification number suffix "-85" after receipt of an application demonstrating that the design meets the requirements of this Section.
5. For purposes of this Section, package types are defined in 10 CFR 71.4, revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. A general license is issued to any licensee of the Agency to transport fissile material, or to deliver to a carrier for transport, licensed material in a specification container for fissile material or for a Type B quantity of radioactive material as specified in 49 CFR 173 and 178 (Revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), if the following requirements are met:

1. The licensee shall maintain a quality assurance program approved by the Agency as satisfying R12-1-1507.
2. The licensee shall:
   a. Maintain a copy of the specification; and
   b. Comply with the terms and conditions of the specification and the applicable requirements in 10 CFR 71, Subparts A, G, and H, revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
3. The licensee may not use the specification container for a shipment to a location outside the United States, except by multilateral approval, as defined in 49 CFR 173.403, revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
4. The general license applies only when a package's contents:
   a. Contain no more than a Type A quantity of radioactive material; and
   b. Contain less than 500 total grams of beryllium, graphite, or hydrogenous material enriched in deuterium.
5. The general license applies only to packages containing fissile material that are labeled with a CSI which:
   a. Has been determined in accordance with Subsection (E) of this Section;
   b. Has a value less than or equal to 10; and
   c. For a shipment of multiple packages containing fissile material, the sum of the CSIs must be less than or equal to 50 (for shipment on a nonexclusive use conveyance) and less than or equal to 100 (for shipment on an exclusive use conveyance).
6. The CSI value must meet the following requirements:
   a. The value for the CSI must be greater than or equal to the number calculated by the following equation: CSI=10[(grams of ^{235}U/X) + (grams of ^{235}U/Y) + grams of ^{235}U/Z)];
   b. The calculated CSI must be rounded up to the first decimal place;
   c. The values of X, Y, and Z used in the CSI equation must be taken from Tables 71–1 or 71–2 as appropriate located in 10 CFR 71.22, (revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
   d. If Table 71–2 is used to obtain the value of X, then the values for the terms in the equation for uranium-233 and plutonium must be assumed to be zero; and
   e. Table 71–1 values for X, Y, and Z must be used to determine the CSI if:
      i. Uranium-233 is present in the package;
      ii. The mass of plutonium exceeds 1 percent of the mass of uranium-235;
      iii. The uranium is of unknown uranium-235 enrichment or greater than 24 weight percent enrichment; or
      iv. Substances having a moderating effectiveness (i.e., an average hydrogen density greater than H_2O) (e.g., certain hydrocarbon oils or plastics) are present in any form, except as polyethylene used for packing or wrapping.

D. Foreign packaging.

1. A general license is issued to any licensee of the Agency to transport, or to deliver to a carrier for transport, licensed material in a package the design of which has been approved in a foreign national competent authority certificate that has been revalidated by the Federal Department of Transportation as meeting the applicable requirements of 49 CFR 171.~~12~~**23**, revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.
2. Except as otherwise provided in this Section, the general license applies only to a licensee who has a quality assurance program approved by the Agency as satisfying the applicable provisions of R12-1-1507.
3. This general license applies only to:
   a. Shipments made to or from locations outside the United States.
   b. A licensee that:
      i. Has a copy of the applicable certificate, the revalidation, and the drawings and other documents referenced in the certificate, relating to the use and maintenance of the packaging and to the actions to be taken before shipment; and
      ii. Complies with the terms and conditions of the certificate and revalidation, and with the applicable requirements in 10 CFR 71, Subparts A, G, and H, revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. With respect to the quality assurance provisions of Subpart H of the regulations, the licensee is exempt from design, construction, and fabrication requirements.

E. Assumptions as to unknown properties. When the isotopic abundance, mass, concentration, degree of irradiation, degree of moderation, or other pertinent property of fissile material in any package is not known, the licensee shall package the fissile material as if the unknown properties have credible values that will cause the maximum neutron multiplication.

F. Routine determination before each shipment of licensed material shall ensure that the package with its contents satisfies the applicable requirements of this Article and of the license. The licensee shall determine that:

1. The package is proper for the contents to be shipped;

2. The package is in unimpaired physical condition except for superficial defects such as marks or dents;
3. Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects;
4. Any system for containing liquid is adequately sealed and has adequate space or other specified provision for expansion of the liquid;
5. Any pressure relief device is operable and set in accordance with written procedures;
6. The package has been loaded and closed in accordance with written procedures;
7. For fissile material, any moderator or neutron absorber, if required, is present and in proper condition;
8. Any structural part of the package that could be used to lift or tie down the package during transport is rendered inoperable for that purpose, unless it satisfies the design requirements of 10 CFR 71.45 (revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
9. The level of non-fixed (removable) radioactive contamination on the external surfaces of each package offered for shipment is as low as reasonably achievable, and within the limits specified in DOT regulations in 49 CFR 173.443 (revised October 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.);
10. External radiation levels around the package and around the vehicle, if applicable, will not exceed the limits specified in 10 CFR 71.47 (revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), at any time during transportation; and
11. Accessible package surface temperatures will not exceed the limits specified in 10 CFR 71.43(g) (revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), at any time during transportation.

G. Fissile material meeting the requirements of at least one of the paragraphs (1) through (6) of this section are exempt from classification as fissile material and from the fissile material package standards of §§ 71.55 and 71.59, but are subject to all other requirements of this part, except as noted.

1. Individual package containing 2 grams or less fissile material.

2. Individual or bulk packaging containing 15 grams or less of fissile material provided the package has at least 200 grams of solid nonfissile material for every gram of fissile material. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass for solid nonfissile material.

3. a. Low concentrations of solid fissile material commingled with solid nonfissile material, provided that:

(i) There is at least 2000 grams of solid nonfissile material for every gram of fissile material, and

(ii) There is no more than 180 grams of fissile material distributed within 360 kg of contiguous nonfissile material.

b. Lead, beryllium, graphite, and hydrogenous material enriched in deuterium may be present in the package but must not be included in determining the required mass of solid nonfissile material.

4. Uranium enriched in uranium-235 to a maximum of 1 percent by weight, and with total plutonium and uranium-233 content of up to 1 percent of the mass of uranium-235, provided that the mass of any beryllium, graphite, and hydrogenous material enriched in deuterium constitutes less than 5 percent of the uranium mass, and that the fissile material is distributed homogeneously and does not form a lattice arrangement within the package.

5. Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 percent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 percent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2. The material must be contained in at least a DOT Type A package.

6. Packages containing, individually, a total plutonium mass of not more than 1000 grams, of which not more than 20 percent by mass may consist of plutonium-239, plutonium-241, or any combination of these radionuclides.

Historical Note

New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2). Amended by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (12-3).

R12-1-1511. Air Transport of Plutonium

A. Notwithstanding the provisions of any general licenses and notwithstanding any exemptions stated directly in this Section or included indirectly by citation of 49 CFR 107, and 171 through 180, previously incorporated in this Article, as may be applicable, the licensee shall ensure that plutonium in any form, whether for import, export, or domestic shipment, is not transported by air or delivered to a carrier for air transport unless:

1. The plutonium is contained in a medical device designed for individual human application; or
2. The plutonium is contained in a material in which the specific activity is less than or equal to the activity concentration values for Plutonium specified in 10 CFR 71, Appendix A, Table A-2 (Revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.), and in which the radioactivity is essentially uniformly distributed; or
3. The plutonium is shipped in a single package containing no more than an A2 quantity of plutonium in any isotope or form, and is shipped in accordance with R12-1-1503 and 10 CFR 71.5 (Revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.); or

4. The plutonium is shipped in a package specifically authorized for the shipment of plutonium by air in the Certificate of Compliance for that package issued by the NRC.

B. Nothing in subsection (A) is to be interpreted as removing or diminishing the requirements of 10 CFR 73.24, January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. For a shipment of plutonium by air that is subject to subsection (A)(4), the licensee shall, through special arrangement with the carrier, require compliance with 49 CFR 175.704, revised October 1, 2007, incorporated by reference, and available under R12-1-101. This U.S. Department of Transportation regulation is applicable to the air transport of plutonium. This incorporated material contains no future editions or amendments.

Historical Note

New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1512. Advance Notification of Shipment of Irradiated Reactor Fuel and Nuclear Waste

A. A licensee shall provide advance notification to the Governor, or the Director of the Agency, of the shipment of licensed material as specified in 10 CFR 71.97, revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

B. After June 11, 2013, each licensee shall provide advance notification to the Tribal official of participating Tribes referenced in paragraph (c)(3)(iii) of 10 CFR 71.97, or the official's designee, of the shipment of licensed material, within or across the boundary of the Tribe's reservation, before the transport, or delivery to a carrier, for transport, of licensed material outside the confines of the licensee's plant or other place of use or storage.

C. Advance notification is also required under this section for the shipment of licensed material, other than irradiated fuel, meeting the following three conditions:

1. The licensed material is required by this part to be in Type B packaging for transportation;

2. The licensed material is being transported to or across a State boundary en route to a disposal facility or to a collection point for transport to a disposal facility; and

3. The quantity of licensed material in a single package exceeds the least of the following:

a. 3000 times the A1 value of the radionuclides as specified in appendix A, Table A–1 for special form radioactive material;

b. 3000 times the A2 value of the radionuclides as specified in appendix A, Table A–1 for normal form radioactive material; or

c. 1000 TBq (27,000 Ci).

D. Procedures for submitting advance notification. (1) The notification must be made in writing to:

1. The office of each appropriate governor or governor's designee;

2. The office of each appropriate Tribal official or Tribal official's designee; and

3. The Director, Division of Security Policy, Office of Nuclear Security and Incident Response.

Historical Note

New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

R12-1-1513. Opening Instructions

Before delivery of a package to a carrier for transport, the licensee shall ensure that any special instructions needed to safely open the package have been sent to, or otherwise made available to, the consignee for the consignee's use in accordance with 10 CFR 20.1906(e) revised January 1, 2010, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

Historical Note

New Section made by final rulemaking at 18 A.A.R. 1895, effective September 10, 2012 (12-3).

R12-1-1514. Reserved

R12-1-1515. Exemption for Low-level Radioactive Materials

A licensee is exempt from all the requirements of 10 CFR 71 with respect to shipment or carriage of the low-level materials listed in 10 CFR 71.14(a), revised January 1, 2008, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

Historical Note

New Section made by final rulemaking at 15 A.A.R. 1023, effective August 1, 2009 (Supp. 09-2).

Appendix A. Repealed

Historical Note

Adopted effective December 20, 1985 (Supp. 85-6). Repealed effective June 13, 1997 (Supp. 97-2).

ARTICLE 19. PHYSICAL PROTECTION OF CATEGORY 1 AND CATEGORY 2 QUANTITIES OF RADIOACTIVE MATERIAL

R12-1-1901. Purpose

This Article has been established to provide the requirements for the physical protection program for any licensee that possesses an aggregated category 1 or category 2 quantity of radioactive material listed in Appendix A to this Article. These requirements provide reasonable assurance of the security of category 1 or category 2 quantities of radioactive material by protecting these materials from theft or diversion. Specific requirements for access to material, use of material, transfer of material, and transport of material are included. No provision of this Article authorizes possession of licensed material.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1902. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1903. Scope

A. R12-1-1921 through R12-1-1957of this Article apply to any person who, under the rules in this chapter, possesses or uses at any site, an aggregated category 1 or category 2 quantity of radioactive material.

B. R12-1-1971 through R12-1-1981 of this Article applies to any person who, under the rules of this chapter:

1. Transports or delivers to a carrier for transport in a single shipment, a category 1 or category 2 quantity of radioactive material; or
2. Imports or exports a category 1 or category 2 quantity of radioactive material; the provisions only apply to the domestic portion of the transport.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1904. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1905. Definitions

The following definitions apply in this Article, unless the context otherwise requires:

"Access control means a system for allowing only approved individuals to have unescorted access to the security zone and for ensuring that all other individuals are subject to escorted access.

"Act" means the Atomic Energy Act of 1954 (68 Stat. 919), including any amendments thereto.

"Aggregated" means accessible by the breach of a single physical barrier that would allow access to radioactive material in any form, including any devices that contain the radioactive material, when the total activity equals or exceeds a category 2 quantity of radioactive material.

"Agreement State" means any state with which the Atomic Energy Commission or the U.S. Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b. of the Act. Non-agreement State means any other State.

"Approved individual" means an individual whom the licensee has determined to be trustworthy and reliable for unescorted access in accordance with R12-1-1921 through R12-1-1933 of this Article and who has completed the training required by R12-1-1943(C).

"Background investigation" means the investigation conducted by a licensee or applicant to support the determination of trustworthiness and reliability.

"Becquerel (Bq)" means one disintegration per second.

"Byproduct material" means the same as in R12-1-102.

"Category 1 quantity of radioactive material" means a quantity of radioactive material meeting or exceeding the category 1 threshold in Table 1 of Appendix A to this Article. This quantity is determined by calculating the ratio of the total activity of each radionuclide to the category 1 threshold for that radionuclide and adding the ratios together. If the sum is equal to or exceeds 1, the quantity would be considered a category 1 quantity. Category 1 quantities of radioactive material do not include the radioactive material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet.

"Category 2 quantity of radioactive material" means a quantity of radioactive material meeting or exceeding the category 2 threshold but less than the category 1 threshold in Table 1 of Appendix A to this Article. This quantity is determined by calculating the ratio of the total activity of each radionuclide to the category 2 threshold for that radionuclide and adding the ratios together. If the sum is equal to or exceeds 1, the quantity would be considered a category 2 quantity. Category 2

quantities of radioactive material do not include the radioactive material contained in any fuel assembly, subassembly, fuel rod, or fuel pellet.

“Commission” means the U.S. Nuclear Regulatory Commission or its duly authorized representatives.

“Curie” means the same as in R12-1-102.

“Diversion” means the unauthorized movement of radioactive material subject to this Article to a location different from the material's authorized destination inside or outside of the site at which the material is used or stored.

“Escorted access” means accompaniment while in a security zone by an approved individual who maintains continuous direct visual surveillance at all times over an individual who is not approved for unescorted access.

“Fingerprint orders” means the orders issued by the U.S. Nuclear Regulatory Commission or the legally binding requirements issued by Agreement States that require fingerprints and criminal history records checks for individuals with unescorted access to category 1 and category 2 quantities of radioactive material or safeguards information-modified handling.

“Government agency” means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government.

“License”, except where otherwise specified, means a license for byproduct material issued pursuant to the rules in Articles 3, 5, 7, and 15 of this chapter.

“License issuing authority” means the licensing agency that issued the license, i.e. the Agency, U.S. Nuclear Regulatory Commission, or the appropriate agency of an Agreement State.

“Local law enforcement agency (LLEA)” means a public or private organization that has been approved by a federal, state, or local government to carry firearms and make arrests, and is authorized and has the capability to provide an armed response in the jurisdiction where the licensed category 1 or category 2 quantity of radioactive material is used, stored, or transported.

“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.

“Mobile device” means a piece of equipment containing licensed radioactive material that is either mounted on wheels or casters, or is otherwise equipped for moving without a need for disassembly or dismounting; or designed to be hand carried. Mobile devices do not include stationary equipment installed in a fixed location.

“Movement control center” means an operations center that is remote from transport activity and that maintains position information on the movement of radioactive material, receives reports of attempted attacks or thefts, provides a means for reporting these and other problems to appropriate agencies and can request and coordinate appropriate aid.

“No-later-than arrival time” means the date and time that the shipping licensee and receiving licensee have established as the time at which an investigation will be initiated if the shipment has not arrived at the receiving facility. The no-later-than arrival time may not be more than 6 hours after the estimated arrival time for shipments of category 2 quantities of radioactive material.

“Person” means:

> Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the DOE (except that the Department shall be considered a person within the meaning of the rules in 10 CFR chapter I to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission under section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244), the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3021), the Nuclear Waste Policy Act of 1982 (96 Stat. 2201), and section 3(b)(2) of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (99 Stat. 1842), any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and
>
> Any legal successor, representative, agent, or agency of the foregoing.

“Reviewing official” means the individual who shall make the trustworthiness and reliability determination of an individual to determine whether the individual may have, or continue to have, unescorted access to the category 1 or category 2 quantities of radioactive materials that are possessed by the licensee.

“Sabotage” means deliberate damage, with malevolent intent, to a category 1 or category 2 quantity of radioactive material, a device that contains a category 1 or category 2 quantity of radioactive material, or the components of the security system.

“Safe haven” means a readily recognizable and readily accessible site at which security is present or from which, in the event of an emergency, the transport crew can notify and wait for the local law enforcement authorities.

"Security zone" means any temporary or permanent area determined and established by the licensee for the physical protection of category 1 or category 2 quantities of radioactive material.

"State" means a State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

"Telemetric position monitoring system" means a data transfer system that captures information by instrumentation and/or measuring devices about the location and status of a transport vehicle or package between the departure and destination locations.

"Trustworthiness and reliability" means characteristics of an individual considered dependable in judgment, character, and performance, such that unescorted access to category 1 or category 2 quantities of radioactive material by that individual does not constitute an unreasonable risk to the public health and safety or security. A determination of trustworthiness and reliability for this purpose is based upon the results from a background investigation.

"Unescorted access" means solitary access to an aggregated category 1 or category 2 quantity of radioactive material or the devices that contain the material.

"United States" when used in a geographical sense, includes Puerto Rico and all territories and possessions of the United States.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1906. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1907. Communications
Except where otherwise specified or covered under licensing program as provided in this chapter, all communications and reports concerning the rules in this Article may be sent as follows:

1. By mail addressed to: ATTN: Arizona Radiation Regulatory Agency; Radioactive Materials Program; 4814 South 40th Street, Phoenix, Arizona 85040;
2. By hand delivery to the Agencies' offices at 4814 South 40th Street, Phoenix, Arizona 85040;
3. Where practicable, by electronic submission, for example, Electronic Information Exchange, or CD–ROM. Electronic submissions shall be made in a manner that enables the Agency to receive, read, authenticate, distribute, and archive the submission, and process and retrieve it a single page at a time. Electronic submissions can be by visiting the Agency's Website at http://www.azrra.gov and selecting specific RAM (Radioactive Material) Staff contact information or by email to ram@azrra.gov.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1908. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1909. Interpretations
Except as specifically authorized by the Agency in writing, no interpretations of the meaning of the rules in this Article by any officer or employee of the Agency other than a written interpretation by the Arizona Assistant Attorney General counsel assigned to the Agency will be recognized as binding upon the Agency.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1910. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1911. Specific Exemptions

A. The Agency may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the rules in this Article as it determines are authorized by law and will not endanger life or property or the common defense and security, and are otherwise in the public interest.

B. Any licensee's NRC-licensed activities are exempt from the requirements of R12-1-1921 through R12-1-1957 of this Article to the extent that its activities are included in a security plan required by 10 CFR part 73 revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

C. A licensee that possesses radioactive waste that contains category 1 or category 2 quantities of radioactive material is exempt from the requirements of R12-1-1921 through R12-1-1981 of this Article, except that any radioactive waste that contains discrete sources, ion-exchange resins, or activated material that weighs less than 2,000 kg (4,409 lbs.) is not exempt from the requirements of this Article. The licensee shall implement the following requirements to secure the radioactive waste:

1. Use continuous physical barriers that allow access to the radioactive waste only through established access control points;
2. Use a locked door or gate with monitored alarm at the access control point;
3. Assess and respond to each actual or attempted unauthorized access to determine whether an actual or attempted theft, sabotage, or diversion occurred; and
4. Immediately notify the LLEA and request an armed response from the LLEA upon determination that there was an actual or attempted theft, sabotage, or diversion of the radioactive waste that contains category 1 or category 2 quantities of radioactive material.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1912. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1913. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1914. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1915. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1916. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1917. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1918. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1919. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1920. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1921. Personnel Access Authorization Requirements for Category 1 or Category 2 Quantities of Radioactive Material

A. General:

1. Each licensee that possesses an aggregated quantity of radioactive material at or above the category 2 threshold shall establish, implement, and maintain its access authorization program in accordance with the requirements of this Article.
2. An applicant for a new license and each licensee that would become newly subject to the requirements of this Article upon application for modification of its license shall implement the requirements of this Article, as appropriate, before taking possession of an aggregated category 1 or category 2 quantity of radioactive material.
3. Any licensee that has not previously implemented the Security Orders or been subject to the provisions of R12-1-1921 through R12-1-1933 shall implement the provisions of R12-1-1921 through R12-1-1933 before aggregating radioactive material to a quantity that equals or exceeds the category 2 threshold.

B. General performance objective:

The licensee's access authorization program shall ensure that the individuals specified in subsection (C)(1) are trustworthy and reliable.

C. Applicability:

1. Licensees shall subject the following individuals to an access authorization program:
   a. Any individual whose assigned duties require unescorted access to category 1 or category 2 quantities of radioactive material or to any device that contains the radioactive material; and
   b. Reviewing officials.
2. Licensees need not subject the categories of individuals listed in R12-1-1929(A) to the investigation elements of the access authorization program.
3. Licensees shall approve for unescorted access to category 1 or category 2 quantities of radioactive material only those individuals with job duties that require unescorted access to category 1 or category 2 quantities of radioactive material.
4. Licensees may include individuals in the access authorization program under R12-1-1921 through R12-1-1933 and needing access to safeguards information-modified handling under 10 CFR part 73 revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1922. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1923. Access Authorization Program Requirements

A. Granting unescorted access authorization:

1. Licensees shall implement the requirements of this Article for granting initial or reinstated unescorted access authorization.
2. Individuals who have been determined to be trustworthy and reliable shall also complete the security training required by R12-1-1943(C) before being allowed unescorted access to category 1 or category 2 quantities of radioactive material.

B. Reviewing officials:

1. Reviewing officials are the only individuals who may make trustworthiness and reliability determinations that allow individuals to have unescorted access to category 1 or category 2 quantities of radioactive materials possessed by the licensee.
2. Each licensee shall name one or more individuals to be reviewing officials. After completing the background investigation on the reviewing official, the licensee shall provide under oath or affirmation, a certification that the reviewing official is deemed trustworthy and reliable by the licensee. The fingerprints of the named reviewing official shall be taken by a law enforcement agency, Federal or State agencies that provide fingerprinting services to the public, or commercial fingerprinting services authorized by a State to take fingerprints. The licensee shall recertify that the reviewing official is deemed trustworthy and reliable every 10 years in accordance with R12-1-1925(C).
3. Reviewing officials shall be permitted to have unescorted access to category 1 or category 2 quantities of radioactive materials or access to safeguards information or safeguards information-modified handling, if the licensee possesses safeguards information or safeguards information-modified handling. Reviewing officials permitted unescorted access to category 1 or category 2 quantities of radioactive materials shall receive appropriate radiation safety training initially and at a frequency not to exceed 12 months. The licensee shall maintain records of the initial and refresher training for three years from the date of training for Agency review.
4. Reviewing officials cannot approve other individuals to act as reviewing officials.
5. A reviewing official does not need to undergo a new background investigation before being named by the licensee as the reviewing official if:
   a. The individual has undergone a background investigation that included fingerprinting and an FBI criminal history records check and has been determined to be trustworthy and reliable by the licensee; or
   b. The individual is subject to a category listed in R12-1-1929(A).

C. Informed consent:

1. Licensees may not initiate a background investigation without the informed and signed consent of the subject individual. This consent shall include authorization to share personal information with other individuals or organizations as necessary to complete the background investigation. Before a final adverse determination, the licensee shall provide the individual with an opportunity to correct any inaccurate or incomplete information that is developed during the background investigation. Licensees do not need to obtain signed consent from those individuals that meet the requirements of R12-1-1925(B). A signed consent shall be obtained prior to any reinvestigation.
2. The subject individual may withdraw his or her consent at any time. Licensees shall inform the individual that:
   a. If an individual withdraws his or her consent, the licensee may not initiate any elements of the background investigation that were not in progress at the time the individual withdrew his or her consent; and

b. The withdrawal of consent for the background investigation is sufficient cause for denial or termination of unescorted access authorization.

D. Personal history disclosure:

Any individual who is applying for unescorted access authorization shall disclose the personal history information that is required by the licensee's access authorization program for the reviewing official to make a determination of the individual's trustworthiness and reliability. Refusal to provide, or the falsification of, any personal history information required by this Article is sufficient cause for denial or termination of unescorted access.

E. Determination basis:

1. The reviewing official shall determine whether to permit, deny, unfavorably terminate, maintain, or administratively withdraw an individual's unescorted access authorization based on an evaluation of all of the information collected to meet the requirements of this Article.
2. The reviewing official may not permit any individual to have unescorted access until the reviewing official has evaluated all of the information collected to meet the requirements of this Article and determined that the individual is trustworthy and reliable. The reviewing official may deny unescorted access to any individual based on information obtained at any time during the background investigation.
3. The licensee shall document the basis for concluding whether or not there is reasonable assurance that an individual is trustworthy and reliable.
4. The reviewing official may terminate or administratively withdraw an individual's unescorted access authorization based on information obtained after the background investigation has been completed and the individual granted unescorted access authorization.
5. Licensees shall maintain a list of persons currently approved for unescorted access authorization. When a licensee determines that a person no longer requires unescorted access or meets the access authorization requirement, the licensee shall remove the person from the approved list as soon as possible, but no later than 7 working days, and take prompt measures to ensure that the individual is unable to have unescorted access to the material.

F. Procedures:

Licensees shall develop, implement, and maintain written procedures for implementing the access authorization program. The procedures shall include provisions for the notification of individuals who are denied unescorted access. The procedures shall include provisions for the review, at the request of the affected individual, of a denial or termination of unescorted access authorization. The procedures shall contain a provision to ensure that the individual is informed of the grounds for the denial or termination of unescorted access authorization and allow the individual an opportunity to provide additional relevant information.

G. Right to correct and complete information:

1. Prior to any final adverse determination, licensees shall provide each individual subject to this Article with the right to complete, correct, and explain information obtained as a result of the licensee's background investigation. Confirmation of receipt by the individual of this notification shall be maintained by the licensee for a period of 1 year from the date of the notification.
2. If, after reviewing his or her criminal history record, an individual believes that it is incorrect or incomplete in any respect and wishes to change, correct, update, or explain anything in the record, the individual may initiate challenge procedures. These procedures include direct application by the individual challenging the record to the law enforcement agency that contributed the questioned information or a direct challenge as to the accuracy or completeness of any entry on the criminal history record to the Federal Bureau of Investigation, Criminal Justice Information Services (CJIS) Division, ATTN: SCU, Mod. D–2, 1000 Custer Hollow Road, Clarksburg, WV 26306 as set forth in 28 CFR 16.30 through 16.34. In the latter case, the Federal Bureau of Investigation (FBI) will forward the challenge to the agency that submitted the data, and will request that the agency verify or correct the challenged entry. Upon receipt of an official communication directly from the agency that contributed the original information, the FBI Identification Division makes any changes necessary in accordance with the information supplied by that agency. Licensees shall provide at least 10 days for an individual to initiate action to challenge the results of an FBI criminal history records check after the record being made available for his or her review. The licensee may make a final adverse determination based upon the criminal history records only after receipt of the FBI's confirmation or correction of the record.

H. Records:

1. The licensee shall retain documentation regarding the trustworthiness and reliability of individual employees for 3 years from the date the individual no longer requires unescorted access to category 1 or category 2 quantities of radioactive material.
2. The licensee shall retain a copy of the current access authorization program procedures as a record for 3 years after the procedure is no longer needed. If any portion of the procedure is superseded, the licensee shall retain the superseded material for 3 years after the record is superseded.
3. The licensee shall retain the list of persons approved for unescorted access authorization for 3 years after the list is superseded or replaced.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1924. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1925. Background Investigations

A. Initial investigation:

Before allowing an individual unescorted access to category 1 or category 2 quantities of radioactive material or to the devices that contain the material, licensees shall complete a background investigation of the individual seeking unescorted access authorization. The scope of the investigation shall encompass at least the 7 years preceding the date of the background investigation or since the individual's eighteenth birthday, whichever is shorter. The background investigation shall include at a minimum:

1. Fingerprinting and an FBI identification and criminal history records check in accordance with R12-1-1927;
2. Verification of true identity. Licensees shall verify the true identity of the individual who is applying for unescorted access authorization to ensure that the applicant is who he or she claims to be. A licensee shall review official identification documents (e.g., driver's license; passport; government identification; certificate of birth issued by the state, province, or country of birth) and compare the documents to personal information data provided by the individual to identify any discrepancy in the information. Licensees shall document the type, expiration, and identification number of the identification document, or maintain a photocopy of identifying documents on file in accordance with R12-1-1931. Licensees shall certify in writing that the identification was properly reviewed, and shall maintain the certification and all related documents for review upon inspection;
3. Employment history verification. Licensees shall complete an employment history verification, including military history. Licensees shall verify the individual's employment with each previous employer for the most recent 7 years before the date of application;
4. Verification of education. Licensees shall verify that the individual participated in the education process during the claimed period;
5. Character and reputation determination. Licensees shall complete reference checks to determine the character and reputation of the individual who has applied for unescorted access authorization. Unless other references are not available, reference checks may not be conducted with any person who is known to be a close member of the individual's family, including but not limited to the individual's spouse, parents, siblings, or children, or any individual who resides in the individual's permanent household. Reference checks under this section shall be limited to whether the individual has been and continues to be trustworthy and reliable;
6. The licensee shall also, to the extent possible, obtain independent information to corroborate that provided by the individual (e.g., seek references not supplied by the individual); and
7. If a previous employer, educational institution, or any other entity with which the individual claims to have been engaged fails to provide information or indicates an inability or unwillingness to provide information within a time frame deemed appropriate by the licensee but at least after 10 business days of the request or if the licensee is unable to reach the entity, the licensee shall document the refusal, unwillingness, or inability in the record of investigation; and attempt to obtain the information from an alternate source.

B. Grandfathering:

1. Individuals who have been determined to be trustworthy and reliable for unescorted access to category 1 or category 2 quantities of radioactive material under the Fingerprint Orders may continue to have unescorted access to category 1 and category 2 quantities of radioactive material without further investigation. These individuals shall be subject to the reinvestigation requirement.
2. Individuals who have been determined to be trustworthy and reliable under the provisions of 10 CFR part 73 revised January 1, 2015, incorporated by reference, available under R12-1-101, and containing no future editions or amendments; or the security orders for access to safeguards information, safeguards information-modified handling, or risk-significant material may have unescorted access to category 1 and category 2 quantities of radioactive material without further investigation. The licensee shall document that the individual was determined to be trustworthy and reliable under the provisions of 10 CFR part 73 revised January 1, 2015, incorporated by reference, available under R12-1-101, and containing no future editions or amendments; or a security order. Security order, in this context, refers to any order that was issued by the NRC that required fingerprints and an FBI criminal history records check for access to safeguards information, safeguards information-modified handling, or risk significant material such as special nuclear material or large quantities of uranium hexafluoride. These individuals shall be subject to the reinvestigation requirement.

C. Re-investigations

: Licensees shall conduct a reinvestigation every 10 years for any individual with unescorted access to category 1 or category 2 quantities of radioactive material. The reinvestigation shall consist of fingerprinting and an FBI identification and criminal history records check in accordance with R12-1-1927. The re-investigations shall be completed within 10 years of the date on which these elements were last completed.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1926. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1927. Requirements for Criminal History Records Checks of Individuals Granted Unescorted Access to Category 1 or Category 2 Quantities of Radioactive Material

A. General performance objective and requirements:

1. Except for those individuals listed in R12-1-1929 and those individuals grandfathered under R12-1-1925(B), each licensee subject to the provisions of this Article shall fingerprint each individual who is to be permitted unescorted access to category 1 or category 2 quantities of radioactive material. Licensees shall transmit all collected fingerprints to the Agency for transmission to the FBI. The licensee shall use the information received from the FBI as part of the required background investigation to determine whether to grant or deny further unescorted access to category 1 or category 2 quantities of radioactive materials for that individual.
2. The licensee shall notify each affected individual that his or her fingerprints will be used to secure a review of his or her criminal history record, and shall inform him or her of the procedures for revising the record or adding explanations to the record.
3. Fingerprinting is not required if a licensee is reinstating an individual's unescorted access authorization to category 1 or category 2 quantities of radioactive materials if:
   a. The individual returns to the same facility that granted unescorted access authorization within 365 days of the termination of his or her unescorted access authorization; and
   b. The previous access was terminated under favorable conditions.
4. Fingerprints do not need to be taken if an individual who is an employee of a licensee, contractor, manufacturer, or supplier has been granted unescorted access to category 1 or category 2 quantities of radioactive material, access to safeguards information, or safeguards information-modified handling by another licensee, based upon a background investigation conducted under this Article, the Fingerprint Orders, or 10 CFR part 73 revised January 1, 2015, incorporated by reference, and available under R12-1-101. This incorporated material contains no future editions or amendments. An existing criminal history records check file may be transferred to the licensee asked to grant unescorted access in accordance with the provisions of R12-1-1931(C).
5. Licensees shall use the information obtained as part of a criminal history records check solely for the purpose of determining an individual's suitability for unescorted access authorization to category 1 or category 2 quantities of radioactive materials, access to safeguards information, or safeguards information-modified handling.

B. Prohibitions:

1. Licensees may not base a final determination to deny an individual unescorted access authorization to category 1 or category 2 quantities of radioactive material solely on the basis of information received from the FBI involving:
   a. An arrest more than 1 year old for which there is no information of the disposition of the case; or
   b. An arrest that resulted in dismissal of the charge or an acquittal.
2. Licensees may not use information received from a criminal history records check obtained under this section in a manner that would infringe upon the rights of any individual under the First Amendment to the Constitution of the United States, nor shall licensees use the information in any way that would discriminate among individuals on the basis of race, religion, national origin, gender, or age.

C. Procedures for processing of fingerprint checks:

1. For the purpose of complying with this Article, licensees shall use an appropriate method listed in 10 CFR 37.7 revised January 1, 2015, incorporated by reference, available under R12-1-101, and containing no future editions or amendments; to submit to the U.S. Nuclear Regulatory Commission, Director, Division of Facilities and Security, 11545 Rockville Pike, ATTN: Criminal History Program/Mail Stop TWB–05 B32M, Rockville, Maryland 20852, one completed, legible standard fingerprint card (Form FD–258, ORIMDNRCOOOZ), electronic fingerprint scan or, where practicable, other fingerprint record for each individual requiring unescorted access to category 1 or category 2 quantities of radioactive material. Copies of these forms may be obtained by writing the ~~Office of Information Services~~ **Office of the Chief Information Officer**, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001, by calling 1–630–829–9565, or by email to FORMS.Resource@nrc.gov. Guidance on submitting electronic fingerprints can be found at *http://www.nrc.gov/site-help/e-submittals.html*.
2. Fees for the processing of fingerprint checks are due upon application. Licensees shall submit payment with the application for the processing of fingerprints through corporate check, certified check, cashier's check, money order, or electronic payment, made payable to "U.S. NRC." (For guidance on making electronic payments, contact the Security Branch, Division of Facilities and Security at 301–492–3531.) Combined payment for multiple applications is acceptable. The Commission publishes the amount of the fingerprint check application fee on the NRC's public website. (To find the current fee amount, go to the Electronic Submittals page at *http://www.nrc.gov/site-help/e-submittals.html* and see the link for the Criminal History Program under Electronic Submission Systems.)
3. The U.S. Nuclear Regulatory Commission will forward to the submitting licensee all data received from the FBI as a result of the licensee's application(s) for criminal history records checks.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1928. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1929. Relief From Fingerprinting, Identification, and Criminal History Records Checks and Other Elements of Background Investigations for Designated Categories of Individuals Permitted Unescorted Access to Certain Radioactive Materials

A. Fingerprinting, and the identification and criminal history records checks required by section 149 of the Atomic Energy Act of 1954, as amended, and other elements of the background investigation are not required for the following individuals prior to granting unescorted access to category 1 or category 2 quantities of radioactive materials:

1. An employee of the U.S. Nuclear Regulatory Commission or of the Executive Branch of the U.S. Government who has undergone fingerprinting for a prior U.S. Government criminal history records check;
2. A Member of Congress;
3. An employee of a member of Congress or Congressional committee who has undergone fingerprinting for a prior U.S. Government criminal history records check;
4. The Governor of a State or his or her designated State employee representative;
5. Federal, State, or local law enforcement personnel;
6. State Radiation Control Program Directors and State Homeland Security Advisors or their designated State employee representatives;
7. Agreement State employees conducting security inspections on behalf of the NRC under an agreement executed under section 274.i. of the Atomic Energy Act;
8. Representatives of the International Atomic Energy Agency (IAEA) engaged in activities associated with the U.S./IAEA Safeguards Agreement who have been certified by the NRC;
9. Emergency response personnel who are responding to an emergency;
10. Commercial vehicle drivers for road shipments of category 1 and category 2 quantities of radioactive material;
11. Package handlers at transportation facilities such as freight terminals and railroad yards;
12. Any individual who has an active Federal security clearance, provided that he or she makes available the appropriate documentation. Written confirmation from the agency/employer that granted the Federal security clearance or reviewed the criminal history records check shall be provided to the licensee. The licensee shall retain this documentation for a period of 3 years from the date the individual no longer requires unescorted access to category 1 or category 2 quantities of radioactive material; and
13. Any individual employed by a service provider licensee for which the service provider licensee has conducted the background investigation for the individual and approved the individual for unescorted access to category 1 or category 2 quantities of radioactive material. Written verification from the service provider shall be provided to the licensee. The licensee shall retain the documentation for a period of 3 years from the date the individual no longer requires unescorted access to category 1 or category 2 quantities of radioactive material.

B. Fingerprinting, and the identification and criminal history records checks required by section 149 of the Atomic Energy Act of 1954, as amended, are not required for an individual who has had a favorably adjudicated U.S. Government criminal history records check within the last 5 years, under a comparable U.S. Government program involving fingerprinting and an FBI identification and criminal history records check provided that he or she makes available the appropriate documentation. Written confirmation from the agency/employer that reviewed the criminal history records check shall be provided to the licensee. The licensee shall retain this documentation for a period of 3 years from the date the individual no longer requires unescorted access to category 1 or category 2 quantities of radioactive material. These programs include, but are not limited to:

1. National Agency Check;
2. Transportation Worker Identification Credentials (TWIC) under 49 CFR part 1572;
3. Bureau of Alcohol, Tobacco, Firearms, and Explosives background check and clearances under 27 CFR part 555;
4. Health and Human Services security risk assessments for possession and use of select agents and toxins under 42 CFR part 73;
5. Hazardous Material security threat assessment for hazardous material endorsement to commercial driver's license under 49 CFR part 1572; and
6. Customs and Border Protection's Free and Secure Trade (FAST) Program.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1930. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1931. Protection of Information

A. Each licensee who obtains background information on an individual under this Article shall establish and maintain a system of files and written procedures for protection of the record and the personal information from unauthorized disclosure.

B. The licensee may not disclose the record or personal information collected and maintained to persons other than the subject individual, his or her representative, or to those who have a need to have access to the information in performing assigned duties in the process of granting or denying unescorted access to category 1 or category 2 quantities of radioactive material, safeguards information, or safeguards information-modified handling. No individual authorized to have access to the information may disseminate the information to any other individual who does not have a need to know.

C. The personal information obtained on an individual from a background investigation may be provided to another licensee:

1. Upon the individual's written request to the licensee holding the data to disseminate the information contained in his or her file; and
2. The recipient licensee verifies information such as name, date of birth, social security number, gender, and other applicable physical characteristics.

D. The licensee shall make background investigation records obtained under this Article available for examination by an authorized representative of the Agency to determine compliance with the rules and laws.

E. The licensee shall retain all fingerprint and criminal history records (including data indicating no record) received from the FBI, or a copy of these records if the individual's file has been transferred, on an individual for 3 years from the date the individual no longer requires unescorted access to category 1 or category 2 quantities of radioactive material.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1932. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1933. Access Authorization Program Review

A. Each licensee shall be responsible for the continuing effectiveness of the access authorization program. Each licensee shall ensure that access authorization programs are reviewed to confirm compliance with the requirements of this Article and that comprehensive actions are taken to correct any noncompliance that is identified. The review program shall evaluate all program performance objectives and requirements. Each licensee shall periodically (at least annually) review the access program content and implementation.

B. The results of the reviews, along with any recommendations, shall be documented. Each review report shall identify conditions that are adverse to the proper performance of the access authorization program, the cause of the condition(s), and, when appropriate, recommend corrective actions, and corrective actions taken. The licensee shall review the findings and take any additional corrective actions necessary to preclude repetition of the condition, including reassessment of the deficient areas where indicated.

C. Review records shall be maintained for 3 years.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1934. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1935. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1936. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1937. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1938. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1939. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1940. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1941. Security Program

A. Applicability:
1. Each licensee that possesses an aggregated category 1 or category 2 quantity of radioactive material shall establish, implement, and maintain a security program in accordance with the requirements of this Article.
2. An applicant for a new license and each licensee that would become newly subject to the requirements of this Article upon application for modification of its license shall implement the requirements of this Article, as appropriate, before taking possession of an aggregated category 1 or category 2 quantity of radioactive material.
3. Any licensee that has not previously implemented the Security Orders or been subject to the provisions of R12-1-1941 through R12-1-1957 shall provide written notification to the Agency, as specified in R12-1-1907, at least 90 days before aggregating radioactive material to a quantity that equals or exceeds the category 2 threshold.

B. General performance objective:

Each licensee shall establish, implement, and maintain a security program that is designed to monitor and, without delay, detect, assess, and respond to an actual or attempted unauthorized access to category 1 or category 2 quantities of radioactive material.

C. Program features:

Each licensee's security program shall include the program features, as appropriate, described in R12-1-1943, R12-1-1945, R12-1-1947, R12-1-1949, R12-1-1951, R12-1-1953, and R12-1-1955.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1942. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1943. General Security Program Requirements

A. Security plan:
1. Each licensee identified in R12-1-1941(A) shall develop a written security plan specific to its facilities and operations. The purpose of the security plan is to establish the licensee's overall security strategy to ensure the integrated and effective functioning of the security program required by this Article. The security plan shall, at a minimum:
   a. Describe the measures and strategies used to implement the requirements of this Article; and
   b. Identify the security resources, equipment, and technology used to satisfy the requirements of this Article.
2. The security plan shall be reviewed and approved by the individual with overall responsibility for the security program.
3. A licensee shall revise its security plan as necessary to ensure the effective implementation of Agency requirements. The licensee shall ensure that:
   a. The revision has been reviewed and approved by the individual with overall responsibility for the security program; and
   b. The affected individuals are instructed on the revised plan before the changes are implemented.
4. The licensee shall retain a copy of the current security plan as a record for 3 years after the security plan is no longer required. If any portion of the plan is superseded, the licensee shall retain the superseded material for 3 years after the record is superseded.

B. Implementing procedures:
1. The licensee shall develop and maintain written procedures that document how the requirements of this Article and the security plan will be met.
2. The implementing procedures and revisions to these procedures shall be approved in writing by the individual with overall responsibility for the security program.
3. The licensee shall retain a copy of the current procedure as a record for 3 years after the procedure is no longer needed. Superseded portions of the procedure shall be retained for 3 years after the record is superseded.

C. Training:
1. Each licensee shall conduct training to ensure that those individuals implementing the security program possess and maintain the knowledge, skills, and abilities to carry out their assigned duties and responsibilities effectively. The training shall include instruction in:
   a. The licensee's security program and procedures to secure category 1 or category 2 quantities of radioactive material, and in the purposes and functions of the security measures employed;
   b. The responsibility to report promptly to the licensee any condition that causes or may cause a violation of Agency requirements;
   c. The responsibility of the licensee to report promptly to the local law enforcement agency and licensee any actual or attempted theft, sabotage, or diversion of category 1 or category 2 quantities of radioactive material; and
   d. The appropriate response to security alarms.

2. In determining those individuals who shall be trained on the security program, the licensee shall consider each individual's assigned activities during authorized use and response to potential situations involving actual or attempted theft, diversion, or sabotage of category 1 or category 2 quantities of radioactive material. The extent of the training shall be commensurate with the individual's potential involvement in the security of category 1 or category 2 quantities of radioactive material.
3. Refresher training shall be provided at a frequency not to exceed 12 months and when significant changes have been made to the security program. This training shall include:
   a. Review of the training requirements of subsection (c) and any changes made to the security program since the last training;
   b. Reports on any relevant security issues, problems, and lessons learned;
   c. Relevant results of Agency inspections; and
   d. Relevant results of the licensee's program review and testing and maintenance.
4. The licensee shall maintain records of the initial and refresher training for 3 years from the date of the training. The training records shall include dates of the training, topics covered, a list of licensee personnel in attendance, and related information.

D. Protection of information:
1. Licensees authorized to possess category 1 or category 2 quantities of radioactive material shall limit access to and unauthorized disclosure of their security plan, implementing procedures, and the list of individuals that have been approved for unescorted access.
2. Efforts to limit access shall include the development, implementation, and maintenance of written policies and procedures for controlling access to, and for proper handling and protection against unauthorized disclosure of, the security plan and implementing procedures.
3. Before granting an individual access to the security plan or implementing procedures, licensees shall:
   a. Evaluate an individual's need to know the security plan or implementing procedures; and
   b. If the individual has not been authorized for unescorted access to category 1 or category 2 quantities of radioactive material, safeguards information, or safeguards information-modified handling, the licensee shall complete a background investigation to determine the individual's trustworthiness and reliability. A trustworthiness and reliability determination shall be conducted by the reviewing official and shall include the background investigation elements contained in R12-1-1925(A)(2) through (A)(7).
4. Licensees need not subject the following individuals to the background investigation elements for protection of information:
   a. The categories of individuals listed in R12-1-1929(A); or
   b. Security service provider employees, provided written verification that the employee has been determined to be trustworthy and reliable, by the required background investigation in R12-1-1925(A)(2) through (A)(7), has been provided by the security service provider.
5. The licensee shall document the basis for concluding that an individual is trustworthy and reliable and should be granted access to the security plan or implementing procedures.
6. Licensees shall maintain a list of persons currently approved for access to the security plan or implementing procedures. When a licensee determines that a person no longer needs access to the security plan or implementing procedures or no longer meets the access authorization requirements for access to the information, the licensee shall remove the person from the approved list as soon as possible, but no later than 7 working days, and take prompt measures to ensure that the individual is unable to obtain the security plan or implementing procedures.
7. When not in use, the licensee shall store its security plan and implementing procedures in a manner to prevent unauthorized access. Information stored in non-removable electronic form shall be password protected.
8. The licensee shall retain as a record for 3 years after the document is no longer needed:
   a. A copy of the information protection procedures; and
   b. The list of individuals approved for access to the security plan or implementing procedures.
9. **State officials, State employees, and other individuals, whether or not licensees of the Commission or an Agreement State, who receive schedule information of the kind specified in R12-1-1943(D)(1) shall protect that information against unauthorized disclosure as specified in R12-1-1943(D)(2).**

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1944. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1945. Local Law Enforcement Agency (LLEA) Coordination

A. A licensee subject to this Article shall coordinate, to the extent practicable, with an LLEA for responding to threats to the licensee's facility, including any necessary armed response. The information provided to the LLEA shall include:
1. A description of the facilities and the category 1 and category 2 quantities of radioactive materials along with a description of the licensee's security measures that have been implemented to comply with this Article; and

2. A notification that the licensee will request a timely armed response by the LLEA to any actual or attempted theft, sabotage, or diversion of category 1 or category 2 quantities of material.

B. The licensee shall notify the Agency listed in R12-1-1907 of this Article within 3 business days if:
1. The LLEA has not responded to the request for coordination within 60 days of the coordination request; or
2. The LLEA notifies the licensee that the LLEA does not plan to participate in coordination activities.

C. The licensee shall document its efforts to coordinate with the LLEA. The documentation shall be kept for 3 years.

D. The licensee shall coordinate with the LLEA at least every 12 months, or when changes to the facility design or operation adversely affect the potential vulnerability of the licensee's material to theft, sabotage, or diversion.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1946. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1947. Security Zones

A. Licensees shall ensure that all aggregated category 1 and category 2 quantities of radioactive material are used or stored within licensee established security zones. Security zones may be permanent or temporary.

B. Temporary security zones shall be established as necessary to meet the licensee's transitory or intermittent business activities, such as periods of maintenance, source delivery, and source replacement.

C. Security zones shall, at a minimum, allow unescorted access only to approved individuals through:
1. Isolation of category 1 and category 2 quantities of radioactive materials by the use of continuous physical barriers that allow access to the security zone only through established access control points. A physical barrier is a natural or man-made structure or formation sufficient for the isolation of the category 1 or category 2 quantities of radioactive material within a security zone; or
2. Direct control of the security zone by approved individuals at all times; or
3. A combination of continuous physical barriers and direct control.

D. For category 1 quantities of radioactive material during periods of maintenance, source receipt, preparation for shipment, installation, or source removal or exchange, the licensee shall, at a minimum, provide sufficient individuals approved for unescorted access to maintain continuous surveillance of sources in temporary security zones and in any security zone in which physical barriers or intrusion detection systems have been disabled to allow such activities.

E. Individuals not approved for unescorted access to category 1 or category 2 quantities of radioactive material shall be escorted by an approved individual when in a security zone.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1948. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1949. Monitoring, Detection, and Assessment

A. Monitoring and detection:
1. Licensees shall establish and maintain the capability to continuously monitor and detect without delay all unauthorized entries into its security zones. Licensees shall provide the means to maintain continuous monitoring and detection capability in the event of a loss of the primary power source, or provide for an alarm and response in the event of a loss of this capability to continuously monitor and detect unauthorized entries.
2. Monitoring and detection shall be performed by:
   a. A monitored intrusion detection system that is linked to an onsite or offsite central monitoring facility; or
   b. Electronic devices for intrusion detection alarms that will alert nearby facility personnel; or
   c. A monitored video surveillance system; or
   d. Direct visual surveillance by approved individuals located within the security zone; or
   e. Direct visual surveillance by a licensee designated individual located outside the security zone.
3. A licensee subject to this Article shall also have a means to detect unauthorized removal of the radioactive material from the security zone. This detection capability shall provide:
   a. For category 1 quantities of radioactive material, immediate detection of any attempted unauthorized removal of the radioactive material from the security zone. Such immediate detection capability shall be provided by:
      i. Electronic sensors linked to an alarm; or
      ii. Continuous monitored video surveillance; or
      iii. Direct visual surveillance.
   b. For category 2 quantities of radioactive material, weekly verification through physical checks, tamper indicating devices, use, or other means to ensure that the radioactive material is present.

B. Assessment:

Licensees shall immediately assess each actual or attempted unauthorized entry into the security zone to determine whether the unauthorized access was an actual or attempted theft, sabotage, or diversion.

C. Personnel communications and data transmission:

For personnel and automated or electronic systems supporting the licensee's monitoring, detection, and assessment systems, licensees shall:

1. Maintain continuous capability for personnel communication and electronic data transmission and processing among site security systems; and
2. Provide an alternative communication capability for personnel, and an alternative data transmission and processing capability, in the event of a loss of the primary means of communication or data transmission and processing. Alternative communications and data transmission systems may not be subject to the same failure modes as the primary systems.

D. Response:

Licensees shall immediately respond to any actual or attempted unauthorized access to the security zones, or actual or attempted theft, sabotage, or diversion of category 1 or category 2 quantities of radioactive material at licensee facilities or temporary job sites. For any unauthorized access involving an actual or attempted theft, sabotage, or diversion of category 1 or category 2 quantities of radioactive material, the licensee's response shall include requesting, without delay, an armed response from the LLEA.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1950. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1951. Maintenance and Testing

A. Each licensee subject to this R12-1-1941 through R12-1-1957 shall implement a maintenance and testing program to ensure that intrusion alarms, associated communication systems, and other physical components of the systems used to secure or detect unauthorized access to radioactive material are maintained in operable condition and are capable of performing their intended function when needed. The equipment relied on to meet the security requirements of this part shall be inspected and tested for operability and performance at the manufacturer's suggested frequency. If there is no suggested manufacturer's suggested frequency, the testing shall be performed at least annually, not to exceed 12 months.

B. The licensee shall maintain records on the maintenance and testing activities for 3 years. The record shall include:

1. The date of activity;
2. Type of activity performed;
3. A list of the equipment involved;
4. The results of the activity;
5. The name of the individual that conducted the activity;
6. The repair or maintenance (if applicable) that was performed.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1952. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1953. Requirements for Mobile Devices

Each licensee that possesses mobile devices containing category 1 or category 2 quantities of radioactive material shall:

A. Have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee; and

B. For devices in or on a vehicle or trailer, unless the health and safety requirements for a site prohibit the disabling of the vehicle, the licensee shall utilize a method to disable the vehicle or trailer when not under direct control and constant surveillance by the licensee. Licensees shall not rely on the removal of an ignition key to meet this requirement.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1954. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1955. Security Program Review

A. Each licensee shall be responsible for the continuing effectiveness of the security program. Each licensee shall ensure that the security program is reviewed to confirm compliance with the requirements of this Article and that comprehensive actions are taken to correct any noncompliance that is identified. The review shall include the radioactive material security program

content and implementation. Each licensee shall periodically (at least annually) review the security program content and implementation.

B. The results of the review, along with any recommendations, shall be documented. Each review report shall identify conditions that are adverse to the proper performance of the security program, the cause of the condition(s), and, when appropriate, recommend corrective actions, and corrective actions taken. The licensee shall review the findings and take any additional corrective actions necessary to preclude repetition of the condition, including reassessment of the deficient areas where indicated.

C. The licensee shall maintain the review documentation for 3 years.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1956. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1957. Reporting of Events

A. The licensee shall immediately notify the LLEA after determining that an unauthorized entry resulted in an actual or attempted theft, sabotage, or diversion of a category 1 or category 2 quantity of radioactive material. As soon as possible after initiating a response, but not at the expense of causing delay or interfering with the LLEA response to the event, the licensee shall notify the Agency. Notification shall be to a live person, a voice mail is not considered adequate notification. In no case shall the notification to the Agency be later than 4 hours after the discovery of any attempted or actual theft, sabotage, or diversion.

B. The licensee shall assess any suspicious activity related to possible theft, sabotage, or diversion of category 1 or category 2 quantities of radioactive material and notify the LLEA as appropriate. As soon as possible but not later than 4 hours after notifying the LLEA, the licensee shall notify the Agency.

C. The initial telephonic notification required by subsection (A) shall be followed within a period of 30 days by a written report submitted to the Agency by an appropriate method listed in R12-1-1907. The report shall include sufficient information for Agency analysis and evaluation, including identification of any necessary corrective actions to prevent future instances.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1958. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1959. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1960. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1961. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1962. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1963. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1964. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1965. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1966. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1967. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1968. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1969. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1970. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1971. Additional Requirements for Transfer of Category 1 and Category 2 Quantities of Radioactive Material
A licensee transferring a category 1 or category 2 quantity of radioactive material to a licensee of the Agency, NRC, or an Agreement State shall meet the license verification provisions listed below instead of those listed in sections of this chapter:

1. Any licensee transferring category 1 quantities of radioactive material to a licensee of the Agency, NRC, or an Agreement State, prior to conducting such transfer, shall verify with the Agency's license verification system or the license issuing authority that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred and that the licensee is authorized to receive radioactive material at the location requested for delivery. If the verification is conducted by contacting the license issuing authority, the transferor shall document the verification. For transfers within the same organization, the licensee does not need to verify the transfer.
2. Any licensee transferring category 2 quantities of radioactive material to a licensee of the Agency, NRC, or an Agreement State, prior to conducting such transfer, shall verify with the Agency's license verification system or the license issuing authority that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred. If the verification is conducted by contacting the license issuing authority, the transferor shall document the verification. For transfers within the same organization, the licensee does not need to verify the transfer.
3. In an emergency where the licensee cannot reach the license issuing authority and the license verification system is nonfunctional, the licensee may accept a written certification by the transferee that it is authorized by license to receive the type, form, and quantity of radioactive material to be transferred. The certification shall include the license number, current revision number, issuing agency, expiration date, and for a category 1 shipment the authorized address. The licensee shall keep a copy of the certification. The certification shall be confirmed by use of the NRC's license verification system or by contacting the license issuing authority by the end of the next business day.
4. The transferor shall keep a copy of the verification documentation as a record for 3 years.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1972. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1973. Applicability of Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material During Transit

A. For shipments of category 1 quantities of radioactive material, each shipping licensee shall comply with the requirements for physical protection contained in Sections R12-1-1975(A) and (E); R12-1-1977; R12-1-1979(A)(1), (B)(1), and (C); and R12-1-1981(A), (C), (E), (G) and (H).

B. For shipments of category 2 quantities of radioactive material, each shipping licensee shall comply with the requirements for physical protection contained in R12-1-1975(B) through (E); R12-1-1979(A)(2), (A)(3), (B)(2), and (C); and R12-1-1981(B), (D), (F), (G), and (H). For those shipments of category 2 quantities of radioactive material that meet the criteria of Article 15 of this Chapter, the shipping licensee shall also comply with the advance notification provisions of R12-1-1508 or R12-1-1512 as appropriate.

C. The shipping licensee shall be responsible for meeting the requirements of R12-1-1971 through R12-1-1981 unless the receiving licensee has agreed in writing to arrange for the in-transit physical protection required under R12-1-1971 through R12-1-1981.

D. Each licensee that imports or exports category 1 quantities of radioactive material shall comply with the requirements for physical protection during transit contained in R12-1-1975(A)(2) and (E); R12-1-1977; R12-1-1979(A)(1), (B)(1), and (C); and R12-1-1981(A), (C), (E), (G), and (H) for the domestic portion of the shipment.

E. Each licensee that imports or exports category 2 quantities of radioactive material shall comply with the requirements for physical protection during transit contained in R12-1-1979(A)(2), (A)(3), and (B)(2); and R12-1-1981(B), (D), (F), (G), and (H) for the domestic portion of the shipment.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1974. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1975. Preplanning and Coordination of Shipment of Category 1 or Category 2 Quantities of Radioactive Material

A. Each licensee that plans to transport, or deliver to a carrier for transport, licensed material that is a category 1 quantity of radioactive material outside the confines of the licensee's facility or other place of use or storage shall:

1. Preplan and coordinate shipment arrival and departure times with the receiving licensee;
2. Preplan and coordinate shipment information with the governor or the governor's designee of any State through which the shipment will pass to:
   a. Discuss the State's intention to provide law enforcement escorts; and
   b. Identify safe havens; and
3. Document the preplanning and coordination activities.

B. Each licensee that plans to transport, or deliver to a carrier for transport, licensed material that is a category 2 quantity of radioactive material outside the confines of the licensee's facility or other place of use or storage shall coordinate the shipment no-later-than arrival time and the expected shipment arrival with the receiving licensee. The licensee shall document the coordination activities.

C. Each licensee who receives a shipment of a category 2 quantity of radioactive material shall confirm receipt of the shipment with the originator. If the shipment has not arrived by the no-later-than arrival time, the receiving licensee shall notify the originator.

D. Each licensee, who transports or plans to transport a shipment of a category 2 quantity of radioactive material, and determines that the shipment will arrive after the no-later-than arrival time provided pursuant to paragraph (B), shall promptly notify the receiving licensee of the new no-later-than arrival time.

E. The licensee shall retain a copy of the documentation for preplanning and coordination and any revision thereof, as a record for 3 years.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1976. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1977. Advance Notification of Shipment of Category 1 Quantities of Radioactive Material

As specified in subsections (A) and (B), each licensee shall provide advance notification to the Agency and the governor of a State, or the governor's designee, of the shipment of licensed material in a category 1 quantity, through or across the boundary of the State, before the transport, or delivery to a carrier for transport of the licensed material outside the confines of the licensee's facility or other place of use or storage.

1. Procedures for submitting advance notification:
   a. The notification shall be made to the Agency and to the office of each appropriate governor or governor's designee. The contact information, including telephone and mailing addresses, of governors and governors' designees, **and participating Tribes** is available on the NRC's website at ~~http://nrc-stp.ornl.gov/special/designee.pdf~~ **https://scp.nrc.gov/special/designee.pdf**. A list of the contact information is also available upon request from the Director, Division of Material Safety, State, Tribal, and Rulemaking Programs, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001. Notifications to the Agency shall be to the Agency Director or their designee. The notification to the Agency may be made by email to *ram@azrra.gov* or by fax to (602) 437-0705.
   b. A notification delivered by mail shall be postmarked at least 7 days before transport of the shipment commences at the shipping facility.
   c. A notification delivered by any means other than mail shall reach the Agency at least 4 days before the transport of the shipment commences and shall reach the office of the governor or the governor's designee at least 4 days before transport of a shipment within or through the State.
2. Information to be furnished in advance notification of shipment:

Each advance notification of shipment of category 1 quantities of radioactive material shall contain the following information, if available at the time of notification:

a. The name, address, and telephone number of the shipper, carrier, and receiver of the category 1 radioactive material;
b. The license numbers of the shipper and receiver;
c. A description of the radioactive material contained in the shipment, including the radionuclides and quantity;
d. The point of origin of the shipment and the estimated time and date that shipment will commence;
e. The estimated time and date that the shipment is expected to enter each State along the route;
f. The estimated time and date of arrival of the shipment at the destination; and
g. A point of contact, with a telephone number, for current shipment information.

3. Revision notice:
   a. The licensee shall provide any information not previously available at the time of the initial notification, as soon as the information becomes available but not later than commencement of the shipment, to the governor of the State or the governor's designee and to the Agency's Director at the contact information available in R12-1-1907.
   b. A licensee shall promptly notify the governor of the state or the governor's designee of any changes to the information provided in accordance with subsections (B) and (C)(1). The licensee shall also immediately notify the Agency's Director at the contact information available in R12-1-1907 of any such changes.
4. Cancellation notice:
   Each licensee who cancels a shipment for which advance notification has been sent shall send a cancellation notice to the governor of each State or to the governor's designee previously notified and to the Agency's Director at the contact information available in R12-1-1907. The licensee shall send the cancellation notice before the shipment would have commenced or as soon thereafter as possible. The licensee shall state in the notice that it is a cancellation and identify the advance notification that is being cancelled.
5. Records:
   The licensee shall retain a copy of the advance notification and any revision and cancellation notices as a record for 3 years.
6. Protection of information:
   State officials, State employees, and other individuals, whether or not licensees of the Agency, the NRC, or an Agreement State, who receive schedule information of the kind specified R12-1-1977(B) shall protect that information against unauthorized disclosure as specified in R12-1-1943(D) of this Article.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1978. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1979. Requirements for Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material During Shipment

A. Shipments by road:

1. Each licensee who transports, or delivers to a carrier for transport, in a single shipment, a category 1 quantity of radioactive material shall:
   a. Ensure that movement control centers are established that maintain position information from a remote location. These control centers shall monitor shipments 24 hours a day, 7 days a week, and have the ability to communicate immediately, in an emergency, with the appropriate law enforcement agencies.
   b. Ensure that redundant communications are established that allow the transport to contact the escort vehicle (when used) and movement control center at all times. Redundant communications may not be subject to the same interference factors as the primary communication.
   c. Ensure that shipments are continuously and actively monitored by a telemetric position monitoring system or an alternative tracking system reporting to a movement control center. A movement control center shall provide positive confirmation of the location, status, and control over the shipment. The movement control center shall be prepared to promptly implement preplanned procedures in response to deviations from the authorized route or a notification of actual, attempted, or suspicious activities related to the theft, loss, or diversion of a shipment. These procedures will include, but not be limited to, the identification of and contact information for the appropriate LLEA along the shipment route.
   d. Provide an individual to accompany the driver for those highway shipments with a driving time period greater than the maximum number of allowable hours of service in a 24-hour duty day as established by the Department of Transportation Federal Motor Carrier Safety Administration. The accompanying individual may be another driver.
   e. Develop written normal and contingency procedures to address:
      i. Notifications to the communication center and law enforcement agencies;
      ii. Communication protocols. Communication protocols shall include a strategy for the use of authentication codes and duress codes and provisions for refueling or other stops, detours, and locations where communication is expected to be temporarily lost;

iii. Loss of communications; and
iv. Responses to an actual or attempted theft or diversion of a shipment.

f. Each licensee who makes arrangements for the shipment of category 1 quantities of radioactive material shall ensure that drivers, accompanying personnel, and movement control center personnel have access to the normal and contingency procedures.

2. Each licensee that transports category 2 quantities of radioactive material shall maintain constant control and/or surveillance during transit and have the capability for immediate communication to summon appropriate response or assistance.

3. Each licensee who delivers to a carrier for transport, in a single shipment, a category 2 quantity of radioactive material shall:

a. Use carriers that have established package tracking systems. An established package tracking system is a documented, proven, and reliable system routinely used to transport objects of value. In order for a package tracking system to maintain constant control and/or surveillance, the package tracking system shall allow the shipper or transporter to identify when and where the package was last and when it should arrive at the next point of control.

b. Use carriers that maintain constant control and/or surveillance during transit and have the capability for immediate communication to summon appropriate response or assistance; and

c. Use carriers that have established tracking systems that require an authorized signature prior to releasing the package for delivery or return.

B. Shipments by rail:

1. Each licensee who transports, or delivers to a carrier for transport, in a single shipment, a category 1 quantity of radioactive material shall:

a. Ensure that rail shipments are monitored by a telemetric position monitoring system or an alternative tracking system reporting to the licensee, third-party, or railroad communications center. The communications center shall provide positive confirmation of the location of the shipment and its status. The communications center shall implement preplanned procedures in response to deviations from the authorized route or to a notification of actual, attempted, or suspicious activities related to the theft or diversion of a shipment. These procedures will include, but not be limited to, the identification of and contact information for the appropriate LLEA along the shipment route.

b. Ensure that periodic reports to the communications center are made at preset intervals.

2. Each licensee who transports, or delivers to a carrier for transport, in a single shipment, a category 2 quantity of radioactive material shall:

a. Use carriers that have established package tracking systems. An established package tracking system is a documented, proven, and reliable system routinely used to transport objects of value. In order for a package tracking system to maintain constant control and/or surveillance, the package tracking system shall allow the shipper or transporter to identify when and where the package was last and when it should arrive at the next point of control.

b. Use carriers that maintain constant control and/or surveillance during transit and have the capability for immediate communication to summon appropriate response or assistance; and

c. Use carriers that have established tracking systems that require an authorized signature prior to releasing the package for delivery or return.

C. Investigations:

Each licensee who makes arrangements for the shipment of category 1 quantities of radioactive material shall immediately conduct an investigation upon the discovery that a category 1 shipment is lost or missing. Each licensee who makes arrangements for the shipment of category 2 quantities of radioactive material shall immediately conduct an investigation, in coordination with the receiving licensee, of any shipment that has not arrived by the designated no-later-than arrival time.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1980. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1981. Reporting of Events

A. Within one hour of its determination that a shipment of category 1 quantities of radioactive material is lost or missing, a shipping licensee shall notify the appropriate LLEA and the Agency. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212. The appropriate LLEA is the law enforcement agency in the area of the shipment's last confirmed location. During the investigation required by R12-1-1979(C), the shipping licensee shall provide agreed upon updates to the Agency on the status of the investigation.

B. Within four (4) hours of its determination that a shipment of category 2 quantities of radioactive material is lost or missing, a shipping licensee shall notify the appropriate LLEA and the Agency. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212. If, after 24 hours of its determination that the shipment is lost or missing, the radioactive material has not been located and secured, the licensee shall immediately notify the Agency.

C. The shipping licensee shall notify the designated LLEA along the shipment route as soon as possible upon discovery of any actual or attempted theft or diversion of a shipment or suspicious activities related to the theft or diversion of a shipment of a category 1 quantity of radioactive material. As soon as possible after notifying the LLEA, the licensee shall notify the Agency upon discovery of any actual or attempted theft or diversion of a shipment, or any suspicious activity related to the shipment of category 1 radioactive material. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212

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D. The shipping licensee shall notify the Agency as soon as possible upon discovery of any actual or attempted theft or diversion of a shipment, or any suspicious activity related to the shipment, of a category 2 quantity of radioactive material. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212.

E. The shipping licensee shall notify the Agency and the LLEA as soon as possible upon recovery of any lost or missing category 1 quantities of radioactive material. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212.

F. The shipping licensee shall notify the Agency as soon as possible upon recovery of any lost or missing category 2 quantities of radioactive material. The Agency shall be notified by calling (602) 255-4845 during business hours, or by calling the after-hours emergency Department of Public Safety dispatch line, at (602) 223-2212.

G. The initial telephonic notification required by subsections (A) through (D) shall be followed within a period of 30 days by a written report submitted to the Agency by an appropriate method listed in R12-1-1907. A written report is not required for notifications on suspicious activities required by subsections (C) and (D). The report shall set forth the following information:

1. A description of the licensed material involved, including kind, quantity, and chemical and physical form;
2. A description of the circumstances under which the loss or theft occurred;
3. A statement of disposition, or probable disposition, of the licensed material involved;
4. Actions that have been taken, or will be taken, to recover the material; and
5. Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

H. 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.

Historical Note

New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-1982. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1983. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1984. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1985. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1986. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1987. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1988. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1989. Reserved

Historical Note

Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1990. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1991. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1992. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1993. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1994. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1995. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1996. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1997. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1998. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-1999. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19100. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19101. Form of Records

A. Each record required by this Article shall be legible throughout the retention period specified by each Agency rule. 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, shall include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

B. The licensee who transferred the material shall retain each record of the transfer of source or byproduct material until the Agency terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-19102. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19103. Record Retention

Licensees shall maintain the records that are required by the rules in this Article for the period specified by the appropriate rule. If a retention period is not otherwise specified, these records shall be retained until the Agency terminates the facility's license. All records related to this Article may be destroyed upon Agency termination of the facility's license.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-19104. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19105. Inspections

A. Each licensee shall afford to the Agency, at all reasonable times, opportunity to inspect category 1 or category 2 quantities of radioactive material and the premises and facilities wherein the nuclear material is used, produced, or stored.

B. Each licensee shall make available to the Agency for inspection, upon reasonable notice, records kept by the licensee pertaining to its receipt, possession, use, acquisition, import, export, or transfer of category 1 or category 2 quantities of radioactive material.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-19106. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19107. Violations

A. The Agency may obtain an injunction or other court order to prevent a violation of the provisions of:
1. A.R.S. § 30-685, as amended;
2. A.A.C. Title 12, Chapter 1; or
3. A rule or order issued by the Agency pursuant to Statute or the rules under A.A.C. Title 12, Chapter 1.

B. The Agency may obtain a court order for the payment of a civil penalty imposed under A.R.S. § 30-687, as amended:
1. For violations of:
   a. The rules in A.A.C. Title 12, Chapter 1, as amended;
   b. Nonpayment of fees listed in A.A.C. Title 12, Chapter 1, Article 13;
   c. Any rule, or order issued pursuant to the sections specified in subsection (B)(1)(a);
   d. Any term, condition, or limitation of any license issued under the sections specified in subsection (B)(1)(a).
2. For any violation for which a license may be revoked.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

R12-1-19108. Reserved

Historical Note
Section reserved at 22 A.A.R. 603 (Supp. 16-1).

R12-1-19109. Criminal Penalties

Arizona Revised Statutes § 30-673, as amended, provides for criminal sanctions for willful violation of, attempted violation of, or conspiracy to violate, any rule issued under A.A.C. Title 12, Chapter 1. For purposes of this section, all the rules in this Article are issued under A.R.S. § 30-673 or the rules of the Agency.

Historical Note
New Section made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).

Appendix A
. — Table 1-Category 1 and Category 2 Threshold

The terabecquerel (TBq) values are the regulatory standard. The curie (Ci) values specified are obtained by converting from the TBq value. The curie values are provided for practical usefulness only.

Radioactive Material	Category 1 (TBq)	Category 1 (Ci)	Category 2 (TBq)	Category 2 (Ci)
Americium-241	60	1,620	0.6	16.2
Americium-241/Be	60	1,620	0.6	16.2
Californium-252	20	540	0.2	5.40
Cobalt-60	30	810	0.3	8.10

Curium-244	50	1,350	0.5	13.5
Cesium-137	100	2,700	1	27.0
Gadolinium-153	1,000	27,000	10	270
Iridium-192	80	2,160	0.8	21.6
Plutonium-238	60	1,620	0.6	16.2
Plutonium-239/Be	60	1,620	0.6	16.2
Promethium-147	40,000	1,080,000	400	10,800
Radium-226	40	1,080	0.4	10.8
Selenium-75	200	5,400	2	54.0
Strontium-90	1,000	27,000	10	270
Thulium-170	20,000	540,000	200	5,400
Ytterbium-169	300	8,100	3	81.0

***Note**: Calculations Concerning Multiple Sources or Multiple Radionuclides*

The "sum of fractions" methodology for evaluating combinations of multiple sources or multiple radionuclides is to be used in determining whether a location meets or exceeds the threshold and is thus subject to the requirements of this part.

1. If multiple sources of the same radionuclide and/or multiple radionuclides are aggregated at a location, the sum of the ratios of the total activity of each of the radionuclides shall be determined to verify whether the activity at the location is less than the category 1 or category 2 thresholds of Table 1, as appropriate. If the calculated sum of the ratios, using the equation below, is greater than or equal to 1.0, then the applicable requirements of this part apply.
2. First determine the total activity for each radionuclide from Table 1. This is done by adding the activity of each individual source, material in any device, and any loose or bulk material that contains the radionuclide. Then use the equation below to calculate the sum of the ratios by inserting the total activity of the applicable radionuclides from Table 1 in the numerator of the equation and the corresponding threshold activity from Table 1 in the denominator of the equation.

   Calculations shall be performed in metric values (i.e., TBq) and the numerator and denominator values shall be in the same units.

   R1 = total activity for radionuclide 1
   R2 = total activity for radionuclide 2
   RN = total activity for radionuclide n
   AR1 = activity threshold for radionuclide 1
   AR2 = activity threshold for radionuclide 2
   ARN = activity threshold for radionuclide n

$$\sum_{1}^{n} \left[\frac{R_1}{AR_1} + \frac{R_2}{AR_2} + \frac{R_n}{AR_n} \right] \geq 1.0$$

Historical Note

Appendix A, consisting of Table 1 - Category 1 and Category 2 Threshold, made by final rulemaking at 22 A.A.R. 603, effective February 2, 2016 (Supp. 16-1).